of small-pox and typhus were mainly due to these causes. (3) The cheapness of food, clothing, and fuel had, of course, diminished the tendency to disease, and the ease with which fresh fruit and vegetables were to be got had abolished the taint of scurvy which was so fatal to our ancestors. (4) The water-supply had been improved, and the intake of the water companies was now removed to a portion of the river less tainted with sewage than that formerly in use. (5) Although the system of sewage disposal was an undoubted evil, and had given us three or four epidemics of cholera, and was the foster-mother of typhoid, still it was probable that so far the balance for good was in its favour, because it had removed a good deal of filth from dwellings.

The outlook in the future was dashed by three considerations :—(1) Our system of sewerage and water-supply had increased overcrowding by enabling us to build houses of any height without inconvenience to the occupant, and without any curtilage whatever, and since all sanitarians recognized that overcrowding was the greatest of all sanitary evils, it was impossible to shut one's eyes to this danger.

(2) There was an expensive and menacing "loose end" to our sanitation in the shape of 150,000,000 gallons of sewage pouring into the Thames every day. The only proper destination of organic refuse was the soil, and it was not possible to see the end of the gigantic blunder we had committed in throwing it into the water.

(3) The rapid increase of population along the Valley of the Thames where sewage disposal is on the same lines as in London, must make us apprehensive for our water-supply, because the various tricks played with sewage in the shape of precipitations, &c., were not probably of a kind to make the effluent a desirable or a wholesome beverage. If the evil effects of free trade are to be counteracted, it will be by returning the refuse of our towns free of cost to the impoverished agriculturist. "If we go on as we are going," said the lecturer, in conclusion, "and if our brethren in the colonies follow our bad example, as they appear to be doing, it will be a Chinaman rather than a visitor from New Zealand who will sit in contemplation on the ruins of London Bridge."

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Among the scientific lectures this term, we may note the following :—

Prof. Clifton, Acoustics and Magnetism ; Mr. Selby, Theory of Electrical Measurements.

Prof. Odling, Four-carbon Compounds ; Mr. Veley, Physical Chemistry ; Mr. Vernon-Harcourt, Quantitative Analysis.

On the Biological side, the Linacre Deputy-Professor, Mr. Hatchett Jackson, lectures on the Morphology of the Invertebrata, Mr. P. C. Mitchell on the Morphology of the Cell, and Mr. Barclay Thompson on the Osteology of the Sauropsida. Prof. Burdon-Sanderson's subject is the Nervous System. Prof. Green is giving two courses of lectures on Geology, and Prof. Gilbert lectures on the Rotation of Crops and the Feeding of Animals.

On the Mathematical Lecture List we find that Prof. Sylvester is treating of Surfaces of the Second Order (illustrated by models), Prof. Price of Hydromechanics, and Prof. Pritchard of the Elements of the Planetary Theory.

## SCIENTIFIC SERIALS.

THE *Quarterly Journal of Microscopical Science* for December 1888 contains the following :—Note on a new organ, and on the structure of the hypodermis, in *Periplaneta orientalis*, by Edward A. Minchin (plate xxii.). The new organ consists of two pouch-like invaginations of the cuticle lying close on each side of the middle line, between the fifth and sixth terga of the dorsal surface of the abdomen. They are covered by the fifth tergum ; when exposed they are seen to open by two slit-shaped openings, which open backwards. They are lined by a continuation of the chitinous cuticle, which forms within the pouches numerous stiff, branched, finely-pointed hairs, below which are numerous glandular epithelial cells. As to their function, it is suggested that they are stink glands.—On certain points in the structure of Urochæta, E.P., and of Dichogaster, nov. gen., with further remarks on the nephridia of earthworms, by Frank E. Beddard (plates xxiii. and xxiv.). The important facts recorded about the anatomical structure of the species of these two genera, and on the nephridia in earthworms, do not admit of being further condensed. *Dichogaster damonis*, nov. gen. et sp., is described from Fiji.—On the development of *Peripatus novæ-zelandiæ*, by Lilian Sheldon (plates xxv. and xxvi.). A further supply of living specimens was obtained in January 1888. Twenty-seven out of forty-nine were females. The uteri of all but nine of these were filled with embryos. The stages of development did not allow of all the gaps left in Miss Sheldon's previous paper being filled up, but this paper is a welcome addition to our knowledge. A useful summary of the author's investigations is appended.—Note on the development of Amphibians, chiefly concerning the central nervous system ; with additional observations on the hypophysis, mouth, and the appendages and skeleton of the head, by Dr. Henry Orr, (plates xxvii. to xxix.).—Studies on the comparative anatomy of Sponges, ii. on the anatomy and histology of *Stelospongus flabelliformis*, Carter ; with notes on its development, by Arthur Dendy (plates xxx. to xxxiii.). This interesting paper may be regarded as the first-fruits of Mr. Dendy's researches into the anatomy and embryology of recent Australian Sponges, and we hope to be long favoured with such. The embryos, "each as large as a small pea," of *S. flabelliformis*, Carter, were found in abundance. Though varying in diameter from about 3 to almost 5 mm., they exhibited nearly the same stage of development. Doubtless we may expect at some future time the whole story of their evolution. The membrane connecting the fringes of the "choanocytes," which have been so clearly demonstrated by Sollas in the Tetractinellida, and the occurrence of which in *Leuconia aspera* has been described by George Bidder, also occurs in this Sponge, and has been called by Mr. Dendy "Sollas's membrane."—On some points in the natural history of Fungia, by J. J. Lister.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, January 24.—"On the Influence of Carbonic Anhydride and other Gases on the Development of Micro-organisms." By Percy F. Frankland, Ph.D., B.Sc. (Lond.), F.C.S., F.I.C., Assoc. Roy. Sch. of Mines, Professor of Chemistry in University College, Dundee.

Carbonic anhydride, hydrogen, carbonic oxide, and nitrous oxide, were the gases employed in a series of experiments for observing what action was exerted by them on pure cultivations of Koch's comma Spirillum, Finkler's comma Spirillum, and the *Bacillus pyocyaneus*. It was found that hydrogen had the least, and carbonic anhydride the most, prejudicial influence upon these micro-organisms. There is, therefore, no longer any doubt that in the anaërobic culture of organisms hydrogen is by far the most suitable medium for the expulsion of air, whilst carbonic anhydride is not only ill-suited owing to its markedly deleterious action upon many forms of Bacteria, but in many cases is quite unfit for such a purpose.

With carbonic oxide and nitrous oxide it was found that although the development of the *B. pyocyaneus* was checked, yet on removing the cultivations to an *air*-chamber almost the same number appeared as were developed on the original air-control plates. This was not, however, the case with Koch's comma Spirillum and Finkler's comma Spirillum, only a comparatively small number of the organisms surviving the exposure to these gases. Similar experiments made with nitric oxide, sulphuretted hydrogen, and sulphurous anhydride resulted in the complete destruction of the above organisms.

January 31.—"Auto-Infection in Cardiac Disease." By L. C. Wooldridge, M.D., Assistant-Physician, Guy's Hospital.

The author had previously described the fact that the lymph and chyle produce a poisonous influence when injected into the blood. The symptoms so produced have been described by the author as "fibrinogen intoxication." The chief symptoms of this condition already described are intravascular clotting, delay in clotting of the shed blood, great tendency to hæmorrhages, occasionally marked fever. In the present paper the author shows experimentally the following :—

(1) To affect the blood a certain quantity of the fluid of lymph, or the fibrinogen solution, must reach the blood in a given time or no poisoning is produced. A small quantity of the fluid, injected rapidly, will cause instant death. The same quantity, diluted and injected during three or four minutes, instead of suddenly, has no effect at all. The author regards

this as an explanation of the fact that normally the flow of the lymph from the thoracic duct into the blood produces no poisonous effect.

(2) It has long been known that mere mechanical disturbance to the circulation, unless it be of a most extreme character, will not produce dropsy. The ligature of the femoral vein in the dog produces no dropsy. But if previous to the ligature, some of the lymph fluid or fibrinogen solution be injected into the blood, the most severe œdema of the leg is produced, or this accompanied by hæmorrhage.

(3) In cardiac disease and disturbance of the circulation through the lungs there is no reason to suppose that a sudden increase in the flow of lymph ever takes place. But it is certain that the circulation of the blood in the neighbourhood of the thoracic duct is materially slowed in these conditions. This slowing of the circulation acts in the same way as a more rapid injection of lymph, and hence in cardiac disease the conditions for fibrinogen intoxication—auto-infection from the lymph—prevail.

(4) The dropsy, which is so common a symptom of cardiac disease, is commonly explained as being due to the mechanical disturbance of the circulation. This explanation does not harmonize with experimental observations. The fact that even very slight fibrinogen intoxication produces a pronounced tendency to dropsy renders it extremely probable that the dropsy and other symptoms of cardiac disease depend on fibrinogen intoxication.

**Physical Society**, January 26.—Prof. Fuller, F.R.S., in the chair.—The thanks of the Society were tendered to Mr. Freeman, for presenting to the library a rare and interesting work, "Réflexions sur la Puissance Motrice du Feu, et sur les Machines propres à développer cette Puissance," par S. Carnot, ancien élève de l'École Polytechnique.—Dr. S. P. Thompson read three notes on polarized light, entitled respectively: "The Structure of Natural Diffraction Gratings of Quartz," "Ahrens's Modification of Delezenne's Polarizer," and "The Use of Two Quarter-Wave Plates in Combination with a Stationary Polarizer." Two microscope slides of iridiscent quartz (prepared by the late Mr. Darker), which have recently come into the possession of the author, exhibit remarkable peculiarities. Both act like diffraction gratings, one as if the rulings were about 12,000, and the other about 26,000, to the inch. On examining the specimens by the microscope, it was found that the parts which exhibited the grating effect showed a spindle-like structure, and by micrometer measurements the dimensions of the spindle-shaped bodies were determined to be from 1/1000 to 1/3000 of an inch in diameter, and 1/100 to 1/300 of an inch long. These were much too large to cause the effects noticed, but on closer examination it was found that the bodies were crossed at right angles by fine markings, the distances between which are in close accordance with those deduced from the spectra produced. As a probable cause of the phenomenon, the author mentioned a recent paper by Prof. Judd, "On the Production of a Lamellar Structure in Quartz by Pressure," and suggested the possibility of making diffraction gratings by such means. Ahrens's modification of Delezenne's polarizer consists of a total-reflection prism combined with glass plates and black glass mirror, arranged so that the polarized beam is parallel to the original one. The combination of plates and mirror is adopted so as to give enough light and still keep the polarization sufficiently good. One or two plates laid over the mirror are found to give the best results. The fact that a beam polarized by reflection is not coincident with the original beam, renders it inconvenient, if not impossible, to rotate the polarizer, and to overcome this defect, the author has arranged two quarter-wave plates, one of which may be rotated. The first plate circularly polarizes the plane-polarized beam, and the second (or rotating one) re-plane-polarizes it in any desired plane. Objects were shown on the screen to illustrate the degree of perfection attainable by using the new polarizer in combination with the two quarter-wave plates.—A note on a relation between magnetization and speed in a dynamo machine was read by the same author. In a note presented to the Society in June last, it was shown that $\Sigma\rho \cdot \Sigma R = 4\pi n CS$; where $\Sigma\rho$, and $\Sigma R$ are the magnetic and electric resistances respectively, $n$ = speed, and C and S the numbers of armature and field windings. By writing the equation in the form—

$$\frac{4\pi CS}{\Sigma R} = \frac{\Sigma\rho}{n},$$

it is seen that, *when the electric resistance is maintained constant, the magnetic resistance is proportional to speed.*—Prof. Herroun read selections from a paper on the divergence of electromotive forces from thermo-chemical data. The fact that the electromotive forces of voltaic cells do not always coincide with calculated values has not hitherto received a satisfactory explanation, and this paper describes an experimental research bearing on the question. Several suggested explanations are given. In some cells the anticipated chemical change does not occur, and some metals become coated with oxide or subsalts; others are affected by dissolved gases, and the hydration or solution of the salts formed may supplement or diminish the E.M.F. of a cell, as well as the absorption or evolution of sensible heat. The question of absorption and evolution of heat is the one chiefly dealt with. If such actions do take place, the total heat evolved by passing a definite current through the cell must depend on the direction of the current, and by inclosing the cell in a calorimeter the difference should be detected. The total heat developed by a current C in $t$ seconds is—

$$\frac{C^2rt}{J} \mp eCt;$$

where $r$ is the resistance of the cell, and $e$ the divergence of the observed from the calculated E.M.F., the − or + sign depending on the direction of the current. In the case of mercury cells, which are usually said to give about half a volt excess E.M.F., the heat was found to be independent of the direction of the current. The heats of formation of mercury salts were then re-investigated, and the results showed that Julius Thomsen's numbers (the ones usually accepted) were greatly in excess of the true values. This accounts for the difference between the observed E.M.F.'s and those calculated from Thomsen's numbers. A copper, silver, nitrate cell was tested in the calorimeter, and the reversible heat effect agreed closely with that deduced from the "thermo-voltaic constant," or divergence of observed from calculated E.M.F. Other experiments on tin, lead, nickel, iron, and calcium cells are described, and the chief conclusions arrived at are: (1) the primary factor in determing the E.M.F. of a voltaic cell is the relative heat of formation of the anhydrous salts of the two metals employed; (2) that this E.M.F. may set up chemical changes of a different direction and character from those predicable from the heat of formation of the dissolved salts; (3) that the E.M.F. set up by (1) may be, and usually is, supplemented by the energy due to the hydration or solution of the solid salts, and may have values which accord with the heat of formation of the dissolved salts. The absorption or evolution of sensible heat depends primarily on the attraction between the salts and water, combined with the heat of solution. Finally, the author states that the E.M.F. of a cell gives a more accurate measurement of chemical affinity than that derived from calorimetric observations.

**Chemical Society**, January 17.—Mr. W. Crookes, F.R.S., in the chair.—The following papers were read:—A cubical form of bismuthous oxide, by Messrs. M. M. P. Muir and A. Hutchinson. When the puce-coloured precipitate produced by adding an excess of potassium cyanide to a boiling solution of bismuth nitrate in dilute nitric acid is repeatedly treated with boiling concentrated potash solution, a residue is left, consisting of tetrahedral crystals of bismuthous oxide, which have a density of 8·838.—Cupric iodide, and the interaction of iodides with cupric salts, by Mr. D. J. Carnegie. By digesting cuprous iodide with iodine and water in a tightly-closed bottle at 80° for a few minutes, the author has obtained solutions of cupric iodide containing as much as 0·82 gramme per 100 cubic centimetres, but has been unable to obtain cupric iodide in the solid state, either from such solutions or by other means. A well-defined basic periodide, $CuI_2$, $2CuO$, $4H_2O$, was obtained by digesting copper with barium iodide.—Periodates, part 2, by Mr. C. W. Kimmins. The periodates of lead, iron, copper, nickel, cadmium, and silver were described.—Compounds of arsenious oxide with sulphuric anhydride, by Mr. R. H. Adie. A series of compounds, of the formula $As_2O_3 \cdot xSO_3$, where $x = 1, 2, 4$, or 8, can be prepared by the interaction of arsenious oxide and either sulphuric acid or sulphuric anhydride.—A compound of boric acid with sulphuric anhydride, by Mr. R. F. d'Arcy.—Notes of experiments with butter fat, by Messrs. A. W. Blyth and G. H. Robertson. The main result of the experiments is to show that butter fat is composed of about 54·5 per cent. of solid crystalline fats, and about 45·5 per cent. of an oil. The authors consider that butter is mainly made up of compound and not simple triglycerides, and have separated a crystalline glyceride, to which they ascribe the formula $(C_4H_7O_2) \cdot C_3H_5 \left\{ \begin{matrix} C_{16}H_{31}O_2 \\ C_{18}H_{34}O_2 \end{matrix} \right.$.

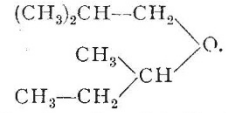
—Gawalowski's method for the volumetric estimation of sulphuric acid, by Mr. B. North.—Note on the 1 : 3 homo- and the isomeric hetero-α-β-dichloronaphthalenes melting at nearly the same temperature, by Prof. H. E. Armstrong, F.R.S., and Mr. W. P. Wynne. In their last note on the isomeric dichloronaphthalenes (Proc. Chem. Soc., 1888, 104), the authors brought forward evidence proving that the dichloronaphthalene melting at 61°·5, and characterized by yielding a sulphochloride melting at 148°, is the meta- or 1 : 3-derivative, and pointed out that the dichloronaphthalene melting at 64°, and characterized by yielding a sulphochloride melting at 118°, is the hetero-α-β-dichloronaphthalene. Erdmann and Kirchhoff recently effected the synthesis of a heteronucleal α-β-dichloronaphthalene from parachlorobenzaldehyde, which had a melting of 61°·5 (*Annalen*, ccxlvii. 366). The description of the compound was, however, insufficient to determine its identity, so the authors have prepared it by Erdmann and Kirchhoff's method, and find that it forms a sulphochloride melting at 117°, which, on hydrolysis, yields the pure dichloronaphthalene melting at 63°·5. The authors' conclusions have also received additional confirmation by the synthesis of the 1 : 3 dichloronaphthalene from the 1 :,3 dichlorobenzaldehyde (Erdmann, *Ber.* xxi. 3446). The remainder of the note is devoted to a reply to Erdmann, who, among other matters which are dealt with in the note, calls attention to the existence of two dichloronaphthalenes melting at about the same temperature as if it were an original observation, whereas the fact was first brought under notice by one of the authors at the Manchester meeting of the British Association (B.A. Report, 1887, 231).—The constitution of β-naphthol-α-sulphonic acid (Bayer's acid), by Prof. H. E. Armstrong. The author points out that Witt (*Ber.* xxi. 3489) altogether misrepresents his views on the constitution of β-naphthol-α-sulphonic acid, and quotes passages from his Report to the Manchester meeting of the British Association (B.A. Report, 1887, 231), showing that in his opinion Bayer's acid is a heteronucleal compound, a view, moreover, which has recently found experimental confirmation, inasmuch as the amido-acid corresponding in constitution with Bayer's β-naphthol-α-sulphonic acid has been shown to yield a heteronucleal α-β-dichloronaphthalene (Armstrong and Wynne, Proc. Chem. Soc., 1888, 104).—The sulphonation of naphthalene-β-sulphonic acid, by the same. The so-called new naphthalenedisulphonic acid, for the preparation of which a patent has been taken out by Ewer and Pick, is identical with that obtained by sulphonating potassium naphthalene-β sulphonate with chlorosulphonic acid (Armstrong and Wynne, Proc. Chem. Soc., 1886, 230).

**Royal Microscopical Society**, January 9.—Dr. C. T. Hudson, President, in the chair.—Mr. T. F. Smith called attention to his further researches on the structure of *Pleurosigma formosum*. He had found not more than three layers, the first consisting of a grating with square meshes, the second had them of diagonal pattern, and the third was composed of alternate rings and squares. He also described *P. angulatum* as giving appearance of a fine grating showing image in each alternate square.—Mr. Crisp exhibited a form of spirit-lamp sent from America, the reservoir of which was facetted instead of globular, so that it could not be upset and might be used in various positions; also Mawson and Swan's camera arrangement for fixing on the front of an ordinary camera; also the binocular arrangement of Messrs. Bausch and Lomb, which, although described in the Journal in 1884, had not until the present time been seen in this country; also another arrangement for rotating a number of objects so as to bring them in succession under the objective of a microscope.—Mr. A. D. Michael gave an interesting *résumé* of his paper on the internal anatomy of *Uropoda krameri*. He finds that, although the anatomy is essentially of the Gamasid type, yet the external resemblance of *Uropoda* to the *Oribatidæ*, which deceived Hermann, is accompanied by many internal similarities, while many organs differ considerably from those of *Uropoda obscura*, lately described by Winkler. He describes a curious organ which he calls the "vestibule," forming the outer chamber of the female genital system, and which it is suggested may serve to remove the thin egg-shell at the moment of deposition, producing ovo-viviparous reproduction. The female genital organs form a ring with two oviducts, the tracheæ are unbranched; the alimentary canal, excretory system, and male genital system of the œsophageal ganglion are also described.—Dr. F. H. Bowman's paper on the frustule of *Surirella gemma* was read.—Count Abbé F. Castracane's paper on the reproduction and multiplication of Diatoms, was also read.

PARIS.

**Academy of Sciences**, January 28.—M. Des Cloizeaux, President, in the chair.—Reaction of oxygenated water on chromic acid, by M. Berthelot. The remarkable character of the reactions of oxygenated water has induced the author to undertake further researches on the phenomena which it manifests in the presence of chromic acid. These studies show that the chemical mechanism of the so-called actions in presence is characterized by three fundamental conditions; (1) the unlimited nature of the decomposition under certain circumstances, here determined, without permanent alteration of the chromic acid; (2) the formation of an intermediate compound forming the "pivot" of the decomposition: (3) the exothermic properties of the oxygenated water and of the total transformation.—True and mixed butylic ethers (continued), by M. E. Reboul. The study of these compounds is here completed with the description of di-isobutylic ether, $[(CH_3)_2CH{-}CH_2]_2O$; and secondary

isobutylic ether,



It is further shown that the ethers (7), (8), (9), (10), anticipated by theory, are not produced by the method generally employed. No. 7 (di-secondary ether) has been obtained by Fresnel by a different process.—On M. Marignac's gadolinium, by M. Lecoq de Boisbaudran. The elementary nature of the earth Yα, discovered by M. de Marignac, and since named gadolinium, has been denied by Mr. W. Crookes, who holds that this substance consists of samaria with the greenish blue of yttria, and some of the other yttria bands added to it. M. de Marignac has consequently subjected gadolinium to a fresh analysis with the results here described. M. de Marignac's researches having been interrupted by the state of his health, his papers have been placed in the hands of M. de Boisbaudran, who considers that, although the impurities are not yet entirely eliminated, gadolinium may still be regarded as a new element. He also thinks Mr. Crookes may in this case have exaggerated the difficulties and tedious nature of the preliminary work of fractionation, which, instead of occupying a space of time compared with which "the life of man is all too brief," might perhaps be accomplished in a few weeks. However, he does not deny the extreme difficulty of separating the residuums, which have so far resisted fractionations sufficient to get rid of nearly the whole of Yt and Zα.—On a chromatic circle, an æsthetic recorder and triple decimeter, by M. Charles Henry. These instruments embody a practical application of a theory, the principle of which was communicated to the *Comptes rendus* of January 7, and the chief results of which are here detailed. The chromatic circle has for its object the rational determination of the complements and harmonies of colours; the two other apparatus are intended to facilitate the æsthetic study and improvement of forms.—On the relation between solubility and the point of fusion, by M. A. Etard. The object of the present note, and of the diagram accompanying it, is to show that solubility increases steadily with the temperature, and that it becomes unlimited at or close to the point of fusion of the salt entering into the solution; a given quantity of water may then always dissolve a quantity of any salt. It has been supposed that normally the solubility of salt increases up to a certain point and then decreases. But the facts here verified lead to quite a different conclusion.—New solvents of prussic blue, by M. Ch. Er. Guignet. Experimenting with ordinary prussic blue and with Turnbull blue thoroughly purified, M. Guignet has discovered an easy process for preparing ordinary soluble blue and pure prussic blue soluble in water.—On the quantitative analysis of organic nitrogen by Kjeldahl's method, by M. C. Viollette. The author has subjected this new method to certain tests which yield results somewhat different from those recently communicated to the Academy by M. L'Hôte. He finds that, if applied under the conditions here described, it may prove quite as efficient as the processes of M. Dumas and of sodaic lime, although not more expeditious than either.—On the lime present in the ground in combination with other substances, by M. Paul de Mondesir. Nearly all soils, even the most acid, contain a considerable quantity of lime, not as a carbonate, but in combination with the other elements of the earth. It is here shown that this lime may be eliminated at a low temperature by means of diluted acids.—On the precursors of the Canidæ, by M. Marcellin Boule. The

researches which the author is now prosecuting on the Pliocene faunas of the central plateau of France, have afforded an opportunity of studying remains of the canine group older than those of the Quaternary (Pleistocene) epoch, and tending to throw some light on the origin of existing species. During the Middle and Upper Pliocene there existed a considerable number of species, not only closely related to the present Canidæ, but also anticipating the various living forms of dog, fox, jackal, and wolf. These discoveries tend to overthrow the generally accepted opinion that the present domestic varieties of the dog are all merely artificial modifications of living or Quaternary wolf and jackal types.—Papers were contributed by M. Lerch, on the serial development of certain arithmetical functions; by M. Sauvage, on the regular solutions of a system of linear differential equations; by M. W. Lœwenthal, on the virulence of the cultivated Bacillus of cholera, and on the action of salol on this virulence; and by M. C. Pagès, on the locomotion of quadrupeds.

**Astronomical Society**, January 9.—M. Flammarion, President, in the chair.—Among the communications were the following:—M. de Meissas sent an observation of M. de Boë's second companion to Polaris.—H.R.H. the Prince of Monaco gave an account of the scientific investigations made on board *l'Hirondelle* during the past four years with a view of studying the general physics of our globe.—M. Moussette described an eye-piece for measuring the size of sun-spots and of lunar objects.—M. Mailhat read a paper on a new mercury-bath for artificial horizons, which had been successfully tried at the Paris Observatory.

BERLIN.

**Meteorological Society**, January 8.—Dr. Vettin, President, in the chair.—Dr. Sprung spoke on some new apparatus for the registration of rainfall and wind.—Dr. Vettin presented a number of curves representing his measurements of the velocity of the wind, by which he confirmed the results of his earlier observations as to the existence of a maximum velocity at midday in the summer, and at midnight in the winter. The measurements were made with Dr. Vettin's feather manometer. On the discussion which ensued, it was pointed out that the records yielded by this anemometer do not confirm the above results.

**Physical Society**, January 11.—Prof. von Helmholtz, President, in the chair.—The President opened the first meeting of the current year by a memorial address on Clausius, in which he briefly touched upon his most important works and their significance in connection with the whole range of chemistry and physics.—Prof. Kundt gave a short *résumé* of the researches which he had been carrying on of late years on the behaviour of metals to light. He took as his starting-point Kern's discovery that light which is reflected from magnets undergoes a rotation of the plane of polarization, and fully confirmed this as well as all subsequent observations of the English experimenter. In order to avoid any objections which might be raised against the accuracy of the observed phenomenon, he investigated the rotation produced by extremely thin films of metal, whose production was found, after several preliminary experiments, to be most easily attained by pulverizing the kathode *in vacuo*. The light which was transmitted showed signs of rotation, and as a result of a full experimental investigation all metals were found to exert a dextro-rotatory action on light. This law of the positive rotation of the plane of polarized light could be extended to all simple bodies. The thin metallic films further exhibited a doubly-refractive action which led him to determine the refractive index of the metals, after he had succeeded by means of electrolysis in preparing transparent metallic prisms. The speaker described the methods which he employed in these experiments and exhibited the apparatus which he had used. The result of the experiments is already known. The metals possess a varying refractive power, some exhibiting normal, others abnormal, dispersion. The velocity of light in the several metals followed exactly the same serial order as that of their respective conducting powers for electricity and heat. Since it was possible that the deviation of the rays while passing through the metals did not depend upon a true refraction, the speaker had recently examined the behaviour of the refractive indices of the metals at different temperatures. Metals whose refractive index is large showed an increase of the angle of deviation of light as the temperature rises, and thus all doubt as to the fact that he was here dealing with a true refraction was set aside. A further outcome of these experiments was to show that the velocity of light in metals is dependent on changes of temperature in a way exactly similar to that in which their electrical conductivity is dependent. In order to determine accurately the relationship of the velocity of light to their conductivity, these two values must be measured on one and the same piece of metal. When determining the electrical conductivity in films of metal as thin as those he was using for his optical researches, he found that the greatest difficulty was presented by the measurement of the thickness of the film. In his earlier researches, local thicknesses of 0·11 to 0·14 millionths of a millimetre were measured, values which approximate to the diameter of a molecule. These measurements, the preparation of transparent metallic prisms, and a number of other questions which have become prominent in the course of the above researches, partly carried out by pupils of the speaker, he intends to pursue further.

## BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Life and Correspondence of Abraham Sharp: W. Cudworth (S. Low).—Transactions of the Royal Irish Academy, vol. xxix. Part 3. On Two-nosed Catenaries and their Application to the Design of Segmental Arches: T. Alexander and A. W. Thomson (Williams and Norgate).—A Treatise on Statics, vol. ii. fourth edition, corrected and enlarged: G. M. Minchin (Oxford, Clarendon Press).—Encyklopædie der Naturwissenschaften, Chemie, Zweite Abthg. 49 and 50 Liefg. (Breslau).—Encyklopædie der Naturwissenschaften, Botanik, Erste Abthg. 58 Liefg. (Breslau).—Results of Meteorological Observations made in New South Wales: H. C. Russell (Sydney).—Studies from the Laboratory of Physiological Chemistry, Sheffield Scientific School of Yale University for the Years 1887–88, vol. iii.: edited by R. H. Chittenden (New Haven).—Nautical Monographs, No. 5, the Great Storm off the Atlantic Coast of the United States, March 11–14, 1888: E. Hayden (Washington).—Annuaire de l'Observatoire de Bruxelles: D. Folie (Bruxelles, Hayez).—Butter Making in Denmark: S. Hoare (Norwich).—Le Climat de la Belgique en 1888: A. Lancaster (Bruxelles, Hayez).—Industrial Education in the South: Rev. A. D. Mayo (Washington).—Second Annual Report of the Liverpool Marine Biological Station on Puffin Island: W. A. Herdman (Liverpool).—Insect Life, vol. i. No. 7 (Washington).—Sources of the Nitrogen of Vegetation: Sir J. B. Lawes and Prof. J. H. Gilbert (Trübner).—London Geological Field Class Excursions during the Summer of 1888 (Philip).—Michigan Forestry Commission, First Report (Lansing).—Results of Rain, River, and Evaporation Observations made in New South Wales during 1887: H. C. Russell (Sydney).—Journal of the Society of Telegraph-Engineers and Electricians, vol. xvii. No. 76 (Spon).

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