

## RESEARCH ITEMS

## Fishing Mortality and Effort

BARANOFF in 1918 formulated most of the present theory of the relation of the catch to rate of fishing, rate of natural mortality, of growth and of recruitment. His exposition, in the Russian language, was, however, somewhat inaccessible, and various other workers have discovered parts of the theory without knowing of Baranoff's work. William E. Ricker (*Copeia*, No. 1; 1944) has been back to Baranoff's paper, and has also corresponded with most of the other workers interested. He has now produced a clear and comprehensive development of the necessary definitions and equations. Formulae are derived by which the expected catch can be calculated under different rates of fishing—given knowledge of the catch at one rate of fishing, and of the rates of natural mortality, of recruitment and of growth. Such calculations are necessary for advising immediately whether increase or decrease of fishing should take place, and Ricker's statement will therefore serve a practical purpose. He realizes, however, that no method exists at present by which one can extrapolate to determine the best rate of fishing, or the yield in any state very different from the one observed, unless Graham's approximation of 1935 is generally applicable—which remains to be seen. The difficulty in applying, in extrapolation, the kind of formula developed by Baranoff is that the rates of mortality, growth and recruitment are expected to vary with population density (growth-rate certainly does), and the law of their variation is not known. Graham's approximation assumes a simple law, which may be too crude; but it is regarded by Ricker as possibly the most interesting recent development in the theory of fishing.

## New Fishes

IN a series of notes in *Notulae Naturae* of the Academy of Natural Sciences of Philadelphia, Nos. 115, 117, 119 and 120, March–April 1943, Henry W. Fowler describes several fishes which are new to science. These include a goby from the Fiji Islands, a species of *Poecilia* from Honduras, two new characins from eastern Ecuador and some additional new fishes obtained from the second Bolivian Expedition from the Academy of Natural Sciences of Philadelphia 1936–37.

## Tegumental Glands in Cirripedes

C. M. YONGE's work on the tegumental glands in *Homarus vulgaris* has been extended to the Cirripedes by H. J. Thomas (*Quart. J. Micro. Sci.*, 84; 1944). As in the Decapods, the exoskeleton consists of a chitinous layer secreted by the chitinogenous epithelium, and outside this a cuticle secreted by the tegumental glands. In correlation with the sessile habit of the Cirripedes, the structure of the animal as a whole and of the tegumental glands have undergone specialization. Unicellular and compound glands secrete the cuticle of the peduncle and of the capitulum, and that of the surface of the mantle cavity is secreted by the labial and suboesophageal glands. The latter are sometimes, but inaccurately, termed the salivary glands. In the Operculata the labial glands also constantly secrete a material which entangles the waste matter entering the mantle cavity and so facilitates its removal. Apart from this activity the

glands secrete only at the moult. The cement with which the animal attaches itself to the substratum is of the same nature as the cuticle, and consequently the glands secreting it are to be regarded as tegumental glands. In the Operculata, the gland cells degenerate after secretion and new cells are developed from the wall of the duct.

## Structure of the Walls of Phloem Fibres

R. D. PRESTON (*Chronica Botanica*, 7, 414; 1943) points out that there is now considerable scope for the botanist, and especially the biophysicist, to make his contribution to the knowledge of the fine structure of the cellulose walls of plant cells. Owing to their commercial value, the fibres of the phloem (sclerenchyma) have so far been chiefly studied; in these the X-ray diagram indicates the presence of cellulose chains in the longitudinal direction only, while observations on swollen walls by optical methods have led to the view that at least two layers are present and that they differ in the direction of their cellulose chains. Crossed cellulose chains definitely occur in the walls of certain algae. The X-ray diagrams of fibres of hemp and jute reveal the presence of cellulose chains in one direction only, running parallel with the major extinction plane; this diagram remains the same for fibres of different degrees of wall thickening, suggesting homogeneity of wall construction. However, by optical examination of swollen walls in cross-section, there is indication of heterogeneity, which does not appear to be accounted for entirely by differential distribution of lignin and pectin. Differential swelling of the wall in different regions leads to the production of striations of various kinds. Also the swollen material is easily broken into separate fibrils with associated change in direction of cellulose chains, which appears to have misled at least one worker. Swelling under certain conditions produces a 'ballooning' of the outer wall layer in hemp, but not in jute, and this fact, associated with observed optical phenomena, suggests that the outer layer in hemp and the inner in jute differ appreciably from the rest of the wall. It seems clear that in such walls the aggregates of the cellulose complex must differ in their association with one another in the different layers. Comparisons with long collenchyma cells suggests that the optical heterogeneity may be due to a variation in *angular dispersion* of the cellulose chains from layer to layer; this argument is less convincing for hemp and jute fibres, but not precluded by the X-ray diagram. There is therefore still doubt as to whether any chains exist in the secondary wall of these phloem fibres other than those which run in the longitudinal direction.

## Internal Discharges in Dielectrics

A PAPER on the observation and analysis of internal discharges in dielectrics was read in London recently before the Institution of Electrical Engineers by A. E. W. Austen and Miss W. Hackett. Discharges on the surface of, or in inclusions in, insulants, constitute a particular case of a large class of discontinuous phenomena common in electrical equipment. They are important as they are a form of partial breakdown and may afford evidence of incipient failure, while also they give rise to undesirable currents and voltages. The present paper is concerned chiefly with the former aspect. In cases of gross defect or deterioration of condition, surface discharges may



be the forerunners of complete spark-over. Internal discharges may be the immediate cause of breakdown due to local overheating, but their effects are more commonly cumulative, the most important probably being the carbonization of organic insulants, resulting in field distortion and spreading of defects. The paper refers to the various detector circuits employed for observing the discharges and discusses the probable characteristics of the latter. In dealing with applications of the methods, particular attention is given to impregnated-paper capacitors and to paper-insulated cables. The conclusions which the authors have drawn from the investigation are that the validity of discharge-detection methods is established, and that, of the methods of observation described, the discharge detector approaches the form likely to give the greatest sensitivity attainable by normal methods and is satisfactory for the purpose. The oscillograph bridge, though less sensitive, is more suitable for the measurement of discharges and is capable of yielding much information on their sources.

#### Rapid Estimation of Sugar in Urine

J. E. STANLEY LEE (*Brit. Med. J.*, 847; June 24, 1944) describes an improved apparatus for the rapid estimation of sugar in the urine. This is adapted for use with Gerrard's cyano-cupric method, which depends on the power of the colourless double cyanide of copper and potash to hold cuprous oxide in solution. If Fehling's solution is titrated with a sugar solution in the presence of this cyanide, the blue colour gradually fades and there is no precipitate. The colourless end-point is therefore very sharp and, because there is no tendency to re-oxidation, the process can be carried out in an open flask. The apparatus, with its graduations, is illustrated, and directions for its use are given. The apparatus can also be used for estimation by Fehling's method.

#### New Complex Compounds of Rhenium

STARTING with the double chlorides of rhenium and potassium,  $K_2ReCl_6$  and  $K_3ReCl_6$ , two Russian investigators, V. V. Lebedinskij and B. N. Ivanov-Emin, have succeeded in preparing complexes with ethylene diamine in which rhenium occurs in the cation (*J. Gen. Chem. U.S.S.R.*, 13, 253; 1943). At first they found that it was not possible to form complex rhenium compounds by the action of ammonia, pyridine or thiourea upon aqueous solutions of rhenichlorides. Anhydrous liquid ammonia reacted with the potassium rhenichlorides, but no stable amines could be isolated, whereas with excess of ethylene diamine on saturated rhenichloride solutions there was formed a new derivative of pentavalent rhenium having the formula  $ReO_2(en)_2Cl$ , where 'en' stands for ethylene diamine. This compound is soluble in water and does not form precipitates with anions except cobaltinitrite and platinumchloride ions. A corresponding iodide,  $ReO_2(en)_2I$ , much less soluble than the chloride, was obtained from it by adding potassium iodide. With hydrochloric acid the rhenyl ethylene-diamine chloride gave a hydroxy-dichloride,  $ReO(OH)(en)_2Cl_2$ , which could be converted back into the monochloride by treatment with sodium hydroxide. This dichloride reacted with sodium platinumchloride to yield a sparingly soluble complex rhenyl platinumchloride,  $ReO(OH)(en)_2PtCl_6$ . With potassium iodide it gave the di-iodide,  $ReO(OH)(en)_2I_2$ . Excess of hydrochloric acid acted upon the original chloride

derivative to form a further complex compound having the formula  $Re(OH)_2(en)_2Cl_3$ . These are the first reported instances of complexes with rhenium in the cation.

#### Periodic and Asymptotic Orbits in a Five-Body Problem

DANIEL BUCHANAN, dean of the Faculty of Arts and Science, University of British Columbia, Vancouver, B.C., has discussed this topic (*Canadian J. Research*, Sect. A, Phys. Sci.; Jan. 1944). He considers four bodies of equal mass, which remain relatively fixed at the vertices of a square, while they revolve about their common centre of gravity with uniform angular velocity. An infinitesimal body is subject to the Newtonian attraction of the four finite bodies, and the problem is to determine the orbits in which it can move. A very full investigation of the subject is given, and periodic orbits in the plane of motion of the finite bodies and also cutting this plane, and in addition, asymptotic orbits within the above plane, are obtained for the infinitesimal body moving in the vicinity of its points of libration. Four diagrams show approximate orbits for different libration points, and among these are included the ellipse, parabola, a double loop and a figure-8 curve symmetrically situated with respect to the diagonal of the square of which the finite masses are the corners. The question of the convergence of the series arises because these solutions are power series in a parameter  $\epsilon$ ,  $\epsilon$  denoting the scale factor of the orbits. Regarding the periodic solutions, their convergence can be established by an existing proof in which use is made of Poincaré's extension to Cauchy's theorem "Les méthodes nouvelles de la mécanique céleste" (1, 338; 1892-99). This shows that periodic solutions exist and will converge for all values of the time, provided  $\epsilon$  is sufficiently small numerically. Alternatively, MacMillan's theorem (*Trans. Amer. Math. Soc.*, 13, 146; 1913) can be used. The convergence of asymptotic solutions was treated by Poincaré (see ref. above) and the conditions which he established are fully satisfied for the asymptotic orbits that were constructed.

#### Distribution of Intensity within the Solar Corona

H. A. BRÜCK has described the results of a photometric study of the inner corona, especially of the region extending from  $2'$  to  $5'$  from the solar limb (*Mon. Not. Roy. Astro. Soc.*, 104, 1; 1944). The photograph of the corona which has been used was taken by the late Prof. H. F. Newall during the eclipse of August 30, 1905, and photographic densities within the corona were investigated with the Cambridge recording microphotometer. Records were made of the variation of density along 72 solar radii, beginning with the radius in the direction from the solar centre to the north pole of rotation and proceeding along radii with equal intervals of  $5^\circ$  in position angle. The intensity gradients, the method for deriving which is briefly described, show in the immediate vicinity of the sun a definite correlation with the structure of the corona. Along streamers or rays the intensity decreases less rapidly with increasing distance from the sun than in normal regions. No such correlation is indicated for the region extending from  $5.6'$  to  $8.7'$  from the solar limb. An effect opposite to that found by Brück for the inner corona was observed by von Klüber for streamers extending from about  $6'$  to about  $70'$  from the solar limb.