colleges, fully two-thirds of the undergraduates who would otherwise have been in residence being absent on military service. The number of resident undergraduates in the University of Cambridge, which was 3306 in Michaelmas term, 1913, fell to 1658 at Michaelmas, 1914, and a still further decline was observable last term. The number was 1097 at the commencement of the term, but many had disappeared before the conclusion. A similar reduction in numbers is reported, in the articles, in the Universities of Birmingham, Bristol, Durham, Leeds, Liverpool, Manchester, and Sheffield. To mention a few instances: at Durham there are 573 students as against 947 in 1913-14; at Liverpool the undergraduates attending classes this session number 420 and the post-graduates 150, while in 1913–14 the numbers were 548 and 289 respectively; at Manchester there is a decline of more than 500 in the number of men students as compared with 1913.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 18.—Sir William Crookes, president, in the chair.—Lord **Rayleigh**: The theory of the capillary tube. In a recent paper Richards and Coombs comment on deficiencies in the mathematical treatment of the capillary tube, some of which it is here attempted to remedy. In the best experimental arrangement a wide and a narrow tube are connected below, and the difference between the levels of the lower parts of the two meniscuses is measured. In the interpretation of the results for deducing the surface-tension of the liquid, two problems arise (i) how to allow for the weight of the meniscus in the narrow tube, and (ii) to find what diameter is necessary for the wide tube in order that the elevation due to curvature of the liquid surface may be neglected. The first problem was considered by Poisson, but his results in the only really important case, viz., when the liquid wets the walls of the tube, have been disputed. Poisson's formula is here confirmed and extended. If r denotes the radius of the tube, h the measured height of the meniscus above the truly plane level, T the surface-tension, g gravity, and ρ the density of the fluid, $2T/g\rho.r=h+r/3-0{\cdot}1288r^2/h+0{\cdot}1312r^3/h^2$, an approximation which should suffice for experimental purposes. It may be remarked that the first two terms on the right correspond to the assumption of a spherical surface, which is legitimate when r is small enough. A completely adequate solution of the second problem is more difficult. But it is easy to show theoretically that such diameters as are sometimes used for the wide tube (2·5 cm. or 3·0 cm.) are quite insufficient, at any rate in the case of water, a conclusion reached also by Richards and Coombs in direct experiment. It appears further that the widest tube used by these observers (3·8 cm.) would be insufficient to take advantage of the actually achieved delicacy of reading. An approximate calculation of the diameter necessary for this purpose gives 4·7 cm. —Prof. C. H. **Lees**: The effect of the form of the transverse section on the resistance to the motion of an elongated body parallel to its length through a fluid the viscosity of which is not negligible. When a very elongated body moves parallel to its length through a fluid, the resistance due to the viscosity of the fluid varies considerably with the form as well as with the magnitude of the cross-section of the body. Values of the total resistance and of the resistance per unit area of contact with the fluid are given in various cases. In all cases so long as the fluid is in streamline motion, the law of resistance can be expressed in a simple form, and it is desirable that measurements of the resistance when the motion is turbulent should be made in order to determine the extent to which these laws may be utilised in practical engineering.—Prof. J. **Joly**: A method of estimating distance at sea in fog or thick weather. The method proposed is based upon the different velocities of disturbances in differing media. If aerial and submarine signals are simultaneously emitted at a lighthouse station or lightship the lag of the aerial compared with the submarine sound is about 4·3 seconds to the nautical mile. An approaching ship picking up the signals and measuring the lag to an error even of one second becomes aware of her distance to less than one-quarter of a mile. Similarly, wireless signals and submarine signals, or wireless and aerial signals, may be used. If the faster-moving signals be sent out in groups, the individual signals being spaced to regular intervals—say, of one second—and the slower moving signal be always emitted simultaneously with the first signal of a group, the navigator has only to count the faster signals until the slower signal reaches him, in order to estimate his distance from the signal station. In this case the signals themselves tell him his distance, and no actual time-measurements are required on board ship. It is shown that this system enables the mariner to determine his position completely in all circumstances which may arise.—Prof. J. **Joly**: A method of avoiding collision at sea. This paper deals with an extension of the method described in the preceding paper for estimating distance at sea to the problem of avoiding collision in fog. It is shown that if vessels possess the means of emitting a loud and crisp sound signal which can be sent out simultaneously with a wireless or a submarine signal, the determination of distance rendered possible thereby, along with wireless information as to course and speed, will enable the navigator on each ship to determine with certainty (1) whether there is risk of collision or whether there is no risk, and (2) the point upon his own course and the moment at which collision is threatened. The solution of the problem is based upon the fact that at each instant the rate of mutual approach is the maximum if the ships are advancing so as to collide. A simple geometrical construction, which by its character is unlikely to involve error, enables the mariner to solve the problem immediately the signals are received.—S. W. **Richardson**: The flow of electricity through dielectrics.—S. **Chapman**: The kinetic theory of gaseous viscosity and thermal conduction, and the law of distribution of molecular velocities in the disturbed state. The first object of the paper is to determine the velocity-distribution function $f(u, v, w)$ in a gas in which there are small variations of temperature and velocity from point to point. Both simple and mixed gases are considered; the mixtures are supposed uniform, the study of diffusing mixtures being deferred to a later paper.

Zoological Society, November 9.—Dr. S. F. Harmer, vice-president, in the chair.—Dr. G. E. **Nicholls**: The anatomy of *Rana tigrina*, the so-called bull-frog of India. Attention was directed to certain features in which this species differs from its European congeners. —Dr. J. C. **Mottram**: Pattern-blending with reference to obliterative shading and concealment of outline. The paper recorded the results of laboratory experiments with artificial patterns. The experiments showed that obliterative, or counter-shading, could be produced by blended black-and-white pattern, and that beyond the blending distance, interruptions at the margin of a pattern, or similarly placed eye-spots, blur the margins. The laboratory experiments were compared with actual patterns of animals.—Dr. J. C. **Mottram**: The distribution of secondary sexual characters amongst birds, with relation to their liability to

the attack of enemies. The paper was based upon a statistical inquiry into the possible existence of a correlation between these factors.—C. Boden **Kloss**: Mammals from the coast and islands of south-east Siam. More than 500 specimens were collected by the author. One species and twenty-two subspecies were described as new.—Prof. W. J. **Dakin**: The fauna of West Australia. (Two papers.) The first paper contained the description of a new land Nemertean, the first to be recorded from West Australia. The second paper described a new prawn-like Crustacean of the genus Palæmonetes, which genus had not hitherto been recorded in Australia.

Mineralogical Society, November 9.—Mr. W. Barlow, president, in the chair.—W. **Barlow**: Crystallographic relations of allied substances traced by means of the law of valency volume. The ordinary parameters of a crystal do not necessarily express the actual ratio between the minimum translations of the crystal structure, and it is justifiable to multiply one or sometimes two of them by a small integer in order to obtain the equivalence parameters. A number of cases were taken which showed that in crystals which either contain the same radicle or closely related radicles the similar parts are arranged in identical strata intercalated between the remaining constituents of the crystal.—A. F. **Hallimond**: Torbernite. From measurements made on several specimens the axial ratio, $a:c=1:2{\cdot}947$ was determined, and the forms 001, 101, 103, 111, 112, besides vicinal faces, were observed. The mineral becomes unstable at vapour-pressures about one-third that of water, and passes into Rinne's meta-torbernite I. At higher temperatures the transition-curve rises sharply, and meets the vapour-pressure curve of water at 75° C., above which torbernite has no stable existence in air.—T. V. **Barker**: The solution of the problem of four tautozonal poles. The indices of two poles, C, D, may be expressed as functions of those of the other two, A(*abc*), B (*def*) in the form $(pa+qd,\ pb+qe,\ pc+qf)$, $(ma+nd,\ mb+ne,\ mc+nf)$, where p, q, m, n are small, positive or negative, integers. Since $np\cot AD=(np-mq)\cot AB+mq\cot AC$, a table of natural cotangents enables a numerical example to be solved rapidly. Usually $p=q=1$, and the equation reduces to $n\cot AD=(n-m)\cot AB+m\cot AC$.—L. J. **Spencer**: Crystals of iron phosphide (rhabdite) from a blast-furnace. The small, acicular, tin-white, and strongly magnetic crystals were found sparingly in cavities in a large mass of metal at the bottom of a blast-furnace near Middlesbrough. They are tetragonal (sphenoidal-hemihedral) with the axial ration $a:c=1:0{\cdot}3469$.—Dr. G. T. **Prior**: The meteoric stone of Cronstad, Orange Free State.

Royal Meteorological Society, November 17.—Major H. G. Lyons, president, in the chair.—J. S. **Dines**: The mounting and illumination of barometers and the accuracy obtainable in the readings. The author described the method of mounting and illuminating the barometer in accordance with the plan adopted at the Meteorological Office, South Farnborough. This consisted in hanging the barometer against a window, with a thin wooden screen, 6 in. wide, placed behind it about 1 in. from the tube. In this screen was a narrow slit $\frac{3}{4}$ in. wide, which came immediately behind the top of the mercury column, and admitted light from the window. The opening in the screen was covered with a piece of ground glass or thin paper, which prevented the passage of direct sunlight and gave a diffused illumination in all circumstances. Another feature of the mounting was the clamping of the bottom of the tube as was generally done in the case of instruments of the Fortin type, in order to prevent swinging of the barometer. The paper also contained an account of several sets of comparative readings of the barometer taken by different observers and between different types of instruments, which showed a remarkably close agreement with one another. The prevalent habit of tapping the instrument before reading was not considered desirable.—N. A. **Comissopulos**: The seasonal variability of rainfall over the British Isles. This paper dealt with a method of presenting rainfall statistics brought forward the year previously by Dr. H. R. Mill and Mr. C. Salter in a paper entitled "Isomeric Rainfall Maps of the British Isles." The author has treated the paper in a slightly different manner from the methods in the paper he has discussed, and has made use of the standard deviation as a measure of variability. The conclusions relating to the distribution of rainfall which arise from this method of discussion are the same as those given by the isomeric maps.

PARIS.

Academy of Sciences, November 15.—M. Ed. Perrier in the chair.—T. H. **Gronwall**: Minimum surfaces forming a family of Lamé.—Léon **Bouthillion**: The application to wireless telegraphy with sparks of the method of charging condensers by dynamos of constant E.M.F.—Albert **Colson**: Heats of equilibrium and the law of saturated solutions.—Paul **Bary**: The velocity of solution of liquids in india-rubber. The experimental results of G. Flusin are shown to be exactly represented by a simple formula.—Emile **Saillard**: The action of copper solutions on saccharose. The estimation of invert-sugar in presence of saccharose.—F. **Kerforne**: The presence of mylonites at the base of the Cambrian at the south of Rennes.—J. **Repelin**: New observations of the tectonic of the north-east portion of Basse Provence.—Henri **Coupin**: The ferment action of marine bacteria. Forty-three species of bacteria of marine origin have been studied from the point of view of their action on sugars and starches. Only four species caused no fermentation, and twenty-eight out of the forty-three fermented glucose.—M. **Marage**: Treatment of loss of speech resulting from shock. Loss of speech is frequently caused by the explosion of shells of large calibre, without any apparent lesions, and this is frequently accompanied by deafness. Details of treatment are given for five cases.—G. A. **Le Roy**: Waterproofing military cloths and fabrics. The materials are treated with solutions of sodium aluminate, dried, and then passed through a bath of weak acetic or formic acid. The material thus treated is waterproof, but not impervious to air.—R. **Kœhler**: Description of a new species of Astrophiura.—A. **Vayssiere**: The Eupteropods collected during the scientific expeditions directed by S.A.S. the Prince of Monaco.—Mlle. Janina **Wiszniewska**: Antiphenol serum. In certain fermentative processes in the intestine a specific substance is produced, always producing by injection into animals definite lesions. Although behaving like a phenol with the reagents used for detecting phenols, it is distinct from oxyphenylacetic acid or other known phenol derivatives. By injecting this substance into the horse, an anti-body is produced in the serum of the animal, and this neutralises the antigen, both *in vitro* and in guinea-pigs, rabbits, and dogs.

WASHINGTON, D.C.

National Academy of Sciences (Proceedings No. 11, vol. i.).—R. G. **Harrison**: Experiments on the development of the limbs in Amphibia. At the time of appearance of the tail bud, the anterior limb of Amblystoma is already determined in the mesoderm cells of that region of the body-wall which lies close to the pronephros and ventral to the third, fourth, and fifth myotomes. The prospective significance of this

group of cells as a whole thus is defined some time before differentiation becomes visible.—C. G. **Bull**: A mechanism of protection against bacterial infection. Bacteria circulating in the blood are quickly removed when they are agglutinated or clumped, and the clumps deposited within the organs are taken up by phagocytes and digested. They appear not to be destroyed by solution or lysis through the operation of serum constituents of the blood.—C. A. **Kofoid** and Elizabeth B. **Christiansen**: The life-history of Giardia. *Giardia muris* and *Giardia microti* produce a readily recognisable enteritis in mice, and both binary and multiple fission take place in the free non-encysted stage. There is no Octomitus stage. The morphological characters separate six species. The parasite in mice appears to be distinct from that in man.—F. W. **Clarke** and W. C. **Wheeler**: The stony corals have been repeatedly analysed and with generally concordant results. Thirty analyses here made have confirmed the older data. The object of the investigation is to determine what each group of organisms contributes to the formation of marine limestones. The highest proportions of calcium phosphate are commonly associated with high values for magnesia.—C. R. **Stockard**: An experimental analysis of the origin and relationship of blood corpuscles and the lining cells of vessels. Vascular endothelium erythrocytes and leucocytes, although all arise from mesenchyme, are really polyphyletic in origin; that is, each has a different mesenchymal anlage.

BOOKS RECEIVED.

Scientific Ideas of To-day. By C. R. Gibson. Fifth edition. Pp. 344. (London: Seeley, Service and Co., Ltd.) 5*s*. net.

Mathematics for Machinists. By R. W. Burnham. Pp. viii+229. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 5*s*. 6*d*. net.

Determinative Mineralogy, with Tables for the determination of Minerals by Means of their Chemical and Physical Characters. By Prof. J. V. Lewis. Pp. vii+155. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 6*s*. 6*d*. net.

Properties of Steam and Ammonia. By Prof. G. A. Goodenough. Pp. vii+108. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 5*s*. 6*d*. net.

Wisconsin Geological and Natural History Survey. Bulletin No. xlv. Economic Series. No. 20: The Peat Resources of Wisconsin. By F. W. Huels. Pp. xvii+274. (Madison, Wis.)

Tuberculosis: a General Account of the Disease, its Forms, Treatment, and Prevention. By Dr. A. J. Jex-Blake. Pp. viii+231. (London: G. Bell and Sons, Ltd.) 2*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 25.

ROYAL SOCIETY, at 4.—Special General Meeting to receive the Annual Report of Council: at 4.30.—The Measurement of the Rate of Heat Loss at Body Temperature by Convection, Radiation and Evaporation: M. Flack, O. W. Griffith and L. Hill.—The Growth of the Body in Man; The Relationship between the Body Weight and the Body Length (Stem Length) E. W. A Walker.—The Rate of Absorption of Various Phenolic Solutions by Seeds of *Hordeum vulgare* and the Factors Governing the Rate of Diffusion of Aqueous Solutions across the Semi-permeable Membranes: Prof. A. J. Brown and F. Tinker.—The Controlling Influence of Carbonic Dioxide. Part III. The Retarding Effect of Carbon Dioxide on Respiration: F. Kidd.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Some Difficulties of Design of High-speed Generators: Prof. A. B. Field.

OPTICAL SOCIETY, at 8.—The Influence of Visual Errors in Musketry: J. H. Sutcliffe.

FRIDAY, NOVEMBER 26.

PHYSICAL SOCIETY, at 5.—Obtaining and Maintaining a Bright Hydrogen Spectrum, with special reference to the 4341 Line: J. Guild.—Determination of the Coefficient of Diffusion of Potassium Chloride by an Analytical Method Dr. A. Griffiths.—Apparatus for Evaluating Elliptic Integrals: A. F. Ravenshear.

MONDAY, NOVEMBER 29.

ROYAL SOCIETY OF ARTS, at 4.30.—Optical Glass: Dr. W. Rosenhain.

MEDICAL SOCIETY, at 8.30.—Gas Poisoning: Physiological Symptoms and Clinical Treatment: Dr. Leonard Hill.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Railway Development of Africa, Present and Future: Sir Charles Metcalfe, Bart.

TUESDAY, NOVEMBER 30.

ROYAL SOCIETY OF ARTS, at 4.30.—Recent Developments in Jamaica; Internal and External: Sir Sydney Olivier.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Harbour and Coast-Defence Works at Alexandria: D. E. Lloyd-Davies.—Galvan Port, Bahia Blanca, Argentine: C. A. Trery.

WEDNESDAY, DECEMBER 1.

ROYAL SOCIETY OF ARTS, at 4.30.—Insects and War: Dr. A. E. Shipley.

GEOLOGICAL SOCIETY, at 5.30.—The Petrological Microscope; New or Little-known Methods and Accessories: Dr. J. W. Evans.

ENTOMOLOGICAL SOCIETY, at 8.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Microchemistry of some Alkaloids: Dr. G. D. Lander.—The "Presumptive Coli Test" on Unchilled Water: W. Partridge: Notes on Methods of Analysing Oleaginous Seeds and Fruits: E. R. Bolton.

THURSDAY, DECEMBER 2.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Note on the Existence of Converging Sequences in certain Oscillating Successions of Functions: W. H. Young.—The Emulsifying Action of Soap; a Contribution to the Theory of Detergent Action: S. A. Shorter and S. Ellingworth.—The Newtonian Constant of Gravitation as affected by Temperature: P. E. Shaw.—Skin Friction of the Wind on the Earth's Surface: G. I. Taylor.

FRIDAY, DECEMBER 3.

GEOLOGISTS' ASSOCIATION, at 7.30.—Some Features of the Antarctic Ice: J. D. Falconer.

CONTENTS.

Editorial and Publishing Offices:

MACMILLAN & CO., LTD.,

ST. MARTIN'S STREET, LONDON, W.C.

Advertisements and business letters to be addressed to the Publishers

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.

Telephone Number: GERRARD 8830.