Registrar of the University their application, and also any documents which they may wish to submit to the electors, on or before Saturday, January 26, 1884.

The Professorship of Rural Economy—now separated from that of Botany—will be filled up in December. Candidates are requested to send to the Registrar of the University their applications, and any documents they may wish to submit to the electors, on or before Monday, December 10, 1883. According to the regulations sanctioned by the Court of Chancery, the Sibthorpian Professor of Rural Economy shall lecture and give instruction on the scientific principles of agriculture and forestry. He shall be entitled to the emolument of 200*l.* derived from the benefaction of Dr. John Sibthorp, Doctor of Medicine, and assigned to the professorship. The professor holds his office for a period of three years from election, and no longer. He may be re-elected for a second period of three years, and no longer; but no professor shall hold the professorship for more than six years consecutively. The professor will have the use of the garden appropriated for making experiments on the subjects of his professorship. The professor shall give not less than twelve lectures in the course of the academical year, in full term, and not more than two in any one week.

CAMBRIDGE.—The following are the speeches made to the Senate of the University by the Public Orator (Mr. J. E. Sandys) in presenting Professors Foster and Macalister for the complete degree of M.A. *honoris causâ*, on November 8:—

"Dignissime domine, domine procancellarie et tota Academia: In hoc ipso loco, duodecim abhinc annos, unum e Collegii maximi Prælectoribus auspiciis optimis titulo vestro honorifico exornastis. Hodie eundem, tot annorum usu et experientia spectatum probatumque, et Academiæ totius Professoribus merito adscriptum, senatus nostri in ordinem honoris causa adsciscimus. Quantum interim, hujus præsertim laboribus, inter alumnos nostros creverit vigueritque physiologiæ studium, vosmet ipsi omnes animo grato recordamini. Ut animantium in corporibus ex ipso corde, velut e fonte quodam, salutares illi sanguinis rivi per membra omnia fluunt refluuntque; non aliter corporis Academici in partes quam plurimas ex hoc fonte scientiæ flumina effluxisse atque inde rursus redundasse dixerim. Tali e fonte quot alumnis vires novæ redditæ sunt: quotiens ex alumnis rivuli fontem ipsum denuo auxerunt! E discipulis vero tam multis cum magistro tanto feliciter consociatis, plurimos adhuc superesse, nonnullos etiam adesse hodie gaudemus; unum illum non sine lacrimis desideramus qui nascentis vitæ primordiis hujus auxilio sagacissime investigatis, nuper inter Alpium culmina, in ipso ætatis flore, morte immatura e nobis est abreptus. Talium filiorum progenies Matri Almæ indies nova succrescat: magistrorum talium accesionibus et Professorem et Senatorum ordo identidem nobis augeatur!

"Vobis præsento Collegii sacrosanctæ Trinitatis socium, Physiologiæ Professorem illustrem, MICHAELEM FOSTER."

"In Professoribus novis vestro omnium nomine salutandis, fato quodam iniquo successoris laudes decessoris desideria nonnunquam aliquatenus imminui videntur. Hodie vero ornat adhuc Professorum ordinem eloquentissimus ille Anatomiæ Professor quem diu sumus admirati. Integro igitur sinceroque gaudio Professorem illum salvere jubemus, quem Caledonia Hiberniæ quondam donavit, Hibernia Britanniæ nuper reddidit. Salutamus virum qui corporis humani scientiam interiorem, antiquissimum illud atque regium (ut nuper audivimus) scribendi argumentum, quasi propriam provinciam penitus exploravit; qui ne his quidem finibus contentus, sed etiam in alias rerum naturæ regiones egressus, non modo de zoologia et de comparativa quæ dicitur anatomia egregie meritus est, sed geologiæ quoque operam singularem impendit, petrographiæ præsertim recentiores, progressus curiositate minuta perscrutatus. Idem et litterarum amore et linguarum peritia insignis, inter rerum antiquarum monumenta ne hieroglyphica neglexit, neque historiam ecclesiasticam intactam reliquit. Ergo non uni tantum Collegio sed toti Academiæ gratum est, virum tot tantisque animi dotibus instructum, societati illi tam cito esse adscriptum, cui medicinæ studia commendavit olim vir et de litteris antiquis et de scientiis recentioribus præclare meritus, Thomas Linacre.

"Vobis præsento Collegii Divi Johannis socium, Anatomiæ Professorem insignem, ALEXANDRUM MACALISTER."

The allusions to the growth of the physiological school, to the loss of Prof. F. M. Balfour, to Prof. Macalister's inaugural lecture with its happy antiquarian illustrations, and his speedy enrolment as a Fellow of St. John's, were heartily taken up by the members of the Senate and the undergraduates present.

The Special Board for Medicine publish for the guidance of students proceeding to medical and surgical degrees the following schedule defining the range of the examination in elementary biology under the regulations which come into effect on the first day of January, 1884 (Grace, November 15, 1883). The examination in elementary biology will have reference to (1) the fundamental facts and laws of the morphology, histology, physiology, and life-history of plants as illustrated by the following types: *Saccharomyces*, *Protococcus*, *Mucor*, *Spirogyra*, *Chara* or *Nitella*, a fern, *Pinus*, and an angiospermous flowering plant; (2) the fundamental facts and laws of animal morphology, as illustrated by the following types: *Amœba*, *Paramœcium* or *Vorticella*, *Hydra*, *Lumbricus*, *Astacus*, *Anodon*, *Amphioxus*, *Scyllium*, *Rana*, *Lepus*. Under the head of vegetable physiology the student will not be expected to deal with special questions relating to the more highly differentiated flowering plants. He will be expected to show a practical knowledge of the general structure of each of the animal types above specified, and an elementary knowledge of the chief biological laws which the structural phenomena illustrate. He will also be expected to show an elementary knowledge of the general developmental history of *Amphioxus* and of *Rana*. He will not be expected to deal with purely physiological details.

The subject announced for the next Adams Prize to be adjudged in 1885, is as follows: Investigate the laws governing the interaction of cyclones and anticyclones on the earth's surface. In order to give precision to this, the following suggestions are given to the examiners:—An infinite plane has surface density $\frac{g}{2\pi}$ (where g is gravity); on one side of it is air in equilibrium, the density of which must diminish according to the barometric law as we recede from the plane. The system revolves as a rigid body, about an axis perpendicular to the plane, with a constant angular velocity ω. If one or more vortices, with a revolution either consentaneous with ω (cyclones), or adverse thereto (anticyclones), be established in the air, investigate their motions. It may be well to consider the axes of the vortices as either straight or curved, and perpendicular or inclined to the plane. If possible, pass to the case in which the vortices exist in the atmosphere surrounding a rotating globe.

The Rev. H. W. Watson has been approved for the degree of Sc.D.—Prof. Darwin is arranging to give a course of practical teaching in astronomy with the instruments under his charge. Next term Mr. H. H. Turner of Trinity College will undertake this course.—The General Board of Studies, in reissuing its recommendations as to Readers, Demonstrators, &c., has asked that power be given to the Museums and Lecture Rooms Syndicate to obtain plans for a foundry for the Department of Mechanism, for buildings for Botany, and for additional buildings for Comparative Anatomy and Physiology.—It is recommended that a Curator of the Museum of General and Local Archæology be appointed, at a salary of 100*l.* per annum.

SCIENTIFIC SERIALS

Journal of the Franklin Institute, vol. cxvi. No. 694, October, 1883.—The commercial and dynamic efficiencies of steam-engines, by Prof. R. H. Thurston. In this paper there are calculated the ratio of expansion to furnish power most economically, the maximum efficiency of a given plant, and maximum efficiency of fluid, when such data are taken into account, as total annual cost of steam, and total annual cost of all items variable with size of steam-cylinder.—Mr. R. Grimshaw, in a paper on the steam-engine indicator as a detector of lost motion, describes the use of the indicator to pick out defective setting of cranks, cross-heads, &c.—The next three articles are on the water supply of cities in ancient times, on oil-dressed belting, and a report on the pressure-governed gas-meter and burner.—The address by Prof. Rowland, entitled "A Plea for Pure Science," lately reprinted in NATURE, is also reproduced *in extenso*.

Annalen der Physik und Chemie, xxii. No. 10, contains a long memoir by Professors Sohncke and Wangerin on interference phenomena obtained with thin and especially with wedge-shaped laminæ. The article will be continued in the next number.—On the changes of volume of metals and alloys on melting, by Prof. Eilhard Wiedemann. The metals were cast in thin rods, then dropped into a nearly-fitting glass tube,

ending into a capillary. The wide end was sealed, and a dilatometric fluid such as oil introduced. The conclusions arrived at are that tin, soft solder, and probably also lead, expand on melting; but bismuth contracts. Many observations were made on alloys of bismuth and lead.—On the liquefaction of oxygen, nitrogen, and carbonic oxide, by S. von Wroblewski and C. Olszewski. Intense cold was obtained by evaporation, under reduced pressure, of liquefied ethylene in an apparatus modified from that of Cailletet. Temperatures were measured by a hydrogen pressure-thermometer. Oxygen proved to be liquefiable at temperatures varying from −129°·6 to −135°·8 C., under pressures varying from 27·02 to 22·2 atmospheres. The liquefaction of nitrogen and of carbonic oxide proved more difficult, and was not accomplished at a temperature of −136° C., even under a pressure of 150 atmospheres, though a sudden release of pressure produced a temporary mist of condensed spherules, and a slower release of pressure yielded a deposit of liquid with a distinct meniscus. Liquefied nitrogen and liquefied carbonic oxide are both colourless and transparent.—On the internal friction of certain solutions, and on the viscosity of water at different temperatures, by K. F. Slotte. The results confirm those previously obtained by Rosencrantz and Poiseulle.—On a lecture apparatus for demonstrating Poiseulle's law, by W. C. Röntgen.—On the deduction of the crystal systems from the theory of elasticity, by H. Aron; a mathematical discussion of the possible cases arising from the position of planes of symmetry, proving that no others than the recognised six systems of crystals can exist.—On the properties of benzine as an insulator and as a substance exhibiting electric reaction, by H. Hertz. *Pure* benzine appears to be remarkably good as an insulator and remarkably free from reaction effects.—On the influence of galvanic polarisation on friction, by K. Waitz. Treats of the phenomenon discovered by Edison, and recently examined by K. R. Koch.—On the properties of calc-spar in the homogeneous magnetic field, by Fr. Stenger.—Notes on a photometric apparatus, by Leonhard Weber.—On "the Exhibition of the Treatise on Light" of Ibn al Haitam, by E. Wiedemann.—On the Cologne air-pump of the year 1641, a historical notice by Dr. G. Berthold.—Remarks on the memoir of Herr Christiansen, "Researches on Heat-Conductivity," by A. Winkelmann.

Atti of the Royal Academy dei Lincei, July 12-15, 1883.—Obituary notice of William Spottiswoode.—Two communications from Signor Tacchini on the observations made by him at Caroline Island during the solar eclipse of May 6, 1883.—On the average variation in tension of the atmospheric aqueous vapour according to latitude and elevation in Italy, by A. Lugli.—Meteorological observations at the Royal Observatory of the Campidoglio for the months of June and July.—Most of the present number is occupied with the new reforms and statutes of the Academy, whose constitution has recently been remodelled. There are also long inventories of the works of art, furniture, and fixtures of the Palazzo Corsini, which has been purchased as the future home of the Academy.

Rivista Scientifico Industriale, Florence, September 15-30.—The total eclipse of May 6. Results of the observations of Tacchini, Janssen, and others, in Caroline Island.—Eclipses and terrestrial magnetism, by P. Denza. All connection is denied between eclipses and magnetic phenomena.—On the compressibility of water, by S. Pagliani and G. Vicentini.—A new electrodynamometer, by Prof. Bellati.—On the deformation detected by Gouy in polarised electrodes, by A. Volta.—An improved reversible magnetico-electric machine, by M. Delaurier.—Anatomical description of two extremely rare birds (*Somateria mollissima* and *Phalaropus fulicarius*) preserved in the Civic Museum of Venice, by P. A. Ninni.—On the fossil vertebrates of the Miocene formations in the Venetian Alps, by Baron Achille de Zigno.—On the fossil gastropods, cephalopods, and corals of the lower titonic formations of Sicily, by Dr. G. de Stefano.

SOCIETIES AND ACADEMIES

LONDON

Chemical Society, November 15.—Dr. Perkin, F.R.S., president, in the chair.—It was announced that a ballot would take place at the next meeting (Dec. 6).—The following papers were read:—On the estimation of starch, by C. O'Sullivan. The method may be briefly described as follows:—About five grms. of the finely ground grain are successively extracted with ether, alcohol (sp. gr. 0·90), and water at 35° to 38°. Fat, sugar, albuminoids, amylams, &c., are thus got rid of. The starch in the washed residue is gelatinised by boiling with water, cooled to 62°, about 0·03 grm. diatase (prepared by precipitating a cold, aqueous extract of malt with alcohol) added; the starch is thus converted entirely into maltose and dextrin, and by a quantitative determination of these two products the starch originally present can be calculated. The author states, as the result of his experience with the method, that the difference in results obtained by any two observers need not exceed 0·5 per cent. of the total starch.—On the illuminating power of ethylene when burnt with non-luminous combustible gases, by P. F. Frankland. The author summarises his results as follows:—Pure ethylene burnt at the rate of five cubic feet per hour from a Referees Argand burner, emits a light of 68·5 standard candles; the illuminating power of equal volumes of mixtures of ethylene with either hydrogen, carbon monoxide, or marsh gas is less than that of pure ethylene; when such mixtures contain 60 per cent. of ethylene or more, the illuminating power of the mixture is but slightly affected by the nature of the diluent; in mixtures containing less than 60 per cent. of ethylene, the illuminating power is the highest when marsh gas, and lowest when carbon monoxide, is the diluent.—On the products of decomposition of aqueous solutions of ammonium nitrite, by G. S. Johnson. The nitrogen evolved from alkaline solutions of ammonium nitrite contains no oxides of nitrogen; nitrogen is evolved from aqueous solutions below 100°; by adding crystallised cupric chloride, a continuous evolution of pure nitrogen takes place in the cold. When solutions are acid, the nitrogen may contain 4 per cent. of nitric oxide. About 2 per cent. of the nitrogen evolved by the cupric chloride is stated by the author to possess peculiarly active properties, and forms ammonia when passed with hydrogen over spongy platinum.—On the estimation of iron by standard potassium bichromate, by E. B. Schmidt. The author recommends the above process, but states that zinc should not be used to reduce the iron, as it interferes with the end reaction with potassium ferricyanide. He prefers Kessler's method of reduction with stannous chloride.

Western Microscopical Club, November 5.—Mr. W. Crookes gave a lecture on "Recent Discoveries in High Vacua." He illustrated his theme with a series of brilliant and interesting experiments. The effects were produced by a large electric coil, having sixty miles of secondary wire, and worked by two cells of a storage-battery. The coil, when attached to its full complement of thirty cells, would give a spark in air of twenty-four inches. "High vacua" were defined as those ranging from above the 1/1000 to the 1/100,000,000 of an atmosphere. Air and all gases are conceived to consist of myriads of excessively minute molecules, which in the ordinary state vibrate with enormous velocity; but being crowded together in that condition their extent of vibration is impeded by each other, and is, in fact, limited to a path of only 1/10,000 of a millimetre. When, as in a partial vacuum, there are fewer of these molecules, they have more room in which to vibrate, and hence their "mean length of path" is increased. Under the influence of electricity these molecules are driven in straight lines from the negative pole. In a comparatively low vacuum, on the passage of an electric current, the residual air assumes a stratified condition, showing alternate light and dark bands. The width of the dark bands marks the length of the excursions of the molecules. Further exhaustion increases the width of these bands, so that in a vacuum of 1/1,000,000 of an atmosphere the free path of the molecules was seen to extend to about four inches. By means of an exhausted V-shaped tube it was shown that these molecules are driven from the negative pole in straight lines, and hence cannot turn a corner. First one limb of the V, then the other, was connected with the negative pole of the coil, with the result that each in turn was in darkness. In another vacuum-tube a concave negative pole was fixed; the molecules were driven normally from this concave surface, and, meeting the cylindrical surface of the glass inclosure, were thrown into beautiful caustic curves. That these molecules, under the influence of electricity, possessed mechanical force was shown by causing them to impinge on the vanes of a radiometer, when a rapid rotation took place. On reversing the current, the direction of rotation was also reversed. That this was not due merely to the passage of an electric current was shown by a vacuum-tube containing a small, horizontal "water-wheel." Its upper and lower floats being struck equally by the radiant matter, no motion took place; but