Pigment Polymorphism in the Blue Mussel, *Mytilus edulis*

BY

M. WALDRON, R. M. PACKIE AND F. L. ROBERTS

Department of Zoology, University of Maine at Orono, Orono, Maine 04473

(2 Plates)

PART OF our our University of Maine Sea Grant Project in molluscan genetics has used the blue mussel, *Mytilus edulis* Linnaeus, 1758. Collections of this species have been made from Machias, Bar Harbor, Walpole, South Bristol, and York Beach, Maine. At each of these sites we have found variations in foot and mantle pigmentation, ranging from the predominant completely dark brown color to a variegated pattern of splotchy brown and white to albino devoid of pigmentation (see Figure *1*). These variations appear to be correlated with environmental differences between at least two of the sites sampled. In addition, we have observed more subtle variations in pigment density such that animals are found with all gradations of uniform brown ranging from nearly melanistic to pale creamy brown, and several variegated patterns have been seen with dark brown splotches on a lighter brown background. Several reports have dealt with variation in *M. edulis* shell morphology (COE & FOX, 1942; FOX & COE, 1943; HUXLEY & TESSIER, 1936; SEED, 1968; STASEK, 1963), but we have not found tissue polymorphism in this species reported, although such polymorphism is known to occur in other mollusks.

To insure that the observed variations were not produced environmentally through cell damage or loss, histological sections were prepared from the feet of mussels of 3 types: uniform dark brown, variegated brown and white, and albino. Figure *2* illustrates the distribution of pigment within the epithelial cells of these 3 tissue types. The dark brown foot (Figure 2A) shows uniform pigment distribution within the cells of the epithelium, while Figure 2B shows the patchy distribution of pigment in the variegated foot. Cells adjacent to pigmented cells in this foot are intact, indicating a lack of physical damage which might have produced the unpigmented tissue areas. Figure 2C shows the complete lack of pigment in the epithelial cells of the animal with an albino foot. Again no physical damage is apparent in this section to account for the lack of pigmentation. Based upon these histological sections, it is clear that these pigment anomalies are not the result of environmental damage, but rather have a genetic and developmental origin.

The frequency of occurrence of variegated plus albino animals within the different populations sampled geographically along the Maine coast ranged from a low of 4% in a low tide population from Bar Harbor to 27% in a low tide population from Machiasport. These 2 populations occupied similar environments, with similar degrees of exposure, and were separated by about 160 linear coastal kilometers. The highest frequency of variegated plus albino animals, 49%, occurred in a population occupying a rocky, exposed shore near the high tide line about 8 km distant from the Bar Harbor population which yielded a 4% frequency. This large difference in proportion of variegated plus albino animals from 2 populations which were geographically in close proximity suggested that the frequency of polymorphism might be related to an ecological situation and may involve some form of natural selection. To test this possibility, a rocky shore population sampled near the low tide line was compared to a population growing on a nearby floating dock, the

Explanation of Figure *1*

Photographs illustrate the three main types of foot tissue pigmentation occurring in *Mytilus edulis*. Figure *1*A: the dominant dark brown foot; Figure *1*B: typical variegated brown and white pattern; Figure *1*C: albino foot.

Explanation of Figure *2*

Photographs of histological sections through the three tissue types in Figure *1* illustrate the distribution of pigment in each type and the lack of physical damage to unpigmented epithelial cells. × 200

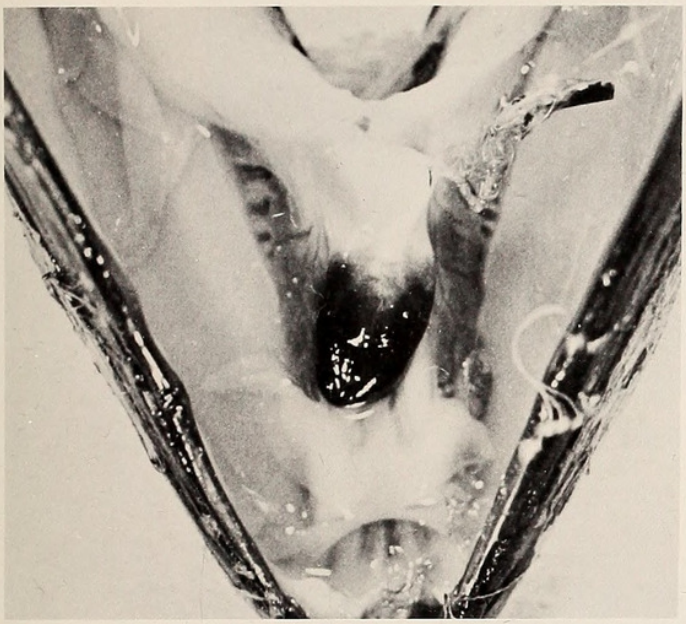

Figure 1A

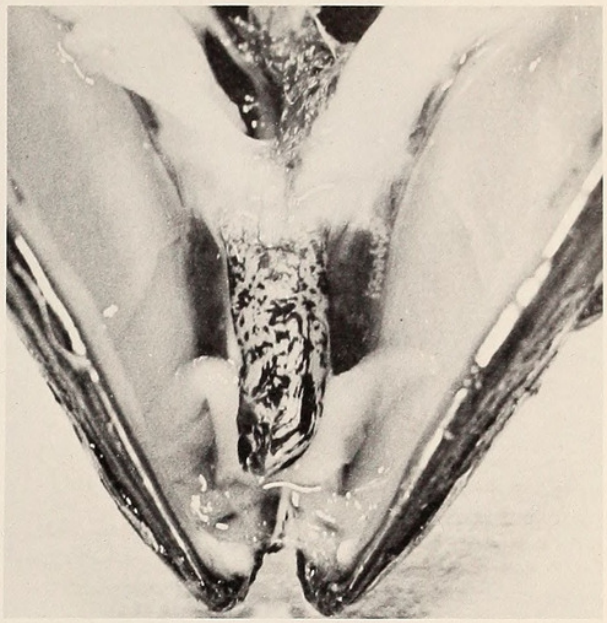

Figure 1B

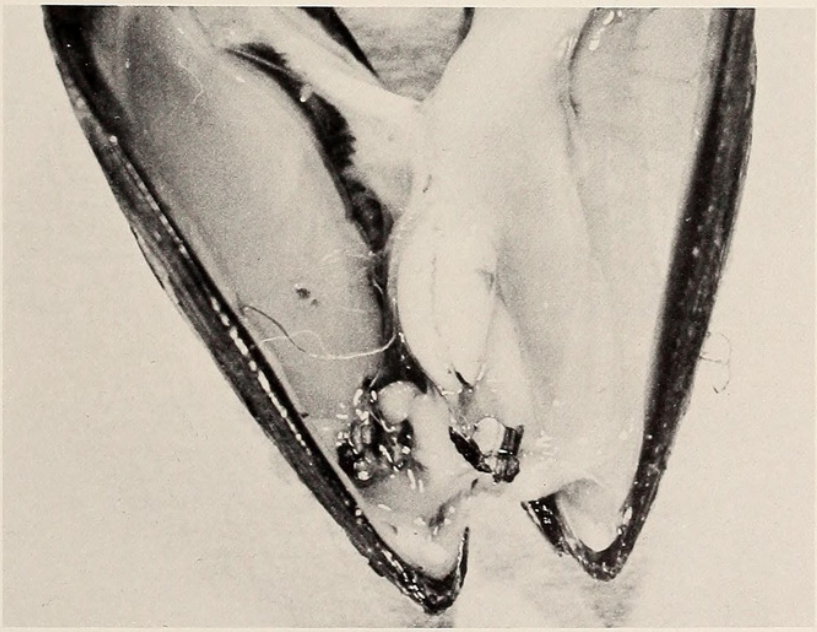

Figure 1C