Chapter 28 **Arthropods and Echinoderms** **Name _____**

Lab Sea Star Dissection - Internal Structures

Background Information

The familiar starfish is a representative of the phylum Echinodermata, the spiny-skinned animals. Other members include brittle stars, sea urchins, sand dollars, sea cucumbers, and sea lilies. All echinoderms live in the ocean. The early life of a starfish is spent as a microscopic, bilaterally symmetrical, free-swimming larva. After a few weeks, the larva changes and becomes sessile, attaching to a surface on the ocean bottom. As further development takes place, the right side of the larva becomes the upper surface of the starfish and the left side becomes the lower surface. The starfish develops short, stubby arms. At this stage it can move about, but it is still less than one millimeter in diameter. The starfish you will study represents one of about 6,000 species of echinoderms.

Problem

Does the interior of a sea star display pentaradial symmetry?

Materials (per group)

Preserved starfish	Dissecting tray
Hand lens or dissecting microscope	Forceps
Scissors	Dissecting needle

Procedure

Part A. Digestive System

1. Once again, place the sea star in the dissecting tray so that the aboral surface faces upward.

2. Carefully cut a ring around the madreporite plate.

3. Use your scissors to cut off the tips of the three arms that are not next to the madreporite. At this time, do not remove the skin of the two arms next to the madreporite plate.

4. Starting at the end of the arm with its tip cut off, use your scissors to remove the remaining skin/skeleton from the top of the arm and from the central disc. Be careful as you separate the skin from the digestive system underneath. This will expose the sea star's internal organs. Look for the intestine attached to the anus. Verify that radial symmetry exists inside the sea star's body.

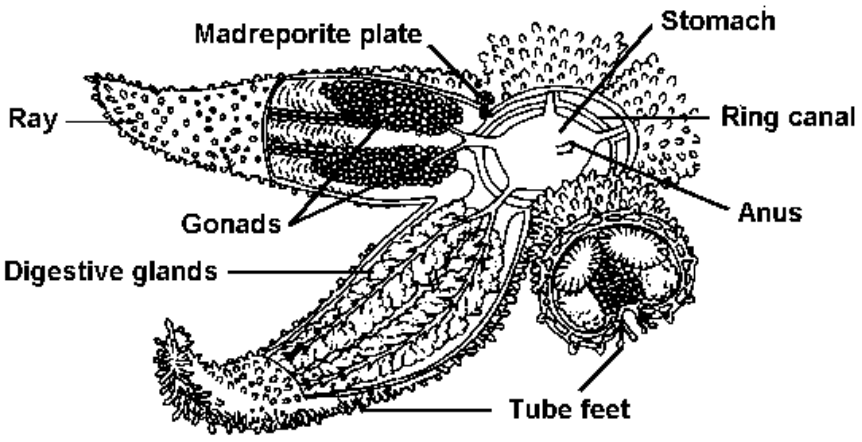
5. Use Figure 1 to locate the **digestive gland**, also called the pyloric caeca. It is a large olive-green gland with two branches that will fill most of the arm. Their large surface areas are lined with secretory cells that produce the digestive enzymes.

6. Turn your sea star over and locate the **mouth.** The mouth is attached to a star-shaped **stomach**, which can be seen through the opening you have cut in the top surface.

Starfish are famous for their method of feeding. Using the tube feet, a starfish attaches to a bivalve mollusk with its central disc opposite of the umbo. It steadily pulls the valves of the mollusk until they open - an opening of less than 0.1 mm is enough. The starfish then everts its stomach and inserts it between the valves of the mollusk. Digestive enzymes are released and the mollusk is digested. The starfish absorbs the food and then retracts its stomach into its normal position.

7. Locate the short tube that connects the stomach to the digestive glands.

Figure 1



Part B. Reproductive Organs

1. Remove the entire digestive gland from the dissected arm of your sea star.

2. Locate the pale, lumpy organs under the digestive gland near the central disc as shown in Figure 1. These are the reproductive organs. They are called **gonads.** Sea stars have separate sexes. During spawning, the gonads are very large, but in preserved specimens, they are usually quite small. The male and female gonads look very much alike in preserved specimens. In living sea stars, the testes are gray and the ovaries are orange.

Water Vascular System

1. Carefully remove the reproductive organs and the remaining parts of the digestive system (including the stomach). This will expose the **water vascular system.** Be careful not to damage the madreporite plate.

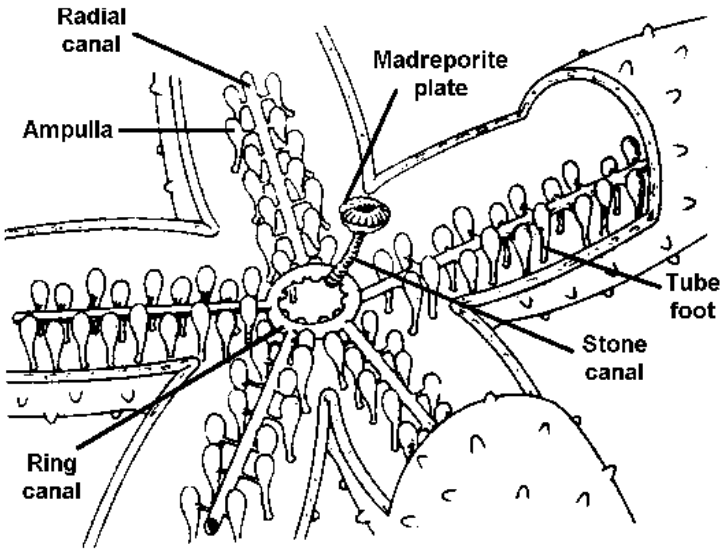
2. Study your sea star. Use Figure 2 to find each of the structures of the water vascular system that are in bold print in the following paragraph.

Water enters the system through the **madreporite plate.** The madreporite plate is connected to the circular **ring canal** by the **stone canal.** The water is then distributed to the **radial canals** that are in each of the rays. These canals deliver water to the **tube feet.** The tube feet contain **ampullae** (bulb-like structures). By alternating between contracting and expanding the ampullae, the sea star is able to move. As the ampullae contract, they force water into the tube feet, and the tube feet lengthen. The sea star places the lengthened tube feet in the direction it is going. Then the ampullae relax and expand. When this happens, water leaves the tube feet, thus shortening each tube foot and creating suction at its end.

3. Trace the pathway that seawater takes from the madreporite plate to the tube feet. Mark this pathway on Figure 2 with short dashed lines.

4. After completing the dissection, dispose of your sea star according to your teacher's instructions.

Figure 2



Observation

1 The sea star actually has two distinct types of stomachs. The pyloric stomach appears to be star shaped and remains inside the body at all times. The cardiac stomach is more of a thin pouch that will be extended from the starfish's mouth and into a mollusk's valves. Could you distinguish between the two stomach areas?

2. Was your starfish harvested during the breeding season? Explain your answer.

3. Could you tell if you were working with a male or female starfish?

Analysis and Conclusions

1. What structures are used for locomotion that are unique to only the echinoderms?

2. What are the two functions of tube feet?

3. Explain how a starfish feeds.

4. How does respiration occur in a starfish?