the work of the University is really a stupendous monument to activity in all departments of knowledge. We are only concerned with the volumes containing papers from the scientific laboratories, but even these are of far too elaborate a character to be described adequately in this short article. Five volumes have been received, which can only be briefly noticed. Two of these, edited by Prof. F. A. Gooch, contain records of researches carried on in the Kent Chemical Laboratory of Yale University from the opening of the laboratory in 1888 to the present time. In one volume there are fifty-nine papers, and in the other forty-nine, together with a systematic index, index of authors and index of subjects. A consideration of the more familiar phenomena of optics is given by Prof. C. S. Hastings in a volume on "Light," which ought to receive the attention of students of the subject. The laboratory of invertebrate palæontology contributes a volume, edited by Prof. C. E. Beecher, on "Studies in Evolution," containing papers bearing on the investigation and study of the development of a number of invertebrate animals. The papers deal with the origin and significance of spines, structure and development of trilobites, development of the brachiopoda and miscellaneous studies in development. The fifth volume which has reached us is edited by Profs. S. L. Penfield and L. V. Pirsson, and it contains papers on the results of researches in mineralogy and petrography made in the Sheffield Scientific School of the University. The man of science needs no better evidence of the life and progress of a university than is afforded by volumes like these, which are published in New York by Messrs. Charles Scribner's Sons, and in London by Mr. Edward Arnold.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The president of Magdalen (Mr. T. H. Warren), who has always taken an active part in furthering the interests of science, has been elected a member of the Hebdomadal Council. Prof. Elliott has been elected a delegate of the University Museum.

CAMBRIDGE.—Dr. L. E. Shore, St. John's, has been reappointed University lecturer in advanced physiology, and Mr. F. F. Blackman, St. John's, University lecturer in botany. Mr. H. O. Jones, Clare, has been appointed demonstrator in organic chemistry to the Jacksonian professor, in place of the late Mr. Spivey. Mr. C. Shearer, advanced student, Trinity, has been appointed to occupy the University table in the Naples zoological station.

MR. W. MAITLAND (Aberdeen) has been appointed junior demonstrator of chemistry at University College, Sheffield, in succession to Dr. T. S. Price.

THE Report of the work of the Examinations Department of the City and Guilds of London Institute again directs attention to the fact that the general education of a large number of students who enter the technological classes is still defective, and they are consequently unable to profit, as they should do, by the special instruction they receive. Insufficient knowledge of the elementary principles of science, and particularly of such subjects as mensuration, geometry and drawing, is a frequent cause of failure of students to pass the examinations in technology. The preliminary course of instruction, and corresponding examinations, arranged by the Institute, provides a partial remedy for this defect; and the recent announcement that the Board of Education is prepared to consider suggestions from schools for grouped courses of instruction in branches of science cognate to certain trade subjects should do something to decrease the number of candidates without a knowledge of scientific principles. The Institute's Examination Committee strongly recommend students to attend courses in geometry, mathematics and elementary science, prior to, or concurrently with, the study of technology and workshop practice. "Technical instruction," it is wisely remarked, "fails altogether of its purpose if the student does not understand the 'why' and the 'wherefore' of the operations he performs. The aim of such teaching as is given in technological classes is not to make expert workmen, but to show how difficulties may be overcome, and how skill in drawing and a knowledge of the principles of science may, with sufficient practice, help to produce expert workmen. It is not the object of the Institute's examinations to test mere skill in workmanship. The craftsman's own work is the best certificate he can produce. But as evidence of training in the principles underlying the practice of his trade, the class certificate in technology has a distinct and recognised value."

THE current number of the *Record*, the organ of the National Association for the Promotion of Technical and Secondary Education, contains several interesting articles. Specimen lessons are given to show how interest in nature-knowledge may be encouraged, and how it may be assisted by Museums. It may be doubted, however, whether any useful purpose is served by creating an animistic attitude in the minds of children studying nature. The following statement, for instance, is, to say the least, misleading: "When the horse-chestnut feels winter coming on, it says to itself—you can hear the branches whispering during any autumn evening—'Dear me, my leaves will begin falling off in a minute, and there are those new leaves and things to see about in the spring; I must begin making buds this very instant.'" The child who is taught on these lines will believe that a hawthorn tree is really able to look ahead to a severe winter, and takes pains to provide plenty of haws for the birds during the forthcoming hard times.

THE funds available for purposes of technical education are the residue received under the Local Taxation (Customs and Excise) Act, direct aid from the rates, and grants from the Public Libraries rate. A Return has been issued showing the extent to which, and the manner in which, local authorities are applying these funds in (A) England, (B) Wales, and (C) Ireland. The results are summarised below, the amount shown for Wales and Monmouth, in line B, being exclusive of the amount—estimated at 43,203*l.*—to be devoted annually to intermediate and technical education under the Welsh Intermediate Education Act, 1889:—

	Total amount expended on technical education during the year 1898–99.	Total amount expended on technical education during the year 1899–1900.	Total amount raised by loan on the security of the local rate under the Technical Instruction Acts (or otherwise) during the years 1898–99 and 1899–1900 respectively.	
			Year 1898–99.	Year 1899–1900.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
(A)	830,404 17 2	876,436 6 11	104,301 2 4	80,347 10 7
(B)	35,658 11 4	33,526 1 11	1,000 0 0	—
(C)	4,549 3 1	5,172 6 3	—	10,000 0 0
	870,612 11 7	915,134 15 1	105,301 2 4	90,347 10 7

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, November 8.—Mr. T. H. Blakesley, vice-president, in the chair.—A paper on a voltameter for small currents was read by Dr. R. A. Lehfeldt. The instrument consists of a capillary tube about 25 cms. long completely filled with mercury with the exception of a bubble of mercurous nitrate solution about 1 cm. long placed near the middle of the tube. Connection with the two mercury columns is made by means of platinum wires passing through the side of the tube. To use the instrument it is placed in a vertical position, the anode being at the top, and the quantity of electricity which passes through is measured by the change in volume of either electrode. In a test experiment the change in volume was measured by means of a micrometer, and agreed within 0·6 per cent. with the amount deduced from the known value of the current. It is necessary that the currents should be small, so as to avoid complications due to polarisation. The chairman pointed out that the presence of air in the tube would render the readings inaccurate, and asked if it was necessary to apply any temperature correction. Dr. Lehfeldt said that it was quite easy to seal the tube without admitting air, and the temperature correction was negligible.—A note on a paper by Prof. Fleming and Mr. Ashton entitled "On a Model which Imitates

the Behaviour of Dielectrics," by Dr. J. Buchanan, was read by the secretary. The action of this model depends on the viscosity of a liquid, and the diagrams derived from it show by their form that the motion of the pencil which traced them approximated closely to what may be expressed by the term "motion of a viscous fluid by diffusion." In other words, the displacement curves obtained from the model and their derived velocity curves are of the same form as the graphs of certain solutions of Fourier's well-known equation $\frac{dv}{dt} = K\frac{d^2v}{dx^2}$. Lord Kelvin has shown that the potential and the current at any point in the wire of a cable can be expressed by appropriate solutions of this equation, and in the same manner by the use of solutions of this equation the diffusion of electricity into or out of the dielectric of a condenser can be treated. It appears, therefore, that the motion of the model and the diffusion of electricity in a dielectric are subject to one and the same mathematical law. The author suggests that the inventors should obtain hysteresis diagrams by cyclical loading of the springs. Prof. J. A. Fleming said he was glad that Dr. Buchanan had drawn attention again to the model because there were points about it which might be amplified with advantage. After giving a short description of the apparatus he said that Dr. Buchanan had shown that mathematically the theory of the model was the same as that of diffusion in a cable, and he suggested that there might be something more than mathematical analogy. Prof. Fleming referred to the discussion on the original paper in which Prof. Ayrton asked in what respect the model served its purpose better than a twisted wire. A twisted wire cannot represent the properties of a dielectric, because if twisted beyond the elastic limits there is a permanent set. There is no permanent set in the present model. He would like to know if a dielectric has a true conductivity, and suggested that experiments should be made by subjecting a dielectric to constant electric pressure at constant temperature, for years if necessary, and observing whether the curve of current becomes asymptotic to the zero line or to a line parallel to it. The model could be made to represent a conduction as well as a displacement current by so arranging the bottom piston that it could descend but not return. The fact that the movements of the model were similar to the diffusion of current in a cable suggested that the process of conduction in a metal was *similar* to that of displacement in a dielectric.—Mr. J. Macfarlane Gray read a note on the numerical value of the "characteristic" of water. The author referred to a paper on thermodynamics which he wrote twenty years ago and in which he supported the theory of a granular ether under enormous pressure. This theory easily explains the properties of bodies. There is a numerical characteristic for every substance in the state of vapour. This characteristic can be deduced from an analytical expression involving certain physical data which must be experimentally determined. His original number for water was 25·30693, but later experiments by Lord Rayleigh on the weight of hydrogen have altered this number to 25·33776. The author's original value for the absolute specific heat of water was 124960 "mms. lift at Paris," but recent experiments of Callendar give 126230. According to the author's theory, water commences to freeze at 95° F. and the variation of the specific heat of water at low temperatures is due to the latent heat of ice. The formation of ice particles also explains the peculiar changes in volume of water as it cools to the freezing point. The chairman asked if this theory could explain the fact that water can remain liquid below 32° F. Mr. Macfarlane Gray said it could.

PARIS.

Academy of Sciences, November 4.—M. Bouquet de la Grye in the chair.—On *Analysis situs*, by M. H. Poincaré.—On some chemical effects produced by the radium radiation, by M. Henri Becquerel. It is pointed out that the radium radiations consist of a part capable of deviation in the magnetic field, identical with the kathode rays, and a part non-deviable, a fraction of which is absorbable and the remainder extremely penetrating. Some kind of spectrum analysis is, therefore, necessary before studying the chemical action of these rays. Fresh observations are brought forward showing the action of the rays upon glass, the transformation of yellow into red phosphorus, the reduction of mercury perchloride in the presence of oxalic acid and the effect upon seeds. In the latter case it was found that prolonged exposure to the radium radiations had the effect of destroying the power of germinating in the seed.—The electrolysis of ammonium chloride in solution in liquefied ammonia, by M. Henri Moissan. Liquid ammonia at −80° C. is readily electrolysed with a potential difference of 115 volts, and it is remarkable that no nitrogen is produced. At the positive pole chlorine is evolved, and at the negative pole hydrogen, the purity of the latter being proved by analysis. Dry iodine is not attacked or dissolved by liquid ammonia at −70°, or at temperatures below this, but at higher temperatures the iodine goes into solution.—The decomposition of calcium-ammonium and of lithium-ammonium by ammonium chloride, by M. Henri Moissan. Both calcium-ammonium and lithium-ammonium react upon ammonium chloride in solution in liquid ammonia at a temperature of −80° C. Under these conditions the group ammonium could not be isolated, ammonia and hydrogen being set free.—On a new method of detecting very small electric charges, by M. R. Blondlot. Attempts were made, without success, to determine some very small electric charges by means of the usual electroscopes and electrometers. A new instrument was, therefore, constructed, details of which are given, possessing the required sensibility.—The sugars in the blood and their glycolysis, by MM. Lepine and Boulud. It is shown that the difference between diabetic blood and normal blood consists not only in the fact that the former preserves its reducing power better than the latter, but also in the decisive fact that after keeping for an hour in glass vessels at 39°, the fermentable sugar of the blood is not modified, whilst it is destroyed in normal blood.—Remarks by M. Marey on two reports on chronophotography and of a commission on physiology and hygiene.—Report by a committee appointed to examine the papers left by the late M. Halphen. The memoirs left in a state fit for publication are too few in number to publish in volume form, but it is desirable that some periodical would insert certain fragments.—Observations of the 1901 comet made at the Observatory of Santiago, Chili, and the elements of the same comet, by M. Obrecht.—Sunspots and planets, by M. Birkeland. The results given in a former paper have been recalculated, taking into account the action of the planet Saturn, but the conclusions previously arrived at are not thereby altered.—On persistent conjugated network, by M. J. Raffy.—On the adiabatic curve, by M. George Moreau. The usual equation to the adiabatic curve, $PV^r = \text{const.}$ is obtained under the suppositions that the ratio of the specific heats, the specific heat at constant volume and the coefficient of expansion are constant. It has been shown, however, by MM. Mallard and Le Chatelier that the specific heat at constant volume is not constant, but is a linear function of the temperature, and the coefficient of expansion is also a function of the temperature. On these assumptions a more general form of the equation to the adiabatic curve is worked out.—On the chlorobromides of thallium of the type Tl_4X_6, by M. V. Thomas. The current theories of the constitution of double salts would allow of the prediction of two sesquichlorobromides of thallium. The mode of preparation of two isomers of $Tl_4Cl_3Br_3$ is described in detail.—Some reactions of trichloracetic acid, by M. A. Clermont. The ethyl ester and amide of this acid are so readily prepared that their formation may be used as tests for the acid.—Researches on some isomerides of pinacone and its derivatives, by M. Maurice Delacre. The reactions of pinacoline agree in part with the formula suggested by Butlerow $(CH_3)_3.C.CO.CH_3$, and in other respects corresponds to Friedel's formula $(CH_3)_2C\!\!<\!\!\overset{O}{}\!\!>\!\!C-(CH_3)_2$. As a result of the experiments here given the author inclines to the view that pinacoline contains the two substances represented by the above formulæ in a state of equilibrium.—The constitution of piceol, by MM. Ernest Charon and Démétrius Zamanos. The glucoside piceine, extracted by M. Tanret from *Pinus picea*, was shown by him to be hydrolysed by acids into glucose and a substance piceol. It is now shown that this latter substance is paraoxyacetophenone, the properties of the natural and synthetical piceols agreeing completely.—On the calculation of the amounts of water added to and cream abstracted from milk, by M. V. Génin.—On the formation of the perfume of vanilla, by M. Henri Lecomte. The following hypothesis would best appear to explain the formation of vanillin in the fruits during their preparation. The coniferine is converted into coniferyl alcohol and glucose by means of a hydrolytic ferment, crude vanilla, in fact, always containing glucose. This alcohol is then transformed into vanillin by the action of an oxydase, the existence of

which has been proved in the plant extracts in several ways. It is a curious fact that the varieties which are the most esteemed commercially are those which contain the greatest amount of this oxydase.—On the *Iboga*, on its exciting properties, its composition, and on the new alkaloid, ibogaine, which it contains, by MM. J. Dybowski and Ed. Landrin. A plant much used by the natives in the French Congo, and called by them *iboga*, has been found to owe its sustaining and fatigue-resisting properties to the presence of a new alkaloid, ibogaine, to which the constitution $C_{52}H_{66}N_6O_2$ is assigned. In small doses this substance produces a peculiar excitement, in large doses the effects resemble those due to the absorption of alcohol in excess.—The influence of methylal upon the growth of some algæ in soft water, by M. Raoul Bouilhac. Certain algæ, nostoc and *Anaboena*, were placed in nutritive solutions and exposed to light of feeble intensity, too feeble to enable the algæ to decompose carbonic acid; it was found that under these conditions growth could take place if a small quantity of methylal were present.—Researches on the formation of the ovule and the embryonic sac in the Araliaceæ and of the modifications undergone by the tegument, by M. L. Ducamp.—The germination of the spores of *Penicillium* in water, by M. Pierre Lesage.—The effects of freezing upon milk, by MM. F. Bordas and de Raczkowski.—On the secular variations of terrestrial magnetism, by M. V. Raulin.—Experiments in maritime aëronautics, by M. H. Hervé.

NEW SOUTH WALES.

Linnean Society, September 25.—Mr. J. H. Maiden, president, in the chair.—Arachnida from the South Seas, by W. J. Rainbow. Thirty-four species are enumerated, of which four are described as new, namely, *Leptodrassus insulanus*, *Argyrodes walkeri*, *Diaea bipunctata* and *D. regale*. The most interesting of them is *L. insulanus*, as it records a new locality for the genus.—On the systematic position of *Purpura tritoniformis*, Blainv., by H. L. Kesteven. Reasons are given for removing *P. tritoniformis* from *Urosalpinx* and *Cominella* and transferring it to *Purpura*. In selecting the subgenus of the latter for its reception, the resemblance of the larval shell and anatomical characters to *P. succincta* cause the writer to place it in *Trochia*. The names *Adamsia* and *Agnewia* consequently lapse into the synonymy of *Trochia*.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 14.

MATHEMATICAL SOCIETY, at 5.30.—Linear Groups in an Infinite Field: Dr. L. E. Dickson.—Note on the Algebraic Properties of Pfaffians: J. Brill.—On Burmann's Theorem: Prof. A. C. Dixon.—The Puiseux Diagram and Differential Equations: R. W. H. T. Hudson.—Determination of all the Groups of Order 168: Dr. G. A. Miller.—An Outline of a Theory of Divergent Integrals: G. H. Hardy.—On the Representation of a Group of Finite Order as a Permutation Group; and on the Composition of Permutation Groups: Prof. W. Burnside, F.R.S.—(1) On the Inversion of Plane Stress; (2) On the Theory of Hele-Shaw's Experiments on Fluid Motion: J. H. Michell.—On the Steady Motion of a Sphere through Viscous Liquid: T. Stuart.—Addition Theorems for Hyperelliptic Integrals: A. L. Dixon.—Limits of Logical Statements: H. MacColl.

FRIDAY, NOVEMBER 15.

EPIDEMIOLOGICAL SOCIETY, at 8.30.—The President, Dr. Patrick Manson, C.M.G., F.R.S., will deliver his Inaugural Address on the Ætiology of Beriberi.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.

TUESDAY, NOVEMBER 19.

ZOOLOGICAL SOCIETY, at 8.30.—Okapia, a New Genus of Giraffidæ from Central Africa: Prof. E. Ray Lankester, F.R.S.—On the Giraffe discovered by Sir Harry Johnston, K.C.B., near Mount Elgon, Central Africa: Oldfield Thomas, F.R.S.—On the Genital Organs of the Male Lepidosiren and Protopterus: J. Graham Kerr.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Paper to be further discussed*: The Discharge of Sewage into a Tidal Estuary: W. Kaye Parry and Dr. W. E. Adeney.—*And, time permitting*: The Treatment of Trades Waste Bacterially: William Naylor.

ROYAL STATISTICAL SOCIETY, at 5.30.—Local and Imperial Burdens: Lord Avebury, F.R.S.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—Japan as illustrated by Herself: J. W. Groves.

WEDNESDAY, NOVEMBER 20.

GEOLOGICAL SOCIETY, at 8.—On the Origin of Certain Concretions in the Lower Coal Measures: H. B. Stocks.—Some Remarks on the Meteorological Conditions of the Pleistocene Epoch: Nils Ekholm.—Notes on the Genus Lichas: F. R. C. Reed.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—The Exploration of the Atmosphere at sea by means of Kites: A. Lawrence Rotch.—Meteorological Phenomena in relation to the Changes in the Vertical: Prof. John Milne, F.R.S.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Stereomicrography: Prof. G. P. Girdwood, preceded at 7.30 by an Exhibition of some Antipoints seen under the Microscope: Conrad Beck.

SOCIETY OF ARTS, at 8.—Opening Address: Sir William Henry Preece, K.C.B., F.R.S.

ENTOMOLOGICAL SOCIETY, at 8.

THURSDAY, NOVEMBER 21.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On Skin-currents. Part II. Observations on Cats: Dr. Waller, F.R.S.—The New Biological Test for Blood in relation to Zoological Classification: Dr. G. H. F. Nuttall.—Observations on the Cerebral Cortex of the Ape (Preliminary Communication): A. S. F. Grünbaum and Prof. Sherrington, F.R.S.—On the Inheritance of the Mental Characteristics in Man: Prof. K. Pearson, F.R.S

LINNEAN SOCIETY, at 8.—Report on the Botanical Publications of the United Kingdom as a Part of the International Catalogue of Scientific Literature: B. Daydon Jackson.

CHEMICAL SOCIETY, at 8.—On the Oxidation of Sulphurous Acid to Dithionic Acid by Metallic Oxides: H. C. H. Carpenter.—Optically Active β-hydroxybutyric Acids: A. McKenzie.—On the Hydrochloride of Thiocarbamide: H. P. Stevens.—The Constituents of the Essential Oil of Asarum Canadense: F. B. Power and F. H. Lees.—Note on the Reduction of Trinitrobenzene and Trinitrotoluene with Hydrogen Sulphide: J. B. Cohen and H. D. Dakin.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

CONTENTS.

SUPPLEMENT.