

SQUID DISSECTION

OVERVIEW The students will be dissecting a squid to study this amazing animals adaptation so they can have a better understanding of living creatures.

OBJECTIVES Following completion of this lesson, the students will be able to:

- Gain an understanding of mollusk anatomy and adaptations.
- Learn why and how to perform a dissection properly with respect.

GRADE LEVELS 6th -12th grades

MATERIALS

- Squid (available at local bait shop or seafood market),
- hand lenses,
- dissection pan (plate),
- scissors,
- tweezers,
- probe or toothpick,
- paper towels

PROCEDURES **Dissection of External Anatomy**

Cephalopods: Have students observe their squids for a few moments looking at the relationship between head and the rest of the body. Then ask students why they think squid are in the family of cephalopods (head-feet).

Tentacles and Arms: Have students count the number of **arms**. They may use the toothpicks to spread out the squid **arms**. Ask if all the **arms** look the same? There should be eight short **arms** and 2 long **arms**. Explain that the long thin arms with suckers only at the ends are called **tentacles**. The **tentacles** large ends with suckers are known as **clubs**. The **tentacles** are used to strike out and capture prey. The eight **arms** are used to hold onto prey when captured and bring food into its mouth.

Suction Cups: Student may use the magnifying lenses to get a closer look at the **suction cups** on each arm and tentacles. The **suction cups** have a small-toothed ring around each one and they are on short stalks. The **suction cups** are like suckers that help the **arms** hold onto the prey when it is captured and tries to escape.

Beak and Buccal Mass: Located within the circle of arms students can locate the squids mouth which is a **beak**.

Have the students feel for something hard and pointy, and look for a black speck; with close examination they will see this is the squid's **beak**. Using tweezers have the students carefully remove the round, muscular encasing around the beak known as the **buccal mass**. When the **buccal mass** is removed a small long tube may be attached, this is the **esophagus** that connects to the stomach. Students may remove **buccal mass** from around the **beak**. The beak has two halves and is much like a parrot's beak. The **beak** tears food into small pieces before it is swallowed.

Radula: Each half the **beak** can be removed and tongue with a toothed ribbon known as the **radula** will be found. The **radula** shreds the small pieces of foods to be easily digested.

Eyes: Students may now examine the eyes. Explain how the eyes are much like ours, however the lens is shaped differently and not quite round. Students may snip open the cornea, the soft covering of eyes and use their fingers to search for the only hard part of the eye, the lens. Squids can tell the difference between light and dark, but not color. They can also see a complete image of what it is looking and even receive polarized light to allow them to see through the shiny mirror reflections on many fish scales.

Mantle: The main part of the body is the **mantle**. Squids have no external shell so this soft, dotted and colored tube encloses the main part of the body. All the small dots the students see are pigment cells called **chromatophores**. Muscles controlled by the nervous system surround each chromatophore. Squid can change colors depending on their mood such as angry, scared or hungry, or to camouflage itself to its surroundings to escape from predators. They will also change colors to attract mates, or communicate. The **chromatophore** muscles expand or contract to reveal the colors of the pigments within. When the muscles tighten the squid will darken in color, when they relax the squid becomes a lighter color. Students may use the magnifying lenses to inspect the **chromatophores** and the colors they see in them, such as brown, black, purple, orange.

Fins: At the tail (posterior) end of the squid students will notice the two fins on the mantle. The fins allow the squid to steer themselves, help stabilize their position and propel the squid at slow speeds.

Funnel: Now have the students find the **funnel** that acts as siphon. This is a short tube located just under the eyes and on the underside of the mantle. Have the students use a probe or toothpick and stick it in one end of the **funnel** and see it come out the other. The **funnel** allows the squid to move through the water by jet propulsion. The squid will take in water into the **mantle cavity**, the large opening around the front of the **mantle**. Muscles will close off the mantle and now the water may only leave the squid's body through the **funnel**. The **mantles** muscles contract and the water will jet through the siphon with a high force. This allows the squid to be one of the fastest moving animals in the ocean!

Notice the squid's body shape; it is very hydrodynamic allowing for high speeds.

Dissection of Internal Anatomy

Mantle Cavity: Reorient the squid on your plate so squid's ventral side (funnel side) is facing up. Students will cut using scissors down the middle of the squid's **mantle** starting from the funnel. Students must be careful they cut the mantle and not the underlying organs. Once the squid is open have students spread back the sides of the **mantle** like an open book. Give students a few minutes to observe what they see inside the **mantle cavity**.

Reproductive System

Gonads: The most prominent structure on the inside of the squid is its Reproductive System. Inside the mantle cavity of the squid, down by the fins the squid's **gonads** can be found, ovaries in females, testes in males. Next to the **gonads** is the **caecum** that is part of the digestive system.

Female or Male: Have students determine if they have a male or female squid. Female **gonads** will have eggs inside the ovaries that are slightly yellowish that look and feel like jelly. Depending on the reproductive stage, the eggs may be plentiful and look like tiny spheres in gelatin. Females also have a large white organ above their ovary called the **nidmental gland** used to harden the eggs before they are released. Male's **gonads** have sperm, which is white in color and more cloudy and watery than eggs. Have students circulate around the room so they can see the differences between male and female squids. Students may carefully remove the nidmental gland from their female squid to better view the squid's organs.

Digestive System

Esophagus: This part of the squid starts with the squids beak and radula, food travels down into the **esophagus**, which is passes through the center of the squids brain and runs midway down the squids mantle cavity. Squids must tear off and swallow small bites so food does not get caught in the brain as it passes through.

Stomach: Next locate the **stomach**. It is small an oval structure connected to the top part of the caecum, below the esophagus, sometime difficult to locate. The stomach is the main part of digestion and the **caecum** increase the surface area for digestion.

Caecum, intestine, and anus: Waste products leave the **caecum** through the **intestine**, a long tube, which end, is called the **anus**, the anus runs into the funnel where waste is released.

Funnel Retractor Muscles: The two large masses surrounding the organs, attached to the mantle are muscles, named the **funnel retractor muscles**. These two muscles allow the squid to move, direct and create jets streams of water through its funnel. They feel different than the rest of the squid's soft body and feel like strong tendons.

Ink Sac: Attached to the intestine and can look like a small silver fish, or thin black line, is the **ink sac**, the larger it will be depends on how much ink is inside. Have students carefully remove the **ink sac** with scissors, snipping beyond both ends. Careful not to puncture the **ink sac** itself while still inside the mantle cavity. Have the students place the **ink sac** on a plate next to the squid.

Ink: Have students come up with ideas of why squids have **ink**. Explain that the **ink** is used as a defense against predators. Squids may squirt the **ink** from its body through its funnel, the water surrounding the squid turns black, camouflaging the squids from its predator, confusing the predator and allowing it to escape. The squid's body will change to the color of the **ink** when it is released into the water. The **ink** is also thought to numb some predator's sense of smell, which makes it harder to pursue the squid. Have students piece the **ink sac** and watch the ink diffuse through any liquid. Students may write their name on their papers with the squid's **ink**.

Respiratory and Circulatory System

Gills: Have students locate the gills on the squid, they are the two white, feathery structures located on each side of the mantle cavity. Ask students what gills are used for. Explain that gills are used to breathe; they extract oxygen from the water, the same as our lungs extract oxygen from the air. The water that enters the mantle cavity to be used for jet propulsion also bathes the gills with oxygenated water.

Heart and Kidney: Ask students what structure is used to pump blood through the squid's body. The heart pumps oxygenated blood from the gills to the rest of the body. Squids actually have 3 hearts! The two **branchial hearts** are located at the base of each gill; they are used pump blood from the body to the gills. The **systematic heart** is larger and located between the branchial hearts; they are used to circulate blood around the entire body. The **kidney**, a slightly larger organ is located in the same location as the **systematic heart** and may be covering the heart. The students may locate **kidney**, used to remove waste products from the blood, and move away its tissues to find the heart underneath.

Nervous System

Brain: Explain to students that the brain in squids is highly developed, same as it's relative the octopus. They are considered the most intelligent invertebrates. The brain is located right between the eyes and consists of many bundles of nerves fused together.

It is surrounded by a "skull" made of cartilage and surrounds the esophagus. Students will have to carefully cut in-between the squids eyes through the protective cartilage of the brain case, the brain will then be obvious.

Many large nerves radiate out from the brain through the mantle wall. The nerves are highly developed and consist of giant axons to control the squid's actions. The nervous system is difficult to dissect and does not have to be located.

Support System

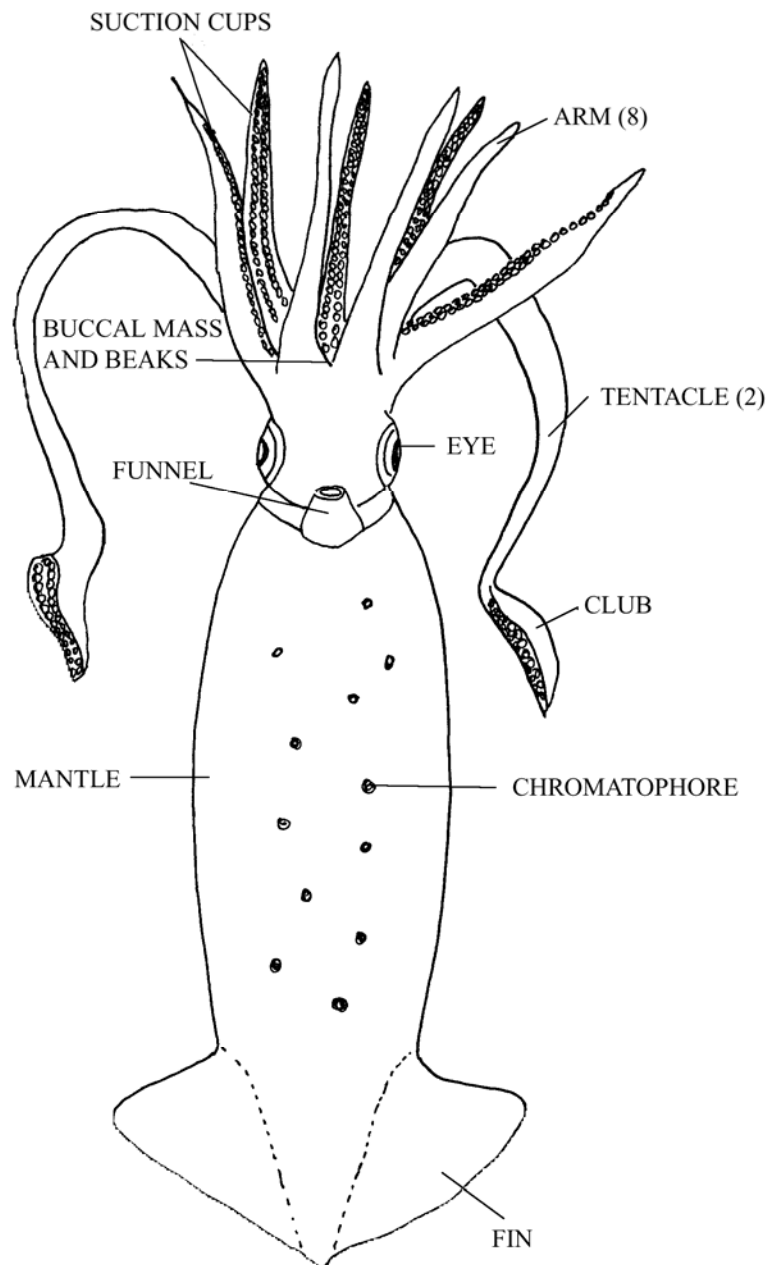
Pen: Explain that the squid is supported as it speeds through the water by a support structure remnant of the shells from its ancestors; this is now a stiff, slender, internal structure called a **pen**. The **pen** can be found by shallowly cutting the length of the dorsal midline, underneath the muscles and organs, starting near the reproductive organs. Grasp the tip of the pen and gently tug until it is removed. The **pen** is looks like a thin flexible piece of plastic or transparent feather. It is made of chitin instead of calcareous. Ask students why a thin internal shell is advantageous to the squid unlike the calcareous, external shelled relatives clams, snails, and the Chambered Nautilus.

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