Name _____ Class _____ Date _____

Examining a Clam

Pre-Lab Discussion

The phylum Mollusca has many species, including clams, snails, slugs, octopi, and squids. Mollusks are soft-bodied invertebrates that have a muscular foot and a mantle. In most mollusks, the mantle secretes a hard shell. The many different types of mollusks may swim freely, float, or burrow into the sand or mud. Although most mollusks are marine, or sea-living, some mollusks live in fresh water, and others live on land. For thousands of years, people have eaten many types of mollusks, such as clams, scallops, oysters, and squids. Other kinds of mollusks have been used to make buttons, ornaments, tools, money, and dyes.

One representative mollusk is the clam. Clams are pelecypods, or bivalves, and have a two-part hinged shell. They are found in fresh water in streams, ponds, and lakes. They are also commonly found burrowed into the mud of ocean mud flats.

In this investigation, you will observe the behavior of a clam. You will also examine the internal and external structures of a clam.

Problem

What are some structures of a clam?

Materials *(per group)*

Live freshwater clam
Fresh or preserved clam
One valve of a clam shell
Large beaker containing water and sand
Carmine solution in dropper bottle
Glass stirring rod
10% hydrochloric acid in dropper bottle
Dissecting tray
Scalpel
Paper towels

Safety

Put on a laboratory apron if one is available. Put on safety goggles. Handle all glassware carefully. Always use special caution when working with laboratory chemicals, as they may irritate the skin or cause staining of the skin or clothing. Never touch or taste any chemical unless instructed to do so. Be careful when handling sharp instruments. Follow your teacher's directions and all appropriate safety procedures when handling live animals. Note all safety alert symbols next to the steps in the Procedure and review the meanings of each symbol by referring to the symbol guide on page 10.

Procedure

Part A. Observing a Live Clam

1. Place a live clam on its side in a large beaker of water (or an aquarium) with at least 4 cm of sand on the bottom. Observe what happens. Record your observations in the Data Table. Continue to observe the clam for several minutes without disturbing it. Answer question 1 in Observations.

2. Locate the incurrent and excurrent siphons on the live clam. These are the areas where water enters and exits the body of the clam. Obtain a dropper bottle of carmine solution. Place one or two drops of carmine solution near the siphons. **CAUTION:** *Handle the carmine solution with care because it stains the skin and clothing.* Observe what happens to the carmine solution. Record your observations in the Data Table.

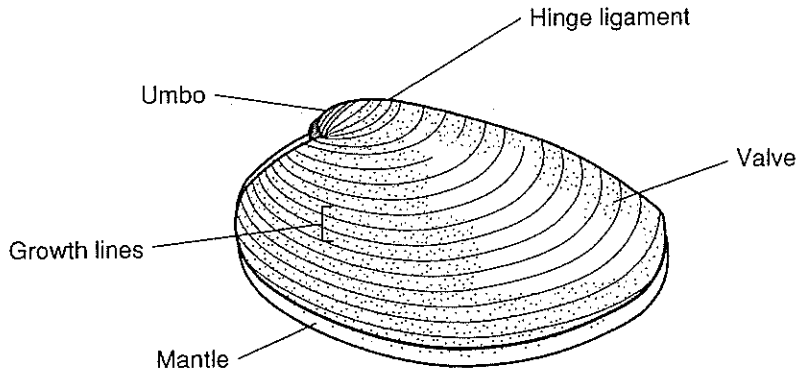


Figure 1

3. Locate the mantle on the live clam. See Figure 1. With a glass stirring rod, carefully and gently touch the clam on different parts of the mantle. Record your observations in the Data Table.

4. Return the live clam in the beaker to your teacher when you have completed your observations.

Part B. External Anatomy of the Clam

1. Thoroughly rinse a preserved clam to remove excess preservative. **CAUTION:** *The preservative used on the clam can irritate your skin. Avoid touching your eyes while working with the preserved clam.* Place the clam in a dissecting tray. Observe the bivalve shell. Notice the hinge ligament. Answer question 2 in Observations.

2. Locate the small, pointed area near the hinge ligament. This is the umbo, which is the oldest part of the clam. Note that the umbo is on the dorsal side toward the anterior end of the clam. Notice the concentric growth lines. They represent alternating periods of slow and rapid growth. Answer question 3 in Observations. Locate the posterior, anterior, dorsal, and ventral surfaces of the clam shell. Hold the clam shell with the anterior end up and the hinge facing toward you. Locate the hinge, right valve, and left valve of the clam shell. In the appropriate place in Observations, label the surfaces of the clam shell as they appear. Also label the hinge and right and left valves.

3. Hold the clam in the dissecting tray as shown in A of Figure 2. With a scalpel, carefully expose the middle layer by scraping away some of the horny outer layer of the shell. **CAUTION:** *Be careful when handling sharp instruments. Scrape in a direction away from your hand to avoid cutting yourself.*

Name _____ Class _____ Date _____

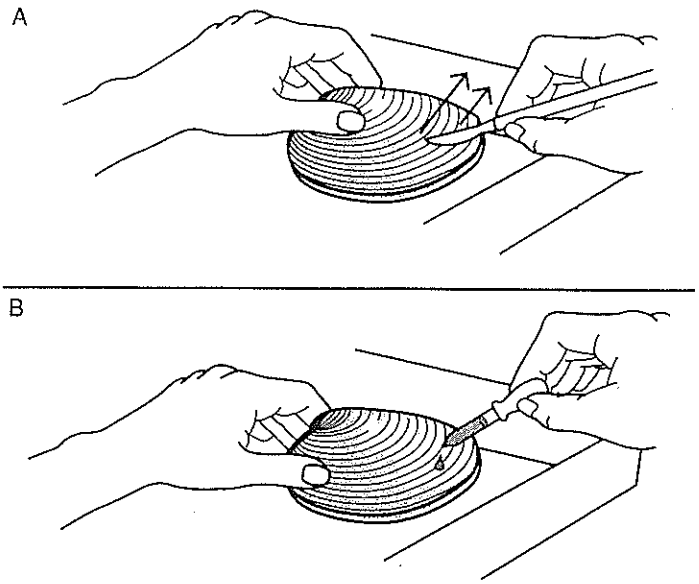


Figure 2

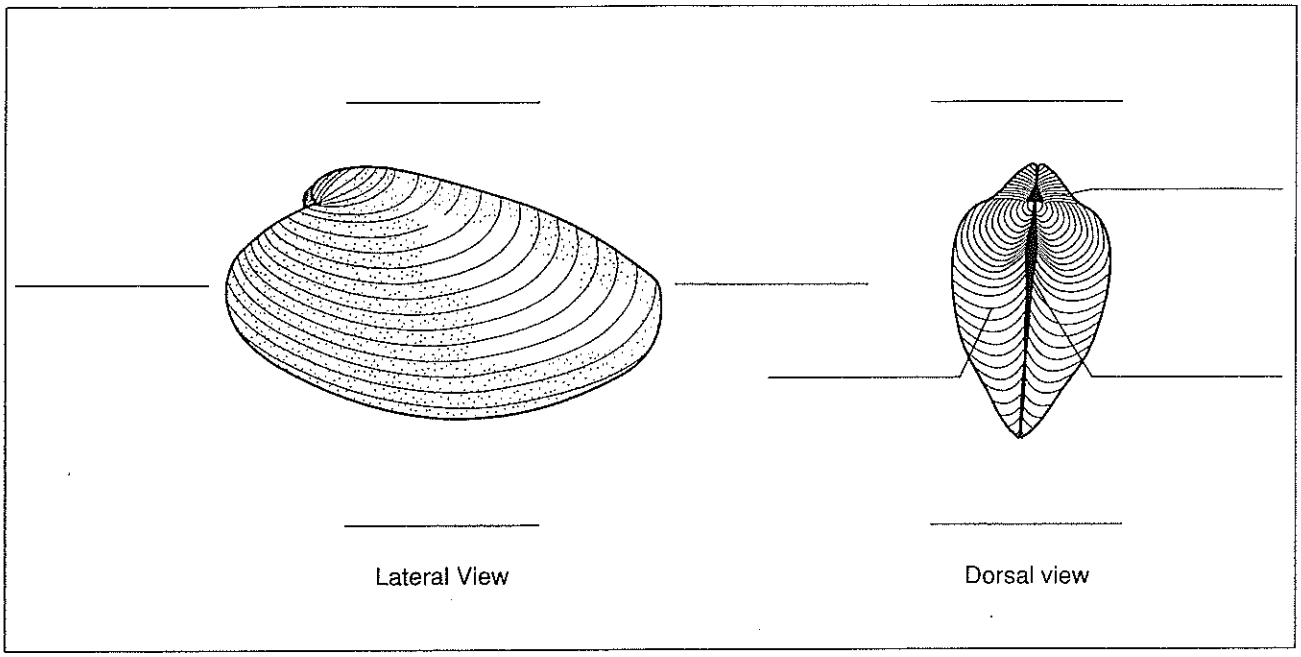
4. The shell of a clam is made up of three layers: the horny outer layer; the thick, middle layer called the prismatic layer; and the innermost layer called the pearly layer. Place one drop of hydrocholoric acid on the exposed prismatic layer, as shown in B of Figure 2. **CAUTION:** *Be careful when handling acids as they can burn the skin.* The bubbling of the acid indicates that calcium carbonate is present in the shell. Answer question 4 in Observations.
5. Follow your teacher's directions for storing the clam for further use or properly disposing of the clam.
6. Observe a valve of an opened clam shell. Note the inner surface of the valve and the pearly layer. Answer question 5 in Observations. Locate the "scars" left by the anterior and posterior adductor muscles on the inner surface of the valve. In the appropriate place in Observations, label the anterior adductor muscle, posterior adductor muscle, mantle, and umbo.

Observations

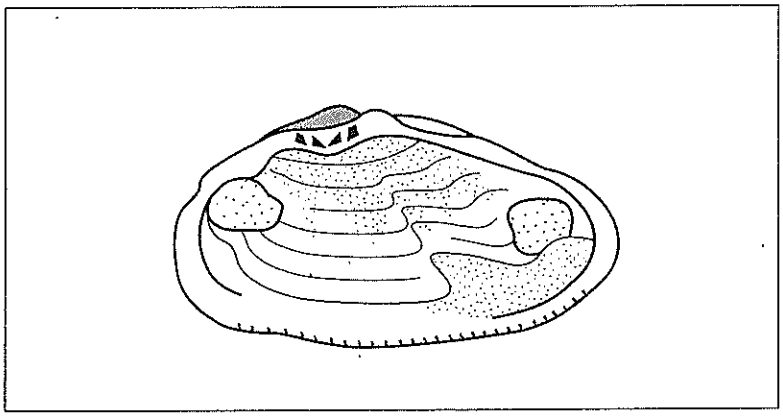
Data Table

	Observations
Clam placed on side	
Movement of carmine solution	
Touching mantle with glass rod	

Clam Shell



Clam Shell Valve



1. Describe how a clam moves and buries itself in the sand. _____

_____

_____

2. Describe the location of the hinge ligament in relation to the two halves of the shell.

_____

_____

3. How many growth lines did you count on your clam shell? _____

Name _____ Class _____ Date _____

4. Describe what happened when acid was placed on the exposed prismatic layer of the clam shell. _____

_____

5. Describe the inner layer of the clam shell. _____

_____

Analysis and Conclusions

1. Why is it important for a clam to take in water through the incurrent siphon?

_____

_____

2. Why is it important for a clam to expel water through the excurrent siphon?

_____

_____

3. What is the function of the hinge ligament? _____

_____

4. Why would the number of growth lines vary among clams? _____

_____

5. Of what is the prismatic layer of a clam's shell composed? _____

_____

6. In addition to the valve you observed, where else would adductor muscles be found?

_____

_____

Critical Thinking and Application

1. The nervous system of a clam is very simple. How can a clam function with such a simple nervous system? _____

2. List one advantage and one disadvantage of the shell surrounding a clam.

3. Why is it important for the hinge ligament and the adductor muscles of the clam to be very strong? _____

4. Clams reproduce by releasing eggs and sperm into the water. Would you expect clams to release large or small numbers of eggs and sperm? Explain your answer.

5. Why are fossils of mollusks more abundant than those of the worm phyla?

Going Further

1. Examine the gills from a preserved clam under a dissecting microscope. Remove some of the gill tissue and prepare a wet mount of it for examination under the microscope. Sketch what you see.
2. Shell collecting is an interesting hobby. Many books on shell collecting and identification are available in bookstores and libraries. If you live near the ocean, or if you vacation at the seashore, you may wish to start a shell collection.

DISSECTION GUIDE FOR THE CLAM

The clam is a member of one of the largest and most familiar groups of invertebrates - the molluscs. This group is characterized by a ventral muscular foot, a fleshy visceral mass containing the various organs, and a protective shell secreted by an underlying mantle layer. The foot and the fleshy parts of the body show extreme modifications among the various members of the phylum. Because of their soft, fleshy bodies, the molluscs - more than any other invertebrates - are widely used as food by man. Included in this group are the snails, slugs, clams, chitons, squids, nautilli and octopi.

The molluscs, characterized by having a shell consisting of two valves, include the common freshwater clams and marine varieties of clams and oysters. Freshwater clams are abundantly distributed and live on the bottoms of lakes, rivers, ponds and streams, where they feed on small plant and animal life.

Study the shell of the clam and note that it consists of two valves hinged together along the dorsal side (Figure 1). On the anterior part of each valve is a swollen region, the umbo. Concentric lines extend outward from the umbo and represent lines of growth.

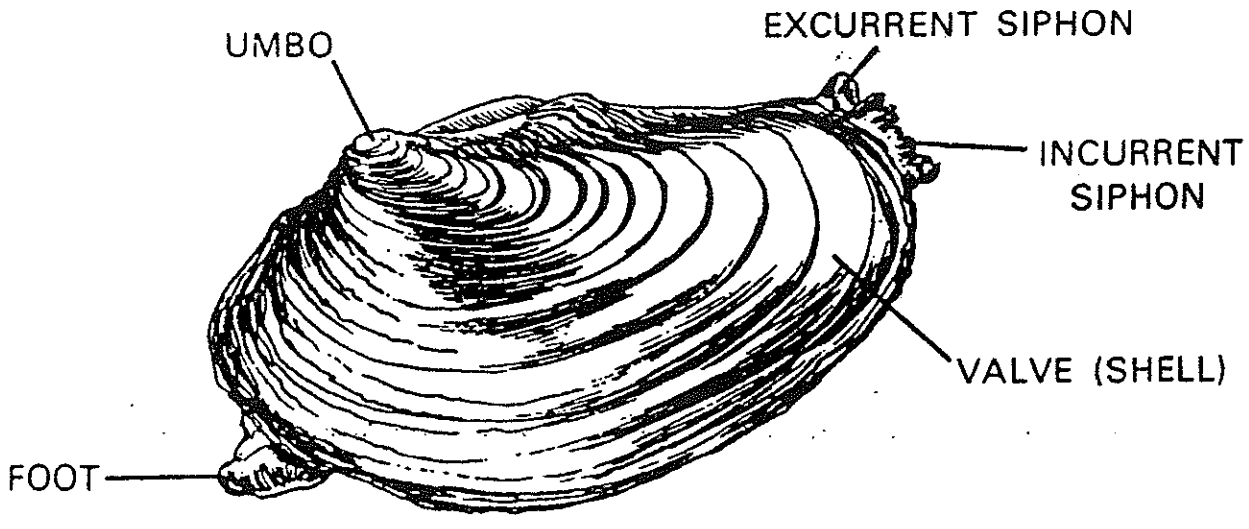


FIGURE 1 EXTERNAL STRUCTURE OF THE CLAM (FRESH WATER) ANODONTA

Locate two pair of flaplike palps on the anterior edge of the visceral mass, near the anterior muscle. These palps surround the mouth. Dorsal to the gills is the pericardial sac that encloses the heart. Carefully cut open this sac and locate the heart. Note that the heart consists of three chambers: two lateral auricles and one ventricle (Figure 3). Carefully cut away the gills and locate the "kidney" which appears as a dark-coloured organ, lying near the gills and just below the pericardial cavity. What is the function of this organ? _____

_____.

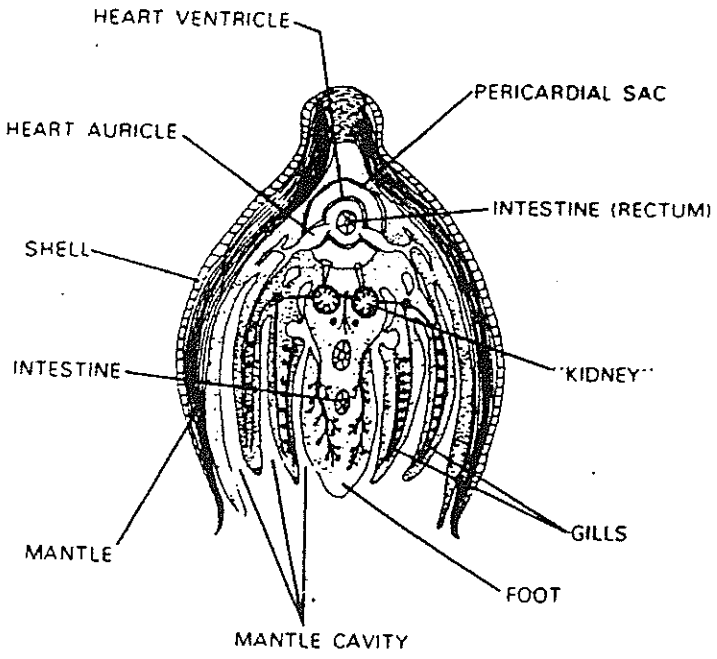


FIGURE 3 DIAGRAMMATIC CROSS-SECTION OF A CLAM

Most of the digestive system is located in the visceral mass. Carefully cut the visceral mass into left and right halves. The mouth, located between the palps, leads the way of a short esophagus, into an expanded stomach, which is flanked on either side by two large digestive glands. Remove these glands carefully and note that the stomach leads into an intestine that winds through the visceral mass and then passes through the pericardial sac as the rectum. The rectum empties into the excurrent siphon via the anus. Locate as many sections of the digestive tract as possible in your dissection.

FIGURE 1 EXTERNAL STRUCTURE OF THE CLAM (FRESH WATER) ANODONTA

The valves are held together by two large muscles located at opposite ends of the shell (Figure 2). Cut these muscles by inserting a knife or scalpel between the shell and cutting in the direction where the shells are joined together. Open the valves and observe that they are lined by a glistening mantle. At the posterior margin of the shell the mantle is thickened and comes together to form two openings, the siphons. Water enters the clam through the ventral incurrent siphon, circulates through the mantle cavity and over the gills, and then leaves through the dorsal excurrent siphon.

Remove one of the valves and its mantle, thus exposing the mantle cavity and the internal organs (Figures 2 or 3). Observe the large muscular foot extending down from the visceral mass. Locate the gills, which hang down into the mantle cavity. How many gills are there? _____

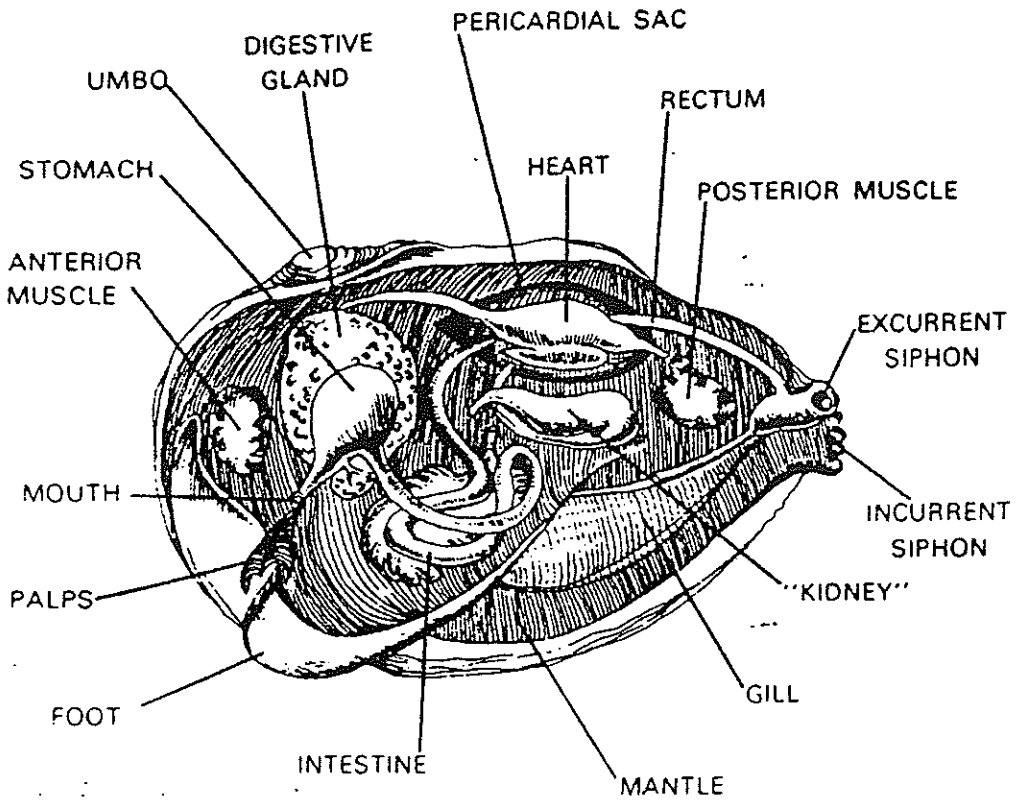


FIGURE 2 INTERNAL STRUCTURE OF THE CLAM

Draw the following views and label as many features as possible. Use the lab handout, diagrams posted, as well as your textbook.

Dorsal External View

Interior View