An Illustrated Dissection Guide to the Clam
by David Hall

Illustrations
by Glen Folsom

Cover Design and Guide Layout
by Lynn Huggins

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An Illustrated Dissection Guide to the Freshwater Clam

All clams belong to the animal phylum: Mollusca. In addition to clams the phylum includes chitons, snails, slugs, tusk shells, squid, and octopi. All mollusks share the following body features:

1. Unsegmented body that is bilaterally symmetrical with a greatly reduced body cavity or ceolom.

2. A well developed heart consisting of one or two atria and one ventricle. Circulatory system closed with some molluscs utilizing blood sinuses.

3. Presence of a radula *(except in filter-feeders)* a rasp-like organ used for breaking food down into fine particles.

4. Body covered by a thin mantle that produces the shell (which may be reduced or absent in some molluscs).

Freshwater clams belong to the class of mollusks called ***Pelecypoda.*** This class is composed of the *bivalves:* clams, oysters, scallops and the boring molluscs. Pelecypods are characterized by these features:

1. Body is laterally compressed.
2. Mantle lobes form posterior siphons, no jaws present.
3. Head absent, nervous system reduced.
4. Mantle secretes left and right shells which open and close by one or two adductor muscles.
5. Larval stages characterized by free swimming larval forms.
6. Locomotion by a single foot.

The best clams for dissection are specimens from the genus *Anodonta.* This group of freshwater clams have thin shells which close incompletely. This results in a clam that is easier to open for dissection and more inexpensive to process and ship. Thicker shelled clams are offered by some supply companies, these clams come from the genus *Unio.* Although they can readily be used, they are not as ideal a specimen.

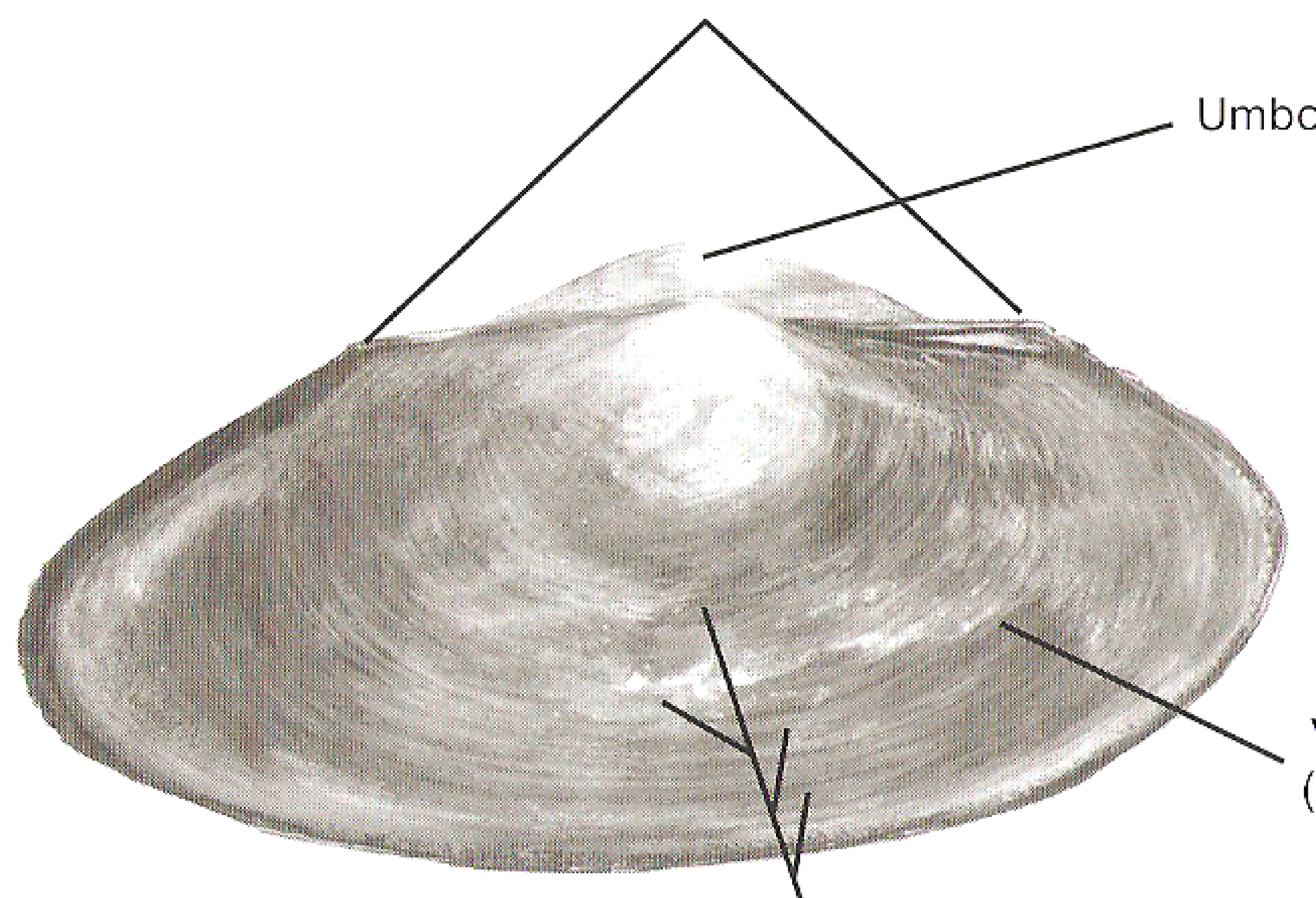

Figure 1: External anatomy

External Anatomy

The exterior of the clam has several basic features which are shown in Figure 1. The shell consists of two halves called ***valves*** which are connected together by an elastic ***hinge ligament.*** The ***umbo*** is the swollen point of both valve halves and represents the oldest part of the shell. From this point concentric ***growth lines*** occur. The spaces between the major lines represent periods of extended growth. In the clam genus Andonata there is an opening of the shell valves at the lips that allow the ***incurrent*** and ***excurrent siphons*** access to the outside.

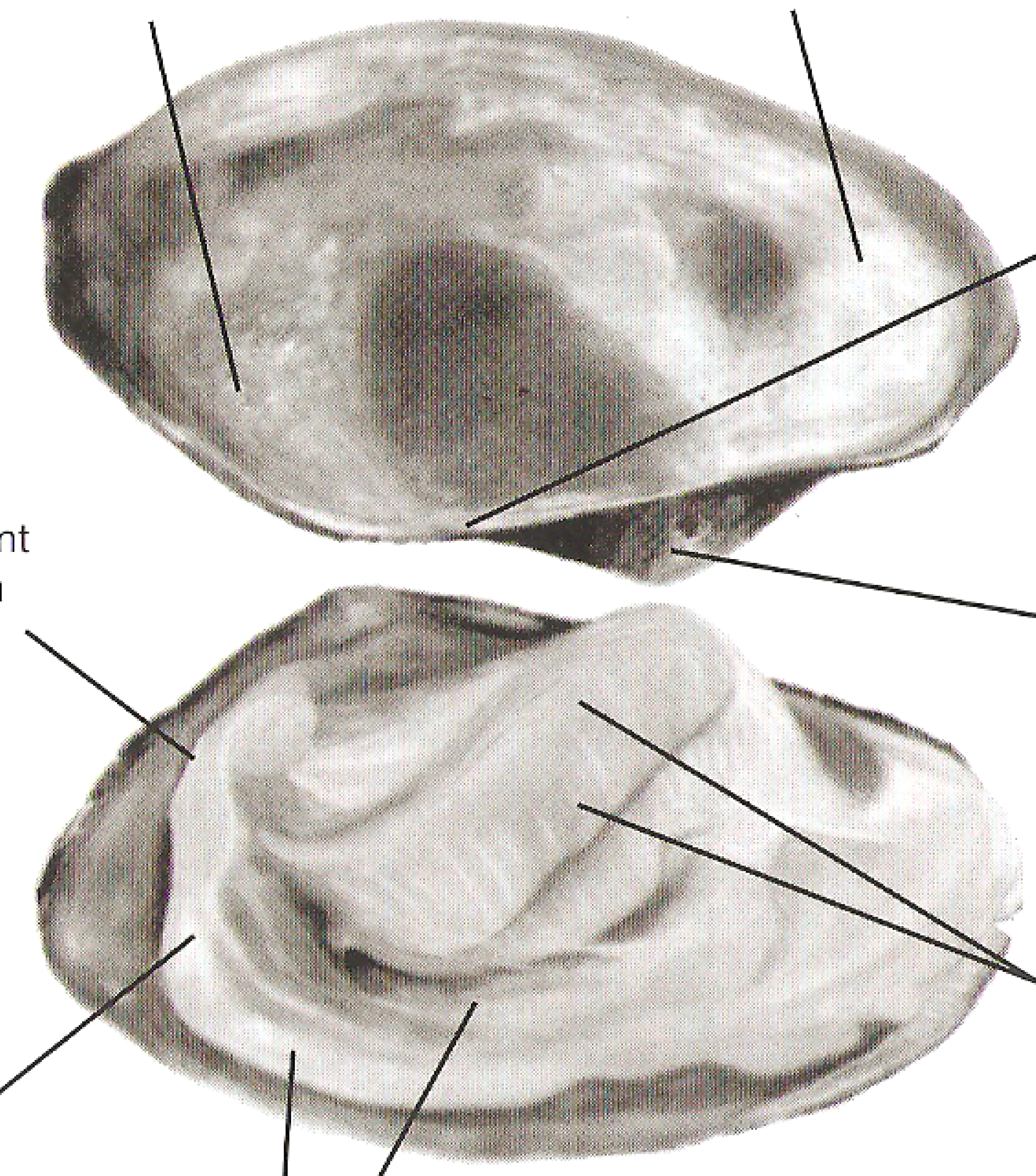

Figure 2: Internal view with mantle in place.

Internal Anatomy

Some clam shells can be easily opened while others are difficult to pry open. If you have a specimen that is not easy to open ask your instructor for assistance. Generally all that is required is for a knife blade to be run along and through the hinge ligament length. This loosens the two valves so a knife can be inserted to free the adductor muscles from one of the shells. Carefully free the thin membrane from the top valve of the shell so that your opened clam looks similar to Figure 2.

At this point identify the following features:

Hinge teeth/Lateral teeth—These shell formations aid in hinging the two valves together.

Muscle scar—These shell markings are for the attachment of the large adductor muscles.

Incurrent and Excurrent siphons—Water is moved into and out of the clam through these openings. The incurrent opening is larger than the excurrent.

Mantle—This is the thin Gladular membrane that covers the interior organs. The mantle lines the interior of the shell and secretes the thick mother of pearl coating known as the ***nacre.***

Carefully remove the mantel to expose the body mass. Compare your specimen to figures 3 & 4 and identify and familiarize yourself with the listed anatomical parts.

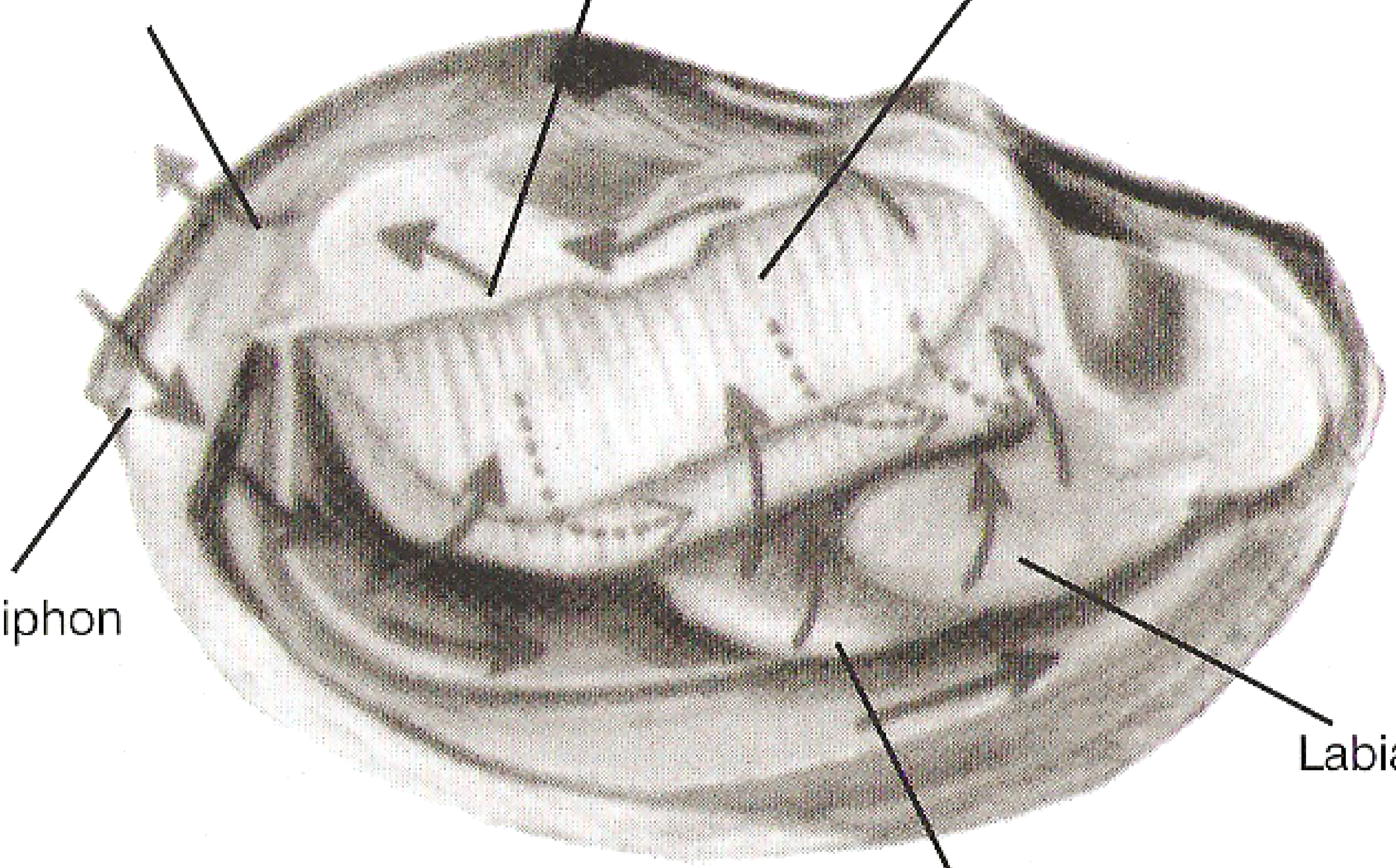

Figure 3: Water circulation and food particle flow. Solid lines illustrate water flow while dotted lines track trapped food particles and their flow into the mouth.

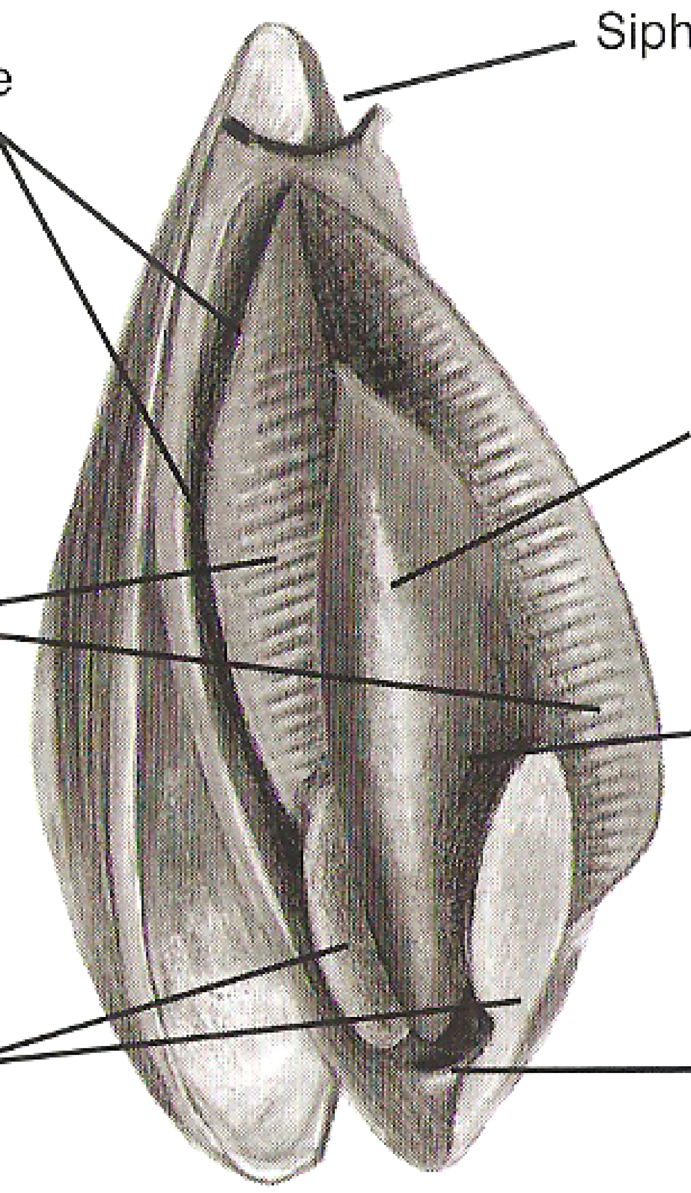

Figure 4: Internal Anatomy.

Water Circulation, Respiration, and Filter Feeding

There are two pairs of gills, one pair located on each side of the body between the mantle and the foot/visceral body mass. The gills perform two general functions: Respiration and food filtration. The surface of the gills, mantle, and viseral mass are lined with cilia that beat in a coordinated manner. This movement causes water to enter the mantle cavity through the incurrent siphon. Along with water, zooplankton, phytoplankton and organic detritus are carried into the mantle cavity (figure 3). Water enters minute openings or ostia which line the gills. Lamellae (the many folds and ridges which make up the gills, (figure 5) into gill chambers which lead upward into larger collecting tubes that eventually lead to the cloacal chamber that empties out through the excurrent siphon. As the continuous stream of water passes along and through the gills, food particles become entrapped in the mucus that lines the surface of the gills. The food laden mucus is driven to the labial palps where the indigestible inorganic material is separated and the food carried into the mouth. The rejected material is moved to the mantle edge of the clam shell and expelled out of the clam.

Internal Organs

The body cavity in clams is so reduced that normal dissection is extremely difficult. The internal organs are encased in either the viseral mass or the muscle of the foot. However, the internal organs are shown in figure 5 and their function is outlined below.

Food ingested through the mouth passes into the stomach. Here the food is broken up into fine particles and mixed with a digestive enzyme. This is accomplished by the rod-like organ within the stomach called the crystalline style. Digestible food particles are swept into the digestive gland that surrounds the stomach. Indigestible particles are swept into the intestine.

Food is digested by cells in the digestive gland and is distributed throughout the body intracellularly. Fecal material is formed into a compact pellet as it travels through the intestine and is expelled through the rectum into the cloacal chamber and out through the excurrent siphon. No digestion take place in the intestine whose function is limited to fecal pellet formation.

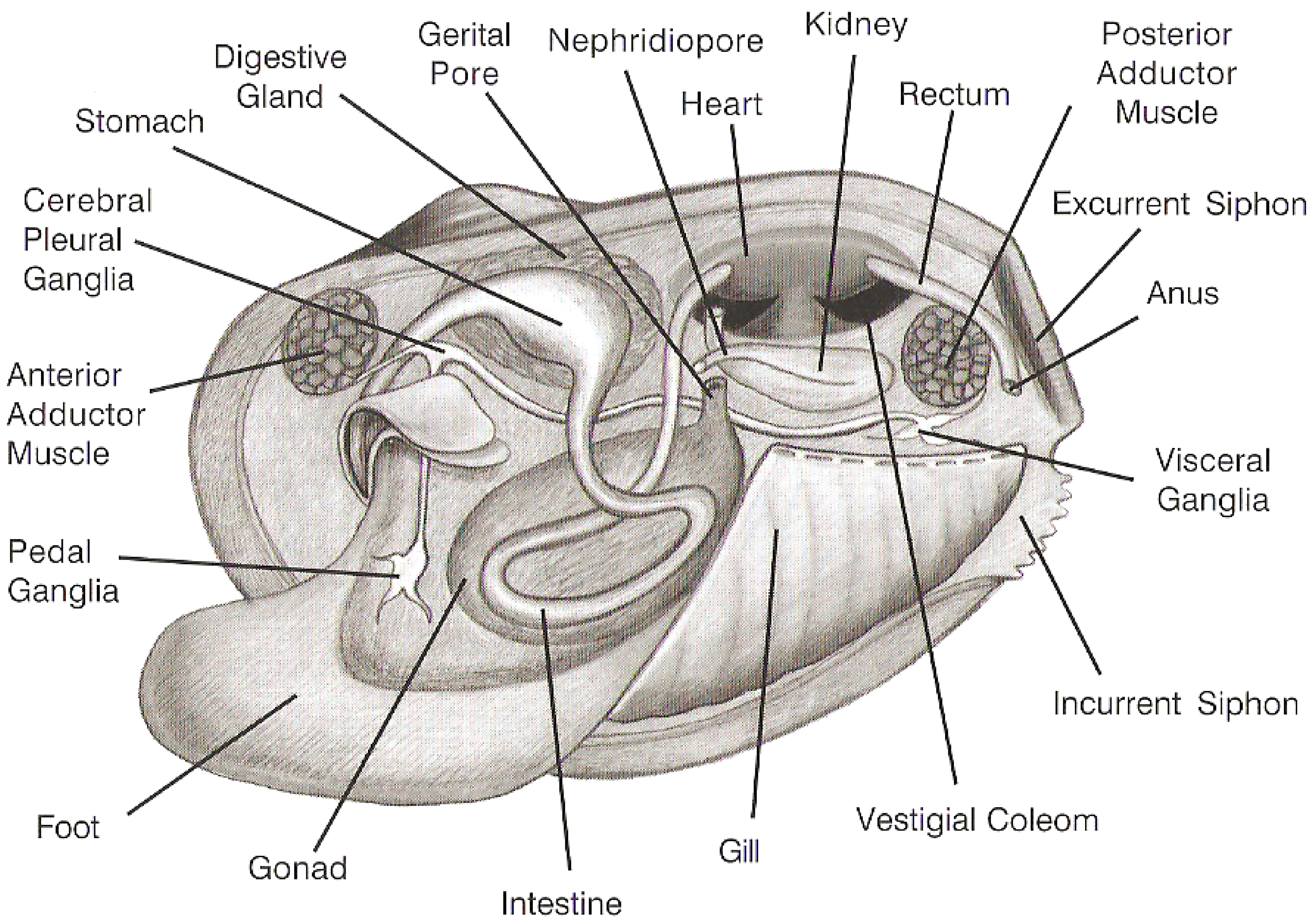

Figure 5: Internal organs

The circulatory system of the clam is a closed system where blood is carried to the body cells through vessels. The heart has one ventricle and two atria. The blood is passed through the kidney before it returns to the heart for re-circulation. Here protein wastes are removed from the body through the cloacal chamber.

Some clams have both male and female sex organs *(hemaphroditic)* while others are either male or female. In either case the gonad or gonads are imbedded in the upper section of the foot. Generally eggs are lodged in the gills while sperm is released into the surrounding waters via the excurrent siphon. Water carrying sperm passes through the gills and fertilizes the eggs. Early embryonic growth occurs here. When the embryos are large enough they are passed on to develop independently of the parent. The larval development is outlined later.

The nervous system of the bivalves are very simple compared to other molluscs, with only three pairs of connected ganglia. Each pair of ganglia is a source of nerve fibers that lead to adjacent organs. There are a pair of minute sense organs that detect changes in equilibrium called statocysts. The statocysts are located posteriorly *(behind)* to the pedal ganglions.

The foot is a large muscular appendage that is responsible for clam movement. The clam moves in response to environmental conditions. If conditions are unfavorable or food is scarce the clam will migrate to more favorable habitats. Clam locomotion is demonstrated in Figure 6.

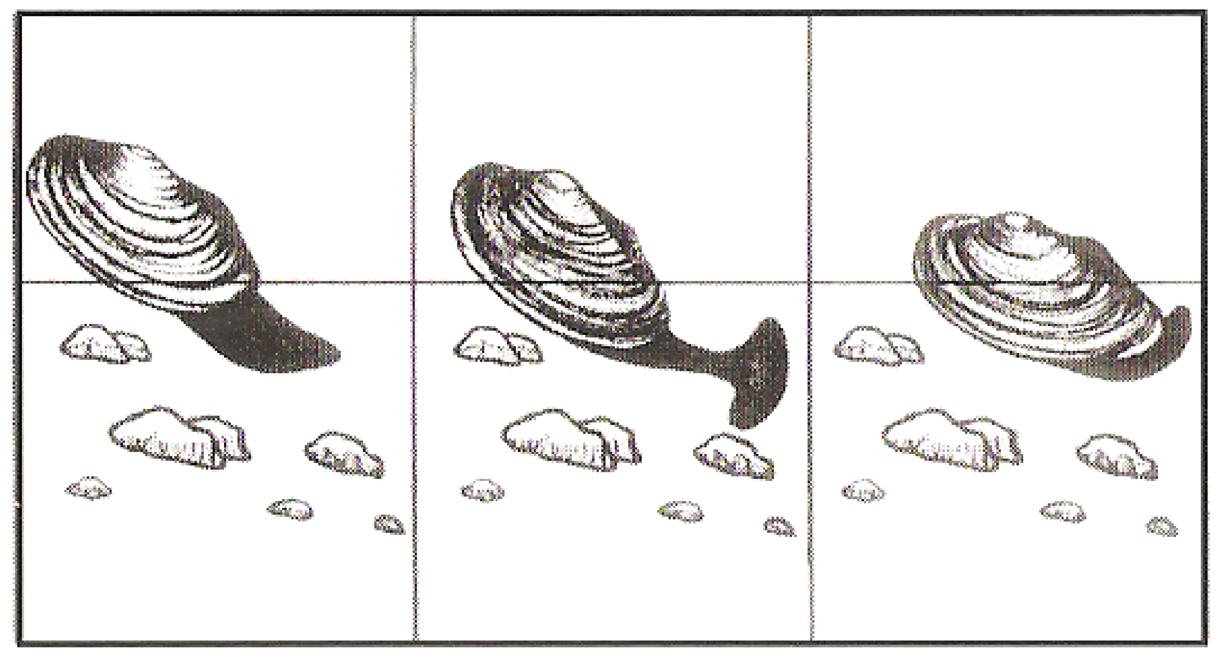

Figure 6: Foot extension, expansion, and contraction demonstrating clam movement.

Development Of The Freshwater Clam

The fertilized eggs develop within the gills of the female and become larval clams known as glochidium. The larval clams superficially resemble their parents with two chitinous halves joined by a hinge. These halves are held together in an open position by a single adductor muscle. The open end of the valves have teeth which are hook shaped. When the glochidium reach a particular size they are expelled by the parent into the surrounding waters. Here the larva either sink to the bottom or become suspended in the water. In either case the glochidia remain with their valves gaping awaiting a fish to brush against them. The larva are sensitive to their fish host and clamp tightly onto any superficial fish tissues they touch. If the larva do not attach themselves to a host within a few days of leaving their parents they die.

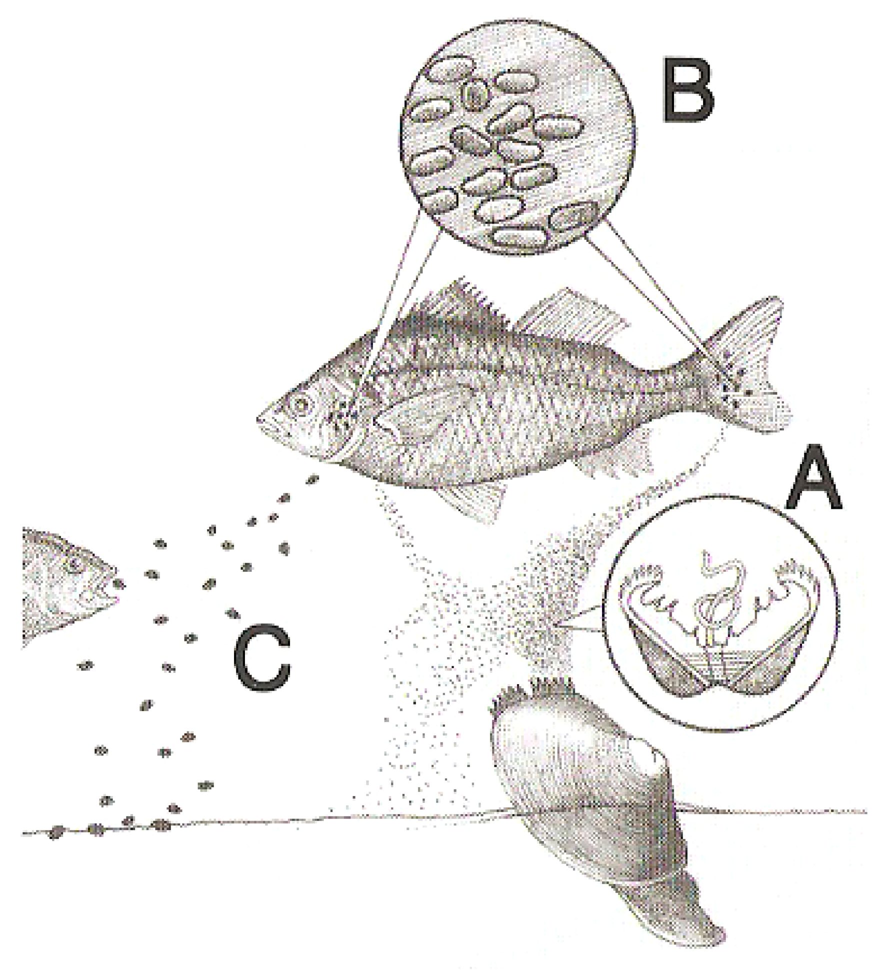

Figure 7: The life history and development of the clam. The figure inside circle A is a larval clam called a glochidium. Inside circle B are glochida that are encysted inside superficial fish tissues. Area C demonstrates juvenile clams falling to the bottom to begin juvenile life.

When the glochidia is attached to a fish the tissues of the fish soon grow around it. During this encystment the larva undergoes marked changes and the adult organs are formed. After a period of 10 to 30 days the young clam breaks free of its host, falls to the bottom and begins the juvenile phase of its existence. The juvenile phase lasts until the clam becomes sexually mature in one to eight years.

Most zoologists believe that the larval parasitic phase of the clam allows for the glochidia to disperse more efficiently away from their parents. A *"free ride"* so to speak on the backs of their host fish.