

LONG BEACH MARINE INSTITUTE

Squid Dissection

For years sailors would come home from long journeys with tales of fierce sea monsters and horrific creatures that could swallow a man whole. In 20,000 Leagues Under the Sea, Verne writes of a large squid who attacks a submarine in an attempt at getting a quick meal. The truth is that the ocean is full of many strange and often misunderstood animals and though we know more than men of old did, we are still continually learning about our worlds oceans and the life they possess.



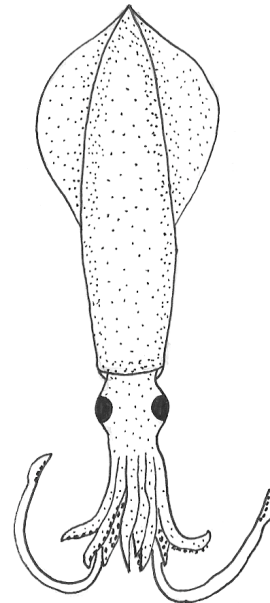
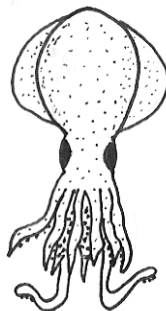
Although squid may be bizarre looking and unfamiliar to most humans they do not deserve the title of “monster.” These fascinating creatures are part of the most advanced class of mollusks; Cephalopoda

(meaning “head-foot”). A mollusc is defined as a soft-bodied animal that secretes a shell. Familiar molluscs include snails, clams and oysters. It may be hard to believe that squid are related to snails but there are a few physical characteristics that all molluscs share:

1. bodies that are bilaterally symmetrical and unsegmented
2. bodies covered with a tissue layer called the mantle
3. well developed, segmented heart
4. use radula to scrape and manipulate food (those that are not filter feeders such as clams)

Cephalopods are said to be the most advanced molluscs because they have well-developed brains and eyes. Their heads are distinct from their bodies and attached to their foot giving meaning to the class name. This “foot” is not normally associated with these animals because it does not look like a foot at all but is instead split into 8-10 flexible, and very muscular arms. A squid's mouth is equipped with strong jaws and a parrot-like beak for tearing pieces of food from their prey. These attributes along with the fact that they can all be very rapid swimmers allow these animals to be quick and agile predators able to live in many different marine habitats. Other animals in the cephalopod class are the octopus, cuttlefish and nautilus.

There are over 400 different species of squid ranging from the small *Radia* who digs in the sandy bottom awaiting prey to the giant squid that swim about attacking almost anything they see. These giants are thought to put up a good fight against the likes of sperm whales. However, these invertebrates are not only good predators, but prey for many animals. In fact, squid are often referred to as the “candy of the sea.” Animals such as moray eels, sharks, tuna and most marine mammals enjoy these tasty morsels making them squid great bait for fishing. Despite how well squid have adapted their life span is very short. Squid have only one year to live out their whole lives. They are born, develop into adults, mate and then die. Most of a squid's life is spent in the open ocean at depth. At mating season they move to the protective near-shore waters to lay their eggs.



If they have so many predators how is it that squid have survived so long as a species? More than likely, their survival is due to the fact that they have become masters of disguise. Squid have special skin cells called chromatophores that they use to change their body color and match their surroundings. The cells occur with three different pigments: purple, black and orange. By manipulating the intensity of

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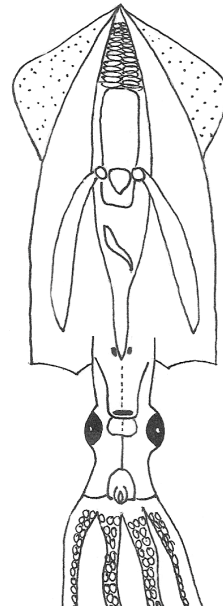
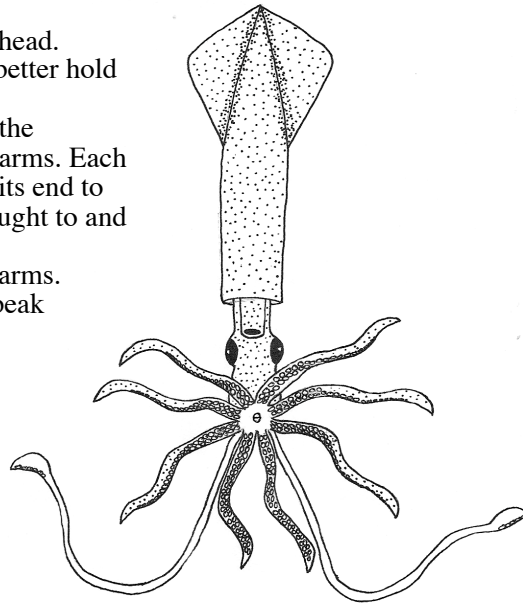
the colors and blending them together they can match not only the color but also the apparent texture of their surroundings and virtually disappear. If this doesn't work and a predator is able to see them, they then still use the chromatophores to put false eyespots on their back. This is a measure to confuse the predator. With the false eyespots (or "maculae"), the animal no longer looks like a squid and it may be hard for the predator to locate the head and thus anticipate its direction of retreat.

If the predator is still persistent in its pursuit the squid will turn to its last line of defense. The squid will raise its arms to startle the predator and stop its forward movement. While the predator adjusts to this display the squid ejects ink in the general shape of a squid and using jet propulsion will dart out of harms way. The hope is that the predator will bite into the ink instead of the squid and in doing so lose sight of the animal. This is a double blow to the predator, not only does it not get to eat the squid but it will get a bad taste in its mouth from the ink.

Now that we know how this animal survives in its environment lets take a closer look at the internal and external anatomy to better understand what is required for this animal to function and survive.

External Anatomy

- **Arms:** The Squid has eight arms attached to its head. Each arm has two rows of suction cups on it to better hold on to prey while eating.
- **Tentacles:** Squid have two tentacles. These are the appendages that are longer and thinner than the arms. Each tentacle has suckers and tooth-like structures at its end to hook and grab prey. Once seized the prey is brought to and held by the arms.
- **Mouth:** The mouth is located inside the ring of arms. Inside the mouth lies a sharp, black parrot-like beak made of keratin (the same material that your fingernails are made of) used to tear off pieces of prey.
- **Chromatophores:** Speckled dots located all over the body of the squid usually purplish in color. By expanding and contracting, these cells enable the squid to change color and hide from predators.
- **Mantle:** The long torpedo shaped part of the squid, which comprises most of the animal. This cone is made entirely of muscle and houses the animal's internal organs.
- **Fins:** The fins are the two triangle shaped flaps at the top of the mantle. These appendages help the animal with steering and balance thus making maneuvering much easier.
- **Siphon:** A small tube located on the ventral side of the animal that hangs down between the eyes. The squid will draw in water through a hole between its mantle and head. It then squeezes this water out of the siphon tube by clinching its muscular mantle and is able to propel itself. The animal can change direction by turning the siphon tube.
- **Eyes:** The squid's eyes are located on opposite sides of the animal's head. This gives the squid an incredible range of vision allowing the animal to see in front and behind at the same time. The eyes also have polarizing filters that allow the animal to sift out confusing rays of light that might hide a predator.



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Internal Anatomy

- **Male:** Externally males tend to have beefier more muscular arms. When the mantle is open one can see a large sac of a cloudy white substance at the pointy end. This sac is full of sperm.
- **Female:** Inside of a female one will find a large white gland called the nidamental gland. This is her egg casing and will be expelled when the eggs have been fertilized. The eggs look like a gelatinous mass above the nidamental gland.
- **Ink sac:** The ink sac is located about one third of the way up from the head of the animal. It resembles a small silvery fish. The ink is expelled when the animal feels it is in danger. Once the sac is empty the animal has to make more which *takes about 24 hours*.
- **Gills:** The gills are long feathery appendages on either side of the animal. Squid, like most fish, breathe with gills instead of lungs.
- **Three hearts:** The three hearts are located toward the middle of the mantle where the gills are attached. They are small off-white or yellowish balls in a row. The two smaller hearts go to the gills and make sure the blood gets oxygenated. The third and larger of the hearts pumps the blood from the gills to the rest of the body. Squid are very active and this system helps keep a good supply of nutrients and oxygen in the blood.
- **Nerve Ganglia:** The nerve ganglia are located at the base of the mantle, above the head, just on the outside of the pen. Squid have a highly developed nervous system and were the animals studied when humans were learning about our own nerves. Because their nerves are so large these animals have very fast reflexes.
- **Pen:** The pen is located behind the internal organs right up against the mantle. This thin plastic like blade is the animal's internal shell and is used to stiffen the long floppy mantle.
- **Esophagus:** This thin tube attaches the mouth to the stomach. Everything that the animal eats has to fit down this tube to reach the stomach where it will be digested. Food is moved down the esophagus by muscle contraction.
- **Radula:** The radula is inside the mouth behind the beak. It feels like a small stone or piece of sand. This organ is used to scrap and grind up all the food that the squid eats so it is small enough to fit down the esophagus and into the stomach.
- **Brain:** The squid's brain is located directly between the two eyeballs. Unlike most invertebrates squid have the brain capacity to learn.

Rules to abide by:

- 1) Make sure you are responsible with the equipment you are given. There are some sharp tools you are going to be using and there is to be no horse-play with them.
- 2) Do not go ahead of your instructor in the dissection. This means you are not to cut anything unless told to do so. There is a certain procedure that needs to be followed so you can see all the different parts of the squid and we don't want you to miss out.
- 3) Pay close attention to your instructor. In order for the dissection to move along as smoothly as possible we need your cooperation, which means we need you to get quiet as quickly as possible.
- 4) When the dissection is over make sure you clean up your work area. All of the utensils should be placed where directed and all trash needs to be made into the trashcan and the tables need to be wiped down with disinfectant. No students will be dismissed until an adult has checked their workstation.
- 5) Have a great time learning about this amazing creature.

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Squid Dissection Worksheet

Date: _____ Time: _____

Location: _____

Purpose: _____

In the box below, draw the external anatomy of the squid and label the parts listed to the right.



External Anatomy of the Squid

1. fins
2. mantle
3. chromataphores
4. eyes
5. 8 arms
6. 2 tentacles
7. suckers
8. siphon
9. mouth and beak



Chromataphores



Squid Ink

In Your Journals:

Why is this animal classified with the mollusks?
What is the phylum and class of the squid.
Name one part of the squid and how this animal uses the part.
Describe your favorite part of the dissection.

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Squid Dissection Notes

Why are we dissecting this squid?

to examine and understand one marine animal in detail
because it has many adaptations that help it to survive
because it is the food for many other marine animals

Taxonomy of the squid

Kingdom: Animal, Phylum: Mollusk, Class: Cephalopoda, Order: ???, *Loligo opalescens*

Mollusk- any soft bodied animal that secretes a shell

other mollusks: snails, clams, oysters

bilaterally symmetrical and unsegmented bodies covered with a tissue layer called the mantle well developed, segmented heart use radula to scrape and manipulate food (not a filter feeder)

Cephalopoda: head-foot. Head directly connected to 'feet'

other cephalopods: octopus, cuttlefish and nautilus

advanced mollusks, well-developed brains and eyes,

Types of Squid

Racia dig on the sandy bottom. Giant Squid in the deep sea. Humboldt Squid: jumbo squid.

Squid are prey more often than predators: "candy of the sea"

Defenses of the squid

Chromatophores-purple, black and orange. Can mix and match the texture. They can only see in black and white

Also make eye spots.

Startle the predator-raise arms to look bigger, confuse the predator

Ink- release ink from ink sac to confuse predator, then dart away

Dissection Rules

No cutting anything I don't tell you to, i.e. cutting off tentacles, paper towel or plate, friend's hair, etc.

Use inside voices

Be quiet when I get your attention.

Pay attention!

External Anatomy – examine your squid while I explain what you're looking at

Arms-eight arms, 2 rows of suction cups

Tentacles-two tentacles, suction cups and tooth like hooks. Used to grab prey

Mouth- muscles surround a parrot-like beak that is used to crush food

Chromatophores-dots of color

Mantle-long cone of muscle, protection for internal organs

Fins-two triangular stabilization flaps

Siphon-maneuverable propulsion tube hanging between eyes.

Eyes-two on either side of the head. Almost 360° vision

Internal Anatomy

First cut. Put squid "belly up" with fins flat against plate. Pinch mantle up and away from internal organs. Begin the cut on the edge nearer the eyes and cut toward the arrow made by the fins.

Male-if your squid has beefier arms and you see a large sac of cloudy white stuff

Female-if you see a large white gland: *nidamental gland*. Entire gland is deposited on the ocean floor after fertilization.

Ink Sac-looks like a small silvery fish. Do not touch or poke! The ink will stain your clothes and make your dissection very messy!

Gills- two long, feathery appendages

Hearts- 3 yellowish balls. One for each gill and one for the rest of the body.

Nerve ganglia- base of the mantle, have a developed nervous system

Pen- behind the internal organs (**V.A.**)

Esophagus-very tiny tube connecting the mouth and stomach (**V.B.**)

Radula- inside the mouth behind the beak. A small stone or piece of sand. For grinding up food

Brain- between the eyes

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Dissection instructions

Four step pen and ink directions

Lift up ink sac and cut around it. Do not break it. Put it aside

Hold mantle down and grab whole body just above the eyes. Lift/ “unzip” and pull toward the top, in the direction of the fins.

find the pen and remove it. Dry on the paper towel.

Carefully poke/open the ink sac and use the pen to write and X or initial your journal. You can keep the pen.

Three step mouth directions

Hold tentacles apart and cut out mouth casing (the round, muscular ball with the black speck in the middle).

The mouth should be connected to the esophagus, which is connected to the stomach. If so you can pull the rest of the body up like a puppet.

Disconnect mouth from esophagus, cut out 2 halves of beak.

Three step eye directions

Do not squeeze the eyeball, it will stain! We are looking for the lens of the squid which is spherical. You can keep them.

Cut all the way around the eye

Remove it from the head and find the lens

Bait -give me back the mantles and cut off the head from the main arms and tentacles.

Clean-Up

No one is dismissed until everything is clean! Throw squid, paper plates and towels into ONE trash can. Have students wipe off their scissors and return them. Have them return their diagrams. Chaperones will spray the tables and someone will wipe them with paper towels. Then they are dismissed to wash their hands.