

Name: \_\_\_\_\_ Date: \_\_\_\_\_



## Gen Bio 2 Lab #7: Echinoderms and Mollusks

**Pre-lab Reading:** Read pages 652-656 and 676-680 from your textbook. **Read the entire lab ahead of time and complete all vocabulary and Pre-Lab activity** before attending.

### **Pre-Lab Vocabulary:**

1. Echinoderm –
2. Pentaradial symmetry –
3. Water vascular system –
4. Tube feet –
5. Ampulla –
6. Endoskeleton –
7. Pedicellariae –

**Pre-Lab activity:** Look in your text and online and write the predominant traits for each of the following classification levels:

- A. Class Crinoidea –
- B. Subclass Asteroidea –
- C. Subclass Ophiuroidea –
- D. Class Echinoidea –
- E. Class Holothuroidea –

## Introduction:

Echinoderms are radially symmetrical animals that are only found in the sea (there are none on land or in fresh water). Echinoderms mean "spiny skin" in Greek. Many, but not all, echinoderms have spiny skin. There are over 6,000 species. Echinoderms usually have five appendages (arms or rays), but there are some exceptions.

Radial symmetry means that the body is a hub, like a bicycle wheel, and tentacles are spokes coming out of it (think of a starfish). As larvae, echinoderms are bilaterally symmetrical. As they mature, they become radially symmetrical. Most adult echinoderms live on the bottom of the ocean floor. Many echinoderms have suckers on the ends of their feet that are used to capture and hold prey, and to hold onto rocks in a swift current.

## Sea Stars

Sea stars (group name Stellerioidea) are sometimes called starfish, however they are not really fish (they lack both vertebrae and fins). There are two **sub-types** of sea stars:

- Asteroids include: true sea stars and sun stars (A)
- Ophiuroids include: brittle stars (B) and basket stars (C)

The differences between the two sub-types lie in how the arms connect to the central disk. Ophiuroids have arms that do not connect with each other. There is a distinct boundary between arm and central disk. Asteroids have arms that are connected to each other. Also, it is harder to tell with asteroids where the central disk ends and the arms begin. The sea star's top surface (aboral) is very spiny, to resist predation. If you look very closely, however, you will notice that there are different types of growths on the surface. Some bumps are used to absorb oxygen, they are called **dermal branchiae**. **Pedicellaria** are pincher-like organs used to clean the surface of the skin. Barnacle larvae could land on a sea star and start growing if it were not for these organs.

## How Do Sea Stars Move?

Each sea star had hundreds of tiny feet on the bottom of each ray. These are tube feet, or podia. These tiny feet can be filled with sea water. The vascular system of the sea star is also filled with sea water. By moving water from the vascular system into the tiny feet, the sea star can make a foot move by expanding it. This is how sea stars move around. Muscles within the feet are used to retract them. Each ray of a sea star has a light sensitive organ called an eyespot. Though it cannot see nearly as well as we do, sea stars can detect light and its general direction. In other words, they have some idea of where they are going.



## **Procedure 1: Echinoderm Gross Anatomy**

**Procedure 1A: Fossilized echinoderms.** Write down your observations about these fossilized organisms. Note any you can identify as relatives to ones in your Biology Atlas.

**Question: Why are these animals easy to fossilize?**

**Procedure 1B: Examine the sand dollars and sea urchins.** Write down your observations about the sand dollar and sea urchins, include descriptions of the **morphology** (external appearance), differences between the 2, and then use the chart on **page 4** of this handout and write down their **classification system**.

**Question: Do they have radial symmetry with 5, or multiples of 5, arms?**

**Procedure 1C: Examine the sea cucumber.** Write down your observations down about the sea cucumber, including descriptions of the **morphology** and the sea cucumbers' **classification system**.

**Questions: a) Why would someone eat a sea cucumber? (It's an Asian delicacy.)**

**b) What is the unique thing that sea cucumbers will do when harassed by a predator?**

## Echinoderm classification “key”:

- Kingdom Animalia - They're animals like us
  - Phylum Echinodermata – or Echinoderms
    - Subphylum Crinozoa - Radially symmetric as ADULTS, with a dorsal (upward) mouth
      - Class Crinoidea - Feather stars
    - Subphylum Asterozoa - Radially symmetric as ADULTS, with a star shaped ventral (downward) mouth
      - Class Stelleroidea
        - Subclass Asteroidea - Sea stars
        - Subclass Ophiuroidea - Brittle stars
    - Subphylum Echinozoa - Globular or disc-shaped, ventral (downward) mouth
      - Class Holothuroidea - Sea cucumbers
      - Class Echinoidea - Sea urchins, sand dollars

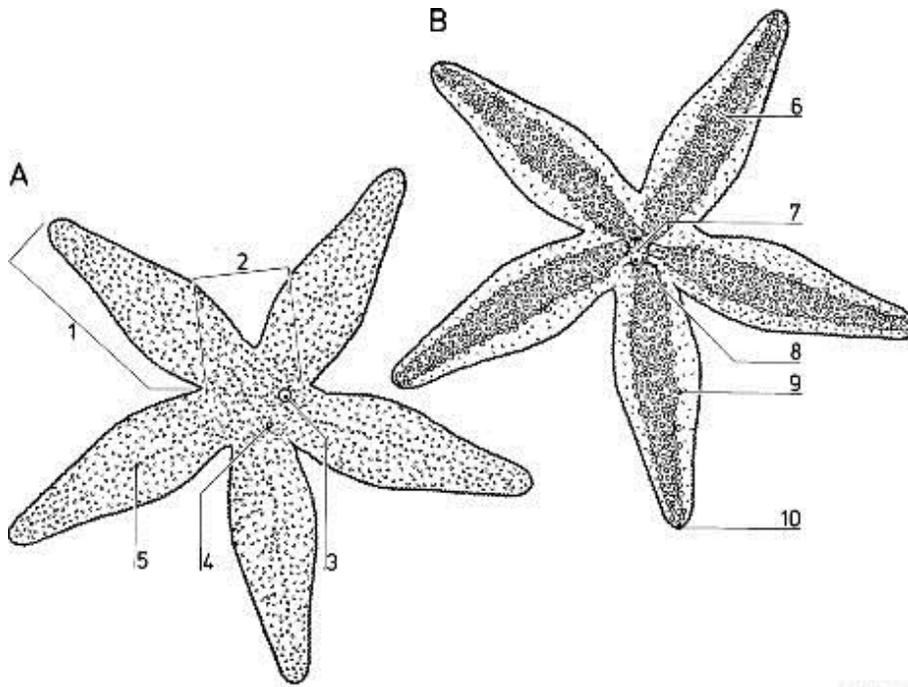
## Procedure 2: Self-Guided Starfish Dissection

**Materials:** Preserved starfish, dissecting pan, scissors, scalpel, forceps, T-pins, pencil, lab apron, safety glasses

### **Procedure (Aboral Surface):**

1. Obtain a preserved starfish and rinse off preservative with tap water.
2. Place the starfish in the dissecting pan with its dorsal or aboral (top) surface upward.
3. Observe the starfish and **determine its symmetry**. \_\_\_\_\_
4. Locate the **central disc**. **Count and record** the number of arms or rays the starfish has. \_\_\_\_\_
5. Locate the small, round hard plate called the **madreporite** on top of the central disc. Water enters through this into the water vascular system. Label the central disc, arms, and madreporite on **Figure 1A**.
6. The anus, for excretion following digestion, is a smaller opening right next to the madreporite. Label this on **Figure 1A**.
7. Feel the upper surface of the starfish for spines. These spines protect the starfish and are part of their internal skeleton. Label this on **Figure 1A**.

**Figure 1: A = Aboral Surface, B = Oral Surface**



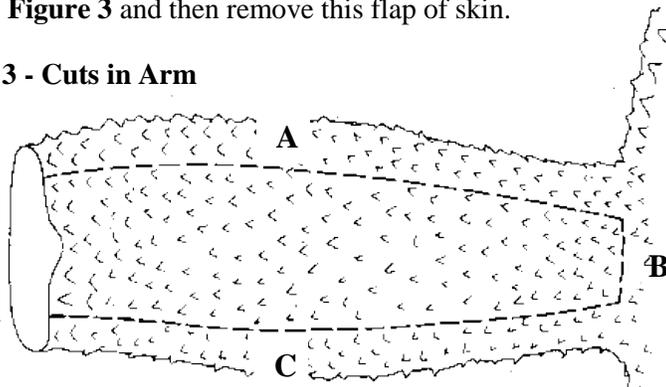
**Procedure (Oral Surface):**

7. Turn the starfish over to its ventral or oral surface (underside).
8. Look at the tip of each arm and find the eyespot. Label this on **Figure 1B**.
9. Locate the mouth in the center of the central disc. Find the ring of oral spines surrounding the mouth. Label these structures on **Figure 1B**.
10. Find the groove that extends down the underside of each arm. This is called the ambulacral groove. Label this on **Figure 1B**.
11. Feel the numerous, soft tube feet inside each groove. These are part of the water vascular system & aid in movement and feeding. Label these on **Figure 1B**.

**Procedure (Internal anatomy):**

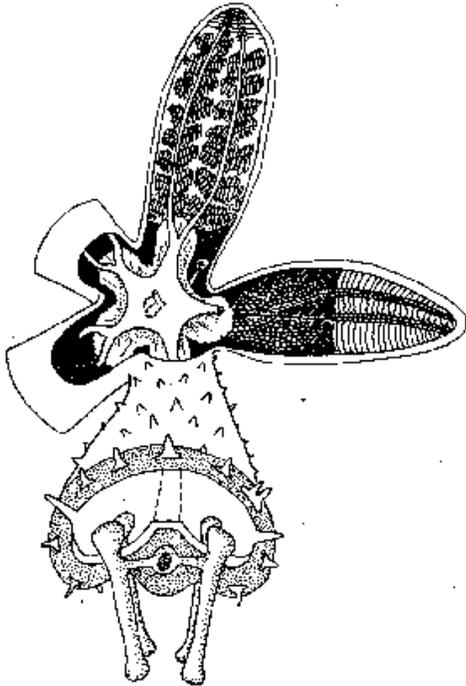
11. With the starfish's aboral surface facing you, cut off the tip of a ray. Cut along lines **A, B, and C** on **Figure 3** and then remove this flap of skin.

**Figure 3 - Cuts in Arm**



12. Inside each arm, locate two long digestive glands called the **pyloric caeca**. These make enzymes to digest food in the stomach. Label these in **Figure 4**.

**Figure 4 - Starfish Digestive & Reproductive Systems**



13. Cut a circular flap of skin from the central disc. (You will have to also cut around the madreporite in order to remove this flap.) Observe the stomach under the central disc. Label this on **Figure 4**.

14. Remove the pyloric caeca from the dissected ray. Find the gonads (**testes or ovaries**) underneath. These may be small if the starfish is NOT in breeding season. Label these on **Figure 4**. Remove these to see the rest of the water vascular system.

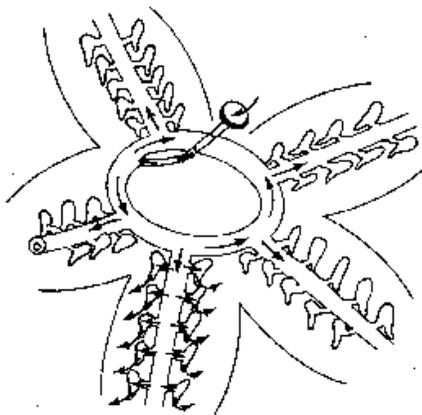
15. Cut off the tip of a ray to observe the parts of the **tube feet**. Find the zipper-like ridge that extends the length of the ray. The tube feet are attached to these.

16. Locate the bulb-like top of a tube foot called the **ampulla**. This sac works like the top of an eyedropper to create suction. The bottom of the tube foot is a sucker. Label these in **Figure 4**.

17. Embedded in the soft body wall are skeletal plates called **ossicles**. Locate these and label them in **Figure 4**.

18. Running down the center of each arm is a lateral canal to which tube feet are attached. Label this in **Figure 5**.

**Figure 5 - Water Vascular System**



19. In the central disc the five lateral canals connect to a circular canal called the **ring canal**. Find this canal & label it on **Figure 5**.

20. A short, canal called the **stone canal** leads from the ring canal to the madreporite where water enters. Find this canal & label the stone canal & madreporite on **Figure 5**.

21. Note the arrows on **Figure 5** tracing the path that water takes when it enters & moves through the starfish. **Color these in** to trace the path of the water for yourself.

**Procedure 3: Observations of preserved Mollusca:**

**Procedure 3A: Examine the Chiton. Write down** your observations down about Chiton, including descriptions of the **morphology** and then write down the Chitons **classification system**.

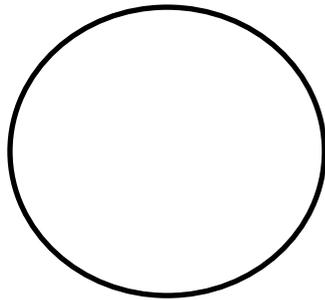
**How many plates cover this animal?**

**Procedure 3B: Observe specimens from Class Gastropoda.**

**What does Gastropoda mean?**

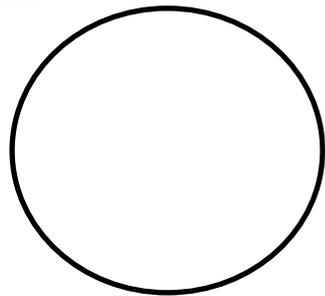
**What are the familiar species?**

**Procedure 3C: Observe the slide of the c.s. of a radula. Draw what you observe.**



**What is a radula?**

**Procedure 3D: Examine the preserved specimen of *Dentalium*, from the Class Scaphopoda. Draw what you see.**



**Why do you think is it named as such?**

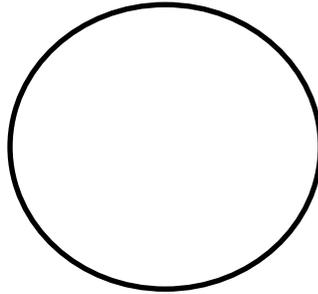
**Procedure 3E: Examine the clam pearls and shells.**

**What is a pearl and how does it form?**

**Why are some clams or oyster shells attached to each other (or very closely)?**

**Procedure 3F: Observe the two preserved specimens from Class Cephalopoda.  
What are they?**

**Procedure 3G: Examine the Nautilus, also in this class Cephalopoda.  
Observe the fossil casts of Nautilus-like shells found near Austin. Draw what you observe.**



**What does this tell you about Austin?**

**Procedure 4: Self-guided dissection of a squid:**

Squid Facts

- The common squid is a carnivorous mollusk belonging to the same class as the nautilus, cuttlefish, and octopus.
- The squid has a large head and a relatively large brain.
- Its body, stiffened by an interior cartilaginous skeleton, is spherical or cigar-shaped, with two lateral fins. Around the mouth are eight sucker-bearing arms and two contractile tentacles with spatulate tips; on the latter are four rows of suction cups encircled by rings of chitinous (horny) hooks.
- The contractile tentacles, longer than the rest, are used to seize the prey and pass it to the shorter arms, which hold it to be torn by strong jaws shaped like a parrot's beak. Squid can swim faster than any other invertebrate by rapidly expelling water from the mantle cavity through the funnel, which can be turned to direct movement. Many deep-sea squid are bioluminescent. They shoot out a cloud of dark ink when pursued; one genus secretes luminescent ink.
- In the male squid, one smaller arm is modified for the purpose of planting a packet of sperm (a spermatophore) in the female's oviduct. In some squid, such as the common squid of the east North Atlantic coast, the sperm can also be deposited in a vesicle below the female's mouth; the spermatophore, already opened by the male, releases the sperm as the eggs are produced. The females fasten their eggs to seaweed or to the ocean bottom by a viscous filament. The eggs of deep-water squid are free-floating.

- Squid species vary greatly in size. The common squid of the east North Atlantic coast is 30-45 cm (12-18 in) long, and the giant squid, at least 18 m (60 ft) long, is the largest aquatic invertebrate. It lives at depths of 300-600 m (985-1970 ft), where it is the prey of sperm whales. Scientific classification: Squid belong to the order Teuthoidea of the class Cephalopoda.
- Squid that secrete luminescent ink are classified in the genus *Heteroteuthis* of the family Sepiolidae. The common squid of the east North Atlantic coast belongs to the family Loliginidae and is classified as *Loligo vulgaris*. The giant squid is classified in the genus *Architeuthis* of the family Architeuthidae.

"Squid," Microsoft® Encarta® Online Encyclopedia 2003: <http://encarta.msn.com> © 1997-2003 Microsoft Corporation. All Rights Reserved.

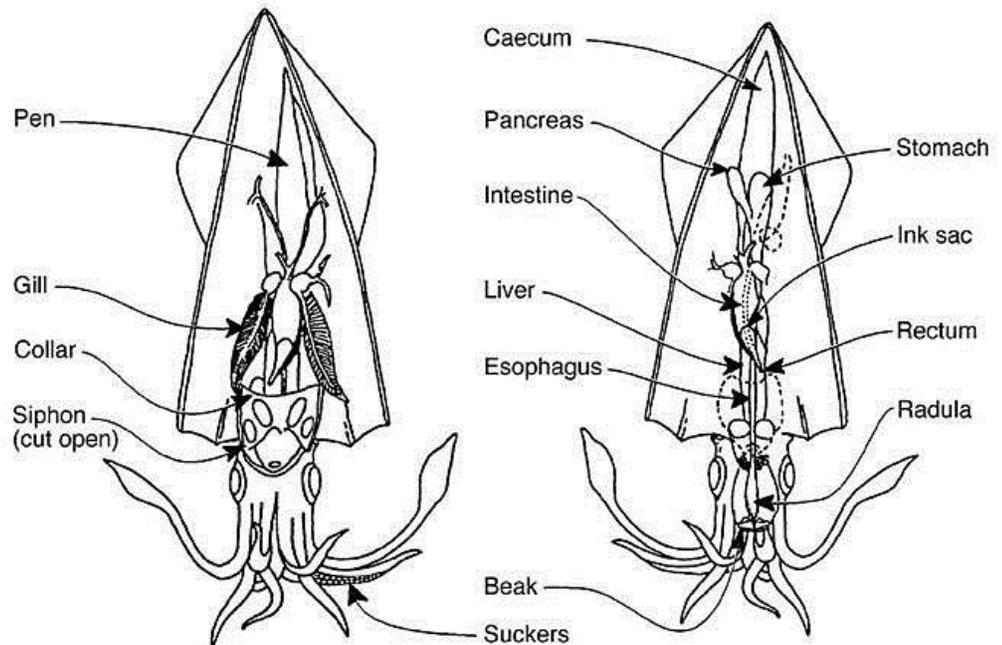


## Squid Dissection

### Procedure: Examine External Anatomy

Find each of the parts; **check the box** to indicate that you found it using the diagram below as reference.

1. Locate the water siphon or funnel. The water siphon or funnel is found on the ventral side of the squid.
2. The tentacles (long) and arms (short) are attached to the head of the squid.
3. Find the two large eyes on the side of the head.
4. Locate the body, which is covered by the mantle, and locate the two fins.
5. Each arm has sucker disks, count the number of sucker disks on one arm: \_\_\_\_\_

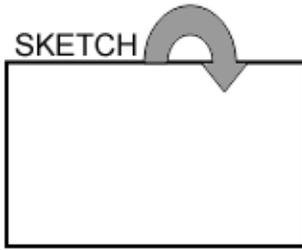


Sketch the external view of the squid; label all the parts that are underlined above.



**Procedure: Finding the Jaw**

Open up the arms and remove any that are in your way. Deep in the middle of the arms are the **mouth** and a **beak-like jaw**. Use forceps to remove the jaw (beak) and lay it table so that you can draw it below.

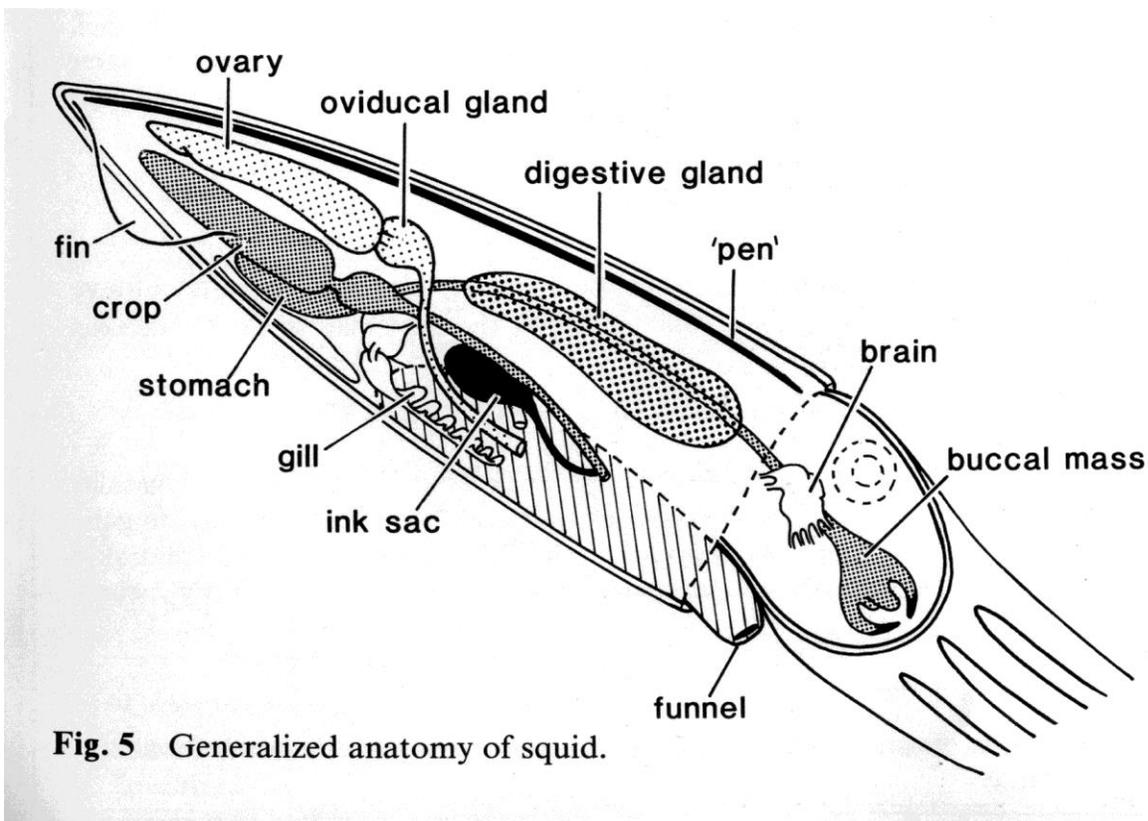


**Procedure: Examine Internal Anatomy**

Turn the squid **ventral side up**. Pull the mantle up with the scissors where the water jet is, it should be loose and easy to pull up. Use scissors to **cut from the water jet to the fins**.

Open the mantle to expose the structures inside. **Check the boxes on each step** as you proceed, using the diagram below as reference.

1. Find the **ink sac**; this is a small dark sac near the water jet. Remove the ink sac and use your dissecting needle to puncture the pouch. **Write your initials** on this paper in squid ink or just smudge the paper here. Save the pouch for step 8.
2. Find the **esophagus** by looking into the mouth and seeing where it leads. The muscular mass that surrounded the beak can be pulled up (and out) to show the tube that is the esophagus.
3. Find the **stomach** by following the esophagus toward the posterior.
4. The **anus** empties into the water jet. Use scissors to cut the water jet down the center so you can see the small opening of the anus.
5. Locate the **gills**. These are feathery structures that may be hidden under other things. There are two of them.
6. Follow the gills toward the interior to find an enlarged structure at their base: the **gill heart**.



7. All the way toward the fin is a whitish or yellowish structure: **the gonad**. The **male** gonad is generally **white**, while the **female** gonad is usually more **yellow to clear**. Is your squid male or female? \_\_\_\_\_

8. The hard shell-like structure that lies along the backside of the squid is the **pen**. See if you can **remove the pen in one piece**. The pen serves to stabilize the squid while it swims (like our backbone). **Sketch** the pen in the space below. *For a challenge, sketch the pen using the pen itself dipped in the squid's ink.*



### Observations and Analysis Questions:

## Starfish

1. What type of symmetry did your starfish have?
2. What is the upper surface of the starfish called?
3. What is the lower surface of the starfish called?
4. On which surface are these parts of a starfish visible:
  - a. Mouth -
  - b. Madreporite -
  - c. Suckers -
  - d. Oral spines -
  - e. Eyespots -
  - f. Ambulcaral groove -
5. In words, trace the path water takes through the water vascular system.
6. What part of the tube foot creates suction to open clams whenever the starfish feeds?

7. Why do the gonads sometimes appear larger?
8. What type of skeleton, endoskeleton or exoskeleton, does the starfish have?
9. What bony plates make up its skeleton?
10. What is the function of the pyloric caeca?
11. Where is the stomach of a starfish located? What can the starfish do with its stomach when feeding on clams & oysters?
12. Name the kingdom, phylum, and class for the starfish you dissected.

## Squid

1. How many arms does the squid have? \_\_\_\_\_ How many tentacles? \_\_\_\_\_
2. What is the function of the arms and tentacles? \_\_\_\_\_
3. What is the function of the water jet? \_\_\_\_\_
4. Name two features that are adaptations for the squid's predatory life. \_\_\_\_\_
5. Name two traits that the squid shares with other mollusks. \_\_\_\_\_
6. To what kingdom does a squid belong? \_\_\_\_\_ What phylum? \_\_\_\_\_  
What class? \_\_\_\_\_
7. Name one other organism in the same CLASS \_\_\_\_\_
8. How many gills does the squid have? \_\_\_\_\_
9. In the squid, where does the ink sac empty prior to release? \_\_\_\_\_
10. What is the function of inking? \_\_\_\_\_

11. What is the function of the pen? \_\_\_\_\_

12. Where do wastes exit the squid? (be specific) \_\_\_\_\_

**Now, for a break from all of these questions, sit back and watch some fun Squid videos!**

[http://www.oceanfootage.com/video\\_clips/BRF01\\_006](http://www.oceanfootage.com/video_clips/BRF01_006)

[http://www.oceanfootage.com/video\\_clips/BRF01\\_004](http://www.oceanfootage.com/video_clips/BRF01_004)