Studies of bile pigment metabolism in the dogfish (Squalus acanthia) and the goosefish (Lophius piscatorius) (*)

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In mammalian liver, bilirubin must be conjugated to be excreted in the bile. The biosynthesis of bilirubin glucuronide, the major conjugate, involves the transfer of glucuronic acid from uridine diphosphate glucuronic acid (UDPGA) to bilirubin in a reaction catalyzed by a microsomal enzyme, glucuronyl transferase. UDPGA pyrophosphatase hydrolyzes UDPGA in broken cell suspensions to glucuronic acid-1-phosphate and UMP and is inhibited by EDTA. Beta glucuronidase hydrolyzes ester and etheral glucuronides and is inhibited by saccharate. These enzymatic activities were estimated in homogenates of liver obtained from dogfish pups and adults. Beta glucuronidase and glucuronyl transferase activities were similar in homogenates of liver from dogfish pups and adults. UDPGA pyrophosphatase activity was considerably greater in homogenates of liver from dogfish pups as compared with adults. These observations are in contrast with the delayed development of glucuronyl transferase activity which has been described in newborns of several mammalian species including man.

Gallbladder bile was obtained from adult dogfish and goosefish. Following the addition of diazotized sulphanilic acid, the resulting dipyrrolazopigments were characterized by paper chromatography in methyl ethyl ketone: propionic acid: water (75:25:30). Whereas bile obtained from mammals contains only conjugated bilirubin, the fish bile was demonstrated to contain unconjugated bilirubin as well as bilirubin glucuronide and large amounts of a yellow pigment which does not react with diazotized sulphanilic acid and demonstrates different spectral characteristics from bilirubin or biliverdin.

*Supported by a research grant from the USPHS.

The Obligate Ciliate Commensals of the Sea Urchin (Strongylocentrotus dröbachiensis): Infection and Division in Relation to the Age of the Host

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Of the 7 species of intestinal ciliates which are known from *S. dröbachiensis* at Mt. Desert Island, 3 are obligate commensals, *viz.*, *Biggaria gracilis*, *Entodiscus borealis* and *Madsenia indomita*. Whereas *B. gracilis* divides continually, dividing individuals of *Entodiscus* and *Madsenia* are uncommon, since long periods of trophic life alternate with brief intervals of division (Beers, Biol. Bull. *94*:99, 1948).

Using diameter of the test as the measure of age, the condition of the ciliates was studied in 152 urchins (diam. 8-65 mm.) which represented 6 age-groups (1.5-6.5 years, in increments of 1 year). Urchins 8 mm. in diam. (age about 1.5 years) were uninfected; urchins 9-14 mm. (age likewise 1.5 years) were lightly infected (1-28 ciliates of each species per urchin), but dividing individuals were absent. Urchins 15-23 mm. (age about 2.5 years) contained large numbers of dividing specimens of all 3 species. All the urchins of the remaining age-groups were infected, and *B. gracilis* was dividing in every urchin, but the division of *E. borealis* and *M. indomita* was sporadic and could not be correlated with the age of the host.

The results indicate that urchins become infected in their second summer (at age 1.5 years) and that their ciliate populations build up rapidly in the third summer. Once the populations are established, infrequent division suffices to maintain *E. borealis* and *M. indomita*, though constant division is necessary to maintain *B. gracilis*, which, unlike its confreres, inhabits the rectum and escapes regularly among the fecal pellets.

Further Observations on the Relation of the Ciliate (Conchophthirus mytili) to Its Host, (Mytilus edulis)

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Various studies on the behavior of metazoan commensals have shown that some commensals respond positively to their respective hosts or even to host fragments (Davenport, J. Mar. Biol. Assoc. U. K. *32*:161, 1953). Such studies raise the question as to whether *Conchophthirus mytili*, an ectocommensal of the foot of the mussel *Mytilus edulis*, displays similar responses.

Since *C. mytili* tolerates pure sea water reasonably well (Beers, J. Elisha Mitchell Sci. Soc. *75*:3, 1959), specimens were washed from the foot of freshly collected mussels into "outside" sea water, meaning water collected well beyond the mussel beds, or into artificial sea water (M. B. L. formula). Their response was tested in turn to the detached whole foot and to excised pieces of living foot, gill, mantle and labial palp, but the results were negative. However, specimens that arrived by chance on the epithelial surface of the foot or specimens that were placed on it by means of a pipette remained on it for periods that varied from 9 to 12 hours. But specimens that arrived on the other surfaces that have been mentioned usually remained no longer than a minute before swimming away.

The results indicate that *C. mytili* is carried passively through the incurrent siphon into the mantle chamber of the host and that its arrival on the foot is dictated by chance. Once on the foot, however, it remains "bound" to the epithelial surface of the foot, in all probability by a chemical attractant, though the nature of the attractant is undetermined.