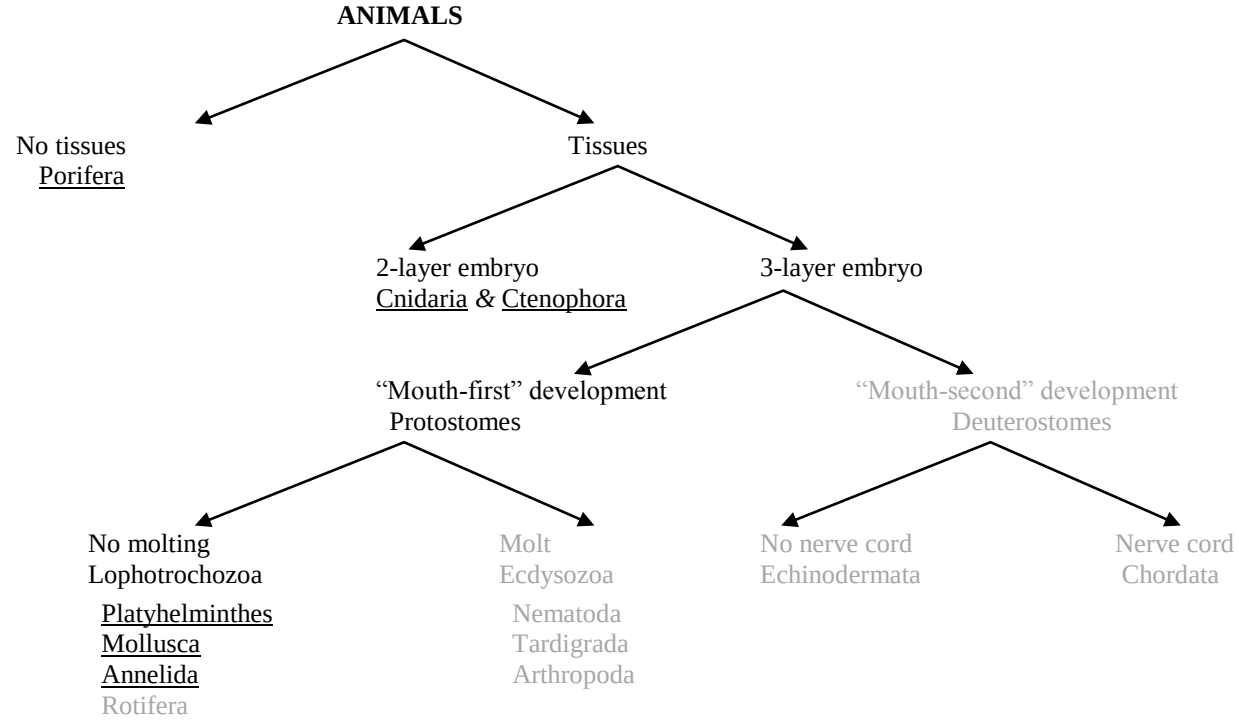
NAME: _____ DATE: _____

PARTNER: _____

DIVERSITY III

Animalia I: Lower Invertebrates and Non-Molting Protostomes

During the course of the next two laboratory sessions, we will focus our attention on members of the animal kingdom. Although the direction of our studies will follow the taxonomic approach studied during the lecture sessions (see figure below), we will begin by making an initial general distinction between "vertebrate" (with backbone) and "invertebrate" (without backbone) organisms. The invertebrates are by far the largest of the two groups (>1 million species compared to <50,000 species, respectively) and have members ranging from the microscopic (e.g., nematodes, rotifers) to some that can grow to 21 meters in length (giant squid). In this session, we will study and compare examples of animals up to the division Lophotrochozoa, the non-molting protostomes. You will need to refer to your text at times throughout the exercise.



I. PHYLUM PORIFERA

The sponges are examples of asymmetrical animals. Regardless of how a plane is passed through the body, two "equal" halves will not result. In this exercise you will review basic structures of sponges and look closely at the spicules that provide strength to sponge bodies.

A. Sponge Anatomy

1. Watch the video clip on sponges (🎬 sponge_body) at one of the computer stations.
2. Sponges feed by circulating water (and the material within it) through their bodies. The water enters the body through (a)_____ into a central cavity called the (b)_____ and out through an opening called the (c)_____.

   Terms: (a) pores, (b) spongocoel, (c) osculum

3. What are the <u>two</u> primary functions of the choanocytes (collar cells) and how do they accomplish these? _____

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B. Representatives of the Sponges

Examine the examples of different sponges on display and try to locate the structures identified in the previous section.

C. Observation of Spicules

The organism we will examine, *Spongilla*, is a member of the only family of sponges found in fresh water.

1. Look in the microscope on display to observe an example of a <u>gemmule</u> produced by these sponges. These are aggregates of ameboid cells, produced during harsh conditions, which will eventually "hatch" and differentiate into new sponges; a type of asexual reproduction.
2. Under the other display microscope is a small piece of *Spongilla* to which has been added a drop of bleach solution to dissolve away the organic material of the sponge.
   a. Draw a few of the structures observed. What are these structures called and what is their function? _____

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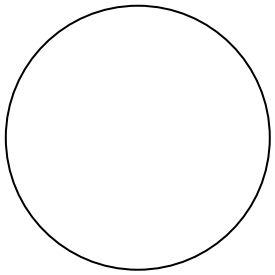

II. PHYLA CNIDARIA AND CTENOPHORA

The Cnidarians include the jellyfish (class Scyphozoa), the corals & sea anemonies (class (Anthozoa) and the hydra (class Hydrozoa). These organisms may show two body forms, medusa and polyp, during their life cycle, but both forms are characterized by their radial symmetry and the presence of specialized cells called cnidocytes. These contain structures called nematocysts that, when triggered, act as mini-harpoons that pierce their prey. The Ctenophora are the comb jellies which get their name from the 8 rows of comb-like cilia that beat to provide propulsion. In this exercise, you will examine preserved specimens and observe feeding practices of hydra.

A. Representatives of the Cnidarians and Ctenophorans

Examine the specimens on display:

1. Which body form is displayed by the sea anemone? _____
2. Which body form is displayed by the jellyfish? _____
3. What do these forms tell us about the mobility of these animals? _____

_____

_____

_____

4. Watch the following video clips at one of the computer stations: 🎬 cnidarians_clone wars, 🎬 ctenophora_deep sea combs.
   a. What was the basis for the anemone "war" and how might you explain this behavior in terms of species survival? _____

      _____

      _____

   b. What are the moving structures visible on the ctenophorans and what is their function?

      _____

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B. Class Hydrozoa (the *Hydra*)

1. Obtain a depression slide or small culture dish and use a dropper to carefully select and add 1-2 *Hydra* to your dish (the bigger the better).
2. Use a dissecting microscope to examine your specimens. Be sure to <u>only use the top light</u> to avoid "cooking" your specimens.
   a. The cnidarian body plan shows 2 general forms depending on the organism and/or stage of the life cycle. Which body form is displayed by this organism? _____
   b. *Hydra* reproduce by the process of <u>budding</u>. This may be an asexual or sexual process which entails the "daughter" organism developing from the outer surface of the parent. Are there are any budding *Hydra* present with your specimens? _____
3. Use a dropper to transfer 2-3 small *Daphnia* (a crustacean) into the culture dish with the *Hydra* and observe how the *Hydra* captures and consumes its prey. You may have to be patient and watch for some time; or, the *Hydra* may strike immediately.
   a. What are the "harpoon-like" structures that allow cnidarians to immobilize their prey?

      _____

III. PHYLUM PLATYHELMINTHES

The "flatworms", most of which live as parasites of other animals, include the turbellarians (class Turbellaria), flukes (class Trematoda) and tapeworms (class Cestoda). These organisms represent our first look at bilaterally symmetrical animals as well as our first division of animals based on body cavity organization; the acoelomates (those without a body cavity). After observing representative specimens from this group, we will pay special attention to a member of the Tubellaria called Dugesia.

A. Representatives of the Platyhelminthes

1. Examine the preserved specimens on display.
2. Most flatworms are hermaphroditic. What does this mean and how might this provide a reproductive advantage over species that possess individual sexes?

   _____

   _____

   _____

3. Watch the video clip "🎬 blood_fluke" at one of the computer stations. How do humans contract this parasite and then pass it along to others? _____

_____

_____

4. Observe the demonstration slide of the tapeworm scolex and watch the video clip "🎬 tapeworm" at one of the computer stations. What does the narrator mean by humans being the definitive host (think reproductive cycle)? _____

_____

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5. Watch the video clip "🎬 platy hermaphrodites" at one of the computer stations. What "prize" was forced upon the loser of the encounter and how does this still prove to be of benefit to the loser? _____

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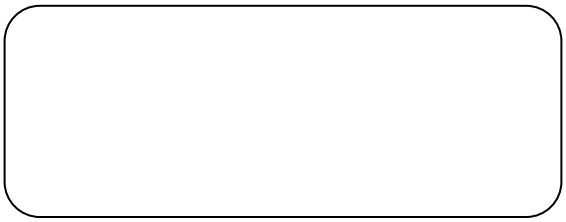
B. Feeding and Phototaxis

We will use the planarian *Dugesia*, a fresh water Turbellarian, for the following exercises.

1. General Observation of *Dugesia*
   a. Obtain a small culture dish, fill approx. 1/4 full of filtered water and add 1-2 of the planarians.
   b. Observe under a dissecting microscope. Again, be sure to only use the top light to avoid "cooking" your live flatworm.
      (1.) Sketch one of these organisms in the box below, and draw a line to indicate the plane of symmetry. What type of symmetry does this represent?
      _____



      (2). Observe the "eyespots". These are photosensitive structures used to detect light. However, they do not provide vision.

2. Phototaxis in *Dugesia*
   a. Obtain a Petri dish and use a grease pencil to draw a line across the middle of the bottom of the dish (on the outside). Mark one side "light" and the other "dark."
   b. Cover half of the dish with aluminum foil or other covering.
   c. Place enough "spring water" into the dish to cover the bottom and provide enough space for the planarian to move.

d. Add a planarian, cover the dish (matching the lid with the light/dark sides) and place the dish under a light source.
   - Formulate a hypothesis (what you think will happen) about how *Dugesia* will react to the light and <u>why</u> you think they will react this way. Then support this hypothesis based on your limited observations and knowledge of *Dugesia*.

     _____

     _____

     _____

     _____

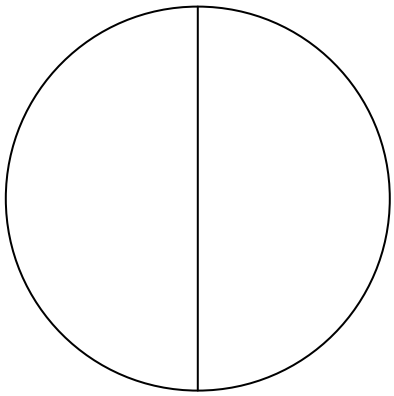
     _____

e. After about 15 minutes, carefully remove the planarian and place it back in its original container.

f. Sprinkle a very small amount of carmine powder over the surface of the water, let it settle and then gently swirl it around to cover the entire bottom surface of the dish.

g. In one swift motion, pour the contents of the dish into the sink and observe the bottom of the dish.

h. Draw what you see:

light  dark

   - What do the trails represent? _____

     _____

   - Does this support your hypothesis? Why or why not? _____

     _____

     _____

i. As you observed (hopefully), *Dugesia* exhibit negative phototaxis (movement away from light). Contrast this with reasons why organisms such as *Euglena* (from the Diversity I lab) show positive phototaxis. _____

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IV. PHYLUM MOLLUSCA

The molluscs are commonly divided into four classes: Gastropoda (e.g., snails, slugs), Bivalva (e.g., clams, oysters, scallops), Cephalopoda (e.g., octopus, squid, nautilus) and Polyplacophora (e.g., chitons). Some common characteristics include the presence of a muscular foot (used for locomotion or food capture), a visceral mass (contains organ systems) and a mantle (secretes the shell, if present). In this exercise, you will examine various members of this phylum and learn to recognize some of these structures.

A. Gastropods (Class Gastropoda)

1. Examine the specimens on display. Refer to your text and the manuals on display for additional information.
   a. What characteristic of these animals led to their being dubbed the "stomach-footed" mollusks? _____

      _____

   b. These mollusks also have a structure called a radula. What is its function? _____

      _____

      _____

2. Pick up and examine one of the snail shells. Most gastropods with coiled shells display a right-handed coil. That is, starting at the peak and moving out toward the opening, the shell coils in a clockwise direction. However, there are some that show a left-handed or counterclockwise coil. There are certain species of snails, *Limnaea peregra* for example, where the direction is determined by the genetic characteristics of the maternal parent (the one that produced the eggs).
   a. What is the direction of coiling of the shell you are holding (see below)? _____

right-handed   left-handed

   b. Is this the same for all or most of the snail shells on display? _____

B. Chitons (Class Polyplacophora)

1. Similar to the gastropods in that they are also "stomach-footed", these animals are set apart by the row of plates along their dorsal (superior) surface.
   a. How many plates are present in their shells? _____

C. Bivalves (Class Bivalva)

1. Examine the specimens on display. Refer to your text and the manuals on display for additional information.
   a. Watch the following video clips at one of the computer stations:
      (1). "Cocheanas". Note how these clams use their muscular foot for movement.
      (2). "Lampsilis mussel". Note the unusual life cycle of these fresh water mussels.

b. Using the shells and preserved specimens on display and the figure below, locate the smooth muscle scars and the pallial line. What do these represent?

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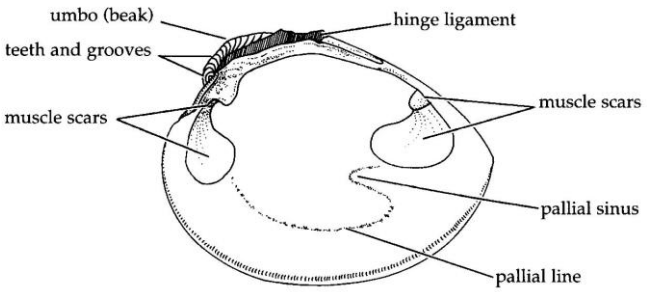

D. Cephalopods (Class Cephalopoda)

1. These are the "head-footed" mollusks. Examine the octopus, squid and nautilus (shell only) specimens on display.
   a. What structures represent the "foot" of the cephalopods? _____

   _____

   b. Examine the preserved squid specimen.
      (1). Locate the siphon and describe its function. _____

      _____

      _____

      _____

      (2). How many arms are present? _____ How many tentacles? _____

      (3). How do the tentacles of the squid differ in appearance from the arms? What functional differences might they serve? _____

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V. PHYLUM ANNELIDA

These are referred to as the segmented worms, as their bodies show distinct repeating body units. Classes of animals within this phylum include the Oligochaetes (e.g., earthworms), the Polychaetes (e.g., tube worms, sand worms) and the Hirudinea (leeches). Refer to your text and the manuals on display for additional information.

A. Earthworms (Class Oligochaeta)

1. Locate the clitellum on a live earthworm. What is the function of this structure? _____

   _____

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2. Use a magnifying glass and see if you locate the setae. What is their general function?

_____

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B. Polychaete Worms (Class Polychaeta)

1. Watch the video clip "Swimming Polychaete" at one of the computer stations.
2. The bristle-like setae of these worms extend from parapodia (fleshy appendages of each body segment). Look at the preserved *Neries* specimens. How do their setae differ in appearance from those of the earthworms and how might that be of benefit to them? _____

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3. Some species within this group, such as the tube worms and fan worms (see pictures on display), have elaborate structures extending from their head. Since they are sessile (anchored to a rock or other substrate), what might be the function of these specialized appendages? _____

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C. Leeches (Class Hirudinea)

1. These segmented worms do not possess setae. However, their most anterior and posterior segments have been modified into suckers. What types of activities would these structures allow the leech to perform? _____

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