ABSTRACTS OF MEMOIRS

RECORDING WORK AT THE PLYMOUTH LABORATORY

BONE, Q. & CHUBB, A. D., 1978. The histochemical demonstration of myofibrillar ATPase in elasmobranch mnscle. *Histochemical Journal*, **10**, 489–494.

A modification of the histochemical method of Guth & Samaha (1970) is presented, which gives good results with dogfish material. The routine involves pre-incubation in diethanolamine buffers, and the addition of urea to the pre-incubation and incubating media. The results obtained accord with the view that contraction speed is related to myofibrillar ATPase activity.

BONE, Q. & MACKIE, G. O., 1977. Ciliary arrest potentials, locomotion and skin impulses in *Doliolum* (Tunicata: Thaliacea). *Rivista di Biologia normale e Patalogica*, **3**, 181–191.

The electrical correlates of arrests in the beat of gill bar cilia are described, the initial arrest of a series involves all the gill cilia whereas succeeding cyclical events involve only the lower portion of the gill bars. The rhythmic arrest patterns are not dependent upon the central nervous system, but on local innervation around the edges of the gill bars.

The animal can swim in either direction and to do so changes the delay between the main body muscles and those of front and rear lips. Muscular contractions are nearly synchronous multiple events. The epithelia of young stages does not propagate epithelial action potentials, but such skin pulses are seen in the old nurse stage, where they do not affect the rhythmic locomotor activity. Finally, the significance of the occurrence of skin impulses and ciliary arrest potentials in various tunicates is discussed, and it is concluded that except in the special case of *Oikopleura*, the two systems are incompatible, and are not found in the same animals.

BONE, Q. & RYAN, K. P., 1978. Cupular sense organs in *Ciona* (Tunicata: Ascidiacea). *Journal of Zoology*, **186**, 417–429.

The cupular organs of the atrial (exhalant) siphon of *Ciona* have been studied with scanning and transmission microscopy and are shown to resemble those of the vertebrate acoustico-lateralis system in several respects. The sensory cells are ciliated, and their cilia are apparently non-motile, having a modified inner tubular array. These cells lie amongst supporting cells that probably secrete the cupula, which is composed of polysaccharide and proteins as is the test. *Ciona* is sensitive to near-field vibrations, even after the brain has been removed; the significance of this observation and of the arrangement of the cupular organs is discussed. It is concluded that the tunicates show a suitable morphological starting point for the vertebrate acoustico-lateralis system.

BRIDGES, C. R., BICUDO, J. E. P. W. & LYKKEBOE, G., 1979. Oxygen content measurement in blood containing haemocyanin. *Comparative Biochemistry and Physiology*, **62** A, 457–462.

A modification of an earlier technique for rapid determination of O_2 content in fluid samples is described.

The method has been shown to have a standard deviation of 0·064 ml O_2/100 ml blood between replicate samples of haemocyanin containing blood.

The method has been used for studying O_2 equilibrium curves of haemocyanin containing blood of *Sepia officinalis* and has been compared with a spectrophotometric method for accuracy and reproducibility.

DAVIES, A. G., 1978. Uptake of micronutrients and toxic metals. In *Handbook of Phycological Methods: Physiological and Biochemical Methods* (ed. J. A. Hellebust and J. S. Craigie), pp. 435–445. Cambridge University Press.

This Handbook, the second of four on experimental phycology planned by the Phycological Society of America, is a compilation of the methods which are being used in detailed studies of the physiological and biochemical properties of algae, the first volume having dealt with culture methods and growth measurements.

The chapter on the uptake of micronutrients and toxic metals is concerned with techniques for determining how the growth rates of phytoplankton cultures are related to the quantities of these potentially rate-limiting substances taken up by the plant cells. It describes the apparatus required and the precautions necessary to ensure the cleanliness of the glassware used. Suitable culture media are mentioned and the advantages of using radioactively labelled forms of the trace components are discussed. A list of the radioactive tracers available for most of the micronutrients and toxic metals of interest is also included. The chapter finishes with a step-by-step description of how to carry out the measurements, and the way in which the resulting data are interpreted is illustrated using figures taken from an actual experiment on the accumulation of mercury by *Isochrysis galbana*.

GIBBS, P. E., 1978. Macrofauna of the intertidal sand flats on low wooded islands, northern Great Barrier Reef. *Philosophical Transactions of the Royal Society* (B), **284**, 81–97.

An account of the macrofauna inhabiting the mobile substrata of the intertidal zone on low wooded islands in the Northern Region of the Great Barrier Reef Province is given. Excluding mangrove habitats, three main sediment–fauna types can be recognized: (i) well sorted sands forming the sloping beaches of sand cays, colonized by *Ocypode*, mesodesmatids and hippids; (ii) muddy sand flats supporting a very diverse fauna dominated in most areas by *Edwardsia* and chaetopterids; and (iii) areas of fine deposit, characterized by *Uca*, *Gafrarium* and *Marphysa*.

Some associations of animals, chiefly involving commensal polychaetes and bivalves, are described.

MADDOCK, R. G. & NICOL, J. A. C., 1978. Studies on the eyes of *Hydrolagus* (Pisces: Chimaeridae). *Contributions in Marine Science, University of Texas*, **21**, 77–87.

The chimaerids *Hydrolagus affinis* and *H. colliei* have a tapetum lucidum located in the chorioid. It consists of a layer of reflecting cells whose orientations change from parallel to the surface of the retina in the central fundus to very oblique at the periphery of the eyes. The whole fundus is bright in *H. affinis*; in *H. colliei* black pigment extends inwards over the tapetum in extracentral regions, to an increasingly greater extent towards the periphery, and the ventral fundus is black. The reflecting cells contain hexagonal crystals of guanine, their surfaces exhibit a medley of colours, and the overall colour of the tapetum is light green. *H. affinis* has a golden rhodopsin, λ_{max} 484 nm, similar to that reported for *H. colliei*. The former is a deep-sea species, the latter coastal, and several features of their eyes are compared with reference to photic conditions in the environment.

NICOL, J. A. C., 1978. Studies on the eye of the stingaree *Dasyatis sabina*, with notes on other selachians. I. Eye dimensions, cornea, pupil and lens. *Contributions in Marine Science, University of Texas*, **21**, 89–102.

Measurements of ocular diameters and pupillary apertures of stingarees *Dasyatis sabina* are presented. The position of the optic axis relative to the chief axes of the fish has been determined, pupillary apertures of dark-and-light-adapted eyes have been measured and estimates have been made of the light entering the pupil at various angles of tilt. Changes of pupillary aperture involve both descent of an operculum and iridial constriction; the pupil closes in about 5 min and opens in about 30 min. The corneas of the stingarees examined were cloudy; this condition was a feature of the epithelium. Spectrum transmission of the lens was measured, short wavelengths, below 425 nm, were heavily absorbed. Some consequences of these optic conditions are discussed.

PINGREE, R. D. & GRIFFITHS, D. K., 1978. Tidal fronts on the shelf seas around the British Isles. *Journal of Geophysical Research*, **83**, 4615–4622.

A numerical model is used to derive the Simpson–Hunter stratification parameter on the shelf seas surrounding the British Isles. Positions of predicted fronts are compared with structures observed in infra-red satellite images and the measurements of sea surface temperature recorded on a cruise around the British Isles. The numerical model predicts the stability of the frontal systems, and baroclinic instability is suggested as the main candidate for cross-frontal mixing.

PINGREE, R. D., HOLLIGAN, P. M. & MARDELL, G. T., 1978. The effects of vertical stability on phytoplankton distributions in the summer on the northwest European shelf. *Deep-Sea Research*, **25**, 1011–1028.

Comparative data on phytoplankton distributions in frontal regions on the northwest European shelf, obtained in July 1977, are interpreted in terms of the tidal energy dissipation rate per unit mass and the water depth scaled by the extinction coefficient. In the summer months nutrient renewal along frontal boundaries, due to mixing by wind and tide, and surface stabilization during settled weather and neap tides intermittently create conditions suitable for the rapid growth of plant cells. This effect is likely to be most widespread where the transitional region between well-mixed and well-stratified waters is broad.

RUDY, B., 1978. Slow inactivation of the sodium conductance in squid giant axons. Pronase resistance. *Journal of Physiology*, **283**, 1–21.

Squid giant axons internally perfused with CsF have their Na conductance inactivated due to the low value of the resting potential. When hyperpolarized with voltage clamp to normal values of resting potential, the Na conductance recovers with an exponential time course. The time constant of recovery is of the order of 30 s at a membrane potential of -70 mV and at 5 °C. The recovery from slow inactivation has a Q_{10} of about 3.

The development of inactivation during depolarization is also slow. The time constant varies between 10 and 20 s at 5 °C, depending upon the value of the membrane potential.

Slow inactivation is also observed in NaF perfused axons and in intact axons with a low resting potential.

Although internal perfusion with pronase (or a purified fraction of this enzymic complex) blocks the fast (h) inactivation of the Na conductance, the slow inactivation remains. The recovery is similar before and after the proteolytic treatment. However, slow inactivation appears to develop faster after enzymic perfusion.

Slow inactivation develops without any apparent change in distributed or local membrane surface charge.

The experiments suggest that slow inactivation is a general property of the Na conductance as in many other conductance channels in excitable membranes. The experiments can be interpreted by proposing that slow inactivation is a phenomenon independent of fast inactivation, and that pronase somehow accelerates the onset of slow inactivation.

An alternative model, in which slow inactivation is coupled to fast inactivation, is proposed. This model is consistent with the results presented here and is very similar to one proposed to explain the frequency response of the sodium currents in *Myxicola* giant axons (Rudy, 1975, 1978).

STODDART, D. R., MCLEAN, R. F., SCOFFIN, T. P. & GIBBS, P. E., 1978. Forty-five years of change on low wooded islands, Great Barrier Reef. *Philosophical Transactions of the Royal Society* (B), **284**, 63–80.

During the 1928–9 Expedition, centred at Low Isles, Spender mapped the 'low wooded islands' or 'island-reefs' of Low Isles and Three Isles in detail, and additional information was published by Steers, T. A. Stephenson and others. From this work, two different models of the evolution of low wooded islands were proposed, Spender holding that the islands were in a state of equilibrium resulting from their location on the reef, Steers that they could be placed in an evolutionary sequence. Moorhouse described the results of cyclones at Low Isles in 1931 and 1934, and Fairbridge & Teichert reconsidered the general issues following aerial reconnaissance and a brief visit to Low Isles in 1945. Subsequently, aspects of change since 1928–9 have been studied at Low Isles by W. Stephenson, Endean & Bennett in 1954 and by W. Macnae in 1965. Maps produced since 1929, however, have all been based on Spender's surveys. In 1973, Low Isles and Three Isles were remapped in detail, and a direct comparison can now be made over an interval of 45 years. This shows changes in island topography, and substantial alteration in the size and location of shingle ramparts which has affected conditions for coral growth on reef flats. Mangroves have extended greatly at Low Isles, but not at all at Three Isles. The implications of these findings for the general models of Steers and Spender will be discussed and related to the Holocene history of the Great Barrier Reefs.