

ABSTRACTS OF MEMOIRS

RECORDING WORK DONE AT THE PLYMOUTH LABORATORY

CORKETT, C. J., 1972. Development rate of copepod eggs of the genus *Calanus*. *Journal of Experimental Marine Biology and Ecology*, **10**, 171–5.

The development time to hatching of eggs of four closely related species of copepods, *Calanus helgolandicus* (Claus), *C. finmarchicus* (Gunn.), *C. glacialis* Jaschnov, and *C. hyperboreus* Kröyer as a function of temperature is given by $D = a(T - \alpha)^b$.

The constant a is positively correlated with egg diameter, so that large eggs take longer to develop than small eggs. The value of constant α is related to the geographical range of the species.

CORNER, E. D. S., 1973. Phosphorus in marine zooplankton. *Water Research*, **7**, 93–110.

In the euphotic zone, phosphorus compounds dissolved in sea water are utilized by growing plants, many of which are subsequently eaten by herbivorous zooplankton and the dietary phosphorus invested partly in growth and egg production, partly released in insoluble form as faecal pellets and partly metabolized. The fraction metabolized is excreted back into the sea water mainly as inorganic phosphate, which is again available as a nutrient for the plants.

Quantitative aspects of this cyclic process are discussed with particular reference to the Calanoid copepods, animals of central importance to the marine food web in several sea areas. Topics include: (1) laboratory and field investigations of the assimilation of dietary phosphorus and the efficiency of this process; (2) the rates at which zooplankton release soluble forms of phosphorus in relation to species, body-size, food availability and season; (3) the importance of zooplankton in regenerating phosphorus compounds that may be used by the plant population; (4) the daily rations of phosphorus captured by zooplankton; (5) the total amounts and chemical forms of phosphorus in the animals; (6) growth of zooplankton and the use of N:P ratios in animals, diets and excretion products in estimations of gross growth efficiency in terms of phosphorus; (7) future studies.

HUGHES, G. M., 1972. The relationship between cardiac and respiratory rhythms in the dogfish, *Scyliorhinus canicula* L. *Journal of Experimental Biology*, **57**, 415–34.

In order to facilitate transfer of oxygen from water to blood, a relationship is expected between the flows of these two media across the gills. The most convenient way of investigating this relationship is to record the electrocardiogram and pressure changes within the respiratory cavities. Previous studies suggested a simple relationship between these two rhythms (1:1, 2:1, 3:1 etc.).

The present experiments were started because of indications from longer-term recordings that the situation was not so simple. Recordings were made within a closed water circulation of constant temperature (15–17 °C) from specimens which had fully recovered from anaesthesia. Tape recordings made at regular intervals over many hours, often on several days, were analysed using a Biomac averaging computer.

The results indicated variations in cardiac frequency of 11–64 /min and ventilatory frequency 30–70/min in individuals of similar body size. Variations in inter-beat interval were usually greater for the cardiac rhythm. Analysis of event correlograms showed the position of the ECG in an averaged ventilatory cycle which was divided into 10 equal phases. In many fish the heart tended to beat in a particular phase at least for short periods, but in some cases this was never observed. Individuals also varied in the preferred phase, and absolute synchrony with a particular phase was rarely observed. Analysis of the incomplete synchrony was carried out by a new method using polar coordinates which showed that in 60% of the recordings analysed there was some significant (1% level) coupling between the rhythms. Phase angle was variable but usually lay between 0 and 180°, i.e. during the first half of the cycle following the maximum positive pressure in the oro-branchial cavity. The results emphasize the need for analyses of the detailed flow patterns of water and blood across single secondary lamellae, but this will be extremely difficult technically.

IZZARD, C. S. Development of polarity and bilateral asymmetry in the pallear bud of *Botryllus schlosseri* (Pallas). *Journal of Morphology*, **139**, 1–26.

The development of the polarity and bilateral asymmetry of the future adult zooid has been traced to their earliest morphological expression in the pallear bud of *Botryllus*. The account is based upon continued observation of living buds. The polarized antero-posterior and dorso-ventral axes are first expressed by the skewing of a symmetrical, hemispherical bud towards the anterior end of the parental bud. Identification of these axes is reinforced by the development of a loop-like blood circulation, the *primary circulation*, in the horizontal plane during the enlargement of the skewed hemisphere to form a stalked vesicle. Bilateral asymmetry is first expressed by the asymmetrical expansion of the vesicle stage. The right posterior corner of the vesicle expands further posteriorly and becomes more acute than the left posterior corner. This larger expansion persists throughout the development of the right atrial cavity, which finally expands across the mid-line to partially surround the gut. The bilateral asymmetry, expressed in the expanded vesicle, is reinforced by the development in sequence of a rounded gut rudiment and a pericardial rudiment in positions that would be expected from the asymmetry of the expanded vesicle. The first appearance of the gut rudiment occurs earlier than had been recognized previously. Conflicting accounts of the time and mode of formation of the pericardial rudiment have been clarified. The results of this study are discussed in the context of determination of bud territory, polarity and bilateral asymmetry.

NICOL, J. A. C., ARNOTT, H. J. & BEST, A. C. G., 1973. Tapeta lucida in bony fishes (Actinopterygii): a survey. *Canadian Journal of Zoology*, **51**, 69–81.

Bony fishes belonging to 75 families were examined for ocular tapeta lucida. The results are collated with published records, and tapeta are shown to occur in 28 families of teleostomes (Holo-stei and Teleostei). Except in the bigeyes Priacanthidae, they are diffuse reflectors located in the pigment epithelium. Based on chemical composition, several types can be distinguished, lipid, guanine (purine), and some others, coloured yellow or light tan, of unknown composition. In several tapeta minutely examined, the reflecting material occurs as platelets (guanine type) or as minute tapetal spheres (lipid and others). The tapetum of the bigeye lies in the chorioid, it is a specular reflector containing guanine; as such it is the solitary known exemplar among teleosts.

SMALDON, G., 1973. Osmoregulation in *Pisidia longicornis* (L.) and *Porcellana platycheles* (Pennant) (Decapoda, Anomura) subjected to reduced salinities. *Comparative Biochemistry and Physiology*, **44**(A), 893–5.

1. *Pisidia longicornis* and *Porcellana platycheles* exhibit hyperosmotic regulation to a slight extent in reduced salinities.
2. *P. platycheles* has a greater tolerance of reduced salinities than *P. longicornis*.
3. This tolerance, rather than regulation, accounts for their capacity to penetrate waters of low salinity.

STODDART, D. R., BRYAN, G. W. & GIBBS, P. E., 1973. Inland mangroves and water chemistry, Barbuda, West Indies. *Journal of Natural History*, **7**, 33–46.

Mangrove vegetation on Barbuda, West Indies, comprising not only *Laguncularia* and *Conocarpus* but also a closed woodland of *Rhizophora*, found in inland situations having no connection with the sea and associated with geological and geomorphic features of either late Pleistocene or possibly earlier Holocene age, is described.

The mangroves are associated with brackish water, analysis of which shows, in particular, high calcium and strontium concentrations, probably resulting from diagenetic changes in the limestone.

It is concluded that the inland mangroves may be relict from the period when the lithified beach ridges on the island were formed.

P. E. G.

WHITFIELD, M., 1972. Progress towards a chemical model for sea water. *Proceedings of the Royal Society of Edinburgh (B)*, 72, 389–99.

The historical development of models used to represent the chemical constitution of sea water has been reviewed. The evolution of ideas is presented as a pattern interwoven between the disciplines of physical chemistry, marine chemistry and geochemistry. The progressive refinement of this pattern is traced from the work of Lavoisier (1776) through the proposal of the first explicit model for sea water by Garrels & Thompson (1962). Following a brief survey of current work on the properties of mixed electrolyte solutions, indications are given of the possible future development of computer simulation of the major inorganic processes occurring in the sea.

M. W.