Research Items.

CHINESE GONGS.—Major E. C. Kenny, in *Man* for September, describes the two types of rare 'Chinese gongs' which are found in Burma, and usually called by the English residents there 'Karen War Drums.' They are now only found in the little frontier State of Karenni. The gongs are of two types, and of these the taller and more modern were made up to a time so recent as 1894 by the Shan for their overlords the Karen. The flatter ancient type is beyond doubt of Chinese origin, and is very rare. The Karen assert that these latter were not made by human agency at all, but by spirits, who are said to assume the forms of beautiful maidens and to sing sweetly in the jungle on the outskirts of villages, attracting youths whom they destroy. One gong of this type in the British Museum is dated "Made by Chang Fu in the 7 month of the 4 year of the reign of Chien Hsing," *i.e.* A.D. 226. The gongs are designated 'male' and 'female' according to whether they are decorated or not, the latter being the male, and are frequently found in pairs. The drums are used for crop and other festivals, and periodically for summoning the outlying villages ; but apparently never for war.

THE STONE BATTLE-AXE.—The spread of the stone or copper battle-axe is discussed by Prof. H. J. Fleure and Mr. Harold Peake in a communication in *Man* for September. They take the view that the axe-hammer with a shaft-hole was probably first made in metal and that the oldest example published is that from Cemetery A at Kish, dated at 3100–3000 B.C., although older examples have recently come from Ur. Although it may seem a far cry from Mesopotamia to a European centre, the connexion between early Kuban and the Cyclades has been demonstrated, while the former has too many elements of kinship with Mesopotamia to leave any doubt of their common origin. It is suggested that it was through the Cycladic contact with Kuban that the battle-axe entered Cycladic Minoan culture in Early Minoan II. The early metal axe of copper had the butt end bent round to form the shaft-hole, and the earliest cast specimens had the hole nearer one end. When copied in stone the axe would have one cutting-edge with the shaft toward the butt end, though not so near as in the metal type, to avoid splitting. It has been argued that of the British perforated axes, those with the hole nearer one end are earlier than those in which it is situated centrally. It is agreed that in the Baltic area the stone battle-axe underwent great development, but even here a copper axe from Norway would serve as a metal prototype. The authors' view is that in the Baltic area the only culture was that of the shell mounds until the Megalithic culture impinged on it from the south-west and the culture of the battle-axe and fine flint work came from the south-east.

INTERNATIONAL HERRING INVESTIGATIONS.—*Rapports et Procès-verbaux des Réunions*, vol. 41, of the Conseil Perm. Internat. pour l'Expl. de la Mer, contains a good deal of information concerning the present state of our knowledge of the herrings in the North Sea, and sets out the programmes of investigations which are being undertaken by the countries interested. The immense value of continuous observation over an extended period is admirably demonstrated by the striking results achieved by the Norwegian investigators through an unbroken series of years from 1907 to the present time. Mr. Einer Lea's preliminary report on these results, and his discussion on the most

satisfactory method of summarising the observations for one season so as to give the best possible representation of the age-composition of the stock, will be read with interest. The report on Scottish investigations regarding the larval and post-larval stages of herring in the northern North Sea not only indicates the immediate difficulties experienced, but also demonstrates the general fact that great caution must be exercised when estimating age from scales of adult fishes. Evidence is advanced that some of the Scottish post-larvæ acquire scales during the calendar year in which they are born, so that their first winter of life is recorded on the scale as a winter-ring. Others, however, remain in the unscaled condition until the year following birth, the first winter-ring not being formed on the scale until the *second* winter of life. This fact very materially adds to the difficulty of estimating the age and origin of the adult fishes which visit Scottish waters.

FISH EGGS AND LARVÆ FROM THE JAVA SEA.— In vol. 8 and vol. 9 (1926) of *De Treubia*, Dr. H. C. Delsman gives a detailed account of his studies of fish eggs and larvæ from the Java Sea. His observations of the time of the day at which spawning appears to occur, and of the length of the incubation period of some of the eggs, are particularly interesting. Thus, the eggs of three species of the genus Caranx are all set free at a definite time towards midnight. At 9 A.M. on the following morning, that is, less than 12 hours after, those of *C. macrosoma* hatch out. Between 11 A.M. and 1 P.M. those of *C. kurra* hatch, while at 6 P.M. the young of *C. crumenophthalmus* emerge. In the course of egg-sampling with tow-nets, therefore, the eggs of *C. macrosoma* are to be found only in early morning hauls ; those of *C. kurra* disappear from the tow-nets at about 1 P.M., so that in the afternoon only those of *C. crumenophthalmus* remain. These results are in accordance with a general rule that larger, more yolk-laden eggs take a longer time for their development than smaller ones with less yolk. Equally striking is the author's account of the growth of the embryo assigned to *Clupea fimbriata*. Eggs taken at 7 A.M. showed only a small germinal disc and had evidently been laid shortly before capture. At 8.45 A.M. the germinal disc had grown half round the circumference of the egg, and the first indication of the embryo had appeared. At 10.45 A.M. the blastopore closed and the rudiment of the embryo had grown more distinct. During the afternoon the tail grew out, the embryo began to 'sprawl' within the spacious egg-membrane, and at 6 P.M. it hatched. Some idea of the speeding-up of the incubation period can be gathered from the comparison between the hatching of *Scomber kanagurta* in less than 24 hours, and that of the mackerel (*Scomber scomber*) in 6 days in British waters, or with the 5 days for the American mackerel.

JAPANESE FRESHWATER BRANCHIOPODA.—M. Ueno (*Mem. Coll. Sci. Kyoto Imp. Univ.*, B, vol. 2, No. 5, art. 12, 1926) gives a list and some details of the genera, species, and varieties of freshwater branchiopoda hitherto found in Japan, together with a few records from eastern China. Of the thirty-one species of Cladocera, twenty-five are found also in Europe, but the Japanese Phyllopoda belong to species not represented in Europe. The author is inclined to believe that Japanese examples of the Cladocera are generally smaller in size than corresponding specimens from Europe or America, but he adds that further study is required before this can be decided.

GROWTH OF PARAMŒCIUM.—F. Mizuno has made careful observations (*Science Reports, Tôhuku Imp. Univ.*, 4th series, vol. 2, No. 4, 1927) on the normal growth of *Paramœcium caudatum*. He found that at a temperature of 24°-26° C., division occurs at the end of eight or nine hours and that there was no difference in the rate of division between examples in light and others in the dark. More than 600 specimens were killed at definite intervals after fission had occurred and they were drawn, their length and breadth measured, and their area determined by a planimeter. Immediately after fission, the daughter Paramœcia increase markedly in length but decrease in breadth ; that is, there is a change in their form. Size cannot therefore be estimated by measuring only the length, and as the volume could not be accurately ascertained, the most satisfactory method appeared to be the careful determination of the area. When the areas of specimens killed at known times after fission are plotted, they show that the growth of Paramœcium is represented by a linear curve.

LENS DESIGN.—In *Scientific Paper of the Bureau of Standards*, No. 559, ·Mr. I. C. Gardner deals with the application of the third order algebraic aberration equations for a thin lens to the design of lenses to fulfil given conditions. Up to the present, there has been no book giving the third order aberrations in a form quite satisfactory for this purpose, and it has been difficult for a designer to get any information between that given in elementary text-books and that to be found in works on instrument design and other specialised problems. The notation adopted is substantially that of von Rohr, but by the introduction of a modification in that of Taylor, it has been possible to give the results in each of the two notations. The sign of the distance of a point from the lens is positive if in moving with the incident light one passes through the lens before reaching the point. Designs of thin lenses and of systems containing thin lenses and prisms are worked out in detail by the author, and the paper of 130 pages should be of great help to the optical designer.

MOLECULAR VOLUMES AT ABSOLUTE ZERO.—In two interesting papers in the August number of the *Journal of the Chemical Society*, S. Sugden has shown that the simple equation $D - d = D_o(1 - T_r)^{3/10}$ applies with great accuracy to Young's results for the liquid and vapour densities of thirty substances. D, d are the densities of liquid and saturated vapour, D_o is the density at the absolute zero, T_r is the reduced temperature. The equation contains two constants, D_o and the critical temperature, only. It is therefore possible to calculate M/D_o, the molecular volume at the absolute zero. This magnitude, V_o, is shown empirically to be a nearly constant fraction, the values ranging from 0·264 to 0·280, for a number of substances. The value for hydrogen in 0·373. The equation proposed by Sugden is a special case of a general one proposed by Verschaffelt, but the constants chosen give better results. The results apply also to associated liquids. It is further shown that values of V_o can be predicted by adding together certain characteristic constants for the atoms and structures present in the molecule for a very large number of compounds.

RETURN CIRCUITS IN ELECTRIC TRAMWAYS.—In electric tramway systems, for the sake of economy, it is customary to use the rails as part of the circuit connecting the dynamos at the tramway power station with the motors on the car. These rails are connected through the tram wheels with the negative poles of the dynamos, and as they have to carry a large current, an appreciable difference of potential exists between various points on their lengths. As they are not insulated, only part of the return current flows by the rails, the rest flowing through the earth, the pipes of water and gas companies, and the coverings of telephone cables. The possibilities of serious electrolytic corrosion in large telephone cables by these leakage or 'vagabond' currents has made traction engineers consider whether the present precautions are sufficient. In *World Power* for September, G. W. Stubbings gives a helpful contribution to the subject. The Ministry of Transport has imposed the regulation that the difference of potential between any two points on the rails must not exceed 7 volts. This regulation has been in use for many years and so far has been found quite satisfactory. The replacement of overhead telephone wires by underground cables is a new fact that has to be considered. When the current flows from the cable sheath to the rails there are risks of serious erosion occurring. A further restriction has been imposed, that the maximum potential difference between the rails and a buried pipe in its vicinity shall not exceed 1·5 volts when the rail is negative to the pipe and 4·5 volts when the rail is positive to the pipe. This restriction seems desirable, but to apply it equitably in practice is difficult. In Great Britain, traction engineers as a rule rely on maintaining the potentials of the rails low by means of special dynamos taking current from definite points of the rails through insulated circuits. Mr. Stubbings considers the relative merits of this method and that of using special copper conductors. Many interesting mathematical problems arise.

ELECTRIC MOMENTS OF ORGANIC MOLECULES IN BENZENE SOLUTION.—Measurements of the dielectric constants of binary systems in which the first component (*e.g.* benzene) is known to have no electric moment allow of the calculation of the electric moment of the molecule of the second component. The equation used is a combination of the familiar Clausius-Mosotti law with a result deduced by Debye, in which the molar polarisation is shown to be a linear function of the reciprocal of the absolute temperature. In the July number of the *Journal of the American Chemical Society*, J. W. Williams and I. J. Krchma apply this formula to the results found with a number of solutions in benzene. The values for the electric·moments of the solute molecules vary from zero for carbon tetrachloride to 1·70 × 10⁻¹⁸ for phenol ; ethyl ether has the value 1·22 × 10⁻¹⁸, chloroform 1·10 × 10⁻¹⁸, and chlorobenzene 1·55 × 10⁻¹⁸. These are in good agreement with previous results with the pure substances. These results are clearly of importance in certain fields of speculation in organic chemistry. An interesting result is that the moment of symmetrical xylene is very small, whilst it is appreciable in the case of unsymmetrical xylene.

THE SUPPOSED PHOSPHORUS SUBOXIDE, P_2O.— From time to time various lower oxides of phosphorus have been described, but most of these have been shown to be impure amorphous phosphorus. One of them, Besson's oxide, P_2O, has been investigated by Chalk and Partington, whose results are described in the August number of the *Journal of the Chemical Society*. It is shown that the supposed oxide is again an impure form of amorphous phosphorous, contaminated with the materials used in the preparation described by Besson. The existence of an oxide of phosphorus below P_4O_6 should therefore still be regarded as extremely doubtful.

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