STROMATEOID FISHES

Life with Jellyfishes

from our Marine Vertebrate Correspondent

THE stromateoid fishes are a widely distributed group of temperate and tropical marine fishes found in a range of depths in inshore and oceanic waters. Perhaps one of the best known, a member of the family Nomeidae, is the Portuguese man-of-war fish, *Nomeus gronovii*, which is found under the float of the siphonophore *Physalia* swimming actively among the toxin-laden tentacles. Their apparent immunity to the toxin produced by the stinging cells has aroused considerable interest, and one report suggests that they can survive as much as ten times the dose of *Physalia* toxin that would kill a fish of comparable size. In spite of this relative immunity *Nomeus* seems to avoid contact as much as possible with the tentacles. Many other stromateoids are known to similarly associate with jellyfishes and siphonophores.

Stromateoid fishes show marked changes during growth, and the body form of young fishes is often markedly dissimilar to that of the adults. The differences are not all external, however, for although most lack a swimbladder when adult, they possess a functional one as juveniles. Dr Michael H. Horn has discovered that in fourteen out of the fifteen recognized genera of stromateoid fishes the swimbladder regresses with age (*Breviora*, No. 359, 1; 1970). The exception is the largely coastal genus, *Pampus*, which seems to have no swimbladder at any age, and is believed not to associate with jellyfishes when young.

The swimbladder in these fishes is a hydrostatic organ and, even if small, provides a degree of buoyancy. During their young stages the skeleton is poorly ossified and the musculature may not be well developed, and thus the juveniles probably have a lower specific gravity than the adults, and even a small swimbladder will take them close to neutral buoyancy. The reduction of the swimbladder with growth is gradual, the sac diminishing slowly until it is completely resorbed.

The interest in these observations lies in their relation to the biology of these fish. In the American Atlantic coast butterfish, *Peprilus triacanthus*, the swimbladder has completely regressed by the time that the fish is 10 cm in body length, and it is at about this size that the young cease their association with jellyfish medusae. Butterfish smaller than this length swim by hovering close to the medusa, whereas larger specimens do not hover but swim continuously. The pectoral fins increase in size with age and are used extensively for propulsion by the larger fish. It seems that continuous swimming with some propulsion by the pectoral fins is the general way of life for adult stromateoids.

Nomeus, the stromateoid which associates with the siphonophore *Physalia* in a more intimate and enduring way than its other relatives, retains a functional swimbladder at a greater length than other stromateoids. It is not known whether *Nomeus* remains with *Physalia* throughout its life, but specimens as large as 143 mm body length have been captured at the surface with *Physalia* and possess a large swimbladder.

Horn's study shows that the possession of a swimbladder in the young stages could be a positive advantage to a fish which lives under jellyfish medusae, or among the toxin-laden tentacles of a siphonophore, floating at the surface. An ability to stay afloat efficiently and manoeuvre with nicety in such a microhabitat is as obvious an advantage to the small fish as the greater swimming capacity of adults living in deep water in the open ocean.

Carbohydrate or Protein in Transplantation?

Sanderson, Cresswell and Welsh suggest in next Wednesday's *Nature New Biology* that the antigenic determinants responsible for exciting immunological responses to tissue and organ grafts are predominantly carbohydrate rather than protein. Using human spleen tissue from individuals known to possess three quite distinct transplantation (histocompatibility) antigens (Bt 4, Bt 5 and Bt Walde), Sanderson *et al.* prepared glycoprotein fractions by digestion of cell membranes with papain and purification with the aid of chromatography and disc gel electrophoresis. These soluble materials, each with a molecular weight of approximately 45,000, were further digested with insoluble pronase and the resulting glycopeptides were separated from the bulk of the amino-acids and peptides by chromatography on 'Sephadex G-50'. A low molecular weight (probably 8–10,000) fraction with a very high carbohydrate content was obtained for each specificity and was found to be serologically active in that it inhibited the lytic action of the specific antiserum. The glycopeptides of this fraction had a restricted range of amino-acids which always included aspartic acid, serine and threonine—all of which are especially concerned with linking sugar to protein.

At first sight these data seem to be irreconcilable with the now widely held view that the specificity of the "strong" histocompatibility antigens—the antigens controlled in man by the HL-A and in the mouse by the H-2 locus—depends on the amino-acid sequence of glycoproteins. This notion stems largely from the work of Shimada *et al.* (*Proc. US Nat. Acad. Sci.*, **65**, 691; 1970), who analysed and compared tryptic digests of glycoproteins obtained from mice carrying two distinct H-2 specificities. Although 90 per cent of the peptides were identical, each preparation had some that were unique, whereas no detectable differences were found in the composition of their carbohydrate moieties (Nathenson, *Ann. Rev. Genet.*, **4**, 69; 1970). The weakness of these experiments is that Shimada *et al.* did not subject their fractions to biological tests such as *in vitro* inhibition of antibody, and that the amino-acid differences found by them could be unrelated to the activity of immunodeterminants that may form only a very small portion of the glycopeptide molecules. Nevertheless their data, together with those from other laboratories, seem to implicate protein quite strongly. The carbohydrate hypothesis, on the other hand, derives support from the observation that mouse (Billingham *et al.*, *Transplant. Bull.*, **5**, 377; 1958) and human (Sanderson and Cresswell, in *Transplantation Antigens and Tissue Typing*, edited by Elves and Nisbett, p. 87; Oswestry Orthopaedic Hospital Management Committee, 1969) histocompatibility antigens can be largely inactivated by periodate treatment, and that there are serological cross-reactions between mouse H-2 antigens and pneumococcal polysaccharide type XIV as well as human blood group A substance (Brent *et al.*, *Brit. J. Exp. Pathol.*, **42**, 464; 1961).

In an attempt to reconcile their own data with those pointing to the role of protein, Sanderson *et al.* suggest that although the specific determinants may be composed of carbohydrate they are carried on a molecular peptide backbone that plays a crucial part in the spatial arrangement of the determinants and therefore, indirectly, in determining their specificity. This is an interesting idea which has already been considered in relation to the mouse H-2 antigens (Shreffler and Klein, *Transplant. Proc.*, **2**, 5; 1970), but further work is needed to test its validity. Will these low molecular weight glycopeptides prove to have biological activity other than the ability to inhibit antisera; for example, can they sensitize or induce tolerance? Whatever the answer, Sanderson *et al.* have made it clear that carbohydrate is not merely an accidental contaminant of histocompatibility antigens, and that it is likely to have a highly specific function.