MOLLUSCAN DIVERSITY: INTERIOR OF A SHELL

A common introduction to marine biology is through the diversity and beauty of sea shells. Although these shells are interesting to collect and examine, the molluscs that once lived within are even more fascinating. This plate provides an understanding of how some molluscs are structured and how they function, using a clam (the cockle) as an example.

Start by coloring the shell interior at the upper right. In life, the shell is off-white with brown mottling.

On the empty right shell, or valve, shown here, is a peak where shell formation began. Called the beak, or umbo, of the valve, this peak can be used as a reference to indicate the dorsal side (back) of the clam. Below and to the right of the umbo (as pictured), is the hinge ligament. Made of protein, this compressible structure connects the valves and functions in the opening and closing of them. Below and to the side of the ligament are a number of projections called hinge teeth, which fit into corresponding recesses (sockets) in the other valve. This tooth and socket arrangement aids in the articulation of the valves by preventing one from riding over the other. This is important in burrowing, or when the clam is being attacked by a predator, since a tightly closed shell is its most effective defense.

Also visible in the empty valve are four oval muscle scars. These muscle scars are the sites of attachment of the adductor muscles, which pull the valves together and hold them shut, and of the pedal (foot) retractor muscles (not shown). The thin, curving line joining the two adductor muscle scars is called the pallial line, and it marks the point where the mantle attaches to the shell.

Color the end view and the cross section of the two valves on the left of the plate. In the cross-sectional view, the cut is made through a single adductor muscle. The visceral mass has been removed. Also, color the arrows that indicate the direction the valves move as they close upon contraction of the muscle. Use a light color for the mantle.

Looking at the two valves in the cross-sectional view, one can see that the adductor muscles and the ligament have opposing roles. When the adductors contract and the valves are brought together, the lower portion of the ligament is compressed and the upper portion is stretched. When the adductor muscles relax, the compressed part of the ligament expands, and the stretched upper part of the ligament contracts. This results in the valves gaping open so the clam can extend its foot and siphons.

Also visible in this cross-sectional view is the fleshy mantle which completely underlies the valve and is responsible for secretion and maintenance of the valve.

Color the clam at the top of the page and the internal view of the clam at the bottom of the page. Note that some names refer to related structures seen in the empty shell. Arrows that indicate the direction of the feeding current (below the gills) should be colored the same as the incumbent siphon. Those arrows above the gills should be colored the same as the excurrent siphon.

At the top of the plate, the cockle is shown in left side view with its incumbent and excurrent siphons extended from the posterior end, and its large foot extended from the anterior end. This is the normal position of a burrowed cockle while actively pumping water for feeding and respiration. The radial ridges on the outside of the shell add strength and help anchor the cockle in the sand.

In the illustration of the cockle at the bottom of the plate, the left valve with its underlying mantle has been removed to expose the internal organs. The large adductor muscles are clearly visible. It can also be seen how the extended siphons are continuous with the fleshy mantle that lines the inside of the shell. Note the large bilobed gill, the smaller labial palp, and the foot beneath the gills. The gills are covered with cilia, which beat in unison to create a current. The arrows indicate the direction of the water current. As water passes through the gills, small particles, such as phytoplankton and organic detritus, are trapped by specialized cilia, bound up in mucus, and transferred to ciliated food grooves along the gill margins. The food grooves carry the mucous-bound food particles in thin strands to the labial palps where the particles are sorted by size. Smaller particles are directed to the mouth, located beneath the labial palp. Rejected, larger particles accumulate below the gills, near the foot, and are periodically expelled.
INTERIOR OF A SHELL

COCKLE

VALVE
UMBO
HINGE LIGAMENT
HINGE TEETH
ADDUCTOR MUSCLE
SCAR
PEDAL RETRACT
SCAR
PALLIAL LINE

MANTLE ATTACHMENT
ADDUCTOR MUSCLE
MANTLE
INCURRANT SIPHON
EXCURRANT SIPHON
FOOT
GILLS
LABIAL PALP