

architect must recognise that he is a man of business, with grave responsibilities to his client, and must cultivate methodical habits and exactness. The art of public speaking should be part of the architect's equipment; he may thus often contribute profitably to discussions.

THE scheme for a London pageant which was before the public some time ago is now merged into a larger scheme of a Festival of Empire, to be held at the Crystal Palace this summer in the months of May, June, and July. The London pageant will form part of the scheme of the festival of empire. The council of the festival has invited the cooperation of the University Extension Board of the University of London in arranging courses of lectures preparatory to the pageant. The Board has accordingly arranged a course, to be given by Mr. Kenneth H. Vickers, on the history of London, arranged specially in view of the pageant of London to be held at the Crystal Palace as a part of the festival of empire. This course will be given in the London Day Training College on Thursday evenings at 8 o'clock, beginning February 17, when Sir R. Melvill Beachcroft, chairman of the London County Council, will take the chair. It is hoped that further courses of this kind will be arranged in different parts of London later in the year.

OF recent years the system of furthering scientific research most in vogue has consisted in the foundation of studentships or fellowships tenable at some university, for which recently graduated students of that or other universities are eligible. While this movement has undoubtedly led to the performance of a large amount of research in experimental science, and has, in this respect, been an unqualified success, it is a matter of common experience that the holders of these endowments have not, as a rule, reached a sufficiently mature age or acquired sufficient experience to initiate and develop original work in pure science. Indeed, it is not uncommon to find a successful research student baffled by a comparatively simple problem in mathematical analysis. In an article on "An Empire University" in the *Standard* for February 7, Dr. Waller, F.R.S., proposes a scheme which would obviate this difficulty. He suggests a class of appointment the holder of which should devote half his time to, and receive half his stipend from, teaching, the other half of his time being given to research, for which the corresponding remuneration should take the form of a fellowship. It is pointed out that this combination of teaching and research could not fail to have a beneficial effect in infusing an element of originality and individuality into the teaching. Dr. Waller's proposal might further have the advantage of improving the position of the existing underpaid assistant lecturers in our university colleges. Many of these at the present time turn out really excellent original work in addition to teaching, in return for a stipend which compares unfavourably with the awards made to research students for advanced study alone. There certainly appears to be a loss of efficiency in the existing system.

THE annual meeting of the Association of Technical Institutions was held at the Skinners' Hall, London, on February 11 and 12. Dr. R. T. Glazebrook, F.R.S., president of the association, delivered his address, and dealt with the questions, What should be the aims of those teachers whose work lies mainly in the technical institutions of the country, and what should be their position in the scheme of education which is being gradually evolved? He pointed out that in Germany the great technical institutions have developed almost independently of the old universities, and asked, Are we to look forward to the growth of technical universities in each town arising naturally out of the technical colleges, but independent of and at the same time rivals of the existing universities? The answer Dr. Glazebrook thinks should be in the negative, with possibly one or two exceptions. It would be suicidal to suggest that in Manchester, Birmingham, Leeds, or Liverpool there should be two degree-giving bodies, one concerned with arts and pure science and the other with applied science. Modern universities, he said, will do for us what technical high schools have done for Germany. Speaking of London, Dr. Glazebrook said we may take it that the Imperial College of Science and Technology will in time become the technical university of London, whether as a part of London University or

as a new university. On the second day of the meeting a general discussion took place upon the examination of evening students by the Board of Education, the City and Guilds Institute, the Royal Society of Arts, and the London Chamber of Commerce. Speaking on behalf of the Board of Education, Mr. C. A. Buckmaster said the Board is at present considering the whole subject of examinations, and will be glad to receive any information which the association can put before it. It realises the immense difficulties connected with the long period of the examinations, and will be prepared to do what it can to diminish the inconvenience. With regard to the Whitworth examinations, the Board of Education has to administer the will of Sir Joseph Whitworth, and though slight modifications of the scheme are possible, it would require an Act of Parliament to enable the Board to put it wholly into the melting-pot so that it may come out in a different form. After further discussion, a resolution was passed instructing the council to consider the subject of examinations in all its bearings.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society**, February 10.—Sir Archibald Geikie, K.C.B., president, in the chair.—Dr. C. Chree: Some phenomena of magnetic disturbances at Kew. A recent paper ("Phil. Trans.," A, vol. cviii., p. 205) discussed the diurnal inequality of Kew magnetic declination derived from 209 of the most highly disturbed days of the eleven years 1890 to 1900. The present paper discusses the corresponding phenomena for the same days in the other magnetic elements. It is shown that the irregular changes which form the most obvious feature of magnetic storms are accompanied by large *regular* diurnal changes, which are specially striking in the vertical force. In this element the disturbed days referred to above gave a regular diurnal inequality, the range of which in the average month of the year was about four times that given by the Astronomer Royal's "quiet" days. The influence of the hour of the day on the character of the disturbance is visible even on casual inspection of the vertical force curves. When disturbances lasting only a few hours occur in the late afternoon, there is almost invariably a rise in the force, whereas when they occur in the early morning there is a fall. Besides dealing with the analysis of the diurnal inequalities derived from the disturbed day curves, the paper discusses some new phenomena observed in the a-periodic changes of the magnetic elements.—R. B. Sangster: A novel phenomenon in the diurnal inequality of terrestrial magnetism at certain stations. The mean diurnal inequality at Greenwich for epoch 1900-6, at Falmouth, 1903-7, and at Pawlowsk (Russia), 1873-85, is dealt with so as to exhibit the inequality in the plane of the astronomical meridian. It is then shown that the component of the force parallel to the earth's axis has little, or no, variation during the hours from noon to about 5 p.m. There is, however, considerable simultaneous variation in the declination and in the horizontal and vertical forces. The winter months invariably showed a shorter duration of the feature, and, generally, a larger diurnal range produced a more exact and lengthened exhibition of the phenomenon. The phenomenon was found to exist whether "quiet" days or "all" days were dealt with, and, while long periods naturally furnished smoother curves, the feature was also prominent in cases where the mean of only five "quiet" days in a single month was employed.—Prof. P. V. Bevan: The absorption spectra of vapours of the alkali metals. The paper gives an account of the absorption spectra of vapours of the metals potassium, rubidium, and caesium. Prof. R. W. Wood has shown that the absorption spectrum of sodium vapour has for its most striking feature the lines of the principal series. The same series lines for the metals of this communication appear in the absorption spectra. The author has measured the wave-lengths of these lines so that now 24 potassium lines, 25 rubidium lines, and 19 caesium lines are known of the principal series. Of these, 15 are new in the case of potassium, 21 in the case of rubidium, and 12 in the case of caesium. In the cases of rubidium and caesium, the metals themselves were not available, but by heating the chlorides with sodium or

potassium, enough vapour was obtained to show the absorption spectrum quite definitely. These lines, with the lines measured by Wood for sodium, give good data for testing various formulæ that have been suggested for representing the series lines. None of the suggested formulæ tested give values representing the series within the limits of experimental error. In particular, the quantity of Rydberg's formula  $N_0$ , or of the modified Rydberg formula of Rit., is shown not to be constant. One of the most interesting facts arising out of the investigation is that none of the lines of the associated series appear in these absorption spectra. Channeled space spectra appear which are analogous to the similar spectra for sodium vapour. Further interesting facts noted are in regard to the effect of mixtures of vapours. Some lines or bands appear in spectra of mixtures which are apparently unconnected with the spectra of either constituent. This was specially evident in the case of caesium and sodium; a set of bands appeared at about W.L. 3000-3500 which do not appear in the sodium spectrum, nor in the mixture of potassium and caesium spectrum. Other interesting phenomena appear as the density of the vapour is increased in the widening of the lines and the appearance of satellites connected with the lines of the series. The vapour of lithium has not yet been successfully investigated, as it attacks the material of all tubes hitherto tried.—Prof. C. H. Lees: The shapes of the isotherms under mountain ranges in radio-active districts. The author shows that for mountain ranges of many different forms of section, the shapes of the isotherms may be accurately determined in cases in which the heat conductivity and radio-activity of the materials of the range may be taken as constants. Curves showing the isotherms in three typical cases are given, and it is shown that some of the statements generally made with respect to them are not correct.—F. B. Pidduck: The propagation of a disturbance in a fluid under gravity. The paper relates to the determination of the motion set up in a heavy incompressible fluid of uniform depth by a limited initial disturbance; the generally accepted solution in terms of a definite integral represents the disturbance as being propagated instantaneously, although the velocities of the simple harmonic wave-trains of which the solution is built up are all finite. In the paper this solution is transformed into a series-solution analogous to that given by Cauchy and Poisson for infinite depth. In the more general problem of one-dimensional motions in dispersive media the integral solution may represent the disturbance as either being limited at any time by an advancing wave-front, or as being propagated instantaneously. A method, based on the examination of the convergence of the definite integral, is given for deciding between these conditions. An investigation is given of the propagation of waves over a slightly compressible heavy fluid. Solutions of the Cauchy-Poisson type give motions which such a fluid can execute; but these are not due to limited initial disturbances, as they imply a diffused initial condensation. The corresponding result for incompressible fluids is that solutions of the type in question imply a diffused un-equilibrated distribution of pressure on release from the initial state.—Dr. A. H. Gibson: The flow of water through pipes and passages having converging or diverging boundaries. A series of twenty-five pipes, all having the same initial and final area, but having different angles of convergence or divergence, were examined. Some of these pipes were circular in section; others square; others rectangular. The following are the main conclusions:—(a) In a circular pipe with uniformly diverging boundaries, the total loss of head attains its minimum value with an angle of divergence  $\theta$  of about  $5^\circ 30'$ . Owing to the comparatively large effect of friction in a pipe having a small value of  $\theta$ , the value giving the minimum loss of head will be somewhat less in pipes larger than those examined, which had a larger diameter of 3 inches and a smaller diameter of 1.5 inches. (In large pipes of the type used in the Venturi meter, experiment shows that this value is about  $5^\circ 6'$ .) As  $\theta$  is increased the loss of head, expressed as a percentage of  $(v_1 - v_2)^2/2g$ , increases very rapidly from its minimum value of about 13.5 per cent. to a maximum of about 121 per cent. when  $\theta = 63^\circ$ , afterwards diminishing to about 102 per cent. as  $\theta$  is increased up to  $180^\circ$  (a sudden enlargement of section). (b) The effect of making the pipe trumpet-shaped so as to

give a rate of change of velocity uniform per unit length of the pipe may in some cases be to increase, in other cases to reduce, the loss of head. In the only case tried in the circular pipes the loss in the trumpet-shaped pipe was 23.5 per cent., as against 17.3 per cent. in a straight-taper pipe of the same length, and having  $\theta$  equal to  $10^\circ$ . In the case of a rectangular pipe, however, boundaries curved to give respectively uniform retardation in time and length ( $dv/dt = \text{const.}$ ) and ( $dv/dx = \text{const.}$ ), showed that the loss, as compared with that in the corresponding straight-taper pipe ( $\theta = 20^\circ$ ), was reduced respectively by 5.3 per cent. and 12.1 per cent. Further experiments are desirable to determine precisely the form of curve giving least loss of head. (c) The loss of head in a pipe of square section is greater—at the least 20 per cent.—greater than in a circular diverging pipe of the same length and same initial and final area, while the minimum loss is obtained when the angle between opposite faces of the pipe is approximately  $4^\circ$ . (d) A change in the shape, as opposed to the area, of the cross-section of a pipe leads to considerable loss of head. Thus, by changing the section of a pipe from that of a square of 2.66 inches side to a rectangle 1.33 inches by 5.32 inches in a length of 9.94 inches, a loss of head equal to  $0.484 v^2/2g$  was experienced. (e) Where a rectangular pipe has one pair of sides parallel and the second pair uniformly diverging, the loss of head is much greater than in a circular pipe having the same length and the same initial and final areas. The minimum loss is obtained with  $\theta$  about  $11^\circ$ . (f) The critical velocity of flow in a circular pipe with uniformly converging boundaries is much greater than in a parallel pipe of the same mean diameter. The critical velocity increases rapidly with the angle of convergence, its lower value, at  $57.5^\circ$  F. in the experimental pipes (from 3 inches to 1.5 inches diameter), being as follows at the point where the diameter is  $2\frac{1}{4}$  inches:—

$\theta$	$5^\circ$	$7\frac{1}{2}^\circ$	$10^\circ$	$15^\circ$
C.V. (ft. per second) ...	2.7	3.4	4.3	5.7

The lower critical velocity in a parallel pipe of the same mean diameter is 0.13 foot per second at this temperature.—R. Rossi: The effect of pressure upon arc spectra:—Titanium. The work is on the range from  $\lambda 4000$  to  $\lambda 4600$ , examined with the  $2\frac{1}{2}$  ft. concave grating spectrograph of the Manchester University Physical Laboratory, which gives on the photographic plate a dispersion of 1.3 Ångström units per millimetre. The arc was formed between a carbon pole and a graphite tube filled with titanium carbide. The pressures at which the photographs were taken were 15, 30, 50, and 100 atmospheres. The broadening, reversal, displacement, and changes of relative intensity of fifty-two lines were studied. All lines were found to broaden out with an increase of pressure, the amount and type of broadening being different for different lines. Several lines were found to reverse under pressure, some symmetrically and some asymmetrically. All lines were found to be displaced towards the red end of the spectrum, the displacement being a linear function of the pressure within the limits of accuracy of experiment. The value of the displacement varies for different lines, and the un-reversed lines cannot be grouped into sets giving the same displacement. The reversed lines, however, with the exception of one, can be formed into two groups, their mean displacements being very nearly in the ratio 3:5. The mean displacement per atmosphere of all the titanium lines studied is found to be 0.003652 Ångström unit. The limited number of lines studied, both in this work and by other workers on the Zeeman effect, do not enable one to obtain any relation between the pressure displacement and magnetic separation. The relative intensity in nearly all lines is altered by pressure, and a list is given of the lines which are thus enhanced or weakened.—Sir James Dewar and Dr. H. O. Jones: The change of carbon disulphide into a gaseous product condensable and explosive near the temperature of liquid air.

Physical Society, January 21.—Dr. C. Chree, F.R.S., president, in the chair.—R. E. Baynes: Saturation specific heats, &c., with van der Waals's and Clausius's characteristics. By use of a special variable, exact expressions may be found with van der Waals's characteristic for the specific heats  $s$ ,  $s'$  of saturated liquid and vapour and for all other magnitudes connected with the state of

saturation, and if  $k$  denotes the isometric specific heat, which is constant or a function of the temperature only, (i)  $s-k$  is always positive, increasing from  $R$  to  $\infty$  as the reduced temperature  $\tau$  rises from 0 to 1; (ii)  $k-s'$  is always positive, having a minimum value  $4.96 R$  when  $\tau=0.72$ , and being  $\infty$  when  $\tau$  is either 0 or 1; (iii) inversion in the sign of  $s'$  can thus occur when  $k/R > 4.96$  or  $\kappa=1+R/k < 1.202$ , so that, on the assumption that  $k/R=N+\frac{1}{2}$  for an  $N$ -atomic gas, inversion can occur only if the gas has at least five atoms in its molecule; (iv) the latent heat of vaporisation increases continuously from 0 to its largest value  $(27/8)RT$  as  $\tau$  falls from 1 to 0,  $T$  being the absolute critical temperature; (v) the work of vaporisation has a maximum value  $0.55 RT$  when  $\tau=0.70$ . Clausius's characteristic similarly treated gives widely different results:—(i) while  $s-k$  is always positive, it is  $\infty$  when  $\tau$  is either 0 or 1, having a minimum value  $15.3 R$  for  $\tau=0.83$ ; (ii)  $k-s'$  is always positive, is  $\infty$  when  $\tau$  is either 0 or 1, and has a minimum value  $11.36 R$  for  $\tau=0.81$ ; (iii) inversion in the sign of  $s'$  can thus only occur if  $k/R > 11.36$  or  $\kappa < 1.088$ , or, on the above assumption, if there are at least eleven atoms in the molecule; (iv) the latent heat of vaporisation increases continuously from 0 to  $\infty$  as  $\tau$  falls from 1 to 0; (v) the work of vaporisation has a maximum value  $0.69 RT$  when  $\tau=0.77$ . The contrast between these results is especially marked for  $s-k$  and the latent heat.—Prof. **Thornton**: The polarisation of dielectrics in a steady field of force. Experiments on the polarisation of dielectric ellipsoids and cylinders suspended in a steady electric field. From measurements of the field-intensity, the dimensions of the ellipsoids, and the frequency of torsional swings with and without the field, the dielectric constant can be found from time to time. The longitudinal component of polarisation reached a higher value than previously recorded, and was found to be independent of the intensity of the field inside the ellipsoid and to be quasi-elastic in type. Quartz, fused and crystalline, flint-glass, amber, sulphur, ebonite, rubber, gutta-percha, paraffin-wax, resin, and sealing-wax were examined. From the rate of increase of the dielectric constant the specific resistance of these was found by considering the change of polarisation to be equivalent to a current. The rate of depolarisation when the field was reversed was the same as that of polarisation, and uniform for several hours. The cause of this and for the independence of the field-intensity may be looked for in the continued separation of molecular charge by the attraction of the opposite charges on adjacent molecules induced by the application of the field. From a comparison of these results and those in alternating fields, the variation of the dielectric constants with frequency can be anticipated.—A. **Campbell**: The use of mutual inductometers. In the use of mutual inductometers, the use of a balancing coil in one arm of the bridge causes considerable loss of sensitivity. With an equal-arm bridge this difficulty is overcome by putting the halves of the secondary circuit in adjacent arms of the bridge. The auxiliary balancing coil is dispensed with, and the usual formula is applicable. The measurement of effective resistance, which is, in general, more troublesome than that of self-inductance, was discussed. The effective resistance determines the total power spent by an alternating current in a conductor, and is important in telephonic and other high-frequency work. When measured by a self-inductance bridge, large errors may be introduced by the small residual inductances of the ratio arms. The analogous formulas for mutual inductance bridges, which indicate that the inductances of the ratio arms must be accurately proportional to their resistances if errors are to be avoided, are here worked out. A null method in iron testing analogous to Max Wien's self-inductance method is described. The ring to be tested is wound with primary and secondary coils. The magnetising current,  $I_1$ , is passed through the primary coil, the primary circuit of a mutual inductometer, and a slide-wire resistance. The detecting instrument is put across a circuit consisting of the secondaries of the ring and the inductometer in opposition, and a part,  $Q$ , of the slide-wire resistance. By adjusting  $Q$  and the reading  $M$  of the inductometer a balance is obtained, in which case the power lost in the ring is equal to  $QI_1^2 \times N_1/N_2$ , where  $N_1$

and  $N_2$  are the numbers of turns in the windings of the ring. The method is applicable to the testing of current transformers.

**Mineralogical Society**, January 25.—Prof. W. J. Lewis, F.R.S., president, in the chair.—Dr. S. J. **Shand**: A group of minerals formed by the combustion of pyritous shales in Midlothian. At the Emily coal-pit, Arniston, as the result of the slow combustion of a heap of shaly refuse, which became spontaneously ignited, presumably owing to the evolution of heat caused by the atmospheric oxidation of pyrites, a number of uncommon mineral species have been formed, of which five have been recognised, viz. native sulphur, sal-ammoniac, tschermigite, mascagnite, and a possibly new species, aluminium sulphate.—Prof. W. J. **Lewis**: A crystal-holder for measuring large specimens. For this purpose a clamp of convenient form and with various adjustments has been designed and made by Mr. Pye.—T. **Crook**: Some observations on pleochroism. The phenomena of pleochroism displayed by plates of coloured minerals when examined in ordinary light were treated in a general way for both parallel and convergent rays, and the factors upon which they depend were discussed.—L. J. **Spencer**: Notes on the weight of the "Cullinan" diamond, and on the value of the carat-weight. Varying statements of the weight of the "Cullinan" diamond, in its original, uncut form have been published, but from a comparison of the carat-weights against which it was weighed in 1905 it is concluded that the correct weight was 621.2 grams, or 3025½ English carats of 205.304 milligrams (as defined by the Standards Department of the Board of Trade in 1889). Other values are, however, given for the English carat and for the carat in other countries, and the average value has decreased, on the whole, in course of time. The carat-weight had its origin in the use as weights of seeds of *Ceratonia siliqua*, which weigh approximately a carat. The existing confusion would be obviated by the general adoption of the metric carat of 200 milligrams (one-fifth of a gram) recently recommended by the International Committee of Weights and Measures (NATURE, 1908, vol. lxxii., p. 611).—Dr. G. T. **Prior**: A basalt from Rathjordan, Co. Limerick. Specimens of basalt from Rathjordan in the Allport collection in the British Museum show in thin slices under the microscope round sections of isotropic material containing central and marginal inclusions, and thus resembling small leucites. The rock is very similar, mineralogically and chemically, to leucite-basalts from Bohemia, but contains only a small fractional percentage of potash. This fact, combined with observations of the refractive indices, leads to the conclusion that the isotropic material is mainly analcite, and not leucite.—Dr. G. F. H. **Smith** and Dr. G. T. **Prior**: A fluo-arsenate from the Indian manganese deposits. A crystallographical and chemical examination made of the green arsenate from Kajlidongri, Jhábua State, mentioned in Mr. Fermor's monograph on the manganese-ore deposits of India (Rec. Geol. Surv. India, 1908), led to the following results:—composition,  $(MgF)CaAsO_4$ ; specific gravity, 3.768; hardness, 3½; colour, apple- to brownish-green; monoclinic,  $a:b:c=0.7485:1:0.8453$ ,  $\beta=120^\circ 50'$ ; forms present, (010), (110), (111), ( $\bar{1}\bar{1}\bar{1}$ ), (311), ( $\bar{1}\bar{1}2$ ),  $\{1\bar{1}52\}$ ; good cleavage parallel to ( $\bar{1}01$ ), and partings parallel to (110), ( $\bar{1}02$ ), (331); twin plane, (100); refractive indices, 1.640, 1.660, 1.666; acute bisectrix nearly perpendicular to ( $\bar{1}01$ ), and axial plane at right angles to the plane of symmetry, but no horizontal dispersion was noticed;  $2E=105^\circ$  approximately, with negative birefringence. The material is probably identical with tilasite, which was first described by Sjögren in 1905 from the manganese deposits of Långban, Sweden.—H. E. **Clarke** and Prof. H. L. **Bowman**: The composition of a stone from the meteoric shower which fell at Dokáchi, Bengal, on October 22, 1903. The small crusted stone examined, weighing 17.8 grams, shows chondritic structure, and belongs to the class Ci of Tschermak. The chief constituent minerals are bronzite (37.9 per cent.), olivine (37.7 per cent.), nickel-iron (18.5 per cent.), troilite (4.1 per cent.).—Dr. G. F. H. **Smith** exhibited cut and rough specimens of synthetic sapphire recently produced by Prof. Verneuil, oxides of iron and titanium being the colouring agents.

**Geological Society**, January 26.—Prof. W. J. Sollas, F.R.S., president, in the chair.—Dr. A. S. **Woodward**: A skull of *Megalosaurus* from the Great Oolite of Minchinhampton. The specimen was discovered and prepared by Mr. F. Lewis Bradley, and shows, for the first time, the skull of *Megalosaurus*. It agrees closely with the megalosaurian skulls of other genera already discovered in the Jurassic and Cretaceous of North America, and resembles *Ceratosaurus* in possessing a bony horn-core on the nose. As in the jaws of *Megalosaurus* previously known, the premaxilla of the new specimen bears four teeth; but these teeth are so different from those of the typical *M. bucklandi* of the same horizon that they prove the Minchinhampton fossil to belong to a distinct species.—A. M. **Finlayson**: Problems of ore-deposition in the lead and zinc veins of Great Britain. Chemical analyses show traces of lead and zinc in several of the rock-formations of Britain, but the ores of the veins are concluded to be derived, not from the country-rock, but from deeper sources, probably in the first place by magmatic segregation. They were transported in the deeper zones by "juvenile" waters, in which fluorine was an important constituent, while in the upper zones, especially in limestone districts, underground waters of meteoric origin have played a large part. The vein-solutions carried (1) alkaline sulphides, which held the sulphides of the metals in solution, and (2) alkaline and earthy carbonates. The presence of the latter is indicated by the alteration of the wall-rock, which shows a concentration of potash, lime, and carbon dioxide, and a leaching of soda, magnesia, oxides of iron, and silica. In limestones, however, the chief effects of solution on wall-rock were concentration of silica and magnesia. Ore-deposition has persisted over a vertical range of 5000 to 6000 feet, of which more than one-half has been shorn off by denudation. The effects of secondary processes have been exerted to depths of more than 600 feet.—J. W. **Jackson**: The vertebrate fauna found in the cave-earth at Dog Holes, Warton Crag (Lancashire). The remains described in this communication were obtained during the systematic investigation by the author of a cave on Warton Crag (west Lancashire) in 1909. The cave, known as Dog Holes, is situated on the western side of Warton Crag, and opens on a sloping "pavement" of limestone. It owes its origin to the erosion of a series of master-joints in the Carboniferous Limestone. The specimens were derived from the cave-earth below the surface-soil in one of the chambers of the cave. They comprise a large series of small vertebrates, including rodents, Insectivores, amphibians, birds, &c. Among the rodents are some interesting forms, the chief of which are the Arctic and Norwegian lemmings and the northern vole. A large series of non-marine Mollusca was found along with these remains, one species being of particular interest, namely, *Pyramidula ruderata*, only known in this country by its fossil remains in Pleistocene deposits. The Pleistocene age of the remains is fully discussed, as well as their possible mode of origin through a former swallow-hole. In many respects the cave and its contents bear a striking resemblance to the famous Igtham fissures.

**Zoological Society**, February 1.—Prof. E. A. Minchin, vice-president, in the chair.—The Hon. P. A. **Methuen**: A collection of fresh-water Crustacea from the Transvaal. An account of some Entomostraca collected from Lake Chrissie and other pans or lakes in the Carolina district, which is high veldt country lying near the borders of Swaziland. The paper also gave a short description of the "lie" of the lake, and notes on the geology of the district and the composition of the water.—Dr. J. **Pearson**: Holothurioidea from the Kerimba Archipelago, Portuguese East Africa, and from the Mergui Archipelago, Lower Burma. The collection from the Kerimba Archipelago contained twenty-one species, all of which had been previously described. In this paper it is proposed to establish a new genus for the inclusion of *Colochirus violaceus*, Théel. The collection from the Mergui Archipelago called for no special comment, none of the fourteen species being new.—Dr. G. S. **Brady**: A revision of the British species of Ostracoda belonging to the subfamilies Candoninae and Herpetocyphridinae. The paper was a synopsis intended to show our present knowledge of the

families referred to, describing briefly the known British species. Some few new genera and species, and others already described by foreign authors but not previously recognised as British, were dealt with.—F. E. **Beddard**: The anatomy of *Hippoopotamus amphibius*.

**Royal Anthropological Institute**, February 8.—Mr. J. Gray, treasurer, in the chair.—A. L. **Lewis**: Some dolmens of peculiar types in France and elsewhere. The author described several *allées couvertes* in the department of the Oise, in France, which have at one end an open portico or shrine with a round hole 18 inches in diameter opening into the *allée*. He then sought to find the monuments most nearly resembling them, which appeared to be some of those in the provinces of Bohuslan and Vestergothland, in Sweden, described by Dr. Oscar Montelius. The "Giants' Graves" in Sardinia, recorded ninety years ago by Count de la Marmora, and quite recently by Dr. Duncan Mackenzie, had some points in common with them, but they also had quite special features of their own, and it did not appear to the author that there was any real connection between the dolmens of the Oise and those of Sweden or Sardinia, as several other kinds of dolmens seemed to bar the way between them. His general conclusion was that the building of dolmens was not confined to one race and the building of circles to another, nor that there was any one race which originated or diffused both, but rather that megalithic construction was a phase of culture through which many races have passed and which was developed in different ways, not only by separate races, but also, in very restricted areas, by different tribes, without regard to any racial differences or connections between them.—Dr. J. S. **Holden**: The existence of a Palaeolithic bed beneath the glacial Boulder-clay in south-west Suffolk. The implements were discovered in a well sinking at a depth of 100 feet in a seam of unrolled gravels beneath the blue Boulder-clay. The finding of these rude implements *in situ* beneath the glacial Boulder-clays is of considerable importance, as they are evidence of the existence of man on this old land surface probably long before the beginning of the Glacial period. In the discussion, although doubt was expressed as to the artificial character of the implements by some of the speakers, the general opinion was that they were of human workmanship.

**Mathematical Society**, February 10.—Sir W. D. Niven, president, in the chair.—H. W. **Richmond**: Note on double-sixes of lines.—Dr. H. F. **Baker**: Notes on the theory of functions. (1) On a certain logical principle; (2) on the establishment of the order of a doubly periodic function; (3) two queries.—Prof. H. **Lamb**: The diffraction of a solitary wave.

#### EDINBURGH.

**Royal Society**, January 10.—Dr. James Burgess, vice-president, in the chair.—E. M. **Wedderburn**: Current measurements in Loch Garry. The measurements were made with an Ekman current meter. The general conclusions drawn from the Loch Ness observations were confirmed. At the end of the lake the currents were not very uniform, but some very steady currents were observed at the centre. The return current was strongest just above the temperature discontinuity, and at the bottom indications were obtained of currents in the same direction as the wind. The currents were most uniform with moderate and steady winds. In stormy weather they were very variable, both in direction and in velocity.—John **McWhan**: Observations on some spark-gap phenomena. The paper described a number of curious effects produced by and on sheets of dielectrics interposed in various ways in the path of the electric discharge in air. Many of these depended on the fact that the electrodes were not in the line of the spark. In some the dielectric was perforated, in others it was driven in a definite direction with or without rotation, as the case might be, and in other cases the accompanying luminous effects with the brush discharge were very remarkable. The phenomena could not be coordinated on any of the ordinarily accepted theories.—Dr. G. A. **Carse** and D. **MacOwan**: Earth-air electric current and atmospheric potential gradient near Edinburgh. The observations were made with Wilson's portable electrometer. The values of the earth-air current in the town were found to be about one-tenth of those got by

Mr. Wilson at Peebles; at the Blackford Hill, just outside the city on the south, the value was about three times as great as in the city, and at an intermediate station intermediate values were found.—Dr. J. S. Thomson: Alcyonaria from the Cape of Good Hope, part i. The paper contained a description of thirteen species obtained off the shore in depths varying from 10 to 70 fathoms. Six were new to science, and one new genus was recorded.—Prof. J. T. Morrison: Notes on proposed meteorological instruments. The one was a self-recording anemometer capable of giving at once the north-south and east-west components of the wind's velocity. This was to be accomplished by use of a sphere which, by means of appropriate gearing, was kept rotating at a rate proportional to the wind velocity, while its horizontal axis of rotation was so connected to the vane as to point along the direction of the wind. Two small discs, equidistant from and respectively north and east of the vertical line through the centre of the sphere and pressed against the lower surface, would then rotate with the sphere and thus record the two components. The other instrument was a modified air thermometer, which could be set by comparison with a contiguous Six's thermometer in such a way that the reading gave at once the barometric pressure. The instrument was portable, and was intended to take the place of the aneroid, one of the most untrustworthy of all instruments used by travellers.

January 24.—Prof. Ewart, vice-president, in the chair.—Dr. Williamina Abel: The development of the autonomic nervous mechanism in the alimentary canal of the bird. In the wall of the alimentary canal there are various nerve plexuses and ganglia arranged in two layers, the function of which is to control and regulate the movements of the intestine. Are these nerve structures developed *in situ* or are they outgrowths from the central nervous system? From the point of view of physiological experiment the balance of evidence is in favour of the first view, the work of Bayliss, Starling, Langley, Elliot and others pointing to the possession of peculiar properties which separate these intestinal plexuses off fundamentally from the nerve elements of the central nervous system. The evidence afforded by histological examination of the developing embryo is, however, for the most part in favour of the second view. His, senior, Onodi, and His, junior, all support the outgrowth theory as a result of investigations made by them on the relationship of the visceral nerve supply to the central nervous system. It seemed desirable to repeat the investigations with the use of the modification of the silver nitrate staining method introduced by Ramon y Cajal. The material used was embryonic chicks varying in age from two to seven days' incubation. The work was carried out in the physiological laboratory of Glasgow University, and led to the conclusion that the autonomic nerve mechanism in the alimentary canal is formed as an outgrowth from the central nervous system. This view, which receives the support of different histologists, would suggest that the peculiar properties to the autonomic nerve mechanism of the alimentary canal were secondary in development to that of the cells.—J. J. Simpson: A new species of Cactogorgia. This specimen, which differed in certain specific characters from other known forms of Alcyonaria, was one of the collection in the Royal Scottish Museum. Unfortunately, there was no label of any kind or mention of the locality where it had been found.—Dr. J. Oliver: The stimulatory action of the oosperm in the uterus.—Dr. J. Brownlee: The significance of the correlation coefficients applied to Mendelian distributions. This paper gave an account of the manner in which the values of the correlation coefficient varied according to the method of calculation when populations of parent and offspring obtained on the Mendelian hypothesis were examined, and it was shown that in cases of dominance the four-fold division method gave higher correlation values than the product method. The effect of different forms of assortive mating on the correlation coefficient was also shown, and from one form of assortive mating a series of hereditary correlation coefficients were obtained identical with those found from observation. The effect of selective mating was considered, and the forms of selective mating which raised were distinguished from those which lowered the correlation coefficient. The correlation coefficient from

parent to offspring when three races mix instead of two was also investigated, and the value of the coefficient in this case found to be considerably higher. Fraternal correlation was found to be considerably increased by assortive mating, and in certain cases by selective mating, while in the case of a mixture of more than two races further increase took place. These theoretical deductions were illustrated by cases of inheritance of colour in animals.

## PARIS.

Academy of Sciences, February 7.—M. Émile Picard in the chair.—D. Gernez: A means of restoring phosphorescent properties to the sulphides of the alkaline earths. A sulphide of strontium, which immediately after its preparation phosphoresced brilliantly, slowly lost this property on exposure to air, but regained its phosphorescence on heating to redness in a current of hydrogen. This regeneration of the phosphorescence also takes place with barium sulphide.—M. van der Waals was elected a foreign associate.—M. Luizet and J. Guillaume: Observations of the Innes comet (1910a) made at the Observatory of Lyons. Results for January 26, 29, 30, and 31.—MM. Javelle, Charlois, and Schaumasse: The comet 1910a. Observations made at Nice. Data given for January 25, 26, 27, February 1, 2, 3. The comet has a round, well-defined nucleus 10" in diameter.—M. Borrelly: Observations of the comet 1910a made at the Observatory of Marseilles with the comet finder of 16 cm. aperture. Data given for January 25, 26, 27, 29, 30, and February 1 and 3.—M. Coggia: Observations of the comet 1910a made at the Observatory of Marseilles with the Eichens equatorial of 26 cm. aperture. Results for January 25, 26, 29, 30, and February 1 and 3.—MM. Claude, Ferrié, and Driencourt: The comparison of chronometers or clocks at a distance by the method of coincidences by means of radio-telegraphic signals. Details are given of the mode of transmission of the signals. The method was tested between the observatories of Paris and Montsouris. The errors are less than 0.01 second. Further comparisons will be carried out between Paris and Brest as soon as the damage done to the apparatus at the Eiffel Tower by the floods has been repaired.—A. Demoulin: The K systems and congruences.—Johannes Mollerup: A remark on integral equations of the first species.—Nicolas Kryloff: Developments following hypergeometric polynomials.—Michel Plancherel: The representation of an arbitrary function by a definite integral.—Richard Birke-land: Some irregular integrals of linear differential equations.—A. Étève: Autorotation. An explanation of an experiment due to M. Riabousschinsky.—C. E. Guye and S. Ratnovsky: The variation of the inertia of the electron as a function of the velocity in the cathode rays and on the principle of relativity. The experimental results are compared in parallel columns with the figures calculated from the hypotheses of Lorentz and with those calculated from Abraham's formula. The deviations from the Lorentz are about 1 to 2 per cent., 16 being positive and 11 negative. The divergences from the Abraham formula amount to nearly 4 per cent., 26 being positive and 1 negative. Hence it is clear that the Lorentz formula alone is compatible with the experimental results.—G. A. Hemsalech and C. de Watteville: The high-temperature flame spectrum of iron. The temperature used was that of the oxyacetylene blow-pipe. The spectrum is very nearly the same as that obtained with the oxyhydrogen blow-pipe, except that the intensity of all the lines is so much increased that an exposure of ten minutes is sufficient to give the image of a well-developed spectrum.—M. Guilleminot: The radiochromism of organic bodies towards the  $\alpha$ ,  $\beta$ , and  $\gamma$  rays of radium and the X-rays.—Louis Dunoyer: The emission of electric charges by the alkaline metals. A repetition of an experiment due to J. J. Thomson on the emission of negative corpuscles by rubidium. The author thinks that the assumption of the spontaneous explosion of some atoms, analogous to the destruction of radio-active atoms, is not necessary for the explanation of the facts observed.—Louis Nombrot: The reduction of the nitroso derivatives of acetyl- and benzoyl-hydrazobenzene. Various attempts to produce triazane derivatives by the reduction of these compounds with hydrazine hydrate, aluminium amalgam, and zinc powder

were unsuccessful.—**A. Trillat** : Disinfection by incomplete combustion.—**F. Bordas** and **M. Touplain** : Contribution to the study of the reactions due to the colloidal state of milk. The authors think that their results demonstrate the uselessness of assuming the intervention of amæroxydases, catalases, &c., to explain the phenomena of the decomposition of hydrogen peroxide in milk.—**MM. Maurain** and **Warcollier** : The action of the ultra-violet rays on wine in course of fermentation. It is shown that the sterilisation of white wine is easier than cider.—**J. Chevalier** : The influence of culture on the amount of alkaloids in some Solanaceæ. In the cultivation of belladonna the addition of phosphatic or potash manures did not cause any addition to the alkaloid percentage; the amount of the latter is considerably increased, however, by the use of nitrogenous manures, a mixture of nitrates and farmyard manure giving the best results.—**M. Hegyi** : Some observations on the black scab of the potato. This disease, which has caused great damage to the potato crops in Hungary and Germany, has been attributed to *Bacillus phytophthorus*, propagated by infected tubercles. The author's observations have led to the conclusion that the disease is not propagated by the tubercles, but is due to the bacteria of the soil penetrating through lesions into the interior of the stem.—**M. Doyon** : The formation in the liver of an anti-coagulating substance under the influence of an alkaloid.—**A. Rosenstiehl** : The consequences of Young's theory. Chromatic construction in space.—**Louis Roule** : Fishes of the family of Nemichthyides.—**E. Vasticar** : The structure of the tectoria.—**H. Vincent** : The experimental bases of anti-typhoid vaccination.—**H. Carré** : The efficacy of intestinal congestion in the horse.—**L. Cayeux** : The limestone algæ of the *Girvanella* group, and the formation of ooliths.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 17.

ROYAL SOCIETY, at 4.30.—Phosphorescence produced by  $\alpha$ - and  $\beta$ -Rays : E. Marsden.—Theory of the Luminosity produced in Certain Substances by  $\alpha$ -Rays : Prof. E. Rutherford, F.R.S.—(a) The Scattering of the  $\alpha$ -Particles by Matter; (b) The Ionisation produced by an  $\alpha$ -Particle. Part II.: Connection between Ionisation and Absorption : Dr. H. Geiger.—The Influence of Pressure on the Boiling Points of Metals : H. C. Greenwood.—On the Viscosities of the Gases of the Argon Group : A. O. Rankine.  
 ROYAL INSTITUTION, at 3.—Illumination, Natural and Artificial (Experimentally Illustrated) : Prof. S. P. Thompson, F.R.S.  
 LINNEAN SOCIETY, at 8.—The Plum-moths of the Seychelles Expedition : T. B. Fletcher, R.N.—Die von Herrn Hugh Scott, auf den Seychellen gesammelten Embiidinen, Coniopterygiden und Hemerobiden : Dr. G. Enderlein.—Die Termiten der Seychellen-Region : Dr. Nils Høghgreen.—On the Land and Amphibious Decapoda of Alabura : L. A. Borradaile.  
 ROYAL SOCIETY OF ARTS, at 4.30.—The Bombay Housing Question : G. O. W. Dunn.  
 INSTITUTION OF MINING AND METALLURGY, at 8.  
 ROYAL GEOGRAPHICAL SOCIETY, at 5.—Waves in Water, Sand, and Snow : Dr. Vaughan Cornish.  
 ROYAL ANTHROPOLOGICAL INSTITUTE, at 5.—Head Hunters in Assam : T. C. Hodson.  
 INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Electric Clocks : F. Hope-Jones.

FRIDAY, FEBRUARY 18.

ROYAL INSTITUTION, at 9.—Halley's Comet : Prof. H. H. Turner, F.R.S.  
 INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Annual General Meeting.—Further discussion : Ninth Report to the Alloys Research Committee : On the Properties of some Alloys of Copper, Aluminium, and Manganese (with an Appendix on the Corrosion of Alloys of Copper and Aluminium when Exposed to the Sea) : Dr. W. Rosenhain and F. C. A. H. Lansberry.  
 INSTITUTION OF CIVIL ENGINEERS, at 8.—Irrigation Works : Sir R. Hanbury Brown, K.C.M.G.

SATURDAY, FEBRUARY 19.

ROYAL INSTITUTION, at 3.—Electric Waves and the Electromagnetic Theory of Light : Sir J. J. Thomson, F.R.S.

MONDAY, FEBRUARY 21.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Explorations in and around Lake Chad : Captain J. Tilho.  
 ROYAL SOCIETY OF ARTS, at 8.—The Petrol Motor : Prof. W. Watson, F.R.S.  
 VICTORIA INSTITUTE, at 4.30.—Arianism in its Bearing on Modern Questions : Prof. H. M. Gwatkin.

TUESDAY, FEBRUARY 22.

ROYAL INSTITUTION, at 3.—The Emotions and their Expression : Prof. F. W. Mohr, F.R.S.  
 ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Notes on the Northern Albanians : Miss M. Edith Durham.  
 INSTITUTION OF CIVIL ENGINEERS, at 8.—The Hudson River Tunnels of the Hudson and Manhattan Railroad Company : C. M. Jacobs.

WEDNESDAY, FEBRUARY 23.

GEOLOGICAL SOCIETY, at 8.—Metamorphism around the Ross of Mull Granite : T. O. Bosworth.  
 ROYAL SOCIETY OF ARTS, at 8.—Oxy-acetylene Welding : H. S. Smith.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.  
 ROYAL METEOROLOGICAL SOCIETY (in the Physical Laboratory of the University of Manchester), at 5.—Investigation of the Electrical State of the Upper Atmosphere made at the Howard Estate Observatory, Glossop : Dr. W. Makower, A. J. Makower, and Miss M. White.—Results of the Hourly Registering-balloon Ascents from Manchester, June 2 and 3, 1909 : W. A. Harwood.—Line Squalls and Associated Phenomena : R. G. K. Lempfert and R. Corless.

THURSDAY, FEBRUARY 24.

ROYAL SOCIETY, at 4.30.—Probable Papers : Colour-blindness and the Trichromatic Theory of Colour Vision : Sir William Abney, K.C.B., F.R.S.—Contributions to the Biochemistry of Growth : (a) The Total Nitrogen Metabolism of Rats bearing Malignant New Growths; (b) Distribution of Nitrogenous Substances in Tumour and Somatic Tissue : W. Cramer and H. Pringle.—The Alcoholic Ferment of Yeast Juice : Part V., The Function of Phosphates in Alcoholic Fermentation : Dr. A. Harden, F.R.S., and W. J. Young.—And other Papers.  
 ROYAL INSTITUTION, at 3.—Illumination, Natural and Artificial : Prof. S. P. Thompson, F.R.S.

FRIDAY, FEBRUARY 25.

ROYAL INSTITUTION, at 9.—Colours of Sea and Sky : Lord Rayleigh, O.M., F.R.S.  
 PHYSICAL SOCIETY, at 5.—Telephone Circuits : Prof. J. Perry, F.R.S.—On the Laws regarding the Direction of Thermo-electric Currents enunciated by M. Thomas : Prof. C. H. Lees, F.R.S.—A New Method of Determining Thermal Conductivity : H. R. Nettleton.  
 INSTITUTION OF CIVIL ENGINEERS, at 8.—Irrigation Works : Sir R. Hanbury Brown, K.C.M.G.

SATURDAY, FEBRUARY 26.

ROYAL INSTITUTION, at 3.—Electric Waves and the Electromagnetic Theory of Light : Sir J. J. Thomson, F.R.S.

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