ABSTRACTS OF MEMOIRS

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY

ATKINS, D., 1960. The development of the pleopods in the young crab stages of *Pinnotheres* (Crustacea). *Proc. zool. Soc. Lond.*, Vol. 133, pp. 435–51.

In female *Pinnotheres pinnotheres* (L.) and *P. pisum* (Pennant) the four pairs of pleopods present in the megalopa persist, undergoing modification to form those of the adult.

In male *P. pinnotheres* in addition to pleopods 1 and 2 (the copulatory appendages), pleopods 3–5 of the megalopa persist in degenerate form in crabs of 4 mm carapace width, and pleopods 3 and 4 in crabs 6 mm wide. The exopodite of pleopod 2 is recognizable in large males of carapace width 7 mm.

In male *P. pisum* pleopods 3–5 disappear early, pleopod 3 only being present in a male of 1·40 mm carapace width, but absent in one of 1·44 mm carapace width. The exopodite of pleopod 2 is absent in males from a carapace width of 3·5 mm. D.A.

BONE, Q., 1960. The origin of the chordates. *J. Linn. Soc.* (*Zool.*), Vol. 44, pp. 252–69.

This consideration of chordate origins re-states the case for the neotenic origin of the chordate line from the larvae of primitive hemichordates. It is assumed that the ancestral semi-sessile hemichordate group possessed a tadpole-like larva as the distributory phase in their life-cycle, and that the gradual neoteny of this larva led to the chordates and the acraniates. The urochordates are derived from the ancestral group by the modification of the adult and the retention of the larval stage, the larval stage becoming modified for short range site-selection upon the adoption of an absolutely sessile habit. The larval stages of the acraniates and of modern hemichordates are regarded as of secondary origin, consequent upon the adoption of a more completely sessile habit than at the origin of each group, and upon the paedomorphic changes which have been assumed to have taken place in the history of the modern hemichordates. These conclusions are reached from a consideration of the types of larvae which are found in the modern representatives of the groups discussed; from a consideration of their adult organization; and from a consideration of the functional problems involved in the neotenic transformation which is supposed to have resulted in the origin of the chordate line. The paper is followed by a discussion, in which the views put forward are criticized by protagonists of other theories of chordate origins. Q.B.

BONEY, A. D., 1960. Observations on the spore output of some common red algae. *Brit. phycol. Bull.*, Vol. 2, pp. 36–7.

The spore output of six common red algae was measured. Estimates of the spore output per 1 g fresh weight per hour indicated that plants making a shorter annual appearance on the shore tended to have a greater spore output than those with more protracted fruiting periods; the output of plants producing larger spores also tended to be low. A count made of all the tetrasporangia on a plant of *Plumaria elegans* (preserved weight 6 g) gave a total of 47,387, of which 62·3% were ready to release their spores, 16·4% were developing, 20·3% had liberated their spores, and 0·8% were abortive. A.D.B.

BONEY, A. D., 1960. The spore output of *Antithamnion plumula* over a number of days. *Brit. phycol. Bull.*, Vol. 2, pp. 37–8.

A fruiting tuft of *Antithamnion plumula* (dry weight 0·0082 g), produced 10,071 tetraspores over a 6-day period, 51·7% of the spores being liberated in the first 24 h. A plant of dry weight 1 g might be expected to produce 1·25 million spores over the same time interval. A.D.B.

BONEY, A. D., 1960. Nurture of a fruiting *Antithamnion* tuft and the physiological condition of the liberated spores. *Brit. phycol. Bull.*, Vol. 2, pp. 38–9.

Sporelings grown from spores which had developed in sporangia borne by branches cultured in Erd–Schreiber medium showed a growth rate which was twice that of sporelings grown from the spores produced by sporangia of branches cultured in filtered sea water. A.D.B.

CALDWELL, P. C., 1960. The phosphorus metabolism of squid axons and its relationship to the active transport of sodium. *J. Physiol.*, Vol. 152, pp. 545–60.

The effects of cyanide, 2-4-dinitrophenol, azide and ouabain on the phosphate compounds in giant axons from the squid, *Loligo forbesi*, have been studied. 2 mM cyanide, 0·2 mM dinitrophenol and 3 mM azide each bring about a decline in the amounts of the 'high energy' phosphate compounds (arginine phosphate and ATP) and there is some recovery when the inhibitor is removed. Since these inhibitors are known to block the sodium efflux of cephalopod giant axons, it is suggested that the decline in the 'high energy' phosphate compounds may be connected with the blocking of sodium transport. 10^{-5} M ouabain, which is also known to block the sodium efflux, does not, however, appear to have an effect on the 'high energy' phosphate compounds. P.C.C.

CALDWELL, P. C., HODGKIN, A. L., KEYNES, R. D. & SHAW, T. I., 1960. The effects of injecting 'energy-rich' phosphate compounds on the active transport of ions in the giant axons of *Loligo*. *J. Physiol.*, Vol. 152, pp. 561–90.

Injections of ATP, ADP, GTP, arginine phosphate and phosphoenol-pyruvate (PEP) caused a transient increase in the efflux of labelled sodium from squid giant axons which had been poisoned with cyanide. Injections of creatine phosphate, arginine, AMP, inorganic phosphate and other compounds were ineffective as were ATP and arginine phosphate when applied externally.

The number of Na ions extruded was roughly proportional to the number of energy-rich phosphate groups injected, the Na/~ P ratio for arginine phosphate, ATP and PEP being about 0·7.

High concentrations of arginine phosphate and PEP restored the normal K-sensitivity of the Na efflux but ATP, ADP and GTP did not.

Injections of arginine phosphate but not ATP caused a substantial increase in the uptake of potassium in fibres poisoned with cyanide.

It is concluded that the extrusion of sodium depends on a supply of energy-rich phosphate groups and that the presence of arginine phosphate as well as ATP is important. P.C.C.

CALDWELL, P. C., HODGKIN, A. L., KEYNES, R. D. & SHAW, T. I., 1960. Partial inhibition of the active transport of cations in the giant axons of *Loligo*. *J. Physiol.*, Vol. 152, pp. 591–600.

Under conditions when a squid giant axon should contain ATP but not arginine phosphate the sodium efflux is not reduced by removing external potassium and is higher than the efflux from an unpoisoned fibre into a K-free solution. A transient rise in the Na efflux into a K-free solution is seen in the early stages of cyanide poisoning and a sustained rise occurs if the axon is treated with 0·2 mM-DNP at pH 8. Since K-sensitivity can be partly restored by injecting arginine phosphate but not ATP it is concluded that the normal coupling between K and Na movements may depend on the presence of arginine phosphate. P.C.C.

CARLISLE, D. B., 1960. Softening chitin for histology. *Nature, Lond.*, Vol. 187, pp. 1132–33.

Chitin may be softened for sectioning, without damage to other tissues, by the enzyme chitinase, extracted from mushrooms or puffballs. D.B.C.

ENDEAN, R., 1960. The blood-cells of the ascidian, *Phallusia mammillata*. *Quart. J. micr. Sci.*, Vol. 101, pp. 177–97.

An investigation has been made of the structure, histochemistry and histogenesis of the blood-cells of *Phallusia mammillata* (Cuvier).

Vanadocytes, pigment cells, phagocytes and cells with acid vacuoles arise from primitive lymphocytes. A series of transition stages can be recognized in each case. During the development of each cell type, there is a progressive reduction in nuclear volume and RNA appears to be released from the nucleus.

About 98% of the total number of blood cells are vanadocytes or their precursors. A number of globules is possessed by each vanadocyte. Each globule possesses a refractive surface membrane containing compound lipid and a core containing a vanadium compound, protein, H_2SO_4, and carbohydrate material. Part of the carbohydrate material is in a dispersed form and can be hydrolysed with 2N-H_2SO_4. The remainder is in the form of birefringent grains and appears to be a very insoluble polysaccharide. The carbohydrate material may be the precursor of the tunicin of the test.

The pigment cells contain melanin and oriented submicroscopic crystallites. R.E.

LEON, Y. A., BULBROOK, R. D. & CORNER, E. D. S., 1960. Steroid sulphatase, arylsulphatase and β-glucuronidase in the Mollusca. *Biochem. J.*, Vol. 75, pp. 612–17.

Acetone-dried powders prepared from thirteen species of molluscs have been tested for steroid-sulphatase activity with the sulphates of dehydro*epi*androsterone, androsterone and aetiocholanolone as substrates.

Three species (*Helix pomatia*, *Buccinum undatum* and *Nassarius reticulatus*) were found to possess activity towards both dehydro*epi*androsterone sulphate and aetiocholanolone sulphate, whereas in four species (*Patella vulgata*, *Littorina littorea*, *Patina pellucida* and *Nucella lapillus*) activity towards only dehydro*epi*androsterone sulphate was found. Steroid sulphatase activity was not detected in six species.

No enzyme capable of hydrolysing androsterone sulphate was found in any of the

animals tested; therefore complete enzymic hydrolysis of urinary steroid conjugates cannot be achieved with enzyme preparations from these molluscs.

β-Glucuronidase and arylsulphatase activity are widely distributed in the Mollusca, but the activities of these enzymes are not related to the activity of steroid sulphatase.

MURRAY, R. W., 1960. The response of the ampullae of Lorenzini of elasmobranchs to mechanical stimulation. *J. exp. Biol.*, Vol. 37, pp. 417–24.

Electrical recording shows that the ampullae are sensitive to weak tactile stimuli (< 1 mg) applied to the ends of their tubes. The response may be either increase or decrease in the resting frequency, with an opposite after-effect. Adaptation is rapid, but this may be due to accommodative changes of the tissues. Possible functions are discussed. R.W.M.

MURRAY, R. W., 1960. Electrical sensitivity of the ampullae of Lorenzini. *Nature, Lond.*, Vol. 187, p. 957.

The nerve impulse discharge from the ampullae of Lorenzini of rays is sensitive to changes in the voltage gradient in the surrounding water of 1–2 μV/cm. The impulse frequency increases when the gradient lies along the tubes, openings negative. Adaptation occurs to maintained stimuli. Possible functions are suggested. R.W.M.

MURRAY, R. W., 1960. Initiation of cutaneous sensory nerve impulses. *Proc. physiol. Soc.*, 22–23 April 1960. *J. Physiol.*, Vol. 152, 53–54*P*.

The impulse discharge from single cutaneous fibres in rays has been recorded without dissection by a wire electrode on the skin surface. Mechanical and electrical stimuli are effective. The details of the recorded potentials suggest that propagated impulses are initiated subterminally in the nerves. R.W.M.

NICHOLS, D., 1960. The histology and activities of the tube-feet of *Antedon bifida*. *Quart. J. micr. Sci.*, Vol. 101, pp. 105–17.

The histological structure of the tube-feet of this crinoid is interpreted functionally. The epithelium of each tube-foot is raised in places into papillae, each of which contains mucous glands, a single muscle fibre and terminal nerve processes. In a feeding animal the tube-feet are exceedingly active, each one making periodic rapid bending movements towards the food-groove of the arm or pinnule; it is suggested that the tube-feet act to produce a mucous food-trap by the throwing action of the tube-feet combined with the contraction of the papillal muscles serving to squeeze out the mucus. In the absence of ampullae, protraction of the tube-feet is likely to be brought about by contraction of muscle fibres stretched across the water-vascular canal, the volume of which will be decreased at the expense of the underlying perihaemal canal. D.N.

RALPH, P. M., 1960. *Tetraplatia*, a coronate scyphomedusan. *Proc. roy. Soc.*, Ser. B, Vol. 152, pp. 263–81.

The true relationships of the pelagic coelenterate *Tetraplatia* have long been a matter of controversy. The most recent and widely held view, that it is a highly modified trachyline medusa, is here demonstrated to be untenable because it has no velum, it

has gastric filaments, a sense organ that is a rhopalium with an endodermal statolith, and gonads that originate in the endoderm. A reinvestigation based on adequate samples shows that it is a scyphomedusan.

It is suggested first that *Tetraplatia* has no ephyral stage and the planula develops directly into a juvenile, and secondly that *Tetraplatia* evolved from a coronate scyphomedusan in which the normal radial expansion of the ephyra larva was arrested at an early stage and replaced by accelerated growth in the oral-aboral axis. Later, or accompanying the increased growth rate on the oral-aboral axis, four pairs of pouches were formed, causing displacement and crowding of the eight ephyran lappets into four pairs and finally their fusion into a single locomotory organ. Thus, there were four locomotory lappets separated by four pairs of pouches. *T. volitans* remains essentially unaltered from this basic pattern, but in *T. chuni* the pouches fuse to form the well known flying buttresses.

Tetraplatia should now be placed in the coronate Scyphomedusae, near the Ephyropsidae and Periphyllidae, in a family of its own, the Tetraplatidae. For this study, material of both *T. volitans* and *T. chuni* has been available. P.M.R.

Ross, D. M., 1960. The association between the hermit crab *Eupagurus bernhardus* (L.) and the sea anemone *Calliactis parasitica* (Couch). *Proc. zool. Soc. Lond.*, Vol. 134, pp. 43–57.

Preliminary observations on *Calliactis parasitica* and *Eupagurus bernhardus* in experimental containers suggested that, at Plymouth, the crab plays no part in attaching the anemone to the shell. This contrasts sharply with the descriptions of the association between *Calliactis* and hermit crabs in the Mediterranean. In Plymouth, the anemone transfers itself to a shell by a complicated manoeuvre, in which the adhesion of the tentacles, the detachment of the base, the swinging of the base to the shell, and the subsequent settling on the shell and resumption of an upright posture, follow each other in a co-ordinated sequence of orderly movements, taking 15–30 min to complete.

Experiments with empty shells and shells occupied by crabs showed that *Calliactis* transfer with equal frequency in both cases, although individual anemones show a wide variation in the tendency to transfer to shells of both kinds. The anemone settles on shells of living *Buccinum*, although not found thereon in nature, and does not desert these for empty shells or for shells occupied by crabs. These activities of *Calliactis* in response to shells were not observed when the shells offered had been cleaned of organic matter by boiling in alkali. Comparing the accounts of this association in the Mediterranean and Atlantic habitats points to a number of interesting problems of comparative ecology and behaviour. D.M.R.