

ABSTRACTS OF MEMOIRS

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY

DIGBY, P. S. B., 1965. Semi-conduction and electrode processes in biological material. I. Crustacea and certain soft-bodied forms. *Proc. R. Soc., B*, Vol. 161, pp. 504-25.

The presence of semiconducting materials in a biological membrane across which a potential difference exists leads to a leakage of charge through semiconducting elements. Various Crustacea, particularly *Palaemonetes varians* (Leach) and *Garcinus maenas* (L) are negative to the surrounding water; semiconduction in the cuticle is shown by the liberation of hydrogen or metallic silver or copper in suitable solutions when potentials of several volts are applied, and by the production of mauve, purple or red tints in adsorbed films of the dye Nile blue sulphate at normal potentials, or potentials slightly increased by outward diffusion of salt. These alkaline colours indicate cathodic action. Similar phenomena occur in *Cyanea* and other planktonic coelenterates, though to a much lesser degree. It is concluded that in these forms too the surface acts partly as a cathode.

P. S. B. D.

GEE, J. M., 1964. The British Spirorbinae (Polychaeta: Serpulidae) with a description of *Spirorbis cuneatus* sp.n. and a review of the genus *Spirorbis*. *Proc. zool. Soc., Lond.* Vol. 143, pp. 405-41.

Since the publication of the Monograph of British Serpulids by McIntosh in 1923 a large amount of material and data has accumulated on the British Spirorbinae which is brought together in this paper. In a review of the characters used in *Spirorbis* taxonomy special attention has been paid to the form and distribution of setae and uncini which have been shown to vary from species to species. The method of embryo incubation, the number of thoracic segments, the form of the tube, operculum and setae and the morphology of the larvae are regarded as characters of major importance. The adults and larvae of the ten British species of *Spirorbis* listed here are described in detail. These include *Spirorbis cuneatus* n.sp., a form found only so far sublittorally round the Dale Peninsular, Pembrokeshire. It is very similar to the original description of *S. mediterraneus* but varies from it in certain respects. As no original material of that species could be examined, *S. cuneatus* is here regarded as a separate new species. The classification of the genus *Spirorbis*, which now contains about sixty-four well recognized species, has been briefly reviewed. From a discussion of the phylogeny of the group it is concluded that to judge from the number of thoracic segments, method of embryo incubation and larval characters, *S. malardi* and *S. spirillum* may be regarded as more primitive than most British forms and *S. pagenstecheri* as more advanced. The abdominal setation is most asymmetrical in these apparently primitive species and least so in the advanced ones.

J. M. G.

HALL, D. N. F., 1962. Observations on the taxonomy and biology of some Indo-West-Pacific Penaeidae (Crustacea, Decapoda). *Fishery Publ. colon. Off.*, No. 17, 229 pp.

An examination of some important environmental conditions was made, in particular the directions of flow of the water in the Straits of Malacca and Singapore.

The taxonomy of fifty-three species of Malay-Asian Penaeidae was considered, and the following new species and varieties were created: *Solenocera bedokensis*, *Metapenaeus ensis* var. *baramensis*, *Metapenaeus lysianassa* var. *malaccaensis*, *Parapeneopsis aroaensis*, *Parapenaeus ruberoculatus*, *Metapenaeopsis barbeensis* and *Metapenaeopsis toloensis*.

The relationship between weight and carapace length was determined for twenty-four species. It was concluded that unit weight of any species will have the same food value no matter what the size of the specimens, and that weight for weight the catch of the Penang Ambai fishery (species of *Parapeneopsis*) is of less food value than the catch of a Singapore prawn pond (species of *Penaeus* and *Metapenaeus*).

From the analysis of stomach contents of thirty-one species, it was concluded that most species have a food preference. The three species of greatest importance in the Singapore prawn ponds do not compete for food. Further, as the species first and fourth in numerical order are both vegetarians, the detrimental effects of clearing prawn ponds of vegetation was stressed.

A description of a Singapore prawn pond, and its method of operation was given. It was noted that the salinity of the water is as much dependent on land drainage as on the sea, and that the temperature of the water depends primarily on the amount of solar radiation received during the day.

The result of the analysis of random samples of Penaeidae from the prawn pond commercial catches was given. Four species, *Penaeus indicus*, *Metapenaeus ensis*, *M. mastersii*, and *M. brevicornis* accounted for more than 96% of the catches. Almost every specimen was a juvenile.

It was shown that, whereas *Penaeus indicus* has but a single peak of breeding activity each year (Feb.-Apr.) the species of *Metapenaeus* have two peaks (May-July, Oct.-Dec.). Two distinct populations of *Metapenaeus* produce the two peaks of breeding activity during any one year, the two populations alternating one with the other, but speciation is prevented by some intermixing at the time of breeding. The name *Equatorial Alternation of Populations* is given to this phenomenon.

The analysis of plankton samples was discussed. Penaeid larvae enter the Singapore ponds mostly as late mysis and early post-larvae, probably in equal numbers by day and by night, and recommendations for the improvement of prawn pond catches were made.

Notes were made on the vertical migration of penaeid juveniles in Singapore Strait: 80% of the juveniles appear to be buried in the seabed during the afternoon.

Samples of Penaeidae from Singapore Strait, from Penang, from Alor Star, and from offshore waters of the South China Sea and the Strait of Malacca were examined. *Metapenaeopsis barbata* dominates the catches of Singapore Strait: species of *Parapeneopsis* dominate the Penang Ambai catches. The South China Sea was found to have a very low concentration of Penaeidae away from a 20-mile wide coastal strip, but localities in the Malacca Straits were found to have concentrations of *Penaeus penicillatus* of possible commercial importance. Five possible prawn breeding areas in and near Singapore Strait were predicted.

The closure of the Malacca Strait during the Pleistocene and its bearing on the present distribution of Malay-Asian Penaeidae was examined, and suspicion cast on the validity of all littoral penaeid species which are alleged to range throughout the Indo-West-Pacific.

D. N. F. H.

HURST, A., 1965. Studies on the structure and function of the feeding apparatus of *Philine aperta* with a comparative consideration of some other opisthobranchs. *Malacologia*, Vol. 2, pp. 281-347.

A study has been made of the fine anatomy of the buccal region of *Philine* and of the vascular and nervous supply of the anterior region of the body. An explanation of the functioning of the apparatus is given, based on observations of feeding, the varying relation of constituent parts of the buccal apparatus and results of experimental stimulation and injection.

The muscular walls of the buccal region are capable of great change in shape. They enclose a compact buccal mass in which the radula is supported by large muscles and a malleable tissue of vacuolated cells with cell inclusions and interspersed muscle fibres. This supporting tissue also serves as a base for muscle attachment, whilst one large pair of muscles also acts in closing the radula. The last is opened by two sets of oblique muscle fibres running in the buccal mass walls. Four pairs of small buccal tensors bind the buccal mass together. The intrinsic musculature maintains the shape and relationship of component parts of the buccal mass, causes its rising and sinking movements when releasing food to the oesophagus and is involved in movements of the teeth.

Six pairs of extrinsic muscles attach the buccal region to the body wall and determine its topographical position. In feeding four pairs of these pull the buccal region forward and the buccal mass is protruded so that the radula is well in advance of the mouth and can be used as a grab. Protrusion may be accompanied by extrusion and expansion of the anterior oesophagus to form a blood-filled extrovert, depending on specialization of the blood system and the degree of relaxation of separate bundles of the columellar muscle. These muscles open and close the mouth and control blood-flow to the anterior regions by their ability to constrict the anterior aorta. This vessel may also be constricted posteriorly where it passes through the diaphragm. It is confluent with many small haemal sacs and some large anterior sinuses involved in control of the protrusion and retraction of the proboscis. Withdrawal depends largely on strong contraction of the six pairs of proboscis retractors, which can also cause side-to-side and rotatory movements of the proboscis. The radula is short and each row of teeth comprises only a single pair of laterals. These pairs may be widely opened or closed so that adjacent ones interdigitate or can grasp food firmly. Opening depends on lateral pull of muscles with increased blood pressure below the radular membrane to flatten it, whilst in closing it is folded longitudinally by muscular pull from below.

Whilst many gastropods can protrude the buccal mass to some extent it has been shown that in *Philine* it can protrude further forming part of a large gut extrovert. Use of the teeth does not depend on a bending plane nor is to-and-fro movement of the radular membrane involved. The diets and methods of feeding of species of *Scaphander*, *Acteon*, *Cylichna* and *Retusa* are described or discussed but evolutionary trends are not readily traceable due to extreme adaptation of the buccal region for the mode of feeding. The anatomy of the buccal regions of these animals and its vascular supply in *Scaphander* are also considered.

A. H.

MANGUM, C. P. & DALES, R. P., 1965. Products of haem synthesis in polychaetes. *Comp. Biochem. Physiol.*, Vol. 15, pp. 237-57.

The tetrapyrrole pigments found in a number of polychaetes were extracted and identified. Worms were selected for study with haemoglobin, chlorocruorin or no respiratory haem pigment in the blood. All were found to contain not only large

amounts of free porphyrins but also the corresponding haematins. Their distribution in various tissues is described and their significance discussed. It is suggested that there is a quantitative difference from vertebrate haemoprotein biosynthesis in that these byproducts accumulate and the porphyrins are converted to their corresponding haematins which are not known from other organisms.

R. P. D.

MURRAY, J. W., 1965. Significance of benthic foraminiferids in plankton samples. *J. Palaeont.*, Vol. 39, No. 1, pp. 156-7.

After a period of storms during January 1962, dead, empty tests of benthic foraminiferids were found in six plankton samples collected from three stations across the Channel in the surface 10 m of water. Only thin-walled forms were represented and most of these were 0.15-0.20 mm in length or diameter according to shape. Disturbance of the sea floor sediments during the storms had led to the preferential removal of these small foraminiferids and the mechanism would enable them to be widely dispersed before they settled back to the sea floor. This phenomenon must be considered when making a palaeoecological interpretation of fossil foraminiferid assemblages.

J. W. M.

NEWELL, R. C. & COURTNEY, W. A. M., 1965. Respiratory movements in *Holothuria forskali* Delle Chiaje. *J. exp. Biol.*, Vol. 42, pp. 45-57.

The respiratory rate of *Holothuria forskali* was found to be between 0.0162 and 0.0465 ml. O₂/g. dry wt./h. at 17° C. By separating the water pumped by the cloaca from that in contact with the general body surface it was found that cloacal gas exchange accounted for approximately 60% of the total consumption.

Uptake of oxygen through the cloaca occurred only when the pumped water was more than 60-70% saturated with air. At lower oxygen concentrations than this, pumping ceased whilst at higher concentrations the nature of the pumping rhythm was found to be dependent upon the oxygen concentration of the water surrounding the animal.

There are three main types of rhythm. (a) When the whole animal was surrounded by well oxygenated sea water, a rhythm was shown in which approximately 20 ml. were taken up by cloacal pumping and then gradually expelled. (b) The second type was exhibited when the anterior end and general body surface was aerated but the water entering the respiratory trees was approaching 70% saturation. In this rhythm, water was taken in by cloacal pumping and then followed a series of rapid influxes each followed by expulsion. The net result of such pumping was that the total volume pumped in and out of the trees per minute was greatly increased. (c) The third rhythm was shown by animals whose anterior end and general body surface was deoxygenated. It involved a regular series of cloacal contractions driving water into the trees, followed by a sudden expulsion of fluid.

Cessation of pumping was accompanied by an increase in the volume of the coelomic fluid which was subsequently used as an oxygen store.

R. C. N.

ROBERTSON, J. D., 1965. Studies on the chemical composition of muscle tissue. III. The mantle muscle of cephalopod molluscs. *J. exp. Biol.*, Vol. 42, pp. 153-75.

Mantle muscle from *Sepia officinalis*, *Loligo forbesi* and *Eledone cirrhosa* has been analysed for all the major constituents contributing to its osmotic concentration. By using the inulin space of the muscle as a measure of extracellular fluid, calculations have been made of the intracellular concentrations of ions and molecules. Over half

of the osmotic concentration of the muscle cells is made up by free amino acids, trimethylamine oxide and betaine. These nitrogenous compounds plus inorganic ions and organic phosphates make up 94% of the osmotic concentration of the muscle cells in *Sepia*.

Direct measurements of the osmotic concentration of muscle-juice and plasma of *Eledone* show that the juice is slightly hyperosmotic (+3.2% on plasma value), probably owing to breakdown of labile compounds. Chemical analysis of the muscle-juice lends support to the view that the whole of the cell calcium, much of the magnesium and sodium, and a lesser proportion of the potassium is bound to cell constituents; the chloride ion is completely free.

J. D. R.