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ABSTRACTS OF MEMOIRS

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY

BAREL, C. D. N. & KRAMERS, P. G. N., 1970. Notes on associates of echinoderms from Plymouth and the coast of Brittany. *Proc. K. ned. Akad. Wet.*, Ser. C, Vol. 73, pp. 159–70.

Various echinoderms of the Plymouth region and the coast of Brittany (Roscoff, Morgat) were investigated for internal and external associates: Protozoa, Turbellaria, Mollusca, Tardigrada, Rotatoria, Polychaeta, and Crustacea. Incidence, intensity and location on or in the host were determined. Several new data on the geographical distribution of associates and of the holothurian *Leptosynapta bergensis* (Östergren) were obtained. Some new associations between known species were found. The uniformity of the umagillid flatworm *Syndesmis echinorum* François has been discussed. Another umagillid, once found but not yet described, was rediscovered by the present authors.

C.D.N.B.

CHAPMAN, D. M., 1969. The nature of cnidarian desmocytes. *Tissue Cell*, Vol. 1, pp. 619–32.

The electron microscope reveals that the cnidarian desmocyte is an ectodermal cell which forms acidophil protein tonofibrillae intracellularly. One end of the cell is bound to mesogleal fibrils; the other becomes embedded in the thickening cuticle. The bundle of tonofibrillae later becomes rivet-shaped and the cell dies, but still the mesoglea remains bound to the cuticle by means of the rivet. The histochemistry and formation of the rivet as well as the comparative cytology of cnidarian desmocytes are discussed.

D.M.C.

COHEN, L. B., HILLE, B. & KEYNES, R. D., 1970. Changes in axon birefringence during the action potential. *J. Physiol., Lond.*, Vol. 211, pp. 495–515.

Observations have been made on the changes in optical retardation accompanying the passage of impulses along crab leg nerves and squid giant axons.

The nerves were mounted on the stage of a polarizing microscope, at 45° to the planes of polarization and analysis, brightly illuminated with white light. During the nerve impulse the intensity of the light passing the analyser decreased temporarily by 1 part in 10^3–10^6. Signal-averaging techniques were used to obtain an acceptable ratio of signal to noise.

The changes in light intensity recorded under these conditions were shown to arise almost entirely from alterations in retardation, with little or no interference from scattering, absorption, linear dichroism or optical rotation effects; the occurrence of stimulus and coupling artifacts was also ruled out.

In the squid giant axon, the retardation change was shown to be located in a thin cylinder immediately surrounding the axoplasm, and to have a radially orientated optic axis.

The time course of the decrease in optical retardation was very similar to that of the action potential recorded with an intracellular electrode, suggesting that the retardation closely followed the electrical potential across the membrane.

L.B.C.

DENTON, E. J., 1970. On the organization of reflecting surfaces in some marine animals. *Phil. Trans. R. Soc.* B, Vol. 258, pp. 285–313.

Recent work has been concerned mainly with the physical and chemical properties and the disposition of reflecting layers. It is shown here that the organization of such layers is often very detailed. For example, in a given situation on the surface of a fish, the crystals of reflecting material will have a particular shape and thickness, they will be arranged in stacks (platelets) of a particular spacing within cytoplasm and the platelets themselves will be orientated at special angles with respect to the surface in which they lie. Layers of such platelets of different but predictable spectral properties and orientations may, moreover, be superposed. In certain cases plausible functions

for these complicated reflecting layers have been suggested but these usually remain unproved and it is not possible to assign functions to all the structures which have been found. There has, as yet, been very little advance in our knowledge of the mechanisms whereby crystals and platelets of reflecting material can be manufactured with such precision, nor do we know how the development of the reflecting layers is controlled.

E.J.D.

DENTON, E. J., GILPIN-BROWN, J. B. & SHAW, T. L., 1969. The buoyancy mechanism found in cranchid squid. *Proc. R. Soc.* B, Vol. 174, pp. 271–9.

Three species of cranchid squid have been studied at sea and found to be nearly neutrally buoyant in sea water. They each possess a very large coelom filled with a fluid whose density is low in comparison with sea water and this gives a lift sufficient to balance the denser tissues of the animal. This coelomic fluid is nearly iso-osmotic with sea water and its relatively low density arises because it is principally a solution of ammonium chloride in water. The fluid is acid and the significance of this is discussed.

Two additional species of cranchid squid whose buoyancies were not measured were also shown to have very high concentrations of ammonium chloride in their coeloms and it seems likely that this buoyancy mechanism is used by all the Cranchidae.

E.J.D.

FORSTER, G. R., BADCOCK, J. R., LONGBOTTOM, M. R., MERRETT, N. R. & THOMSON, K. S., 1970. Results of the Royal Society Indian Ocean Deep Slope Fishing Expedition, 1969. *Proc. R. Soc.* B, Vol. 175, pp. 367–404.

During a 6-week Royal Society Expedition in the western Indian Ocean 638 fishes were caught on drop lines worked chiefly at night at depths between 100 and 1000 m. Many of the species caught were rare or unrecorded from the area. The primary aim of the Expedition, to find specimens of the coelacanth *Latimeria* and thereby extend its known range, was not fulfilled. One teleost, the lutianid *Etelis marshi*, and a squaloid shark, *Centrophorus* sp., were particularly common, accounting for 60% of the total catch; the remainder comprised 24 teleost and 11 elasmobranch species. Details are given of the itinerary, the fishing gear, fishing methods and the individual species caught, together with a brief discussion on the effect of depth, height of hooks above the sea floor and geographical position on the composition of the catches.

G.R.F.

LYONS, K. M., 1969. Sense organs of monogenean skin parasites ending in a typical cilium. *Parasitology*, Vol. 59, pp. 611–23.

Single receptors seen with the electron microscope to consist of a terminal cilium embedded in a nerve bulb have been found in the skin parasitic monogenean *Gyrodactylus* sp., adult and larval *Entobdella soleae*, *Leptocotyle minor* (adult) and in the endoparasitic juvenile of *Amphibdella flavolineata*. These are presumed to be 'tangoreceptors'. Their distribution in *Gyrodactylus* sp. has been mapped using phase-contrast microscopy, and staining with indoxyl acetate method for non-specific esterases revealed a nervous connexion between the lateral ventral nerve cord and the 'tangoreceptor'. The general relationships of the nervous system in *Gyrodactylus* were investigated by staining with the thiocholine method for cholinesterase. The 'sensory' ending contains vesicles, microtubules and mitochondria and the whole nerve bulb is sealed into the epidermis by means of septate desmosomes. The basal body of the cilium is not greatly modified and there is no obvious rootlet system. The terminal cilium of single receptors in *Entobdella soleae* has a $9+2$ structure. A compound sense organ from the head of *Entobdella soleae* is described and consists of a cluster of single receptors similar to the 'tangoreceptors' already described. The significance of the microtubule arrangement in the terminal cilia and the possible roles of these sense organs is discussed.

K.M.L.

LYONS, K. M., 1969. Compound sensilla in monogenean skin parasites. *Parasitology*, Vol. 59, pp. 625–36.

The fine structure of two kinds of compound – presumed sense organs from the heads of three skin parasitic monogeneans, *Gyrodactylus* sp., *Entobdella soleae* (larva only) and *Acanthocotyle elegans* – is described. One kind of compound receptor consists of a number of associated sensilla, each ending in a single cilium (the spike sensilla of *Gyrodactylus* and the cone sensilla of *E. soleae* oncomiracidium). The other kind of compound organ is made up of one or a few neurones only, each of which bears many cilia (pit organs of *E. soleae* oncomiracidium and sensilla from the head of *Acanthocotyle elegans*). The spike sensilla of *Gyrodactylus* have also been studied using a Cambridge Instrument Co. stereoscan electron microscope and by phase-contrast microscopy. The ciliary endings of all these sense organs are highly modified and have lost the $9+2$ structure being packed with many tubules. The arrangement of the ciliary microtubules in the cone sensillae of *E. soleae* oncomiracidium and the head sensilla of *Acanthocotyle* has been compared with that in the ciliary endings of other invertebrate mechano- and chemoreceptors. It is argued that spike sensilla of *Gyrodactylus* may be chemoreceptors; the nerves supplying the spike sensilla contain electron-dense, membrane-bound inclusions which appear to be neurosecretory material.

K.M.L.

LYONS, K. M., 1970. The fine structure and function of the adult epidermis of two skin parasitic monogeneans, *Entobdella soleae* and *Acanthocotyle elegans*. *Parasitology*, Vol. 60, pp. 39–52.

Electron-microscope work on the body covering of the skin-parasitic fish flukes *Entobdella soleae* and *Acanthocotyle elegans* (Monogenea) has shown this to be a living syncytial cytoplasmic layer which constitutes a metabolically active interface with the parasite's environment. This layer is not itself nucleated but sends long connexions through the basement lamina and integumentary muscle layers to epidermal 'cell' body regions which lie in the parenchyma and are nucleated. The covering layer of these monogeneans is therefore basically similar to that of the endoparasitic platyhelminths, i.e. the digeneans and cestodes. The epidermal 'cell' bodies of the monogeneans investigated are secretory and have a well-developed granular endoplasmic reticulum and Golgi stacks. Only one kind of epidermal 'cell' body has been found in *Entobdella* and this secretes electron-dense granules into the outer layer. Two kinds of 'cell' body occur in *Acanthocotyle*, one secretes dense granules, the other produces electron-lucent fibrous inclusions. These epidermal inclusions could either be discharged and contribute to the epidermal mucus layer or could add material to the epidermal matrix itself. The dorsal surface of both these worms bears long, irregularly shaped microvilli (9–11 μm in length) whilst their ventral surfaces are smooth and avillous. The function of these dorsal microvilli is difficult to assess. Work with ferritin and colloidal thorium dioxide indicated that the epidermis did not pinocytose these substances and it seems unlikely that the microvilli are concerned with the absorption of nutrients in these ectoparasites. The microvilli support a mat of PAS-positive mucoproteinaceous or mucopolysaccharide material; only a thin layer of acid mucopolysaccharide is present overlying the tips of the microvilli, and this may be of host origin. The possible function of the mucous layer and glycocalyx is discussed.

K.M.L.

MÜLLER, W. A., 1969. Die Steuerung des morphogenetischen Fliessgleichgewichts in den Polypen von *Hydractinia echinata*. I. Biologisch-experimentelle Untersuchungen. *Wilhelm Roux Arch. EntwMech. Org.*, Bd. 163, pp. 334–56.

At any axial level in the polyp developmental potency was polarized, with apical regeneration predominating. Basal growth, if it occurred at all, gave rise to apical structures. The probability of such growth occurring was positively correlated with distance from the apex and increased with removal of the hypostome. The time-lag between amputation and the appearance of new tentacles increased from apex to base. A breakdown in polarity occurred after tissue dissociation, reaggregated cell associations developing stolons. Stolon formation also occurred after operative displacement of the polar axis by 90°.

When two sections from different axial levels were brought into contact, regeneration of those

axial regions normally present between them was induced. In further experiments the inductive system was shown to consist of two components: an apical system directed from apex to base induced structures belonging to higher axial levels, and a basal system directed from base to apex induced structures with properties characteristic of deeper axial levels. The direction of the inductive system is therefore opposed to the direction of tissue movement during steady-state growth.

W.A.M.

MÜLLER, W. A., 1969. Die Steuerung des morphogenetischen Fliessgleichgewichts in den Polypen von *Hydractinia echinata*. II. Chemisch-analytische Untersuchungen. *Wilhelm Roux Arch. EntwMech. Org.*, Bd. 163, pp. 357–74.

A substance isolated from gastrozooid and blastostyle extracts induced the development of supernumerary tentacles. The substance was digested with trypsin and had a molecular weight within the range of peptide hormones.

Thermo-stable factors capable of inducing heteropolar regeneration were present in homogenates of all tissues, including the hydrorhiza. There was evidence that heteropolar regeneration could also result from the effects of certain inhibitory factors through interference with the dominance system. Freeze-dried hydrorhiza tissue retained its inductive capacity.

W.A.M.

MÜLLER, W. A., 1969. Determination der Geschlechtspolypen von *Hydractinia echinata*. Eine biologische und chemische Analyse. *Wilhelm Roux Arch. EntwMech. Org.*, Bd. 164, pp. 37–47.

Gastrozooid buds and regenerating gastrozooids brought into contact with blastostyle tissues were transformed into blastostyles; the inductive capacity of the blastostyle tissue decreased from apex to base.

Spontaneous transformation of regenerating gastrozooids into reproductive polyps, observable in winter, was increased by treatment with α-ketoglutarate, isocitrate, colcemide and (to a lesser extent) CO_2. Chromatographically separated fractions of blastostyle extracts also increased the rate of transformation. The capacity for transformation started at the time of tentacle formation, and the causative agent appeared to reside in blastostyle fractions also containing the tentacle-inducing substance.

W.A.M.

POTTS, G. W., 1970. The schooling ethology of *Lutianus monostigma* (Pisces) in the shallow reef environment of Aldabra. *J. Zool.*, Vol. 161, pp. 223–35.

Field observations on a school of *Lutianus monostigma* have been made off Aldabra in the shallow-reef environment. The school does not exhibit any obvious response to temperature. The response to current is the main factor that determines school orientation and position in the channel. Longshore movements are performed but their function is not known. The morning and evening dispersal may be associated with changes in light intensity and/or the crepuscular feeding habits. The response to predators depends upon the behaviour of the predator, its species and size. Other factors affecting the school in their natural environment are described.

G.W.P.

WICKSTEAD, J. H., 1970. On a small collection of Acrania (Phylum Chordata) from New Caledonia. *Cah. Pacif.*, No. 14, pp. 237–43.

A small collection of acraniates from the Bay of St Vincent, New Caledonia, was examined. The three species *Asymmetron lucayanum* Andrews, *Asymmetron cultellus* (Peters) and *Asymmetron parvum* (Parker) were recorded, with their distributions. The two specimens of *A. parvum* differ a little from the original description, and reasons for allocating them to this species are given. These are the first records of this species since the original description in 1904. The relationship between *A. parvum* and *Amphioxides valdiviae* Goldschmidt is discussed briefly.

J.H.W.