Lake, St. John's (Geology); Melsome, Queens' (Physiology); Rendle, St. John's (Botany); Turpin, St. John's (Chemistry). No women were placed in the first class.

Mr. Lake, of St. John's, whose name appears in the above list, has been elected to the first Harkness Scholarship for Geology and Palæontology.

Dr. William Hunter, M.D., F.R.S.Edin., has been elected the first John Lucas Walker Student in Pathology.

The degree of Doctor in Science has been conferred on Mr. James Ward, of Trinity College, and Prof. F. O. Bower, of Trinity College and Glasgow University.

In consideration of this year being the two hundredth anniversary of the publication of Newton's "Principia," the Chancellor's Medal is to be given for an English poem on Isaac Newton.

The botanical teachers in the University have made a pressing appeal for the erection of a class-room for practical microscopical botany.

The Examiners for the Mathematical Tripos, Part II., have issued the following class list:—

Class I. Division 1: C. W. C. Barlow, and Bryan, Peterhouse; Dixon, Trinity; Fletcher, St. John's; Platts, Trinity. Division 2: Coates, Queens'; F. W. Hill, St. John's. Division 3: Clark, Pembroke; H. G. Dawson, Christ's.

Class II. Division 1: Askwith, Trinity. Division 2: Johnston, Peterhouse; McAulay, Caius; Nicolls, Peterhouse. Division 3: Tate, St. John's.

Class III. Division 1: Dickinson, Trinity.

The appointment of a Demonstrator of Pathology has been approved.

The proposals regarding the teaching of geography and the appointment of a University Lecturer in Geography have been confirmed.

The modified proposals to build new plant-houses in the Botanic Garden have been approved. A small research laboratory is to be built in connexion with them.

At the annual election at St. John's College, on June 18, the following awards in Natural Science and Mathematics were made:—

Foundation Scholarships:—Science: Rendle, £50; d'Albuquerque, £60; Groom, £50—Mathematics: Norris, £40; Varley, £50; H. H. Harris, £50; Rudd, £40. Scholarships prolonged or increased in value:—Science: Rolleston, £80; Shore, £60; Seward, £40; Harris, W., £50; Lake, £80—Mathematics: Fletcher, £80; Hill, £60; Tate, £40; Orr, £80; Sampson, £80; Baker, £100; Flux, £100.

Exhibitions:—Science: Grabham, d'Albuquerque, Baily, Hankin, Shaw—Mathematics: Orr, Sampson, Carlisle, Millard, Cooke, Humphries, Shawcross, Palmer. Proper Sizarships:—Science: Kellett—Mathematics: Box, Brown, Lawrenson; Shawcross, Palmer. Hughes Prizes:—Science: Lake; Mathematics: Baker and Flux, equal. Wright Prizes:—Science: Turpin, d'Albuquerque; Mathematics: Orr, Cooke. Hockin Prize (for Physics, and in particular Electricity): Turpin. Herschel Prize (for Astronomy): Flux. Hutchinson Studentship (for Sanskrit): Strong.

Among the distinguished persons upon whom honorary degrees were conferred on June 20 was Prof. Asa Gray, Professor of Natural History and Keeper of the University Herbarium and Botanical Library, Harvard University, author of the "Elements of Botany" (1836), the "Botanical Text-Book" (1842, ed. 6, 1880), "Darwiniana" (1876), "Flora of North America" (1878), &c., &c. We append the text of the speech delivered by the Public Orator, Dr. Sandys, in presenting him for the degree:—

Iuvat tandem pervenire ad historiae naturalis professorem Harvardianum, botanicorum transmarinorum facile principem. Annorum quinquaginta intra spatium de scientia sua pulcherrima quot libros, eruditione quam ampla, genere scribendi quam admirabili composuit. Quotiens oceanum transiit ut Europae herbaria diligentius perscrutaretur, virosque in sua provincia primarios melius cognosceret. In aliorum laboribus examinandis, recensendis, nonnunquam leviter corrigendis, iudicem quam perspicacem, quam candidum, quam urbanum sese praebuit. Quanta alacritate olim inter populares suos occidentales Darwini nostri solem orientem primus omnium salutavit, arbitratus idem doctrinam illam de formarum variarum origine causam aliquam primam postulare, et fidei de numine quodam, quod omnia creaverit gubernetque, esse consentaneum. Viro tanto utinam contingat ut opus illud ingens quod Americae Borealis Florae accuratius describendae olim dedicavit, ad exitum felicem aliquando perducat. Illum interim, qui scientiam tam pulchram suis laboribus, sua vita, tam diu illustravit, usque canam ad senectutem, ut poeta noster ait, 'vitae innocentis candidum florem gerens,'—illum, inquam, his saltem laudis flosculis, hac saltem honoris corolla, libenter coronamus.

Plurimos in annos Academiae coronam illustriorem reddat Florae sacerdos venerabilis, ASA GRAY.

SCIENTIFIC SERIALS.

THE *Journal of Botany* for May contains the following articles:—Angolan Scitamineæ, by Mr. H. N. Ridley.—Forms and allies of *Ranunculus Flammula*, by Mr. Chas. Bailey.—Notes on British Characeæ for 1886, by Messrs. H. and J. Groves.—The progress of botany in Japan, by Mr. F. V. Dickins.—Conclusion of the Rev. Mr. Purchas's list of plants for South Derbyshire.

In the number for June Mr. E. M. Holmes describes and figures two species of seaweed new to Britain, *Ectocarpus simplex* and *E. insignis*.—There are also papers on Queensland ferns, by Baron von Müller and Mr. J. G. Baker; on the genus *Potamogeton*, by Mr. A. Fryer; on plants of Northern Scotland, by Mr. F. J. Hanbury and Rev. E. S. Marshall; on Chinese ferns, by Mr. J. G. Baker; and on Australian species of *Potamogeton*, by Mr. A. Bennett.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 16.—"Abstract of Investigations upon Rabies." By G. F. Dowdeswell.

The first experiments made by inoculations with the saliva of rabid street dogs, during the outbreak of the disease in 1885, all failed to produce infection, thus confirming the reputed uncertainty of the result of the bite of a rabid animal.

Subsequently, adopting the methods recently described by M. Pasteur, it was found:—

(1) That the virus of rabies in the lower animals and of hydrophobia in man resides in the cerebro-spinal substance and in the peripheral nerves, and is not confined to the salivary secretion, as previously believed, nor is even as constantly present or as actively virulent in it as it is in the nervous tissues.

(2) That inoculation of a portion of the nervous tissue from a rabid animal upon the brain of another by trephining produces infective rabies or lyssa, much more certainly, and with a far shorter incubation period, than by subcutaneous inoculation of the same substance; but that the disease is identically the same in both cases.

(3) That the virulence of "street rabies" is usually increased and ultimately becomes remarkably constant by passing through a series of rabbits, in which animals the symptoms are somewhat different from those in others, and which are generally regarded as typical, being essentially paralytic, but that paresis to some extent is always present in this disease in dogs and others of the lower animals, and that there is no constant distinction between the so-termed "dumb" and "furious" rabies in the latter animal, the difference consisting in the preponderance of the paralytic or other symptoms.

(4) That the tissues of an infected animal do not themselves usually become infective till towards the close of the incubation period.

(5) That of a large number of drugs that were tried, both germicides and those which act specifically upon the cerebro-spinal system, including those most esteemed for the treatment of rabies and hydrophobia, none have any material effect in modifying the result of infection in the rabbit.

(6) Lastly, that with respect to the methods of protection against infection by a series of inoculations with modified virus, as advocated and practised by M. Pasteur, these are unsuccessful with the rabbit, and that his recent "rapid" or "intensive" method of inoculation is liable itself to produce infection; and that with the dog the natural refractoriness of this animal to infection with rabies by any method of inoculation, is so great, that it is exceedingly difficult to determine the effect of any remedial or prophylactic measures upon it; and that with man the statistics of the treatment must determine its effects.

Physical Society, June 11.—Mr. Shelford Bidwell, F.R.S., Vice-President, in the chair.—A number of Puluj and other vacuum-tubes were exhibited by Dr. Warren De la Rue. The Puluj tubes consisted of a phosphorescent lamp, and radiometers with phosphorescent vanes and mica disks painted with phosphorescent substances. The other tubes contained different phosphorescent minerals, such as magnesium carbonate, calcium silicate, and Iceland spar. When illumined by a large induction-coil, beautiful colour-effects were produced.—The following papers were then read:—Note on beams fixed at the ends, by Profs. Ayrton and Perry. This paper contains a simple method of solving problems relating to horizontal beams with vertical loads, and fixed at both ends. The curve of bending-moment for the given distribution of load is first plotted, supposing the beam "*supported*" at the ends, and the constant c, by which the ordinates of this curve exceed those of the true curve, is determined from the condition that the angle between the end sections must be nought. If M is the bending-moment at a section, I the amount of inertia of the section about its neutral line, and E Young's modulus of elasticity for the material, then $\frac{M}{EI}$ is the curvature of the beam at that section. If O O′ is a short length of the beam, the angle between the originally parallel sections at O and O′ is $\frac{M}{EI}$. O O′. Hence, if the beam be divided into a great number of parts, and the values of M and I determined at the middle of each, then

$$\Sigma \frac{M}{I} \cdot OO' = o \quad . \quad . \quad . \quad . \quad . \quad (1)$$

since E is supposed constant. But $M = m - c$, where m is the bending-moment at the same section, supposing the ends "supported";

$$\therefore \Sigma \frac{m - c}{I} = o,$$

or,

$$\Sigma \frac{m}{I} = \Sigma \frac{c}{I},$$

$$\therefore c = \frac{\Sigma \frac{n}{I}}{\Sigma \frac{1}{I}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

The following rule results: Knowing m and I at every point, divide the beam into any number n of equal parts, find $\frac{m}{I}$ at the middle of each part, and take their sum; this gives the numerator of (2). Find $\frac{1}{I}$ at the middle of each part, their sum gives the denominator of (2). From this c is determined. Diminish all the ordinates of the m diagram by c, and we have the diagram of bending-moment for a beam fixed at both ends, with any assumed distribution of load and variation of cross-section. Particular cases are worked out in full. Numerous drawings made by students of Finsbury Technical College were exhibited, showing applications of the method to different distributions of loading.—Note on Messrs. Vaschy and Touanne's method of comparing mutual induction with capacity, by Prof. G. C. Foster. In November last the author described a method of comparing the mutual induction of two coils with the capacity of a condenser. Since then he has found that a very similar method was used by Messrs. Vaschy and Touanne in July 1886, and published in the *Electrician* the following month. The formulæ are identical, and the difference consists in interchanging the galvanometer and the variable resistance p. Messrs. Vaschy and Touanne's arrangement has the advantage that the resistance of the secondary coil need not be known. Prof. Foster's method had been used by one of his students (Mr. Draper) about two years ago, but priority in publication belongs to Messrs. Vaschy and Touanne.—Prof. Perry asked the meeting for suggestions to explain why a strip of steel twisted about its longitudinal axis at a red heat, and allowed to cool, tends to untwist when under tension, and for a formula to calculate the amount.—A note on magnetic resistance by Profs. Ayrton and Perry was postponed.

Geological Society, June 8.—Prof. J. W. Judd, F.R.S., President, in the chair.—The following communications were read:—A revision of the Echinoidea from the Australian Tertiaries, by Prof. P. Martin Duncan, F.R.S. After calling attention to a previous paper by himself published in the Society's Journal for 1877, and to additions to the fauna made by Prof. R. Tate and Prof. McCoy, the author proceeded to give notes on the characters, relations, and nomenclature of 29 species of Echinoidea. A few notes were added on the relations between this fauna and that now inhabiting the Australian seas, also on the connexions with the Tertiary Echinoidea of New Zealand, Sind, &c.—On the lower part of the Upper Cretaceous series in West Suffolk and Norfolk, by Mr. A. J. Jukes-Brown, and Mr. W. Hill. The district described in this paper is that of West Suffolk and Norfolk, and is one which has never been thoroughly examined; for no one has yet attempted to trace the beds and zonal divisions which are found at Cambridge through the tract of country which lies between Newmarket and Hunstanton. Until this was done the Hunstanton section could not be correlated definitely with that of the neighbourhood of Cambridge. It was the authors' endeavour to accomplish this, and the following is an outline of the results obtained by them. The paper was divided into six parts: (1) stratigraphical, (2) palæontological, (3) microscopical, (4) chemical analyses, (5) faults and alteration of strike, (6) summary and inferences. In the four first parts separate lines of argument were followed, and each led to the same set of conclusions. The chief interest of the paper probably centres in the gault, and its relations to the chalk marl and the red chalk. Quite recently the very existence of gault in Norfolk has been disputed, but the authors think the facts they adduce and the fossils they have found will decide that point. The gault at Stoke Ferry is about 60 feet thick, and in the outlier at Muzzle Farm *Ammonites interruptus* occurs plentifully in the form of clay-casts with the inner whorls phosphatized. At Roydon a boring was made which showed the gault to be about 20 feet thick, the lower part being a dark blue clay, above which were two bands of limestone inclosing a layer of red marl, and the upper 10 feet were soft gray marl; the limestones contained *Amm. rostratus*, *Amm. lautus*, *Inoceramus sulcatus*, and *Inoc. concentricus* (?), while the marls above contained *Belemnites minimus* in abundance. At Dersingham another boring was made which proved the gray marl (2 feet) to overlie hard yellow marl, passing down into red marl which rests on Carstone. The gray marl thins out northward, and as the red marl occupies the position of the red chalk, the authors believe them to be on the same horizon, an inference confirmed by the presence of gault *Ammonites* in the red chalk. Another point of importance is the increasingly calcareous nature of the gault as it is followed northward through Norfolk. This was regarded as evidence of passing away from the land supplying inorganic matter, and approaching what was then a deeper part of the sea; this inference is borne out by the microscopical evidence. As regards the chalk marl, it also becomes more calcareous: at Stoke it is still over 70 feet thick, and its base is a glauconitic marl which can be traced to Shouldham and Marham, but beyond this the base is a hard chalk or limestone, which is conspicuous near Grimston and Roydon, and passes, as the authors believe, into the so-called "sponge bed" at Hunstanton. The Totternhoe stone is traced through Norfolk, but is thin at Hunstanton (2 feet); its existence, however, enables the limits of the chalk marl to be defined, with the result that some 13 feet of the hard chalk at Hunstanton must be referred to that subdivision. The gray chalk also thins northward, and from 90 feet near Cambridge is reduced to about 30 at Hunstanton. The Belemnite-marls are traceable in Norfolk, but either thin out or are replaced by hard white chalk near Heacham. The Melbourn rock is continuous, and maintains similar characters throughout. The total diminution in the thickness of lower chalk is from 170 feet at Newmarket to 55 feet at Hunstanton, viz. 115 feet. An endeavour was made to estimate the amount and extent of gault removed by erosion from Arlesey and Stoke Ferry.—On some occurrences of Piedmontite-schist in Japan, by Mr. B. Kotô. Communicated by Mr. Frank Rutley.

Mathematical Society, June 9.—Sir James Cockle, F.R.S., President, in the chair.—The President announced that the Council had awarded the second De Morgan Medal to Prof. Sylvester, F.R.S.—The following communications were made:—Note on the linear covariants of a binary quintic, by A. Buchheim.—The motion of a sphere in a viscous liquid, by A. B. Basset (the method of solution was by definite integrals analogous to Fourier's solution of equations determining the propagation of heat).—On the reversion of series in connexion with reciprocants, by Capt. Macmahon, R.A.—Explanation of illustrations

accompanying a preliminary note on diameters of cubics, by J. J. Walker, F.R.S.

PARIS.

Academy of Sciences, June 13.—M. Janssen in the chair.—On the life and labours of M. Laguerre, Member of the Section for Geometry, by M. Poincaré. A brief sketch is given of the important discoveries made, especially in pure geometry, by this distinguished mathematician, who was born at Bar-le-Duc on April 9, 1834, and died there on August 14, 1886.—General method for the determination of the constant of aberration, by M. M. Lœwy. By means of the table published in the *Comptes rendus for May 23, the author has determined the two* azimuths relative to the horizontal direction of the terrestrial movement. The solution of this problem affords a good illustration of the easy application of the new method, as well as the high degree of accuracy of which it is capable.—Note on the earthy phosphates, by M. Berthelot. Some practical remarks are offered in connexion with M. Joly's recent communication on the earthy phosphates. While confirming the numerical data of previous thermo-chemical studies, they extend and in some respects modify their application.—Note on the residuums resulting from the action of the acids on the alloys of the metals in association with platina, by M. H. Debray. In a previous communication it was shown that the common metals, such as tin, zinc, lead, alloyed with a small quantity of the metals of platina, when heated with an acid capable of dissolving the common metal yield either the metal of platina in the crystalline state, or perfectly distinct alloys, or, lastly, residuums containing a considerable portion of water and oxygen. Here it is shown that these residuums even contain nitrogen when the acid employed is nitric acid.—Figures in relief representing the successive attitudes of a pigeon on the wing; disposition of these figures on a zootrope, by M. Marey. By the method already described and applied to other birds, the author here represents the flight of a pigeon in eleven successive attitudes taken at equidistant phases in a single revolution of the wing. The zootrope on which these phases are reproduced is an instrument derived from Plateau's phenakistiscope, which reflects the continuous flight of a bird. The large number of the images and the slow rotation of the instrument reproduce the apparent movements so gradually that the eye is easily able to follow them in all their shifting phases. The bronze figures are painted on a white ground, the illusion being completed by appropriate tints imparted to the bill, feet, and eyes.—"The Pygmies of the Ancients in the light of Modern Science," by M. A. de Quatrefages. On presenting to the Academy the work bearing the above title, the author remarks that, although now found only in scattered groups everywhere oppressed or encroached upon by larger and stronger races, the dwarf Negrito peoples existed in compact bodies forming the bulk of the population in many parts of Africa, Southern Asia, and the Eastern Archipelago. The Akkas, discovered by Schweinfurth south of the Monbuttu country, formerly reached as far north as the parallel of Khartoum, and were known by this name to the ancient Egyptians, Mariette having found it inscribed under a pygmy sculptured on a monument dating from the old empire. The Negritoes of Malaysia and Melanesia, characterized by their low stature and a relative degree of trachycephaly, are quite distinct from the Papuans of the same region, and this distinction is now generally recognized by anthropologists. The Asiatic pygmies described by the ancients are represented by these eastern Negritoes, just as the African pygmies of Herodotus and Pliny were the ancestors of the Negrilloes still surviving in many parts of Africa. In stature the modern pygmies range from 1·507 (various tribes in the Malay Peninsula) down to 1·300 metre (the Batwas recently discovered by Dr. Wolff in the Congo Basin).—Observations of the Borrelly planet made at the Observatory of Algiers, by M. Trépied.—Observations of the new planet, No. 267, discovered at Nice on May 27, by M. Charlois.—On a new form of electrometer, by M. J. Carpentier. The apparatus here described has been prepared especially with a view to industrial appliances. It is distinguished by its exceptional qualities of aperiodicity, by which its readings are rendered perfectly sure and rapid.—Researches on the trimetallic phosphates, by M. A. Joly. Here are studied the sodico-strontianic and sodico-barytic phosphates and arseniates, which are specially interesting owing to the readiness with which they are formed in the crystalline state with a considerable liberation of heat, and under conditions analogous to those yielding the ammoniaco-magnesian phosphate.—On the metallic vanadates, by M. A. Ditte. Having already prepared a number of vanadates by the dry process, the author here shows that many metallic vanadates, such as those of magnesia, lime, nickel, cobalt, zinc, copper, lead, and silver, may also be produced by the wet process. The crystallized vanadates thus obtained present, like the others, compositions analogous to those of the alkaline vanadates.—On the hydrochlorates of chlorides, by M. Engel. This paper deals more especially with the hydrochlorate of perchloride of iron.—On the composition of different butters, by M. E. Duclaux. The experiments made by the author with butters from various parts of France show that, contrary to the generally accepted opinion, the quality of this article does not depend so much on *the method of preparation as on the breed of cattle* and their food, the character of the pastures—that is to say, the geological constitution of the soil—the influence of the seasons, the age of the milk, &c.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Journal of the Chemical Society, June (Gurney and Jackson).—Proceedings of the Society for Psychical Research, May (Trübner).—Journal of the Royal Microscopical Society, June (Williams and Norgate).—Bulletin de la Société Impériale des Naturalistes de Moscou, No. 2 (Moscou).—Beiblätter zu den Annalen der Physik und Chemie, 1887, No. 5 (Barth, Leipzig).—Records of the Geological Survey of India, vol. xx. Part 2.—The True Sources of the Mississippi: P. Giles.—A Century of Electricity: T. C. Mendenhall (Macmillan).—Atlas de la Description Physique de la République Argentine. Deux. Section, Mammifères: Dr. H. Burmeister and E. Daireaux (Buenos Aires).—Metal Plate Work: C. T. Millis (Spon).—Animal Biology: C. L. Morgan (Rivingtons)—My Hundred Swiss Flowers: M. A. Pratten (Allen).—Dinocerata, an Extinct Order of Gigantic Mammals: Prof. O. C. Marsh (Washington).—Introductory Text-book of Physical Geography, 12th Edition: D. Page (Blackwood).—On Light (NATURE Series): Prof. G. G. Stokes (Macmillan).—Manchester Microscopical Society, Transactions and Annual Report, 1886.—Geodätische Arbeiten, v. Heft; Vandstandsobservationer, iv. Heft (Kristiania).—The Nature of Fever: Dr. D. MacAlister (Macmillan).—Proceedings of the American Academy of Arts and Sciences, New Series, vol. xiv., Part 1 (Boston).—Natural History Transactions of Northumberland, Durham, and Newcastle-upon-Tyne, vol. ix., Part 1 (Williams and Norgate).—Bulletin de la Société Impériale des Naturalistes de Moscou, 1886, No. 3 (Moscou).

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