

Crayfish Anatomy

PURPOSE :

To become familiar with the anatomy of a crayfish.

INTRODUCTION :

Crayfish are grouped in the phylum Arthropoda, which also includes such animals as insects and spiders. Arthropods are characterized by having jointed appendages and segmented bodies. In crayfish and other higher arthropods each appendage has a specific function. Crayfish, which are aquatic, use their appendages for swimming, walking, food-getting, reproduction, biting, touching, and tasting.

Another striking feature of crayfish is the armorlike shell, called the exoskeleton, that covers the body. This is characteristic of all arthropods. Crayfish belong to the class Crustacea. Other familiar crustaceans are lobsters, crabs, and shrimp.

In this lab you will examine the characteristic external structures of a crayfish, as well as the internal anatomy.

PROCEDURE

A. External Anatomy

Line a dissecting pan with wet paper towels and place the crayfish in the pan with its dorsal side up. Feel the hard exoskeleton. It is made of a substance called chitin.

Body Segments The crayfish's body is divided into two major regions: the abdomen and the cephalothorax, which includes the head and thorax.

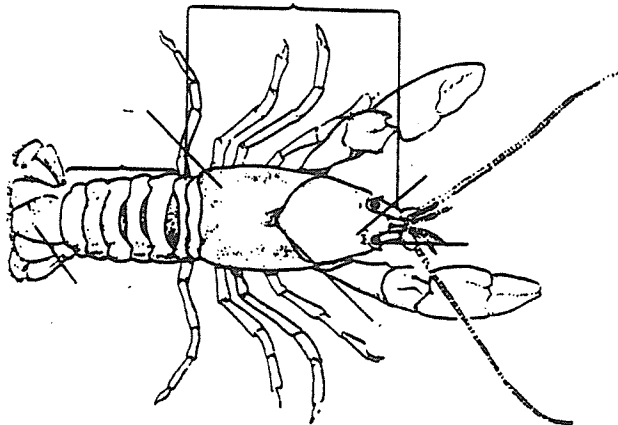
The cephalothorax is covered by a piece of exoskeleton called the carapace. Note the curved cervical groove that marks the division

between the head and thorax. The pointed anterior end of the carapace is the rostrum. Beneath it are the stalked compound eyes.

The segmented abdomen ends in a segment called the telson. Unlike the cephalothorax, the abdomen can be flexed.

1. How might the flexing of the abdomen be useful?

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2. On the diagram of the dorsal surface, label the cephalothorax, abdomen, carapace, cervical groove, rostrum, eyes, and telson.



Appendages Turn the crayfish over to expose its ventral side. Note the many paired appendages. Crayfish have the ability to regenerate lost body parts, so you may find an appendage that has only partially regrown.

Protruding from the head are two long antennae. Two shorter branched antennules are located between the antennae. The crayfish uses these structures for taste, touch, and smell.

Locate the mouth opening. Surrounding the mouth are jagged jaws called mandibles, used for biting and chewing. Posterior to the mandibles are two pairs of maxillae and three pairs of leglike maxillipeds; these structures are used to hold food. Use a hand lens or dissecting microscope to examine these mouth parts. If you have trouble identifying them, refer to the diagram.

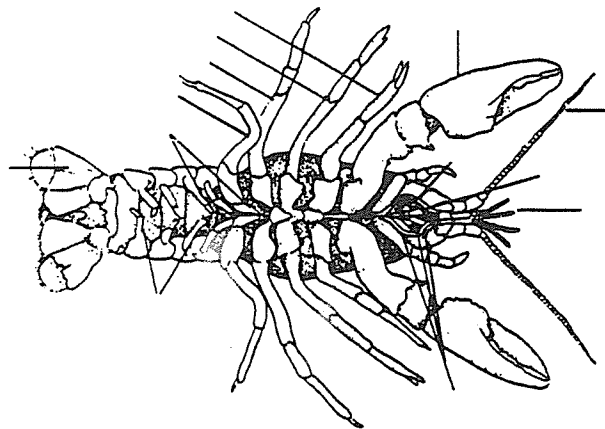
The four pairs of appendages on the thorax are the walking legs. The large, pincerlike appendages are the chelipeds ("pinching legs"), which the crayfish uses for defense and capturing prey.

On the abdomen, note the small appendages called swimmerets. These are used in swimming and reproduction. In a female crayfish the first pair of swimmerets are small. In a male the first two pairs, which transfer sperm to the female, are larger and folded forward.

3. What sex is your crayfish?

At the posterior end, on each side of the telson, are modified swimmerets called uropods. The uropods and telson form a tail fin that is used to propel the crayfish backward through the water.

4. On the diagram of the ventral surface, label the antennae, antennules, chelipeds, walking legs, swimmerets, and uropods.



B. Internal Anatomy

Turn the crayfish so that its dorsal side is up. Insert the point of your scissors just under the carapace at its posterior end. Cut forward along the midline to the rostrum, then cut across the carapace on both sides just posterior to the eyes. Remove the two pieces of carapace.

Take Care: Make shallow cuts, so as not to damage the underlying organs.

Respiratory System Note the exposed feathery gills. Move one of the walking legs and notice how this affects the gills. Pull off the leg and the attached gill.

It is best to store the crayfish in individual plastic bags between class periods. Students should include identification written in pencil on a piece of paper.

- 5. How does the leg attachment aid in the respiratory function of the gill?

Cut out the remaining gills and the thoracic legs. Move one of the maxillae.

- 6. What is their function?

- 7. How do the maxillae help in respiration?

Circulatory System Separate the dorsal muscle layer in the thorax to expose the heart, a vase-shaped light-colored organ. The depressions on the heart, called ostia, allow blood to enter. Extending forward and backward from the heart is the dorsal artery.

Remove the heart and the muscles at the sides of the thorax to reveal the organs underneath.

Reproductive System If the crayfish is male, you will see a small pair of white Y-shaped testes below the heart. Sperm ducts extend from the Y to the base of the last legs. If the crayfish is a female, the orange ovaries are likely filled with eggs. Oviducts extend to the second legs.

Mating takes place in autumn. Sperm pass from a male's testes through the ducts to the outside. Using the modified swimmerets, the

male transfers his sperm to the female's seminal receptacle, where the sperm are stored over the winter. The eggs are not fertilized until the female lays them in April.

Carefully remove the mass of dark-colored eggs. Insert the point of the scissors under the dorsal side of the abdominal shell and cut back to the telson. Spread the shell to expose the organs underneath.

Digestive System Food enters the digestive tract through the mouth and travels through the short esophagus to the stomach. The large, thin-walled, white stomach is located in the middle of the cephalothorax.

On each side of the stomach are the yellowish digestive glands. They secrete enzymes into the stomach and store food.

Food passes from the stomach into the intestine. This tube lies on top of the abdominal muscles and runs to the ventral surface of the telson. Waste passes out of the body through the anus.

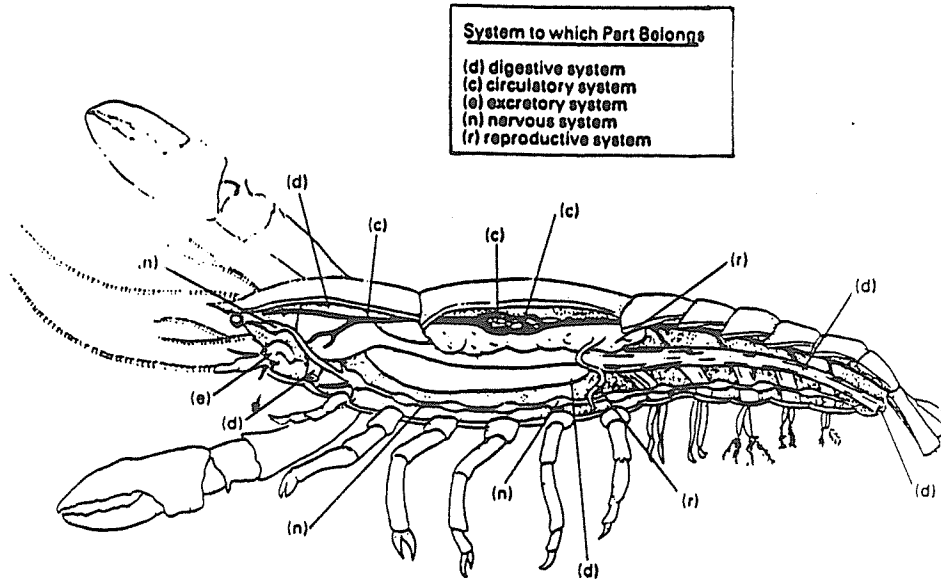
Remove the digestive organs as follows. Cut through the esophagus and the bands of muscle behind the eyes that hold the stomach. Lift out the stomach and any structures that are connected to it.

Excretory System Carefully remove any remaining tissue in the head to expose the large pair of green glands, which are just behind the antennules. The green glands empty wastes into the surrounding transparent bladder. A duct from the bladder opens to the exterior.

Nervous System Carefully cut away the rostrum and any remaining carapace. Between the eyestalks is the brain, a small white mass. Note the nerves traveling from the brain to the eyes and antennae.

Remove any remaining organs in the thorax and abdomen, and cut through the hard plates lining the cephalothorax. Locate the double threadlike nerve cord that extends from the brain along the ventral surface of the body. Where the nerve cord branches are enlargements called ganglia.

8. On the diagram of the internal anatomy, label the heart, ostia, dorsal artery, gonad (ovaries or testes), reproductive duct, esophagus, stomach, digestive gland, intestine, anus, green gland, brain, nerve cord, and ganglia. The system to which each part belongs is noted on the diagram.



ANALYSIS

9. What are the functions of the following appendages?

maxillae _____

maxillipeds _____

chelipeds _____

walking legs _____

swimmerets _____

10. Beside each structure listed below, write the system to which it belongs. (Systems: digestive, circulatory, respiratory, excretory, reproductive, nervous.)

artery _____ heart _____

brain _____ intestine _____

digestive glands _____ nerve cord _____

esophagus _____ ovaries _____

ganglia _____ reproductive duct _____

gills _____ stomach _____

green glands _____ testes _____

11. In the crayfish, blood is pumped into spaces called sinuses around the organs. After delivering oxygen and picking up wastes, the blood drains back into the heart through the ostia. What type of circulatory system is this?

12. To what structure in humans are the digestive glands comparable?

13. To what structure in humans are the green glands comparable?

14. Why is the crayfish grouped in the phylum Arthropoda?

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26-1 THE CRAYFISH

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A study of the crayfish is a good introduction to the phylum Arthropoda. Crayfish are common freshwater arthropods in much of the world. They are very similar in structure to the lobster. They are large enough that you can observe most of their features without even a hand lens. The crayfish has many appendages which are similar to each other, but are modified to perform a great variety of functions.

OBJECTIVES

- To observe the behavior of a crayfish.
- To observe the major external and internal structures of a crayfish.
- To relate structure and function in crayfish anatomy.

MATERIALS

dissecting microscope or hand lens
dissecting pan
scissors

forceps
scalpel or single-edge razor blade
small aquarium or battery jar

India ink
piece of fresh meat
living crayfish, starved for one week
preserved crayfish

PROCEDURE AND OBSERVATIONS

Part 1 Live Crayfish

1. Place a living crayfish in a glass vessel and cover it with water. Observe its behavior for three minutes. How does it walk?

2. Touch its antennae with a pencil. Describe its reaction: _____

3. Try to startle the crayfish. How does it respond? _____

4. Add a drop of India ink just beside the crayfish's mid-section. Describe the direction of water flow. _____

5. What causes these water currents?

6. Replace the inky water with clean water. Place a piece of meat in the vessel with the crayfish or offer it at the end of a dissecting needle. Carefully observe how the meat is located and handled. Describe the process. _____

Part 2 Preserved Crayfish

7. Obtain a preserved or freshly-killed crayfish and observe it carefully. What external feature of the crayfish reminds you of the

annelids? _____

8. How does the crayfish exoskeleton differ from the shells of a clam or snail? _____

9. How does the crayfish skeleton differ from yours? _____

10. The head and thorax, or chest, are fused to form the cephalothorax, which is covered by a part of the shell called the carapace.

11. Extending from many of the segments of the most primitive arthropods are two-branched appendages. Even in early embryonic stages of the crayfish, the appendages are basically similar. As the crayfish matures, however, they become modified to perform a great variety of functions. Using your textbook as a guide, find the various appendages described and indicate the function of each in the spaces provided in Fig. 1.

12. Examine an eye through the dissecting microscope. Compound eyes of arthropods are composed of hundreds of separate units. Such eyes do not produce as sharp an image as your eyes do, but they detect the slightest movement of predators and prey.

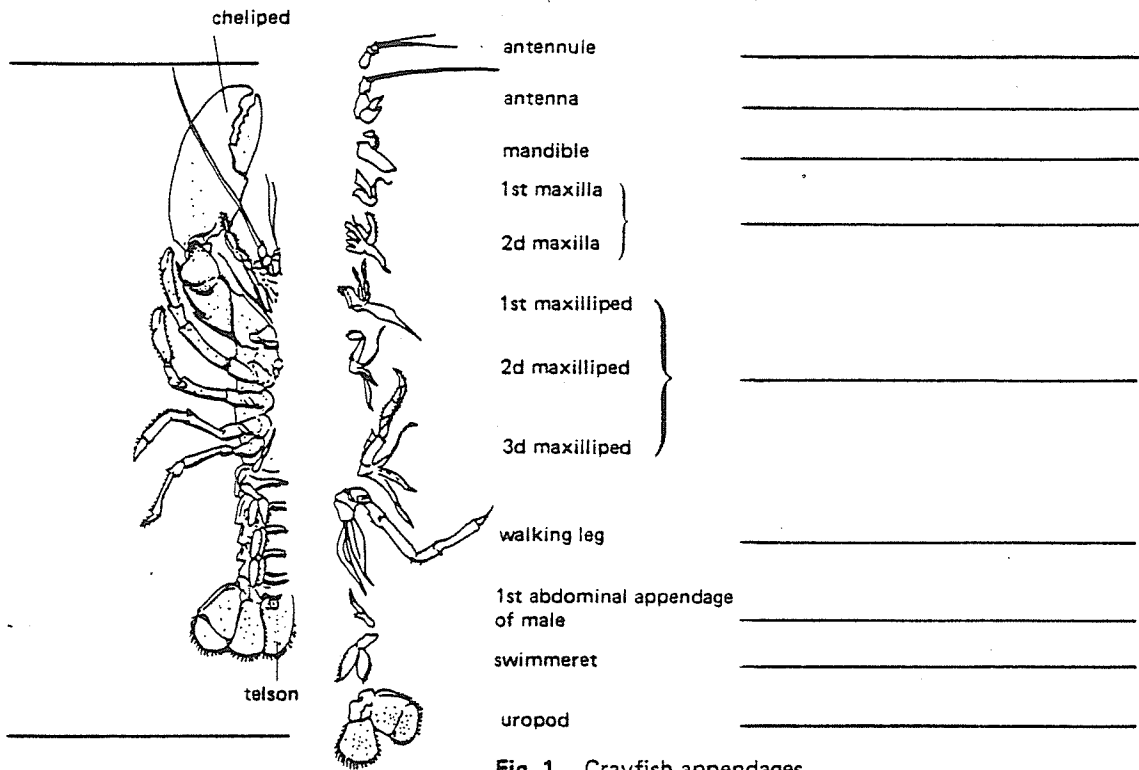


Fig. 1. Crayfish appendages.

13. To expose internal organ systems, use scissors to cut across the carapace behind the eyes. Lift off the carapace carefully, tearing or cutting any connections. Notice the feathery organs that curve from near the base of the walking legs up to the top of the body. What are they and what is their function? _____

14. Using the drawing and description in your text, locate as many structures as you can of the circulatory, digestive, reproductive, nervous and excretory systems. In Fig. 2, label the parts you recognize in your preserved crayfish.

15. How does the open circulatory system of arthropods differ from the closed system of the annelids? _____

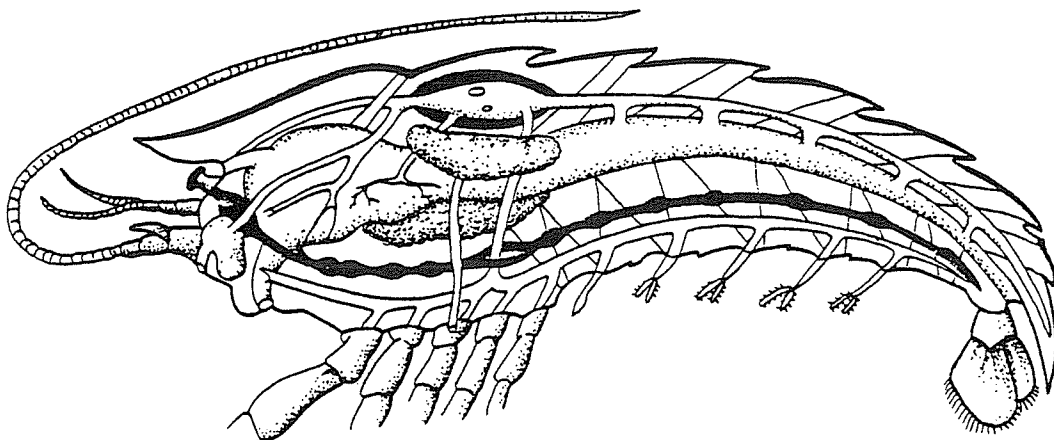


Fig. 2. Internal anatomy of a crayfish.

CRAYFISH

Arthropoda

