reach the Bagrot Pass from the north, we returned to Nagyr, and started inwards towards the wholly-unknown region. We left Nagyr behind on June 27, and in a mile or two came to the foot of the Hopar Glacier. This glacier was once joined by the Hispar Glacier, and their united moraines were deposited at Nagyr, the town being actually built upon their crest. Now the foot of the Hispar Glacier has retreated some twenty miles into the mountains. The Hopar Glacier is greatly shrunken in width, and in its shrinkage it has left a fine, almost level area, beside its left bank, which is covered by the fields of Hopar.

We were delighted to find an enormous and almost unsuspected series of glacier basins above Barpu. In order to get some idea of them we spent a day mounting to the crest of the ridge north of our camp, which divides Barpu from the Hispar Valley. The view was of peculiar interest to us, for we looked for the first time into the Hispar Valley and beheld the long avenue of peaks that lined the way up the Hispar Glacier towards the unknown snowy regions through which lay our intended route into Baltistan. We reached the summit of the Hispar Pass on July 18, and Askole on the 26th, our slow progress being caused by the exigencies of the survey in weather that was oftener bad than fair.

We left Askole on July 31 and returned to it again on September 5, the intervening time having been spent over our expedition up the Baltoro Glacier and the ascent of Crystal and Pioneer Peaks. On September 10 we embarked on a skin raft, which carried us down the Shigar River to the Indus. We landed, and in half an hour reached the scattered villages of Skardo, capital of Baltistan. Of our journey from Skardo to Leh to verify our instruments, and from Leh back to Srinagar, it is unnecessary to speak. We reached Abbottabad on October 28, exactly seven months from the day on which we left it.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—During this term Prof. Clifton is lecturing on the optical properties of crystals, and other lectures and practical instruction are given by Mr. Walker and Mr. White at the Museum, by Mr. Baynes at Christchurch, by Sir J. Conroy at Balliol, and Mr. F. J. Smith at Trinity. In chemistry, Mr. Fisher and Mr. Watts are lecturing on inorganic and organic chemistry respectively, and Messrs. V. H. Veley and J. E. Marsh are demonstrators at the Museum. Mr. Vernon Harcourt is lecturing on inorganic chemistry at Christchurch, and Mr. D. H. Nagel at Trinity.

The professor of geology announces a course of lectures on economic geology and geological excursions. Prof. Ray Lankester is giving two courses, on embryology, and on the protozoa, rotifera, and urochorda; and supplementary lectures are given by Dr. Benham, Mr. J. Barclay Thompson, Mr. Bourne, and Mr. Minchin.

Prof. Burdon Sanderson is lecturing on the central nervous system, and has the assistance of Dr. Haldane and Mr. Pembury.

Prof. Vines is lecturing on outlines of classification, and has appointed Mr. P. Groom, of Cambridge, as demonstrator.

At the end of last term a sum of £3500 was voted by Convocation towards the renewal of a portion of the buildings and hothouses in the Botanic Garden. Prof. Vines made a full report on the condition of the houses at the end of last year, showing that all were old, of faulty construction, and so dilapidated as to entail a heavy annual expenditure for repairs. At the same meeting of Convocation a sum of £1000 was placed to the credit of the delegates of the University Museum, to be employed at their discretion for the maintenance and improvement of the collections in the Museum.

At a meeting of the Ashmolean Society on Monday, May 1, under the presidency of Mr. E. B. Poulton, Prof. A. W. Rücker, F.R.S., gave an interesting lecture on the electrical conductivity of thin films, which was largely attended.

On the 16th inst. Lord Kelvin will give the annual Boyle lecture to the Junior Scientific Club, and on the 18th the Romanes lecture will be given in the Sheldonian theatre by the Right Hon. T. H. Huxley.

CAMBRIDGE.—The term for which Mr. J. Y. Buchanan, F.R.S., was appointed to the University Lectureship in Geography expires at the end of the present term. The Committee of Selection for the appointment of a Lecturer to hold office for the next five years, will meet at Gonville and Caius Lodge on May 31. The stipend of the Lecturer is £200 a year, and he is required to deliver courses of Lectures in Geography during two terms at least, and to give informal instruction and assistance to students attending his lectures, and to promote the study of his subject in the University. The retiring lecturer is re-eligible. Candidates are to send their names and testimonials to the Master of Gonville and Caius College, on or before May 27.

The first Arnold Gerstenberg Studentship, of the value of £90 a year for two years, will be competed for in May, 1894, by men or women who have obtained honours in either part of the Natural Science Tripos, and whose first term of residence was not earlier than the Easter term 1888. The subjects of examination are Logic and Psychology, and the successful candidate must undertake to pursue a course of philosophical study.

Applications for permission to occupy the University's tables at the Zoological stations of Naples and Plymouth are invited; they should be addressed to Prof. Newton, and reach him on or before May 25.

The names of Prof. John Couch Adams, and of William, seventh Duke of Devonshire, have been inserted in the list of Benefactors of the University, recited at the annual Commemoration Service.

The plans for the Sedgwick Memorial Museum of Geology, prepared by Mr. T. G. Jackson, A.R.A., were approved, by a large majority, in the Senate on Thursday last. The work of construction cannot however be begun until the finances of the University, which this year show a deficit of some £4000, are in a more satisfactory state. A proposal to raise funds, by increasing the capitation-fee paid by undergraduates from 17s. to 40s. a year, is now before the Senate.

Alfred Eichholz, B.A., first class in both parts of the Natural Science Tripos 1891-92, with distinction in physiology, has been elected to a Fellowship at Emmanue College. Mr. Eichholz has already published papers of interest on physiological and anatomical subjects, and his election reflects great credit on his college.

SCIENTIFIC SERIAL.

Bulletin of the New York Mathematical Society, vol. ii. nos. 5, 6 (New York, 1893).—The earlier number opens with an account of the theory of substitutions (pp. 83-106), by Prof. Oskar Bolza. This is a warmly appreciative notice of Dr. F. N. Cole's translation of Netto's "Theory of Substitutions and its Applications to Algebra," to which attention has recently been drawn in our columns (see NATURE, pp. 338, 339).—Dr. M. Bôcher in a bit of mathematical history (pp. 107-109) calls attention to a remarkable memoir by Euler ("De motu Vibratorio Tympanorum," 1764).—No. 6 contains a paper read before the New York Mathematical Society by Dr. T. Craig on some of the developments in the theory of ordinary differential equations (pp. 119-134). This is likely to be useful to students. Another paper read before the same Society is one entitled "On a General Formula for the Expansion of Functions in Series," by Prof. Echols (pp. 135-144), which is intended to be a brief exposition of a general theorem which forms the basis of a series of papers on certain determinant forms and their applications.—A short note follows by Dr. E. McClintock on the early history of the non-euclidian geometry (pp. 144-147), in continuation and part correction of his previous note in No. 2 of this volume. It discusses the claim to priority, brought forward recently by Prof. Beltrami, of Saccheri (1733) in his "Euclides ab omni nævo Vindicatus" as against Lobatschewsky.—"Notes" and "new publications" complete each number.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 16.—"On a Portable Ophthalmometer." By Dr. Thomas Reid, Glasgow. Communicated by Lord Kelvin, P.R.S.

The object of this instrument is to measure the curvature of the central area of the cornea, the polar or optical zone, and as this polar zone is the part of the cornea utilised for distinct vision, the instrument furnishes all the data practically requisite for the diagnosis and measurement of corneal astigmatism. Its use

may be extended to the measurement of convex and concave reflecting surfaces within the limits of this instrument, *i.e.* from 6 to 10 mms. of radius.

The theory of its construction is based on a particular application of the following well-known optical law :—that when two centred optical systems are so combined that their principal foci coincide, the ratio of the size of the object to the size of the image formed by the combined systems is equal to the ratio of the principal foci of the two optical systems adjacent respectively to object and image. The two optical systems in this case are a convex lens and the cornea as a reflecting surface, the object being in the principal focus of the convex lens.

The instrument is composed of the following parts : an aplanatic lens of 26 mms. focus, a rectangular prism neutralised in the visual axis by a smaller prism, one side of the rectangular prism being adjacent to the lens and an iris diaphragm being opposite to the other side in the principal focus of the lens. Behind the prism is a telescope with a double image prism fixed in front of the object glass of the telescope, which has precisely the same focus as that of the aplanatic lens. Cross wires at its principal focus are viewed by a Ramsden eye-piece.

Before using the instrument it is essential that the cross wires should be distinctly seen at the punctum remotum of the observer. The adjusted instrument is held in the observer's left hand, which rests on the forehead of the patient, the diaphragm being directed to a luminous source to the right of the observer. When the observed eye is directed to the central or fixation point of the instrument, the image of the diaphragm in the cornea can only be distinctly seen, when the principal focus of the lens coincides with the principal focus of the cornea, the point of coincidence of the principal foci being found by moving the instrument to and fro. The image of the diaphragm by means of the double image prism appears as two images in the centre of the field, when the visual line of the observer's eye is perpendicular to the surface of the cornea, through which it passes. If these images are not seen in the centre, their position indicates the direction of the angle α. The size of the corneal image being constant (2 mms.) the images are brought into exact contact by suitable variations of the iris diaphragm. By using a circular object, the circular, elliptical or irregular form of the image reveals at once the condition of the surface. When the images are elliptical, the minor axes of the two images are to be brought into the same straight line by a rotation of the telescope, and similarly with the major axes.

Equal differences in the size of the diaphragm correspond to equal differences in dioptric power, each millimetre of difference in diameter corresponding to three dioptres. The amount of astigmatism in dioptres can thus be read off on a graduated scale fixed to the instrument.

This instrument reads certainly to within half a dioptre, which between 7 and 8 mms. of radius of curvature is equivalent to ·088 mms. of difference of radius.

April 20.—"The Potential of an Anchor Ring," by F. W. Dyson, Fellow of Trinity College, Cambridge, Isaac Newton student in the University of Cambridge. Communicated by Prof. J. J. Thomson, F.R.S.

This paper is a continuation of some researches on rings published in the Phil. Trans. 1893. A system of solutions of Laplace's equation applicable to space *inside* an anchor ring is found. By means of these and the value of the potential at external points found in the previous paper, the potential of a ring at internal points is found. The stability of the annular form of rotating gravitating fluid is discussed ; the ring form is shown to be stable for fluted and twisted disturbances, but unstable for long beaded ones. The potential of a ring of gravitating matter whose cross section is elliptic is obtained. Applying the result to Saturn's system, it is shown that for his ring to be continuous fluid its density would have to be 100 times that of the planet. The steady motion of a single vortex-ring of finite cross section in an infinite fluid is discussed, and also the motion of a number of vortex rings on the same axis. Numerical calculations are entered into for the particular cases of a vortex ring followed by another of equal strength, a vortex ring approaching an infinite plane, and one passing directly over a spherical obstacle.

Physical Society, April 28.—Prof. W. E. Ayrton, F.R.S., Past-President, in the chair.—Adjourned discussion on the viscosity of liquids, by Prof. J. Perry, J. Graham, and L. W. Heath. Prof. Perry read a communication he had received from Prof. Maurice Fitzgerald on the subject, in which the latter discusses the corrections necessary for reducing the results obtained by circular motion to the corresponding motion in plane layers. He shows that in addition to the circular motion, the effect is complicated by radial flow due to "centrifugal head," which causes the liquid to pass outwards near the bottom of the trough and inwards across the edge of the suspended cylinder, with continuations along the sides of the trough and cylinder. Taking this motion into account the formula $v = Ar^{1+\frac{c}{\mu}} + \frac{B}{r}$ is deduced, where v is the velocity, μ the viscosity, A and B arbitrary constants, and c a constant depending on the radial flow. When $c = 0$ the formula reduces to equation (5) of the paper, whilst if $c = -2\mu$ it becomes $v = \frac{C}{r}$. The subject of critical velocities in non-turbulent motion is referred to, and some probable effects of the anomalous variations of density and viscosity of sperm oil noticed by the authors of the paper are pointed out. Prof. Perry, in further reply to Prof. Osborne Reynolds' comments, said he understood Prof. Reynolds to have proved that friction was proportional to velocity when the motion was steady. Experiments he (Prof. Perry) had made with discs of iron and glass in revolving mercury seemed to show that this was not the case. On replacing the mercury by sperm oil he found that up to a certain speed friction was strictly proportional to velocity, whilst above that speed friction varied as $v^{1\cdot25}$ Coloured streaks in the liquid remained unbroken even at the highest speeds. He therefore concluded that continuity of the streaks was not necessarily accompanied by a linear law of friction.—Mr. E. C. Rimington read a paper on luminous discharges in electrodeless vacuum tubes. The luminous rings produced in exhausted bulbs and tubes by discharging Leyden jars through coils surrounding them, had, he said, been attributed by Mr. Tesla (*Elec. Eng. of New York*, July 1, 1891) to the electrostatic action of the surrounding wire rather than to the rapidly varying magnetic induction through the rarefied gas. The present paper describes several experiments bearing on this point which lead the author to conclude that varying magnetic induction is the chief cause of the luminous rings. They also show that a superposed electrostatic field greatly assists the production of the luminosity. Most of the experiments described were performed before the meeting, some of the effects being particularly brilliant. In one experiment an exhausted bulb was placed within a coil connecting the outside coatings of two Leyden jars and placed between two metal plates, which could be connected at will with the outside of either jar. The spark gap between the inner coatings was then arranged so that no luminosity was seen in the bulb. On connecting one or both the metal plates with the jars in such a way as to increase the electrostatic field through the bulb, bright rings immediately appeared. An electrostatic field produced by a small induction coil connected to a piece of tin-foil on the bulb caused the rings to form at irregular intervals when the discharge of the jars and coil happened to be properly timed. In another experiment two loops of wire in series were used, and when put on the bulb in such a way as to produce a large magnetic effect but small electrostatic field, bright rings appeared, but if the magnetic effects of the coils opposed each other, whilst the electrostatic field was increased, no rings were seen. The subject is treated mathematically at some length in the paper, the times at which the maximum values of the current, the potential difference between the outside of the jars and the rate of change of current occur, as well as the values of their successive maxima being determined. The influence of size of jars is next considered, and the time-integral of rate of change of current on which the effect on the eye depends, expressed as a geometrical series. Taking an approximation the author shows that the time-integral is roughly proportional to the fourth root of the capacity. Large jars are therefore theoretically only slightly better than small ones, and this agrees with observation. On the subject of apparently unclosed discharges, such as are seen when discharges pass through a coarse spiral wound on an exhausted tube, the author said he had observed that the discharges were really closed, but the return part much diffused and of feeble intensity. Experiments were exhibited showing that under some circumstances an exhausted bulb acted like a closed metallic circuit, whilst under other conditions dissimilar effects were produced. Another experiment was shown in which a faint luminous ring, produced by a single turn of insulated wire round a bulb, was

apparently repelled on touching the wire with the finger. The author also showed that fan-shaped luminosities could be produced by rotating an exhausted tube in the electrostatic field produced by a charged ebonite or glass rod. Dr. Sumpner, speaking of the apparently unclosed discharges, pointed out that they might be closed through the wire forming the primary circuit, in the same way as the coil of a transformer might be arranged to act partly as primary and partly as secondary. Mr. A. P. Trotter, after referring to Dr. Bottomley's researches, said it was important in discussing such experiments to distinguish between electrostatic and electromagnetic effects. In Mr. Campbell Swinton's experiments the luminosity always appeared to get as far away from the wire as possible and to be at right angles to it, whereas in Mr. Rimington's the luminous portions were close to the wire. With a view to puzzling the discharge in Mr. Swinton's tubes he had made a right-angled bend in the spiral surrounding the tube, the result of which was to make the luminosity discontinuous, one end of the break being bifurcated. In all Mr. Swinton's experiments brush discharges surrounded the wire. Prof. S. P. Thompson thought an electrostatic field would aid a discharge even if its direction was not the same as the E.M.F. due to varying magnetic induction. Planté had found that vacuum tubes through which 800 cells were insufficient to produce a discharge, immediately allowed a discharge to pass when a rubbed ebonite rod was brought within about 10 feet distance. This effect was found to be independent of the direction of the disturbing field. Analogous effects had also been observed by Prof. Schuster, and described in his Bakerian lecture. Mr. E. W. Smith regarded the stresses set up in the medium as cumulative, a very slight cause acting on a substance already strained nearly to breaking point, being sufficient to cause breakdown. Mr. Blakesley inquired if the effects were the same if the induction coil, used in one of the experiments, was replaced by an electric machine, and whether the direction of the field so produced influenced the result. Mr. W. R. Pidgeon said closed circuits were necessary, and he had found it very difficult to produce discharges in tubes unless the ends of the primary wire were brought together. In his reply Mr. Rimington said each turn of the luminous spiral formed a complete circuit of itself. The phenomena observed by Mr. Campbell Swinton were quite different to those he had shown, and due to different causes. Mr. Swinton's spirals were reversed, and were due to phosphorescence of the glass.

Zoological Society, April 18.—Sir W. H. Flower, F.R.S., President, in the chair.—The Secretary read a report on the additions that had been made to the Society's menagerie during the month of March, and called special attention to three White-tailed Gnus (*Connochætes gnu*) from the Transvaal (a male and two females), obtained by purchase March 7, and to three Springboks (*Gazella euchore*) from South Africa, deposited by H.R.H. the Prince of Wales.—Mr. Sclater exhibited and made remarks on a specimen of a curious variety of the Pig-tailed Monkey (*Macacus nemestrinus*) from the Baram River, Sarawak, lately living in the Society's menagerie.—Mr. Sclater read a communication received from General Sir Lothian Nicholson, Governor of Gibraltar, respecting the Barbary Apes (*Macacus inuus*) living on the Rock of Gibraltar, which were stated to have increased of late years, and were now supposed to be nearly sixty in number.—Mr. W. L. Sclater made some remarks on the principal animals noted in the Zoological Gardens of Antwerp and Amsterdam, which he had lately visited.—A communication was read from Mr. A. E. Shipley containing an account of the anatomy and histology of two Gephyrean worms of the genus *Sipunculus* from Zanzibar, together with a few observations on Sipunculids in general.—Mr. Oldfield Thomas gave an account of a small collection of Mammals obtained in Central Peru by Mr. J. Kalinowski. Amongst several species represented in this collection, either new or of such interest as to deserve a record was especially noted a new form of Rodents of the family, Muridæ, proposed to be called *Ichthyomys stolzmanni*.—Mr. H. J. Elwes read a communication from Mr. W. Warren describing a large number of new species and new genera of Moths of the family Geometridæ in Mr. Elwes's collection, from Sikkim and other districts of India. Notes on the localities and on other points were added by Mr. Elwes.

Geological Society, April 26.—W. H. Hudleston, F.R.S., President, in the Chair.—The following communications were read:—The origin of the crystalline schists of the Malvern Hills, by Dr. Charles Callaway. This paper was the third of a series of three. In the first of these, published in the *Quarterly Journal* in 1887, the author contended that many of the gneisses and schists of Malvern were formed out of igneous rocks. In the second, which appeared in the Journal in 1889, he discussed the origin of secondary minerals at shear-zones in the Malvern rocks, and arrived at the conclusion that all the mica and much of the felspar, to say nothing of quartz and other minerals, were of secondary origin. In the present paper the author first pointed out that some of the most important mineral changes described in his second communication—such, for example, as the conversion of chlorite into biotite—had since been confirmed by independent investigators. He held that, as a whole, the gneisses and schists of Malvern had been formed by the crushing and shearing of consolidated igneous rocks; but he did not deny the possibility that here and there the foliated structure might have been produced in a fused mass. In the first stage of metamorphism the diorite or granite was crushed and decomposed. This slightly compressed rock could be traced step by step into a typical gneiss or schist. The signs of pressure progressively increased, and the mineral and chemical changes became proportionately greater. Reconstruction set in. The process of metamorphism did not always follow the same lines. Felspar was sometimes crushed into seams of fragments, and these, by partial re-fusion and pressure, were converted into gneissose lenticles of quartz and felspar. Intervening chlorite was changed to biotite, or even to muscovite or sericite. Thus a typical gneiss, consisting of quartz-felspar lenticles in a felt-work of mica, was formed out of a diorite. Sometimes the felspar was reconstituted without becoming fragmental; and it was then deposited on, or it included, idiomorphic mica. Or a soda lime felspar might, by a process of corrosion, be converted into quartz, or a soda-felspar, or both. In an early stage of metamorphism, the rock was often dirty and rotten through the abundance of chlorite and disseminated iron oxide. The former being changed to mica, and the latter being either absorbed in the production of biotite, or reconstituted in a crystalline form, a sound clear gneiss was the result. In the completed product, the signs of crushing and shearing were often entirely wanting. Even strain-shadows were rare in it. The metamorphism, however, was demonstrated in numerous localities by tracing the gradations inch by inch, and by the subsequent study of large numbers of microscopic slides, in which the transition was still more clearly seen than in the field. The classification of the Malvern schists originally proposed was somewhat enlarged, the injection-schists being subdivided into—(1) Schists of primary injection, in which one rock was injected into another, and (2) Schists of secondary injection, formed by the infiltration of secondary minerals along shear-planes. One of the most important of the chemical changes produced in the conversion of a diorite into an acidic schist was the elimination of magnesia. This was proved by analysis. The recent researches of Mr. Alexander Johnstone had shown that even in the laboratory, and at the ordinary temperatures, carbonated waters were able to remove magnesia from certain of its combinations with silica. The reading of this paper was followed by a discussion, in which the President, Prof. Bonney, Mr. Harker, Mr. Rutley, Prof. Hull, and the author took part.—Supplementary notes on the metamorphic rocks around the Shap Granite by Alfred Harker, and J. E. Marr, F.R.S. This paper contains some additions and corrections to the work submitted to the Society by the authors on a previous occasion (see *Quart. Journ. Geol. Soc.* vol. xlvii. p. 266). In the present communication special attention is paid to the alteration of a group of basic volcanic rocks by the granite. Some remarks were made on this paper by the President, Mr. Rutley, Mr. Teall, Mr. Harker and Mr. Marr replied.

Linnean Society, May 4.—Prof. Stewart, President, in the chair.—Dr. R. B. Sharpe exhibited some new and rare birds from Borneo, and made remarks upon the singular distribution of the genera to which they belonged. On behalf of Miss E. M. Sharpe he also exhibited both sexes of the larvæ and cocoons of a rare silkworm moth, *Gonometa fascia* from Lagos. Prof. J. B. Farmer exhibited under the microscope some preparations showing attraction spheres in Hepatic spores, and gave the result of his recent researches on the subject.—Mr. Thomas Christy exhibited some curious variations in foliage in plants of a *Sterculia* from Brazil, reared from the same pod, and showed also a specimen of *Erythroxylon Coca* in fruit.—Mr. W. B. Hemsley showed two British plants which were interesting on account of the localities, namely *Empetrum nigrum*

from Dorset (where Mr. C. B. Clarke had seen it growing on Poole Harbour Spit though it had not been included hitherto in the county flora), and *Scilla nutans* with prolonged bracts, usually regarded as an introduced garden form, which had been found growing apparently wild in a wood near Ashford, Kent. —Mr. Alfred Sanders then read a paper on the nervous system of *Myxine glutinosa*, a fish allied to the Lampreys.

DUBLIN.

Royal Dublin Society, April 19.—Prof. A. A. Rambaut, Astronomer Royal for Ireland, in the chair.—Dr. J. Joly, F.R.S., described a method of detecting the existence of variable stars by continuous photometric observations from night to night on groups of stars, by receiving the image of the group upon a photographic plate having a slow eccentric circular motion within the telescope, so that the images of the individual stars appear as circular traces upon the plate. Variations in the intensity of any trace, not common to all the linear images, indicate a variability of luminosity in the parti cular star describing the trace.—Prof. A. A. Rambaut read a paper on the distortion of photographic star images due to refraction.—The usual formulæ of refraction by which the relative position of one star with regard to another may be corrected for this effect, such as those published lately by the author in the *Astronomische Nachrichten*, No. 3125, are strictly applicable only to one definite instant of time. It is possible to keep only one star absolutely fixed on the plate by means of the slow motions in R.A. and declination, and the changes in the amount of the differential refraction will cause any other star to alter its position on the plate if the exposure is continued for any considerable time. The effect of this change is that all stars on the plate, except that used to guide by, are more or less distorted. The paper contains tables giving the amount by which the refraction changes at various declinations and hour angles, and from these the amount by which a star image on the plate is distorted in passing from any hour angle to any other can be readily computed. For instance, it is shown that an equatorial star whose distance and position angle from the guiding star are 1400″ and 45° would, in passing from an hour angle of 4h. to one of 5h., be distorted in R.A. by 5″·86 and in declination by 7″·98. It appears, however, that if the zenith distance does not exceed 60° and the exposure is limited to a quarter of an hour, the distortion will not exceed 0″·2, and that if the corrections are computed for the middle of the exposure and the measures made from the middle of the slightly distorted image no error will arise.—Prof. T. Johnson, exhibited *Gomontia polyrhiza*, Born. et Flah., a green alga, perforating the shells of various molluscs. Specimens were collected at different localities on the west and east coasts of Ireland; Galway (April, 1891) being the first locality in which the plant was observed.

PARIS.

Academy of Sciences, May 1.—M. Loewy in the chair.—The motion of liquids studied by chronophotography, by M. Marey. The water whose motion was to be studied was contained in a long tank bent into an elliptic shape and returning upon itself. One of the branches had both sides closed by panes of plate-glass, behind which was placed a screen of black velvet. A centimetre scale was fixed to the inner pane, and the tank was illuminated by sunlight reflected from below. The camera was placed at a distance in front of the glass, screens being arranged so as to keep off all light except that coming from the water. When the water was clear, the only thing photographed was the meniscus formed by its surface against the glass, which appeared as a bright straight line. When the surface was disturbed by waves, the nature of the disturbance was indicated by the successive shapes assumed by the meniscus. To study the internal motions of the liquid, small globules were constructed of wax and resin, silvered like certain pills, and so proportioned as to be slightly heavier than water, so that they could be made to float in neutral equilibrium by adding salt water. Stationary waves were then produced by rapidly changing the immersion of a solid cylinder on the opposite side of the tank, when the meniscus was thrown into the species of trochoidal curve already deduced from hydrodynamical theory. This curve appears in the photographs in great perfection. A wave of translation was also photographed fourteen times per second, and its velocity, as calculated by the scale, was 2·24 m. per second. Streams and eddies were also produced in the tank, and traced by means of the bright balls. On letting the water flow past an obstacle in the form of a fish, more obtuse on one side than on the other, it was proved that no perceptible eddies were formed if the water first encountered the obtuse side, but that it was greatly disturbed if the acute end was presented to the stream.—Determination of the specific heat of boron, by MM. Henri Moissan and Henri Gautier.—On mineral phosphates of animal origin, and on a new type of phosphorites, by M. Armand Gautier.—On the sanitary system adopted by the Dresden Conference for establishing common measures to safeguard the public health in times of epidemic cholera, without placing useless obstacles in the way of commercial transactions or the movements of travellers, by M. Bronardel.—Observations of the comets, Brooks (1892, VI.), Holmes (1892, III.), and Brooks (1893, I.), made with the great equatorial of Bordeaux, by MM. G. Razet, L. Picart, and F. Courty.—On a general case where the problem of the rotation of a solid body admits of uniform integrals, by M. Hugo Gyldén.—On the displacement of the temperature of maximum density of water by pressure, and the return to the ordinary laws under the influence of pressure and temperature, by M. E. H. Amagat.—Researches to establish the bases of a new method of recognising the adulteration of butter by margarine employed either singly or mixed with other fatty materials of vegetable or animal origin, by M. A. Houzeau.—Observation of the solar eclipse of April 16, 1893, at the observatory of the Societe Scientifique Flammarion at Marseilles, by M Léotard.—On a class of differential equations, by M. Vessiot.—On the structure of finite and continuous groups, by M. Cartan.—On the ordinary differential equations which possess a fundamental system of integrals, by M. A. Guldberg.—On the reduction of the problem of tantochronics to the integration of a partial differential equation of the first order and the second degree, by M. G. Kœnigs.—On the densities and molecular volumes of chlorine and of hydrochloric acid, by M. A. Leduc.—On the diminution of the coefficient of expansion of glass, by M. L. C. Baudin.—On the systems of dimensions of electrical units, by M. E. Mercadier.—On the influence of longitudinal magnetisation upon the electromotive form of a copper-iron couple, by M. Chassagny.—Optical phenomena presented by secondary wood in thin sections, by M. Constant Houlbert.—Decomposition of oxalic acid by the ferric salts under the influence of heat, by M. George Lemoine.—Contribution to the study of the Leclanché cell, by M. A. Ditte. On the fluorides of the alkaline earths, by M. C. Poulenc.—On the quantitative determination of phosphoric acid, by MM. A. Villers and Fr. Borg.—On licarene derived from licareol, by M. Ph. Barbier.—On a vegetable nucleine, by M. P. Petit. On an earthquake shock felt at Grenoble on April 8, by M. Kilian.—The month of April, 1893, by M. E. Renou.—On the emission of a sugar-containing liquid by the green parts of the orange-tree, by M. E. Guinier.—On a new genus of conifers found in the Albian of the Argonne, by M. Paul Fliche.—Discovery of two skeletons at Villejuif and at Thiais, their age and ethnic character, by M. Zaborowski.—Periodic form of the doriferous power in the fatty series, by M. Jacques Passy.—Researches on the employment of tree leaves in the feeding of cattle, by M. A. Ch. Girard.

BERLIN.

Physiological Society, April 7.—Prof. du Bois Reymond, President, in the chair.—Dr. Engel gave an account of the outcome of his researches on the development of blood corpuscles. By using appropriate staining reagents, and fixation of the corpuscles by drying, he had found, in the embryos of mice in various stages of development and in leukhæmic children, that at first spheroidal nucleated cells make their appearance, metrocytes, which subsequently divide karyokinetically into daughter-metrocytes. From the latter some non-nucleated cells containing hæmoglobin are developed, as also some red-coloured cells, from which are then formed the red corpuscles, the nucleated white corpuscles and platelets. In the discussion which ensued Prof. Ehrlich confirmed the above results from personal observations, but regarded the origin of white blood-corpuscles from the red cells as not yet definitely established. Prof. Kossel spoke on a new saccharine substance called Dulcin, describing its chemical constitution and its effect on rabbits and dogs. Dulcin is two hundred times as sweet as sugar. Rabbits were unaffected by daily doses of 2 grm. (= 400 grm. sugar), but dogs were found to lose their appetite by prolonged taking of the above dose, recovering it soon when the drug was no longer administered. Prof. Ewald had tried the effect of dulcin upon both

healthy and sick people, observing no ill effect with doses equal to the amount of sugar ordinarily consumed. Prof. Heymans, of Ghent, reported that employing Golgi's method he had observed numerous branching nerves in the muscles of the wall of the cardiac ventricle, and particularly in the apex of the heart. Dr. Lilienfeld had studied the relationship of cell-elements to certain colouring matters, and exhibited a mixture of the latter, which appeared of an equally brownish-violet colour, both in aqueous and alcoholic solution. On shaking up in this crystals of nucleinic acid, the chief constituent of the nucleus they were at once coloured bright green, whereas white of egg assumed an intense red colour.

April 21.—Prof. du Bois Reymond, President, in the chair.—Dr. Goldscheider reported upon experiments on the sense of touch in the blind, as made by Hocheisen on eight individuals, of whom some were born blind, while others became blind in early youth. The results obtained showed that the muscular sense of the blind is far more acute than of those who can see, being more acute in the youthful blind than in those who are older; in the latter the sense is scarcely more acute than that of those who can see. Similarly the power of localising was more acute in the young than in those who are older, and did not differ appreciably from that of those who can see. By practice both the above senses can be so sharpened in those who possess sight that they are ultimately as acute as for the blind.—M. Krüger spoke on the chemical constitution of adenin and hypoxanthin, and described the reactions which led to the establishing of their constitutional formulæ.

Physical Society, April 28.—Prof. Kundt, President, in the chair.—Prof. Neesen spoke on a new mercurial pump he had constructed on the principle of a Sprengel pump. Dr. Fröhlich developed his views on the theory of the electromagnet, which by bringing Hopkinson's theory into accord with conceptions of magnetic resistance and ideas on saturation had led to a considerable advance in generalisation. The discussion which ensued was chiefly taken up by Dr. Du Bois, who urged that the views propounded were rather of technical than scientific interest.

[*Note.*—In the report of the Physical Society (see NATURE, April 27, p. 624), in line five from the top, for "pressure" read "thickness," and in line six from the bottom for "Wren" read "Wien."]

DIARY OF SOCIETIES.

LONDON.

THURSDAY, MAY 11.

MATHEMATICAL SOCIETY, at 8.—On some Formulæ of Codazzi and Weingarten in Relation to the Application of Surfaces to each other: Prof. Cayley, F.R.S.—On the Expansion of Certain Infinite Products: Prof. L. J. Rogers.—A Theorem for Bicircular Quartic Curves and for Cyclides Analogous to Ivory's Theorem for Curves and Surfaces of the Second Degree: A. L. Dixon.—On the Linear Transformations between Two Quadrics: H. Taber.—The Collapse of Boiler-flues: A. E. H. Lowe.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—On the Prevention of Sparking, Compound Dynamos without Series Coils or Magnets; and Self-exciting Dnamos and Motors without Winding upon Field Magnets: W. B. Sayers.

ROYAL INSTITUTION, at 3.—The Atmosphere: Prof. Dewar, F.R.S.

FRIDAY, MAY 12.

PHYSICAL SOCIETY, at 5.—The Drawing of Curves from their Curvature: C. V. Boys, F.R.S.—The Foundations of Dynamics: Oliver Lodge, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 8.

ROYAL INSTITUTION, at 9.—Isoperimetrical Problems: Lord Kelvin, Pres.R.S.

AMATEUR SCIENTIFIC SOCIETY, at 8.—Geological Time (with Special Reference to Mr. Mellard Reade's Paper in the *Geological Magazine* for March): W. H. Davis.

SATURDAY, MAY 13.

ROYAL BOTANIC SOCIETY, at 3.45.

ROYAL INSTITUTION, at 3.—Johnson and Swift: Dr. Henry Craik, C.B.

TUESDAY, MAY 16.

ZOOLOGICAL SOCIETY, at 8.30.—On the Atrium and Prostate of the Oligochætous Worms: F. E. Beddard, F.R.S.—Descriptions of Fifteen New Species of Pleurotomidæ: G. B. Sowerby.—List of Mammals inhabiting the Bornean Group of Islands: A. H. Everett.—On a Second Collection of Mammals sent by Mr. H. H. Johnston, C.B., from Nyassaland: O. Thomas.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Monthly Ballot for Members.—Reception by the President and Council.—Wreck-raising in the River Thames: C. J. More.

ROYAL INSTITUTION, at 3.—Modern Society in China: Prof. R. K. Douglas.

WEDNESDAY, MAY 17.

ROYAL METEOROLOGICAL SOCIETY, at 7.—Mean Daily Maximum and Minimum Temperature at the Royal Observatory, Greenwich, on the Average of the Fifty Years from 1841 to 1890: William Ellis.—Suggestions, from a Practical Point of View, for a New Classification of Cloud Forms: Frederic Gaster.—Notes on Winter: Alex. B. MacDowall.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Exhibition with the Projection Microscope: Sir David L. Salomons.—Notes on Rotifers: C. Rousselet.

THURSDAY, MAY 18

ROYAL SOCIETY, at 4.30.

CHEMICAL SOCIETY, at 8.—Observations on the Production of Ozone during Electric Discharge through Oxygen: W. A. Shenstone and M. Priest.—The Relative Strengths or Avidities of some Weak Acids: Dr. Shields.—The Boiling Points of Homologous Compounds, Part I.: Dr. James Walker.

ROYAL INSTITUTION, at 3.—The Geographical Distribution of Birds: Dr R. Bowdler Sharpe.

FRIDAY, MAY 19.

ROYAL INSTITUTION, at 9.—Poetry and Pessimism: Alfred Austin.

SATURDAY, MAY 20.

ROYAL INSTITUTION, at 3.—Johnson and Wesley: Dr. Henry Craik, C.B.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—The Future of British Agriculture: Prof. Sheldon (W. H. Allen).—The Nests and Eggs of British Birds: C. Dixon (Chapman and Hall).—Theorie der Optischen Instrumente: Dr. S. Czapski (Breslau, Trewendt).—Practical Astronomy, 2nd edition: J. S. Michie and F. S. Harlow (K. Paul).—An Analytical Index to the Works of the late John Gould, F.R.S.: Dr. R. B. Sharpe (Sotheran).—The New Technical Educator, vol. 1 (Cassell)

PAMPHLETS.—Determinations of Gravity with Half-second Pendulums on the Pacific Coast, in Alaska, and at Washington, D.C., and Hoboken, N.J.: T. C. Mendenhall (Washington).—The Photoscope (Liverpool, Sanders).

SERIALS.—Medical Magazine, May (Southwood).—Quarterly Journal of the Geological Society, vol. xlix. Part 2, No. 194 (Longmans).—Journal and Proceedings of the Royal Society of New South Wales, vol. xxvi. (K. Paul).—Verhandelingen der Koninklijke Akademie van Wetenschappen te Amsterdam, Erste Sectie, Deel. 1, Nos. 1, 2, 4, 5, 6; Tweede Sectie, Deel. 1, Nos. 1, 4, 10 (Amsterdam, J. Müller).—Journal of the Chemical Society, May (Gurney and Jackson)—Proceedings of the Royal Society of Edinburgh, vol. xix. pp. 193–295 (Edinburgh).—Himmel und Erde, May (Berlin, Paetel).—Jahrbuch der k.k. Geologischen Reichsanstalt, Jahrg. 1892, xlii. Band 3 and 4 Heft (Wien).—Journal of the Scottish Meteorological Society, third series, No, ix. (Blackwood).—Proceedings of the American Academy of Arts and Sciences, new series, vol. xix. (Boston, Wilson)—Report of the Marlborough College Natural History Society, No 41 (Marlborough).

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