1888, No. 1.—Some remarks on the consequences of the earthquake of February 1887 in the Riviera, by H. Trautschold.—The chief noxious insects on tobacco in Bessarabia, an elaborate research by Prof. K. Lindeman. (Both papers in German.)—Count Alexis Razumovsky, first President of the Society, by Dr. Benzengre (in French).—List of plants of Tambof, by D. Litvinoff (continued).—On the hairs called auditive of the spiders, by W. Wagner (*Gehör-Organe* of Dahl). They belong to different types, and none of them can be recognized as performing the auditive function; they seem merely to be tactile organs of a higher structure.—Studies on the palæontological history of the *Ungulatæ*, by Marie Pavloff (second memoir). After having discussed the genealogy of the horse as viewed by V. Kovalevsky, Messrs. Marsh, Cope, Lydekker, Branco, and Schlosser, and discussed the rich material which Mrs. Pavloff was in possession of, the writer arrives at the following scheme. The eldest ancestors of the horse, *Phenacodus*, are found in the Eocene of North America; in Europe they are represented by the *Hyracotherium leporinum*, which, together with the *Pachynolophus* and *Anchilophus*, inhabited both continents. In the Miocene we find the *Anchitherium*, in America first, and later on in Europe; it was transformed in America into the *Protohippus* of the Mio-Pliocene. This last gave rise to the *Hippidium* and *Equus*, which largely developed during the Pliocene period in America (*E. parvulus*), Asia (*E. nomadicus*), Europe and Africa, where the *E. stenonis* was the ancestor of the Post-Pliocene *Equus caballus*. In how far our present horse originates from this later will be discussed next. Two plates illustrate the paper, written in French.

THE *Memoirs of the Odessa Society of Naturalists* (vols. xi. and xii.) contain the usual quantity of elaborate work, especially in anatomy and physiology. The papers on the embryogeny of the fresh-water lobster, by M. Morin; on the embryogeny of the Caucasian scorpion *Androctonus ornatus*, by MM. A. Kovalevsky and Shulghin; on the development of the *Urospora mirabilis*, by M. Woltke; on the embryology of the *Mysis chameleo*, by M. Nusbaum; and on the morphology of the *Haplotrichum roseum*, by M. Khmielevsky, are elaborate articles profusely illustrated by excellent plates.—M. Krasilschik's researches on the structure and life of the *Cercobodo laciniægerens*—a new genus of the Flagellatæ—are most interesting, showing how this microscopic organism preys on Bacteria and digests them, and how complicated is its organization altogether.—The same author contributes an interesting paper on the parasite Fungi of insects, and M. Khawkin has an article on the buccal apparatus of the *Euglenæ* and *Astasiæ*, as also on the laws of heredity in the case of unicellular organisms; and Dr. Kultchitsky studies the intestinal canals of several fishes.—Geology and mineralogy are represented by R. Prendel's article on the Wiluite, from which it appears that the crystals of this interesting mineral have a double composition—those parts of it which penetrate into the depth of the crystal as cones set upon the surfaces of the pyramids differing both by their density and refractive power from the parts which are built upon the faces of the prisms; three papers by Prof. Sintsoff on the water-bearing deposits of Kishineff, the Steppe deposits on the left bank of the Lower Volga, and the Pliocene of South Russia; and on the crystalline rocks of Crimea, by M. Prendel.—Prof. Klossovsky contributes a paper on the oscillations of temperature and density of the water of the Black Sea in the neighbourhoods of Odessa; andMrs. Mary Balashoff has an article on the influence of small ponds and of limited supplies of water on the development of *Planorbis*.—Chemistry is represented by one paper, on the laws of dissolution of salts, by R. Umoff.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 26.—"On the Occurrence of Aluminium in Certain Vascular Cryptogams." By A. H. Church, M.A., F.C.S. Communicated by Dr. J. H. Gilbert, F.R.S.

Most of the older and more complete analyses of plant-ashes disclosed the presence of sensible quantities of alumina. But of late years this substance has been regarded as accidental, and has been excluded from ash-constituents with the single exception of certain species of *Lycopodium*. Since 1851 several analysts have proved the presence of large quantities of alumina in the ashes of these plants The author has confirmed and extended their results, and has shown that the allied genus *Selaginella* does not absorb alumina. He found, however, two species of *Lycopodium*—namely, *L. Phlegmaria* and *L. billardieri*—from which this constituent is absent. The anomaly was explained by the epiphytic nature of these plants, which have no direct access to the soil. The author has further examined certain species belonging to genera nearly related to *Lycopodium*, such as *Equisetum*, *Ophioglossum*, *Salvinia*, *Marsilea*, and *Psilotum*, in all cases with negative results. But he has found 20 per cent. of alumina in the ash of a New Zealand tree-fern, and has also discovered abundance of this substance in *Cyathea medullaris* and *Alsophila australis*, and more than mere traces in *Dicksonia squarrosa*. The last part of the paper is occupied with some considerations having reference to the connection between elementary plant-food and the periodic law.

May 17.—"On the Electromotive Properties of the Leaf of *Dionæa* in the Excited and Unexcited States." No. II. By J. Burdon-Sanderson, M.A., M.D., F.R.S., Professor of Physiology in the University of Oxford.

The author has continued his experimental inquiries, of which the results were communicated to the Royal Society under the same title in 1881. In the introduction to the paper he gives a summary of his previous observations, which led to the conclusion that the property by virtue of which the excitable structures of the leaf respond to stimulation, is of the same nature with that possessed by the similarly-endowed structures of animals. He then proceeds to state that the main purpose of his subsequent investigations has been to determine the relation between two sets of phenomena which might, in accordance with the language commonly used in animal physiology, be termed respectively those of the "resting current" and of the "action current" of the leaf, *i.e.* between the electrical properties possessed by the leaf when stimulated, and those which it displays when at rest. Assuming the excitatory response in the leaf to be of the same nature as the excitatory variation or "action current" in muscle and nerve, the question has to be answered, whether in the leaf the response is a sudden diminution of a previously existing electromotive action (according to the pre-existence theory of du Bois-Reymond), or the setting up at the moment of stimulation of a new electromotive action—in short, whether and in how far the two sets of phenomena are inter-dependent or the contrary.

An observation recorded in his former paper suggested proper methods. It had been shown that by passing a weak voltaic current through the leaf for a short period in a particular direction, its electromotive properties could be permanently *modified* without loss of its excitability. If it could be shown that the influence of this modification extended to both orders of phenomena, those of rest and excitation, and that both underwent corresponding changes of character under similar conditions, this would go far to prove that an essential relation existed between them.

Acting on this suggestion, the author has had recourse to modes of experiment similar to those which have been employed during the last few years in the investigation of the newly-discovered "secondary electromotive" phenomena of muscle and nerve (see "Oxford Biological Memoirs," vol. i. part 2). The details of these experiments, made in 1885, are given in the first three sections of the paper. They relate to (1) the more immediate effect of the current as seen in the records of successive galvanometric observations made at regular intervals; (2) the more permanent influence of the current on the electromotive properties of the unexcited leaf, and on its electrical resistance; and (3) the concomitant modification of its behaviour when stimulated.

The general result of these experiments is to show that the two orders of phenomena, the excitatory and those which relate to the resting state, are so linked together that every change in the state of the leaf when at rest conditionates a corresponding change in the way in which it reacts to stimulation—the correspondence consisting in this, that the direction of the response is opposed to that of the previous difference of potential between the opposite surfaces, so that as the latter changes from ascending to descending, the former changes from descending to ascending.

The author considers that this can only be understood to mean that the constantly operative electromotive forces which find their expression in the persistent difference of potential between the opposite surfaces, and those more transitory ones which are called into momentary existence by touching the sensitive filaments or by other modes of stimulation, have the same seat, and that the

opposition between them is in accordance with a principle applicable in common to the excitable structures of plants and animals, viz. that the *property which renders a structure capable of undergoing excitatory change is expressed by relative positivity, the condition of discharge by relative negativity.*

The fourth section of the paper is devoted to an investigation made in 1887, of the events of the first second after excitation, made with the aid of a pendulum-rheotome specially adapted for the purpose. The fifth contains the description of the records obtained by photographing the electrical phenomena of the excitatory reaction, as observed with the aid of the capillary electrometer, on rapidly-moving plates. Both of these series of observations serve to confirm and complete the results obtained by other methods. The photographs were exhibited.

Physical Society, May 12.—Prof. Reinold, F.R.S., President, in the chair.—The following papers were read:—Note on the condition of self-excitation in a dynamo machine, by Prof. S. P. Thompson. It is a well-known fact that a series dynamo running at a given speed will not excite itself unless the resistance is less than a certain value, depending on the speed and construction of the machine, and if the resistance is slightly less than this critical value the excitation will not be such as to saturate the magnets. According to the primitive statement of the action of self-exciting dynamos on the "compound interest law," a dynamo should excite itself to saturation at any finite speed providing the resistance is not infinite. An explanation of the observed facts is given in the paper, without any assumption as to the curve of magnetization. If E = E.M.F. of the machine, n = speed, C = number of wires on outside of armature, N = number of magnetic lines, i = current, S = number of turns on magnet, ΣR and $\Sigma\rho$ the sums of the electric and magnetic resistances respectively, then $E = nCN$, $i = nCN/\Sigma R$, and $N = 4\pi Si/\Sigma\rho$. From these it is easily seen that $4\pi nCS = \Sigma\rho \cdot \Sigma R$, (A). ; *i.e.* for a dynamo running at constant speed the product of the magnetic and electric resistances is constant, and the dynamo will not excite itself if ΣR is greater than $4\pi nCS/\Sigma\rho$. Similarly for a given value of ΣR, excitation is impossible if n is less than $\Sigma\rho \cdot \Sigma R/4\pi CS$. For a value of ΣR less than the critical value the excitation increases until the magnetic resistance is increased so that equation (A) is satisfied. The corresponding formula for shunt machines is $4\pi nCZ = \Sigma\rho\left\{(r_a + r_s) + \frac{r_a r_s}{R}\right\}$; where Z = number of shunt turns ; r_a, r_s, and R, the resistances of armature, shunt, and external circuits respectively. In the discussion which followed, Mr. Kapp described a method used in testing dynamos, for determining the minimum speed at which dynamos will excite themselves, and from thence determining the magnetic resistance of the air gap. In all cases experiment showed this to be less than the calculated resistance, generally in the proportion of 1500 to 1860, the difference being greater in low-tension machines. Prof. Ayrton pointed out that permanent magnetism was not taken into account, and that the apparent resistance due to self-induction, and between the brushes and commutator were considerable for small currents. Lord Rayleigh and Sir W. Thomson had shown critical speeds for given resistances to exist in Faraday's disk dynamo. He (Lord Rayleigh) did not approve of the term "magnetic resistance," and thought "reluctance," as recently suggested by Mr. Heaviside, would be preferable.—Note on the conditions of self-regulation in a constant potential dynamo machine, by the same author. In "Dynamo-Electric Machinery" a formula $\frac{Z}{S} = \frac{r_s}{r_a + r_m}$ is given as expressing the ratio of the number of turns in the shunt and series windings of a compound dynamo. This is on the assumption that there is no saturation within the working limits. As this assumption is not legitimate, a correcting factor is necessary. The factor is shown to be the ratio of the average permeability over the whole working range to the permeability corresponding with no external current. The formula is transformed so as to be expressed in terms of the "satural" data of the machine, which, as shown in a previous paper, can be calculated from its details.—On magnetic lag, and the work lost due to magnetic lag in alternating current transformers, by Mr. Thomas H. Blakesley. The method adopted to detect the lag is to place dynamometers in both circuits, and one with a coil in each. Then, on the supposition that the E.M.F. of the secondary circuit is entirely due to the changing magnetism of the core, the author proves that the tangent of the magnetic lag angle must be equal to $\frac{\frac{m}{n} C\alpha_3 - B\alpha_2}{\frac{m}{n}\sqrt{(AB\alpha_1\alpha_2 - C^2\alpha_3^2)}}$; where m and n are the number of turns in the primary and secondary coils respectively ; A, B, C, the constants of the dynamometers ; and α_1, α_2, α_3, their angular reading. A is such that $A\alpha_1 = \frac{I_1^2}{2}$, where I_1 is the maximum value of the primary current. A table of actual results is given, where the magnetic lag is about $5\frac{1}{4}°$. The whole power given out by the machine takes the form $r_1 A\alpha_1 + r_2 \frac{m}{n} C\alpha_2$, where r_1 and r_2 are the resistances of the primary and secondary circuits, while the power lost in hysteresis is expressed by $r_2\left(\frac{m}{n} C\alpha_3 - B\alpha_2\right)$. The lag is attributed to an induced magnetic stress called into being by the increasing or decreasing magnetism itself, and always opposing it as motion in a medium induces an opposing force of friction. By supposing such an induced magnetic stress in quadrature (as Mr. Blakesley expresses it) with the magnetism, and of such a value as when compounded with the stresses due to the currents shall bring the resultant into quadrature with the secondary current, the effective magnetic stress is obtained. This involves a new idea called magnetic self-induction with its coefficient. The whole problem is treated by the geometrical method, which the author has applied to several other problems in alternating currents. Mr. Kapp, Profs. Thompson, Perry, and Ayrton, and Lord Rayleigh took part in discussing the paper.—On a simple apparatus for the measurement of the coefficient of expansion by heat, by Prof. W. E. Ayrton, F.R.S., and Prof. J. Perry, F.R.S. The apparatus consists of a metal tube, within which the wire or rod whose coefficient is to be determined is placed. One end of the wire is rigidly attached to one end of the tube, and the other end connected to an Ayrton and Perry magnifying spring, a pointer attached to which indicates the change of length due to alteration of temperature. Steam or water may be passed through the tube, the temperature of the wire being shown on a thermometer. The arrangement is very sensitive, and with a pointer about 20 cm. long, the motion is magnified about 1000 times.—A magnifying spring attached to an aneroid was also shown, and its great sensitility demonstrated. A combination of a spring of large diameter and pitch with one of small diameter and pitch was exhibited. By such a combination small rotations can be immensely magnified. The great features of the patent spring as a magnifier are the entire absence of friction and back lash, and the large range of proportionality.

Chemical Society, May 17.—Mr. W. Crookes, F.R.S., in the chair.—The following papers were read:—Researches on the constitution of azo- and diazo-derivatives ; (iv.) diazo-amido-compounds, by Prof. Meldola, F.R.S., and Mr. F. W. Streatfield.—The colour of some carbon compounds, by Prof. Carnelly, and Mr. J. Alexander. An investigation of a number of metallic derivatives of ortho- and para-nitrophenol has given the following results: (1) in all cases without exception the colour passes towards the red end of the spectrum as the temperature rises ; (2) the colour of the ortho-derivative is nearer the red end than that of the corresponding para-compound ; (3) a comparison of the nitrophenates of the metals belonging to the same sub-group shows that the colour passes towards the red end as the atomic weight of the metal increases ; (4) when the same salt occurs in both the anhydrous and the hydrated state, the colour passes towards the red end as the quantity of water of crystallization diminishes ; (5) as regards the salts investigated, the para-compound always takes up a larger quantity of water of crystallization than the corresponding ortho-compound. In the course of the discussion which followed the reading of the paper, Prof. Armstrong, F.R.S., remarked that the facts advanced were far too few to justify the very general conclusions arrived at by the authors ; all who had worked with the nitrophenols were well aware that the colour changed on heating in the manner described ; and there was no novelty in the statement that the para-nitrophenols crystallized with the larger proportion of water. Referring to the authors' fourth deduction, he quoted calcium parachlorodiorthonitrophenate as an exception, since this compound can be obtained either in yellow anhydrous crystals, or in deep-orange hydrated crystals.—The identity of natural and

artificial salicylic acid, by Prof. Hartley, F.R.S. Spectroscopic examination of the two compounds establishes their identity.—Researches on the relation between the molecular structure of carbon compounds and their absorption spectra (part viii.), by the same.—A definition of the term atomic weight and its reference to the periodic law, by the same. The author is of opinion that the fact that the atomic weights are real measures of the quantity of matter in the atoms of the elements is often overlooked, and advocates the adoption of the definition: The atomic weight of an element is the ratio of the mass of its atom to the mass of an atom of hydrogen. The periodic law then admits of being stated thus: The properties of the atoms are a periodic function of their masses.

Geological Society, May 23.—Dr. W. T. Blanford, F.R.S., President, in the chair.—The following communications were read:—On the spheroid-bearing granite of Mullaghderg, Co. Donegal, by Dr. Frederick H. Hatch. Communicated with the permission of the Director-General of the Geological Survey. This paper deals with a remarkable variety of granite which may be compared with the well-known orbicular diorite or Napoleonite of Corsica. According to Mr. J. R. Kilroe, of the Geological Survey of Ireland, who first discovered this interesting rock, the concretionary balls occur in close juxtaposition in a mass of granite of 5 or 6 cubic yards in size. They have not been found in any other portion of the granite area. The author gave a detailed description of the microscopic structure of the normal granite. He also described the spheroidal bodies, and gave a synopsis of the literature concerning the occurrence of similar concretionary bodies in granite. The conclusion arrived at was, that concretionary bodies occurring in granite may, according to the mode of arrangement of their constituents, be divided into three classes, viz. (1) the *concretionary patches* of Phillips; (2) the *granospherites* of Vogelsang; (3) the *belonospherites* of Vogelsang. The spheroids from Mullaghderg belong to the last-mentioned class. They must be regarded as concretions formed, during the consolidation of the granite magma, by a process of zonal and radial crystallization around an earlier-formed nucleus. Remarks on this paper were offered by Mr. Rutley, Prof. Bonney, Dr. Hicks, and Prof. Judd.—On the skeleton of a Sauropterygian from the Oxford Clay near Bedford, by R. Lydekker.—On the Eozoic and Palæozoic rocks of the Atlantic coast of Canada in comparison with those of Western Europe and the interior of America, by Sir J. W. Dawson, F.R.S. The author referred to the fact that since 1845 he had contributed to the Proceedings of the Geological Society a number of papers on the geology of the eastern maritime provinces of Canada, and it seemed useful to sum up the geology of the older formations and make such corrections and comparisons as seemed warranted by the new facts obtained by himself, and by other observers of whom mention is made in the paper. With reference to the Laurentian, he maintained its claim to be regarded as a regularly stratified system probably divisible into two or three series, and characterized in its middle or upper portion by the accumulation of organic limestone, carbonaceous beds, and iron-ores on a vast scale. He also mentioned the almost universal prevalence in the northern hemisphere of the great plications of the crust which terminated this period, and which necessarily separate it from all succeeding deposits. He next detailed its special development on the coast of the Atlantic, and the similarity of this with that found in Great Britain and elsewhere in the west of Europe. The Huronian he defined as a littoral series of deposits skirting the shores of the old Laurentian uplifts, and referred to some rocks which may be regarded as more oceanic equivalents. Its characters in Newfoundland, Cape Breton, and New Brunswick were referred to, and compared with the Pebidian, &c., in England. The questions as to an upper member of the Huronian or an intermediate series, the Basal Cambrian of Matthew in New Brunswick, were discussed. The very complete series of Cambrian rocks now recognized on the coast-region of Canada was noticed, in connection with its equivalency in details to the Cambrian of Britain and of Scandinavia, and the peculiar geographical conditions implied in the absence of the Lower Cambrian over a large area of interior America. In the Ordovician age a marginal and a submarginal area existed on the east coast of America. The former is represented largely by bedded igneous rocks, the latter by the remarkable series named by Logan the Quebec Group, which was noticed in detail in connection with its equivalents further west, and also in Europe. The Silurian, Devonian, and Carboniferous were then treated of, and detailed evidence shown as to their conformity to the types of Western Europe rather than to those of America. In conclusion, it was pointed out that though the great systems of formations can be recognized throughout the northern hemisphere, their divisions must differ in the maritime and inland regions, and that hard and fast lines should not be drawn at the confines of systems, nor widely different formations of the same age reduced to an arbitrary uniformity of classification not sanctioned by Nature. It was also inferred that the evidence pointed to a permanent continuance of the Atlantic basin, though with great changes of its boundaries, and to a remarkable parallelism of the formations deposited on its eastern and western sides. The President, whilst recognizing the importance of the paper, doubted whether the question of correlation of the Pre-Cambrian rocks on either side of the Atlantic was ripe for discussion. Dr. Hicks agreed with most of the conclusions of the author, including the correlation of the Huronian with the Pebidian. Some observations on the paper were also made by Dr. Scott, Dr. Hinde, and Mr. Marr.—On a hornblende-biotite rock from Dusky Sound, New Zealand, by Captain F. W. Hutton.

Zoological Society, May 15.—Dr. A. Günther, F.R.S., Vice-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 1888; and called special attention to two Rock-hopper Penguins from the Auckland Islands, presented by Capt. Sutcliff, R.M.S.S. *Aorangi*, on April 19; also to two Indian Hill-Foxes, and to a fine example of the Spotted Hawk-Eagle (*Spizaëtus nipalensis*), presented by Colonel Alex. A. A. Kinloch, and received on April 20.—A communication was read from Mr. George A. Treadwell, containing an account of a fatal case of poisoning from the bite of the Gila Monster (*Heloderma suspectum*).—Mr. Boulenger exhibited the type-specimen of a singular new genus of Snakes (*Azemiops feæ*) recently discovered by M. Fea, of the Museo Civico of Genoa, in the Kakhim Hills, Upper Burma. Mr. Boulenger proposed to refer this genus provisionally to the family Elapidæ.—The Secretary read a letter addressed to him by Mr. E. C. Cotes, Entomological Department, Indian Museum, Calcutta, respecting the insect-pests of India, and requesting the assistance of entomologists in working out the species to which they belong.—Mr. H. Seebohm exhibited and made remarks on a series of specimens of Pheasants from Mongolia, Tibet, and China, including examples of the two species discovered by Colonel Prjevalski, *Phasianus strauchi* and *P. vlangali*.—Prof. F. Jeffrey Bell exhibited and made remarks on three specimens of a large Pennatulid (*Funiculina quadrangularis*) obtained by Mr. John Murray on the west coast of Scotland. They showed very clearly the differences between examples of this species of different ages.—Mr. R. Bowdler Sharpe gave an account of a third collection of birds made by Mr. L. Wray in the main range of mountains of the Malay Peninsula, Perak. The present paper contained descriptions of ten species new to science, amongst which was a new *Pericrocotus*, proposed to be called *P. wrayi*.—Prof. F. Jeffrey Bell read the descriptions of four new species of Ophiuroids from various localities.—Mr. F. E. Beddard read a paper containing remarks on certain points in the visceral anatomy of *Balæniceps rex* bearing upon its affinities, which he considered to be with the Ardeidæ rather than with the Ciconiidæ. Mr. G. B. Sowerby gave the description of a gigantic new species of Mollusk of the genus *Aspergillum* from Japan, which he proposed to name *A. giganteum*.

Institution of Civil Engineers, May 29.—Annual General Meeting.—Mr. George B. Bruce, President, in the chair.—After the reading of the Report, hearty votes of thanks were passed to the President, to the Vice-Presidents, and other members of the Council, to the Auditors, to the Secretaries and staff, and to the Scrutineers.—The ballot for the Council resulted in the election of Mr. G. B. Bruce, as President; of Sir John Coode, Mr. G. Berkley, Mr. H. Hayter, and Mr. A. Giles, M.P., as Vice-Presidents; and of Mr. W. Anderson, Mr. B. Baker, Mr. J. W. Barry, Sir Henry Bessemer, F.R.S., Mr. E. A. Cowper, Sir James N. Douglass, F.R.S., Sir Douglas Fox, Mr. C. Hawksley, Mr. J. Mansergh, Mr. W. H. Preece, F.R.S., Sir Robert Rawlinson, K.C.B., Sir E. J. Reed, K.C.B., F.R.S., M.P., Mr. W. Shelford, Mr. F. C. Stileman, and Sir William Thomson, F.R.S., as other members of the Council.—The Council has made the following awards to the authors of some of the papers read and discussed at the ordinary meetings during the past session, or printed in

the minutes of proceedings without being discussed, as well as for papers read at the supplemental meetings of students :—For papers read and discussed at the ordinary meetings: a Telford Medal and a Telford Premium to Robert Abbott Hadfield, for "Manganese in its Application to Metallurgy," and "Some Newly-discovered Properties of Iron and Manganese"; a Watt Medal and a Telford Premium to Peter William Willans, for "Economy-Trials of a Non-condensing Steam-Engine, Simple, Compound, and Triple"; a Telford Medal and a Telford Premium to Dr. Edward Hopkinson, for "Electrical Tramways—the Bessbrook and Newry Tramway"; a Watt Medal and a Telford Premium to Edward Bayzand Ellington, for "The Distribution of Hydraulic Power in London"; a Telford Medal and a Telford Premium to Josiah Pierce, Jun., for "The Economic Use of the Plane-Table in Topographical Surveying"; a George Stephenson Medal and a Telford Premium to Sir Bradford Leslie, K.C.I.E., for "The Erection of the 'Jubilee' Bridge, carrying the East Indian Railway across the River Hooghly at Hooghly"; and the Manby Premium to the late Hamilton Goodall, for "The Use and Testing of Open-hearth Steel for Boiler-making." For papers printed in the Proceedings without being discussed: a Watt Medal and a Telford Premium to Prof. Victor Auguste Ernest Dwelshauvers-Dèry, for "A New Method of Investigation applied to the Action of Steam-Engine Governors"; and Telford Premiums to William Mann Thompson, for "Improved Systems of Chaining for Land and Engineering Surveys"; to James William Wyatt, for "Sizing Paper with Rosin"; and to Dugald Drummond, for "The Heating of Carriages by Exhaust Steam on the Caledonian Railway." For papers read at the supplemental meetings of students the following Miller Prizes have been given: to David Sing Capper, for "The Speed-Trials of the latest addition to the *Admiral* Class of British War-Vessels"; to Lawrence Gibbs, for "Pumping-Machinery in the Fenland and by the Trentside"; to Harold Medway Martin, for "Arched Ribs and Voussoir Arches"; to John Henry Parkin, for "River-Gauging at the Vyrnwy Reservoir"; to Alfred Chatterton, for "The Prevention and Extinction of Fires"; to John Holliday, for "Boiler Experiments and Fuel-Economy"; to Arthur Wharton Metcalfe, for "The Classification of Continous Railway-Brakes"; to Robert Jarratt Money, for "Railway Engineering in British North America."

Victoria Institute, June 4.—The annual general meeting was held at the house of the Society of Arts. The President, Prof. G. G. Stokes, P.R.S., M.P., took the chair. The twenty-second Annual Report was read by Captain Frank Petrie, the Honorary Secretary, and Sir Monier-Williams delivered an address on mystical Buddhism. A vote of thanks was accorded to the President.

PARIS.

Academy of Sciences, May 28.—M. Janssen, President, in the chair.—New theory of equatorials (continued), by MM. Lœwy and Puiseux. In order to verify the already explained theory, the authors here compare the values of the constants obtained by physical processes with those resulting from the astronomical methods based on the observation of transits or on the apparent variations of the right ascensions or declinations. They conclude with some general remarks on the employment of the equatorial *coudé*.—On the measurement of low temperatures, by MM. L. Cailletet and E. Colardeau. The researches here described have been undertaken for the purpose of obviating the difficulties hitherto felt in employing hydrogen thermometers for the measurement of low temperatures.—Researches on ruthenium, by MM. H. Debray and A. Joly. These studies are occupied chiefly with the rutheniates of potassa and silver, and the heptarutheniates of potassa and soda. The authors find that, although there exists an evident analogy in the composition and reactions of the rutheniate and heptarutheniate of potassa on the one hand, and the manganate and permanganate of potassa on the other, no relation of isomorphism has been detected between the salts of the acids of ruthenium and those of manganese. The rutheniate of potassa is hydrated, while the manganate, like the sulphate, is anhydrous.—On the monthly charts of the North Atlantic currents, by M. Simart. Continuing the work of Commander Brault, the author has prepared two series of charts (diagrams and results) based on 60,400 observations obtained from the records of the French Admiralty and various other sources. The charts of results give the currents most likely to be met with from month to month all the year round, while the diagrams indicate the currents that may possibly be met, especially near the coasts, where they present the greatest dangers to seafarers.—Origin of the aurora borealis, by M. Jean Luvini. This phenomenon is regarded as analogous to the discharge of electricity in thunderstorms, the only difference consisting in their different degrees of intensity. Both are attributed to the friction of particles of water and ice and occasionally of other minute bodies drawn by the aërial currents into the higher atmospheric regions and disseminated over the terrestrial atmosphere some hundred miles thick. The northern lights are most frequent about the pole, where the air abounds most in icy particles and where the field of terrestrial magnetism is most intense.—Observations of the new planet Palisa (279) made at the Observatory of Algiers with the 0·50m. telescope, by MM. Rambaud and Sy. These observations, which include the positions of two comparison stars and the apparent positions of the planet, cover the period from May 18 to May 22.—Observations of the planet Borelly (278) made at the Observatory of Marseilles with the 0·26m. Eichens equatorial, by M. Esmiol. During these observations, continued from May 13 to May 21, the planet appeared to be of magnitude 11·5.—On the supernumerary arcs accompanying the rainbow, by M. Boitel. The position of these arcs, as determined by Airy on the principles of diffraction, and generally accepted as absolute, is shown to be merely a first approximation, which the author hopes soon to supplement by more accurate calculations.—Researches on the application of the rotatory power to the study of the compounds formed by the action of the neutral tungstates of soda and potassa on the solutions of tartaric acid, by M. D. Gernez. From these experiments it appears that the neutral tungstates of soda and potassa behave analogously in their action on tartaric acid.—On the sesquisulphide of rhodium, by M. E. Leidié. The author describes the methods of preparation of this substance and of the double sulphides both by the wet and dry processes.—On two isomerous naphthoquinoleins, by M. Alphonse Combes. The only terms hitherto known of these rare compounds are those obtained by Skraup by making glycerine act on the naphthylamines in the presence of sulphuric acid. The author here describes two new terms of the series, as well as a means by which several others may also be obtained.—On a new species of Coregonus, by M. Victor Fatio. To this species, discovered in the French Lake Bourget, the author has given the name of *Coregonus Bezola*. It is a well-defined local variety.—On the germination of *Anemone apennina*, by M. Ed. de Janczewski. This species presents in its germination a curious and most remarkable anomaly, differing in this respect from all other dicotyledonous plants.—On the bust of a woman carved in the root of an equine tooth, by M. Ed. Piette. This specimen of prehistoric art, recently discovered by the author in the cave of Mas d'Azil, Ariège, presents several points of interest to the anthropologist. Owing to the contracted space, the artist had to suppress shoulders and arms, merely suggesting the outlines of the sides. But the pendant breasts are well executed, and the profile of the face carefully delineated. The nose is large and rounded, the lips thick, the chin retreating like that of the Naulette jaw, but the forehead is high and not receding like that of the Neanderthal skull. It is the third extant representation of a woman of the Quaternary period, the two others being M. de Vibraye's "Venus" and the "Reindeer Woman," both from Laugerie-Basse.

BERLIN.

Physical Society, May 18.—Prof. du Bois-Reymond, President, in the chair.—Dr. Dieterici gave an account of his experiments on the determination of the latent heat of evaporation of water at 0° C. Regnault's experiments on the latent heat of evaporation of water were made at higher temperatures, and had led to the construction of a formula according to which the latent heat of evaporation at 0° C. must be 607 units of heat. The speaker, using an ice-calorimeter, had made a direct determination of this value. A glass tube, with its lower end blown out into a bulb and filled with water, was immersed in the chamber of the calorimeter, the upper end of the tube being connected with an air-pump, and a small column of sulphuric acid being interposed between the pump and the tube. As soon as the apparatus had assumed a perfectly uniform temperature, a vacuum was produced by the air-pump, whereupon the water in the tube evaporated, taking up from the calorimeter the heat necessary for its evaporation. Values were obtained from a series of ten experiments, which differed from each other by not more than $\frac{3}{4}$ per cent. In order to meet the objection which might be raised—namely, that the temperature at which

the evaporation took place was not 0° C.,—Dr. Dieterici repeated his experiments, using a platinum instead of a glass tube. The values obtained in this set of experiments only differed by ¼ per cent. The mean of the two sets of experiments was identical, and the final outcome of the whole research was that the latent heat of evaporation of water at 0° C. is 596·4 thermal units. The speaker then discussed fully the theoretical significance of the above results, and described an experiment he had made in order to determine the latent heat of evaporation of ice at 0° C. The method employed was the same as above, but it did not yield the value which was theoretically expected, which should have been equal to the sum of the latent heat of evaporation of water and of the latent heat of fusion of ice. The cause of the divergence was due to the fact that the ice used was not clear and crystalline, but milky and opaque. Dr. Dieterici intends to repeat these determinations next winter.—Prof. von Bezold gave an account of a paper which he had recently read before the Berlin Academy on the thermodynamics of the atmosphere. Recent meteorology has derived very considerable benefit from the application of thermodynamics to events taking place in the atmosphere; but up to the present time all the researches had only dealt with adiabatic and reversible processes. As a matter of fact, these processes are neither adiabatic nor reversible, since, when the air is cooled, its aqueous vapour is condensed, and the water thus formed falls as either rain, hail, or snow. If both these facts are taken into account, the calculations involved thereby become so complicated that Prof. von Bezold was only enabled to proceed to the application of thermodynamics to the processes which really take place in the atmosphere by employing an artifice; the latter consisted of the graphic method introduced by Clapeyron with such marked success as a technical method. For this purpose the consideration starts with the assumption that the air is dry, in which case the equation for its condition is given in terms of its volume, pressure, and temperature, and can be represented by plane co-ordinates. The variable amount of aqueous vapour in the air is then treated as a further variable in the third co-ordinate, in such a way that for any given amount of aqueous vapour in the air a new co-ordinate representing the change in condition of the air is obtained. When, on cooling, a portion of this aqueous vapour is condensed, the curve representing the change of condition passes over from one plane to the other, pursuing its further course in the latter plane. In this way it becomes possible, as the speaker fully showed, to treat non-reversible and pseudo-adiabatic processes theoretically, according to the laws of thermodynamics. It can thus be shown in the case of the Föhn and of cyclones, as well as of anticyclones, which are not reversible but reversed processes, that the theoretical considerations lead to results which are found to be confirmed by experience. Thus, according to theory, in an anticyclone occurring in winter, there should be a rise of temperature at some height above the earth, a fact which is now observed at all meteorological stations at high altitudes.

Physiological Society, May 25.—Prof. du Bois-Reymond, President, in the chair.—Dr. Weyl gave an account of the results of his further researches on silk. Among the products of decomposition of albumen and proteid substances, one is known as a snowy crystalline body, which is considered to be leucin, and is generally regarded as being also a product of the decomposition of silk. Since this substance may be obtained in large quantities by the decomposition of silk, the speaker had prepared it from this source and analyzed it, and has come to the conclusion that it is not leucin (amidocaproic acid), but rather another amidated acid—namely, alanin. Of the two possible isomers of alanin, it is α-alanin which is obtained by the decomposition of silk. Dr. Weyl laid stress on the fact that Schützenberger had also concluded that alanin and glycocol occur among the products of decomposition of silk, notwithstanding that, during his elaborate and careful researches on proteids, he employed a method which is as unfavourable as can be imagined for determining this point: this result is now confirmed by the speaker's researches. Schützenberger's further supposition, that an amido-acid of the acrylic series can be prepared from silk, was not supported by Dr. Weyl's analyses.—The same speaker further communicated the results of his researches on the physiological action of anthrarobin and chrysarobin, which have recently been largely used in medical practice. These two substances, whose chemical constitution and relationship to alizarin and anthracene have been made clear by Liebermann, are largely used as reducing-bodies, especially in skin diseases. Dr. Weyl endeavoured, by means of experiments on rabbits and dogs, and on himself, to determine the physiological action of anthrarobin, and found that it possesses absolutely no action on the living organism, even when taken by the mouth in relatively large doses, or injected subcutaneously. It could be detected in an unaltered condition in the urine, so that this substance, notwithstanding that it possesses a great affinity for oxygen, passes through the body without being oxidized. Chrysarobin, on the other hand, has a very different action; notwithstanding its close relationship to the non-injurious anthrarobin, it has a powerfully poisonous action, so that all experiments made with it were of necessity confined to rabbits and dogs. The speaker was unable to confirm the statements of several authors that chrysarobin reappears in the urine as chrysophanic acid. It is rather his opinion that chrysarobin is first excreted in an unaltered condition, and only subsequently undergoes a change into chrysophanic acid. It remains for further experiments to clear up this point.—Prof. Gad spoke on the phosphorescent moss *Schistostega osmundacea*, which he had been for some time cultivating, and which he exhibited. A thorough investigation of the phosphorescent powers of this plant promises a rich harvest of facts from a physical point of view: it is well known, on the basis of morphological research, that the phosphorescence is due to a reflection of the incident light.

In the report of the Berlin Meteorological Society, May 1 (p. 119), the expression "a spring-vane," should have been "a vane made of feathers."

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Travels in Arabia Deserta, 2 vols.: C. M. Doughty (Cambridge Press).—Modern Science in Bible Lands: Sir J. W. Dawson (Hodder and Stoughton).—Catalog der Conchylien-Sammlung, Lief. 7: Fr. Paetel (Berlin).—Charts showing the Mean Barometrical Pressure over the Atlantic, Indian, and Pacific Oceans (Eyre and Spottiswoode).—Inorganic Chemistry, 2nd edition: by Kolbe, translated and edited by Humpidge (Longmans).—Longmans' Test Cards in Mechanics, Stages I., II., III. (Longmans).—Flora of North America (the Gamopetalæ): Dr. Asa Gray (Smithsonian Institution, Washington).—La Biologie Végétale: P. Vuillemin (Baillière, Paris).—Applications of Dynamics to Physics and Chemistry: J. J. Thomson (Macmillan).—Lingua: G. J. Henderson (Trübner).

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