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

Lab Sea Star Dissection - External

Background Information

The starfish, or sea star, is a spiny-skinned marine invertebrate that is a member of the phylum Echinodermata. Echinoderms are animals whose bodies are often covered with hundreds of small spines. Brittle stars, sand dollars, sea cucumbers, and sea urchins are also types of echinoderms.

Starfish are the most familiar echinoderms. They are found in coastal waters and along rocky seashores. They feed on oysters, clams, snails, barnacles, and worms. Starfish are known for their characteristic star-shaped bodies. They typically have five rays, or arms, branching out from a central disk. Because of their division into five parts, starfish are said to have **pentaradial symmetry**. If a ray breaks off, the starfish is able to regenerate, or grow back, a new one. In this investigation, you will examine the external structures of a starfish.

Problem

How is the anatomy of a starfish adapted to life in a marine environment?

Materials (per group)

Preserved starfish
Dissecting tray
Hand lens or dissecting microscope

Procedure

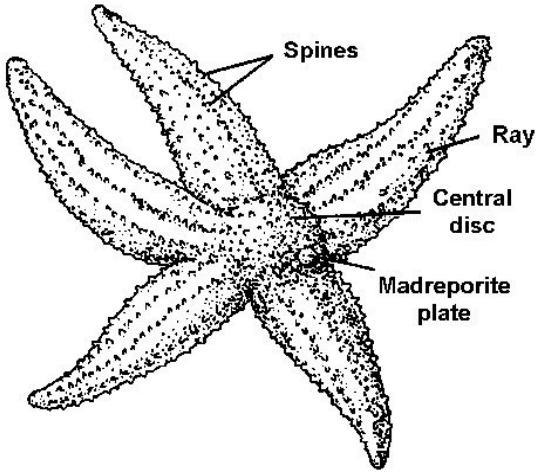
1. Rinse the starfish thoroughly with water to remove any extra preservative. **CAUTION:** *The preservative used on the starfish can irritate your skin. Avoid touching your eyes while working with the preserved starfish.*

2. Place the starfish in the dissecting tray with its **aboral**, or top, surface facing up. Notice that the starfish's body plan consists of 5 rays radiating out from a central disk. Although most starfish have 5 rays, sun stars have 7 to 14 rays, and some sea stars have 15 to 24 rays.

3. Using a hand lens, or a dissecting scope, examine the skin on the aboral surface. Notice the many coarse spines that cover the entire aboral surface. The epidermis is spiny and irregular because parts of the endoskeleton protrude through the skin. Around the base of the spines are **pedicellariae**, which are jaw-like structures. They capture small animals and keep the epidermis free of foreign objects. The **skin gills** are soft projections from the aboral surface that are lined by tissue of the inner cavity. They provide a large, moist area across which oxygen and carbon dioxide can be removed from the water. The skin gills are protected by the pedicellariae.

4. Referring to Figure 1, use a hand lens or a dissecting scope to locate a spine and the pedicellariae around it. Locate skin gills near some pedicellariae. Answer question 1 in Observations.

Figure 1



5. Study the aboral surface of the central disk. Answer question 2 in Observations.

6. Locate a small red or yellow button-like structure on the central disk. This structure is the **madreporite**, or sieve plate. The madreporite contains many tiny pores through which water enters the water-vascular system. The water-vascular system is a system of water-filled canals and appendages that function primarily in locomotion and feeding.

7. Try to find the anus in the center of the central disk. The anus, which opens out from the intestine, is the opening through which solid wastes are eliminated from the body.

8. In the appropriate place in Observations, label the following structures on the aboral side of the starfish: central disk, rays, spines, madreporite, and anus.

9. Turn the starfish over so that its oral, or bottom, surface is facing up.

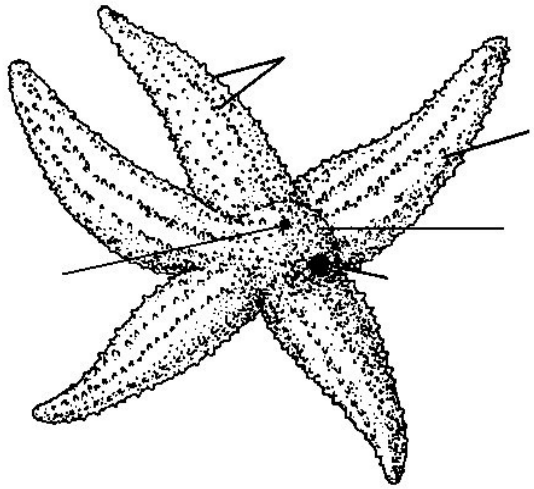
10. With the hand lens or dissecting scope examine the mouth, an opening in the middle of the central disk through which food is taken in. Notice the small spines that surround the mouth. Many types of starfish feed by pushing part of the stomach out through the mouth. The stomach secretes enzymes that digest prey.

11. Find the **ambulacral groove** that begins at the mouth and extends down the center of each ray. Find the small tube feet that line the groove. The tube feet are part of the water-vascular system. The **tube foot** is a hollow, thin-walled cylinder with a bulb-like structure called the **ampulla** at one end and a sucker at the tip. Fluid-pressure changes caused by muscle contractions in the ampulla and tube foot create suction in the tip of the tube foot. The suction enables the starfish to pull itself along a surface or to grasp prey. Answer question 3 in Observations.

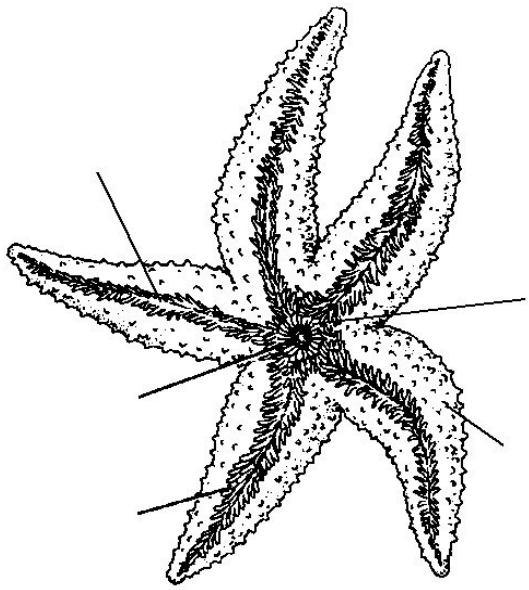
12. Locate the **eyespots**, which are tiny red or pink dots that are found on the oral surface of a small tentacle at the tip of each ray. An eyespot is made up of 80 to 200 **ocelli**, which contain granules of red pigment. The eyespots are sensitive to light but are not capable of forming images.

13. In the appropriate place in Observations, label the following structures on the oral side of the starfish: ambulacral groove, mouth, tube feet, oral spines, and ray spines.

Observations



Aboral side



Oral side

1. Describe the feel of a starfish's spines.

2. How does the number of spines in the central disk compare to the number of spines in a ray?

3. How many rows of tube feet does your specimen have?

Analysis and Conclusions

1. What is the function of a starfish's spines?

2. What kind of body plan does a starfish have?

3. What are two functions of the tube feet?

4. How does a starfish take in food?

5. How does respiration occur in the starfish?

6. List two adaptations of the starfish that make it well adapted to life in marine waters.

Critical Thinking and Application

1. Starfish produce large numbers of eggs and sperm. How is this production an adaptive advantage?

2. When a starfish pries open the shell of a clam or oyster, the mollusk resists. Even if the shell opens only slightly, the starfish will get its meal. How does this occur?

3. Because starfish were eating many clams and oysters, divers were hired to go out and chop the starfish into pieces. After this, fishermen found even more empty clam and oyster shells than before. Why did this occur?

4. Many echinoderms, which are bottom-dwellers as adults, have free-swimming larvae. What advantage do free-swimming larvae provide for the echinoderms?