ation. The rise of the Roman Empire introduced a new era: it was in one sense an iron age—*ferrum* being synonymous with the sword. We now live in another kind of iron age, but in better and brighter times than those of Hesiod, and we may hope that our great engineering works, our iron roads and iron steam-ships may lead not to the enslaving but the brotherhood of nations.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MISS JANE CRUIKSHANK has given 15,000*l.* to Aberdeen University, to provide a botanic garden at Aberdeen in memory of the late Dr. Alexander Cruikshank.

THE University of Edinburgh has conferred the honorary degree of LL.D. upon Mr. Horace T. Brown, F.R.S., Prof. D. G. Ritchie, and Prof. J. Victor Carus, assistant professor of zoology at Leipzig.

IN order to make accessible under the most favourable conditions to university students, to teachers, and to investigators, the facilities and environment of the Illinois Biological Station, reinforced by the equipment of the biological departments of the University of Illinois, the university has decided to open, on June 15, a summer school of field and laboratory biology at this station on the Illinois River, at Havana. Opportunity is thus given for personal studies, in field and laboratory, of the plants and animals of a peculiarly rich and interesting situation, and of the methods of modern biological station work.

THE following are items concerning the extension of provision for scientific training in the United States:—Syracuse University will shortly begin the erection of a 45,000-dollar science building.—Adelbert College at Cleveland, Ohio, has a biological building under way, which will cost about the same amount.—Richmond College, Virginia, has received 5000 dollars towards a science building.—The University of Chicago has received a gift of about 150,000 dollars from an anonymous donor. Miss Gould has given a further sum of 10,000 dollars towards the endowment of the engineering school of New York University.—Mr. Chester W. Kingsley has given 25,000 dollars to Colby University.

IT was briefly noted last week that the University of Paris had taken up a loan amounting in all to 1,700,000 francs. Referring to this action, the Paris correspondent of the *Lancet* remarks:—The law which has reconstituted the universities has given to them a civil personality; they have their own budget and their own sources of income, which are definite and assured, and they are able to contract loans on the security of these sources of income. The 1,700,000 francs which the university has borrowed will be devoted to carrying out two schemes. The greater part of this sum will be devoted to the construction of buildings for the accommodation of first-year students in medicine. The other portion of the loan will be devoted to the keeping-up of a laboratory of natural history at Fontainebleau.

THE Technical Education Board of the London County Council will proceed shortly to award not less than five Senior County Scholarships. These scholarships are of the value of 50*l.* a year, together with the payment of tuition fees up to 30*l.* a year, and are tenable for three years at university colleges and advanced technical institutes. They are confined to residents within the administrative county of London, and are open only to those whose parents are in receipt of not more than 400*l.* a year. Candidates should as a rule be under twenty-two years of age, though the Board reserves the right to give preference to candidates who are under nineteen years of age. The scholarships are intended to encourage more especially the teaching of science, and to enable those students who cannot afford a university training to pursue advanced studies for a period of three years in the highest university institutions in this country or abroad. Of the seventeen students who are now holding Senior Scholarships five are studying at Cambridge, five at the Central Technical College in Exhibition Road, three at the Durham College of Science, Newcastle-upon-Tyne, two at German Universities, and two (ladies) at Bedford College and Holloway College respectively. The scholarships are awarded on a consideration of the past record and general qualifications of the candidates, and not upon the results of a set examination. Application forms may be obtained from the Board's Secretary, 116 St. Martin's Lane, W.C., and must be returned not later than Monday, May 16.

DURING his term of office, Sir A. Mackenzie, the Lieutenant-Governor of Bengal, has done much to advance the cause of scientific and technical education in his province, and a speech he delivered recently at the Indian Association for the cultivation of science is a further expression of his sympathies with the development of education on scientific lines. In the course of his address he said:—"I would have the student of the future cease to be brought up on badly assimilated *words* and on high-faluting rhetoric, and I would have him taught to observe and think, and *educate himself* in the way Herbert Spencer indicates as the great desideratum in all education. The oriental mind is only too prone to rest on authority and accept inaccuracies. Pupils trained on books and books alone are mere passive recipients of other people's ideas. They never learn the arts of observing facts and applying knowledge. The study of science cultivates the judgment as the study of language never can. Science constantly appeals to and develops the individual reason. It is no doubt the case that even in England people are only now waking up to the knowledge of a wise pedagogy, but they *are* waking up at last. The idea of development of faculty is being substituted for that of mere acquisition of knowledge. The mere cultivation of words and application of formulæ is being discredited. The ideal education is being recognised as one which multiplies the power of the eye to see, of the ears to hear, of the hand to execute; which puts a mind well stored with knowledge into active contact with faculties capable of translating it into action." In India at present science holds but a very secondary place in the curriculum of high education, and if the country is ever to advance there must be an educational revolution which will release the youth of India from the bonds of a purely literary education. The University of Calcutta has as yet done little for science culture, but the Bengal Government has within the last few years done good work for the advancement of technical education. The reconstruction of the Medical College begun by Sir Charles Elliott has been pushed on; and the Sibpur Engineering College has been expanded so as to make it a school where civil engineering, mining engineering, mechanical engineering, and electrical engineering can be and are being thoroughly taught to over 300 students. The Presidency College, having as principal Prof. A. Pedler and upon its staff Profs. J. C. Bose and Roy, has also admirable work to show. Sir A. Mackenzie concluded by saying: "As the Bengali has conquered the field of medicine, so he may conquer the field of engineering and mechanical industry, if those engaged in the instruction of the young will only shake themselves free from the trammels of a literary curriculum which, coupled with the absence of moral and religious training and the failure to impart a sound knowledge of their own country, its material wants and capabilities, is in my judgment fast ruining the youth of the country and stunting their development."

SCIENTIFIC SERIAL.

Bulletin of the American Mathematical Society, March.—The relations of analysis and mathematical physics is the translation, by C. J. Keyser, of the interesting address delivered before the International Congress of Mathematicians, at Zürich, on August 9, 1897. The writer, Prof. H. Poincaré, answers some questions which he says are often asked, as "What is the utility of mathematics, and whether its nicely constructed theories, drawn entirely from the mind, are not artificial products of our caprice?" "The end of mathematical physics is not merely to facilitate the numerical calculation of certain constants, or the integration of certain differential equations. It is more; it is, above all, to disclose to the physicist the concealed harmonies of things by furnishing him with a new point of view."—The roots of polynomials which satisfy certain linear differential equations of the second order, is a short note by Prof. M. Bôcher, following up work by Stieltjes in vol. vi. of the *Acta Mathematica*.—Inflexional lines, triplets, and triangles associated with the plane cubic curve, by Prof. H. S. White, considers the configuration of the nine inflexions of a non-singular plane cubic and the twelve lines containing them 3 and 3, from what the writer thinks to be a novel point of view. The statements are of some interest.—On the intersections of plane curves, by Prof. Charlotte Scott, brings together several passages bearing on Maclaurin's paradox (*i.e.* Cramer's so-called, but it is here carried back to Maclaurin). It is a valuable paper on curves.

and is mainly concerned with a recent paper by F. S. Macaulay, viz. point groups in relation to curves (*London Math. Soc. Proc.*, vol. xxvi. pp. 495–544).—Prof. Beman points out the use of *i*, by Euler, to represent an imaginary, thus disposing of Gauss's claim to priority.—The remaining matter consists of shorter notices (*i.e.* reviews), notes, and publications.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 10.—"An Extension of Maxwell's Electro-magnetic Theory of Light to include Dispersion, Metallic Reflection, and Allied Phenomena." By Edwin Edser, A.R.C.S. Communicated by Captain W. de W. Abney, C.B., F.R.S.

All media are considered, as far as their properties affect the propagation of electro-magnetic waves of frequencies as great as those of light, to consist of molecules, each comprising, in the simplest case, two oppositely charged atoms at a definite distance apart. In an electric field the positive atoms move to points of lower, and the negative atoms to points of higher potential. In doing so a molecule may be subjected to a rotational displacement, or its constituent atoms may be separated more widely from each other. Equations are determined giving the relation of the specific inductive capacity (the electric strain being steady) to the molecular displacements.

Maxwell's well-known equations are modified by adding to the total displacement current a term representing the convection current per unit volume. The existence of free ions is not considered capable of materially affecting the value of the refractive index for light waves. Subsidiary equations representing the conditions of the atomic vibrations are assumed, and the refractive index, μ, is finally given by the equation

$$\mu^2=\mu_\infty^2+\frac{c'\lambda_1^2}{\lambda^2-\lambda_1^2}+\frac{c''\lambda_2^2}{\lambda^2-\lambda_2^2}$$

μ_∞^2 represents the specific inductive capacity as previously determined.

Double refraction in a uniaxal crystal is explained by supposing the axes of the molecules to be arranged with their axes all parallel to one direction. Electric disturbances perpendicular to this direction will produce a molecular rotation, whilst those parallel to the molecular axes will produce a separation of the constituent atoms. Hence two different propagational velocities will follow. The connections of the above theory with Kerr's well-known experiments on the double refraction experienced by light when traversing a liquid dielectric subjected to electric stress, and the facts of pyro-electricity are obvious.

In order to account for the phenomena of the propagation of light in metals, a viscous term is added to the equation for the molecular vibrations. The square of the refractive index is hence derived as a complex quantity, the imaginary part being essentially positive. In those cases where the real part of the refractive index is a large negative number, it is pointed out that the velocity of propagation of light waves will be inversely proportional to the molecular viscosity (and therefore to the electrical resistance) of the metal, agreeing with Kundt's experimental relation.

Geological Society, April 6.—W. Whitaker, F.R.S., President, in the chair.—Prof. T. Rupert Jones exhibited and commented upon a series of large stone implements, sent to England by Mr. Sidney Ryan, from the tin-bearing gravels of the Embabaan in Swaziland (South Africa). Some implements lent by Mr. Nicol Brown, and analogous implements of rough quartzite, from Somaliland, lent by the Rev. R. A. Bullen, were also exhibited.—Prof. H. G. Seeley exhibited the humerus of a Plesiosaurian in which the substance of the bone was almost entirely replaced by opal. He explained that the fossil was from the opal mines of New South Wales.—On some Palæolithic implements from the plateau-gravels, and their evidence concerning "Eolithic" man, by W. Cunnington. Although at first inclined to believe that the chipping on the "Eoliths" of the plateau-gravels was the work of man, the author has been led to recant this opinion by the detailed study of specimens lent or given to him by Mr. B. Harrison. His reasons are mainly based on the facts that the chipping is of different dates, even upon the same specimen, and that it was produced after the specimens were embedded in the gravel. A further series of specimens, which, although not found actually *in situ* in the gravels, present undoubted evidence that they came from these, are considered by the author to be of Palæolithic type. One of them appeared to have gone through the following stages: first it was fashioned by man into a Palæolithic implement, then it was abraded, broken and chipped along one edge in the same fashion as the alleged "Eolithic" working; finally it was stained, marked with glacial striæ, and covered with a thin layer of white silica. This implement appears to prove that Palæolithic man lived on the Kentish plateau before or during the deposit of the plateau-gravels, and that the "Eolithic" chipping is not the work of man. A long discussion followed the reading of the paper, and was summed up by Dr. Gregory, who replied on behalf of the author. Dr. Gregory said he noticed in the discussion absolute unanimity on one point: no one denied that some of the specimens exhibited were worked by man, and that they were genuine plateau-gravel flints, which must have been flaked before the deposition of the gravels. Every speaker had therefore admitted that man lived in Kent before or during the deposition of part of the plateau-gravels. Thanks, therefore, to Mr. B. Harrison's magnificent perseverance and industry, man's age in Kent had been carried back one stage further. In the congratulations to Mr. Harrison on that achievement, no one would join more heartily than the author. But that admission did not affect the question of the specimens described as "Eoliths" or "rudes." Those who believed in these specimens still could not agree as to which are genuine and which are not. He thought the critical points of the paper had been ignored in the discussion: no attempt had been made to show that the implements were not Palæolithic, or that the "Eolithic" work was not later than the Palæolithic work. He quoted the opinions of Mr. Montgomery Bell and Mr. Harrison to show the identity of the working of the broken edge of the Palæolith with that of the Eoliths. It was only the "Eolithic" implements that the author had denied. The wide general importance of this question was the claim that the Kent plateau had been the home of a primitive pre-Palæolithic people, which, he held, the author's arguments conclusively disproved.—On the grouping of some divisions of Jurassic time, by S. S. Buckman. The author argues for an arrangement in the division of Jurassic time based upon the zoological phenomena of the Ammonite fauna.

PARIS

Academy of Sciences, April 12.—M. van Tieghem in the chair.—The President announced to the Academy the recent death of M. Aimé Girard, Member of the Section of Rural Economy (see p. 587).—Observations relative to the action of oxygen upon sulphide of carbon and to the chemical influence of light. Preliminary action determining the chemical changes, by M. Berthelot. In a mixture of air with the vapour of carbon disulphide exposed to diffused light no change was found to have occurred at the end of a year. Under the influence of direct sunlight, however, oxidation soon commences, but is by no means completed in a year. The effect produced is, therefore, not simply proportional to the luminous intensity, unlike the combination of hydrogen and chlorine, which commences in the most feeble diffused light and increases with the intensity.—On the absorption of oxygen by pyrogallate of potassium, by M. Berthelot. The principal defect of the common method of estimating oxygen consists in the simultaneous formation of small quantities of carbonic oxide. A number of experiments are described in which the influence of temperature, dilution, and the relative proportions of pyrogallol and potash upon the course of the reaction is ascertained. The author concludes that, in order that only negligible quantities of carbonic oxide may be produced, the absorption should be effected in presence of a large excess of potash and an amount of pyrogallol capable of absorbing four or five times the volume of oxygen likely to be present. From the products of the reaction an oxyquinone ($C_6H_4O_5$) may be extracted with ether, after acidification. This compound will be described later.—Flesh and starch compared with sugar, as regards nutritive value, in the case of a working subject, by M. Chauveau.—Addition to a preceding communication concerning the theory of quadratic forms, by M. de Jonquières.—Observations of Comet Perrine, made at the observatory of Algiers, by MM. Rambaud and F. Sy.—Expression of the derivatives of *theta* functions of two arguments by means of the squares of *theta* functions, by M. E. Jahnke.—On the systems of differential equations satisfied by quadruply periodic functions of the second species, by M. M. Krause.—On the equations of the theory of elasticity, by MM. Eugène and François Cosserat.—On the passage of electric waves from