Anatomy of a Clam

Grade Level:
5-12

Subject Area:
Biology, Anatomy

Time:
Preparation: 10 minutes
Activity: 30-45 minutes
Clean-up: 10 minutes

Student Performance Standards (Sunshine State Standards):
10.03 List examples of aquatic crops and animals (LA.910.1.6.1, 2, 3, 4, 5; LA.910.2.2.2; SC.912.L.17.9).
11.01 List and explain the meaning of morphology, anatomy, and physiology (LA.910.1.6.1, 2, 3, 4, 5; SC.912.L.14.7).
11.02 List and describe the physiology of aquatic animals (LA.910.1.6.1, 2, 3, 4, 5; LA.910.2.2.2; SC.7.L.17.1; SC.912.L. 18. 7, 8, 9).
11.04 Identify and describe the basic structure and internal anatomy of an oyster or a mussel (SC.3.L.15.1).
12.01 Recognize and observe safety practices necessary in carrying out aquaculture activities (LA.910.1.6.1, 2, 3, 4, 5).

Objectives: Students will be able to:

1. Identify types shellfish and provide examples.
2. Describe the biology of common aquacultured mollusk species.
3. Identify key anatomical features and their functions for mollusk species.

Abstract:

Hard clam aquaculture is the largest and most valuable of the shellfish aquaculture industries on the east coast of Florida. The industry is valued at $50 million per year. In this lesson, students will learn about mollusk culture and complete a live or a virtual dissection of a clam. Students will identify the external anatomy of a clam and describe the function of important external features. They will be able to identify the major internal organs of a clam and their functions related to swimming, digestion, and respiration. Additionally, students will

demonstrate dissection skills (for live dissections). Using a dissection guide or a virtual dissection on the computer, the students will participate in a dissection of a clam (preserved or fresh).

Interest Approach:

Have the students list some of the different types of shellfish they have consumed or caught and ask them if they think they are an aquacultured species. What about calamari or conch fritters? Ask them to identify how clams are cultured and see if they are familiar with any clam farms in their own neighborhoods.

Student Materials:

1. *Introduction to the Biology of Mollusks* handout
2. Dissection equipment (or computer access for virtual dissection)
3. *External* and *Internal Anatomy* worksheets

Teacher Materials:

Material	*Store*	*Estimated Cost*
LIVE DISSECTION (per group)		
Dissection kits	Carolina Biological	$16 and up
Clam dissection guide	www.tobinslab.com	$1.99
Dissection pan	Carolina Biological	$15.50
Hard clam	Carolina Biological- preserved (fresh can be obtained from your local market)	$2.35 and up
Paper towels	Local grocery store	$2 and up
Hand sanitizer	Local grocery store	$2 and up
Mix mild bleach solution	Local store	$4
External and *Internal Anatomy of a Clam* handouts	NA	NA
VIRTUAL DISSECTION		
Carolina BioLab software	Carolina Biological	$80 and up
Virtual dissection	http://www.biologyjunction.com/clam_dissection.htm	
Virtual dissection	http://www.8thgradescience.com/id12.html	

Dissection guide	http://home.earthlink.net/~wweinkle/clamdissection.htm
Dissection guide	https://www.msu.edu/course/lbs/158h/manual/clam.pdf
Video dissection part 1	http://www.youtube.com/watch?v=687A-jlcbW4
Video dissection part 2	http://www.youtube.com/watch?v=4VllBsEewpU
Video dissection part 3	http://www.youtube.com/watch?v=TBfzCafp4Bk

Student Instructions:

1. Read the handout *Introduction to the Biology of Mollusks* for homework in preparation for this laboratory.
2. Once assigned to a group, prepare your table for a live dissection (or prepare your worksheets for a virtual dissection).
3. Begin to identify and label the external anatomy and their functions on your worksheet or in your lab notebook.
4. Follow the teacher's instructions and your dissection guide for the internal anatomy and the proper way to prepare your dissection.
5. Be sure to identify the internal organs and their functions in response to swimming, digestion, and respiration.

Teacher Instructions:

Preparations:

1. Obtain clam specimens (fresh or preserved).
2. Divide the class into small groups (2-4 per group when possible).
3. Prepare one dissection kit, pan, and clean-up materials per group.
4. Copy the dissection guide for each student.
5. Copy the *External* and *Internal Clam Anatomy* handouts for each student.
6. Give students a copy of the *Introduction to the Biology of Mollusks* handout and have them read this as homework, or touch on the different types of fishes prior to the dissection in classroom lectures.

Activity:

1. Once students are in their groups, ask them to identify the external anatomy (may put a drawing on the board).
2. Follow the dissection guide step by step in order to ensure each group is moving through the anatomy at the same time.
3. Ask the students to label and/or draw (if using lab notebooks) each step of the dissection and identify major organs and their uses (information will be in dissection guide).

Post work/Clean-up:

1. When students are finished with the dissection, have them fold all materials into their paper towels and set aside a separate trashcan for dissection

materials.
2. Direct each group to thoroughly rinse and sanitize dissection equipment (water and mild bleach solution or other sanitizing agent). Have them dry the equipment and return it to the kit. Make sure that they rinse and dry their tray as well.
3. Dispose of dissection materials appropriately (e.g., outside dumpster due to smell).
4. Wipe all dissection stations with a sanitizer (mild bleach solution).

Anticipated Results:

1. Students will identify the external anatomy of a clam and describe the function of important external features.
2. Students will explain the major internal organs of a clam and their functions related to swimming, digestion, and respiration.
3. Students will demonstrate dissection skills (for live dissections).

Support Materials:

1. *Introduction to the Biology of Mollusks* handout
2. *Molluscan Culture Overview* presentation
3. Video: *Hard Clam Spawning Procedures* (available at www.aquaculture-online.org)
4. Video: *Oyster Settlement* (available at www.aquaculture-online.org)
5. Clam Printables: http://homeschooling.about.com/od/freeprintables/ss/clamprint.htm
6. Whetstone, J.M., L. N. Sturmer, and M. J. Oesterling. 2005. Biology and culture of the hard clam (*Mercenaria mercenaria)*. SRAC Publication No. 433. (http://srac.tamu.edu)
7. Conch in the Classroom lesson plans and virtual dissection (as an example of another cultured mollusk) – www.savetheconch.org
8. *A Conch's Life Cycle* DVD (available at www.savetheconch.org)

Explanation of Concepts:

Anatomy of invertebrates
Dissection skills
Relationship of structure and function

Support Materials

Introduction to the Biology of Molluscs

Mollusks are animals belonging to the phylum **Mollusca**. There are around 93,000 recognized extant species, making it the largest marine phylum with about 23% of all named marine organisms. Representatives of the phylum live in a huge range of habitats including marine, freshwater, and terrestrial environments. Molluscs are a highly diverse group, in size, in anatomical structure, in behaviour and in habitat. The phylum is typically divided into nine or ten taxonomic classes, of which two are entirely extinct. Cephalopod molluscs such as squid, cuttlefish and octopus are among the most neurologically advanced of all invertebrates. Either the giant squid or the colossal squid is the largest known invertebrate species. The gastropods (snails and slugs) are by far the most numerous molluscs in terms of classified species, and account for 80% of the total number of classified molluskan species.

Mollusks have such a varied range of body structures that it is difficult to find defining characteristics that apply to all modern groups. The two most universal features are a mantle with a significant cavity used for breathing and excretion, and the structure of the nervous system. As a result of this wide diversity, many textbooks base their descriptions on a hypothetical "generalized mollusc". This has a single, "limpet-like" shell on top, which is made of proteins and chitin reinforced with calcium carbonate, and is secreted by a mantle that covers the whole upper surface. The underside of the animal consists of a single muscular "foot". Although mollusks are coelomates, the coelom is very small, and the main body cavity is a hemocoel through which blood circulates – mollusks' circulatory systems are mainly open. The "generalized" mollusc feeding system consists of a rasping "tongue" called a radula and a complex digestive system in which exuded mucus and microscopic, muscle-powered "hairs" called cilia play various important roles. The "generalized mollusc" has two paired nerve cords, or three in bivalves. The brain, in species that have one, encircles the esophagus. Most mollusks have eyes, and all have sensors that detect chemicals, vibrations and touch. The simplest type of molluskan reproductive system relies on external fertilization, but there are more complex variations. All produce eggs, from which may emerge trochophore larvae, more complex veliger larvae, or miniature adults. A striking feature of mollusks is the use of the same organ for multiple functions. For example: the heart and nephridia ("kidneys") are important parts of the reproductive system as well as

the circulatory and excretory systems; in bivalves, the gills both "breathe" and produce a water current in the mantle cavity which is important for excretion and reproduction.

The mantle secretes a shell that is mainly chitin and conchiolin (a protein) hardened with calcium carbonate, except that the outermost layer is all conchiolin. The mantle cavity is a fold in the mantle that encloses a significant amount of space, and was probably at the rear in the earliest molluscs but its position now varies from group to group. The underside of the body generally consists of a muscular foot, which has been adapted for different purposes in different classes. In gastropods, it secretes mucus as a lubricant to aid movement. In forms that have only a top shell, such as limpets, the foot acts a sucker attaching to the animal to a hard surface, and the vertical muscles clamp the shell down over it; in other molluscs, the vertical muscles pull the foot and other exposed soft parts into the shell. In bivalves, the foot is adapted for burrowing into the sediment; in cephalopods it is used for jet propulsion, and the tentacles and arms are derived from the foot.

Most mollusks have only one pair of gills, or even only one gill. Generally the gills are rather like feathers in shape, although some species have gills with filaments on only one side. They divide the mantle cavity so that water enters near the bottom and exits near the top. Their filaments have three kinds of cilia, one of which drives the water current through the mantle cavity, while the other two help to keep the gills clean. Each gill has an incoming blood vessel connected to the hemocoel and an outgoing one connected to the heart.

Most mollusks have muscular mouths with radulae, "tongues" bearing many rows of chitinous teeth, which are replaced from the rear as they wear out. This is primarily designed to scrape bacteria and algae off rocks. The particles are sorted by a group of cilia, which send the smaller particles, mainly minerals, to the prostyle so that eventually they are excreted, while the larger ones, mainly food, are sent to the stomach's cecum (a pouch with no other exit) to be digested. The anus is in the part of the mantle cavity that is swept by the outgoing "lane" of the current created by the gills. Carnivorous mollusks usually have simpler digestive systems.

A typical mollusk has: a pair of tentacles on the head, containing chemical and mechanical sensors; a pair of eyes on the head, a pair of statocysts in the foot which act as balance sensors; and a pair of osphra reproductive systems, two gonads sit next to the coelom that surrounds the heart and shed ova or sperm into the coleom, from which the nephridia extract them and emit them into the mantle cavity.