treated under paraffin, by M. Mahoudeau.—A description of the cranium and brain in two assassins, by MM. Fallot and Alezais. This communication gives a minute analysis of the convolutions and other parts of the hemispheres, while it supplies numerous and special measurements of the various parts of the skull together with the respective cerebral and cranial indices.—On the cranial alterations observable in rachitic conditions, by M. Regnault.—On the first temporal convolution in the right and left hemispheres, in the case of a person who was known to have suffered from deafness of the left ear, by M. Manouvrier.—A communication regarding the truth of the reports made by various travellers that cannibalism exists among the Fuegians, by M. Hyades. According to this writer there is absolutely no ground for this charge.—On a Peruvian bell, by M. Verneau.—On the antiquity of Egypt, and the evidences of its condition in prehistoric times, by M. Beauregard. In this very exhaustive article the author passes in review the material evidence remaining of the ages of cut and polished stone and of bronze. He believes that Egypt at the time of the Pharaohs exhibited the mixed condition of combining the use of flint implements with the simultaneous acquaintance with the means of extracting copper, and blending it with other metals, including tin, although no distinct hieroglyphic for the latter has been recognized in the older language of Egypt. It remains undetermined where and when first the ancient Egyptians obtained the tin which enters into the bronze fabricated in the valley of the Nile as far back as the seventeenth century before our era.—On the birth-rate in France, by M. Chervin. This paper contributes the most elaborate and detailed series of statistical tables, for the separate departments, of the births, marriages, and deaths registered, as well as of the numbers of children born in a definite number of households. The means obtained from these lists show that 8 per cent. of all the marriages in France are sterile, and that while 25 per cent. yield only one child, 100 families supply a mean of only 259 children. Many curious points of interest are suggested by this complex report, but it does not do much to explain the causes of the want of increase in the population of France, as compared with that of other countries.—On the hinged and cantoned cross in Cyprian decorative art, by M. Max Richter. The remains of ancient art in Cyprus strongly resemble those of Hissarlik, excepting that there is no trace of the *swastika*, or hinged cross on the decorated red jars of the Bronze Age, while its later appearance and disappearance in Cyprian art appears to coincide with the predominance and decline of Phœnician influence.—On the survival in Brittany of some of the usages and privileges of clanship, by M. Sébillot.—On a semi-pagan procession on St. John's day, in the Basses Alpes, by M. Arnaud. From time immemorial the peasants of Lauzet have proceeded after the benediction of the neighbouring lake to throw stones into its waters amid loud and angry cries of vengeance against the evil spirits who bring rain and hail storms. In this strange ceremony the local *curé* is constrained by popular will to take part.—On phallotomy among the Egyptians, by M. Letourneau.—On the centre of creation, and the first appearance of the human race, by M. Lombard. The writer supports Signor Saporta's view that vegetable forms, which now cover our continents, have spread slowly and continuously from north to south, recent species forcing back or obliterating those of more ancient origin. The laws which Signor Saporta endeavours to establish for the diffusion of vegetable forms, M. Lombard thinks may be extended to the animal kingdom, including man, whose cradle he would seek in circumpolar regions.—Report of sixth Conference on Transformism, under the presidency of M. Duval, by M. Bordier.—Report of fifth Broca-Conference, by M. Topinard, a member of the commission for awarding the prize instituted by Madame Broca in memory of her husband. The memoirs presented between 1885 and 1888 are not numerous, but great value attaches to two among these works, viz. the general ethnography of Tunis, by Dr. René Collignon, to whom the Broca Prize for 1888 has been unanimously awarded; and ethnological researches in regard to the human remains discovered at Spy, by M. Fraipont, who received a silver medal in recognition of the great merit of his work.—On the longevity of the Berber races, by M. Letourneau.—On a Palæolithic station on Mont Roty, and on a novel flint implement, by the Abbé Blanquet.—On an ancient cemetery at Biskra, Algeria, by M. de Mortillet.—On a sepulchral dolmen, discovered at Nanteuil-le-Houdouin (Oise), by MM. Collin and Lair.—A prehistoric station at Frileuse (Seine-et-Oise), by M. Vauvillé.

THE numbers of the *Botanical Gazette* (Crawfordsville, Indiana) for March and April contain a careful study of the histology of the leaves of *Taxodium* by Mr. Stanley Coulter, and a description of a number of new North American mosses, with illustrations, by Messrs. Renauld and Cardot. It is an evidence of the attention paid in the United States to microscopical technique, that this magazine frequently contains (as do both the numbers now before us) valuable hints as to the preparation of sections of tissues for the microscope, the use of staining reagents, or objects specially well calculated to demonstrate difficult points of structure.

IN the *Journal of Botany* for April and May, Messrs. Murray and Boodle complete their account of the genus *Avrainvillea* of Siphonocladaceæ.—Students of conifers will read with very great interest Dr. M. T. Masters's attempt to distinguish the North American pines, *Abies lasiocarpa*, *A. bifolia*, and *A. subalpina*, with their varieties or subspecies. The paper is illustrated by a series of excellent woodcuts.—Most of the other papers in these numbers are of special interest to students of British plants.

THE *Nuovo Giornale Botanico Italiano* for April, a large portion of which is devoted to a report of the proceedings of the Italian Botanical Society, contains several articles of general interest besides those devoted to the Phanerogamic and Cryptogamic botany of Italy.—Dr. H. Ross has an interesting article on the assimilating tissue and development of the periderm in the branches of plants with few or no leaves.—In pursuance of his careful examination of the Nymphæaceæ, Prof. G. Arcangeli now contributes a paper on the seeds of *Victoria regia*.—Signor U. Martelli adds a species to the few hitherto known of the genus *Riccia*—*R. atromarginata* from Sicily.—Signor C. Lumia gives the result of an examination of the composition of the gas found within the inflorescence of the common fig in an unripe condition, which contains more than 5 per cent. of carbon dioxide, showing that an active process of respiration must go on within the receptacle.—Signor G. Cuboni gives an account of experiments carried on with a view to check the plague of grasshoppers by infecting them with a parasitic fungus, *Entomophthora Grylli*, which had, however, only negative results.

Rendiconti del Reale Istituto Lombardo, April.—Palæontological notes on the Lower Lias of the Lombard fore-Alps, by Dr. C. F. Parona. These notes are communicated pending the publication of the author's exhaustive treatise on the fauna of Saltrio. They deal especially with the palæontological features of the Bergamo and Como districts in connection with the various faunas that flourished in the Lombard Sea during the Lower Lias epoch. The results of this summary survey agree generally with the conclusions arrived at by Prof. De Stefani in his comparative study of the various Lower Lias formations throughout Italy.—New measurement of the curvature of surfaces, by Prof. Felice Casorati. A new solution is presented of this problem, that of Gauss being shown to be defective and inadequate, although he laid the first solid foundation for the study of the subject in his classical work, "Disquisitiones generales circa superficies Curvas."—Prof. Giovanni Zoja contributes some historical notices on the cabinet of human anatomy in the University of Pavia, dealing more particularly with the period from 1815 to 1864 under the able administration of Bartolomeo Panizza.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 9.—"Zirconium and its Atomic Weight." By G. H. Bailey, D.Sc., Ph.D., the Owens College, Manchester.

Before proceeding with any final estimation, those salts of zirconium which were at all likely to be of service in the determination were exhaustively examined with special regard to their stability in presence of reagents and under the action of heat.

It was found that in consequence of their instability and tendency to form numerous oxychlorides, neither the chloride nor the oxychloride could be relied upon, and that the sulphate was the most suitable salt to work with. Even this salt when heated above 400° C. undergoes gradual decomposition with the production of basic salts, though it is quite stable up to this temperature A special method (applicable in a number of

other atomic weights) was devised by which the normal salt could be obtained free from acid on the one hand, and from basic salt on the other. In order to have a sufficient check on the results, the carefully purified zirconia was further treated by four perfectly independent methods.

(*a*) The sulphate was prepared and its solution precipitated by means of hydrogen peroxide.

(*b*) The tetrachloride was prepared and its solution precipitated by ammonia.

(*c*) The sulphate was recrystallized several times from concentrated sulphuric acid and precipitated by ammonia.

(*d*) The oxychloride was prepared and recrystallized and precipitated by ammonia.

The average values obtained from the sulphate prepared from the specimens of zirconia so treated by determining the relation $Zr(SO_4)_2 : ZrO_2$, were :—

(*a*) 90·402
(*b*) 90·390
(*c*) 90·471
(*d*) 90·30
} mean 90·401.

In addition to the investigation of the salts which have been used in the estimation of the atomic weight, observations on the peroxides of zirconium discovered by Clève and the author are embodied, as well as an examination of the so-called metallic zirconium.

"Determining the Strength of Liquids by means of the Voltaic Balance." By Dr. G. Gore, F.R.S.

This method is based upon the circumstance that the greater the degree of concentration of a solution the larger is the amount of dilution required to reduce its voltaic energy to a given magnitude. The method of measuring the energy is described in Royal Society Proceedings, vol. xlv. p. 268.

In the present research a known volume of solution was taken, and the proportion of dissolved substance in it was found by ordinary chemical analysis. A second portion was taken, its specific gravity ascertained, and its degree of strength found by aid of the ordinary published tables of specific gravities. A third portion of known volume was then taken, its average amount of voltaic energy measured, and its degree of concentration ascertained by the amount of dilution required to reduce its voltaic energy to the same magnitude; the less dilute it was at starting the greater the amount of dilution required. The following are the results :—

By	HCl.	H_2SO_4.	HNO_3.	NaCl.	Na_2CO_3.	H_3N.
Chemical analysis ...	1·85	5·60	2·97	9·13	7·21	1·05
Specific gravity ...	1·70	5·44	2·80	8·74	7·63	1·03
Voltaic balance ...	1·65	5·70	2·90	8·71	7·57	1·06

A much less quantity of the substance is usually required by the voltaic balance method than by either of the other ones, and the operation is very quickly performed.

Physical Society, May 11.—Prof. Reinold, President, in the chair.—The following communications were read :—On an electrostatic field produced by varying magnetic induction, by Dr. O. J. Lodge, F.R.S. This paper describes a research made with the object of finding some connection between static electricity and magnetism. Several methods of attacking the problem, such as rotating or varying the strength of magnets in the neighbourhood of delicately suspended charged bodies, are indicated, and the one selected was based on an idea of Mr. A. P. Chattock, who conceived that a charged body in the vicinity of a closed magnetic circuit would be affected by varying the magnetic induction. From the theory of the effect it is shown that the magnitude of the quantity sought is exceedingly small, for the expression involves the inverse square of the velocity of light. The E.M.F. induced in any closed curve round the magnetic circuit or solenoid by varying the induction, I, is given by—

$$e = \frac{dI}{dt} \quad \ldots\ldots\ldots\ldots (1)$$

If an E.M.F., e, act on a charge, Q, at distance r from the axis of the solenoid, the work done in one revolution will be eQ, and

$$e\mathrm{Q} = \mathrm{F} \cdot 2\pi r \quad \ldots\ldots\ldots\ldots (2)$$

where F is the mechanical force. Now if the E.M.F. in (1) is the same as that in (2), the impulse given to the charged body by destroying the induction will be—

$$\phi = \int_0^\infty \mathrm{F}dt = \frac{\mathrm{IQ}}{2\pi r} \quad \ldots\ldots\ldots\ldots (3)$$

Since $\mathrm{I} = \frac{4\pi n \mathrm{CA}\mu}{l} = \mu\mathrm{C}$ times a length, and $\mathrm{Q} = s\mathrm{V} = \mathrm{KV}$ times a length,

$$\therefore \phi = \frac{\mathrm{K}\mu\mathrm{CVA}}{2\pi r} \text{ (length)}^2, \text{ and } \mathrm{K}\mu = \frac{\mathrm{I}}{\text{“}v\text{”}^2}; \quad \therefore \phi \propto \frac{\mathrm{I}}{\text{“}v\text{”}}.$$

The magnetic circuit actually used was a wire Gramme ring of trapezoidal section, wound with copper over only a part of its periphery. The indicating apparatus was a suspended needle, consisting of two oppositely charged bodies carried on a small shellac arm, to which a mirror or pointer was attached, and was suspended vertically in the plane of the ring. Great difficulty was experienced from Foucault's currents when metallic films were used for the needle, and the magnetic properties and other semi-conductors tried further complicated the matter. Eventually, the charged bodies were made of paper, in the form of cylinders one-eighth of an inch diameter and three-eighths of an inch long. Considerable trouble was caused by the electrostatic action between the needle and exciting coils, and various methods of screening were tried and abandoned, and subsequently the wire was replaced by a single spiral of copper ribbon, the outer turn of which was put to earth. Observation was rendered difficult, owing to the wandering of the zero when the needle was charged, but this was minimized by suitably shaping the contour of the needle's surroundings. Heat also created considerable disturbance, and the convection currents were cut off by a series of concentric cylinders of tin plate. The method of observation was to charge the two insulated parts of the needle, and then reverse the magnetizing current in synchronism with the period of the needle, noting whether the amplitude of any residual swing could be increased or diminished according as the impulse assisted or opposed the motion. In this way, slight indications have been observed, and the effects reverse when the charges of the cylinders are reversed. In explaining the theory of the experiment, the author made use of a simple transformer, consisting of an ordinary hank of iron wire wound over with insulated copper and provided with several secondary coils; and by it he demonstrated that the primary current increases on closing the secondary, due, as was shown, to the decrease of self-induction of the primary caused thereby. Prof. Fitzgerald, in answer to a question from Dr. Lodge as to the influence of screens, said he had not fully considered the matter in this particular case, and, as the general effect of screens depended on the square of "v," the subject required careful treatment. As a means of checking the results obtained by Dr. Lodge, he suggested calculating the impulse, and seeing whether its magnitude approximately corresponds with that observed. Commenting on an idea for carrying out a similar experiment attributed to him in the paper, in which a charged gold leaf is placed between the poles of a magnet, Prof. Fitzgerald said he had been misunderstood, for he had conceived a disk parallel to the faces of the magnets, which, when excited, should cause the disk to turn in its own plane. Referring to the equations for mechanical force given in Maxwell, § 619, he pointed out that the coefficient of e in the equation—

$$\mathrm{X} = cv - bw - e\frac{d\psi}{dx} - m\frac{d\Omega}{dx}$$

ought to be P, where—

$$\mathrm{P} = cy - b\dot{z} - \frac{d\mathrm{F}}{dt} - \frac{d\psi}{dx},$$

and considered it very important that the existence of the term $e\frac{d\mathrm{F}}{dt}$ should be tested experimentally. Prof. S. P. Thompson mentioned some experiments on which he was engaged by which he hoped to show electric displacement in continuous dielectric circuits, such as a link of gutta-percha. Up to the present the experiments had not been successful, owing to his inability to place the two Gramme ring coils used into such relative positions as to give silence in the telephone connected with the coil used as secondary, when currents were sent through the primary. Prof. Ayrton suggested that Dr. Thompson's difficulty may arise from the fact that such rings do produce considerable external field, even when carefully wound.

Prof. Fitzgerald requested Dr. Thompson to investigate the effects of displacement-currents and of changing vector potential, and pointed out that in a single medium the former can produce no magnetic effect. As regards fields containing different media, he said the calculations would be complicated by the spurious charges on the separating surfaces. Dr. Lodge, in reply, said he had calculated the momentum to be expected in one arrangement of his experiment in which a suspended aluminium cylinder surrounds one limb of a rectangular magnetic circuit which formed the core of an induction coil; one end of the secondary was put to the core and the other to the cylinder, thus forming a condenser. The result came out about 10^{-6} dyne second, but he could not say whether such a small quantity was observable.—On the concentration of electric radiation by lenses, by Prof. O. J. Lodge, F.R.S., and Dr. James L. Howard. The authors' first attempts at concentration were made with mirrors on a comparatively small scale, and, owing to the difficulties experienced, it was considered advisable to try lenses. Two large cylindrical ones of plano-hyperbolic section were cast of mineral pitch in zinc moulds, the plane faces being nearly a metre square, the thickness at vertex 21 centimetres, and each lens weighed about 3 cwt. The eccentricity of the hyperbola was made 1·7, to approximate to the index of refraction of the substance. The lenses were mounted about 6 feet apart, with their plane faces parallel, and towards each other on a table in the College corridor, and an oscillator was placed about the principal focal line of one of them at a distance of 51 centimetres from the vertex. The field was explored by a linear receiver made out of two pieces of copper wire mounted in line on a piece of wood, and the air-gap between their inner ends was adjustable by a screw. When the oscillator worked satisfactorily, the receiver would respond at about 120 centimetres, and with the lenses the distance was 450. The receiver responded anywhere between the lenses, and within the wedge between the second lens and its focal line, the boundaries being clearly defined, but no special concentration was noticed about the focus. Interference experiments were carried out by placing a sheet of metal against the flat face of the second lens, and determining the positions of minimum intensity between the lenses. The distance between these points was 50·5 centimetres, corresponding with a wave-length of 101 centimetres, whereas the calculated wave-length of the oscillator was 100 centimetres. Prof. Fitzgerald congratulated the authors on their success, and also pointed out that although large oscillators give good results at distances within a few wave-lengths, yet at greater distances small ones were decidedly superior, owing to the energy of radiation varying as the fourth power of the rapidity. He had recently made experiments on electric radiations analogous to Newton's rings, and had successfully observed the central dark spot and the first dark band. Referring to Dr. Lodge's experiments, he inquired whether any traces of diffraction were observed near the boundary of the bundle of rays between the lenses. Speaking of polarization experiments, Prof. Fitzgerald said waves reflected from films of water exhibited no polarization, whereas those reflected from non-conductors were completely polarized. In reply, Dr. Lodge said no diffraction-effects had been observed, but in the interference-experiments to determine wave-length, the positions of minimum effect were very decided.—The President, in proposing that the thanks of the meeting be given to the authors of the papers, congratulated the Society on the presence of both Dr. Lodge and Prof. Fitzgerald on the present occasion, when subjects with which they were so well acquainted were brought before the meeting.

Chemical Society, May 2.—Dr. W. J. Russell, F.R.S., President, in the chair.—The following papers were read:—Thiophosphoryl fluoride, by Prof. T. E. Thorpe, F.R.S., and Mr. W. J. Rodger. Thiophosphoryl fluoride, PSF_3, may be prepared by the action of arsenic trifluoride on thiophosphoryl chloride, or by heating a mixture of bismuth trifluoride or lead fluoride with phosphorus pentasulphide in a leaden vessel at a temperature not exceeding 250°. It is a transparent colourless gas, which under a pressure of ten to eleven atmospheres at ordinary temperatures condenses to a colourless, mobile liquid. It is slowly decomposed by water into sulphuretted hydrogen, phosphoric acid, and hydrogen fluoride, but does not attack mercury, and can be stored in a glass gas-holder. In air it is spontaneously inflammable, burning with a greyish-green flame forming phosphorus pentafluoride, phosphorus pentoxide, and sulphur dioxide, and it spontaneously explodes with oxygen. When heated, or subjected to electric sparks, it is decomposed with separation of sulphur and phosphorus, and formation of phosphorus trifluoride, and eventually phosphorus pentafluoride, whilst if the heating be effected in a glass tube at a sufficiently high temperature the gas is ultimately converted into silicon tetrafluoride. Thiophosphoryl fluoride combines with ammonia forming a solid product $P(NH_2)_2SF$, and when shaken with a moderately strong solution of alkali it is absorbed with the formation of a thiophosphate and a fluoride.—The boiling-point of sodium and potassium, by Mr. E. P. Perman. Sodium and potassium were boiled in a hollow iron ball which was heated by means of a blowpipe; the temperature was found in each case by means of an air thermometer consisting of a glass bulb with a capillary stem which was lowered into the vapour, sealed and broken open under water. The mean result for sodium was 742°, and for potassium 667°.—Note on the heat of neutralization of sulphuric acid, by Mr. S. U. Pickering. Calculating the value of the heat of neutralization of sulphuric acid in infinity of water from the results of a series of experiments on the dilution of the acid, the author finds that it becomes reduced to 28,197 cal., a value within experimental error, the same as that of two molecules of hydrogen chloride.—α-ω-diacetylpentane and α ω-dibenzoylpentane, by Dr. F. S. Kipping and Prof. W. H. Perkin.—Acetopropyl- and acetobutyl-alcohol, by Dr. H. G. Colman and Prof. W. H. Perkin.

Royal Meteorological Society, May 15.—Dr. W. Marcet, F.R.S., President, in the chair.—The following papers were read:—Account of some experiments made to investigate the connection between the pressure and velocity of the wind, by Mr. W. H. Dines. These experiments were made for the purpose of determining the relation between the velocity of the wind and the pressure it exerts upon obstacles of various kinds exposed to it. The pressure-plates were placed at the end of the long arm of a whirling machine which was rotated by steam power. The author gives the results of experiments with about twenty-five different kinds of pressure-plates. The pressure upon a plane area of fairly compact form is about 1½ pounds per square foot, at a velocity of twenty-one miles per hour; or, in other words, a pressure of 1 pound per square foot is caused by a wind of a little more than seventeen miles per hour. The pressure upon the same area is increased by increasing the perimeter. The pressure upon a ¼-foot plate is proportionally less than that upon a plate either half or double its size. The pressure upon any surface is but slightly altered by a cone or rim projecting at the back, a cone seeming to cause a slight increase, but a rim having apparently no effect.—On an improved method of preparing ozone paper, and other forms of the test, with starch and potassium iodide, by Dr. C. H. Blackley. Some years ago the author made some experiments with the ordinary ozone test-papers, but found that the papers did not always give the same result when two or more were exposed under precisely the same conditions. He subsequently tried what reaction would take place between unboiled starch and potassium iodide when exposed to the influence of ozone; but the difficulty of getting this spread evenly upon paper by hand so as to insure a perfectly even tint after being acted upon by ozone led him to devise a new method of accomplishing this. Briefly described, it may be said to be a method by which the starch is deposited on the surface of the paper by precipitation, and for delicacy and precision in regulating the quantity on any given surface leaves very little to be desired.—Notes on the climate of Akassa, Niger Territory, by Mr. F. Russell. This paper gives the results of observations made from February 1887 to October 1888 at Akassa, which is the seaport and principal depot of the Royal Niger Company, and is situated at the mouth of the River Nun in the Niger Delta.—Wind storm at Sydney, New South Wales, on January 27, 1889, by Mr. H. C. Russell, F.R.S.

Geological Society, May 8.—W. T. Blanford, F.R.S., President, in the chair.—The following communications were read:—The rocks of Alderney and the Casquets, by the Rev. Edwin Hill. The author in this paper described Alderney, Burhou, with its surrounding reefs, and the remoter cluster of the Casquets, all included within an area about ten miles long. The reading of the paper was followed by a discussion, in which the President, Prof. Bonney, Dr. Woodward, Dr. Hicks, and others took part.—On the Ashprington volcanic series of South Devon, by the late Arthur Champernowne. Communicated by Dr. A. Geikie, F.R.S. The author described the general characters of the volcanic rocks that occupy a considerable area of the country around Ashprington, near Totnes. They comprise tuffs and

lavas, the latter being sometimes amygdaloidal and sometimes flaggy and aphanitic. The aphanitic rocks approach in character the porphyritic "schalsteins" of Nassau. Some of the rocks are much altered; the felspars are blurred, as if changing to saussurite, like the felspars in the Lizard gabbros. In other cases greenish aphanitic rocks have, by the decomposition of magnetite or ilmenite, become raddled and earthy in appearance, so as to resemble tuffs. The beds are clearly intercalated in the Devonian group of rocks, and the term Ashprington Series is applied to them by the author. Alrhough this series probably contains some detrital beds, there are no true grits in it. Stratigraphically the series appears to come between the Great Devon Limestone and the Cockington Beds, the evidence being discussed by the author, however, not so fully as he had intended, as the paper was not completed. The President said that the thanks of the Society were especially due to Dr. Geikie for having rescued this paper from oblivion. Dr. Geikie, after alluding to the melancholy interest attaching to the paper, said that he had himself urged the author to formulate his ideas upon the structure of the country. The present communication, however, was all that was found among his papers in a condition for publication. But it is imperfect, and no materials remained from which it could be completed; still it was too valuable a piece of work to leave unpublished. There were two principal points in this last work of Mr. Champernowne: (1) the non-intrusive character of the beds in question; (2) their geological horizon, regarding which, though, owing to the faulted nature of the country, it is rather obscure, Mr. Champernowne's surmises may turn out to be correct. There was no allusion in the paper to the compression and shearing the rocks had undergone, to which he (Dr. Geikie) attributed much of the schistose structure both of the sedimentary and igneous rocks of the region. The flaky beds of which the author speaks can be traced into the more massive rocks. The flattening out of the amygdaloids was a striking proof of this mechanical deformation. Some remarks on the paper were also offered by Mr. Rutley, Dr. Hatch, Mr. Worth, and Mr. W. W. Beaumont.

Zoological Society, May 7.—Prof. 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 April 1889, and called attention to a young male Sinaitic Ibex (*Capra sinaitica*), from Mount Sinai, presented by Sir James Anderson; and to a young male of the Lesser Koodoo (*Strepsiceros imberbis*), from East Africa, presented by George S. Mackenzie.—Mr. Sclater exhibited and made remarks on a living specimen of an albino variety of the Cape Mole (*Georychus capensis*), lately presented to the Menagerie by the Rev. George H. R. Fisk, C.M.Z.S.—The Secretary read a letter addressed to him by Dr. E. C. Stirling, of Adelaide, containing a copy of his description of a new Australian burrowing Mammal, lately published in the Transactions of the Royal Society of South Australia, and promising to send to the Zoological Society a more complete account of the same animal.—Mr. Seebohm exhibited and made remarks on the skin of a male example of *Phasianus chrysomelas*, which had been transmitted in a frozen state from the Trans-Caspian Provinces of Russia.—A communication was read from Colonel C. Swinhoe, containing descriptions of seventy-five new species of Indian Lepidoptera, chiefly Heterocera.—A communication was read from Rev. O. P. Cambridge, containing the description of a new Tree Trap-door Spider from Brazil, proposed to be called *Dendicon rostratrum*.—Mr. F. E. Beddard read some notes on the anatomy of an American Tapir (*Tapirus terrestris*), based on a specimen lately living in the Society's Collection.—A communication was read from Prof. Bardeleben, of Jena, on the præpollex and præhallux of the Mammalian skeleton. The author recorded the presence of a two-segmented nail-clad præpollex in *Pedetes*, and that of a two-segmented pisiform (post-minimus) in *Bathyergus*. He also stated that he had discovered vestiges of the præhallux and præpollex in certain Reptilia. He then passed to the consideration of the Mesozoic *Theriodesmus* of Seeley, and denied the existence of the *scapho-lunare* of that author, while he produced good reason for believing the same observer's second *centrale* to consist of two elements, and his præaxial *centrale* to be the basal element of a præhallux.—Mr. Oldfield Thomas read the description of a new genus and species of Muridæ from Queensland, allied to *Hydromys*, which he proposed to call *Xeromys myoides*.

Mathematical Society, May 9.—J. J. Walker, F.R.S., President, in the chair.—The following communications were made:—On the solution in integers of equations of the form $x^3 + y^3 + Az^3 = 0$, by S. Roberts, F.R.S.—On the concomitants of K-ary quantics, by W. J. C. Sharp.—Note on the G function in an elliptic transformation annihilator, by J. Griffiths.—On the complete elliptic integrals K, E, G, I, by Dr. J. Kleiber, *Privatdocent* of the University of St. Petersburg.—On the motion of an elastic solid strained by extraneous forces, by Signor Betti ("by *symmetrical algebraic analysis*, the author obtains an expression, in terms of the rotations of the element, for the unbalanced couples acting on each element of a solid when strained by given forces; and he points out that the result is in accordance with a form of the elastic equations given by Sir W. Thomson").—On cyclotomic functions, § iii. the cyclotomics belonging to the f-nomial periods of the pth roots of unity, where p is a prime number, by Prof. Lloyd Tanner.

EDINBURGH.

Royal Society, April 1.—Sir W. Thomson, President, in the chair.—Prof. Tait communicated some of the results obtained from a series of experiments on impact of various bodies.—Sir W. Thomson exhibited and described new forms of magneto-static current- and volt-meters, and an electro-static voltmeter with a multiple voltaic pile to facilitate graduation.—Mr. A. Crichton Mitchell gave an account of the properties of manganese steel.—Dr. W. Peddie described an improved method of measuring small rotations of the plane of polarization by ordinary apparatus.—Prof. Tait read a paper on the relations between line-, surface-, and volume-integrals. He showed that the well-known relation between line- and surface-integrals can be deduced directly from a particular case of the equally well-known relation between surface- and volume-integrals.

April 15.—Prof. Sir Douglas Maclagan, Vice-President, in the chair.—The Keith Prize for 1885–87 was awarded to Mr. J. Y. Buchanan for a series of communications on subjects connected with ocean circulation, compressibility of glass, &c.—The Makdougall-Brisbane Prize for 1884–86 was awarded to Dr. John Murray for his papers on the drainage areas of continents, and ocean deposits, the rainfall of the globe, and discharge of rivers, the height of the land and depth of the ocean, and the distribution of temperature in the Scottish lochs as affected by the wind.—The Makdougall-Brisbane Prize for 1886–88 was awarded to Dr. Archibald Geikie for numerous communications, especially that on the history of volcanic action during the Tertiary period in the British Isles.—Prof. Swan read an obituary notice of the late Mr. R. M. Smith.—Dr. E. Sang read a paper on the resistance of the air to the motion of an oscillating body with special reference to its effect on time-keepers.—Mr. A. Johnstone communicated a paper on a new and easy method for the rapid and sure detection of mercury.

PARIS.

Academy of Sciences, May 13.—M. Des Cloizeaux, President, in the chair.—The thionic series, by M. Berthelot. In this paper the author studies the action of the acids on the thiosulphates, which throws quite a new light on the constitution of the salts of the thionic series, by determining the limits of the heat of neutralization of thiosulphuric acid. The liberated sulphur reacts with the thiosulphuric acid before it decomposes, forming complex thionic acids.—On mesocamphoric acid, by M. C. Friedel.—The author has prepared this substance by a process different from that of Wreden, by whom it was first described, and some of whose statements are here rectified. Instead of being an inactive, non-decomposable acid, it is found to be decomposable by simple crystallization.—On the photographic spectrum of the great nebula of Orion, by Dr. W. Huggins. In 1882 the author obtained a photograph of the spectrum of this nebula, revealing a new luminous ray with wave-length about $\lambda 3730$. Two recent photographs taken in 1888 and 1889 enable him to determine more accurately this wave-length, as well as to describe a certain number of other luminous rays which occur in the ultra-violet region of the spectrum of the same nebula. These photographs are figured in a drawing which accompanies the present note. The wave-length of the bright ray discovered in 1882 is here determined at $\lambda 3724$. Dr. Huggins considers it probable that nebulæ yielding a spectrum of luminous rays, with a very faint continuous spectrum, which is probably formed in part by luminous rays in close proximity, are at or near the beginning of the cycle of their celestial evolution, while those resembling the large nebula in Andromeda have already reached a more

advanced phase of their development. The photograph of this nebula taken by Mr. Roberts reveals a planetary system, in which some planets are already formed, and their central mass condensed.—On the surgical treatment of the foot in cases of suppurated osteo-arthritis, by M. Ollier. Hitherto amputation has generally been considered the only remedy; but the author's experiments show that, by removal of the ankle with abrasion or resection of the limiting articulations, the foot may be preserved almost in its normal state and with little detriment to its locomotive functions.—On the linear expansion of solid bodies at high temperatures, by M. Pionchon. These researches show that by means of the simple process here described M. Fizeau's well-known experiments may be repeated with the greatest ease. M. Pionchon now proposes to apply the process to the study of the linear expansion of amorphous and crystallized solid bodies at high temperatures.—On the direct measurement of the retardation produced by the reflection of luminous waves, by M. A. Potier. These experiments, which are applicable to a large number of substances, constitute a method by means of which the retardation may be directly measured, which is caused by the reflection of the luminous waves on their surface.—On the influence of terrestrial magnetism on atmospheric polarization, by M. Henri Becquerel. In a previous memoir (*Annales de Chimie et de Physique*, xix., 1880) the author showed that in a cloudless sky the plane of polarization is not generally coincident with the theoretic plane (plane of the sun), and further that the two should coincide when the latter is vertical, but that, in a region near the horizon and the magnetic meridian, the plane of polarization then deviates by a small angle in the direction corresponding to the rotation of the plane of polarization of a luminous ray traversing a column of air, subject to the magnetic influence of the earth. In the present paper he determines both the direction and the extent of the rotation, and also shows how this display of terrestrial magnetism is associated with some of the most interesting questions connected with the physics of the globe.—A study of the electric conductivity of saline solutions, as applied to chemical mechanics—the acid salts, by M. P. Chroustchoff. The author has applied M. Bouty's extremely sensitive electrometric method of measuring the electric conductivity of liquids to the study of several problems in chemical statics. In the present paper he tabulates the chief measurements of the electric conductivity of aqueous solutions containing one salt only.—Action of the atmosphere on manganese carbonate, by M. A. Gorgeu. In this paper the author discusses the question whether this action can give rise to any of the natural dioxides, as assumed by MM. Boussingault and Dieulafait.—Papers were contributed by M. L. Pigeon, on platinic chloride; by M. Aug. Lambert, on the action of borax on the polyhydric phenols and alcohols; and by M. H. Prouho, on the structure and metamorphosis of *Flustrella hispida*.—A copy of M. Seligmann-Lui's translation of Clerk Maxwell's classical treatise on "Electricity and Magnetism" was presented to the Academy by M. Sarrau.

BERLIN.

Physical Society, April 26.—Prof. Kundt, President, in the chair.—Prof. Kundt gave a short account of recent researches on electro-magnetic rotatory polarization, and developed the more general point of view from which they had been respectively undertaken. Since the time when Faraday discovered the fundamental phenomena and later physicists had accumulated a mass of material on which ob ervations could be made, two facts had chiefly presented difficulties in connection with the established theory: of these one was the varying direction of rotation produced by different substances, some producing a positive rotation (in the direction of the Ampèrian current), others a negative rotation; the other fact was the absence of magnetic rotation in doubly-refractive crystals. Starting from some theoretical considerations, the speaker was led to surmise that rotation is not wanting in these crystals, but is only obscured by some opposing phenomenon, a view which has been fully confirmed by experiments carried out at his suggestion by Drs. Wedding, Wiener, and du Bois. When a piece of glass was made doubly refractive by pressure, its magnetic rotatory polarization diminished, becoming *nil* when the difference in path of the two rays was $\frac{1}{2}\lambda$; when the difference was $\frac{3}{4}\lambda$, then the rotation took place in the opposite direction. When the difference was λ, the rotation was again *nil*, and it varied thus in a wave-like manner, with increasingly small amplitudes until it ceased entirely. Prof. Kundt concluded from this that the power of electro-magnetic rotatory polarization is common to *all* substances, whether crystalline or isotropous. As regards the varying direction of rotation, his own experiments had shown that simple substances produce a positive rotation, and compound bodies a negative rotation; this last result may be explained by the fact that the Ampèrian currents inside compound bodies run in a direction different from that in the magnetic field. The proportionality of rotation to the strength of magnetization is also a property common to all substances; its relationship to refraction is being made the subject of further researches. Dr. Koenig (from Leipzig) pointed out many analogies which exist between the electrical rays discovered by Prof. Hertz and rays of light, more particularly the polarization of the electrical rays by means of the wire grating and the phenomena which may be observed in the immediate neighbourhood of the rays as they are advancing in straight lines, phenomena which are in exact accord with those described by Stokes in the case of light.

STOCKHOLM.

Royal Academy of Sciences, April 9.—Researches on the deviations of the plumb line in Sweden, by Prof. Rosén.—Résumé préliminaire d'une recherche expérimentale sur l'absorption de la chaleur rayonnante par les gaz atmosphériques, by Dr. Ångström.—Newly found specimens of *Anser brachyrhynchus*, Baill., in Sweden, by Dr. A. Stuxberg.—On a singular Tetrarhynchid larva, by Herr E. Lönnberg.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Eclectic Physical Geography: R. Hinman (Low).—A Treatise on the Principles of Chemistry, 2nd edition: M. M. P. Muir (Cambridge University Press).—Teutonic Mythology: V. Rydberg, translated by R. B. Anderson (Sonnenschein).—Die Entstehung der Arten durch Räumliche Sonderung: M. Wagner (Basel, B. Schwabe).—Examination of Water for Sanitary and Technical Purposes: H. Leffmann and W. Beam (Philadelphia, Blakiston).—Hourly Readings, 1886, Part 3, July to September (Eyre and Spottiswoode).—The Uses of Plants: G. S. Boulger (Roper and Drowley).—Journal of the Institution of Electrical Engineers, No. 79, vol. xviii. (Spon).—Quarterly Journal of the Geological Society, No. 178 (Longmans).—Ergebnisse der Meteorologischen Beobachtungen, Jahrg. x. (Hamburg).

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