

**Pre-Lab Discussion**

In this activity you will study the hydra to see how cells are specialized in a simple invertebrate. You will also observe some characteristics common to members of the phylum Cnidaria, which includes jellyfish, Portuguese man-of-war, and corals, as well as hydra.

Cnidarians are sometimes called coelenterates. Coelenterata means "hollow gut," which describes the bodies of these animals. Most cnidarians live in the ocean, but the hydra lives in freshwater ponds and slow-running streams. The hydra feeds on small swimming animals. It paralyzes its prey with stinging cells, then draws the prey to its mouth with its tentacles.

**Problem**

How does the hydra feed?

**Materials** (per group)

Prepared slide of a hydra  
Concave slides  
Daphnia or fish food  
Toothpick

Living specimens of hydra  
Microscopes  
Eye dropper

**Part A. Hydra Anatomy****Procedure**

1. Obtain a prepared slide of a hydra. Begin viewing the hydra on scanning power and then switch to the low power objective. The body form of hydra is called a **polyp**. At the anterior end of the cylindrical **body stalk** is a cone-shaped **hypostome**, in which the **mouth** is located. Around the base of the hypostome is a circle of **tentacles**. The hydra attaches to surfaces by the **basal disk** at the posterior end of the body stalk.

The body of hydra shows **radial symmetry**, a characteristic of all cnidarians. Radial symmetry is most often found in sessile animals. It enables them to respond to environmental stimuli from all directions.

2. Observe the diagram of the hydra in Observations. *Label* the basal disk, body stalk, hypostome, mouth, and tentacles. The body of hydra is a hollow sac, with the mouth the only opening. The cavity inside the hydra is the **gastrovascular cavity**, where extracellular digestion takes place.

The body wall is composed of two cell layers. The outer layer, the **ectoderm**, has five different kinds of cells. Some of the functions of these cells are contraction, regeneration, mucus secretion, sensing of stimuli, and defense.

The inner cell layer is the **endoderm**, or gastroderm. It lines the gastrovascular cavity. Different cells in this layer can contract, secrete enzymes for extracellular digestion, and engulf food particles for intracellular digestion. Some cells have flagella that protrude into the gastrovascular cavity. The beating of the flagella mixes the contents of the cavity. The endoderm also has some cells that sense stimuli and act like nerve cells.

Between the epidermis and gastrodermis is a thin layer of jellylike material, the **mesoglea**. In jellyfish, this mesoglea is very thick.

3. Focus on one side of the body wall of the hydra. Try to identify the ectoderm and endoderm. You will not be able to distinguish the different types of cells in either layer. *Label* the ectoderm, mesoglea, endoderm, and gastrovascular cavity. Each tentacle of hydra contains **cnidocytes**, or stinging cells. These structures are characteristic of cnidarians. A cnidocyte contains a **nematocyst**, which is a capsule with a threadlike tube that can be discharged. Some nematocysts shoot a thread that entangles prey; some inject a paralyzing poison into prey; and some give off a sticky substance used to anchor the hydra when it turns hand springs, or somersaults. After a nematocyst is discharged, the cnidocyte disintegrates. However, it is replaced with a new one, complete with nematocyst, in a few hours.
  
4. Focus on one tentacle of the hydra. The small bumps on the tentacle are cnidocytes. *Label* one of them on the diagram. The hydra can reproduce both asexually and sexually. It reproduces asexually by **budding**. This usually occurs in the spring and summer. The bud grows out near the middle of the body stalk.
  
5. Observe the hydra to see if it is budding. Does your hydra have a bud? *Label* the bud on the diagram.

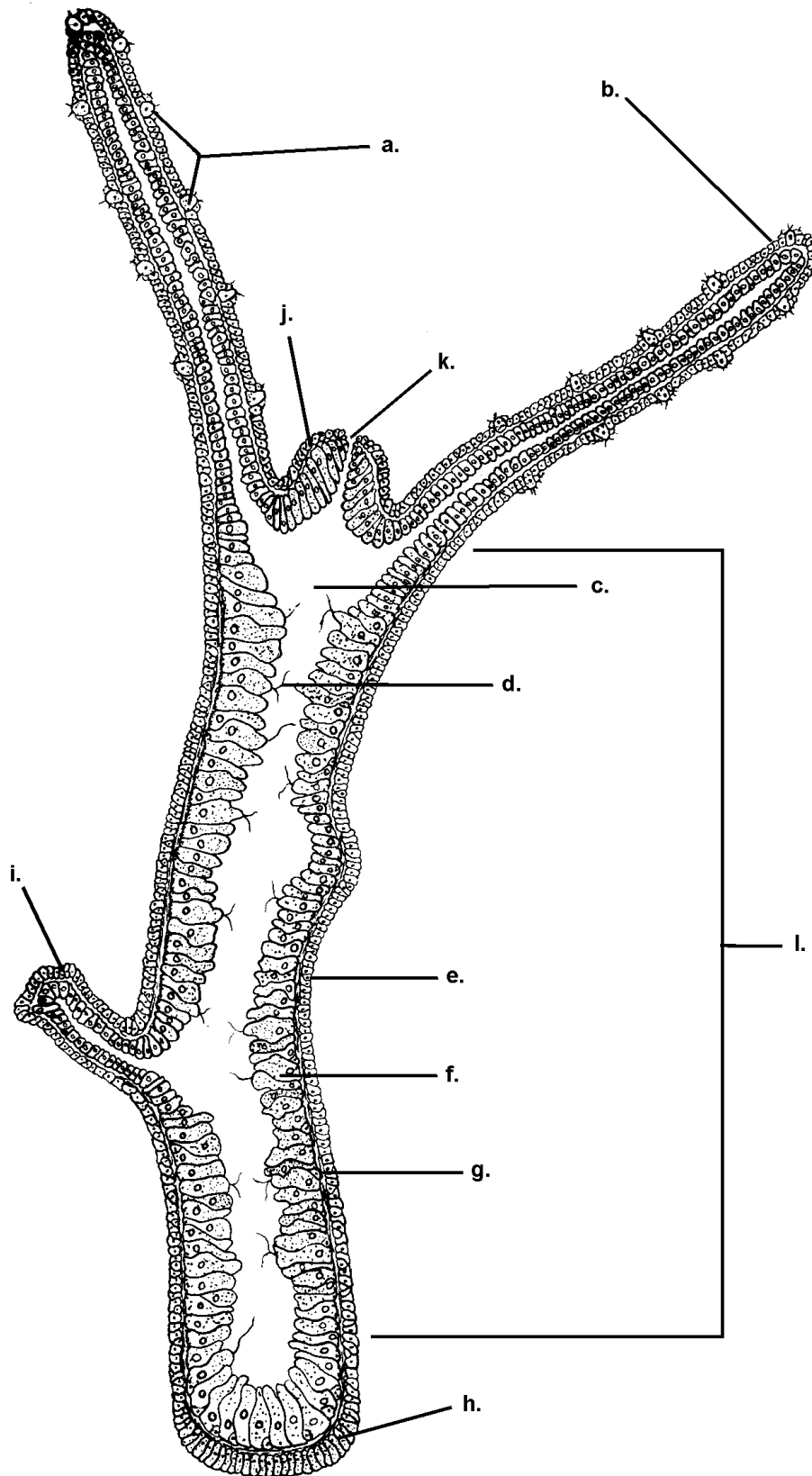
In the fall, the hydra reproduces sexually. Most species of hydra have separate male and female animals. However, some species are **hermaphroditic** - each animal has both male and female reproductive organs. Testes are cone-shaped structures on the upper half of the body stalk. Sperm from the testes are released into the water. An ovary is formed on the lower half of the body stalk and produces one egg. When the egg is fertilized, a shell forms around the hydra embryo. The shell-enclosed egg drops to the bottom of the pond or stream and remains there during the winter. In the spring the egg hatches and develops into a new hydra.

## Part B. Examining Hydra Behavior

### Procedure

1. Have your teacher place a hydra, with 2 or 3 drops of culture water, on your clean concave slide. Do not add a cover slip. This will allow the hydra enough room to move around. The animal may remain contracted for a while, so watch as it relaxes and stretches out.
  
2. Observe your hydra under scanning power and then rotate the nosepiece to low power. Do not use any other power of magnification without a cover slip. You could easily destroy the high power and oil immersion lenses if they were to come in contact with the water.
  
3. Observe your hydra for a few minutes. Is it alive? \_\_\_\_\_.
  
4. Gently touch the hydra's tentacles and basal disk with a toothpick. Be careful not to squish or damage your hydra. Describe how the hydra reacts to the stimulus of touch. \_\_\_\_\_  
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5. Place some food on the slide. Either use living daphnia or fish food flakes. Describe how the hydra reacts to the food. It may take a while for the hydra to respond to the chemical stimulus of food, so be patient. Would you describe the hydra as an animal that is near sighted or far sighted? Explain your answer. \_\_\_\_\_  
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Diagram of a Hydra



## **Analysis and Conclusion**

1. Describe the symmetry found in hydra.
2. Name the two cell layers that make up the hydra body. What kind of cells are in each?
3. What takes place in the gastrovascular cavity?
4. Describe how a hydra catches, eats and digests a small organism.
5. How does sexual reproduction take place in a hydra?
6. Why is the winter egg produced by the hydra an adaptive advantage for species living in cold climates?