ABSTRACTS OF MEMOIRS

RECORDING WORK AT THE PLYMOUTH LABORATORY

BERDUGO, V., HARRIS, R. P. & O'HARA, S. C., 1977. The effect of petroleum hydrocarbons on reproduction of an estuarine planktonic copepod in laboratory cultures. *Marine Pollution Bulletin*, **8**, 138–143.

The effect of short-term exposure to high concentration (mg l^{-1}) of water-soluble fraction of aromatic heating oil on subsequent egg production by the estuarine copepod *Eurytemora affinis* has been studied in laboratory cultures to investigate possibly sublethal biological effects following exposure to hydrocarbon under an oil spill. Significant reduction in subsequent length of life, total number of eggs produced, mean brood size, and rate of egg production was observed. Exposure to naphthalene alone at 1 mg l^{-1} for 24 h produced a significant effect on total fecundity of the females. Ingestion rates were significantly lower when measured in the presence of the water soluble fraction, and also naphthalene alone at mg l^{-1} concentrations. Exposure to low levels (10 and 50 μg l^{-1}) of [^{14}C]naphthalene alone over a period of 10 days produced no significant effect on feeding or reproduction despite the high concentrations of hydrocarbon accumulated during this period. The results are discussed in relation to previous work on the fate of hydrocarbons in planktonic copepods, using [^{14}C]naphthalene as a model compound.

DILLY, P. N., 1977. Material transport within specialised ciliary shafts on *Rhabdopleura* zooids. *Cell and Tissue Research*, **180**, 367–381.

The surface of the *Rhabdopleura* zooid is ciliated. The cilia of the cephalic shield and tentacles have paddle-like swellings of the shaft. These swellings are usually about 0·6–1 μm in diameter and most frequently found in the distal 1–2 μm of the ciliary shaft. Others are found in other positions along the length of the cilium and it is suggested that at least some of these swellings represent material transport within the cilium.

Paddle-shaped cilia are probably more efficient than normal cilia in moving water and food particles. If these cilia are involved in the building of the tubular coenecium then their distribution suggests that the tentacles as well as the cephalic shield are actively involved in tube building.

HEINLE, D. R., HARRIS, R. P., USTACH, J. F. & FLEMER, D. A., 1977. Detritus as food for estuarine copepods. *Marine Biology*, **40**, 341–353.

A variety of detrital foods derived from marsh plants were fed to the copepods *Eurytemora affinis* and *Scottolana canadensis*. The copepods did not survive well or produce eggs when feeding on detritus with smaller amounts of microbiota, but did well when a rich and abundant microbiota was present. Ciliated protozoans appear to be particularly important in the transfer of detrital energy to copepods.

MEVES, H. & VOGEL, W., 1977. Inactivation of the asymmetrical displacement current in giant axons of *Loligo forbesi*. *Journal of Physiology*, **267**, 377–393.

Asymmetrical displacement currents ('gating currents') have been recorded in intracellularly perfused squid giant axons by averaging the currents associated with depolarizing and hyperpolarizing pulses. The relation between 'gating current' and Na inactivation was studied by investigating the effect of pulse duration and conditioning pulses.

Increasing the pulse duration from 0·3–1 to 10–20 ms reduced the off-response of the 'gating current' to 50–70 % of its normal size; the time constant was 5 ms at +20 mV and 8 °C. The decrease of the Na current during a 10–20 ms pulse was stronger and faster; it decayed to 10–26 % with a time constant of 1·35 ms.

The effect of pulse duration could also be demonstrated by using only depolarizing pulses. The charge displacement at the end of single or averaged depolarizing pulses was smaller for long

pulse durations than for short. A long depolarizing pulse was followed by a small long-lasting tail of inward current.

A conditioning depolarizing pulse of 10–20 ms duration to a potential of −30 or +10 mV, followed by a short recovery period at −70 mV, decreased the on-response of the 'gating current'. Its size was reduced to 46–71 % and 61–94 %, respectively, for a recovery interval of 1·75 and 5 ms at 2–3 °C. The reduction of the Na current, measured under similar conditions, was more pronounced; the Na current was decreased to less than 50 % of its normal value.

The observations about the effect of pulse duration and conditioning pulses on the 'gating current' are qualitatively consistent with those of Bezanilla & Armstrong (1974, 1975) and support the view that part of the asymmetrical charge displacement is inactivated during a 10–20 ms depolarization.

MEVES, H. & VOGEL, W., 1977. Slow recovery of sodium current and 'gating current' from inactivation. *Journal of Physiology*, **267**, 395–410.

Asymmetrical displacement currents ('gating currents') and Na currents have been recorded in intracellularly perfused squid giant axons with the voltage-clamp method. Inactivation of the currents by a long-lasting depolarization to −30 mV and subsequent removal of inactivation have been studied at temperatures of 0·5–3 and 8–9 °C.

The asymmetrical displacement current, recorded with the divided pulse procedure, was markedly reduced by a 1·5–800 ms depolarization to −30 mV; a 3 min depolarization led to almost complete blockage.

Recovery of the asymmetrical displacement current from a 3 min depolarization to −30 mV was slow (20–40 % recovery after 50–800 ms at −70 mV and 8–9 °C); full recovery from a long-lasting depolarization took several minutes.

Recovery of the Na current followed a similar time course (20 % recovery after 50–800 ms at −70 mV and 8–9 °C); the time constant of full recovery was 2–3·5 min.

Slow recovery was also demonstrated by recording the displacement currents associated with single depolarizing pulses.

The results are consistent with the idea that the asymmetrical displacement current is related to the function of the Na gates.

PAUL, D. H. & ROBERTS, B. L., 1977. The location and properties of the efferent neurons of the head lateral-line organs of dogfish. *Journal of Comparative Physiology*, A **116**, 117–127.

Efferent neurons of the lateral-line organs of dogfish (*Scyliorhinus*) have been identified in the anterior lateral-line lobe of the medulla. They were identified histologically by filling them with cobalt salts passed electrophoretically along the lateral-line nerve fibres from their cut peripheral ends; in this way multipolar neurons in the rostral region of the lobe were filled with salt.

Efferent neurons were identified electrophysiologically in this region by antidromic invasion following stimulation of the lateral-line nerves. These units were not spontaneously active but would discharge 1–4 spikes reflexly, with a minimum latency of 6·5 ms, in response to lateral-line nerve stimulation. The latency distribution of the reflex discharges was trimodal, the peaks corresponding to the mass discharge of these neurons which could be recorded from the whole lateral-line nerve as a series of three compound potentials.

PINGREE, R. D. & GRIFFITHS, D. K., 1977. The bottom mixed layer on the continental shelf. *Estuarine and Coastal Marine Science*, **5**, 399–413.

The height of the bottom mixed layer of the continental shelf is defined as the height above bottom where the mean potential temperature exceeds the bottom value by 0·01 °C. Direct measurements of vertical current shear and temperature structure indicate that in this region the production of turbulent energy is much greater than the stabilizing effect of the heat flux down the potential temperature gradient. Detailed temperature profiles with a resolution of 10^{-3} °C suggest that the controlling parameters for the potential temperature gradient are the friction velocity and the downward heat flux.

WHITFIELD, M., 1976. The evolution of the oceans and the atmosphere. In *Environmental Physiology of Animals* (ed. J. Bligh, J. L. Cloudsley-Thompson and A. G. Macdonald), pp. 30–45. Oxford: Blackwell Scientific Publications.

This chapter summarizes the evolution of the oceans and atmosphere from their anoxic beginnings to the present day and sets their development against a background of relentless geological activity. Information from the fossil record and from the geochemistry of the rocks is used to put a tentative time scale to the oxygenation of the system and the biological significance of this progress is briefly reviewed. This short treatment is completed with a summary of the present balance of processes maintaining the composition of the oceans and the atmosphere.

ZAMMIT, V. A. & NEWSHOLME, E. A., 1976. The maximum activities of hexokinase, phosphorylase, phosphofructokinase, glycerol phosphate dehydrogenases, lactate dehydrogenase, octopine dehydrogenase, phosphoenolpyruvate carboxykinase, nucleoside diphosphatekinease, glutamate-oxaloacetate transaminase and arginine kinase in relation to carbohydrate utilization in muscles from marine invertebrates. *Biochemical Journal*, **160**, 447–462.

Muscles of marine invertebrates can be divided into three groups with respect to activities of hexokinase, phosphorylase and phosphofructokinase: those with low activities of all three enzymes (e.g. coelenterate muscles); those with high activities of phosphorylase and phosphofructokinase (e.g. lobster abdominal muscles); those with high activities of hexokinase (e.g. radular muscles of prosobranchs). Muscles fall into four groups with respect to activities of enzymes involved in oxidation of glycolytic NADH: those with a high activity of lactate dehydrogenase; those with high activities of octopine dehydrogenase; those with moderate activities of both octopine dehydrogenase and lactate dehydrogenase, and those with low activities of both these enzymes but with activities of phosphoenolpyruvate carboxykinase. The glycerol phosphate cycle does not appear to be important in any of the muscles studied. Rather, the high activities of glutamate-oxalocacetate transaminase in the more aerobic muscles indicates that the malate-aspartate shuttle is in operation. High activities of nucleoside diphosphate kinase were found in muscles that function for prolonged periods under anaerobic conditions. In fast anaerobic muscels the activities of myofibrillar ATPase are about twice the calculated maximum rate of ATP formation from glycolysis. High activities of arginine kinase are found in these muscles; arginine phosphate breakdown is an important source of energy for anaerobic contraction in these muscles. High activities of octopine dehydrogenase are related to this factor in molluscan muscles.