six years. The number of students at the Institute is the greatest in its history, with the exception of the two abnormal post-War years. It is significant that of the total number (3209), 17 per cent are post-graduate students drawn from other engineering schools and State universities. This tendency has been very marked of late years. The establishment of the loan fund of 4,250,000 dollars, by which assistance is afforded to deserving students, has been of great value ; during the past year 226 students have benefited by it. The establishment of special honours courses has been so successful in such departments as have tried them, that it is permissible now for any department to establish them, leading up to a severe comprehensive examination at the end of the course. A new physics and chemistry building and a spectroscopic laboratory are now in course of erection. The main laboratory will be 300 ft. × 60 ft. and will have four stories and a basement, and the spectroscopic laboratory will be 100 ft. × 60 ft. The foundations are exceptionally heavy, more than 3000 piles having been driven for the two buildings. The spectroscopic laboratory is placed upon a mat composed of alternate layers of sand, felt, transite board, ground cork, and reinforced concrete, and it is so well insulated against changes of temperature that if the outside temperature were suddenly to change 100°, it would take the interior of the building about a month to change one degree. Plans have also been drawn for a naval tank combined with a hydraulic laboratory. This has been made possible by the generosity of Mr. J. E. Aldred.

THE "Purpose of a University" is discussed in an article contributed by Prof. S. Alexander to the July-September number of *The Political Quarterly.* The work of a university cannot be divorced from its practical issues in life and it would be misleading therefore to define its purpose as the acquisition, communication, and advancement of knowledge without adding that it pursues the sciences not for their own sake alone, but also, so far as the larger part of its members are concerned, in preparation for the professions or higher occupations of life. The distinguishing mark of university studies is the pursuit in each subject, not only the older and well-established aspects but also the newer, more obviously professional —of the 'science' of the subject—meaning thereby its underlying rational principles and its relations with other subjects. In England much of the work done in universities lacks this characteristic, being such as in France or Germany is done in the lycées or the gymnasia : the student is still too much of a schoolboy or schoolgirl to entertain the true spirit of academic life and needs more than mere guidance. Admitting this immaturity of undergraduates in the early part of their university course, Prof. Alexander nevertheless inveighs against the overteaching of students as a glaring defect of our universities in general and of Oxford in particular. This sins against the ideal of a university not only by incompatibility with training the student in intellectual independence and with the cultivation of the scientific spirit, but also by engrossing time which ought to be devoted by the teacher to scientific research. The Oxford tutorial system, which has so often been held up for admiration as a model of university teaching, has, in his eyes, become a positive evil, and he holds that the new studies of the natural sciences are fortunate in that the system has not taken root strongly in them. To it he ascribes Oxford's failure to keep its place in the front rank of the advancement of science : nor is there, he says, any sufficient evidence that the over-taught undergraduates of Oxford are better fitted for the work of life than those of Cambridge who have not been so tutored.

Birthdays and Research Centres.

Aug. 30, 1871.—The Right Hon. Lord RUTHERFORD OF NELSON, O.M., F.R.S., past president of the Royal Society; Cavendish professor of experimental physics, University of Cambridge; and chairman of the Advisory Council of the Department of Scientific and Industrial Research.

For many years, I have been engaged in researches to throw light on the structure of atomic nuclei. Several lines of attack on this problem are being actively pursued by different workers in the Cavendish Laboratory, including the determination of isotopes, the artificial disintegration of elements by α-particles, measurement of the wave-length of γ-rays, and the effect of high frequency γ-rays on the nucleus. At the moment my co-workers and I are studying in detail with the aid of new counting methods the groups of long range α-particles—about one in a million of the main group—expelled from certain radioactive substances. There is strong evidence that these rare groups of particles are closely connected with the emission of γ-rays. In an excited nucleus it is supposed that some of the α-particles are raised to a high level of energy. The majority fall back to a lower level, emitting γ-rays in the process, but in the short time before this happens a few of the α-particles are able to escape through the potential barrier and issue as long range α-particles. By a study of these particles, it is hoped to account for the origin of the γ-rays and their complicated spectrum.

In order to increase our knowledge of artificial disintegration of atoms and for other investigations, it is desirable to have available for laboratory purposes sources of high speed atoms and electrons. It is of first importance that the best method of generation of very high voltages for this end and their application to produce swift particles should be actively investigated.

Sept. 1, 1877.—Dr. F. W. ASTON, F.R.S., fellow of Trinity College, Cambridge, and Nobel laureate for chemistry (1922).

One of the problems I have been attacking with my mass-spectrograph is the photometrical determination of the relative abundances of the isotopes of complex elements. During this investigation atomic weights have been checked and many new species of atoms discovered. Work has advanced sufficiently far to show that there is little hope of discovering any simple laws connecting these ratios of abundance. I am also making experiments on possible improvements to the apparatus to increase the accuracy of its determination of atomic masses even further. Theoretical investigators of the structure of nuclei ask for an accuracy of 10^5 and I have every hope that in the near future this will be approached.

The crying need in this work is a means of obtaining and controlling really intense beams of high speed positive ions. I hope that all engaged in research in this field will bear this in mind and neglect no byway likely to lead towards this end.

Sept. 2, 1877.—Prof. F. SODDY, F.R.S., professor of chemistry in the University of Oxford and Nobel laureate for chemistry (1921).

I have this year re-determined the rate of growth of radium from uranium. The attempts directly to prove that radium is a product of uranium began simultaneously with those, immediately successful, to detect the production of helium from radium. But, owing to ionium intervening, the growth proceeds according to the square of the time and is infinitesimal for the first few years. Four uranium preparations, purified from radium and ionium a quarter of a century ago, now have from 10^{-9} gm. to 10^{-10} gm. of radium, as much as it is convenient to measure accurately, and they give a very consistent value for the product of the periods of the average lives of ionium and radium, namely, $2 \cdot 44 \times 10^8$ (years)^2.

"Money *versus* Man", published this year, gives a popular account of my theory of virtual wealth—a slight but upsetting modification of the quantity theory of money—and of the problems which confront civilisation owing to the growth of the physical sciences.

I have also applied for a patent for a form of centrifugal reversing and reducing mechanism which I am hopeful will one day find application to turbine-propelled vessels.

Sept. 3, 1882.—Dr. W. L. BALLS, F.R.S., chief botanist of the Egyptian Ministry of Agriculture, and formerly chief of the Experimental Department, Fine Cotton Spinners' and Doublers' Association, Bollington, Cheshire.

A slow development of technological research on spinning quality is taking place concurrently with the isolation, testing, propagation, renewal, and bulk control of pure lines of Egyptian cotton, which occupies much of the time of my staff at Cairo, but my chief personal interest is subterranean, developed from my pre-War studies of the root and its environment. In the Templeton observation-pits we have watched sequences of events and then found them in the open field; roots growing a metre a month and remaining alive for months after the plants had been uprooted; colour changes in soil round the roots demonstrating chemical stages of deterioration through water-logging and re-aeration. We now use the crops as indicators of soil structure, and are interested in the development of aerial survey repeated through a full rotation of crops, with reference to drainage projects. At the moment I am writing up water-table observations which have accumulated on our experimental farm at Giza since 1909.

Societies and Academies.

PARIS.

Academy of Sciences, June 29.—The president announced the death of Friedrich Becke, *Correspondant* for the Section of Mineralogy.—**A. Lacroix**: New observations on the tectites of Indo-China. Discussion of their origin. From the examination of a large number of fresh specimens it is concluded that the tectites result from the vertical fall of fused material possessing a high temperature. This agrees with the hypothesis of a meteoric origin of the tectites.—**Emm. de Margerie**: The last sheets of the *Carte Générale Bathymétrique des Océans* (*Panneau du Pôle Nord*).—**Paul Montel**: Functions of several linearly dependent variables.—**E. Kogbetliantz**: New observations on the orthogonal system of Hermite polynomials.—**Lucien Féraud**: Completely stable systems in the neighbourhood of an equilibrium point.—**H. Guillemet**: The evolution of the wake behind an obstacle for small values of Reynolds's number.—**Mme. V. Popovitch-Schneider**: The extension of Hele-Shaw's method to cyclic movements. The results of the experiments, in spite of the wall effect due to the small dimensions of the apparatus, show good agreement with theory. Four reproductions of photographs accompany the paper.—**Emile Bélot**: The double origin of the small planets and their emission by the rings and vortices of the large planets.—**Louis Gérard**: Reflection on a moving mirror and relativity.—**A. Damiens** and **L. Domange**: An electric furnace made of fluorspar. Details of construction of an electric tube furnace in which the inner tube is made of fluorspar. It permits of working with fluorine or hydrofluoric acid at a temperature of 1000° C.—**B. Decoux**: A piezoelectric quartz frequency meter with synchronous modulation. The meter described is transportable and is capable of high accuracy. It can also be used as a stable receiver by using the apparatus as a heterodyne.—**P. Fleury**: A precision luxmeter with homochrome regions.—**Léon** and **Eugène Bloch**, **F. Esclangon**, and **P. Lacroute**: The observation of the Zeeman effect with high frequency. High frequency discharges in rarefied gases, already proved to be of great service for the production and separation of higher order spectra, can also be utilised with advantage for the study of the Zeeman effect. The results of experiments with neon and with mercury (field 26,250 gauss) are given.—**D. Malan**: The absorption spectrum of oxygen at high temperatures. This work was undertaken with the view of detecting the formation of ozone in oxygen at a high temperature. At 1400° C. no ozone could be detected by the absorption method, and it is concluded that unless the absorption of ozone is diminished at the high temperature, the quantity of ozone produced, if any, must be very small.—**P. Daure** and **A. Kastler**: The Raman effect in some gases. The gases studied were hydrogen, acetylene, cyanogen, and steam.—**Francois Reymond** and **Tcheng da tchang**. The separation of polonium and of protactinium fixed on tantalum oxide. To the tantalic acid gel in solution in hydrofluoric acid some selenious acid is added, followed by sulphuric acid and sodium bisulphite. The reduced selenium produced by boiling carries down with it the whole of the polonium present.—**F. Bourion** and **E. Rouyer**: The cryoscopic study of paraldehyde in solutions of lithium chloride and magnesium chloride.—**Francis Perrin**: Molecular association and the optimum for fluorescence of solutions. The influence of salts.—**Maurice Curie** and **M. Prost**: The radiation accompanying the hydration of quinine sulphate. In water vapour at the pressure of 1 mm. the path of the radiation is about 1 mm.; at atmospheric pressure the path would be of the order of $0 \cdot 001$ mm.—**Mlle. Sabine Filitti**: The determination of the charge of the micelle. It is possible to determine the granular charge of a non-ionised colloid of known micellary weight by measuring the fall of pH produced in the dispersing medium by a given mass of dissolved substance.—**P. Mougnaud**: The estimation of fluorine. A detailed examination of the methods of Rose and of Carrière and Rouanet. The latter is rejected as inaccurate; the former is capable of improvement.—**Mlle. M. L. Delwaulle**: The action of hydrogen upon potassium permanganate.—**P. Carré** and **P. Mauclère**: The chloride of acid ethyl sulphite and the neutral mixed alkyl sulphites. The observation of Michaelis and Wagner on the production of (C_2H_5O) SO.Cl by the interaction of neutral ethyl sulphite and phosphorus pentachloride, with subsequent separation by distillation, is shown to be inaccurate. This compound is formed by treating thionyl chloride with alcohol in the presence of pyridine, but commences to decompose at 18° C. and cannot be distilled.—**Paul Jodot**: The diffusion of silica during the formation of Corsican jaspers.—**Conrad Kilian**: The age of the Harlania grits, and the extension of the Silurian in the eastern Sahara.—**Couvreur**: Comparison of the testa of lamellibranchs and gastropods.—**Louis Dangeard**: The presence of coccolith and coccosphere beds in the laguno-lacustral Oligocene of Limagne.—**H. Colin** and **P. Billon**: Potash in the sugar beet.—**Émile Saillard**: Sugar beets and molasses (nitrogen and