

Dissection: The Crayfish

Objectives

- To learn some of anatomical structures of the crayfish.
- To be able to make contrasts and comparisons of structures between different animal phyla as additional organisms are observed.
- To deduce the adaptive significance of differences in the structures of animal phyla as additional organisms are studied.

Introduction

The following exercises allow you to carefully examine some of the morphological and anatomical structures of a member of the phylum Arthropoda. In terms of its number of species, this phylum is the largest of all phyla of any kingdom with more than 870,000 known species. Members of this phylum are characterized by their paired, jointed appendages and the development of a hard exoskeleton. Other characteristics include a complete digestive system, an open circulatory system and well developed sensory organs.

In this exercise you will examine the crayfish, genus *Procambarus*. This organism is in the subphylum Crustacea. While the crayfish is a freshwater organism, most members of this subphylum are marine. Other members of the Crustacea include shrimp, lobsters, crabs, barnacles and the terrestrial sow bugs. These organisms have chewing mouth parts (mandibles) and differ from the insects in that they have two pairs of antennae.

In the dissection exercises, you will be asked to examine the organisms and learn something of their individual anatomy. Equally important is a comparison of the anatomical structures of between organisms, noting how they are similar, how they differ, and how their differences may be adaptive to the different life styles of these organisms.

To begin this exercise, go to the Diversity section of the BiologyOne DVD. Select Dissections and then, after the introduction screen, select the Crayfish from the list of organisms.

Activity 23d.1

External Features

Examine the body of the crayfish. The body is covered with a chitinous exoskeleton. Chitin is a polysaccharide that is hardened after molting by the deposition of mineral salts.

Note how its body is divided into two large sections. The anterior region is called the cephalothorax. It is composed of a fused head and the thorax (the region of the body between the head and abdomen in the Arthropods). The line where the head and thorax have fused can be seen on the body shell. This is called the cervical groove.

The posterior region of the body is the abdomen. While body segmentation is clearly visible in the abdomen section, the paired appendages of the cephalothorax represent the segmentation of this area. Segments I through XIII make up the cephalothorax and segments XIV through XIX make up the abdomen.

A pair of compound eyes, appearing as small black balls, sits on short movable eyestalks at the anterior end of the cephalothorax. Also located here is a pair of large antennae (also called the second antennae because of their position) and a pair of smaller antennules (also called the first antennae). A pointed extension of the exoskeleton projects forward between the eyes. This structure is called the rostrum.

Along the length of the crayfish body are paired appendages, one pair per segment. The most anterior of these appendages are the antennules and the second pair are the large antennae. These appendages have been modified to serve as sensory organs. The next series of appendages are modified to assist in food manipulation.

The first of these are the mandibles that act like jaws around the mouth opening. The next five appendages are small structures that are used to help manipulate and hold food during feeding. These small appendages are two pairs called maxilla and three pairs called maxillipeds. The next five pairs of appendages are the large walking legs or pereopods. The first pair of these legs has enlarged pincers at their end. These are called the chelipeds. Smaller pincers are found on each of the other walking legs.

The first five appendages of the abdominal segments are called swimmerets. In males, the swimmerets of the first abdominal segment are modified into larger structures used to transfer sperm from the male to the female. The last pair of appendages in the abdomen is called the uropods. These are enlarged, flattened structures. Extending backward from the last segment between the uropods is the flattened telson (not an appendage). The paddle-like uropods and the telson are used to aid the crayfish in swimming backwards.

After reviewing these structures on the BiologyOne DVD, complete the labeling of the diagram of the external anatomy in the Results Section.

Activity 23d.2 **Internal Anatomy**

To begin the dissection of the crayfish, expose the gills by removing a portion of the carapace. Using scissors, cut the carapace along the cervical groove from the legs to the midline of the cephalothorax. Then cut back to the abdomen. Click on the forward arrow to complete this dissection.

After removing this portion of the carapace you will see the gills located within the gill chamber. Water is pumped into the gill chamber by a paddle-like structure on the second maxilla called the bailer. As the water passes through the gill chamber, oxygen diffuses across the thin walls of the gills and into blood vessels. The base of the gills is attached to the walking legs. Remove the walking legs and examine one of the legs with its gills attached.

Click on the forward arrow to complete this dissection. Note that the gill attached to each leg is divided at its base creating an outer row of gills (the podobranchs) and an inner row of gills (the arthrobranchs). With the legs removed you can observe the enlarged first swimmeret of this individual indicating it's a male.

Using your scissors, cut away the remainder of the carapace by cutting along the midline of the cephalothorax from the abdomen through the rostrum. This will expose the internal organs of the crayfish. Complete this dissection by clicking on the forward arrow. Much of what you are able to observe at this point is the large, yellow-white digestive gland. Cut the digestive gland to view other organs in the crayfish. Click on the forward arrow to complete this dissection.

With much of the digestive gland removed, you can observe many of the internal organs of the crayfish. Along the back half of the dorsal region in the cephalothorax is a cavity called the pericardial sinus. Within this cavity lies the heart. The circulatory system in the Arthropods is an open system. Blood fills this pericardial sinus and enters the heart through slits (ostia) in the walls of the heart. When the heart beats, blood is forced through arteries that lead to cavities within and between the organs. Ultimately the blood collects in a large sinus on the ventral side of the cephalothorax that has channels leading back to the pericardial sinus.

The digestive system of the crayfish begins at the mouth located a short ways in front of the attachment point of the chelipeds. Leading upward from the mouth is the short esophagus that leads into the stomach located in the anterior portion of the cephalothorax. The stomach is divided into two sections. The anterior section of the stomach is called the cardiac chamber and the posterior section is the pyloric chamber. Inside the stomach are three teeth-like structures called the gastric mill that grinds food into small particles. In the pyloric stomach bristles strain the food to prevent large pieces from entering the intestine. From the stomach the intestine leads all the way through the crayfish to the anus at the tip of the abdomen. Here enzymatic digestion and food absorption occur. The digestive gland that you removed earlier supplies the digestive system with enzymes for the breakdown of food.

Located at the anterior end of the cephalothorax, just below the attachment of the antennae, are two organs called the green glands. These are part of the excretory system of the crayfish. Wastes removed by the green glands are moved through tubes leading to excretory pores at the base of the antennae.

Just behind and below the attachment point of the eyes you can find the brain of the crayfish. Several pairs of nerves connect the brain to the eyes and antennae. Extending down along the ventral side from the brain is the ventral nerve cord. This runs the length of the body along its ventral side.

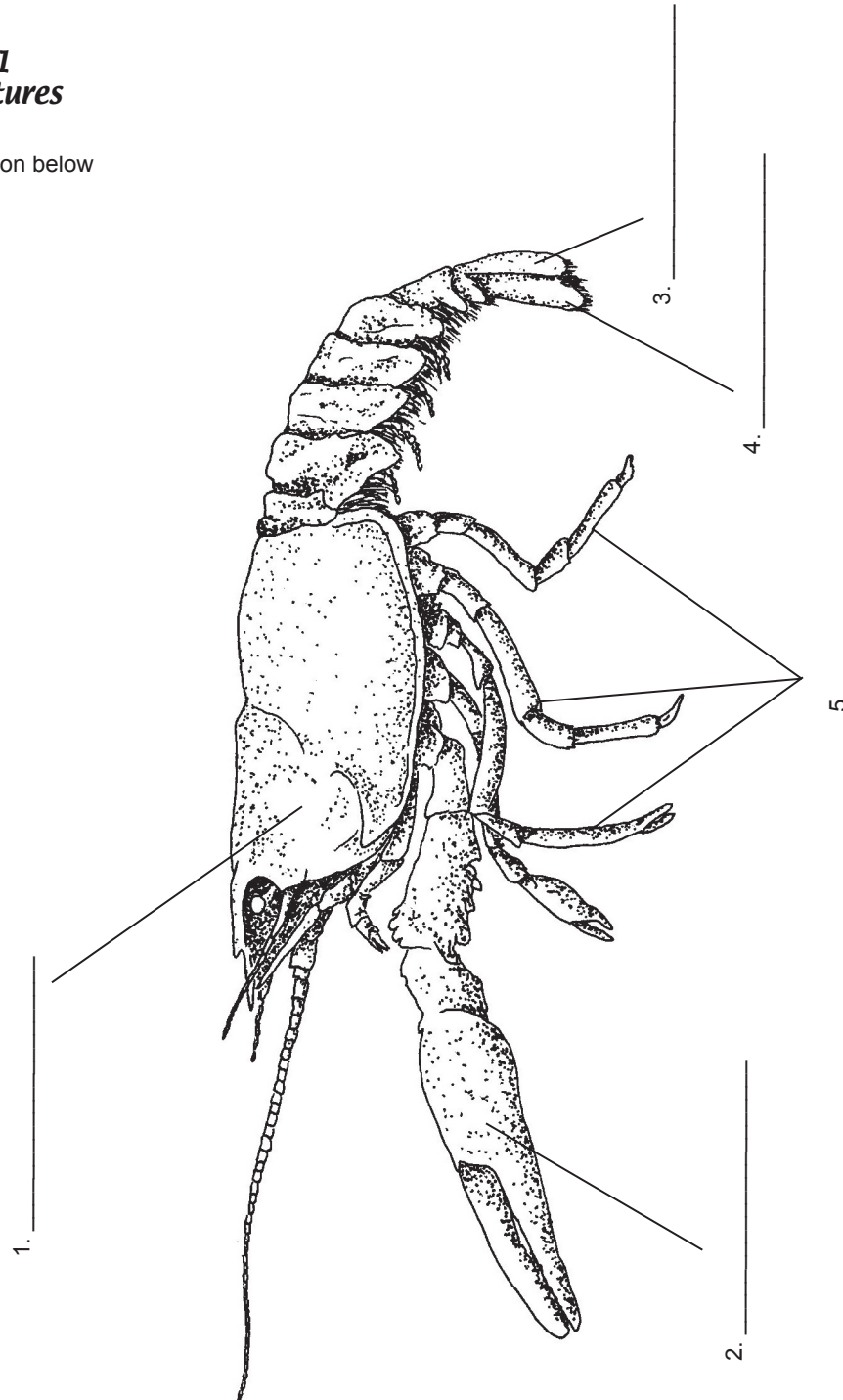
When in season, large reproductive organs, either testes or ovaries, are located just below and to the sides of the pericardial sinus. When not in season, these organs are quite small and difficult to find. Leading from the ovaries or testes is an oviduct or vas deferentia respectively, that leads to the outside. In females, the oviduct exits at the base of the third walking leg. In males, the vas deferentia exits at the base of the fifth walking leg.

After completing your study of the anatomy of the crayfish, label the diagram located in the Results Section.

Results Section

Activity 23d.1
External Features

Label the illustration below



Activity 23d.2
Internal Anatomy

Label the illustration below

