THURSDAY, JULY 9, 1903.

RECENT WORKS ON OPTICS.

Manual of Advanced Optics. By C. Riborg Mann, Assistant Professor of Physics in the University of Chicago. Pp. 196. (Chicago: Scott, Forseman and Co., 1902.)

Practical Exercises in Light: being a Laboratory Course for Schools of Science and Colleges. By R. S. Clay, B.A., D.Sc. Pp. vi+187. (London: Macmillan and Co., Ltd., 1902.) Price 2*s.* 6*d.*

Elementary Ophthalmic Optics. By Freeland Fergus, M.D., F.R.S.E., Surgeon to the Glasgow Eye Infirmary. Pp. viii + 107. (London: Blackie and Son, 1903.) Price 3*s.* 6*d.* net.

Geometrical Optics: an Elementary Treatise upon the Theory, and its Practical Application to the more Exact Measurements of Optical Properties. By Thomas H. Blakesley, M.A. Pp. viii + 120. (London: Whittaker and Co., 1903.) Price 2*s.* 6*d.*

Das Stereoskop. Seine anwendung in den technischen Wissenschaften. Über Entstehung und Konstruktion Stereoskopischer Bilder. Von Wilhelm Manchot, Architekt und Professor am Städel'schen Kunstinstitut zu Frankfurt a.M. Pp. vi (3 blank)+ 68. (Leipzig: Veit and Co., 1903.)

MR. MANN'S book contains an account of the three months' experimental course on optics pursued by the senior students at the University of Chicago. The name Chicago, uttered on this side of the Atlantic, suggests many different things to different persons; to physicists it cannot but bring to mind the name of Prof. Michelson, to whom we are indebted for some of the most valuable and ingenious optical investigations that the last century brought forth. An experimental course, developed according to the ideas of Prof. Michelson, could scarcely be other than original and stimulating; the course before us, in addition, is systematically developed, the descriptions are clear and concise, and the illustrations, though few, are well calculated to serve the purpose for which they were intended. Each chapter commences with a brief theoretical investigation, wherein the aim is to concentrate attention on the physical, as distinguished from the purely mathematical, aspect of the subject; following this is a description of the experiments, and the manipulation of the necessary apparatus. Room is left for the student to develop a certain amount of originality in his methods, and thus avoid reduction to the state of a mere mechanical copyist. Numerous references are given to original memoirs, which should prove very useful to advanced students. Besides the experiments usually found in books on optics, descriptions are given of the method of determining the resolving power of telescopes, spectroscopes, and gratings. It is interesting to find Prof. Michelson's classic researches on the resolution of spectral lines by means of the interferometer included in a course for students. In fine, no one on glancing through this book would hesitate to endorse the concluding words of Prof. Michelson's introductory note:—

"Those who desire to enter into optical investigations cannot get a better foundation for future work than by studying the optical theories here presented, and performing the experiments described."

Teachers have long felt the want of an inexpensive book on practical light, suitable for students who are commencing the study of the subject; and to these Dr. Clay's little book may be confidently recommended. As stated in the preface, it forms the elementary portion of a "Treatise on Practical Light," now in preparation by the author. It is by no means an easy task to arrange a series of elementary experiments on light, which shall be sufficiently varied to prevent the interest of the student from flagging, while of sufficient scope and completeness to give the student a firm grasp of the elementary principles of the subject. The author is to be congratulated on his success in both the above respects. The ordinary laws of reflection, refraction, and dispersion are illustrated by the aid of simple experiments, which can be performed without the aid of expensive appliances; indeed, the spectrometer is the only piece of elaborate apparatus required for the course described. In addition, numerous practical exercises are appended at the ends of the chapters. Attention is directed to the observation of caustics, and the principle of formation of the rainbow. The optical bench described by the author is to be commended for its simplicity and efficacy. Perhaps the most novel part of the course consists in a number of experiments on the optical properties of the eye, and others on diffraction and interference. We do not remember to have previously seen a description of the method of producing Lloyd's single mirror fringes by the aid of a prism and spectrometer. Points to which objections can be raised are neither numerous nor important. On p. 86, it is stated that a telescope focused for infinity and directed towards the sun gives rise to a parallel bundle of emergent rays. This is scarcely correct; the rays from any particular point of the sun will emerge parallel to each other, but the total emergent light consists of a diverging bundle of pencils, each consisting of parallel rays. On p. 127, it is stated that the *fovea centralis* contains rods only and no cones, while the reverse is actually the case. The account given on p. 132 of the mechanism of accommodation could bear revision; modern research indicates that the increased curvature of the anterior surface of the crystalline lens is produced by an increase of tension in the anterior capsule layer, and not by its relaxation, as was supposed by Helmholtz.

The opththalmic surgeon has to deal with the eye, not alone as a delicate organ of the human body, subject, like other organs, to disease; but also, in many cases, as a defective optical instrument. Hence a knowledge of optics is as necessary to him as an acquaintance with the science of electricity is necessary to the electrical engineer. Dr. Fergus's book has been written for medical students, as an elementary introduction to the science of geometrical

optics. There are few points in this book calling for remark, except, perhaps, the very arbitrary limitations of the subject-matter. Thus, chromatic aberration and dispersion, the "power" of a lens and its measurement in dioptres, the use of lenses as spectacles or magnifying glasses, and the optical system of the eye itself, alike remain unmentioned. The mathematical theory of thick lenses is discussed, although the subject of lens combinations is neglected. No experimental methods with regard to lenses are described, and no problems for solution by the student are appended.

In taking up the study of light, students generally commence with the laws of geometrical optics. Further on in their studies they find that the instruments used for even the simplest investigations comprise various combinations of lenses and mirrors, which can be understood and appreciated only when a competent knowledge of geometrical optics has been acquired. In spite, however, of the manifest importance of this branch of knowledge, it has in recent years received scant attention from investigators, and has shown few marks of progress. This is undoubtedly due in part to the fact that the subject of geometrical optics affords a happy hunting-ground for the mathematician, who may, or may not, have anything more than a passing acquaintance with the practical side of the subject; while the attention of experimental investigators has mostly been absorbed in other directions. Let us consider, for instance, the subject of lens combinations. Gauss showed that a thick lens, or combination of lenses, possesses four important points on the axis—the two principal points and the two principal foci. If the distances of the object and image are respectively measured from the first and second principal points, then the formula for the combination takes a form similar to that applicable to a single thin lens. In a sense, then, the work of Gauss affords a complete method of solving any problem connected with lenses; it labours under the disadvantage, however, that in most problems the necessary analysis is of a somewhat clumsy character. It has thus been left for Mr. Blakesley to introduce a remarkable simplification, by measuring the distances of the object and image, not from the first and second principal *points*, but from the first and second principal *foci*. The resulting equations in u and v, as well as those relating to the magnification, now take forms amenable to simple analytical treatment. The focal length of a lens, or lens combination, is taken as a constant of one dimension in space, not necessarily measured from any particular point; in this respect it resembles the coefficient of self-induction of a coil.

The advantage of this method is well illustrated by the investigation on the combination of a lens and a mirror, on pp. 67–71. It also readily adapts itself to the needs of experimental investigations. A distinguishing feature of the book is the attention devoted to practical determinations of the constants of lens systems; those involving the use of a microscope are particularly worthy of remark, though all are interesting. It is to be regretted, however, that Mr. Blakesley has preferred to speak of Gauss's principal points as "the points 1 of the diagram"; a section on the graphical construction of images, using Gauss's principal planes, would also make many problems clearer. In view of their practical importance, with respect to the optical system of the eye, Listing's nodal points also claim some mention. Chapter xi., on forms of lenses for minimum deviation of rays, is of great interest and practical importance. It is to be feared, however, that the geometrical relations of circles, which are cursorily alluded to in the text as "quite clear," may greatly puzzle many students whose leaning is toward practical physics rather than toward pure mathematics. Further, the theory of the achromatisation of an eye-piece (p. 110) could bear amplification. Many students arrive at the conclusion that Huyghens's eye-piece has advantages, with respect to ordinary chromatic aberration, over a single thin lens used as a magnifying glass—a conclusion which is demonstrably erroneous. Mr. Blakesley gives data from which a student, if sufficiently enthusiastic and persevering, might arrive at the truth of this matter; but a page or so devoted to the question would have enhanced the value of the book. It is further to be regretted that a series of problems, to be solved by the student, has not been appended; a loose leaflet containing five such problems, issued as advertising the scope of Mr. Blakesley's book, shows how attractive work of this kind may be made. Finally, however, it must be said that a more interesting and stimulating book than that under consideration is seldom likely to come in the way of the student. Mr. Blakesley has, moreover, effected a notable advance in geometrical optical theory.

The stereoscope is probably mentioned, more or less briefly, in most lecture courses on optics; but it is seldom realised that this instrument is something more than a plaything or a scientific curiosity. Yet it is undeniable that, in many branches of science, the stereoscope could be used as a most valuable aid to instruction. In commencing the study of analytical geometry of three dimensions, for example, the chief difficulty of a student is to realise the actual significance of the more or less conventional diagrams which he must use; there can be little doubt that, if provided with proper diagrams to be viewed stereoscopically, he would avoid much profitless labour, and gain, in the end, much clearer notions of the significance of the processes employed. In practical solid geometry, architecture, crystallography, &c., there are other wide fields for the use of the stereoscope. Prof. Manchot mentions a further novel use to which the stereoscope can be put. If two bank notes are viewed stereoscopically, slight differences, which could scarcely be detected by the eye, will give the printing an appearance of relief or depression, so that a false note can easily be detected.

That the stereoscope is not more largely used is doubtless due to the fact that, in the forms ordinarily met with, the pictures or diagrams are limited to too small a size for the full benefit of the instrument to be felt. Prof. Manchot has invented a stereoscope which can be adapted to viewing diagrams of any size whatever, and this instrument is fully described.

as well as the method of constructing stereoscopic diagrams to be used with it. To those anxious to lighten, so far as possible, the labour of the student, while increasing the efficiency of the teacher's efforts, Prof. Manchot's little book should afford suggestive reading.

EDWIN EDSER.

PREVENTION OF ACCIDENTS IN FACTORIES.

Infortuni sul lavoro. Mezzi Tecnici per Prevenirli. By Ing. E. Magrini. Pp. xxxi+251. (Milano: Ulrico Hoepli, 1903.) Price L.3.

THE introduction opens with this apt quotation, "Le fabricant doit autre chose à ses ouvriers que le salaire." And the book purposes to teach the manufacturer how to pay the debt by providing all the protection possible against dangers attending the use of machinery.

The prevention of accidents is a subject to which much attention has been given in Italy, first by the "Associazione per prevenire gli infortuni sul lavoro," and finally by the Government, which completed its legislation in 1899 by the issue of a set of precautionary rules incumbent on all users of machinery. These rules form the framework of the book, each chapter having, as text, an extract from them, and describing in detail the appliances needed to give effect to the regulation in the various classes of machinery.

The first two chapters deal with prime movers, the means of fencing them and of stopping them, not merely by cutting off the motive power, but by applying brakes to the moving parts. Transmissions—shafts, belts, gears, &c.—form the subject of chapter iii., and share with circular saws (chapter v.) the distinction of causing more accidents than any other class of apparatus. A comparison of these two chapters is instructive. Of all protective devices, those for circular saws have called for most ingenuity and met with least success. The numerous coverings described are costly and complicated without being really effective, and they are devices which a workman would discard whenever possible. On the other hand the protections described in chapter iii. are simple, effective, and devoid of any hindrance in working, and call for more attention than they usually receive. Carding and spinning machines, emery wheels, ladders and protective clothing, spectacles, &c., are dealt with briefly, while elevators of all kinds and their safety appliances are discussed fully. In chapter vii. forty pages are devoted to the dangers of manœuvring with belts in motion. Much in this is of great value, many of the devices being as simple as they are effective.

Electrical machines, fires and boilers receive very inadequate treatment in the remaining twenty-five pages. The chapter on electrical machinery does not approach the standard of the rest of the book; it is far from complete, even on more important points, and contains many statements and recommendations that would find but little acceptance from engineers.

Speaking of the book as a whole, it tends rather towards a catalogue; more critical descriptions of the different devices would have been welcome, and this more especially in regard to two important points, which are almost entirely overlooked. These are, firstly, that a device which does not afford complete protection often increases the danger; it lulls to a sense of false security. Secondly, that a protection which can be discarded by the workman is of far less value than one which he is forced to adopt. Most safety devices are of some hindrance in working, and experience shows that workmen take no interest in efforts made for their protection; they are merely annoyed at the inconvenience in their work.

These few criticisms are easily outweighed by the praise which the book well deserves. Nearly all the devices are illustrated as well as described, and in matters of detail the book gives numberless useful hints, and what may be termed dodges rather than appliances; a master, by following these, could avoid many dangers at little cost and trouble.

G. H. BAILLIE.

A NEW SWISS HANDBOOK.

Guide to Switzerland. Pp. cvi + 235; with 31 maps and 6 plans. (London: Macmillan and Co., Ltd., 1903.) Price 5*s.* net.

MODERN tourists, and in particular those who wander in companies, are prone to haunt certain familiar centres, Lucerne, Grindelwald, Zermatt, Chamonix, Pontresina, and to confine their excursions within narrow bounds. Messrs. Macmillan have designed a handbook to meet the needs of this class. In many respects the conception of the volume is good, but the execution is faulty and unequal. To deal first with its merits. The eulogy of the political institutions of the Swiss Republic, and the notes on the nature of glaciers, introduced among the preliminary chapters, ought to interest and inform the better class of sight-seers, while practical suggestions on health and outfit are useful to all. The separate hotel list will be found convenient for reference; houses frequented by our countrymen are distinguished by larger type, and prices are in many cases quoted. As a whole, the list seems to be compiled with care, but there are singular omissions; amongst them we have noted Binn, St. Beatenberg, Montana, Piora, Promontogno, Lanzo d'Intelvi, all well-known stopping places. At Binn, the text tells us, "refreshments can be procured, and if necessary beds obtained at the Curé's." The village has for years had a large hotel with an English chaplain attached. The inns on the tour of Mont Blanc, at Contamines, Nant Borrant, Chapieux, are mentioned in the route, but not in the list.

When we come to study in detail the guide-book proper, we find that the routes have been conveniently arranged round the centres to which they naturally attach themselves. The editors recommend their text as "concise and accurate." As to accuracy, we cannot endorse their estimate of their work. The section relating to Davos is well done, but that devoted to the Upper Engadine is meagre and untrustworthy. The new railway connecting Thusis and St. Moritz by the Schyn and Albula, opened to Celerina this year, ought to have been described. Promontogno, with its good hotel, the natural halting-place for travellers

coming from the Lake of Como, and the exquisite drive to Soglio, are passed over. The "Palace Hotel" at Maloja has its prospectus printed almost in full, but many of the excursions from it are catalogued under Sils. The carriage roads up the Fex Thal and Roseg Thal, the restaurants at Curtins, on the Surlei Furka, Piz Languard, and elsewhere, are left out, though in other districts restaurants are noted. The Bernina Hospice and Bernina Houses have been confused. The inn at the foot of the Morteratsch Glacier and that on the Diavolezza Pass, the latter the best starting point for many peaks and passes, are ignored. The way to Boval is said to be "rough and over snow"; there is an excellent path; so there is, since 1902, up Piz Julier, said to be "difficult." The Alp Misaun is suggested as a starting point for Piz Morteratsch. No travellers prefer its hay to the good accommodation offered by the Roseg Inn or the much higher Tschierva hut.

It is an easy task to pick holes in a guide-book covering such an extensive field as Switzerland. We have preferred to collect our bundle of blunders almost entirely from a single district. We could easily have made it bigger without going farther, and by extending our survey we might fill columns. But enough has been done to warn travellers who may be tempted by the numerous and, as a rule, excellent maps to purchase this volume that they must not rely on its information as regards either ordinary excursions or glacier expeditions. Nor in many cases can we at all agree with the editors' estimates of scenery. We should hesitate to call the Bel Alp "a beautiful and secluded village," or to characterise "the scenery round the Borromean Islands" as "strikingly grand." The index stands in need of careful revision.

OUR BOOK SHELF.

The Fauna of British India, including Ceylon and Burma. Published under the Auspices of the Secretary of State for India in Council. Edited by W. T. Blanford. Hymenoptera. Vol. ii. Ants and Cuckoo-Wasps. By Lieut.-Colonel C. T. Bingham. Pp. xix+506. (London: 1903.)

THE first volume of this work appeared in 1897, and included the wasps and bees, and now the second volume has been issued, containing the still more interesting family of the Formicidæ, and also the small, but very beautiful, family of the Chrysididæ, or ruby-tail wasps; or, as Colonel Bingham calls them, the cuckoo-wasps. This completes the important section of Aculeata, or stinging Hymenoptera, and the monographing of the remaining groups, which are still very imperfectly known, is very properly deferred for the present. We are, however, pleased to see that Colonel Bingham has undertaken to prepare a work on the butterflies of British India for the same series.

Colonel Bingham divides the Formicidæ into five subfamilies, Dorylinæ, Ponerinæ, Myrmecinæ, Dolichoderinæ, and Camponotinæ (498 species); and Chrysididæ with four subfamilies, Cleptinæ, Ellampinæ, Chrysidinæ, and Parnopinæ (79 species). When we remember that instead of 498 species of Formicidæ there are only about forty species in Britain, and only about a hundred in all Europe, the difference between a temperate and a tropical fauna becomes sufficiently obvious.

A very clear account of the external characters of ants is given in the introduction, elucidated by numerous figures of structure. The bulk of the work is almost exclusively descriptive, but includes useful keys to genera and species, synonymy, and occasional notes on habits. Exigencies of space necessitate the latter being of the utmost brevity, which, though obviously unavoidable, is none the less to be regretted, for the habits of many Indian ants are extremely interesting.

The 577 species described by Colonel Bingham in the volume before us are illustrated by 161 text illustrations, frequently including structural details as well. Occasionally more than one species of a genus is figured. A coloured plate is added, with sixteen coloured figures of Chrysididæ. Among the most interesting of the uncoloured figures are those representing the curious spiny ants of the genus Polyrhachis.

Comparatively few new species are described, for much has been written on Indian Formicidæ in recent years. But, except as regards the obsolete catalogue of F. Smith, almost all that has been published is scattered through a variety of scientific periodicals not always easy of access, and we congratulate Colonel Bingham on the completion of a comprehensive work which must greatly facilitate the study of his subject to all future workers.

Dendrologische Winterstudien. Von Camilla Karl Schneider. Pp. vi+290. (Jena: Gustav Fischer, 1903.) Price 7.50 marks.

THE study of our tropophytic trees and shrubs in their winter condition has been somewhat neglected from the systematist's point of view. While such works as those of Sargent and Willkomm have hitherto supplied the wants of the forester, still the number of species they deal with is limited, and a more extended list is required. To meet this want the author of the above work has set himself no small task, and, in our opinion, has achieved a degree of success which only great patience and perseverance could attain. The book deals with 235 genera, including 434 species of indigenous and introduced deciduous trees and shrubs in Europe. A notable feature of the work is the large number of illustrations, 224 in all, which are reproduced from photographs and hand drawings of actual specimens.

The subject-matter is divided into three sections—a general, a special, and a systematic. The first section deals with general organography, and gives a wide and comprehensive survey of the subject. The reader is thereby well prepared for what is to follow in the next section, which is the bulkiest and most important one in the book. It is devoted to the special consideration of the various species in their winter condition. The descriptions are short and concise, many abbreviations being used, which are, however, fully explained at the beginning of the section. The accompanying figures, which illustrate the salient features of the species described, are very instructive and well drawn. The author attaches more importance to good figures than to descriptions, and has consequently produced a large number of drawings which alone would, in most cases, amply suffice for purposes of identification and comparison. The classification of the leafless twigs is somewhat intricate, but this is unavoidable when a large number of species has to be tabulated. Following this comes a section giving a systematic arrangement of the various species dealt with. The system adopted is that of A. Engler.

In the bibliography at the end, the more important dendrological works are cited, and a short statement of their contents given.

The work is primarily a contribution to systematic dendrology, and cannot fail to be of interest and value to the systematist. At the same time, the subject is of considerable importance to the practical man, be he nurseryman, forester, gardener, or landscape gardener. In those professions winter operations often occur, in which it is very important to be able to identify accurately the different species.

The special descriptions of the species dealt with in the book, so far as they have been tested, have proved to be quite accurate. There are a few misprints and slips, which are, however, corrected in the errata at the end of the book. There are one or two emendations still required, such as "*Spartium junceum*" instead of "*Sportium unceum*," p. 22, line 3. Also in the reference to the wood body of Fig. 31, given on p. 56, line 33, we would substitute "undermost layer" for "uppermost layer." However, such slips will, no doubt, disappear in a second edition, which we hope to see this work reach, and in which the author will be able to enhance the value of his work by the addition of still more species.

La Tecnica delle Correnti Alternate. Vol. i. Parte qualitativa e descrittiva. By G. Sartori. Pp. xv+336; 260 illustrations. (Milano: Ulrico Hoepli, 1903.) Price L.8.

THE course of evening lectures read before a class of artisans is here given in book form. Except for an occasional algebraic expression, mathematics are rigidly excluded, and yet the author tackles the most complex phenomena of alternate currents, and discusses the behaviour of synchronous, asynchronous and rotary-field motors, with their various starting devices; of rotary converters and their tendency to hunt; of alternators running in parallel, and of wave propagation in long lines. And he does this with so much success that the usual treatment on the basis of a sine wave-form compares unfavourably. A mathematical treatment of the subject is practicable only on the assumption of sine-waves, and the evil of this is that students are apt to forget that in practice the wave-form is rarely sinusoidal, and generally so far removed from it that the theoretical deductions are then valueless. To deal with alternate currents is far harder without than with the use of sine waves, and the author is to be congratulated on his success. The book, in fact, is not an elementary manual, but an up-to-date treatise, its language suited to the artisan and its substance to any student.

Monographie des Cynipides d'Europe et d'Algérie. Par l'Abbé J. J. Kieffer, Membre de la Société Entomologique de France. Tome Second. Premier Fascicule. Pp. 288; avec les planches 1 à 9. (Paris: Hermann, 1903.) Price 16 francs.

THIS is another instalment of the important series of monographs forming part of the great work on Hymenoptera inaugurated by the brothers André. It includes the portion of the parasitic Cynipidæ comprised in the tribes Allotriinæ, Eucœlinæ, and the commencement of the Figitinæ. The Allotriinæ must be regarded as very useful insects, for they feed chiefly, if not exclusively, on Aphidæ and Coccidæ; whether they ever attack other insects seems for the present to be somewhat uncertain. The Eucœlinæ, on the other hand, are parasites on the larvæ and pupæ of Diptera, and sometimes on small Coleopterous larvæ, and the single recorded instance of their attacking Aphidæ is considered by Kieffer to require confirmation, while the known larvæ of the Figitinæ are parasitic on the larvæ of Diptera, Coleoptera, and Neuroptera.

The subject is treated in a similar manner to that of the first volume, which we have recently noticed, and several species are described as new. The former standard of excellence is well kept up, both as regards the text and plates.

Spirals in Nature and Art. By Theodore Cook. Pp. xxi+200. (London: John Murray, 1903.) Price 7*s.* 6*d.* net.

THAT spiral curves, or, more strictly, helices, and screw motions should play an important part both in the natural world and in structures constructed by human hands is a fact for which a mathematician can easily suggest an explanation on general grounds. Without professing to bring any extensive scientific or technical knowledge to bear on the subject, Mr. Cook has made a most interesting study of the resemblances between the spiral forms occurring in nature and in art, and has produced a book the study of which will be a delightful recreation to any class of reader. Apart from the mere spiral form, Mr. Cook finds remarkable resemblances between the structure and sculpturing of certain staircases in France and those of the shells of certain mollusca. It is certain that Leonardo da Vinci studied shells, and that he was in France about the time when these staircases were built, and an obvious connection suggests itself. While the author's study of the works of Leonardo da Vinci—illustrated by copies of his drawings—is interesting, the connection of Leonardo's studies of the flight of birds with spiral curves strikes a reader as somewhat doubtful. Even Pettigrew's figure-of-eight-shaped curve, and the oval curve familiar to readers of Marey's "Vol des Oiseaux," which represent, according to modern views, the relative paths of points on the wings of a wasp and a bird, can hardly be said to produce a *spiral* curve when compounded with the forward motion of the animal.

Lois générales de l'Action des Diastases. Par Victor Henri. Pp. xi+129. (Paris: A. Hermann, 1903.)

AFTER a general introduction on catalysis and a classification of catalysers, the author gives a historical account of the work already done on the action of diastases. Then follows a description of his own researches on the action of invertase on cane-sugar, together with the theoretical deduction of a formula which represents with considerable accuracy the actual course of the reaction under varying conditions of concentration. The book concludes with two short chapters on the action of emulsin on salicin, and of amylase on starch. The author shows an intimate acquaintance with the mode of application of the laws governing the velocity of chemical action, and has been successful in selecting appropriate experiments to solve the problem with which he was confronted.

Sylviculture. By Albert Fron. Pp. xii+563. (Paris: J. B. Baillière et Fils, 1903.) Price 5 francs.

THIS is one of the volumes of the useful "Encyclopédie Agricole" which is appearing in France under the auspices of a "Réunion d'Ingénieurs agronomes." It deals succinctly with the methods of cultivation of woods for commercial purposes, gives an account of the chief timber trees, and also deals with the products of forests and the manner of their conversion, in accordance with French practice.

The book has no special feature. It is well adapted to the requirements of students of the "École Nationale d'Agriculture," for whom it is intended, and forms a useful addition to its series without replacing the larger text-books on the forestry of France—such as those of Boppe.

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.]*

Radium and Solar Energy.

THE extraordinary discovery that radium has the property of continuously radiating heat without itself cooling down to the temperature of surrounding objects may possibly afford a clue to the source of energy in the sun and stars.

Taking the Curies' observation that one gram of radium can supply 100 calories per hour, I thought it would be of interest to compute how much radium would suffice to supply the sun's output of energy.

Taking from Langley's observations that this is equal to 828,000,000 calories per square cm. per hour, I find that 3·6 grams of radium per cubic metre of the sun's volume would supply the entire output.

It may be possible that at solar temperatures radium is capable of much more energetic radiation, and, if so, the 3·6 grams might be reduced to a much smaller figure.

Daramona, July 1. W. E. WILSON.

"Red Rain" and the Dust Storm of February 22.

IN a letter under the above heading which you did me the honour to print in your issue of May 21, vol. lxviii. p. 53, I gave the results of the chemical examination of a sample of dust collected from the roof of Bayham Abbey, Lamberhurst, after the dust storm of February 22, and sent to me by the kindness of Lord Camden, and I stated that it would be interesting to compare its characters with those of the dust, presumably of African origin, which was observed to fall in the district of Taormina by Sir Arthur Rücker, and was the subject of an interesting communication to NATURE by Prof. Judd in 1901 (vol. lxiii. p. 514).

Thanks to the kindness of Prof. Judd, who sent me about a gramme of the Taormina dust collected by Sir Arthur Rücker and placed among the geological specimens at South Kensington, I have been enabled to make the comparison.

In external characters the Taormina dust closely resembles that from Bayham Abbey. Its microscopical features are also generally similar.

Mr. C. Simmonds, of the Government Laboratory, to whom I am indebted for the analyses already published, found that after drying at 100° C., the sample had the following composition :—

	Per cent.
Silica	36·32
Alumina	16·35
Ferric oxide, with traces of manganese oxide	6·08
Cobalt oxide	0·32
Lime	6·24
Magnesia	2·21
Sodium oxide	2·59
Potassium oxide	2·72
Water and organic matter	23·49
Chlorides and sulphates	traces
Carbonic acid	3·68
	100·00

The cobalt oxide may include a little nickel, but the quantity was too small to identify with certainty.

After being heated to redness, 28·08 per cent. of the sample was dissolved on boiling with dilute hydrochloric acid, the soluble constituents being :—

	Per cent.
Silica	0·88
Alumina	10·16
Ferric oxide	5·52
Lime	6·24
Magnesia	2·21
Alkalis	2·57
Carbonic acid (by difference)	0·50
	28·08

The organic carbon in the sample amounted to 9·89 per cent., and the organic nitrogen to 0·16 per cent. This small proportion of nitrogen shows that the organic matter is mainly, or entirely, of vegetable origin. Calculated from the mean proportion of carbon in cellulose and humic acid, the amount of organic carbon present in the sample would correspond to about 19 per cent. of organic matter, or, from cellulose alone, to 16½ per cent.

A comparison of the dust from Taormina with the "red rain" dust from Bayham Abbey may be made by calculating the inorganic constituents as percentages on their sum, after deducting water and organic matter :—

	Taormina Dust. Per cent.	Bayham Abbey Dust. Per cent.
Silica	47·47	50·53
Alumina	21·37	20·18
Ferric oxide	7·94	7·23
Cobalt oxide	0·42	—
Lime	8·16	9·50
Magnesia	2·89	2·04
Sodium oxide	3·38	1·27
Potassium oxide	3·56	2·53
Carbonic acid	4·81	6·72
	100·00	100·00

Reduced thus to a common basis for comparison, the inorganic portions of the two samples show a general similarity of composition, the chief differences being that the Bayham Abbey specimen contains a little more silica and chalk, and a little less alumina and alkalis, than the sample from Taormina.

The constituents soluble in dilute hydrochloric acid may similarly be compared, after deducting carbonic acid and raising the figures to percentages :—

	Taormina Dust. Per cent.	Bayham Abbey Dust. Per cent.
Silica	3·19	2·28
Alumina	36·84	39·93
Ferric oxide	20·02	19·35
Lime	22·62	29·20
Magnesia	8·01	4·03
Alkalis	9·32	5·21
	100·00	100·00

It is of interest to compare the foregoing results with an old analysis by Gibbs of dust which fell on a ship in the Atlantic (*Pogg. Ann.*, lxxi., 367). After deducting 18·53 per cent. of water and organic matter, the composition was found to be as follows :—

	Per cent.
Silica	45·58
Alumina	20·55
Ferric oxide	9·39
Manganic oxide	4·22
Calcium carbonate	11·77
Magnesia	2·21
Potash	3·64
Soda	2·33
Cupric oxide	0·31
	100·00

Except for the presence in this sample of a notable quantity of manganese and copper, the analysis bears a close resemblance to that of the Taormina dust; the fact of the similarity is particularly interesting, considering that something like half a century has probably elapsed since Gibbs's sample was collected.

Mr. J. J. H. Teall, the director of the Geological Survey, kindly sent me a sample of "blood rain" dust which fell at Palermo at about the same time as the dust from Taormina collected by Sir Arthur Rücker. This closely resembles the Taormina dust in general characters. Mr. Teall has suggested that the question of the origin of the dust might be elucidated if the samples were found to contain free aluminium hydroxide. The bearing of this upon the question of origin is as follows :—Evidence has been recently adduced to show that laterite, a decomposition-product of the felspars, is an aluminium hydroxide, though always mixed with more or less silica. This type of decomposition, it is believed, occurs only in tropical regions, and hence the presence of uncombined alumina in the dust,

if it could be established, would be evidence of tropical origin.

Following out Mr. Teall's suggestion, the Taormina sample, and also the one from Bayham Abbey, have been examined to see if any evidence could be obtained showing the presence in them of aluminium hydroxide. A study of the actions of solutions of caustic and carbonated alkalis upon the dusts showed that both silica and alumina could be dissolved from them by the former solvent; but similar results were also obtained from orthoclase and oligoclase, whilst the treatment with sodium carbonate showed that no large quantity of amorphous silica was present in either of the specimens. The results are not conclusive, but, so far as they go, they point to there being no uncombined alumina in the samples. T. E. THORPE.

Dust Storms in New Zealand.

AN event of more than ordinary interest occurred here last November, and seeing that it has a certain importance not altogether restricted to us and our neighbourhood, I have ventured to address you on the subject.

From Invercargill, at the extreme south of the South Island, it was reported on November 14 that in various parts of the town and district tank water had a clayey appearance, and exposed objects were covered with a fine dust or mud. A similar report came from many places in the south-east portion of the island, and inland as far as Wakatipu, where heavy gales and thunderstorms are stated to have occurred on that date. At Dunedin no sign of the dust was visible during the day, but in the evening, from 8 to 10 p.m., the moon was at times obscured by clouds of a reddish colour, but the weather kept dry and no dust fell. At Waipawa, near the east coast North Island, a very heavy dust storm commenced at 9 a.m. on November 15. It lasted for several hours, extended, and became very thick. It was not due to local causes.

Samples of the dust examined by a local authority in Dunedin were stated to be of volcanic origin, and possibly connected with eruptions in Samoa or in South Victoria.

Dr. Benham, of the Otago University, kindly gave me a sample of the dust that fell at Otakaia, a few miles south of Dunedin. I submitted it to microscopical and chemical examination with the following result:—

The specimen was in a small bottle with water; it had fallen into a bucket which was quite clean, and in such a position that contamination was impossible. The sediment was of a reddish-brown colour, very fine in grain. A mounted specimen examined with an $\frac{1}{8}$-inch objective showed various vegetable cells, apparently portions of the feathery pappus of fruits of composites and similar light matter. Small rounded grains of inorganic matter were frequent, in some cases large enough (0·03mm. diameter) to depolarise light. They were chiefly quartz, but some were apparently augite, and others particles of weathered minerals coloured red with iron oxides. To these last the colour of the dust in mass was due. There were also in every preparation observed several diatoms. In one preparation there was a piece of vegetable tissue composed of fine cells. In all there was much carbonised matter. A partial quantitative analysis gave the following result after complete drying in an air bath:—SiO_2 53·68, Al_2O_3 18·44, Fe_2O_3 6·54, CaO 0·95, MgO 1·52, K_2O 2·58, Na_2O 1·67. Loss on ignition, 14·60. Total, 99·98. I have been unable to find any analysis of dust borne any great distance by wind with which to compare this. A partial analysis of dust collected in England, given in a March number of your paper, does not differ much from this except that the loss on ignition is 36·4, and the other constituents correspondingly lower.

There is no doubt that this dust was derived from a desiccated surface; the carbonised matter suggests that it had been swept by fire, and as the weather all over New Zealand had been very wet for weeks previously, there is no possibility of a local origin of the dust.

Since Australia had just previously, after a period of most prolonged drought, suffered from the effects of severe gales, causing dust storms that produced almost total darkness in Melbourne and Sydney, it is natural to look to that continent for the origin of the dust storm. Through the kindness of Prof. J. W. Gregory, F.R.S., I was sent a specimen of dust that fell in Gippsland during a dust storm on October 11, and this, though coarser, was so essentially similar to our dust that a comparison of the two specimens at once established the extreme probability of identity of origin.

The distance in a straight line from Melbourne to Invercargill is 1200 miles, and to Dunedin 1300 miles, and from Sydney to Waipawa 1300 miles. The origin of the dust was probably some distance to the west of the Blue Mountains. There seems, therefore, no doubt that this dust was carried 1500 miles, 1200 of which was over a water surface.

Your readers are doubtless aware that the climate of New Zealand, and of Australia on its eastern seaboard, is chiefly dependent on the passage of deep cyclonic disturbances travelling in a general N.W.–S.E. direction. In front of the centre of these the wind blows strong from the N.W., and behind the centre from the S.W. The barometrical and weather records appended show that at the date mentioned such a cyclonic disturbance of rather more than the average intensity was experienced at the time of the dust fall.

In connection with this I may mention that after the famous "Black Thursday" in Melbourne, Dunedin and the southern portion of the south island of New Zealand generally experienced a dense smoke, and comparatively large fragments of carbonised vegetable matter fell.

In conclusion, I should like to point out the significance of such an observation as this in connection with the distribution of plants in the Southern Hemisphere. Since diatoms and vegetable particles of recognisable size were present in the very small portion of the dust examined, it seems quite possible that in the large total of dust that fell some of the smaller and lighter seeds of Australian plants may have been present.

Date, 1902.	Barometer Brisbane.	Barometer Sydney.	Barometer Melbourne.	Barometer Adelaide.	Direction Hobart.	Barometer Hobart.	Direction Dunedin.	Barometer Dunedin.
Nov. 11	30·08	30·01	29·91	29·95	—	—	N.W.	29·72
Nov. 12	30·09	29·96	29 78	29·61	S.E.	29·9	S.W.	29·50
Nov. 13	29·96	29·53	29·63	30·03	W.	29·3	S.W.	29·82
							N.W. to S.W.	29·42
Nov. 14	29·98	29·90	30·04	30·27	—	—	N.E. to S.W.	29·50
Nov. 15	—	30·13	30·14	30·18	—	—	S.W.	29.92

P. MARSHALL.

Otago University, Dunedin, New Zealand, May 3.

Science and Naval Promotion.

THE friends of the advancement of science in the Navy can hardly fail to be very pleased with the recognition it has received in the recent promotions to the rank of commander. Of the twenty-seven lieutenants promoted on June 30 last, twenty-one were "specialised officers." In a batch of promotions such as this there is much to encourage our best officers to direct their attention to the more scientific work of their profession, yet one cannot but remark upon a feature in the analysis of these promotions, namely, the marked difference in the average times these new commanders remained lieutenants. Thus, three lieutenants (T) averaged 10 years; nine lieutenants (G) averaged 10·5 years; nine lieutenants (N) averaged 12·2 years. This is anything but encouraging to the specialist in navigation, but in view of the immense importance of securing the best men to navigate our fleets and handle them in action, it is much to be hoped that in future lieutenants (N) will not be so heavily weighted on their way to the higher ranks of the service. It is, however, only just to add that the theory and practice of navigation under recent legislation have been placed in a position in the front of scientific education they never occupied before. N. G. T.

Purple Flowers.

IT is generally thought that purple flowers are due to selection by bees, and the small number of blue and purple flowers in New Zealand is accounted for by the supposed

absence of bees. This, however, is hardly correct, for there are several species of native bees in New Zealand which constantly visit composite flowers. But *Pleurophyllum speciosum* has very conspicuous purple flowers, although it is found only in Campbell and Auckland Islands, where there are no bees or flower-visiting moths. Nor does it stand alone, for *Celmisia vernicosa*, and its ally *C. chapmani*, are the only species of the genus with purple discs, and yet they also are only found in Campbell and Auckland Islands. In *C. vernicosa*, also, the leaves have become rigid, although no animal feeds upon it.

I think that these facts are of sufficient interest to bring to the notice of botanists, at a time when, perhaps, we too readily accept selection as the explanation of every character. For in these Antarctic islands the conditions of life are so simple that we can eliminate many causes which complicate the same problems in areas with more varied life.

F. W. HUTTON.

Christchurch, New Zealand, May 23.

The Origin of Variation.

THE following argument may be of interest to your readers, if, as I suspect, it has never been thus formulated before.

In order to account for the origin of species, we must assume that the tendency of an individual to vary is handed down to future generations by appropriate modifications in the transmitted germ-plasm. But, unless we believe in the inheritance of acquired characters (for which we have no certain evidence), the tendency of the first individual to vary can only have become manifest if it had originated in a modification of its own parents' germ-plasm; otherwise that tendency could not have been inherited. Leaving out of account the play of changing external conditions, we are thus forced to regard the variability of individuals as the result of variations in the parental germ-plasm. The problem is, how are such variations produced?

CHARLES S. MYERS.

Gonville and Caius College, Cambridge, June 29.

THE BRITISH ASSOCIATION.

THE Southport meeting of the British Association will begin on Wednesday, September 9. The local arrangements, which have been in the hands of a large and representative committee for many months past, are now well advanced, and give every indication that the meeting will not fall short of that held in Southport twenty years ago.

It was not without fear and misgiving on the part of some of its more prominent members that the Association visited Southport in 1883, but the success of the meeting in the northern watering-place was so conspicuous that at the final general meeting there was a unanimous expression of opinion that the Southport meeting of 1883 had been one of the most successful ever held, and a desire to repeat it at some future date. The meeting then stood sixth in point of numbers, and third in receipts. Since that date the Southport meeting has only been exceeded in numbers by the meetings in the neighbouring cities of Manchester and Liverpool, and in receipts by Manchester alone. 2714 people attended the meeting of 1883, and it is confidently hoped that this number will be exceeded in 1903.

The Corporation of Southport is working with the local committee to make the meeting a success, and has placed at its disposal the handsome suite of Municipal Buildings for use during the week of the Association's visit. These buildings include the Town Hall, Cambridge Hall, Art Gallery, and Victoria Science and Art Schools. The three first named of these were in use at the former Southport meeting of the British Association, but they were then without direct communication one with another. They are now connected by corridor bridges, and form an admirable suite of rooms for municipal and other social functions. The Victoria Science and Art Schools occupy a site behind the Cambridge Hall, with which, as well as with the Art Gallery, they are connected on the first floor, thus forming a further addition to the suite of reception rooms. This block of Municipal Buildings, which stands directly in the centre of the town, facing Lord Street, will be the headquarters of the Association. The reception room will be situated in the Examination Hall of the Science and Art Schools, the entrance being by the main doorway of Cambridge Hall. It is proposed that the Examination Hall shall be used for counter business only, the large room of the Art Gallery close by being used as a second reception room for conversational and general purposes. Two other of the picture galleries will be set apart for reading and writing rooms, whilst a fourth will be allotted to the representatives of the Press.

Three of the sections will meet in the Science and Art Schools, viz. Sections A (which is in two departments, Mathematics and Astronomy), B (Chemistry), and G (Engineering). Section L (Education) will meet in the Cambridge Hall, and Section H (Anthropology) in the Town Hall. Five out of the ten sections meeting this year will thus be located in the Municipal Buildings, and in easy communication one with another.

The council of the Association will meet in the council chamber of the Town Hall, and here also the general committee and the council of recommendations will hold their meetings. Two of the Corporation committee rooms in the Town Hall have been set aside for the deliberations of the International Meteorological Committee, which is meeting in Southport at the same time as the British Association, and of which a notice has already appeared in NATURE (May 14).

The laboratory of the Science and Art Schools will be used as a meteorological museum, and for the reception of apparatus and specimens illustrative of papers communicated to the sections.

The remaining five sections are all located in buildings within three minutes' walk of the reception room. Sections D and E (Zoology and Geography) will meet in the Temperance Institute, London Street, Section C (Geology) in Hoghton Street Church schoolroom, Section K (Botany) in Chapel Street Church schoolroom, and Section F (Economics), in the Y.M.C.A. building, Eastbank Street. The conference of delegates of corresponding societies will have two rooms placed at its disposal in Chapel Street Schools. All these buildings lie close to one another, and are easily reached by trams from all parts of the town.

The first general meeting of the Association will be held on Wednesday evening, September 9, at 8.30, in the Opera House, when the president, Sir Norman Lockyer, will deliver his inaugural address.

The Friday evening discourse will be delivered by Dr. Robert Munro, on "Man as Artist and Sportsman in the Palæolithic Period." On Monday evening a discourse will be given by Dr. Arthur Rowe on "The Old Chalk Sea, and some of its Teachings." The Saturday evening lecture to working men will be given by Dr. J. S. Flett, his subject being the recent volcanic eruptions in the West Indies. All these three lectures will be delivered in the Cambridge Hall, which seats about 1500 persons.

On Thursday evening the Mayor of Southport (Mr. T. T. L. Scarisbrick) will give a reception in the Municipal Buildings, and the local committee will give a conversazione in the same place on September 15.

The Mayor will further give a garden party in Hesketh Park on Friday afternoon, and Sir George Pilkington gives a garden party to a limited number of members at his residence, Belle Vue, on the afternoon of Monday or Tuesday, September 14 or 15.

The sections will not meet on Saturday, September 12, that day being set apart for excursions. Six whole-day and two half-day excursions have been arranged, and provision has been made in all for about a thousand persons. The excursions will be to (1) Manchester, visiting the works of the British Westinghouse Electrical and Manufacturing Company at Old Trafford. Opportunity will also be given of inspecting the new Technical School, the John Rylands Library, and the Chetham Hospital; (2) Stonyhurst College and Whalley; (3) Ribchester and Hoghton Tower; (4) Windermere; (5) Chester; (6) The Wirral Peninsula. Specially prepared pamphlets will be issued as guides to the excursions. The Westinghouse Co. has kindly promised to entertain the Manchester party to luncheon, and similar hospitality has been offered by the authorities at Stonyhurst College and by the Chester Society of Natural Science, Literature, and Art at Chester. The afternoon excursions on Saturday comprise drives to Hoole (the scene of the labours of Jeremiah Horrocks, the astronomer), Rufford Old Hall, and the ancient churches of Ormskirk and Halsall.

On the concluding day of the meeting, Wednesday, September 16, the following unofficial excursions have been arranged for the afternoon:—(1) Port Sunlight, Cheshire, Messrs. Lever's model village and soap works; (2) the Diamond Match Works at Seaforth, Liverpool; (3) the Cunard s.s. *Lucania* at Liverpool. On the Thursday following the meeting, opportunity will be afforded of visiting the Prescot Watch Works (a revived Lancashire industry), the British Insulated Wire Co.'s works at Prescot, the Lancashire and Yorkshire Railway Co.'s works at Horwich, and two collieries at Wigan. It has also been arranged for a steamer to run to Llandudno on this day.

Southport has made rapid advances in every direction during the last twenty years. Since 1883 much of the town has been rebuilt, the promenade has been widened, the marine parks and lake constructed, and many other important works of improvement have been effected. The Municipality of Southport is in the forefront of local government, and to its enterprise is in a large measure due the remarkable development of the town in recent years. Lord Street, the principal thoroughfare of the town, is a magnificent boulevard a mile long and more than eighty yards wide, with broad footways bordered by trees, suggesting comparison with the streets of continental rather than with those of English cities. The Municipal Gardens in Lord Street, in front of the Town Hall and Cambridge Hall, have become since last year, especially for visitors, the centre of life and movement in the town. Here the Corporation Military Band plays two or three times daily, and at night the trees are lit up with thousands of electric lights, the effect being striking and unique.

A handbook, or guide to the district, is being prepared, a copy of which will be presented to each member attending the meeting. The book will be illustrated and will contain specially prepared maps illustrating the topography and geology of the district. The district, roughly speaking, is that portion of south-west Lancashire lying between the rivers Ribble and Mersey.

The following subjects will be dealt with in the handbook:—"Sketch of the History of Southport"; "Meteorology," by Mr. Joseph Baxendell, Borough Meteorologist; "Health," by Dr. J. J. Weaver, Medical Officer of Health; "Geology and Physical Features of the District," by Mr. E. Dickson and Mr. H. Brodrick; "Botany," by Mr. Henry Ball and Mr. W. H. Stansfield; "Marine Zoology," by Prof. W. A. Herdman, F.R.S., and Mr. Isaac C. Thompson; "Coleoptera," by Dr. G. W. Chaster and Mr. E. Burgess Sopp; "Mollusca," by Dr. G. W. Chaster; "Mosses," by Dr. J. A. Wheldon; and "Antiquities," by Mr. W. Brunt. Mr. G. Napier Clark is contributing a chapter on Jeremiah Horrocks, the astronomer, and his connection with the district. The scientific portion of the handbook is being prepared under the direction of the Southport Society of Natural Science, and the general editors are Dr. G. W. Chaster, Mr. Geo. E. Johnson, and Mr. F. H. Cheetham.

In connection with the meeting and with the excursions, the following notes on the Southport district will be of interest. For the paragraph dealing with geology I am indebted to Mr. Harold Brodrick, for those on botany to Mr. Henry Ball, and for those on zoology to Mr. Isaac C. Thompson.

Geology.—The geology of the Southport district has for the most part to do with the Glacial and post-Glacial deposits. Of the older formations only comparatively small areas are exposed, having been entirely covered by Glacial deposits which have only in few places been denuded to the underlying strata. In the neighbourhood of Parbold, some ten miles inland, is a good exposure of Millstone Grit, while the Coal-measures may be well seen about Wigan, the Wigan coalfields being some of the most productive in England. Two small sections of the Permian rocks, with a thin stratum of a true magnesian limestone, may be examined in the beds of two small streams near Parbold. These beds have been proved to be fossiliferous, but only slightly so, not more than a dozen fossils in all having been found in them. Underlying the Boulder-clay, within eight miles of the coast and exposed in several places, are considerable deposits of the Keuper and Bunter divisions of the Trias.

In probably no part of England can that combination of clay, sand and gravel known as the Glacial Drift be better studied than in this district. Overlying the older formations, in some cases to a depth of more than one hundred feet, the Boulder-clay has suffered both denudation and erosion. By the latter action a range of prehistoric sand-dunes has been formed several miles inland of the present coast. These dunes offer several exceedingly interesting problems, and papers will be read before the Geological Section on this subject. Further inland, near Tarleton, are several large deposits of Glacial sand and gravel containing a considerable number of shells of an arctic type.

The Boulder-clay itself is of great interest, containing, as it does, boulders of Silurian Grits and Carboniferous Limestone from north Lancashire, Eskdale and Buttermere granites, and also several local granites and grits from the south-west of Scotland. These clays also contain a large number of Foraminifera, mostly of an arctic type.

A very large area is covered by peat mosses which have formed in the beds of old lakes and also covered the surrounding districts. These peat mosses in places are twenty feet in depth, and in them many canoes hollowed out of single tree trunks have been found. One of these, 17 feet long, will be on view during the visit of the Association.

The coast is fringed with a line of sand-dunes for a distance of some fifteen miles, while the whole of Southport is built on ground formerly covered with dunes, which have been levelled; in some places, as near Formby, six miles south of Southport, these dunes are more than three miles in width and rise to a height of more than 80 feet. The sand of the dunes is composed of materials eroded from the Triassic sandstones and then cast on to the shore by the sea, from where it is blown into dunes by the prevailing westerly winds. A considerable area in the estuary of the Ribble to the north of Southport is covered by a salt marsh formed by the deposition of silt at the meeting of the waters of

the Ribble with those of the sea. This district is of considerable interest, as in it may be studied the question of the formation of estuarian clays and their attendant flora and fauna.

On the whole, although at first sight the district does not seem to offer many opportunities of study to the geologist, yet on further consideration many problems and objects of great interest are to be found.

Botany.—Turning to the flora of the district, we find that, in spite of the apparent bareness of the long stretch of sand-dunes, they are by no means barren from a collector's point of view. In addition to the usual littoral flora, which is even here thoroughly representative in variety, nature, and outline, the diligent seeker will be rewarded by many choice finds. We must be pardoned for placing as an easy first, in regard to beauty as well as variety, the seaside form of the round-leaved winter-green, *Pyrola rotundifolia*, Linn., var. *maritima*, Kenyon. This plant is here abundant, and when in full bloom is an object of great loveliness. Here also, nearer to the sea line, may easily be found quite a family group of the centaurys (locally termed sanctuary). Every species now recorded in the London catalogue, save one, has been gathered on this coast. The rarest of them, however, the broad-leaved centaury, *Erythraea latifolia*, though originally found here, seems to be now extinct. Accompanying these plants there occurs, sometimes in patches like small fields, another member of the same natural order (Gentianeæ), the yellow-wort, *Blackstonia perfoliata*, Hudson, whilst in similar patches, and even more luxuriantly, there grows the Grass of Parnassus, *Parnassia palustris*, Linn. In higher and drier situations, too, the searcher is rewarded by the discovery, in fairly large quantities, of two beautiful euphorbias, both comparatively rare elsewhere, namely, *Euphorbia Paralias*, Linn., and *E. Portlandica*, Linn. The latter is a lovely object in the autumn, its green foliage changing to a bright crimson as the plant gradually fades.

The aquatic plants of the district are well worthy serious study, and include a very interesting group of drop-worts (Œnanthe), marestail, *Hippuris vulgaris*, Linn., and a few miles inland whole dykes covered over with the beautiful water-violet, *Hottonia palustris*, Linn. To refer once more to the sand-dunes, the collector may be interested to know that here grows that wonderful botanical enigma, the yellow bird's nest, *Hypopitys Monotropa*, Crantz, and a capital variety of orchids, including *Epipactis palustris*, Crantz. On the whole, to anyone in search of British wild flowers, the district is rich and repaying.

Zoology.—With the exception of its marine fauna, which is very rich, and is to be specially dealt with in the handbook now in preparation, Southport cannot be said to possess any very distinctive zoological features. No quadrupeds are peculiar to the district. But in early times, probably succeeding the last Glacial epoch, when the flat country around Southport was more elevated than now, it is evident that the Irish elk, *Cervus megaceros*, roamed here in abundance, many skulls and other remains of this animal having been found embedded in the clay beds of a large inland lake no longer existing, known as Martin Mere. It is suggested by Mr. G. W. Lamplugh, in his recent geological survey of the Isle of Man, that the Irish elk migrated across the waning ice-sheet which lingered in the Irish Sea at the close of the Glacial period.

In ornithology Southport bears a good record, and though the number must have been decreased of late years, no less than 130 species of birds were known to the district half a century ago. Among the birds that now visit the neighbourhood during spring and summer are the swallow, stone-chat, white-throat, yellow wagtail, northern diver, snow bunting, black and little tern, and wheatear, for many of which the numerous sandhills offer congenial attractions. In winter the bodies of storm-tossed birds, as the puffin, razor-bill, and stormy petrel, are often cast upon the shore, or become entangled in the fishermen's nets.

Numerous lizards haunt the sandhills, where also the conchologist will reap a good harvest not only in land mollusca, which are very abundant, but in marine species, including some of which no representatives are now found on the shore, and which were, doubtless, deposited at a distant era when the sea covered much of the present land. Cockles and shrimps are yet taken at Southport in great abundance. To the entomologist the sandhills of Southport afford a valuable hunting ground, as will be seen from the number of species and genera recorded in the forthcoming handbook.

Archaeology.—The district of Southport is not so destitute of interest to the antiquarian as might at first be supposed. Southport itself can boast no history prior to the end of the eighteenth century, but Birkdale and Churchtown, at the two extremes of the borough, can both claim a respectable antiquity. Roman coins are said to have been found on Birkdale Common.

This part of Lancashire is the "Inter Ripam et Mersham" of the Domesday Survey, but the antiquarian interest goes back to Roman times, when there were Roman stations on both the Mersey and Ribble, a Roman road leading from what is now Warrington through Wigan to Ribchester. The country west of the line of this road was, until comparatively recent times, very isolated, and consisted largely of low, swampy ground interspersed with woods and growing timber. The Roman station at Ribchester will receive the attention of the members of the British Association on one of the Saturday excursions, when Mr. John Garstang, of University College, Liverpool, and author of "Roman Ribchester," will explain the history of the Roman occupation on the site. Mr. Garstang will also read a paper on Roman Ribchester before Section H.

Close to Southport is the site of Martin Mere, once a large shallow fresh-water lake. It is now drained and used as agricultural land. Mention has already been made of a large canoe dug up here, and it is hoped that other antiquities (bronzes, &c.) obtained from the site of the lake may be on exhibition at the time of the meeting. Martin Mere is one of the many places which claim connection with the Arthurian legend. The river Douglas, the whole course of which lies within this district, is reported to be the scene of some of King Arthur's most bloody battles! Claims are also put forward by both the Ribble and Mersey, north and south of Southport, as the site of Athelstane's great victory of Brunanburg.

Lancashire is rich in old halls, and many of these are within easy reach of Southport. Visits will be paid to Rufford Old Hall, which contains a very fine example of a great hall of the fifteenth century, and to Hoghton Tower, an interesting and finely situated Elizabethan mansion, recently restored, the residence of Sir James de Hoghton, Bart. Hoghton Tower disputes with Pimp Hall, Essex, the title of being the house in which King James I. knighted the loin of beef. Of the lesser halls in the immediate vicinity of Southport, mention may be made of Lydiate, Hurleston, Mawdesley, and Heskin. Larger houses, like Speke and Smithells, lie further afield, and can only be visited by special permission.

In ancient ecclesiastical architecture Lancashire cannot be said to be well off. There is an ancient Norman chapel at Stydd, near Ribchester, an opportunity of visiting which will be given, but otherwise nearly all the churches of Lancashire belong to the late Per-

pendicular period. Halsall, however, four miles from Southport, possesses a fine parish church, largely of fifteenth century date, which will be visited, and the church at Ormskirk is unique in England in possessing a western tower and spire standing side by side. Sefton church is a late sixteenth century building, with remains of earlier work in parts, and has some good interior woodwork. At Burscough, eight miles distant, are the remains of an Augustinian priory, which in its day was one of the most considerable religious houses in Lancashire.

Carr House, at Hoole, a brick building erected in 1613, is reputed to be the house in which Jeremiah Horrocks observed the transit of Venus in 1639, and Hoole Church, though without architectural merit of any kind, is interesting as the chapel at which Horrocks officiated. There are the remains of a large number of wayside crosses in this part of Lancashire, an excellent specimen standing in Scarisbrick Park, about four miles from Southport.

Lathom is the scene of the famous siege of Lathom House by the Parliamentary forces in 1644, where Charlotte de la Tremouille, Countess of Derby, made her famous defence. She is buried along with the Earl in the neighbouring church of Ormskirk. Old Lathom House has given place to a classic mansion erected in 1724–34 from the designs of Leoni. Scarisbrick Hall is another old Lancashire mansion that has been rebuilt, the modern house, designed by Augustus Welby Pugin, being a fine example of the domestic work of the Gothic revival.

All along the coast of Lancashire are evidences of submerged lands, and the interest of the Leasowe coast of the Wirral Peninsula is well known to all those who have inquired into the subject of the alteration in the coast line of the country since Roman, or even Norman, times. An opportunity will be afforded of inspecting the submerged forest at Leasowe, and another submerged forest is to be seen nearer to Southport, at the mouth of the Alt, near Formby.

Of places not falling within the Southport district, but which will be visited by the Association, the antiquarian interest of Chester is too well known to need comment. At Whalley are the remains of a great Cistercian abbey, and Whalley church is a building full of architectural and antiquarian interest from the thirteenth to the sixteenth centuries. It contains the stalls belonging to the abbey church, which has completely disappeared. In the churchyard are three pre-Norman crosses. Time may allow also of a visit to Mytton church and Little Mytton Hall, which lie between Whalley and Stonyhurst. Stonyhurst itself has some antiquarian interest, the original building being a fine Elizabethan house, now incorporated in the vast college buildings. At Manchester mention must be made of the fifteenth century Chetham Hospital and Library, adjoining the Cathedral.

The archæology of the immediate district of Southport may be described as of local rather than of general interest, but a reference to the volumes of proceedings of the Historic Society of Lancashire and Cheshire, and of the Lancashire and Cheshire Antiquarian Society, which will be found in the Southport Reference Library, will show that antiquarian research is very active in the two counties.

The railway companies will issue return tickets to Southport from the principal stations in the United Kingdom at a fare and a quarter on surrender of the usual voucher issued to members. The tickets will be available from September 8 to September 18 inclusive. The local railway companies will issue return tickets at a fare and a quarter to members during the meeting for short distance journeys.

F. H. CHEETHAM.

NEW SERUM DEPARTMENT OF THE JENNER INSTITUTE.

UPON the invitation of Lord Lister and the governing body of the Jenner Institute of Preventive Medicine, a number of distinguished guests inspected, on Friday last, the new laboratories and stables which the institute has recently acquired at Queensberry Lodge, Elstree, Herts.

The removal from the former site at Sudbury, near Harrow, became necessary from the encroachment of the Great Central Railway, and the authorities of the institute were fortunate in acquiring a site which is eminently suitable for carrying on the work of the department. This work consists largely in the preparation and testing of antitoxins, such as diphtheria antitoxin, tetanus antitoxin, and antistreptococcic serum, and in carrying on research work in connection with these, and on questions of immunity.

Certain researches also in comparative pathology can be suitably conducted only under such conditions as exist in a department of this character.

The buildings are on the summit of a small hill, and are surrounded by about twenty-eight acres of meadow land, which is conveniently divided into small fields suitable for pasturing and exercising the horses and other animals, such as goats and sheep, which are used in connection with the work. Queensberry Lodge itself has been retained practically as it was when the estate was acquired by the institute, and is now used for the accommodation of the junior staff, administrative offices, &c. The bacteriologist-in-charge lives in a separate house. The laboratories, which have been built by the institute from designs by Mr. Paul Waterhouse, are of the most modern type, with papyrolith floors with rounded corners, white glazed adamant walls with a dado of white tiles, and large window space. They are warmed by open fireplaces. There is a good gas and water supply, and the buildings are lit by Welsbach incandescent gas burners. The main ideas in the arrangement of the departments have been to provide separate buildings and isolated rooms for carrying out the different processes for the production and testing of antitoxins, thus avoiding risk of contamination of the serum, and at the same time affording adequate laboratory accommodation for the prosecution of research work. In this connection it has been considered advisable to have several small laboratories for one or two workers where undisturbed work can be carried on rather than large laboratories capable of accommodating a number of workers.

The laboratories comprise :—

A Large Routine Laboratory.—This room is furnished with both side and roof lights, and is fitted with centre and side benches, fume chamber, &c. It is used for general chemical work, for the filtration of diphtheria toxins, for fitting up apparatus, and for such work as section-cutting and blow-pipe work.

Two Private Research Laboratories.—These rooms are well lighted with a north-east aspect. They are completely equipped as bacteriological laboratories, have low benches for microscopical work, and separate Hearson incubators, shelves for reagents, media, &c.

The Serum Laboratory.—The windows in this room are of ruby glass so as to ensure a non-actinic light. It is used for the filtration and storing of the various sera, and contains two large ice-safes for that purpose. It is fitted with a work bench which has connections with a water-vacuum pump, and is also furnished with a Geryk pump.

The Engine Room is fitted with a gas engine driving a large Runne's centrifugal machine and a disintegrator. There is also a Root's blower, which supplies sterile air to the bottling room. There is a water-pump supplying a vacuum and high-pressure air to the neighbouring rooms.

The Incubation Room is a small insulated room, the insulation being obtained by its having double walls, the space between which is packed with asbestos. It has two doors forming a small "air-lock" to prevent the inrush of cold air on opening the door. By means of a gas stove and Roux regulator the temperature is maintained at body-heat. This room is used for the cultivation of the different microorganisms used in connection with the work of the establishment.

The Bottling Room is reserved entirely for filling the serum into flasks. The windows are of non-actinic ruby glass, and are air-tight. Before bottling is commenced the room is filled with formalin vapour, which is allowed to remain in the closed room all night. In the morning the formalin vapour is displaced by a current of cold air from the outside of the building, which is blown into the room by the Root's blower in the engine room. This air is sterilised before its entry by passage through a large filter of sterile cotton wool. The current of sterile air is maintained throughout the process of bottling, entering the room through the filter and passing out by an exit in the roof through a cotton-wool filter.

The Culture Medium and Sterilising Room.—This room is used for the preparation and sterilising of the media employed in the cultivation of the various microorganisms. It is fitted with autoclaves, steam sterilisers, thermostats, &c. This room communicates with the cultivation room by double doors, through which the flasks can be passed after inoculation, thus avoiding lowering the temperature of the hot room by repeatedly entering it.

The Glass Cleaning Room contains a dry-heat disinfector for sterilising the glass apparatus, and is fitted specially for the purpose of cleaning and sterilising glass apparatus.

An Isolated Laboratory stands entirely apart from any other building. It is used for the preparation, filtration, and precipitation of such things as tetanus toxin, &c., and for the examination of small animals.

At a considerable distance from the main laboratories, there is a complete small department with stables for carrying on work in connection with other infectious diseases, in addition to those previously mentioned.

The Animal Houses are ordinary garden greenhouses which have been adapted and prove excellent for the purpose, as they are easily kept to an even temperature. The largest is used as an experimental animal house for the housing of animals employed in the testing of the sera, toxins, &c. The roof is covered with vines, which have been retained as affording a shelter from the sun in summer. The two smaller houses are used for breeding purposes. The three houses are heated by a system of hot water pipes.

The Principal Stables form two blocks of buildings about 200 yards from the laboratories. They are all brick, and of the most modern type. There are two yards, the first of which is covered by a high glass roof, and opening from this yard is the operating room, where the horses are injected and bled. The stabling consists entirely of loose boxes, which are very well ventilated, and are all of a large size, so that the animals have ample room to move about freely.

In the vicinity of the operating room is a small isolated room with slate benches, where the blood flasks are allowed to stand, and where the serum is decanted.

In one of the meadows, at a distance from the stables, is a loose box which is used as an isolation box. All new horses here undergo a period of quarantine. There are several other loose boxes in the various meadows, as well as an isolated cow-shed, goat-house, pigeon-house, rabbit-runs, &c.

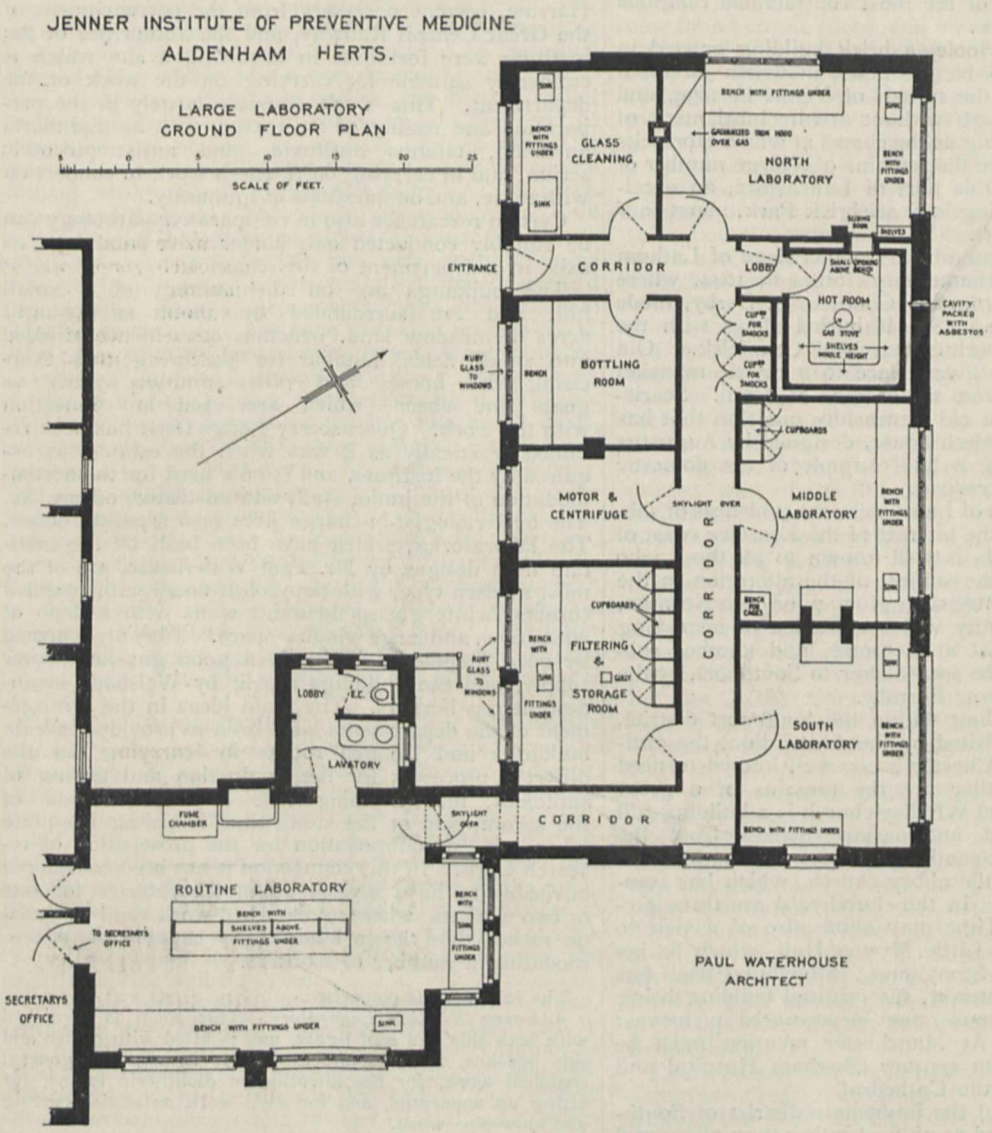


FIG. 1.—Plan of New Laboratories of the Jenner Institute at Elstree, Herts.

ARCHÆOLOGICAL DISCOVERIES IN CRETE AND EGYPT.

THE undoubtedly close connection which existed between the Bronze age civilisations of Greece and Egypt is now generally recognised by archæologists. Not only was Egyptian influence on the development of the "Mycenæan" culture always very marked, especially from the period of the thirteenth Egyptian dynasty (B.C. 2000) to the end of the eighteenth (B.C. 1400), but the most recent discoveries seem to point to the unlooked-for conclusion that the two chief civilisations of the Eastern Mediterranean may have had a common origin, presumably in Africa. Certainly the further we go back the more striking are the parallels between early Egyptian and early Greek culture. It is, then, nowadays natural to group together the archæological discoveries which are being made in Egypt and in Crete, which was apparently the seat of the most fully developed phase of the Greek civilisation of the Bronze age.

During the present season (1903) Mr. A. J. Evans and Mr. Mackenzie have pursued the investigation of the great palace of Knossos in Crete, the legendary seat of the Minoan dominion over land and sea. The chief discoveries of the year are:—(1) a stepped theatre, after the fashion of that at Phaistos, but smaller and not so well preserved, lying to the west of the north gate; (2) a building, perhaps a small sanctuary, lying immediately north of the north gate, and directly in the line of its axis; (3) a house, lying a quarter of a mile to the north-east, on the slope of the hill, overlooking the stream of the Kairatos; and (4) two magnificent bronze vases, one of them closely resembling a type depicted among the offerings of the Keftian Cretans in the tomb of Rekhmara at Thebes in Egypt, *circa* 1550 B.C.

The house is remarkable, and contains a room with an apsidal end; it is, in fact, a sort of prototype of the basilica, which is now carried back to Mycenæan days!

What next year's excavations may bring forth it is impossible to guess, but there certainly seems no end to Knossos.

The Italian excavations at the small palace of Agia Triada, near Dibàki, in the Messarà, are proceeding under the direction of Prof. Halbherr and Drs. Pernier and Peribeni; the finds have been important, consisting of fragments of stone vases decorated with reliefs representing gladiatorial combats, bull-fights, and the presentation of spears to departing warriors by a king, and of a hoard of great talents of copper and bronze, measuring each more than a foot long, which are identical in type with the metal ingots brought as tribute to Egypt by the Keftians. The vases are of the same kind as that representing a harvest-home procession, found at Agia Triada last year.

The American and English excavations at Gournià and Palaiokastro, under Miss Boyd and Mr. R. C. Bosanquet respectively, have produced interesting results, especially in the domain of pottery and small cult-objects, of which Palaiokastro and a hill-sanctuary in its vicinity have afforded numbers of interesting examples.

Apart from the discovery of the tomb of King Thothmes IV. by Mr. Carter at Thebes, and of a small portrait figure of King Khufu (Cheops), the builder of the Great Pyramid, by Prof. Petrie at Abydos, the most interesting excavations undertaken during the past season in Egypt have been those of Mr. Garstang at Beni Hasan. Below the well-known large tombs of the Twelfth Dynasty nomarchs, he has discovered a row of Sixth Dynasty sepulchres, and a great number of "pit-tombs," of the Eleventh and early Twelfth Dynasties. In some of these, notably in that of Nefer-i, a physician, has been discovered the funeral furniture intact. This, as is usually the case with burials of this period, included numbers of wooden models of the boats in which the mummies were ferried across the stream to the necropolis, and of the Nile-ships in ordinary use, with their crews, &c., notably a war-ship on which is a group of two men playing chess under a canopy, formed of two of the great cow-hide shields in use at the time; a similar shield-canopy is seen on a boat of the same period in the British Museum, No. 35293. Models of granaries and model groups of fellahîn engaged in their daily avocations were also found. Photographic records were taken of the various stages of the opening of all tombs, more than 450 negatives being secured. This is a most satisfactory feature of Mr. Garstang's excavations. It is also satisfactory to know that most of the finds will be placed in public museums and private collections in England. The results of the Cretan excavations have to remain in Crete, housed in a ramshackle Turkish *ex*-barrack, the floors, staircases, beams, and pillars of which are of wood, and in which smoking is freely permitted. The collections brought together there by the energy of English, American, and Italian excavators are unique, and include many classes of objects, *e.g.* the inscribed tablets from Knossos, which are unrepresented in the properly built and protected museums of Europe. It would, indeed, be deplorable if the treasures of Knossos, which have survived one conflagration—that in which the palace was destroyed—were to perish in another.

WHITE SPOT ON SATURN.

ON July 1, after observing Jupiter for some time, I directed my 10-inch reflector to Saturn, and found the details sharply defined. The dusky north polar cap was very distinct, and so was the dark belt on the north side of the equator. The belt was darkest and more strongly outlined on its southern side, probably by contrast with the bright equatorial zone. I soon noticed a large bright spot on the north side of the belt, and in a position nearing the western limb of the planet. It was followed by a diffused dusky marking. The luminous spot must have been on the planet's central meridian at about 14h. 1m., but this is only a rough estimate, as the marking was far past transit when I first saw it. It is to be hoped that this feature will prove fairly durable, in which case it may be expected to furnish an excellent means of redetermining the rotation period of Saturn.

A telegram from Kiel (mentioned in your last number) states that Barnard, of the Yerkes Observatory, saw a white spot in Saturn's N. hemisphere central on June 23, 15h. 47·8m. Williams Bay time. Allowing for the difference of longitude, this would be 21h. 42m. G.M.T. Adding eighteen rotations of Saturn of about 10h. 14m. will bring us to the time when the spot was approximately in transit as observed at Bristol, and there seems no doubt as to the identity of the objects.

This disturbance on Saturn will recall Prof. Asaph Hall's white spot seen in the winter of 1876–7, and followed from December 7 to January 2. A number of transits of this object were observed by Hall, Eastman, Newcomb, Edgecomb, and A. G. Clark, and from the data obtained the former found the rotation period of Saturn to be

10h. 14m. 23·8s. ± 2·30s. mean time.

The spot lengthened out into a bright belt, and soon lost its distinctive character.

Should the present object remain visible, it will be on or near the central meridian of Saturn on July 10, 13h., July 13, 12½h., and July 16, 12h. 10m.

W. F. DENNING.

NOTES.

THE visit of President Loubet to England, as a guest of the British Court, is an event which should not pass unnoticed in the scientific world; he comes as the representative of the French nation. On many occasions President Loubet has shown interest in scientific meetings and congresses held in France, and has extended the warmest hospitality to the foreign members who attended them. His country takes a place in the foremost rank of those which are contributing to the advancement of science, and the names of leading French investigators are familiar words not only in the British Isles, but in all places where scientific knowledge is cultivated. It is a pity that the British associates and correspondants of the Academy of Sciences have not taken the opportunity to welcome President Loubet, as the representatives of the scientific interests of both nations. Such an act of simple courtesy ought not to have been omitted.

LORD KELVIN and Lord Lister have been elected honorary members of the Royal Society of New South Wales.

LORD LISTER has been admitted to the honorary freedom of the Merchant Taylors' Company in recognition of his "long and valuable services to the country, and particularly to surgery, by the discovery and application of the antiseptic treatment."

AT a meeting held last week in the rooms of the Royal Statistical Society, it was resolved to form a society for the promotion of scientific and philosophical studies in sociology. A committee was appointed to consider the question of the scope and aims of the society, and to draft a constitution to be submitted to a meeting in the autumn.

A PARIS correspondent writes:—On July 3 the *Temps* resolved to send a message round the world by telegraphy, using the Anglo-French system of transoceanic cables. The message was sent from Paris at 11 a.m., and consisted of the two words *Temps*, Paris, with the indication of the route, *viâ* Malta, Aden, Singapore, Brisbane, Vancouver, and French Atlantic Cable. As the indication of the route is not paid for, the cost of the experiment was only 13*s*. 1½*d*. No previous explanation or preliminary notice had been served to the several companies, but the organisation of the Anglo-French system is so perfect that the message arrived at the *Temps* office at 5.30 p.m. The time spent had been six hours for travelling about 40,000 miles, a measure of the commercial speed of electricity on the occasion of the inauguration of the American, Sandwich, Philippine, and Hong Kong system.

THE automobile races in Ireland last week give remarkable evidence of the power and perfection of modern motors. The race for the Gordon Bennett Cup, over a course of 370¾ miles, was won by a German car, driven by a Belgian, M. Jenatzy. The net time spent in covering this distance was 6h. 39m., which gives an average of nearly 56 miles per hour on ordinary roads. The second place was taken by a French car, the time being 6h. 50m. 40*s*. Three other competitors finished the race, two of them driving French cars, while the fifth place was taken by an English car. Some extraordinary speeds were attained by automobiles over a course in Phœnix Park, Dublin, on Saturday. For racing purposes the programme was divided into three sections, one for motor cycles, one for touring cars, and one for racing cars. The fastest motor cycle travelled at the rate of 48·2 miles an hour, and the fastest touring car at 46·5 miles an hour. In the racing section a Décauville light racer covered the course in 1m. 53 1-5*s*., at the rate of 62½ miles an hour; a 60-h.p. Mercédès at the rate of 78 miles an hour; a 70-h.p. Mors at the rate of 83 miles an hour, and also at 85·9 miles an hour.

REUTER'S Agency is informed that Commander Irizar, the Argentine naval officer who will command the relief expedition which is being sent out by the Argentine Government in search of Dr. Otto Nordenskjöld's South Polar Expedition, will leave for Buenos Ayres in a few weeks. The ship—the *Uruguay*—will be in charge of Argentine officers and crew, and will be provisioned for two years. It is not, however, probable that she will winter in the Antarctic.

THE eighty-sixth annual meeting of the Société helvétique des Sciences naturelles will be held at Locarno on September 2–5. At the same time and place the annual meetings will be held of the Swiss societies of geology, botany, zoology, and chemistry, and the Zurich Physical Society. In addition to the general and special meetings, there will be several receptions, banquets, and excursions to places of interest. The officers of the annual committee are M. A. Pioda, president, Prof. G. Mariani, vice-president, Dr. R. Natoli and M. C. Orelli, secretaries.

AN expedition recently left Baltimore for the purpose of making an exhaustive study of the Bahama Islands, and presenting reports upon them to the United States Government. We learn from the *Scientific American* that the expedition originated with Prof. George B. Shattuck, of the Johns Hopkins University, and is under the auspices of the Geographical Society of Baltimore, which defrays a portion of its expenses. Some of the principal lines of investigation will be concerned with the animal and plant life of the islands. The geology of the group will also be examined, and a bench mark will be left with the view of ascertaining to what extent, if any, the Bahamas are sinking or rising above sea level. The industries will be made the subject of a special chapter of the reports, as well as the physical condition of the inhabitants, the extent of the commerce of the principal towns, and any other economic features which may suggest themselves. An elaborate outfit of scientific apparatus for studying the meteorology and climatic conditions, for microscopic examination, and for photographic work has been provided. The diseases which may be prevalent and general sanitary conditions will be included in the investigation. This portion of the work will be in charge of Dr. Clement A. Penrose, of Baltimore, assistant director of the expedition.

IN NATURE of April 30 (vol. lxvii. p. 601) Prof. J. J. Thomson put forward the view that the energy of the Becquerel radiation given out by radio-active substances is produced by a change in the configuration of the atom. Dr. J. Stark writes from Göttingen to state that this view was suggested by him in his book "Die Elektrizität in Gasen" (Leipzig, 1902, p. 34), and later in the *Naturwissenschaftliche Rundschau* (January, 1903). Dr. Stark adds:—"As the transformation of atoms in some elements is still going on, it may be supposed that there was a time when our chemical atoms did not exist in the present amount, while other types of matter were more common. In the later change of the arrangement of the positive and negative electrons, or in the genesis of the present chemical atoms, a very large amount of the potential energy of their electrons was transformed to kinetic energy. The energy liberated in the change of chemical atoms is of a higher order of magnitude than that produced in known chemical reactions. Therefore it is reasonable to suppose that the temperature of the sun and stars is partly due to the genesis of chemical atoms."

THE prospect of active work in connection with the ship canal across the Isthmus of Panama has directed attention to the climate of the district, in which engineering work of exceptional difficulty will have to be undertaken. The results are generally reassuring, and with ordinary care a repetition of the horrors that accompanied the construction of the Panama railway need not be feared. The most noticeable feature in the temperature factor is its constancy throughout the year, the monthly range, in the mean, being confined between 78°·4 and 80°·1. The daily range on the coast is from 68° to 87°, and in the interior from 64° to 94°. It is easy to see the effect of the oceans in thus limiting the range of temperature, but necessarily there is an increase in the humidity, which is always high, throughout the year. There is a great difference in the rainfall on the Pacific and on the Atlantic coasts; about 140 inches may be anticipated on the former, while only half that amount will fall on the Atlantic side. From January to April the fall is very slight throughout the Isthmus, and therefore several successive months of dry weather can be counted upon, which cannot but be of great advantage in the engineering operations. Winds are always light, and give no trouble. Greater velocities than twenty miles an hour are rarely met with. The general health statistics are not unfavourable. Recent inquiries show that the mortality due to diseases of the climate has steadily diminished since 1881, while the percentage of deaths arising from European diseases has not increased. Of the total death rate, 91 per cent. is due to chronic organic diseases common to all countries, and only 9 per cent. is chargeable to local effects. This material improvement is due, in some measure, to the fact that the excavations have reached a level below the poisonous emanations of decaying organic matter, while, on the other hand, greater sanitary precautions have reduced the effects of the most deadly of the infectious diseases, yellow fever. Colon has been practically free from this scourge for some time, but improvements in Panama are loudly demanded.

IN the *Rendiconto* of the Naples Academy for April, Prof. Ernesto Pascal gives the integration of a differential equation of Riccati's form, but of a more general character than those previously considered. The right-hand side of Prof. Pascal's equation contains three constant coefficients, and the equations integrated by Malmstén, Brioschi, and Siacci are the particular cases deduced by putting one or other of these coefficients equal to zero.

VOL. v., No. 1, of the series of monograph supplements of the *Psychological Review* is a thesis by Dr. Joseph W. L. Jones on "Sociality and Sympathy." The author traces the development of consciousness to the point at which "consciousness of kind" emerges, and discusses the gradual evolution of social relationships and the rise of sympathy in any given race.

DR. COSTANTINO GORINI discusses in the Lombardy *Rendiconti* the remarkable power exhibited by the typhus bacillus of spreading along the surfaces of solids in contact with the nutrient liquid. This effect the author considers is due to the formation of filaments rather than to the mobility of the bacteria themselves, but it suggests the danger which may arise from watering food-plants with water containing the bacteria.

A REPORT on the dilatation of steel at high temperatures is given by MM. G. Charpy and L. Grenet in the *Bulletin de la Société d'Encouragement* for May. The most noticeable features brought out in the experiments were the sudden contraction at a temperature of about 700° common to carbon steels, the existence of a second point of contraction at about 300° in tempered steel containing 0·65 to 1 per cent. of carbon, and of a further point of contraction near 150° for tempered steels with more than 1 per cent. of carbon, and the absence of any observed relation between the dilatation-curves of nickel steel and their magnetic properties.

THE eleventh volume of the *Atti* of the Naples Academy of Physical and Mathematical Sciences contains a monograph by G. de Lorenzo and Carlo Riva on the crater of the Astroni, one of the most remarkable craters in the Phlegrean fields. It derives a melancholy interest from the fact that, before its completion, Signor Riva met with his death in the prime of life while ascending Monte Grigna from the Lake of Como. Another noteworthy feature is the monograph of 220 pages on the totality of prime numbers up to a given limit, by G. Torelli.

UNDER the title of "Bathymeter," Mr. Leonard Murphy describes in the *Economic Proceedings* of the Royal Dublin Society a simple apparatus for gauging the depth of liquids in wells and tanks. An air tube dips into the liquid to be measured, and an air compressor is connected both with this tube and with a reservoir of liquid into which there dips a gauge glass. On working the compressor the liquid in the gauge glass rises until the pressure is sufficient to force the air out at the bottom of the air tube, and the height of liquid in the gauge glass then indicates the height of liquid in the well above the end of the tube.

IN the *Annali di matematica pura ed applicata*, Signor T. Levi-Civita deals with singular solutions in the problem of three bodies or particles which attract each other according to the Newtonian law. The only case in which singular solutions occur is when, at some instant of the motion, two of the particles coincide; this involves an impact between the particles. The motion in which the particles are approaching impact is called by the author a trajectory of collision, the reversed motion being a trajectory of ejection. The case discussed is that in which the bodies are moving in one plane, and the mass of one is negligible compared with those of the other two.

FROM the *Economic Journal* we take the following table of the ages of German university professors in the year 1901, quoted from an article by Dr. F. Eulenburg in the *Jahrbücher für Nationaloekonomie*:—

Age	30	35	40	45	50	55
Number ...	2	23	124	206	256	262

Age	60	65	70	75	80	85
Number ...	197	194	108	36	18	3

where the upper figures represent ages, and the lower figures represent numbers of German professors in 1901 in the intervals between those ages. In 1890 the maximum number was between the ages of forty-six and fifty.

IN *Cosmos*, M. Lucien Fournier discusses the phenomenon recently described as the "flow of marble," which results in a gradual bending or deformation of marble blocks, as was described by Dr. T. J. J. See in a letter to NATURE of November 20, 1902 (vol. lxvii. p. 56). Among the theories proposed to account for the effect, the actions of sunshine and moisture have hitherto received support. M. Fournier now suggests another possible cause—elasticity. It is observed that blocks of granite frequently expand when they have been relieved from the pressure of the surrounding rocks in the process of quarrying. It is now suggested that a similar cause may account for the bending of the blocks of marble, and this explanation would account for deflections which assume a different direction from that which would be expected if heat and damp were the causes.

THE *Journal de Physique* contains two short papers by M. R. Blondlot on a new kind of light obtained originally after filtering the rays from a focus tube through aluminium or black paper. In studying the action of the radiations on an electric spark, they were shown to present the phenomena of rectilinear polarisation, and it was further found that both quartz and sugar produced rotatory effects. On passing the rays through a plate of mica, double refraction took place; finally, the existence of refraction was proved by concentrating the rays with a lens, and reflection was also observed. It followed that the radiations were entirely different from Röntgen rays, and must be attributable to a new kind of light. In the second paper in the July number, M. Blondlot finds that radiations possessing identical properties are obtained from an Auer lamp, and that the new rays will pass through certain metals and substances which are opaque to the radiations discovered by Prof. Rubens.

IN the *Proceedings* of the Royal Society for March, Mr. H. M. Macdonald, F.R.S., gave an investigation of the bending of electric waves round a spherical obstacle, which was suitable to explain Mr. Marconi's successes in employing wireless telegraphy over distances representing considerable arcs of the earth's circumference. Mr. Macdonald's solution has been called in question in papers communicated to the Royal Society by Lord Rayleigh and M. Poincaré. It is pointed out that Mr. Macdonald's conclusion as to the diffraction taking place without the production of any sensible shadow does not agree with the results known in the case of light; indeed, if the conclusion were accepted without any limitations, there would necessarily be daylight all night. From a mathematical point of view the results depend on the assumption that the spherical functions entering into the expression for the potential satisfy a condition of the form $dW/dr = ikW$; this is true in the case of spherical functions of low order, but unless the series for the potential is uniformly convergent, the solution may involve spherical functions of high order, for which the condition in question does not hold good.

WE have received from Prof. B. Sresnevsky a pamphlet containing synoptic tables of the daily rainfall values at all the meteorological stations of the Russian Baltic provinces for the year 1900.

THE *Transactions* of the South African Philosophical Society for April last contains a lengthy contribution by Mr. J. R. Sutton, superintendent of the De Beers meteorological station at Kenilworth, Kimberley, on the results of some experiments upon the rate of evaporation. For, as the author points out, of the dozens of patterns of evaporators, not one has hitherto been unreservedly accepted as a standard, and the results obtained from some of them show a rate of evaporation fully twice as great as others. The greatest mean annual result of seven years' observations by the author gives an evaporation of 90·11 inches, and was obtained from a copper pan about 5 inches deep and 8 inches in diameter, kept nearly full of water, and protected from the sun's rays. The monthly means varied from about 3 inches in June to nearly 12 inches in each of the months November and December. For the year 1900, the comparative annual values given by four evaporators are:—8-inch copper pan, 90·82 inches; a screened iron tub, enamelled white inside and out, 14 inches in diameter and 20 inches high, 61·98 inches; circular steel tank, nearly 4 feet in diameter and 30 inches deep, 55·21 inches; a Piche evaporating tube of the usual pattern, 82·83 inches. The author finds (1) that the most potent agency regulating the rate of evaporation was the humidity of the air; (2) that a wind factor is suggested; and (3) that the great perturbing influence attributed to the temperature of the water has not been exactly confirmed. The paper will well repay a careful study.

EVIDENCE of a connection between the occurrence of thunderstorms and the moon's age has been referred to in NATURE on several occasions. Prof. W. H. Pickering gives a table in *Popular Astronomy* to show the results of investigations of this relationship by various observers. From this table, which is abridged below, it will be seen that, with one exception, the number of thunderstorms occurring near the first two phases of the moon is greater than the number occurring near the last two.

The Moon's Phases and Thunderstorms.

Station.	Authority.	Years.	New and First Quarter.	Full and Last Quarter.
Kremsmünster ...	Wagner	86	54	46
Aix la Chapelle ...	Polis	60	54	46
Batavia, Java ...	Van d. Stok ...	9	52	48
Gotha	Lendicke ...	9	73	27
Germany	Köppen	5	56	44
Glatz County ...	Richter	8	62	38
N. America ...	Hazen	1	57	43
Prague	Gruss	20	51	49
,, ...	,, ...	20	53	47
Göttingen	Meyer	24	54	46
Greenwich	MacDowall ...	13	54	46
Madrid	Ventatasta ...	20	52	48
Providence, R.I.	Seagrave	6	49	51

Prof. Pickering adds:—"The number of observations here collected seems to be large enough to enable us to draw definite conclusions, without fear that further records will revise or neutralise them. From these observations we conclude that there really is a greater number of thunderstorms during the first half of the lunar month than during the last half, also that the liability to storms is greatest between new moon and the first quarter, and least between full moon and last quarter. Also we may add that while theoretically very interesting, the difference is not large enough to be of any practical consequence. Thus it would seem that, besides the tides and certain magnetic disturbances, there is a third influence that we must in future attribute to the moon."

FRESH evidence is continually coming to light to prove the artistic skill of the cave men of late Palæolithic times. M. E. Cartailhac has begun a memoir in *l'Anthropologie* (tome xiv. No. 2) on the stations at Bruniquel, on the banks of the Aveyron, which will add materially to our knowledge of these interesting people. Especially remarkable is an engraving, published by the same author (p. 179), of two bands of horses in alignment on a slab of stone from the main cave at Chaffaud, Vienne. This is the first example of regular grouping, and an indication of perspective in Palæolithic pictorial art.

THE shell-heaps of the Lower Fraser River, British Columbia, have been carefully investigated by Mr. Harlan I. Smith in connection with the Jesup North Pacific Expedition, and his results are now published, with numerous illustrations, in the *Memoirs* of the American Museum of Natural History, vol. iv. These shell-heaps seem to have certain peculiarities of their own; the objects found in them are more numerous and of higher artistic

value than those found in the coast shell-heaps, and skeletons are frequently found in the former and but rarely in the latter. It is probable that at an early time a migration took place from the interior to the coast and Vancouver Island. This migration carried the art of stone-chipping, pipes and decorative art to the coast. The culture of the ancient people who discarded the shells forming these heaps was in all essential particulars similar to that of the tribes at present inhabiting the same area, but it was under a much stronger influence from the interior than is found at the present time.

ARCHÆOLOGICAL excavations have been made by Lieut. L. Desplagnes in the tumuli of Killi, in the region of Goundam, in the neighbourhood of Timbuktu (*cf. l'Anthropologie*, tome xiv. p. 151). The mounds appear to have been the tombs of chiefs, along with whom were buried women and captives, and large quantities of offerings of various kinds. The originators of these funeral monuments surpassed the existing people of the district in the art of making varnished pottery and in the fabrication of bronze. The presence of marine shells shows that they had relation with maritime peoples, and other objects prove an extensive commerce. There appears to be some evidence that these unknown people were partly related to the Berbers, and that they were overwhelmed by the spread of Islamism in the eleventh century. The author thinks that perhaps certain isolated peoples whom he mentions may be the fugitive remnants of this formerly relatively advanced nation.

A MEMOIR on the geology of North Arran, South Bute, and the Cumbraes, with parts of Ayrshire and Kintyre, has just been issued by the Geological Survey. It is the work mainly of the late William Gunn, with contributions by Sir A. Geikie, Dr. Peach, and Mr. A. Harker, and is an explanation of Sheet 21 of the one-inch map of Scotland. A great variety of subjects is dealt with, as may be gathered from the lengthy table of formations represented, and there is much to justify the statement referred to by the authors, that the geology of Arran is an epitome of that of Scotland. The central granite mass forms the dominant feature, rising to 2866 feet at Goatfell, and it is bordered by the older metamorphic rocks, schists into which, as observed by Hutton more than a century ago, the granite has been intruded. Rocks probably of Arenig age, black schists, cherts and grits, similar to those of Ballantrae, and associated with old lavas and tuffs, have been discovered in the course of the survey. Notable additions have also been made to our knowledge of the volcanic rocks, and especially with respect to a huge volcanic vent, probably of Tertiary age, in which are preserved remnants of Rhætic, Liassic and Cretaceous formations, hitherto unrecognised in the region. Full particulars are given of the granite, and of the dykes and sills of felsite and quartz porphyry, pitchstone, and other rocks. The Old Red Sandstone and the Carboniferous rocks, the determination of the Triassic age of the newer red sandstones, conglomerates and marls, and the accounts of the Glacial phenomena and economic geology, furnish many topics of great interest. The memoir contains ten photographic plates, and is issued at the price of 4*s*.

THE additions to the Zoological Society's Gardens during the past week include a Pinche Monkey (*Midas oedipus*) from Colombia, presented by Mr. E. G. Percy; two Grey-headed Love-birds (*Agapornis cana*) from Madagascar, presented by Miss Luff; a Whistling Swan (*Cygnus columbianus*) from North America, presented by Dr. Cecil French; a Mexican Snake (*Coluber melanoleucus*) from Mexico, presented by Mr. W. G. Kershaw; two Whistling Swans (*Cygnus columbianus*), a Mocassin Snake (*Tropidonotus fasciatus*), a King Snake (*Coronella getula*), two Mexican Snakes (*Coluber melanoleucus*), a Seven-banded Snake (*Tropidonotus septemvittatus*), two Testaceous Snakes (*Zamenis flagelliformis*), a Striped Snake (*Tropidonotus ordinatus sirtalis*), a Long-nosed Snake (*Heterodon nasicus*) from North America, a Chained Snake (*Coluber catenifer*), a Couch's Snake (*Tropidonotus ordinatus couchi*) from California, a Horned Lizard (*Phrynosoma cornutum*) from Mexico, two Smooth Snakes (*Coronella austriaca*), an Ocellated Sand Skink (*Chalcides ocellatus*), European; a Black-faced Spider Monkey (*Ateles ater*) from Eastern Peru, a Common Rat Kangaroo (*Potorous tridactylus*), two Brush Bronze-winged Pigeons (*Phaps elegans*) from Australia, a Banded Aracari (*Pteroglossus torquatus*) from Central America, a Rat-tailed Opossum (*Didelphys nudicaudata*), a Salvin's Amazon (*Chrysotis salvini*) from South America, two Cutthroat Finches (*Amadina fasciata*) from West Africa, deposited; a Yak (*Poephagus grunniens*), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

COMET 1903 *c*.—The following elements and ephemeris have been computed by M. G. Fayet, Paris, from observations made on June 22, 24, and 27, and published in *Circular* No. 60 of the Kiel Centralstelle:—

Elements.

T = 1903 *Aug.* 28·4715 (*M.T. Paris*).

$\omega = 125^\circ\ 56'\ 53''$
$\Omega = 293\ 38\ 40$ } 1903 0.
$i = 84\ 6\ 48$
log q = 9·539534

Ephemeris 12*h*. (*M.T. Paris*).

1903		α h. m. s.		δ ° ′		log Δ	Brightness
July 5	...	21 27 33	...	+12 10·9	...	9·6105	... 4·5
,, 9	...	21 6 46	...	+24 44·8	...	9·5213	... 7·6
,, 13	...	20 26 15	...	+38 57·9	...	9·4322	... 12·9
,, 17	...	18 53 22	...	+60 43·0	..	9·4424	... 14·1
,, 21	...	15 46 14	...	+68 40·8	...	9·4948	... 12·9

On July 13 the comet will, according to the above ephemeris, be about 7m. 20s. following, and 58′·9 south of γ Cygni, whilst on July 21 it will be seen in the constellation Draco a little more than one-third the distance from γ Ursæ Minoris to η Draconis on a straight line joining these two stars.

The above scale of brightness takes for its unit value the brightness at the time of discovery, and on June 25, when the value on this scale was about 1·4, M. Pidoux recorded that the comet was equal in brightness to an eighth magnitude star.

PENETRATIVE SOLAR RADIATIONS.—In a paper communicated to No. 24 of the *Comptes rendus*, M. R. Blondlot describes some simple experiments he has performed which appear to show that certain rays (which he calls "the *n* rays") emitted by the sun are capable of passing through various kinds of wood, metals, &c. He placed a fine glass tube containing a phosphorescent material, *e.g.* sulphide of calcium, in a darkened room in which there was a window exposed to the sun, but closed by means of an oaken shutter 15mm. thick, and then found that the phosphorescent material, which he had previously exposed for a very short time to feeble sunlight, continued to glow, but if a plate of lead were interposed between the shutter and the tube the phosphorescence became feebler, whilst it again increased when the lead was removed. Then an oaken joist 3cm. thick, a piece of cardboard, and several plates of aluminium were successively interposed, and the

phosphorescence emitted did *not* diminish, but a thin layer of pure water entirely arrested the *n* radiations. These radiations may be concentrated by a quartz lens, but are regularly reflected by a polished glass surface, whilst an unpolished glass surface diffuses them.

THE SPECTRA OF METALS AND GASES AT HIGH TEMPERATURES.—In No. 25, vol. xxxviii., of the *Proceedings* of the American Academy of Arts and Sciences, Prof. J. Trowbridge gives the details and results of an exhaustive series of experiments on the spectral phenomena observed when gases and metals are together subjected to high temperatures. Employing a large variety of conditions as to the temperature employed, the size of the capillary tubes and the materials from which they are made, and the distance and material of the poles, Prof. Trowbridge arrives at several interesting conclusions, all of which tend to show that in many cases the lines obtained are possibly due to products of the interactions between the gas, the poles, and the containing tube, which take place at high temperatures, rather than to the elements themselves. For instance, the metallic lines obtained from terminals placed 1cm. apart in rarefied air, or hydrogen, were reversed, the reversal coinciding in position with the line obtained in ordinary air, but the line was much broadened on the least refrangible side. The author suggests that this indicates the presence of a gaseous product, probably due to the oxidation or hydration of the poles. Again, when highly heated and rarefied hydrogen, or air, was passed through a tube of amorphous silicon or glass, broad bands, coinciding with the fainter silicon lines obtained under ordinary conditions, were produced, and Prof. Trowbridge believes that in the case of highly refractive metals, such as silicon, these bands are not really due to the metals themselves, but to the interaction between the metals and gases present.

The experiments showed that iron lines did not appear under what seemed to be favourable conditions, whilst aluminium lines did appear under these conditions. For this reason the author enters a *caveat* as to the care it is necessary to exercise when classifying stars solely from the variations in the appearances of their respective spectra.

ZENITH-TELESCOPE RESULTS.—In vol. ii. part i. of the *Publications* of the University of Pennsylvania (Series in Astronomy), Mr. C. L. Doolittle, director of the Flower Observatory, gives the results obtained from the observations made with the zenith-telescope during the period September 6, 1898, to August 30, 1901. After describing the corrections applied to the observed values, the report gives full details of each observation and its corrections, and then gives the values of the "aberration constant" determined during 1898–1899 and 1900–June, 1901, as $20''{\cdot}540 \pm 0''{\cdot}0103$ and $20''{\cdot}561 \pm 0''{\cdot}0085$ respectively. A curve and a set of tables, showing the variation of latitude at Philadelphia from October 1, 1896, to August 30, 1901, are also included in the report.

PHOTOMICROGRAPHY WITH A BROWNIE CAMERA.

THIS article does not put forth anything new in principle, but is the explanation of a simple method by which any student can, with little trouble and little expense, produce his own photographs of microscope objects, the idea being to direct attention to the inexpensiveness of the necessary apparatus.

The apparatus required includes only a small microscope and a light "fixed-focus" camera, and, of course, the necessaries for developing the negatives. The writer used a microscope of the rigid type generally regarded as little more than a toy, and worth only a very few shillings, and a Brownie Kodak. The instruments need practically no alterations to make them fit for use; the utmost that need be done is this:—Cut a piece of rather thick cardboard the same size as the front of the camera, and in the centre of it make a round hole to fit the eye-piece of the microscope. Glue this to the camera front.

In use the microscope is focused on object for distinct vision for a normal eye. If the experimenter be long- or short-sighted, then he must use appropriate spectacles.

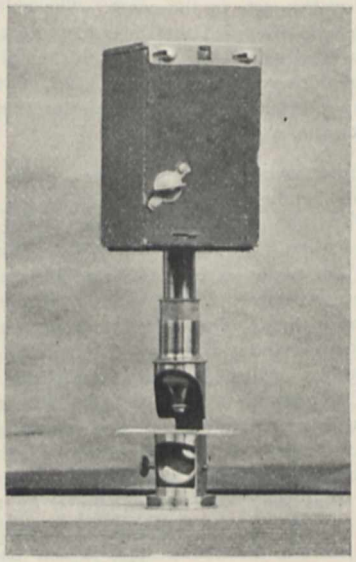
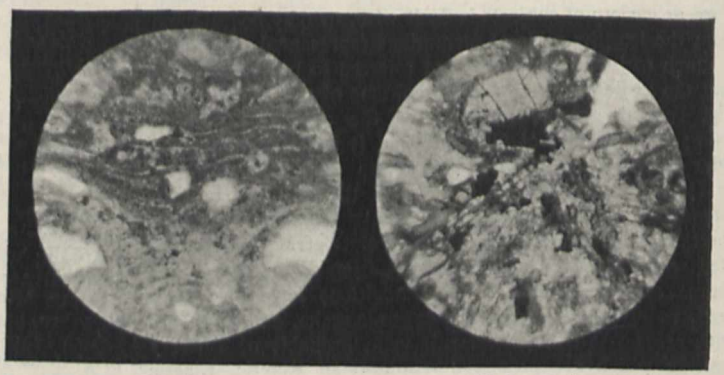


FIG. 1.

The light issuing from the eye-piece is thus rendered parallel, and if the camera be placed on the top of the eye-piece an image of the object will be in focus on the sensitive film. Of course, the optical axes of the camera and microscope must be parts of the same straight line, and the card glued to the camera is to assist the centring. The visual field is the exact area photographed.



Rhyolite. Olivine Diorite.

FIG. 2.

The exposure is made in the usual way, using the camera shutter. In the middle of a fine day exposures of from one to two minutes have been found ample, while in the evening ten or twenty minutes are necessary, using plates of the speed generally known as "Special Rapid." The Brownie camera is made for roll-films, but plates may be used thus:—The camera back is opened and a plate $2\frac{1}{2}'' \times 2\frac{1}{2}''$ laid on the frame over which the film is generally passed. On the back of the plate is placed a piece of black paper or thin card, and the back closed. This paper is necessary in order to exclude the light from the little red window, which is not non-actinic.

After exposure development is proceeded with in the ordinary way, using pyro-soda or any other developer the experimenter may prefer.

It will be seen from the specimens that the definition is, of course, not of the highest order, but considering the apparatus, one must not expect too much. The photo-

graphs are certainly more accurate than the student's sketches would be, and are probably made in less time. The lack of sharp focus at the edges is due to the cheap microscope used, and not to the camera, which is good enough for combination with any instrument likely to be employed in this manner. Any microscope and any similar camera may be used. The specimens reproduced show a magnification of ×20 diameters.

Considering the simplicity of the method and the slight cost of the apparatus, the idea should recommend itself to a good many students. W. Moss.

SEISMOLOGICAL NOTES.

IN the nineteenth report of the Tokio Physico-mathematical Society Dr. F. Ōmori gives two short papers on the velocity with which earthquake waves are propagated. In calculating these velocities it is assumed that the paths followed are in all cases arcual, and that a correct velocity is arrived at by dividing the distance between Tokio and a station in Europe by the difference in time at which similar phases of movement were recorded at two such places. As to the soundness of this method, excepting as applied to the large waves of earthquakes, opinions vary. In another note by the same investigator, attention is drawn to the difference in the character of seismograms obtained at two stations about a mile apart. At one station, two distinct groups of maximum movements are shown. These are explained as the longitudinal and transverse components of elastic vibrations simultaneously produced at the seismic centre. At the other station the records are described as a series of maximum movements at fairly regular intervals. This feature is attributed to a rhythmic interference between the proper oscillation of a soft surface soil and the movements of an underlying harder ground. In a discussion on *pulsations* or small movements of non-seismic origin, it is shown that the period of these corresponds to the period of preliminary tremors, from which it is inferred that for both of these movements their periods depend upon the nature of the soil where they are observed.

The thirteenth number of the *Publications* of the Earthquake Committee (Tokio) consists of a series of papers also by Dr. F. Ōmori, several of which are identical with those to which we have just referred.

Long registers are given for the year 1900, the earthquakes in each of which originated in the same locality or at great distances from the observing stations in Tokio. In the earthquakes with distant origins, the periods of the preliminary tremors do not depend upon their duration, the duration of preliminary tremors being proportional to the distance such earthquake motion may have travelled. This is probably true for other phases of motion, and it has also been shown to exist for *macro-seismic* disturbances.

Other analyses relate to the relative magnitudes of earthquake movements, direction of first displacements, and matters of greater or less seismological interest.

In the *Bulletin* issued by the Philippine Weather Bureau for December, 1902, the Rev. Marcial Solá, S.J., gives an account of a violent earthquake which originated near Manila, and was recorded at many stations around the world. Materials from twenty-three of these stations are analysed, and the velocities with which waves were propagated through and round the world have been calculated. For the first waves, along chords corresponding to axes less than 46°, the velocity was 10·2km. per second., whilst for longer paths, up to 154°, this became 12·4km. per second. The maximum phase, travelling on arcs, did so with a velocity of 3·1km. per second, the lengths of the waves varying between 106 and 181km. Although these results fall closely in line with those of other observers, it may be pointed out that, if the time at which the earthquake originated was known, the values for velocities arrived at would be somewhat reduced.

In the last *Bolletino* (vol. viii. No. 8) issued by the Seismological Society of Italy, Dr. Giulio Grablovitz contributes a short paper describing a modified form of his *vasca sismica*. This is a circular tank about 1·5m. in diameter and 1m. in depth. On this there is a floating tray, the movement of which at the time of earthquakes is recorded upon a rotating cylinder. The chief feature in the records obtained from such a fluid pendulum, the period of which is short, is that the indicated amplitude of the preliminary tremors is usually more pronounced than that shown by other types of instruments.

Dr. G. Agamennone gives an account of the earthquake which, on June 29, 1896, originated in Cyprus, and was recorded at stations more than 3000km. from its centre. With the assumption that the wave paths were *arcual*, the first movements were propagated with speeds slightly exceeding 13km. per second. It may be pointed out that these values would be reduced had the wave paths been considered *chordal*. The remainder of the *Bolletino* is taken up with earthquake registers. These commenced in January, 1895, and have now reached June, 1901. Inasmuch as they do not simply refer to earthquakes noted in Italy, but to earthquakes which have spread over the whole world, for this class of earthquakes the Italian catalogue is for many purposes the most valuable which seismologists possess.

ETHNOGRAPHICAL STUDIES IN NORTH QUEENSLAND.[1]

THE student of folk tale, custom and belief will find in the last *Bulletin* issued by Dr. Walter E. Roth a mine of trustworthy data which will furnish new illustrations of the working of the mind of a primitive people. Though similar stories, ideas and habits may have been recorded previously by various observers in this and other parts of the world, yet none the less this record is of value as it confirms the older accounts in their broad aspects, and gives instructive variations in details. Some of the customs appear to be peculiar to the North Queensland natives, while others are definitely Australian in character. The information is given in those short, pithy paragraphs to which Dr. Roth has accustomed us; at times we could wish for more detailed information, but, on the other hand, we are spared any unnecessary verbiage, and there are no hypotheses or guesses. It is a comfort not to have to pick out facts from a mass of writing, and also to feel that the information can be absolutely trusted.

Readers of Spencer and Gillen's memorable book, "The Native Tribes of Central Australia," will remember that the Arunta do not recognise the relation between the sexual act and conception; this seemed so strange that it was felt that some confirmation of this ignorance was needed, and Dr. Roth now gives it to us, for he says that though the relation is not recognised among the Tully River blacks so far as they themselves are concerned, it is admitted as true for all animals—indeed, this idea confirms them in their belief of superiority over the brute creation. Dr. Roth offers the following explanation of this strange belief:—"When it is remembered that as a rule in all these northern tribes, a little girl may be given to and will live with her spouse as wife long before she reaches the stage of puberty—the relationship of which to fecundity is not recognised—the idea of conception not being necessarily due to sexual connection becomes partly intelligible." Various other beliefs and customs connected with sexual history are narrated, amongst which may be mentioned the seclusion of girls at puberty, at which period, as in the western islands of Torres Straits, as Dr. Seligmann has pointed out, the girls are half-buried and surrounded by a leafy bower.

Numerous magical practices are described; many have for their object the procuring of disease or death, others are curative, some induce success in love, while others give luck in hunting or fishing. A vital principle, breath, thought, will-power, soul, spirit, or whatever it may be termed, is recognised by all the tribes, but some deny this to animals and plants, while others will grant it to animals but not to plants. Dr. Roth's explanation of the opinion widely spread among the white men that the blackfellow believes he is transformed into a white man at death, or, as it is expressed, "black jump-up white-fellow," is that the vital principle, or spirit, of a native may be reincarnated in a white man, and not that his body is actually transformed into that of a European. A number of illustrations further add to the value of this important publication.

A. C. H.

[1] North Queensland Ethnography, *Bulletin* No. 5. "Superstition, Magic and Medicine," by Walter E. Roth, the Northern Protector of Aboriginals, Queensland. (Home Secretary's Department, Brisbane, C.A. 5, 1903.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Allied Colonial Universities Conference is to be held at Burlington House to-day, July 9. Mr. James Bryce is to preside at the morning session, and Lord Strathcona and Mount Royal at the afternoon session. Official representatives have been appointed by the governing bodies of universities throughout the Empire to attend the conference. The universities of England and Wales, Scotland, and Ireland will be represented, and also fourteen Canadian universities, three Australian universities, New Zealand University, and the Cape of Good Hope University. Among the representatives appointed by colonial universities we notice the names of Prof. H. T. Bovey, F.R.S., Prof. E. Rutherford, F.R.S., Prof. J. G. MacGregor, F.R.S., Prof. R. Threlfall, F.R.S., Prof. Horace Lamb, F.R.S., and Prof. T. H. Beare. The following resolutions will be submitted:—(1) That in the opinion of this conference it is desirable that such relations should be established between the principal teaching universities of the Empire as will secure that special or local advantages for study, and in particular for post-graduate study and research, be made as accessible as possible to students from all parts of the King's dominions. Proposed by the Vice-Chancellor of Cambridge, seconded by the Vice-Chancellor of McGill University, Montreal, and supported by the principal of the University of London. (2) That a council, consisting in part of representatives of British and colonial universities, be appointed to promote the objects set out in the previous resolution, and that a committee be appointed to arrange for the constitution of the council. Proposed by the Pro-Vice-Chancellor of Oxford, seconded by Prof. R. Threlfall (representing the University of Sydney, New South Wales), and supported by the principal of the University of Birmingham. In addition to the above-named, Lord Kelvin, Sir Henry Roscoe, Prof. Rutherford, and several other representatives of universities have signified their intention of supporting the resolutions. Mr. R. B. Haldane, Sir Michael Foster, K.C.B., F.R.S., Sir Norman Lockyer, K.C.B., F.R.S., Mr. Fletcher Moulton, F.R.S., Prof. H. L. Callendar, F.R.S., Prof. J. A. Ewing, F.R.S., and Dr. H. P. Gurney (principal of the Durham College of Science) will also be among the speakers. A dinner will be held at the Hotel Cecil to-morrow evening, when the Prime Minister will occupy the chair.

IN an address delivered at a congregation of the University of Birmingham on Saturday last, the Chancellor, Mr. Chamberlain, described the progress and purpose of the university, and referred to the scheme for a post-graduate institute of applied science in London. In the course of his remarks Mr. Chamberlain said that, shortly after the idea of a university for Birmingham and district was put forward, the promoters found that much more than had originally been contemplated would be necessary to keep abreast of modern work and modern enterprise. Accordingly, a million of money was asked for instead of the quarter of a million originally contemplated. Up to the present time donations to the amount of something like 450,000*l.* have been received. Of that amount, 300,000*l.* are being spent in the first buildings of the new university. The City of Birmingham has voted a contribution equivalent to a halfpenny rate, which will provide an annual contribution which at the present time is between 6000*l.* and 7000*l.* a year. The county councils of Worcestershire and Staffordshire have contributed a present sum of 500*l.* per annum each. As to the purpose of the university, the view is perpetually borne in mind that it is to be a seat of all learning and an establishment for the promotion of original research. Every branch of learning which has its technical side will be separately represented by its own library, its own laboratory, and its own museum. The constitution of the university has undoubtedly given a stimulus to the higher education throughout the United Kingdom. Following the example of Birmingham, the colleges of Liverpool and Manchester, and also of Leeds, are developing themselves on the technical side, and are applying for independent charters as separate universities. And a scheme has been put forward for a technical college in London with similar objects to those of Birmingham University. When all these institutions are completed, there will be in our country, as there is already in Germany and in North America, a network of institutions all of which may help each other. These modern universities must of necessity be specialised to suit the conditions of the district in which they are established. May it not be, then, in the future that ideas, and even students, may be exchanged, and that many students, as in Germany already, may find their full course can only be completed by going from one university to another and seeking in each what it is best fitted to afford?

THE Lord Mayor of London laid the foundation stone of the new buildings of the University College of Sheffield on June 30. These buildings are part of a large scheme of extension and consolidation, and will cost more than 110,000*l.* The new metallurgical extension, containing new furnaces, is practically completed. The extensions for engineering, and new accommodation for electrical engineering, are in process of erection. The block for which the foundation has just been laid is situated on a site about three-quarters of a mile from the centre of the city, on the ridge of a hill, 420 feet above sea level, and adjoins the Weston Park on two sides. The general plan is that of buildings surrounding a quadrangle, with an annexe for the library. The buildings on three sides of the quadrangle are to be erected immediately, the fourth side hereafter when required. The building on the west side of the quadrangle, with a front to the park, is for the departments comprising arts, physics, biology, chemistry, law and commerce. That on the north side—also with a front to the park—contains accommodation for architecture, and the whole of the medical department, comprising anatomy, physiology, pathology, bacteriology, and public health, together with lecture rooms and medical library. It is expected that college work will be in full swing in the new buildings in October, 1905. As the result of an appeal that was made a short time ago for funds which would enable a University of Sheffield to be constituted, the sum of 51,400*l.* has been subscribed towards the new buildings, but it is understood that a further sum of 10,000*l.* is required to complete the portion now to be proceeded with, whilst 10,000*l.* will also be needed for the library, and about 10,000*l.* to complete the equipment of the various laboratories. It is desired to make adequate provision for, and to grant degrees in, the four following faculties:—(1) Arts, including education and commerce; (2) pure science; (3) medicine; and (4) applied science (engineering, metallurgy and mining). The City Council has pledged itself by a unanimous vote, in case university powers are obtained, to grant an annual sum not exceeding one penny in the pound out of the rates, equivalent to a capitalised sum of about 200,000*l.* To carry out the proposed university scheme in its entirety, a further annual income of 5000*l.* would be required.

AT University College, London, on Monday, Prof. E. H. Starling, F.R.S., Dean of the Faculty of Science, in his report of the work of the last session, referred to the scheme for the incorporation of the college into the University of London, and the suggested institute for advanced technical work. He remarked that certain conditions had to be fulfilled before the incorporation could take place—namely, the provision of new buildings for the clinical school and for the boys' school. The financial means to completely carry out these objects were still wanting. The college would need 40,000*l.* for the building of the clinical school and 60,000*l.* for the boys' school. Believing that money would be forthcoming for so essential a step in the provision of higher education for London, the council of the college and the university were cooperating in drawing up a Bill to enable incorporation to take place, and they hoped that the Bill would be introduced next session. It was proposed in the Bill to seek general powers for the incorporation of other institutions into the university. Only by incorporation of these interests into one, and by giving to the Senate of the university full control over the whole university teaching of London, could they hope to be strong enough to develop higher education and research in accordance with the growing needs of the time. This being their policy, it was with some apprehension that he had seen the publication of a scheme for creating a body, well equipped and endowed, within the university, but not belonging to the university. If the control of the new institution was secured to the university it would be certain to succeed, and they

need not trouble about the self-contradictory statements of the aims and the objects of the new institution with which they were favoured by enthusiastic amateurs.

A VACATION course in practical and clinical bacteriology will be held at King's College, London, commencing Wednesday, August 5, and ending Saturday, August 15. Names must be sent in as soon as possible to the secretary or to Prof. Hewlett.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 11.—"On the Propagation of Tremors over the Surface of an Elastic Solid." By Horace **Lamb**, F.R.S.

The paper treats of the propagation of vibrations over the surface of a "semi-infinite" isotropic elastic solid, *i.e.* a solid bounded only by a plane. For purposes of description, this plane is conceived as horizontal, and the solid as lying below it.

The vibrations are supposed due to an arbitrary application of force at a point. In the problem most fully discussed this force consists of an impulse applied normally to the surface; but some other cases, including that of an internal source of disturbance, are also considered. Owing to the complexity of the problem, attention is concentrated for the present on the vibrations as they manifest themselves at the free surface, and the modifications which the latter introduces into the character of the waves propagated into the interior are accordingly not examined minutely.

The investigation claims interest on theoretical grounds, and also in relation to the phenomena of earthquakes. Attempts to interpret seismic phenomena by the light of elastic theory have hitherto been based, for the most part, on the general laws of wave-propagation in an unlimited medium, as developed by Green and Stokes; but Lord Rayleigh's discovery of a special type of surface-waves has made it evident that the influence of the free surface in modifying the character of the vibrations is more definite, and more serious, than had been suspected. The present memoir seeks to take a further step in the adaptation of the theory to the actual conditions, by investigating cases of *forced* waves, and by abandoning the restriction to simple-harmonic vibrations.

It is found that the surface disturbance produced by a single impulse of short duration may be analysed roughly into two parts, which we may distinguish as the "minor tremor" and the "main shock," respectively. The minor tremor sets in at any place, with some abruptness, after an interval equal to the time which a wave of longitudinal displacement (in an unlimited medium) would take to traverse the distance from the source. Except for certain marked features at the inception, and again (to a lesser extent) at an epoch corresponding to that of direct arrival of transversal waves, it may be described, in general terms, as consisting of a long undulation leading up to the main shock, and dying out gradually after this has passed. Its time-scale is more and more protracted, and its amplitude more and more diminished, the greater the distance from the source. The main shock, on the other hand, is propagated as a solitary wave (with one maximum and one minimum, in both the horizontal and vertical displacements); its time-scale is constant, and its amplitude diminishes only in accordance with the usual law of annular divergence, so that its total energy, unlike that of the minor tremor, is maintained undiminished. Its velocity is that of free Rayleigh waves, and is accordingly somewhat less than that of waves of transversal displacement in an unlimited medium.

"A Method for the Investigation of Fossils by Serial Sections." By Prof. W. J. **Sollas**, F.R.S.

Mechanical difficulties preclude the study of fossils by serial thin slices, but serial polished surfaces may be obtained at any desired degree of proximity, and these, when the fossil and its matrix offer sufficient optical contrast, serve most of the purposes of thin slices. They may be photographed under the microscope, so as to furnish a trustworthy and permanent record. The sections may be used to obtain reconstructions of the fossil in wax. Several fossils have been successfully studied in this way, such as *Palaeospondylus Gunni, Ophiura Egertoni, Lapworthura Miltoni, Monograptus priodon,* and *Palaeodiscus ferox.* The sections are obtained at regular intervals, usually of 0·025mm., by means of an apparatus designed for the purpose by the Rev. F. Jervis-Smith, F.R.S., reader of mechanics in the university.

"An Account of the Devonian Fish, *Palaeospondylus Gunni,* Traquair." By Prof. W. J. **Sollas**, F.R.S., and Igerna B. J. **Sollas**.

June 18.—"Some Preliminary Observations on the Assimilation of Carbon Monoxide by Green Plants." By Prof. W. B. **Bottomley** and Mr. Herbert **Jackson**. Communicated by Prof. J. Reynolds Green, F.R.S.

"The Bionomics of *Convoluta roscoffensis.*" By Dr. F. W. **Gamble** and Frederick **Keeble**, M.A.

Convoluta is a minute green Turbellarian organism that lives in such prodigious numbers on the coast of Brittany as to cover long stretches of the beach with a thick green scum.

Previous observers have directed attention to the fact that Convoluta is not merely an animal, but is an association of an animal and a plant, or plant-like organism, which is represented by the green cells. These cells contain chlorophyll, perform photosynthesis, and store starch, but, unlike algal cells, they have no cell-wall, and they are believed to have no power of surviving the death of the animal tissue. Whether they are exceptional animal cells or infecting plant-cells, or algæ acquired in past time and now inherited, is unknown. But it is supposed that the life of the animal has been modified to suit their requirements, that from their reserves the animal is fed, and that to the renewal of these reserves its movements are directed.

The present paper is an attempt to gain further insight into this strange problem. Dealing first with the question of food, the authors show what rays of light are effective in producing a surplus of starch, but they believe that this reserve does not furnish the source of food on which the animal tissue of Convoluta is nourished; for not only does this starch disappear with extreme slowness (7–8 days) in darkness, but direct evidence is forthcoming that in all stages of development Convoluta can, and does, ingest, that in the earlier ones diatoms and algæ are normally ingested and digested, and that in the later stages the green cells are bodily aggregated and digested in the gut.

Passing to the development of the green cells, the authors find the first trace of these cells as colourless, nucleated structures in the gut of the recently hatched animal. Direct proof of the intrinsic or extrinsic origin of these colourless cells is still lacking. The indirect evidence, however, is strongly in favour of the latter mode of origin. On this view Convoluta makes a pure culture from a mixed infection.

Further analyses than heretofore of the effects of light, heat, gravity, and other agencies on the behaviour of Convoluta are given. The *tonic,* even more than the *tropic,* effect of light determines the periodic tidal movements, now to the surface of the sand, and now below the surface. The direct tropic effect of light is greatest in the green rays, absent in the blue, and reversed in the red. The effect is modified by the absorbing or scattering character of the background, and by the age of the animal. At the moment of hatching, Convoluta is aphototropic.

Geotropic response is not exhibited by those Convoluta which fail to develop their otolith. Normally it is shown from the moment of birth.

The paper concludes with a description of the daily and lunar variations in the size and behaviour of the colonies, and with an explanation of these variations in terms of the tropisms and other habits of Convoluta.

"The Spectra of Neon, Krypton, and Xenon." By E. C. C. **Baly**, Lecturer on Spectroscopy in University College, London.

The gases were illuminated by the passage of the discharge from an induction coil through them under reduced pressures. Vacuum tubes were filled with each one of them, and the glowing gas in a capillary portion was examined "end on" through a quartz window. Considerable difficulty was experienced in the use of the tubes, owing to the disintegration of the electrodes and the absorption of

the gas when the current was kept passing for long periods. The measurements were all made upon photographs taken with a Rowland concave grating of 10 feet focus and 14,438 lines to the inch; the first three orders of spectra were employed, and nearly all the chief lines were measured in two orders; the probable error of the measurements is less than 0·03 Ångström unit. Each gas gives bright-line spectra, krypton and xenon having two and neon one; the second spectra of krypton and xenon are produced by placing a Leyden jar and a spark gap in the circuit with the vacuum tube.

Physical Society, June 26.—Dr. R. T. Glazebrook, F.R.S., president, in the chair.—Dr. **Waller** gave a demonstration of the effect of light on green leaves. The origin of these researches was the result of the consideration of the retinal effects after light stimulation, and the wish to have a sensitive surface naturally spread out for examination. The effect of light is to produce a current (of an E.M.F. of the order of 0·01 volt), at first from the illuminated to the dark parts in the leaf, and later (or as an after-effect) from dark to illuminated. These currents are apparently an index of two opposite processes in the leaf, *i.e.* dissimilation and assimilation, and give very close analogies to the analogous processes in animal tissues (*e.g.* nerves). Dr. Waller also demonstrated the "blaze" currents in animal and vegetable tissues. These are seen when a strong exciting current (such as an induction-shock of sufficient voltage) is led through a pair of non-polarisable electrodes, and these are then connected with a galvanometer. An electrical response (of greater energy than the exciting current) is given in a direction commonly homodrome to the latter, *i.e.* in the reverse direction to the ordinary polarisation counter-currents. This "blaze" response is the algebraic sum of post-anodic and post-kathodic currents; the resultant is commonly homodrome, but an antidrome blaze, distinguished from polarisation by its much greater order of magnitude, is also seen. Dr. Waller also showed two methods for the quantitative estimation of chloroform vapour in air. The first was by receiving the mixed gases into a flask of known capacity, absorbing the chloroform by means of olive oil, and reading the reduction of pressure by a manometer. The second was by the simple weighing of a light flask, first filled with air, then filled with mixed air and chloroform vapour.—Dr. N. H. **Alcock** exhibited a method of determining the temperature-limits of nerve activity in warm-blooded and cold-blooded animals. The higher limit was obtained by immersing the isolated nerve in 1·05 per cent. NaCl solution. It lies between 40° C. and 42° C. in the frog, 48° and 49° in the mammal, and is at 53° in the bird, corresponding closely to the coagulating point of the tissue proteids. The lower limits were obtained by cooling the nerve-chamber as a whole, and taking the temperature of the nerve with a compensated thermo-junction. The limits were −3°·5 C. for the frog, +3°·8 C. for the mammal, +6°·8 C. for the bird, giving a range of nerve-action of 45° C. to 46° C. for all animals. The method, therefore, permits of an hitherto impossible analysis of actually living nerve-substance.

Zoological Society, June 16.—Dr. F. Du Cane Godman, F.R.S., vice-president, in the chair.—Dr. H. **Woodward,** F.R.S., made a communication from Miss Dorothy M. A. Bate which contained a description of the remains of an extinct species of Genet from a Pleistocene cave-deposit in Cyprus, and which it was proposed to name *Genetta plesictoides*, sp. n.—Mr. G. A. **Boulenger,** F.R.S., described a new species of Gobiid fish from British New Guinea under the name of *Rhiacichthys novae-guineae*.—Mr. G. A. Boulenger also described the following five new species of reptiles from British New Guinea:—*Lygosoma milnense, L. granulatum, L. pulchrum, L. pratti,* and *Toxicocalamus stanleyanus*.—A second instalment of a paper, by Mr. Cyril **Crossland,** on the Polychæta of Zanzibar and British East Africa, contained descriptions of three new species of Marphysa, viz. *M. macintoshi, M. simplex,* and *M. furcellata*, and a new key to the known species of that genus. It also contained remarks on *Lysidice collaris* and its variations, and on the two species *Diopatra neapolitana* and *Onuphis holobranchiata*, which had hitherto not been met with in East Africa.—A communication on the parasites collected by the "Skeat Expedition" to Lower Siam and the Malay Peninsula in the year 1900 was read by the secretary on behalf of Mr. Arthur E. **Shipley.** The author stated that the area in which the collection was gathered had been hitherto unsearched by students of parasites, and referred to the high proportion of new forms that had been obtained. Among these were a new species of Tetrarhynchus, found in an Echinoderm, and an undeterminable species of Tetrarhynchus found in a sea-snake. The occurrence of these forms in such hosts was practically new to science. There were also described eight new species of Acanthocephala.—A communication from Messrs. Louis **Murbach** and Cresswell **Shearer** dealt with a collection of Medusæ from the coast of British Columbia and Alaska made in 1900. Specimens of fourteen species—of which five were new—were contained in the collection, and these were remarked upon or described.—Mr. F. E. **Beddard,** F.R.S., read a paper upon the modifications of the Syrinx in the Accipitres. The syringes of a number of genera were described in detail, and it was pointed out that the group could be divided into two families according to the form of this organ.

Chemical Society, June 17.—Prof. W. A. Tilden, F.R.S., in the chair.—The Longstaff medal was presented to Prof. W. J. Pope in recognition of his researches on the stereochemistry of compounds of elements other than carbon.—The following papers were read:—The estimation of arsenic in fuel, by Prof. T. E. **Thorpe,** F.R.S. A known quantity of the finely-powdered fuel is burnt in a stream of oxygen, the issuing gas is passed through a suitable absorption apparatus, and the absorption liquid, as well as the ash of the fuel, are tested for arsenic.—The electrolytic estimation of minute quantities of arsenic, more especially in brewing materials, by Prof. T. E. **Thorpe,** F.R.S. A special electrolytic arrangement is adopted whereby the electrolysis of dilute sulphuric acid is brought about in presence of the arsenical liquid, and the formation of arseniuretted hydrogen is detected in the usual way.—Crystallised ammonium sulphate and the position of ammonium in the alkali series, by Dr. A. E. H. **Tutton.** The molecular constants of crystals of ammonium sulphate indicate that the substitution of two ammonium groups for the two atoms of potassium in potassium sulphate produces approximately the same change as the substitution of two atoms of rubidium; on the other hand, the specific constants show that the ammonium radicle exerts a certain influence peculiar to itself in the series of alkali sulphates.—The action of hydrogen on sodium, by Mr. A. **Holt.**—The action of halogens on compounds containing the carbonyl group, by Dr. **Lapworth.** It is shown that the bromination of these compounds takes place more rapidly in presence of acids and alkalis.—Reactions involving the addition of hydrogen cyanide to carbon compounds, by Dr. **Lapworth.**—The acetoacetic ester synthesis, by Messrs. **Hann** and **Lapworth.**—Rimu resin, by Prof. **Easterfield** and Mr. **Aston.** This resin consists principally of rimuic acid $C_{16}H_{20}O_3$.—Note on the karaka fruit, by Messrs. **Easterfield** and **Aston.** This material, which in the raw state is bitter and poisonous, contains the glucosides karakin and corynocarpin. When an aqueous extract of the fruit is distilled, a distillate containing hydrocyanic acid is obtained.—The slow oxidation of methane at low temperatures, by Messrs. **Bone** and **Wheeler.**—The alkylation of sugars, by Prof. **Purdie** and Mr. **Irvine.**—Trimethyl-α-methylglucoside and trimethylglucose, by Messrs. **Purdie** and **Bridgett.**—Note on the corrosion of an Egyptian image, by Mr. H. **Bassett,** jun. An examination has been made of a green coating covering a bronze image, probably dating from the period 200–100 B.C., recently found in the delta of the Nile. The principal constituents are cupric chloride and oxide, lead oxide, stannic oxide, water, silica, and small quantities of nickel and iron oxides.—The oxidation of pinene with chromyl chloride, by Prof. **Henderson,** Messrs. **Gray** and **Smith.**—Some physical and chemical properties of strong nitric acid, by Messrs. **Veley** and **Manley.** It is shown that the density, contraction, refractive index, and electrical conductivity vary regularly until the concentration of the acid reaches 92 per cent., but from this point to 100 per cent. the variation is exceptional. These facts are in harmony with Hartley's view that acid of 96 per cent. strength contains a definite compound of the formula $3H_2N_2O_6,H_2NO_4$.—Notes on ozone, by Mr. **Inglis.** The molecular state of

ozone in acid and aqueous solutions cannot be ascertained by solubility determinations, since equilibrium between the gas and its solutions cannot be secured.

Geological Society, June 10.—Mr. J. J. Harris Teall, F.R.S., vice-president, in the chair.—On primary and secondary devitrification in glassy igneous rocks, part i., by Mr. John **Parkinson.** The types of primary devitrification as found at Obsidian Cliff are briefly reviewed, and reference is made to the conditions which favoured primary devitrification at Obsidian Cliff. After a brief reference to secondary devitrification, this part of the paper concludes with a summary in which the several relations of secondary to primary devitrification-structures are given.—Part ii., by Prof. T. G. **Bonney**, F.R.S. Certain conditions, such as slow cooling, supersaturation, and the presence of inclusions are favourable to crystallisation, some special cases of which are discussed in the paper. The structures thus formed in rocks may be classified as (1) the linear, and (2) the granular, and the former may be subdivided into (*a*) the rectilinear, (*b*) the curvilinear. Spherulitic structure in its simpler form falls under (*a*), and is at first little more than a radial grouping of molecules, the process becoming gradually more complicated. Of this, "graphic" or "pegmatitic" structure is a final stage, where two minerals are crystallising out of a solution, and one has slightly the advantage over the other, so that it virtually forms a skeleton-crystal. Into this the ordinary radial growth of a spherulite may be seen to pass; likewise also examples of (*a*) into those of (*b*), the latter being due to the "leading" mineral meeting with a rather stronger resistance, as if a crystal were forming in a very tough jelly. The granular structure is discussed, and explanations are offered of its varieties. In conclusion, the relation of some of these structures to an eutectic composition is discussed.—Geology of the Ashbourne and Buxton branch of the London and North-Western Railway—Crake Low to Parsley Hay, by Mr. H. H. **Arnold-Bemrose.** The present paper is a continuation of one published in 1899, and deals with the geology of the next eight miles of this railway.

Royal Microscopical Society, June 17.—Mr. Wm. Carruthers, F.R.S., vice-president, in the chair.—In the absence of Lord **Rayleigh,** his paper on the theory of optical images with special reference to the microscope was read by Dr. Hebb.—Dr. H. **Siedentopf** read a paper on the rendering visible of ultra-microscopic particles and of ultra-microscopic bacilli. The subject was illustrated by microscopes fitted with special illuminating apparatus, various objects, and drawings on the blackboard.—A communication relating to the preceding subject, sent by Dr. Johnstone Stoney, was read by the secretary. There was a lengthy discussion on the three papers, in which Prof. J. D. Everett, Dr. S. Czapski, Mr. J. W. Gordon, Mr. Rheinberg, Dr. C. V. Drysdale, Dr. Beilby, and Mr. Conrad Beck took part. Owing to the lateness of the hour, the following papers were taken as read:—On the "lag" in microscopic vision (continued); an improved horseshoe stage and a micrometric correction for minute objects, by Mr. E. M. **Nelson**; and a method of mounting bacteria from fluid media, by Mr. J. A. **Hill.**

Challenger Society, June 24.—Dr. R. N. Wolfenden in the chair.—Mr. V. H. **Blackman** contributed some notes on Bipolar plants; a comparison of the 259 Arctic and 269 Antarctic Algæ shows that no less than 54 species are found both north and south of the tropics, but not between them; of the larger brown seaweeds not even a genus is common to the two poles.—Dr. **Fowler** read notes on the distribution of some Amphipoda collected by him in the Bay of Biscay at various depths during a cruise in H.M.S. *Research*, 1900; they had been identified by the Rev. T. R. R. Stebbing. Among these were two Arctic cold-water forms, *Scina borealis*, Sars., and *Cyphocaris anonyx*, Boeck., taken between 750–500 fathoms and 300–400 fathoms respectively, but not known from shallow water at low latitudes; and *Hyperioides longipes*, Chevreux, distributed round the 100 fathom horizon as a centre, but not occurring at the surface or at great depths.

CAMBRIDGE.

Philosophical Society, May 18.—Dr. Baker, president, in the chair.—A coleopterous insect embedded in the wall of the human intestine, by Mr. D. **Sharp,** F.R.S. The author gave an account of the finding, by Dr. W. H. Ligertwood, of a living specimen of *Otiorhynchus tenebricosus* embedded in the wall of the intestine of a patient who died in the Wells Asylum. The position of the foreign body was in the ileum about eighteen inches from the ileo-cœcal valve. This beetle is purely herbivorous in its habits.—Exhibition of a rare parasite, by Mr. A. E. **Shipley.**—On the influence of electrons on colloidal solutions, by Mr. W. B. **Hardy,** F.R.S. Specially purified globulin from blood was dissolved (*a*) in a trace of acetic acid, (*b*) in a trace of sodium hydrate. In presence of acetic acid the globulin was found to move in an electric field from anode to kathode, in presence of alkali it moved from kathode to anode. In the former case, therefore, the globulin particles carried a positive charge, in the latter a negative charge. These two solutions were exposed to the radiations from radium bromide, and it was found that the electro-negative solution of globulin was turned into an opaque jelly in three minutes, while the electro-positive solution became more mobile and less opalescent.—On bismuth, by Mr. R. H. **Adie.** The discrepancies between the atomic weight of bismuth as determined by Schneider and Marignac =208 and by Classen =208·9, have been hitherto discussed on the assumption that the cause is the presence of lead. The author, by adopting a combination of fractionation as subnitrate and distillation as chloride, has succeeded in obtaining sufficient silica from pure bismuth to account for the low values of the former observers. The determination of the atomic weight and the isolation of a new coloured substance is now proceeding.—On the influence of great dilution on the absorption spectra of highly concentrated solutions of the nitrates and chlorides of didymium and erbium, by Mr. J. E. **Purvis.** The experiments prove that (1) the absorption bands of very highly concentrated solutions of the chlorides of didymium and erbium are not altered when the solutions are highly diluted. (2) The absorption bands of very highly concentrated solutions of the nitrates of didymium and erbium are considerably less diffuse when the solutions are highly diluted. This effect is analogous to that produced in the spectra of some gases and vapours by diminishing the density of the gas or vapour. (3) The absorption bands of very concentrated and very diluted solutions of the chlorides of didymium and erbium are precisely similar to those observed in the very diluted solutions of the nitrates of these two earths.—On a method of estimating the amounts of the oxides of didymium and erbium by means of the absorption bands of their solutions, by Mr. J. E. **Purvis.**—A lecture experiment to illustrate the rotation of a magnetic pole around a straight current, by Mr. P. V. **Bevan.**—Irreversible simultaneous linear reactions, by Mr. H. O. **Jones** and O. W. **Richardson.**

PARIS.

Academy of Sciences, June 29.—M. Albert Gaudry in the chair.—Researches on one and two fluid batteries, by M. **Berthelot.**—On the mechanical analysis of soils, by M. Th. **Schlœsing.** A discussion of the relation between the nature and amount of a substance deposited from suspension in water, and the time taken to settle. Experimental results on sandy, clay, and loam soils are given.—On the influence of the introduction of unsaturated radicles on the rotatory power of active molecules, α-allyl, α-propyl, and δ-methyl-β-cyclopentanonecarboxylic esters, by MM. A. **Haller** and M. **Desfontaines.** The conversion of an aliphatic active molecule into a cyclic molecule is accompanied with a large rise in the rotatory power. The rotatory power of the allyl ester is distinctly higher than that of the propyl derivative.—Observations on the comet 1903 *c*, discovered by M. Borrelly at the Observatory of Marseilles, June 21, by M. E. **Stephan.** The comet possesses a nucleus of the tenth magnitude, and a tail extending 5′ or 6′.—Observations made at the Observatory of Lyons during the partial eclipse of the moon of April 11; final results, by M. Ch. **André.**—Observation of the bright spot of Saturn with the 38cm. equatorial of the Observatory of Toulouse, by M. F. **Rossard.**—The elements of the Borrelly comet, by M. G. **Fayet.** Calculated from observations made at the Paris Observatory. The brightness of the comet will reach its maximum about July 14, and the comet will then be in a position very favourable for observation, and may be visible to the naked eye for some days.—Observ-

ations on the new Borrelly comet made at the Paris Observatory, by M. G. **Bigourdan.**—Observations on the Borrelly comet made with the 31·8cm. equatorial at the Observatory of Algiers, by MM. **Rambaud** and **Sy.**—Observations on the Borrelly comet made at the Paris Observatory, by M. **Salet.**—Observations on the comet 1903 *c* (Borrelly) made at the Observatory of Besançon, by M. P. **Chofardet.**—Observations on the Borrelly comet made with the Brunner 16cm. equatorial at the Observatory of Lyons, by MM. J. **Guillaume** and G. **Le Cadet.**—The influence of altitude on the duration of the reduction of the oxyhæmoglobin in man, by M. A. **Hénocque.** The effect of living at altitudes of 1000 to 2000 metres is to produce a marked prolongation in the duration of the reduction of the oxyhæmoglobin, a phenomenon which gives a new explanation of the adaptation of the human body to these heights.—On the integration of series, by M. W. H. **Young.**—On the experimental laws of sliding friction, by M. Henri **Chaumat.**—The electrotypograph and the teletypograph, by M. **de Tavernier.**—On the theory of nickel steels, by M. C. E. **Guillaume.** Nickel steels can be classified in two divisions, according as they do or do not possess a thermal hysteresis.—On the spontaneous dichroism of mixed liquids, by M. Georges **Meslin.** All liquids which possess spontaneous dichroism are also those which are the most active under the influence of the magnetic field; the reciprocal of this is also true.—On the phenomena connected with the mast in wireless telegraphy, by MM. André **Broca** and **Turchini.**—The relation between the dielectric cohesion of a gas and its temperature, by M. E. **Bouty.** For temperatures between 20° C. and 190° C., air, hydrogen and detonating gas possess a dielectric cohesion which is independent of the temperature, from which the law is deduced that the dielectric cohesion of a gas or of a mixture of gases depends only on the mean distance of the molecules.—Determination of the electrochemical equivalent of silver, by MM. **Pellat** and **Leduc.** A detailed account is given of the numerous precautions observed in this determination, the mean result being 0·011195.—On the electrolytic transport of certain ions in gelatin, by M. Aug. **Charpentier.**—The production of ozone in spirals with high tension currents of high frequency, by M. H. **Guilleminot.**—Positive accumulator plates of high capacity, by M. **Vaugeois.** Capacities of from 0·7 to 1·24 ampere-hours per square decimetre of plate have been obtained.—On recent results obtained in the treatment of arterial hypertension by d'Arsonvalisation, by M. A. **Moutier.**—A new method for putting in evidence ultra-microscopic objects, by MM. A. **Cotton** and H. **Mouton.**—On the anticipated liquefaction of oxygen from air, by M. Georges **Claude.** If air is liquefied progressively, the first portions are rich in oxygen.—Study of the mode of oxidation of manganese salts by alkaline persulphates in acid liquids, by M. H. **Baubigny.**—The preparation and properties of some new plumbic derivatives, together with their thermochemical data, by M. Albert **Colson.**—On an organic base containing phosphorus, its constitution and some of its salts, by M. P. **Lemoult.** The substance obtained by the interaction of PCl_5 and aniline has not the constitution $PCl(NH.C_6H_5)_4$ ascribed to it by Gilpin, but is more probably the hydrochloride of a new base, $(C_6H_5.NH)P.N.C_6H_5$, various salts of which are described.—The volumetric estimation of nitric nitrogen, by M. **Débourdeaux.**—On silicon amide and imide, by MM. Em. **Vigouroux** and **Hugot.** The amide is produced by the interaction of silicon tetrachloride and ammonia at temperatures below 0° C., above 0° the imide is the chief product.—Combinations of hydroferrocyanic acid with organic compounds, by MM. **Chrétien** and **Guinchant.**—The preparation of primary alcohols by means of the corresponding acids, by MM. L. **Bouveault** and G. **Blanc.** The methyl and ethyl ester of the fatty acid is reduced by sodium in the presence of absolute alcohol. Details are given for octanol.—The influence of the nature of the external medium on the formation and evolution of odoriferous compounds in plants, by MM. E. **Charabot** and A. **Hébert.**—New method for the estimation of oxalic acid in urine, food, &c., by M. **Albahary.**—On the production of glucose by animal tissues, by MM. **Cadéac** and **Maignon.**—Researches on the transversal scalariform striated bands in the cardiac fibres, by M. F. **Marceau.**—The action of carbon dioxide on the eggs of echinoderms, by M. C. **Viguier.** The theory of temporary poisoning of Delage is not true for the sea urchins; carbon dioxide is not clearly differentiated from other reagents used in experiments on artificial parthenogenesis.—On the development of the ovary of *Polyxenus lagurus*, by M. A. **Lécaillon.**—The action of emulsin on salicin and amygdalin. Theory of the action of emulsin, by MM. Victor **Henri** and S. **Lalou.** The emulsin forms an intermediate compound with the body upon which it is acting, and this is decomposed, regenerating the ferment.—On the teratological forms of *Sterigmatocystis nigra* deprived of potassium, by MM. **Molliard** and H. **Coupin.**—On *Cryptostegia madagascariensis*, by M. Henri **Jumelle.**—On a new group of fungi, the Bornetineæ, and on *Bornetina Corium* of the vine, by MM. L. **Mangin** and P. **Viala.**—On the bilateral symmetry of the rootlets of *Pontederia crassipes*, by M. **Chifflot.**—On the presence of macroscopic crystals of albite in the dolomites of the Trias of Crete, by M. L. **Cayeux.**—Observations on glacial phenomena in Corsica, by M. Paul **Castelnau.**—On the existence of two great circles of maximum seismic instability, by M. de Montessus **de Ballore.**—On a chicken which lived seven days after hatching out, with a second yolk enclosed in the abdomen, by M. Frédéric **Houssay.**—Apparatus for the inhalation of oxygen, by M. **Guglielminotti.**—The variable state of active muscles during the time of a contraction in the ergograph, by MM. A. **Imbert** and J. **Gagnière.**—Dust shower recently observed in Iceland, by M. Stanislas **Meunier.**

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