

RESEARCH ITEMS

Fishes from the Philippines

Bulletin, 13, 100, of the United States National Museum (1941), is the sixth volume of Henry W. Fowler's studies of the fishes collected by the United States Bureau of Fisheries steamer *Albatross* in the Philippines. This is mainly on the primitive fishes, following through the various groups of living forms to the more generalized bony types. The greater part deals with the sharks, rays and chimæras, but among the bony fishes clupeoids, catfishes and carp are included. It is a handsome volume of nearly nine hundred pages and will be of much use to systematists not only for the description of species but also for the analyses given of sub-classes, orders, families and genera which include general definitions. The type of each genus is noted but the species dealt with are only those occurring in the area studied. Most of the localities recorded relate to the Philippines, but other regions where the *Albatross* cruised, as the Netherland Indies, China, Formosa and parts of Oceania, are also listed. General and very brief notes on breeding and food in the various families are occasionally given. More of this would be welcome. The statement on p. 24 that all the Scyliorhinidæ, so far as is known, appear to be viviparous, is obviously a slip, as the egg cases and attachments to weeds and rocks are described.

Study of a Deepwater Fish

WILBERT McLEOD CHAPMAN ("The Osteology and Relationships of the Bathypelagic Fish *Macropinna microstoma* with notes on its Visceral Anatomy", *Ann. and Mag. Nat. Hist.*, Eleventh Series, 9, No. 52; 1942) has described previously the external anatomy of this fish (1939) and indicated its relationships with *Opisthoproctus*. He found, however, that there were sufficient differences from the latter to warrant the formation of a new family. A further specimen being available for anatomical study the skeleton was worked out in detail, also the gross visceral anatomy, and, to some extent, the musculature. Of particular interest are the great changes in the head region occasioned by the enormous dorsally directed eyes, the peculiarities of the oral regions, and the absence of an air bladder. The new family Macropinnidæ is proposed to include the genus *Macropinna*, while in the family *Opisthoproctidæ* the new genus *Grimaldia* is proposed for *Opisthoproctus grimaldi* Zugmayer. The relationships of other little-known genera are also discussed.

Accuracy of a Few Observations in a Large Population

W. L. STEVENS (*J. Genetics*, 43, 301; 1942) points out that the customary attachment of an estimated standard error to indicate the limits of accuracy of a mean value may lead to misinterpretation in those cases where the distribution is not normal and the value is based on small numbers. Such a case is the estimate of a mutation-rate in a population N where the ratio n/N (n being the number of observed mutations) is very small. For example, the occurrence of three mutations in 1431 cultures gave a mutation rate of 0.21 per cent ± 0.12 ; thus a negative mutation rate would be perfectly reasonable with such a method of estimating the limits of accuracy. To overcome these difficulties, the author provides a useful table whereby the limits of accuracy of values

based on less than fifteen individuals may be rapidly estimated. For genetical work and possibly in other directions this table will be of great service.

Cell Division in Small and Large Cells

E. W. SINNOTT (*Proc. Nat. Acad. Sci.*, 28, 36; 1942) has shown that large and small cells divide and multiply at the same rate in the fruits of several cucurbits where cell division is in progress. Therefore he concludes that cell division is controlled by some factor, independent of cell size, throughout the different tissues of an organ.

Carbonization

EXPERIMENTS on the gaseous products of carbonization by heating of cellulose, glycine, petroleum coke, bakelite, anthracite and bituminous coal (K. Bolton, J. E. Cullingworth, B. P. Ghosh and J. W. Cobb, *J. Chem. Soc.*, 252; 1942) throw some interesting light on the mechanism of the process. Substances forming a solid residue form a repatterning of carbon atoms in a hexagonal network which resists any disintegrating tendency of further temperature rise and forms graphitic crystallites. It is established at 400°–500° and its progress is accompanied by a rise in density, rapid up to 800° (in coal, etc., such material is initially present). The other molecular groups form no part of this pattern or are easily detached from it, and are volatilized and expelled with rise of temperature. Some gaseous products (carbon dioxide and some carbon monoxide) appear early; the chief gaseous products (methane, hydrogen and carbon monoxide) come later and are regarded as formed from the more firmly attached CH_3 , H and OH radicals by molecular condensations of the type: $R_1\text{H} + \text{CH}_3R_2 = R_1R_2 + \text{CH}_4$. The maximum emission of methane is at 500°–600°, the maximum hydrogen and carbon monoxide at 700°–800°. The latter is supposed to be formed from steam by a water gas reaction. The amounts of higher paraffins and unsaturated hydrocarbons are small with the substances tested.

Separation of Isotopes

THE separation of isotopes of oxygen and nitrogen by means of fractionating columns working with water and ammonia solutions has proved very successful. Some of these columns are very tall (60 ft. or more) and the question of packing becomes important, among other ways in that of expense. H. G. Thode and F. O. Walkling (*Can. J. Res.*, 20, 61; 1942) have used a packing which is inert, cheap and easily wetted, which has given results and is suggested for use in industrial separation of isotopes. This was a shale which had been passed through a furnace at a temperature well above the melting point, the clinkers being crushed, cleaned and graded according to particle size. The fractionating column was tested with water and ammonia solution. In the second case a 60 per cent solution of ammonium nitrate is pumped to the top of a fractionating column at a constant rate, drains to the foot of the column where it reacts with alkali to liberate ammonia, which is stripped and returns to the column where it flows to the top against the current solution. Since ^{15}N is favoured in the liquid phase, there is a net transport of it towards the foot of the column, where it concentrates. The apparatus is worked at room temperature and 10 cm. pressure. Some figures for different types of packing are given.

Faxén-Waller Theory of Diffuse X-Ray Scattering

An elementary derivation of the Faxén-Waller formula for the diffuse scattering of X-rays by thermally excited lattice vibrations and the shapes of the surfaces of isodiffusion in reciprocal space for some cubic crystals has recently been given by H. A. Jahn (*Proc. Roy. Soc., A*, 179, 320; 1942). It is shown that for substances with high elastic anisotropy large deviations from spherical character are to be expected for the surfaces of isodiffusion belonging to each of the individual lattice planes and, moreover, marked differences in shape between surfaces belonging to different lattice planes. The theory is illustrated by calculations made for a single crystal of sodium.

Magnetostriction

F. Brailsford and R. G. Martindale describe the results of an investigation into the magnetostriction of five grades of iron and silicon-iron electrical sheets, including a cold-rolled silicon steel and a high silicon steel (*J. Inst. Elec. Eng.*, 89, Pt. 1, No. 17, May, 1942). The silicon content varied from 0.14 per cent to 6.26 per cent. Measurements were made on strip specimens 24 in. long by 2 in. wide by 0.014–0.016 in. thick. A solenoid 20 in. long and 3 in. inside diameter was used to magnetize the strip, the magnetic circuit being completed by a massive laminated yoke. Measurements of magnetostriction were confined to a length of 5 in. at the centre of the specimen, and the variation of flux density over this length was less than 5 per cent. Changes in length were measured by a small extensometer specially developed for the purpose. Readings were made by a telescope and cross-wires on an illuminated scale, the magnification being rather more than 100,000. As the scale could be read to 0.01 in., a change in length of 10^{-7} in. could be detected. A typical maximum magnetostrictive strain of 4×10^{-6} could, therefore, be read to about $\frac{1}{5}$ of 1 per cent. Magnetostriction in the sheet materials was found to vary considerably, depending upon the direction in the sheet relative to the rolling direction. The general form and direction of traversal of the hysteresis loops formed by plotting magnetostriction against flux density can also vary, depending upon the material and other factors. The theoretical analysis, while very approximate in its application to polycrystalline material, nevertheless gives some evidence for the view that, on account of the method of demagnetization or the presence of directional residual strains, the initial distribution of domains in the material in the demagnetized condition is not purely a random one. This in turn might be an important contributory factor to the magnetic anisotropy observed to occur at flux densities below the 'knee' of the magnetization curve. A number of graphs is given showing the variations of magnetostriction with changes of values of the different variables affecting the phenomenon.

Impulse Voltage Measurements

In a paper read before the Institution of Electrical Engineers recently on measurements on impulse voltages with a ballistic galvanometer, G. W. Bowdler describes two simple circuits for measuring the crest value and duration of transient impulse-testing voltages. In the measurement of crest voltage, the impulse is applied to a resistor-divider, the voltage across a part of which is applied through a thermionic rectifier to a capacitor which is connected to the galvanometer through a series resistance. A bias

battery suppresses any steady thermionic current tending to flow through the valve and galvanometer. For measuring time-lag, a fraction of the impulse voltage is applied to the grid of a triode from a resistor-divider. The galvanometer and anode battery are shunted by capacitors which have impedances negligible compared with that of the series resistance in the anode circuit. A series resistance in the galvanometer circuit isolates the galvanometer from the applied impulse voltage when measurements are being made on negative impulses. Both methods of measurement are compared with the results obtained simultaneously by a high-speed cathode ray oscillograph. The agreement in crest voltage was within 2 per cent even with voltages of the order of 10^{-7} sec. duration, and in time-lag the agreement was within 0.2 micro-sec. when the grid bias of the valve was suitably adjusted. The measurements are not critically dependent on the characteristics of the thermionic valves used in the circuit, and the range of voltages which may be measured can easily be extended by the use of suitable high-voltage resistors. The two circuits described have been assembled conveniently into a general impulse-measuring equipment with mains-operated supplies for the valves. As an example of its use, the time-lag curve of a 10-in. rod gap, obtained in a small fraction of the time necessary to do so by oscillographic methods, is reproduced. The paper concludes with a record of a few measurements made with this apparatus of the lengths of the front and tail of an impulse wave.

Ionospheric Measurements during Total Solar Eclipse

A. J. HIGGS has published a paper on ionospheric measurements made during the total solar eclipse of October 1, 1940 (*Mon. Not. Roy. Astro. Soc.*, 102, 1) which describes very fully the ionospheric results obtained during the eclipse, with equipment operated at Victoria West, South Africa. The conditions were particularly favourable for settling the question regarding a definite ultra-violet effect and/or corpuscular effect within the F_2 region, because the corpuscular or particle eclipse for particles travelling with the expected velocity of 1,600 km./sec. was due to take place about noon. The F_2 gradient is then generally near its maximum and the diurnal curve flat, so that any corpuscular effect should be more easily detected. In this region it was found that there was no marked corpuscular effect, but that there was an ultra-violet effect. A decrease in maximum ionization density of about 25 per cent was observed, the minimum being reached at approximately 30 minutes after totality, and these results were confirmed by Dr. J. A. Pierce of the Harvard University expedition at Queenstown. The F_1 region was well defined throughout the eclipse, and on the whole it showed the expected results, but the region is more complex than is generally supposed. A subsequent paper will provide detailed examination of the connexion between E region density and size and intensity of bright hydrogen areas. For the present, it can be accepted that the major portion of the ionization responsible for the production of region E was coming, not uniformly from the sun's disk, but from regions near observed clouds of bright hydrogen or calcium. In corroboration of this it may be noticed that observations made by the Carnegie Institution of Washington at the partial eclipse of the sun on April 7, 1940, indicated "that the Sun is not giving out the ultra-violet radiation uniformly from all parts of its surface".