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## Hydra

**Pre-Lab Reading: Prentice Hall Biology Chapter 26 Section 3 pgs 669-675.**

### Objectives:

1. In this lab, you will become familiar with the body plan and specific features of an invertebrate animal. This is a **sampling**; several important groups are NOT included.
2. Focus more specific study on one particular invertebrate group, Phylum Cnidaria, by studying the anatomy and feeding behavior of a freshwater hydra.
  - a. Understand and be able to identify basic characteristics of the Phylum Cnidaria.
  - b. Observe the anatomy, specifically the gastrovascular cavity, of Hydra.
  - c. Observe the feeding behavior of freshwater hydra and see the gastrovascular cavity in action.

**Introduction and Background Information.** In this laboratory you will become familiar with “invertebrate” animals. The categorization of animals as “invertebrates” and “vertebrates” is historical, in some ways unfortunate, and potentially misleading. There are relatively few species and groups of vertebrate animals compared to the rest of the animal kingdom. In that sense, it would make more sense to separate animals into “insects” and “non-insects” or “mollusks” and non-mollusks.” Thus, the categories of invertebrate and vertebrate are enormously unbalanced in terms of numbers of species or subgroups. Secondly, we must all guard carefully against the idea that vertebrates are the “standard” against which all other animals should be compared. The body forms, range of adaptations, physiological capabilities, and modes of life of invertebrates may differ widely from vertebrates, and many of these groups have been enormously successful by any measure of evolutionary “success.” Furthermore, invertebrate animals are very significant in many ecological interactions (by some perspectives, more so than vertebrates) and understanding their diversity and how they live is essential. Many important biological principles at all levels (physiological, cellular, ecological, etc.) have been derived from study of invertebrates.

### **Lab Activity**

**Part A.** The goal of this portion of the laboratory activity is for you to observe specimens that illustrate key features and attributes of a selected group of invertebrate animals, and to learn about the natural history or special biological significance of these animals. You will do this, as in your study of chordates/vertebrates, by studying and describing preserved.

## **METHODS**

Materials

Compound and dissection microscope

Supplies

Preserved specimens

**Procedure:** For each organism you study, carefully observe the specimens, and make drawings in your lab notebook. In the second (Part B) portion of the lab you will observe feeding behavior in Hydra, a representative of the Phylum Cnidaria.

## **RESULTS**

Your report for this portion of the laboratory should consist of a record of your observations.

**Part B.** The phylum **Cnidaria** includes organisms with a variety of radially symmetrical forms; all are carnivores. The life cycle of some cnidarians includes both a **medusa** (jellyfish) stage and a **polyp** (attached) stage. Medusae are usually free-floating, and often produce gametes. Polyps are fleshy columns with an attachment at one end and a mouth and tentacles at the other end. Some polyps secrete a skeleton made of chitin or calcium carbonate. Many members of the phylum exist only in one form or the other.

**Cnidarian body plan.** The body wall of cnidarians consists of two prominent cell layers: an outer **epidermis** and an inner **gastrodermis**. The **mesoglea** is found between the two layers, and may include a thick layer of gelatinous material, which gives the jellyfish its name. Some of the epidermal cells are specialized as protective **cnidocytes**, or **epitheliomuscular** cells which produce movement. The cells lining the gastrovascular cavity secrete digestive enzymes which allow digestion of food to be both internal to the organism and extracellular within the cavity. Although most species of cnidarians are marine, like *Gonionemus*, we will study a common fresh-water species, the **hydra**. The hydra is a small cnidarian polyp that lives in fresh water attached to submerged rocks, leaves and twigs. Its tentacles stretch out waiting for passing prey.

## METHODS

Materials  
Compound AND dissection microscope  
Depression slide

Supplies  
Live cultures of Hydra and *Daphnia*

Needle probe

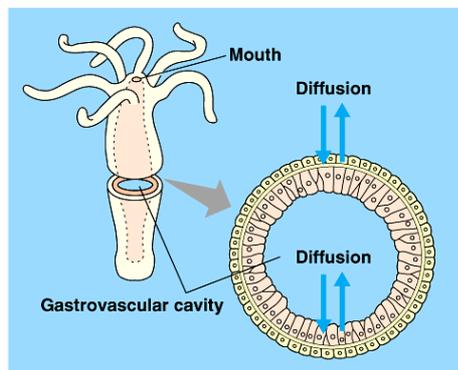
Plastic pipettes

Petri dish

Microscope slides/coverslips

Procedure:

1. Obtain a live specimen of hydra in a depression slide, and examine it under low power, first allowing it to relax after being transferred.
  - a. Draw a diagram of your specimen, labeling as many structures as possible.
  - b. Can you identify the gastrodermis and epidermis?
  - c. Using a needle probe, touch the hydra gently in several places. Are some areas more sensitive than others? How does the animal respond to this touch?



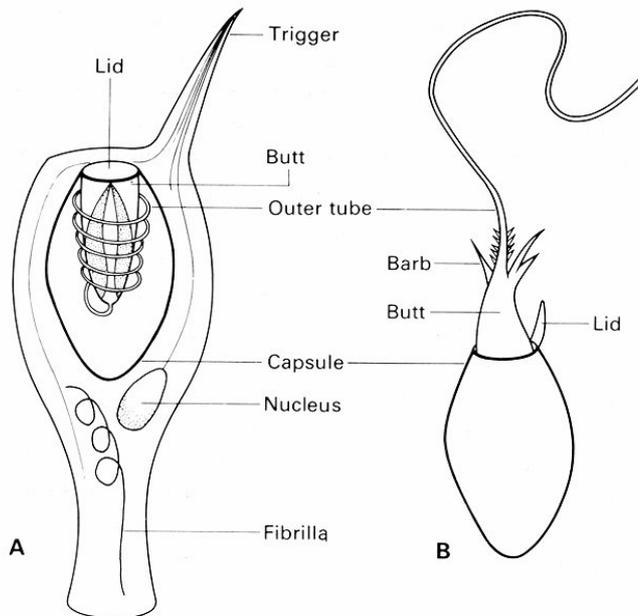
(b) Two cell layers

**Figure 6.** The gastrovascular cavity of hydra.

2. **Feeding Behavior of Hydra.** The capture of prey is normally followed by a relatively complex series of movements in which the prey is transported to the widening mouth and then pushed into the gastrovascular cavity. These actions constitute the “**feeding response**” and are apparently chemically controlled, although the chemical message is not completely understood. The feeding response may also be triggered by a variety of chemical agents, some of which are present in the bodies of prey animals. Hydra are able to capture prey using a specialized cell called a **cnidocyst**, which contains a

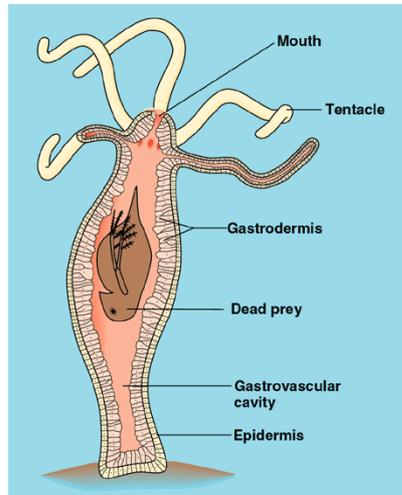
harpoon-like **nematocyst** (Figure 7). The nematocysts may be specialized to penetrate the prey when released, or to entangle it with sticky threads. Often a toxin is released along with the nematocyst to assist in subduing the prey.

3.



**Figure 7.** A nematocyst of a Hydra.

- a. To observe feeding behavior, transfer your hydra to a small petri dish, and observe the animal under the dissecting microscope. You may want to use a dark background and light the specimen from the side.
- b. A container of small organisms (the multicellular arthropod *Daphnia*) are provided to feed the hydra. Introduce a drop containing these organisms to the petri dish with the hydra; and watch the hydra carefully for the next few minutes. Record your observations in as much detail as possible. (Figure 8). **DO NOT** cross-contaminate the pipettes.
- c. If your specimen did not respond in this way, watch another unfed animal capture and ingest prey.



**Figure 8.** Extracellular digestion in the gastrovascular cavity of hydra.

## RESULTS

1. Draw a diagram of your hydra specimen and label as many structures as possible. (Part A)
2. Record detailed observations of hydra feeding on *Daphnia*. (Part B).

## DISCUSSION AND CONCLUSION

Please address the following questions in your lab notebook.

1. What characteristics do *Gonionemus*, and hydra share? How do these organisms differ?
2. How did the hydra respond to the needle probe?
3. How did hydra feed on *Daphnia*? Describe in detail.