MARINE ANIMALS

This activity introduces the diversity and taxonomy of oceanic consumers.

Objectives for Exam #1:
1. Describe characteristics of organisms in different invertebrate phyla, including the sponges, cnidarians, echinoderms, mollusks, annelids, and arthropods.
2. Provide examples of animals representing the different invertebrate phyla.
3. Discuss the characteristics of vertebrate animals, including specifics on the bony fish, sharks, rays, pinnipeds, and cetaceans.

Objective for Portfolio #1:
Observe, sketch, and identify marine invertebrate animals in a coral display tank.

Safety:
Wash hands after handling any organisms.

Clean-up:
Leave the stations in good condition for the next class.

Consumers are organisms that consume other organisms for nutrients and energy. In marine ecosystems, consumers include bacteria, protists, and animals. In this activity we are focused on marine animals. Organisms in *Kingdom Animalia* are primarily **invertebrates**, meaning not having a vertebral column or backbone. Part I of the activity focuses on the invertebrate phyla (plural for phylum). Part II will focus on the **vertebrate** phyla, particularly sharks and whales.

A link to an audio pronunciation webpage is available at the course website

Part I: Invertebrate Animal Stations

Station A: Phylum Porifera

Characteristics

1. Porifera (pronounce: pore-if-er-a) are commonly called the **sponges**. These are structurally simple animals with no distinct organs. Porifera means "pore-bearing," and the pores are openings through which water and the microorganisms they eat enter, and wastes leave. From the *Sponges* mini-poster (white writing), what are three characteristics of sponges?

2. Using the *Porifera* poster, summarize how sponges actually eat.

3. There are many different types of sponges. For example, millions of tiny animals make up silk sponge and finger sponge colonies (the structure we see). The individual sponge organisms work together to form a functioning larger structure. Looking at the dried samples, how do you think the silk sponge got its common name? _____ How about the finger sponge? _____

4. Sponges are primarily classified by the makeup of their "skeleton" and shape. The glass sponge is nearly transparent with complex architecture. From the display, why were dried glass sponges commonly given as wedding gifts in several Asian countries bordering the glass sponge's marine habitat?

Sponge Repoduction

5. Some sponges can reproduce by releasing **gemmules**. Gemmules are like "survival pods." When a sponge is dying, some of its cells get wrapped in a nutrient-rich protective substance, and these gemmule packets are released in large numbers into the water, where they may be spread to a new location and grow into a new sponge colony. Sketch what a gemmule looks like under the microscope:

Station B: Phylum Cnidaria

Characteristics

1. Organisms in *Phylum Cnidaria* (pronounce: nigh-dare-e-ah) include the hydras, jellyfish, and anemones. Some cnidarians are single organisms, others are colonies of many small organisms. Looking at the *Cnidaria* poster, the sea fan coral is actually a colony made up of a large number of smaller _____.

Hydrozoans

2. From the *Cnidarians* mini poster, what are their two basic shapes? _____ and _____ Generally a cnidarian that attaches to a surface is called a **polyp**, and when it floats free it is called a **medusa**. Some spend their whole lives as either a polyp or medusa, some can be both. Examples of hydrozoans ("water animals") that are primarily polyp in form are *Hydra* (which you will see next week in the *Freshwater Life* activity) and *Obelia*. Sketch the general shape of *Obelia*.

3. Cnidarians have cnidocytes (pronounce: nigh-doh-cites), stinging cells that can stun prey or a potential predator. These cnidoctes are typically at the end of tentacles that surround the mouth. A famous hydrozoan that takes medusa form is commonly called the "Portugese Man-of-War." Typically the "Portugese Man of War" stings its small fish prey, but it can also cause painful stings to _____.

Jellyfish

4. Some of the best known cnidarians are the jellyfish. Looking at the jellyfish display, do they have radial (spokes of a wheel) or bilateral (equal halves) symmetry? _____

5. Watching the jellyfish video, how do jellyfish move through the water? Use the words bell and muscle in your description.

Corals

6. **Corals** are marine animals that can form large colonies. Corals use stinging tentacles to catch plankton, but much of their nutrients come from symbiotic algae (protists) called **zooxanthellae** (pronounce: zoe-zan-thell-ee). This is a **mutualistic** relationship where both species benefit. How may the tiny zooxanthellae benefit from this relationship? (The answer is in next week's on-line reading)

7. Hard coral is what we usually think of when we think of coral, many small animals making up a larger structure by secreting minerals that remain long after they have died. Which mineral is the primary mineral making up the hard coral structures (hint: it is also found in bones, teeth and shells of other animals): _____ Soft coral have less mineral deposits, touch the soft coral specimen, how does it feel to the touch? _____

8. Using the coral display, what is the small white unidentified #1 piece of coral washed up on Oregon beaches? _____ Is it an example of a hard coral or soft coral? _____ Using the coral display again, what is the large unidentified #2 coral, washed up on a Jamaican beach after a large storm? _____

Sea Anemones

9. Looking at the sea anemone preserved in plastic and the anemone display, sketch the general structures of a sea anemone.

10. Many sea anemones also have smaller species living inside of them. We have already seen an example of endosymbiosis (one symbiotic species living inside another) in the Lichens activity. What gives green anemone from the Oregon coastal tidal pools their green color?

Station C: Phylum Echinodermata

Characteristics

1. Animals in *Phylum Echinodermata* (pronounce: ee-kine-o-derm-ah-tah) generally have a spiny surface, echinoderm means "spiny skin." All echinoderms have small and flexible tube-like feet for movement. From the *Echinodermata* poster, do echinoderms have radial symmetry (like spokes of a wheel) or bilateral symmetry (has two halves). _____

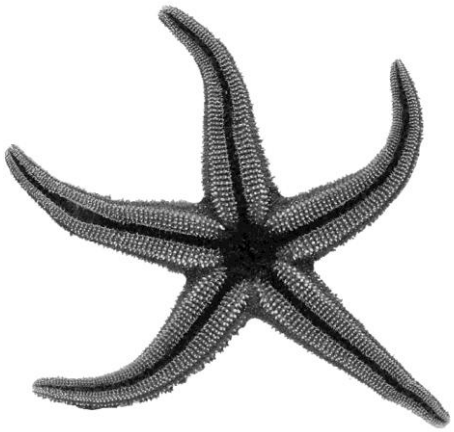
2. Sea urchins, sand dollars, and sea biscuits are echinoderms in *Class Echinoidea.* These organisms have spines that can be used for movement, feeding, and protection from predators. From the display, which has the longest spines, sea urchins or sand dollars? _____ What is the primary structural difference between a sand dollar and a sea biscuit?

   _____

Sea Stars

3. Sea stars (also commonly called starfish) do not have heads and have light-detecting eye spots on their arms. The arms are used for movement and to pry open prey. Sea stars typically have _____ arms, but some species have many more. If arms are lost, some species of sea stars can _____ a new one.

4. From the sea star display, label the mouth and tube feet in the sea star photo below, and describe how a sea star uses its mouth and stomach to eat:



Station D: Phylum Mollusca (or "Molluska")

Characteristics

1. Animals in *Phylum Mollusca* (pronounce: mul-usk-ah) are animals with soft bodies (mollusk means soft), a muscular foot for locomotion, a mass of internal organs, and a heavy tissue called the mantle which can in some species produce a hard _____. An example of a mollusk is a Tusk Shell organism. From the display, how is a tusk shell shaped and how does the organism eat?

Slugs and Snails

2. From the *Mollusca* poster, slugs and snails are classified in *Class* _____. In slugs, the typical structure we associate with mollusks, the _____, is reduced or absent entirely. We will meet terrestrial slugs in the final lab of the term. Sea slugs, also called _____ are covered in this week's on-line readings.

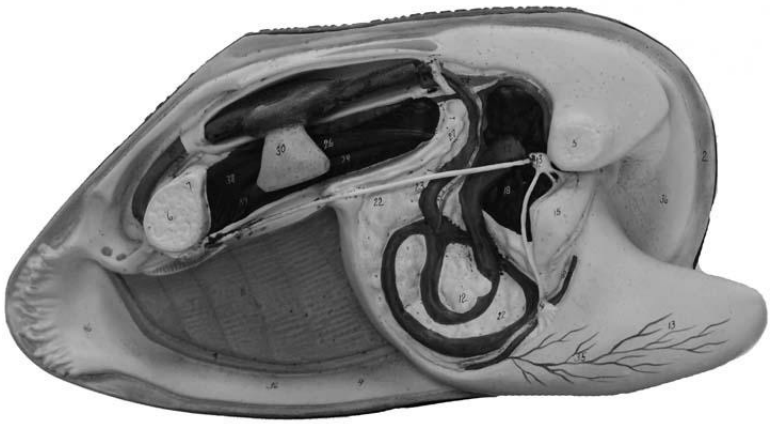
3. Limpets are a type of snail, how do limpet shells differ from the shells of other snail species?

4. One of the larger marine snails is the conch. Hold the conch shell up to your ear. What do you hear (hint: its not the ocean) _____

There will be more coverage of snails in next week's "*Freshwater Life*" activity.

Bivalves

5. From the *Mollusca* poster, clams, oysters, mussels, and scallops are mollusks grouped in *Class* _____, due to their symmetrical two-part shells. All four groups lack the scraping eating structures snail mollusks have, so instead siphon and filter _____ from the water. Most bivalves are sedentary, but clams can move with a muscular foot, label the foot on the photo below:



6. Looking at the display, how can you structurally tell a scallop from a clam?

7. The shells of bivalves (and snails) can last long after the organisms have died. This makes them more likely to be fossilized than soft-bodied mollusks like slugs. The fossilized mollusks displayed were collected from North of Newport on the Oregon coast. Approximately how old are these fossils? _____

8. In addition to food, bivalves have many other human uses (see the example of a "sailor's valentine). Some bivalves secrete **nacre**, or mother-of-pearl, that can in some cases form a 3D pearl structure. Under the microscope, nacre appears _____. Many bivalves produce an adhesive material called **byssus**. Byssus can stick the bivalve to a hard surface, like a rock, under water. What is a potential medical use of a super-sticky substance that can be used in a wet environment? _____

Cephalopods

9. Octopi, squid, and nautili are **cephalopods** (pronounce: sef-ah-lah-pods) which means "heads with feet." Cephalopods have different nervous systems than other mollusks, from eyes structured like vertebrates, to the potential ability to carry out complex behaviors. From the photo sequence provided, what is one complex task an octopus can carry out?

10. Looking at the octopus and squid replicas, both have two eyes and _____ arms. Squids are narrow and streamlined in shape with flap-like fins on their body that can help them maneuver in the water. Posing the squid replica, what can they do with their tentacles to increase their speed in the water? _____

11. Several species of cephalopods change the size of cells in their skin called **chromatophores** to change their _____. What are two possible advantages to being able to change color?

12. The **nautilus** is a cephalod like octopi or squids, but unlike the other living cephalopod species, the nautilus has a _____. The shell of the nautilus develops in a precise geometric pattern known as a logarithmic spiral. From the photos provided, what else occurs in a logarithmic spiral? _____

Station E: Phylum Annelidia

1. Organisms in Phylum *Annelidia* (pronounce: an-el-eh-dah) are segmented worms that lay eggs. From the *Annelidia* poster, annelids are the most structurally developed worms with a true _____ and complex _____ system. Most annelids have bristles called _____ on almost all of their body segments. The annelids in *Class Oligochaeta* (pronounce: ah-lig-oo-key-tah) have fewer setae on their body segments. Well-known oligochaetes include the *Tubifex* worms that we may see next week in polluted water samples, and *Lumbricus*, the _____ a common soil organism that will be covered in our final lab.

2. Worms from *Class Polychaeta* (pronounce: pah-lee-key-tah) are primarily found in marine habitats and have many setae on their segments. Because of all the setae, they are often called "bristleworms." From the *Annelidia* poster, the tube worm polychaetes make protective structures from _____ (the same mineral used to make hard structures in many other organisms) and other minerals. Other polychaetes like the scale worms and clam worms crawl on the surface of coral reefs. From the *National Audubon Society Field Guide to the Pacific Northwest* (p. 170-171), list five species of polychaetes (bristleworms) found in our coastal waters:

3. *Nereis* and *Periaptus* are two different worm species, compare the examples mounted in plastic. One of these is a polychaete annelid. Which one? _____ ***Peripatus*** are velvet worms that appear similar in many ways to the polychaetes, but are actually classified in *Phylum Onychophyta (pronounce: on-key-of-ih-tah)*. They are smoother in appearance with no outer (visible) segments and give birth to live young. *Periapatus* (mounted in plastic) looks like terrestrial caterpillar larva, and similar to the polychaetes, has many _____ for movement.

Station F: Phylum Arthropoda, Subphylum Crustacea

Classification

1. Organisms in *Phylum Arthropoda* (pronounce: arth-rah-pid-ah) are animals that have body segments and jointed appendages (legs and antennae). The word "arthropod" means "jointed feet." **Arthropods** have segmented bodies, jointed appendages and exoskeletons (external skeletons). Do arthropods have radial (spokes of a wheel) or bilateral (two sides that are mirror images of one another) symmetry? _____ There are over a million species of arthropods, not just in the ocean, but also in freshwater and on land. We will be focusing on arthropods in *Subphylum Crustacea* (pronounce: kruss-tae-sha) today. From the poster, when we study insects later this term we will be studying Class _____ and when we study spiders and scorpions we will be studying Class _____.

2. *Subphylum Crustacea* includes many marine species, including barnacles, crabs, lobsters, shrimp, and krill. Since they are all arthropods, they all have _____ bodies and _____ appendages. We will meet microscopic crustaceans in next week's *Freshwater Life* activity. **Krill** crustaceans are introduced in this week's recitation and lecture.

Barnacles

3. At first glance **barnacles** seem like they would be more related to snails than crabs. However, barnacles have specialized jointed appendages, and filter organisms to eat out of the water with their limbs. Barnacles attach themselves to a hard surface by building a shell around their bodies and part of the surface. From the display, sketch a barnacle, including its shell and legs:

Crabs and Hermit Crabs

4. **Crabs** have hard calcium-rich exoskeletons and two large claws. Crabs have complex behaviors and wave their claws to _____ with one another. **Hermit crabs** are decapods, not crabs, they lack the hard _____ to protect their soft abdomen. As a result, hermit crabs salvage the empty shells of _____ to protect their soft body.

Lobsters and Crayfish

5. Lobsters and crayfish species are large aquatic crustaceans. Using the display, contrast these two groups.

Groups	Freshwater or Marine?	Omnivore or Carnivore?	Size?
Lobster			
Crayfish (also called crawdad)			

Shrimp and Brine Shrimp

6. Shrimp are swimming crustaceans, and there are both freshwater and marine species. From the display, like many other smaller crustaceans, shrimp eat _____, small organisms that float with the water currents.

7. Some of the most popular marine aquarium organisms are the various species of cleaner shrimp. These shrimp form a mutualistic relationship with many fish species. Describe how both the fish and the cleaner shrimp can benefit.

8. Millions of people have tried to raise "*Sea-Monkeys*" in their homes. Sea Monkeys are actually brine shrimp, a species that is more closely related to daphnia (introduced in next week's *Freshwater* lab) than to the shrimp we eat. One of the things that has made Sea Monkeys so popular, is that you pour a few packets of dry ingredients into a bowl of water, and the organisms appear to spring to life. It actually takes a day or more for the brine shrimp _____ to hatch. From the display, sketch a "Sea Monkey" brine shrimp:

Part II: Vertebrate Organisms

Station G: Phylum Chordata, Subphylum Vertebrata, Class Osteichthyes

1. Animals in *Phylum Chordata* (pronounce: core-day-tah) all have a nerve chord and a protective skeletal "notochord" structure at some part of their development. Most chordates are classified in *Subphylum Vertebrata* (pronounce: ver-tah-bray-tah). From the poster, vertebrates have a segmented _____ (also called a backbone or spine) which typically replaces the notochord in development. The individual bones protecting the nerve cord are called vertebrae.

2. There are many classes in *Subphylum Vertebrata*, this term we will be studying frogs which are classified in *Class* _____, reptiles (which used to be in *Class Reptilia*, more on that later), and we have already studied birds in *Class* _____. Today we will be studying bony fish in *Class* _____, sharks in *Class* _____ and mammals in *Class* _____.

3. Most fish species have some type of scale protecting their body. From the scale display, what is the function of fish scales?

4. *Thought Question:* Fish are immersed in water, which could rush into their bodies, or draw fluids out. Fish have to manage their body fluids, so they do not become too dilute or concentrated. Freshwater fish have the problem of having a higher salt concentration in their tissues than the water around them (so they can easily gain extra water), while saltwater fish can have lower salt concentrations in their tissues than the surrounding water (so they can easily lose water). Therefore, freshwater fish need to have a mechanism to _____ water, and saltwater fish need to have a mechanism to _____ water.

5. From the *Fish* poster, what are two examples of jawless fish? _____ and _____ What are two examples of cartilaginous fish? _____ and _____. The other group of fish are the bony fish.

Bony Fish

6. Bony fish are classified in *Class Osteichthyes* (pronounce: ahs-tea-ich-thees). Examine the three display cases of vertebrate bones. Bony fish have bones that make up the vertebral column and skull. Do they have bones in their fins as well? _____

7. Marlin, swordfish, and sailfish are sleek fast-swimming predators that can migrate large distances. What other noticeable physical characteristic do they share and what function does this structure serve?

8. **Seahorses** are bony fish that have unusual structures in comparison to most other fish species. From the seahorse display, what are some of these structural differences?

9. Seahorses raise their young in a different manner than most animals. The female sea horse lays her eggs in a pouch in the body of a _____ seahorse. So who fertilizes the eggs, provides the embryos nutrients, and "gives birth" by contracting the pouch muscles, the male or the female seahorse? _____ From the "Leafy Seadragon" seahorse replica, what may be the point of these "leafy" structures and colors? _____

Station H: Phylum Chordata, Subphylum Vertebrata, Class Chondrichthyes

1. *Class Chondrichthyes* (pronounce: con-drik-thees) includes sharks, skates, and rays. These fish have skeletons made of _____ instead of bone.

2. Most skates and rays are noticeably flatter than sharks. Many of the species are bottom-feeders. Looking at the replicas of the rays, what do they have in common about their colors on the top and bottom? _____ How can this **countershading** assist rays in feeding and escaping detection by potential predators?

3. From the poster, approximately how many shark species are found in the waters around the United States? _____

4. Of the shark replicas displayed, which show countershading? _____

5. *Thought Question:* The shark's dorsal (top) fin is one of its most recognizable features as it can be sometimes seen above water. How does the dorsal fin help the shark swim in a straight line?

6. The largest shark (and fish) is a whale shark. It is called a "whale" shark because it filters _____ out of the water to eat, like a whale. How long was the largest recorded whale shark? _____

7. Carefully examine the shark's jaw (photo below). What is different about the tooth arrangement in sharks than teeth we see in mammalian jaws?_____ Most carnivorous sharks replace their teeth throughout their lives. What is the general shape of a shark's tooth? (we will compare it to carnivorous mammalian teeth later this term)

Station I: Phylum Chordata, Subphylum Vertebrata, Class Mammalia

1. Animals in *Class Mammalia* (pronounce: mah-male -ee-ah) are chordates with mammary glands (that produce milk), hair or fur (at some time in their life), three middle ear bones, and are warm-blooded (as are birds). Today we will focus on marine mammals, we have an entire *Mammals* activity later on in the term. Referring to the *Mammals* poster (bottom), seals and sea lions are classified in *Order* _____. Unlike the cetaceans and sirenians (manatees), pinnipeds are not fully aquatic. Why do they need to return to land?

Cetaceans

2. The mammalian *Order Cetacea* (pronounce: set-ay-she-ah) contains whales, dolphins, and porpoises. All of these species are marine except for a few species of freshwater dolphins. *Thought Question*: Dolphins and whales breathe throw a blowhole, not their nose or mouth. If the cetaceans need to continually breathe air to survive, how do they sleep?

3. Compare the dolphin (a mammal) and shark (a fish) anatomical models. There are similarities in shape, but also major structural differences. Label these differences on the photos below:

4. Using the anatomical model of the bottlenose dolphin, how are the skeletons of humans and dolphins similar? _____

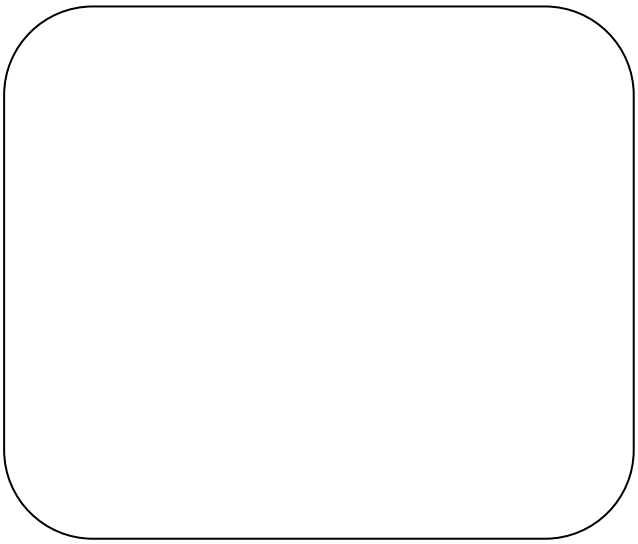
5. Typically humans see little of whales, other than the dorsal (top) fin above water, the flukes (tail fins) as the whale dives, or the back as the whale arches above the water. The dorsal fin of an orca (killer whale) is unmistakable. Sketch it here:

6. The flukes (tail) of humpback whales are dark, with patterned white areas that can be used by researchers as a form of identification. The humpback whale gets its name because its back is _____.

The next page will be included in Portfolio #1,
Instructions for this assignment are written on the back of the next page

STAMP

Marine Animal Observations
(Include this stamped page in Portfolio #1)



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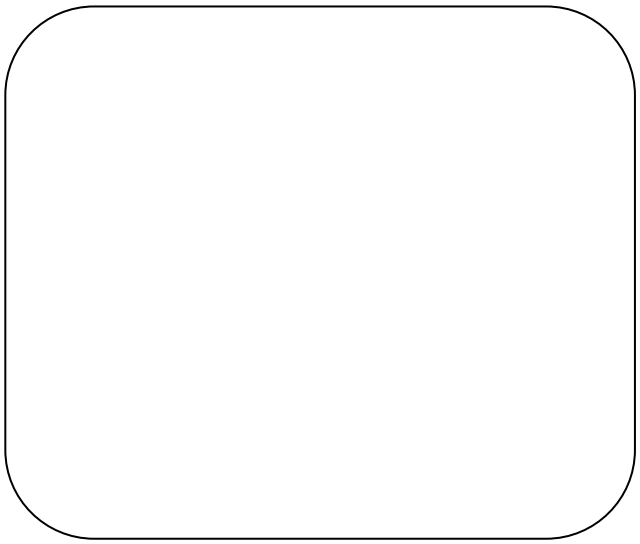

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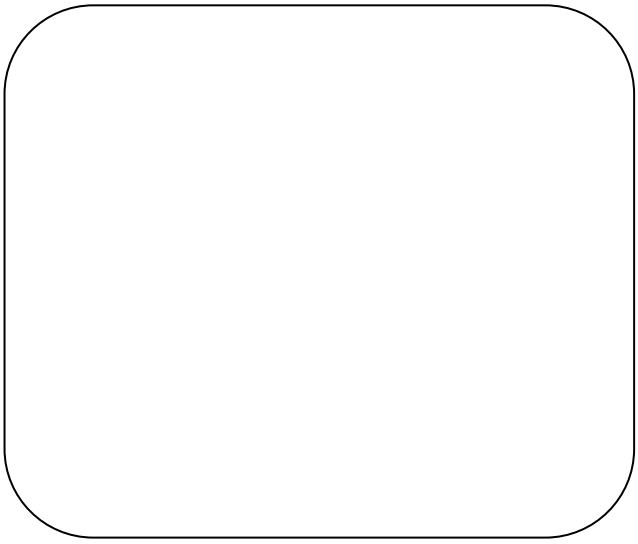

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Part III: Marine Animal Observations (for portfolio #1, stamp required)

Skill: Observe, sketch, and identify marine invertebrate animals in a coral display tank.

Assignment: Observe the coral display tank closely; it may take a few minutes to begin to see the organisms. Find three different species and sketch them on the back of this page. Label any structures, sizes, colors, locations, or behaviors that might help you identify the organisms. Then, based on what you are learning in this activity, and photos in the field guides provided, tentatively identify what the organisms are, writing this information below your labeled sketches.

Assessment: This assignment is worth 3.0 points. Each species is worth 1.0 points (0.25 point for sketch, 0.5 point for labels, 0.25 point for identification). This stamped portfolio assignment needs to be completed and stamped in lab or during GTA office hours week 2 or Monday morning week 3 (no later) to receive any credit for this assignment.

Do not touch the tank or cart, the animals will retreat and stop feeding.