

required information attaches to the secretary or person performing the duties of secretary to the governing body, or, if there is no governing body, the headmaster or person responsible for the management of the school or institution. Notice will be given in due course as to any further particulars which may be required under regulations made by the Board of Education. The Act lays it down that if such responsible person fails to furnish the information required, he will be liable to certain specified penalties. The particulars now demanded are necessary so that the Board of Education may have available the full facts as to the provisions for education in England and Wales, and of the use which is being made of them.

### SOCIETIES AND ACADEMIES.

#### LONDON.

**Royal Society**, February 20.—Sir J. J. Thomson, president, in the chair.—S. S. Zilva and E. M. Wells: Dental changes in the teeth of the guinea-pig produced by a scorbutic diet. The structure of the teeth of guinea-pigs subsisting on a scorbutic diet undergoes radical changes. The ultimate change is characterised by the total disorganisation of the pulp, including the odontoblastic cells. The earliest modification is observed at a period when no other systemic abnormality can be recorded with certainty, and is characterised by the alterations in the odontoblastic cells and by the dilatation of the blood-vessels of the pulp. Monkeys' teeth are also affected when these animals exist on a scorbutic diet. The bearing of the above results on human subjects is discussed.—W. E. Bullock and W. Cramer: A new factor in the mechanism of bacterial infection. The bacteria of gas-gangrene (*B. welchii*, *Vibrio septique*, and *B. oedematiens*) and of tetanus, when completely freed from their toxins, either by washing or by heating to 80° for half an hour so that spores are formed, do not produce the specific disease when injected into a mouse or a guinea-pig. The normal animal disposes of the bacteria mainly by lysis, and partly also by phagocytosis, and this defensive mechanism is so efficient as to render these bacteria non-pathogenic when injected by themselves. If a small dose of a soluble, ionisable calcium salt is injected together with the bacteria of their spores, the specific disease is elicited in a very virulent form. The chlorides of sodium, potassium, ammonium, strontium, and magnesium, when injected together with *B. welchii*, are not capable of producing gas-gangrene. From these experiments and other experimental evidence the conclusion is drawn that calcium salts, when injected subcutaneously, produce a local change in the tissues at the site of injection. The effect of this dosage is to bring about a local breaking down of the defensive mechanism against the bacteria of gas-gangrene and tetanus. The term "kataphylaxis" is proposed to designate this new phenomenon. Sterile watery extracts of earth are capable of producing this phenomenon.—Major W. J. Tulloch: The distribution of the serological types of *B. tetani* in wounds of men who received prophylactic inoculation, and a study of the mechanism of infection in, and immunity from, tetanus. In a previous communication to the Royal Society it was shown that *B. tetani* was susceptible of classification into a number of groups differing one from another in their serological reactions. As this finding might have an important bearing on the preparation of anti-toxin, as many strains of *B. tetani* as possible were investigated by the agglutination method: (i) from cases of the disease; (ii) from wounds of men showing no evidence of tetanus. The

results obtained show that Type I. bacilli are but relatively infrequently obtained from wounds of inoculated men suffering from tetanus. Thus 19 out of 25 (76 per cent.) strains obtained from the wounds of men who showed no evidence of tetanus proved to be Type I. bacilli, while 41 per cent. of the strains obtained from men suffering from the disease proved to be of this type. This observation suggested that there was possibly a mono-typical immunity to each serological type, for the serum used for prophylaxis was prepared mainly from the products of Type I. bacilli. Experiments show that mono-typical anti-toxin neutralises the toxins of all the types. The precise quality, as well as the degree, of tissue debility produced by injury is of importance in initiating the process of infection in tetanus.

**Zoological Society**, February 18.—Dr. A. Smith Woodward, vice-president, in the chair.—R. I. Pocock: External characters of existing Chevrotains (*Tragulina*). The Indian species, commonly cited as *Tragulus memminna*, differs in so many important characters from the Malaysian species that it is necessary to sever it from them as a distinct genus, for which the name *Maschiola*, used by Thomas in a sub-generic sense, is available. In the absence of the interramal scent-gland, in the structure of the penis, and in the retention of shots on the pelage, *Maschiola* is a more primitive type than *Tragulus*, and resembles the still more primitive West African genus *Hymoschus*.—K. M. Smith: A comparative study of certain sense-organs in the antennæ and palpi of Diptera.

**Institution of Mining and Metallurgy**, February 20.—Mr. Hugh F. Marriott, president, in the chair.—S. J. Truscott: Slime treatment on Cornish frames: supplements. This paper, which is one of a series published by request of the Tin and Tungsten Research Committee, relates to a number of experiments conducted with the view of determining the comparative values of fluted and plane surfaces, the most suitable length of bed, and other details connected with the improved recovery of tin in Cornish mills. A number of tests are recorded, made under varying conditions, and the results are embodied in a *résumé* which, after noting the factors governing frame-working which are thereby established, further deals with conclusions in respect to policy, with particular regard to rapid enrichment and complete fine grinding. The paper is illustrated by flow sheets explaining the practice on various Cornish properties.—E. Edser: The comparison of concentration results, with special reference to the Cornish method of concentrating cassiterite. This paper embodies an attempt to determine the relation between the enrichment attained by repetition of the concentration process, and the cassiterite that is lost. It is first assumed that the assay of any small increment washed off the surface used for concentration is proportional to the assay of the material on the surface, and it is shown that the assumption is correct, the amount of cassiterite lost during a complete washing being inversely proportional to the  $n^{\text{th}}$  power of the enrichment effected. The value of  $n$  thus indicates the economy of the process; the smaller the value of  $n$  the more economical will be the process. Experimental data are shown to support the conclusions reached, but additional investigations are called for.—G. F. J. Preumont: Wolfram mining in Bolivia. In view of the fact that wolfram is a product of outstanding importance, and that Bolivia is now yielding quite a considerable proportion of the world output, this paper should be of timely interest. A collection of statistics showing the production and distribution of wolfram in Bolivia

is followed by detailed descriptions of the principal mines and deposits, and particulars of the costs, system of working, conditions of labour, and mining laws.—C. W. **Gudgeon**: The Giblin tin lode of Tasmania. This is a deposit which has so far not been the subject of any published description. Like many another property which has since made good, this lode experienced a chequered career before reaching its present position. The author considers this to be a good example of persistence of ore in depth.

#### MANCHESTER.

**Literary and Philosophical Society**, February 18.—Mr. W. Thomson, president, in the chair.—Dr. H. **Wilde**: The mutual relations of natural science and natural religion.—J. Wilfrid **Jackson**: (1) "Shell-pockets" on sand dunes on the Wirral coast, Cheshire. The paper consisted of a short account of "shell-pockets" in general, and contained remarks on the age of the buried land surfaces in the neighbourhood. (2) A new Middle Carboniferous Nautiloid (*Coelonautilus trapezoidalis*). The species is founded upon two specimens: one from the Lower Coal Measures near Colne, erroneously figured by Wild in 1892 as *Nautilus subsulcatus*, the other from the Pendleside series, Pule Hill, Marsden. The species differs from *C. subsulcatus* in several important details, but presents some affinity with *C. quadratus*.

#### EDINBURGH.

**Royal Society**, January 20.—Dr. John Horne, president, in the chair.—Prof. **Harvey-Gibson** and Miss **Elsie Horsman**: Contributions towards a knowledge of the anatomy of the lower Dicotyledons. II.: The anatomy of the stem of the Berberidaceæ.—Also Miss **Christine E. Quinlan**: Contributions towards a knowledge of the anatomy of the lower Dicotyledons. III.: The anatomy of the stem of the Calycanthaceæ. These two papers are parts of a general investigation into the affinities of the lower Dicotyledons and the Monocotyledons, and contain a number of anatomical facts regarding the stem which support the view that the Dicotyledons are the primitive forms, from which the Monocotyledons have been derived.—Miss **Maud D. Haviland**: The life-history and bionomics of *Myzus ribis*, Linn. (red-currant Aphis). Among the many facts established it was shown that there are two forms of this species which differ in the minute structure of the antennæ and in the dimensions of the abdomen and wings, and are apparently correlated with the nature of the food. The species is migratory, and in summer colonises certain species of labiate and other weeds, but this change of host-plant is not obligatory, and the entire life-cycle may be passed on the red currant. There is a decline in fertility in the later summer, caused probably by lower birth-rate. This may be considered as one of the factors accounting for the frequent disappearance of the species in August and September.—Dr. C. G. **Knott**: Further note on earthquake waves and the interior of the earth. There was evidence that as the compressional and distortional seismic waves penetrated to greater depths, the distortional wave reached its maximum velocity at a less depth than the compressional wave. In other words, the rigidity showed signs of falling off in value, while the incompressibility continued to increase. The hypothesis that the earth consisted of a nucleus of non-rigid, highly compressed material encompassed by a shell possessing the properties of an elastic solid was found to fit well in with the facts, the radius of the nucleus being assumed to be four-tenths of the radius of the earth. These conclusions were based on the accurate determinations of

the velocities of the seismic waves at various depths, and are in fair agreement with the views formerly advanced by Mr. R. D. Oldham.

February 3.—Dr. John Horne, president, in the chair.—Dr. J. M'L. **Thompson**: The stelar anatomy of *Platyzoma microphyllum*, R. Br. The conductive system of the stem of the Australian fern *Platyzoma* lies between the two extreme types of conductive systems in modern ferns. These are known as the protosteles, with a solid cylinder, and the solenostele, characterised by a pithed tubular cylinder with both outer and inner phloëm and with gaps in its wall. In the *Platyzoma* there is the pithed cylinder, but no gaps and no inner phloëm. In the majority of specimens examined the conductive system was an unbroken and unperforated pithed cylinder, but in the smallest, and apparently youngest, specimen the conductive system was locally a protosteles which was directly transformed as the stem was followed forward into the pithed cylinder without gaps in the wall and without inner phloëm. The facts were in favour of the view that the stele of *Platyzoma* is the result of upgrade development directly from within an original protosteles.—Capt. E. W. **Shann**: The comparative anatomy of the shoulder-girdle and pectoral fin of fishes. The observations extend over a wide series of fish types, such as Rhina, Callorhynchus, Accipenser, Polypterus, and Zeus. A new nomenclature was introduced based on the divisions of the great lateral muscles which are found to be constant for any particular group of fishes. The primitive nature of the muscle system in Selachians is emphasised. Among the Holocephali certain characters foreshadow the condition which obtains in the higher vertebrates.—Sir Thos. **Muir**: Note on the determinant of the primary minors of a special set of  $(n-1)$ -by- $n$  arrays.

#### PARIS.

**Academy of Sciences**, February 17.—M. Léon Guignard in the chair.—A. **Rateau**: The flow of gas at very high pressures. The classical formulæ are based on the gas law  $p v = RT$ , and these become inexact when  $p$  is high, several hundred atmospheres. Formulæ based on the characteristic equation  $p(v - \alpha) = RT$  are developed.—J. **Drach**: The integration by quadrature of the equation  $d^2y/dx^2 = \phi(x) + h/y$ .—J. **Cabannes**: The diffusion of light by the molecules of the air. The proportionality predicted by the theory of Lord Rayleigh, between the luminous intensity diffused laterally by a transparent gas and the number of molecules in the illuminated volume, has been exactly verified by a method of photographic photometry devised by MM. Fabry and Buisson. Since certain ultra-violet radiations cause some complications, it is advisable, in the experimental verification, to suppress radiation with a wave-length below  $0.3\mu$ .—P. **Braesco**: Precipitated amorphous silica. From experiments on the coefficient of expansion it is concluded that precipitated silica, dehydrated and heated to  $600^\circ \text{C}$ ., is really amorphous silica, but if calcined at temperatures above  $1000^\circ \text{C}$ . it becomes crystalline in the form of cristobalite.—M. **Portevin**: The influence of various factors on the critical speed of tempering in carbon steels.—P. **Nicolardot** and A. **Reglade**: The estimation of zirconium. In a solution containing 20 per cent. of sulphuric acid zirconium can be quantitatively separated from iron, aluminium, and chromium by ammonium phosphate.—G. **Delépine**: The carboniferous limestone in the Lille district.—A. **Vacher**: An old direction of the Rance valley.—G. **Reboul** and L. **Dunoyer**: A rule for predicting barometric variations and its coefficient of certainty.—E. **Mathias**: Sketch of a theory of rain. The influence

of altitude.—**M. Mollard**: The production of citric acid by *Sterigmatocystis nigra*.—**E. Fauré-Fremiet** and **F. Vlès**: Are the laws of cicatrisation of wounds reducible to the general laws of growth of organisms?—**A. Lécaillon**: The reproduction and development of accidental bivoltins and of the first generation derived from them in the silkworm.

## SYDNEY.

**Linnean Society of New South Wales**, October 30, 1918.—**Prof. H. G. Chapman**, president, in the chair.—**Dr. R. J. Tillyard**: The Panorpid complex. Part ii.: The wing-trichiation and its relationship to the general scheme of venation. The hairs found upon the wings of all Holometabolous orders are classed as (1) *microtrichia*, minute hairs developed in connection with every unspecialised hypoderm cell of the wing, and (2) *macrotrichia*, larger hairs of the nature of sensillæ, only developed from special trichogen cells of large size. The arrangement of these hairs is called the wing-trichiation. The venational scheme is shown to consist of (1) *main veins* and their branches, which are preceded by tracheæ in the pupal wing; (2) true *cross-veins*, not preceded by tracheæ; and (3) the *archedictyon*, or original Palæodictyopterous meshwork formed of irregular venules, and only found complete in fossils. The Triassic fossil *Archipanorpa* possesses all these elements, but the archedictyon is aphantoneuric, or in process of becoming absorbed into the wing-membrane. With this fossil as a basis, the trichiation of the wings of all the orders of the complex is studied. It is shown that the most archaic forms all agree in having *microtrichia* all over the wing, but *macrotrichia* only upon the main veins and upon the membrane (the latter were originally carried upon the archedictyon, but became seated on the membrane when the meshwork disappeared), and not upon the true cross-veins. The various lines of evolution are followed out, showing a tendency in some orders to suppression of both kinds of hairs, and in others to the specialisation of the *macrotrichia* as scales, as in the Lepidoptera. Conclusions are drawn as to the probable phylogenies of the Orders.—**Dr. H. S. H. Wardlaw**: The relation between the fat-content and the electrical conductivity of milk. Removal of fat from milk increases the electrical conductivity. In a given sample of milk the increase of conductivity is directly proportional to the volume of fat removed. The increase of conductivity due to the removal of a given amount of fat is not the same, however, in different samples of milk. The average increase of conductivity due to the removal of 1 per cent. by volume of fat is 1.5 per cent.—**J. L. Froggatt**: A study of the external breathing apparatus of the larvæ of some Muscoid flies. It is shown that the maggots of blowflies of five species pestilent to sheep can be identified by the characters of the anterior and posterior spiracles, especially of the latter.—**W. W. Froggatt**: Notes on Australian sawflies (Fenthredinidæ). Particulars about four species are given, including a record of the death of cattle in Queensland from the abnormal habit of eating the larvæ of *Pterygophorus analis*.—**R. H. Cambage**: Notes on the native flora of New South Wales. Part x.: The Federal capital territory

## WASHINGTON, D. C.

**National Academy of Sciences**, December, 1918 (Proceedings, vol. iv., No. 12).—**W. S. Adams**: The absorption spectrum of the novæ. A discussion of Nova Aurigæ of 1892, Nova Persei of 1901, Nova Geminorum of 1912, and Nova Aquilæ of 1918. The displacements of the lines in all these stars

are directly proportional to wave-lengths, and divide themselves into two pairs of equal amount. Of these the first pair of stars has exactly twice the displacement of the second. In the case of Nova Aquilæ there is a progressive increase in the values of the displacements of the absorption lines at successive dates. Various hypothetical explanations are discussed.—**D. N. Lehmer**: Jacobi's extension of the continued fraction algorithm. A closer study of Jacobi's expansion reveals a number of remarkable points. Six theorems are stated.—**R. L. Moore**: A characterisation of Jordan regions by properties having no reference to their boundaries. The theorem is proved. In order that a simply connected, limited, two-dimensional domain  $R$  should have a simple closed curve as its boundary, it is necessary and sufficient that  $R$  should be uniformly connected *im kleinen*.—**J. A. Harris** and **F. G. Benedict**: A biometric study of human basal metabolism. An analysis of measurements on 136 men, 103 women, and 94 new-born infants.—**A. M. Banta**: Sex and sex intergrades in Cladocera. The presentation of facts in regard to Cladocera, with the discussion of their significance with regard to sex intergrades in general, leading to the tentative conclusion that sex is always relative; and that while most individuals of whatever species are prevailingly male or prevailingly female, every individual may have something of the other sex intermingled with its prevailing sexual characters.—**W. J. Crozier**: The method of progression in Polyclads. In Turbellarians generally muscular operations analogous to those executed by the foot of Chitons and of Gastropods are essentially concerned in creeping locomotion.—**R. Ruedemann**: The phylogeny of the acorn barnacles. The derivation of an Eobalanus from a Rhinocaris-like Phyllopod is illustrated in a set of diagrams.—**J. M. Clarke**: Possible derivation of the Lepadid barnacles from the Phyllopods. So far as present knowledge extends, the metamorphoses of the Phyllopods into the two great branches of the barnacles were essentially contemporaneous.—**T. W. Richards** and **W. C. Schumb**: Refractive index and solubilities of the nitrates of lead isotopes. The difference in atomic weight of the lead (207.20 and 206.41) has no appreciable effect on the refractive index or on the molal solubility of the different samples of lead nitrate.—**T. W. Richards**, **W. M. Craig**, and **J. Sameshima**: The purification by sublimation and the analysis of gallium chloride. The method rests on the fact that gallium trichloride sublimes and distils at a low temperature, whereas the other chlorides likely to be associated with it are much less volatile.—**T. W. Richards** and **S. Boyer**: The purification of gallium by electrolysis, and the compressibility and density of gallium. The method of separating gallium from indium by means of the different solubilities of the hydroxides in caustic alkali was tested without success; much more promising results were obtained by the electrolytic method. The compressibility of solid gallium was found to be  $2.09 \times 10^{-6}$ , and of liquid gallium  $3.97 \times 10^{-6}$ , nearly twice as great, although its volume is less. The density of the liquid was 6.081, and of the solid 5.885.—**A. G. Mayor**: The growth-rate of Samoan coral reefs. The growth-rate of Acropora, Porites, Pocillopora, Pavona, and Psammocora are given, and the weight of limestone added per year to the upper surface of the Aua reef-flat is estimated as 805,000 lb. Other similar estimates are given.—**A. van Maanen**: The distances of six planetary nebulæ. The nebulæ N.G.C. 2302, 6720, 6804, 6905, 7008, and 7662 are examined. The parallaxes range from 0.002" to 0.021", and the diameters from 10,000 to 1350 astronomical units.