will entitle to a printed report of the proceedings. Any intending members who have not yet paid the fee are requested to send it to Prof. Sully.

During the Congress letters may be addressed to Members at the Council Room, University College, Gower Street, London, W.C., where each Member is requested to inscribe his name, on his first attendance at the Congress.

F. W. H. MYERS,
Leckhampton House, Cambridge.

JAMES SULLY,
East Heath Road, Hampstead, London, N.W.

SCIENTIFIC SERIALS.

THE current number of the *Royal Agricultural Society's Journal* is, perhaps, of more than usual interest. The first article is on Vermin of the Farm, by J. E. Harting, and is followed by an editorial note on the same subject. The plague of "mice" on the hill pastures of Scotland this spring gives a special interest to these articles. It appears that the Scotch plague is caused not by mice, but by fieldvoles (*Arvicola agrestis*), and the destruction they have wrought in the hill pastures of Scotland arises from the fondness of these voles for the delicate white stems of the hillside herbage. Judging from the reports of similar plagues in previous years it would appear that the natural enemies of the vole—the short-eared owl and the kestrel hawk—are far more efficacious remedies than any artificial means yet devised for the destruction of the voles; hence a paper on Wild Birds in relation to Agriculture, by Earl Cathcart, is very opportune, protesting as it does against the careless destruction of such birds as the owl, the hawk, and the rook. The Journal also contains a second paper by Mr. Dan Pidgeon on the Evolution of Agricultural Implements. A suggestive paper by Mr. William E. Bear on Desirable Agricultural Experiments advocates extensive experiments to test the economy of nitrogenous manuring by means of leguminous crops. Other papers in this number are Contagious Footrot in Sheep, by Prof. G. T. Brown; Variations of the Four-course System, by Gilbert Murray; and the Trial of Ploughs at Warwick, by F. S. Courtenay.

SOCIETIES AND ACADEMIES.

Oxford University Junior Scientific Club, May 27.—The biennial conversazione of the Club was held in the University Museum, when an address inaugural to the recently founded "Robert Boyle lectures of the O.U.J.S.C." was delivered by Prof. Sir Henry W. Acland, Bart., K.C.B., F.R.S., on Robert Boyle, his life, work, and influence on science. A very interesting series of exhibits was shown by the various departments of the Museum and by the University Observatory, illustrating recent progress in their particular branches of science. Of special interest were the exhibits by the Rev. F. J. Smith on shadow and objective spark photography, illustrated by pictures of objects in rapid motion; by Mr. Cecil Carus-Wilson, of natural and artificial musical sands; by the University Observers, of a series of splendid photographs illustrating recent improvements in astronomical and spectral photography; by the National Telephone Company, of telephonic apparatus; by Dr. Hunt, of preparations and cultivations illustrating the methods of isolation and identification of bacteria; by Mr. B. V. Darbishire, of a series of lantern views in the Caucasus and in the British East Africa Company's territory, the slides for which were kindly lent by the Royal Geographical Society. The Club is much indebted to the Royal Society, the Pharmaceutical Society, the Right Hon. the Earl of Cork and Orrery, Prof. Wyndham R. Dunstan, Prof. Odling, and other gentlemen for the loan of oil paintings, engravings, and relics of Robert Boyle and his contemporary men of science in Oxford.

June 3.—The President, Mr. W. Ramsden, in the chair.—The following papers were read:—The sub-salts of the alkali metals, by Mr. W. Pullinger.—The action of silicon-tetrachloride on benzene, by Mr. C. H. H. Walker.—Marriages of consanguinity, by Mr. H. Anglin Whitelocke.—A new and improved form of rotatory hypsometer, by Mr. S. A. Sworn (Balliol). Mr. C. J. Romanes was elected an honorary member of the Club.

June 14.—The President, Mr. W. Ramsden, in the chair.—The following papers were read:—The action of iodine on a mixture of sulphites and thiosulphates, by Mr. H. A. Colefax.—On marine nests, by Mr. W. B. Benham.

EDINBURGH.

Royal Society, June 20.—Dr. Traquair exhibited some remains of animals occurring in volcanic tuff at Teneriffe.—Dr. Hunter Stewart read a paper on the variations in the amount of carbonic acid gas in the ground air.—Dr. Buchan discussed the diurnal variations of barometric readings in the polar regions during summer. From observations made in the summer of 1876 and the two succeeding summers, in the central part of the North Atlantic, between 62° and 80° north latitude, he showed that only one maximum and one minimum occur during the day. Observations made by the *Challenger* staff in high antarctic latitudes during summer give the same result. A single maximum and a single minimum are also found in the interior parts of the polar continents, but these occur at different times of the day from the ocean maximum and minimum. Superposition of the two sets of variations gives a variation like that ordinarily observed.

July 4.—The Hon. Lord Maclaren, Vice-President, in the chair.—Dr. A. W. Hughes read a paper on the rotatory movements of the human vertebral column. Among other results he points out that while the lumbar vertebræ cannot rotate much about a vertical axis, the dorsal vertebræ are capable of considerable rotation—the total rotation of this part of the vertebral column being 45° or more—and the cervical vertebræ are still more free—the total amount being at least 90°.—Mr. R. Kidston discussed the genus *Lepidophloios*, Sternb.—Prof. C. G. Knott and Mr. A. Shand communicated some further notes on the volume effects of magnetization. Five iron tubes, with bores varying from 16·0 to 3·5 mm. diameter, but otherwise identical in form and substance, were subjected to a series of magnetizing forces. In low fields the thinner-walled tubes experienced the greater dilatations of internal volume; but in high fields the narrower bored tubes showed much the greater dilatations. For example, in field 1400 the dilatations of the tubes in order, beginning with the one of widest bore and thinnest wall, were +4, −3, −20, −53, and −129—each being multiplied by 10^{-7}. With the two tubes of widest bore, the change of volume had reached its limit at this high field, the substance being practically saturated; but with the tubes of narrowest bore there was no evidence of a limit being reached, the innermost layers of iron being evidently far from practical saturation. Some interesting illustrations of magnetic after-effect were also described.—Dr. A. B. Griffiths submitted a paper on the blood of the invertebrata.—Prof. Tait communicated the second part of a paper on the laws of motion. If we assume the principles of inertia of matter and conservation of energy (the energy of a self-contained system consisting of the kinetic energy of all its parts supposed to be moving with the speed of its centre of inertia, the kinetic energy of relative motion of its parts, and the potential energy of its parts), the fact that we cannot attach any definite meaning to the principle of conservation, except when the motion of the system is Galilei-wise, leads at once to the first and third laws of motion, since the centre of inertia moves uniformly in a straight line; and the second law becomes merely a definition of the word "force" as used in the first law, and as used instead of "action" and "reaction" in one interpretation of the third.

PARIS.

Academy of Sciences, July 4.—M. d'Abbadie in the chair.—On local disturbances produced underneath a heavy load uniformly distributed along a straight line normal to the two edges, on the upper surface of a rectangular beam: experimental verifications, by M. J. Boussinesq.—Resemblances in the march of evolution on the old continent and the new, by M. Albert Gaudry.—Experimental researches on falling bodies and the resistance of air to their motion: experiments performed at the Eiffel Tower, by MM. L. Cailletet and E. Colardeau. Metallic spheres were let fall from the second platform of the Eiffel

Tower, and their exact time of describing certain distances was measured to a hundredth of a second by means of an electric chronograph. The body was fixed to a very light thread wound round a set of inverted cones, each of which held 20m. of thread. The latter passed from one cone to another through two fine springs in contact, which contact was broken by the string pulling through, thus producing a mark on the chronograph. The retardation produced by the string was independently determined and found to be less than 0·001 per cent. The following laws were verified: that the resistance of the air is proportional to the area of the resisting surface; and that it is independent of the form of the surface. That it is also proportional to the square of the velocity was not found to be strictly true, since the resistance increased rather more rapidly. The amount of fall after which the velocity of the weights employed became uniform ranged from 60m. to 100m. Contribution to the study of the function of camphoric acid, by M. A. Haller.—A new contribution to the history of morbid associations; anthrax and paludism, by M. Verneuil.—Fixation of ammoniacal nitrogen on straw, by M. de Vogüé.—On the nature of the rotation of the knife-edge of a pendulum on its plane of suspension, by M. G. Defforges. This rotation is not a simple rolling, as was assumed by Euler and Laplace, but is compounded with a sliding motion, whose existence can be proved by means of interference fringes. The sliding is proportional to the amplitude and up to six or seven kgr. to the weight.—On the influence of the place of the external thermometer in observations of zenith distances, by M. Périgaud. In calculating the error due to refraction by Arago's method, the density of the layer of air in the neighbourhood of the objective is measured by a thermometer placed outside the room, near the north side of the observatory. It was sought to fulfil the conditions of the problem more rigidly by suspending a thermometer quite close to the objective. The zenith-distances, calculated on the basis of its indications, showed a difference of 0·2 to 0·8 from those obtained by Arago's method, which made the zenith distances too large. The writer's method has been adopted at the great transit-instrument of the Paris Observatory. —On the primary forms of linear differential equations of the second order, by M. Ludwig Schlesinger.—On the precise determination of the critical density, by M. E. Mathias. This determination is aided by the law of the rectilineal diameter, according to which in the curve of temperatures and densities the locus of the midpoints of the chords parallel to the axis of the ordinates is a straight line. This law, recently confirmed by Young's experiments, implies that the critical density is equal to the ordinate of the diameter which corresponds to the critical temperature. Calculated according to this law, the critical densities of methyl, ethyl, and propyl alcohol are found to be the same.—Influence of the mass of the liquid in the phenomena of heating, by W. A. Witz.—Measurement of the dielectric constant by electromagnetic oscillations, by M. A. Pérot. By the method described, the constant K was determined for glass, and found to range from 2·71 if charged for $72·6 \times 10^{-10}$ sec. to 5·727 if charged for $453·7 \times 10^{-10}$ sec.—On the composition of water and Gay-Lussac's law of volumes, by M. A. Leduc. The writer's researches on the densities of gases have led him to adopt the value 23·24 for the percentage of oxygen in the air. The density of oxygen was determined by a modification of Dumas's process, in which the hydrogen was absorbed by finely-laminated electrolytic copper. The atomic weight deduced was 15·88, while the mean of the best values for the density is 15·90. This shows that Gay-Lussac's law of volumes is only approximate.—On the nitrogen salts of platinum, by M. M. Vèzes.—Researches on the sodic pyrogallols, by M. de Forcrand.—On acetono-resorcine, by M. H. Causse.—Utilization of roasted iron pyrites for the manufacture of iron salts, by MM. A. and P. Buisine.—On the alterations of ferruginous waters, by M. F. Parmentier.—Reproduction of pure potassic nepheline, by M. André Duboin.—On the passage of dissolved substances through mineral filters and capillary tubes, by M. C. Chabrie.—On hæmocyanine, by M. Léon Frédéricq. —On the physiological determinism in the metamorphosis of the silk-worm, by M. E. Bataillon.—On a new *Temnocephala*, a parasite of *Astacoides madagascariensis*, by M. A. Vayssière. —Earthworms and tuberculosis, by MM. Lortet and Despeignes. Proving that worms can bring the bacillus to the surface, preserving all its virulent properties.—On the Californian disease, a disease of the vine caused by *Plasmodiophora californica*, by MM. P. Viala and C. Sauvageau.—An essay on vegetable statics, by M. Augustin Letellier.—On the cavern called the Creux de Souci (Puy-de-Dome), by MM. E. Martel, A. Delebecque, and G. Gaupillat.—On the lakes of the central plateau of France, by MM. A. Delebecque and E. Ritter.

BERLIN.

Physical Society, June 3.—Prof. Schwalbe, President, in the chair.—Dr. Gross continued his remarks on the subject of entropy.—Dr. Wien gave an account of experiments on the measurement of high temperatures, made in conjunction with Dr. Holborn, with a view to testing Le Chatelier's platinum and rhodium thermo-elements. They were first compared with an air-thermometer. The latter consisted of a glazed porcelain tube containing slightly rarefied air, the temperature being recorded by a manometer. The thermo-element was introduced into the cavity of the air-thermometer, and the readings of the respective instruments were compared between −80° and + 1500°. Below 500° the thermo-element was not very sensitive, and is hence of use only for high temperatures. Alloys of platinum with 9, 10, 11, 20 and 40 per cent. of rhodium were tried. It was found that the E.M.F. increased with the increased percentage of rhodium, but that the most suitable alloy was that containing 10 per cent. of rhodium as recommended by Le Chatelier. The above experiments necessitated the determination of the co-efficient of linear expansion of Berlin porcelain. This was found to be ·000004. In some final experiments the melting-point of gold was determined to be 1073° and 1067°, of silver 972° and 968°, and of copper 1082°.

June 17.—Prof. Kundt, President, in the chair.—Prof. Vogel exhibited a remarkably fine series of coloured prints of oil paintings, &c., prepared in accordance with his method by Messrs. Vogel and Ulrich. The method consists in first taking a red, a yellow, and a blue negative of the object on plates specially sensitized for colours. The three negatives are then printed on to one and the same paper by means of complementarily coloured rollers or stones. In order to obtain the colours exactly complementary to those of the negatives, the colours used for printing were either the coloured sensitizers themselves or some substance whose equivalence to these had been determined spectroscopically. The application of the physical principles involved in the above yielded an approximate reproduction of the natural colours which was surprisingly complete, and will become more so as more and more coloured substances are discovered suitable as sensitizers.—Prof. Koenig described his new spectrophotometer. Its chief improvement consists in the introduction of Lummer and Brodhun's glass-cube, which is, however, so modified as to admit of the measurement of the relative intensities of the parallel rays falling into it.

Physiological Society, June 24.—Prof. du Bois Raymond, President, in the chair.—Prof. Kossel communicated the results of some experiments made by Dr. Monti on the absorption of oxygen by the tissues after death, using for this purpose their reducing action on photographic plates. The suprarenals, spleen, and thymus reduced most actively, while brain-substances produced but little effect. Dr. Lilienfeld had investigated the distribution of phosphorus in various tissues by means of micro-chemical reactions with ammonium molybdate and pyrogallol. The presence of phosphorus was usually strongly marked in the nuclei as compared with the cell-substance, except in the case of the cerebral ganglia, in which the reverse was frequently observed. Prof. Gad drew attention to a phenomenon, brought to his notice by Prof. Litten, which may be observed during normal human respiration, and consists in the downward passage of an obvious wave over the wall of the thorax at each inspiration aud the upward passage of a similar wave at each expiration.

AMSTERDAM.

Royal Academy of Sciences, June 25.—Prof. van der Waals in the chair.—Prof. T. Forster spoke (1) On the action of heat upon tuberculous matter. According to former investigations by "pasteurizing" (*i.e.*, warming liquids to a temperature of 60 to 80° C. for a short time and cooling them immediately), bacteria of Asiatic cholera and typhoid-fever are killed at about

60°. From a hygienic point of view it is of still more importance to discover what is the lowest temperature at which the bacilli of tuberculosis are destroyed. It is established that tuberculosis is produced by the consumption of milk secreted by tuberculous cows. Meat also, coming from tuberculous cattle, sometimes contains infectious matter. By boiling heat, indeed, the bacilli of tuberculosis are killed. But if meat is prepared in the usual manner, even small pieces of it are not warmed thoroughly at 100° C.; milk, on the other hand changes in taste if boiled, so that most people do not like boiled milk. By a series of experiments, recently made, Prof. Forster has settled that the bacilli of tuberculosis are destroyed by a temperature of 60° C. acting during one hour, and by the action during six hours of a temperature of 55° C. Higher temperatures than 60°, for instance, 80, 90 or 95° C., destroy the infectious matter in milk from tuberculous cows if they act during *ten* minutes; "pasteurizing," however, at 80° during *one* minute does not hurt the bacilli of tuberculosis. (2) On the development of bacteria at a temperature of melting ice. He had formerly demonstrated cultivations of bacteria, which produce light of phosphorescence. The same kind of bacteria are also able to develop and to multiply at a temperature of 0° C. He found that bacteria which have this peculiar quality, so interesting from a biological point of view, not only live in the sea, but are met with in brackish and fresh water, upon victuals, manures, etc., etc. This agrees with the fact that victuals, kept for some days in an ice-chamber, gradually assume a disagreeable smell and taste; and that meat can be preserved from putrefaction for days but not for weeks. If foods are to be preserved at a low temperature for a long time, beside cold a second agent is necessary—dryness. In the cooling rooms of the most modern establishments (slaughterhouses, stores, etc., etc.) no use is made of ice, which after melting moistens the atmosphere and the objects in the ice-chambers, but arrangements are made by which the atmosphere is cooled to a low temperature and at the same time kept perfectly dry.—M. Beyerinck spoke of the culture of organisms of nitrification on agar-agar and on gelatine. First it was stated, in accordance with the discovery of Warington and Winogradsky, that nitrification consists in two processess—the formation of nitrous acid from the ammonsalt by a specific bacterium and the oxidation of the nitrite into nitrate by another and independent species of bacterium. Secondly, that both these processes occur only when soluble organic matter is reduced to a minimum such as has been proved by the classic researches of Winogradsky and the Franklands. Even 0·1 per cent. of calcium-acetate retards nitrification strongly. Thirdly, it was found that organic matter in the solid state does not in the least interrupt or retard nitrification. Therefore an attempt was made—and successfully—to cultivate the nitrous and nitric bacteria on agar-agar, fully extracted with distilled water and afterwards boiled with the inorganic salts needed for nitrification. If with these salts some pure precipitated carbonate of lime was added to the agar it was possible to obtain a "chalk-agar-plate," whereon the nitrous bacteria of the soil, after their growth into colonies, could directly be numbered. For this purpose the chalk-agar is poured into a glass-box, and some soil suspended in sterilised water brought on the surface of the solidified plate. After three to four weeks the colonies become visible as the centres of clear, transparent, perfectly circular diffusion figures, formed by the solution of the carbonate of lime in the nitrous acid, the very soluble calcium-nitrite diffusing in all directions in the agar-plate. In this way it was found, for example, that out of c.a. 10 millogrammes soil taken from under a sod of white clover in a garden at Delft, thirty colonies of the nitrous bacterium could be cultivated. The species is the same as that described as the European form by Winogradsky, growing, as well as zooglœa, quite free, and possessing the form of a small, moveable mikrokok with one cilium. Gelatine, prepared with the same precautions as the agar, can also be used, but therein the production of nitrous acid soon ceases. The nitrous bacterium does not liquefy the gelatine. Though it does not grow or oxidize when organic matter is present, it does not lose these powers by this contact, as shown when brought anew under adequate conditions. The nitric bacterium was also isolated on fully extracted agar, to which 0·1 per cent. potassium-nitrite and some phosphate was added. The colonies are very small and coloured light yellow. They consist of very small non-moving mikrokoks or short ellipsoids. They lose their power of oxidizing nitrites by the contact of soluble organic matter, without thereby losing their power of growth. The nitric bacterium does not oxidize ammonsalts. It is also without action on potassium rhodanate and hydrochloric-hydroxylamine. It therefore does not seem to produce free acid such as the nitrous bacterium. A simple method for the formation of sterile plates of silica, with and without carbonate, was also described. Many preparations were demonstrated.

BOOKS AND SERIALS RECEIVED.

BOOKS.—Grasses: C. H. Jones (S.P.C.K.).—A Synoptical Geography of the World (Blackie).—London Matriculation Directory, No. xii., June 1892 (Clive).—The Case against Bimetallism: R. Giffen (Bell).—The Birds of Devon: W. S. M. D'Urban and Rev. M. A. Mathew (Porter).—Universal Atlas. Part 16 (Cassell).—Photography Annual, 1892 (Iliffe).—Muséum d'Histoire Naturelle des Pays Bas; tome xi., Cat. Systématique des Mammifères: F. A. Jentink (Leide, Brill).—The Applications of Elliptic Functions: A. G. Greenhill (Macmillan and Co.).—Sunshine: A. Johnson (Macmillan and Co.).—Theory of Numbers, Part 1: G. B. Mathews (Bell).—Alcohol and Public Health: Dr. J. J. Ridge (Lewis).—Murray's Hand-book; Norway, 8th edition (Murray).

SERIALS.—Transactions of the County of Middlesex Natural History and Scientific Society, Sessions 1889-90, 1890, and 1891 (London).—Natural Science, No. 5 (Macmillan and Co.).—L'Anthropologie, 1892, tome 3, No. 3 (Paris, Masson).—Bulletin de l'Académie Royale des Sciences de Belgique, No. 5 (Brüxelles).—Journal of the Royal Agricultural Society of England, 3rd series, vol. 3, Part 2, No. x. (Murray).—Department of Agriculture, Victoria, Bulletin No 14 (Melbourne).—The Asclepiad, No. 34, vol. ix. (Longmans).—Mind, July (Williams and Norgate).—Journal of Anatomy and Physiology, July (Williams and Norgate).—Archives des Sciences Biologiques publiées par l'Institut Impérial de Médecine Expérimentale à St. Pétersbourg, tome 1, No. 3 (St. Petersburg).—Geological Magazine, July (K. Paul).—Annals of Scottish Natural History, No. 3 (Edinburgh, Douglas).—Medical Magazine, vol. 1, No. 1 (Southwood).—Journal of the Royal Statistical Society, June (Stanford).—Journal of the Chemical Society, July (Gurney and Jackson).—Quarterly Journal of Microscopical Science, No. 132 (Churchill).

CONTENTS.