

## RESEARCH ITEMS

## Schooling of Mackerel

ARTHUR SCHLAIFER has made some interesting experiments ("The Schooling Behavior of Mackerel: A Preliminary Experimental Analysis". *Zoologica*. Scientific Contributions of the New York Zoological Society, 27, Part 2, No. 14; 1942). These were carried out at the Woods Hole Station of the U.S. Fish and Wildlife Service. The fishes used were 8-in. specimens of the chub mackerel, *Pneumatophorus grex* (Mitchell), caught in the waters off Woods Hole and afterwards kept in large tanks in the laboratory. It was found that two individuals suffice to form a school, swimming always in line with each other. If one mackerel is kept isolated and another is put in with it, the two immediately school and any others added join them. Schooling is seen still better in larger groups. Blinding, darkness and visual contact experiments indicate that the schooling reaction of the mackerel is visually integrated. Mackerel display no schooling reaction to others of the same species, dead or alive, which move or are moved in a manner not completely normal. Apparently there is no response to body colour. Isolation for three weeks does not eliminate or reduce the schooling proclivity. Good photographs are given of mackerel in fairly strong artificial light, in total darkness and in light in the deep red end of the spectrum.

## Biology of a Carnivorous Snail

WILLIAM MARCUS INGRAM gives some interesting notes on *Euglandina rosea*, a well-known species common on the sea islands of Georgia and around the Keys of Florida ("Food, Eggs and Young of the Carnivorous Snail *Euglandina rosea* (Férussac)". *Zoologica*. Scientific Contributions of the New York Zoological Society, 27, Part 2, No. 15; 1942). A specimen was kept in a terrarium and laid eggs there. Experiments in feeding resulted in its eating the molluscs *Mesomphix inornatus* and *Anguispira alternata*, leaving untouched another species of *Mesomphix*, *M. cupreus*, and young and adults of *Triodopsis albolabrus*. It is evident that there is definite selection here. The method of feeding is described, the snail devouring the whole of the living prey from inside the shell. When completely inert it reacted directly to the food selected, and although ten inches away it was moving towards it within three minutes. All the molluscs eaten were first turned over on their apices. Twenty-two eggs, laid on the upper surface of the humus in the terrarium, exposed to the light, were about 3 mm. in length with hard calcareous shells. The approximate incubation period was 60-68 days, when the young broke through the shell by means of the radula.

## Germ Cell Inclusions

THE investigations into the cytoplasmic inclusions in the germ cells of the mouse by Dr. R. A. R. Gresson have been continued in two further publications. One deals with the inclusions found during the maturation, fertilization and first cleavage division of the ovum (*Quart. J. Micro. Sci.*, 82, Pt. 4; 1942) and the other with those found during spermatogenesis (*Proc. Roy. Soc. Edin.*, B, 61, Pt. 2; 1942). The Golgi elements appear to be fairly evenly distributed throughout the period from maturation to the formation of the first two blastomeres. The mitochondria are most numerous in the central

region during maturation divisions, a few being eliminated with the polar body. During the stage of the pronuclei they concentrate in the neighbourhood of these structures and they congregate around the first cleavage spindle in such a manner that they are distributed approximately equally to the two blastomeres, where they gather into small clumps and are then scattered singly throughout the cytoplasm. In the spermatogonia and spermatocytes the Golgi elements are situated at one pole of the nucleus; during division they remain near the equatorial region of the nucleus and either as two clumps or dispersed they are distributed to the daughter cells. In the young spermatids they are applied to the anterior pole of the nucleus but move away, leaving a vacuole, later filled by the acrosome, then bud off a small portion which moves to the posterior pole and this is later included in the middle piece of the sperm. The spherical mitochondria are most numerous in the neighbourhood of the nucleus in spermatogonia and spermatocytes, and in the transformation of the spermatid into the spermatozoon most of them come to lie around the axial filament. The sperm enters the ovum at the anaphase of the second maturation division.

## Parasites of Horses

A USEFUL account of the nematode parasites of the horse belonging to the family Strongylidae as of Baird 1858 is furnished by Dr. W. A. Rosa and Dr. E. J. Galofré (*Inst. Parasit. Enfer. Parasit. Univ., Buenos Aires*, 1, Fasc., 6; 1940). The 19 species treated are divided among four genera: *Strongylus* 3 spp., *Triodontophorus* 2 spp., *Trichonema* 13 spp., and *Gyalocephalus* 1 sp. The introductory portion consists of a good general account of the anatomy and classification of the family. The remainder of the paper consists of a series of plates, one for each species, of drawings to scale of the diagnostic and comparable parts of both sexes of the strongyles. The plates are accompanied by fully annotated explanations and measurements, so that it should render the identification of any of the species comparatively easy.

## Genetics of the Sorghums

IN a series of notes originating from the Millets Breeding Station, Coimbatore, G. N. Ayyangar and various co-workers describe the mode of inheritance of a number of characters in the Sorghums (*Current Science*, pp. 491, 492, 528 and 533; 1941). One of the most interesting is a dominant mutation for purple anther base ( $A_b$ ), detected in the heterozygous condition in *Sorghum dochna* and later found to be due to a single gene closely associated with one of the two  $B$  genes for brown pericarp colour. The independent genes  $C_1$  and  $C_2$  behave as simple dominants and deepen the light green of normal lines, thus accounting for the dark green ( $C_1C_2$ ), green ( $C_1c_2$  or  $c_1C_2$ ) and light green ( $c_1c_2$ ) noted in the blocks of plants forming the World Collection of Millets at Coimbatore. The curious habit of 'goose-necking' (bearing heads on recurved stems) shown by some of the Sorghums is brought into line with genetical observations. The recessive gene  $w_y$  results in a wavy peduncle to the inflorescence: this condition in a plant having a naturally short peduncle causes the ear to twist and escape out of the side of the last leaf (the 'boot') and so become bent into a 'goose-neck'. The relatively rare long type of hairs

found on the glumes of *S. dochna* var. *burmannium*, *S. Roxburghii*, *S. caffronum*, *S. coriaceum* and *S. cernuum* are described as due to an independent dominant gene *Gf* which lengthens the hairs produced by the gene *Gh* for the normal hairy condition. *GfGh* results in long hairs, *gfGh* the normal hairy condition and *Gfgh* or *gfgh* 'glabrous'.

#### Structure of Urea and Thiourea

PREVIOUSLY reported values for the dipole moment of urea (8.6) and thiourea (7.6) are unexpectedly high in comparison with those of related compounds, and these constants have been redetermined in dioxane as solvent at 25° by W. D. Kumler and G. M. Fohlen (*J. Amer. Chem. Soc.*, 64, 1944; 1942), who find the values 4.56 and 4.89, respectively, which fall in line with those of similar compounds. The molecules were not associated in these solvents. The results throw some light on the old controversy as to whether urea and thiourea are amphions. This was at first taken

to imply the structure  $\bar{O}-C \begin{matrix} \langle NH \\ NH_3^+ \end{matrix}$  but later  $\bar{O}-C \begin{matrix} \langle NH_2^+ \\ NH_2 \end{matrix}$ , involving a separation of charge but

no proton transfer, and thus a resonance hybrid. The moderate values of the dipole moments show that such structures do not contribute predominantly to the state of the molecule. The short C to N distance has been supposed to indicate an amphion structure, but this amounts only to about 20 per cent of double bond character. The fact that the ratio of the solubility of urea in alcohol to its solubility in water is much higher than for an amino-acid with an amphion structure also makes such an ion structure in alcohol improbable. It seems as if everything can be accounted for by about 20-30 per cent of amphion structure, the essential structure of urea and thiourea being that of simple amides except for a somewhat larger contribution of the forms with a separation of charge.

#### Structure of Galactic Clusters

GEORGE ALTER has a paper on the structure of galactic clusters (*Mon. Not. Roy. Astro. Soc.*, 102, 4) deducing a number of important tentative conclusions. He starts by assuming that the structure of a galactic cluster depends on the development of the cluster, which is of two kinds: (a) the dynamical evolution of the whole unit; (b) the spectral evolution of the individual members. Trumpler proposed a hypothetical evolution of clusters, which was based on a detailed classification according to the presence of yellow or red giant stars and the earliest star type within the cluster, and Alter simplifies this by a regrouping into four classes. It is suggested that clusters develop from the giant cool class through the giant hot and main hot to the main cool class, but with a certain indeterminacy near the central classes, where short transitions may occur. From a number of tables it is shown that the relations between these four classes and various structural properties of galactic clusters support the suggested scheme of classification. It is believed that the clusters develop along a life-line similar to that of the Russell diagram, and during this evolution the clusters are subject to the influence of the galactic field. The initial volume of 10-100 cubic parsecs increases until disintegration leads to the loss of stars merging with the surrounding star field. The lowest recognized average spatial star density within a

cluster is about five times that of the star density in the vicinity of the sun, and the highest is about 250 times as much. The true values are actually higher, and this is explained by the star numbers used for determination being restricted by the magnitude limit of the photograph. The largest observed volume is about 1,000 cubic parsecs.

#### Voltage Surges Caused by Contactor Coils

A PAPER on this subject by J. R. Taylor and C. E. Randall, read before the Institution of Electrical Engineers, discusses the phenomena associated with the switching of contactor coils, particularly with reference to the effects of 'switching peak' voltages on insulation and switch contacts. The effect of circuit layout on the switching peaks and the arcing of contacts is described, together with methods of reducing the severity of these effects. Owing to a series of insulation breakdowns, it was decided to make an investigation of the switching-off voltages of a d.c. contactor coil. Early experiments were merely qualitative, but later, equipment was built for quantitative tests. Photographic records of the various phenomena were made in order to give a clear picture of the different conditions which are met. Peak voltages up to ten to fifty times the supply voltage occurred. Eventually it was decided to extend the research to a.c. contactor coils, and peak voltages up to five to six times the mains voltage peak were found to occur under favourable conditions. It is obvious from the tests that clearances which are satisfactory for electric lamps on 230 volts are totally inadequate for coil circuits even on 100 volts, and that on higher voltages it is essential to have large clearances and creepage distances. Instances are known of sparks jumping distances of as much as  $\frac{1}{2}$  in. along the surface of slate on control panels connected to 530-volt tramway supplies.

#### Grid-Controlled Mercury-Arc Mutators

R. FEINBERG, in a paper entitled "Static Conversion of Direct Current to Alternating Current with Grid-Controlled Mercury-Arc Mutators" (*J. Inst. Elec. Eng.*, 89, Pt. 1, No. 22; October 1942), deals with the theory of the push-pull mutator inverter, which is a d.c. arrangement with grid-controlled mercury-arc mutators operating alternately and causing an alternating current to flow in the load circuit. In the case of resistance load, practically any shape of alternating voltage wave-form between rectangular form and triangular form can be produced. The shape of the alternating voltage wave-form depends upon the capacitance of the inverter capacitor, a relatively small capacitance giving the alternating voltage a rectangular form and a large value making it triangular. The ripple factor of the direct current is governed by the smoothing effect of the inductance in the d.c. circuit, a small inductance causing the direct current to flow intermittently. The degree of regulation of alternating voltage at any change of load is determined by the capacitance of the inverter capacitor. A large capacitance may produce such a large voltage regulation that the curve of power output plotted against load describes a V form, the power output being increased when the load is reduced. The inverter stops working when overloaded. Calculations are given for approximate circuit conditions, and the results of experiment have been found to agree satisfactorily with the theory.