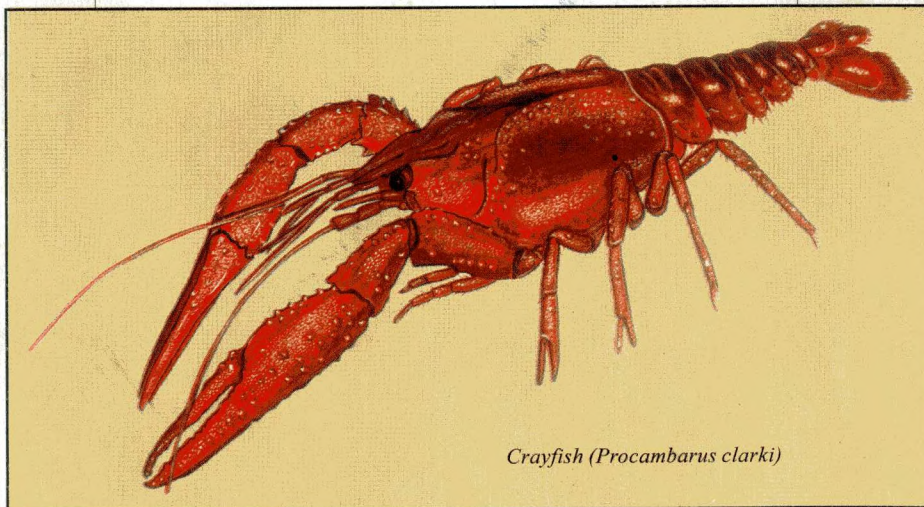
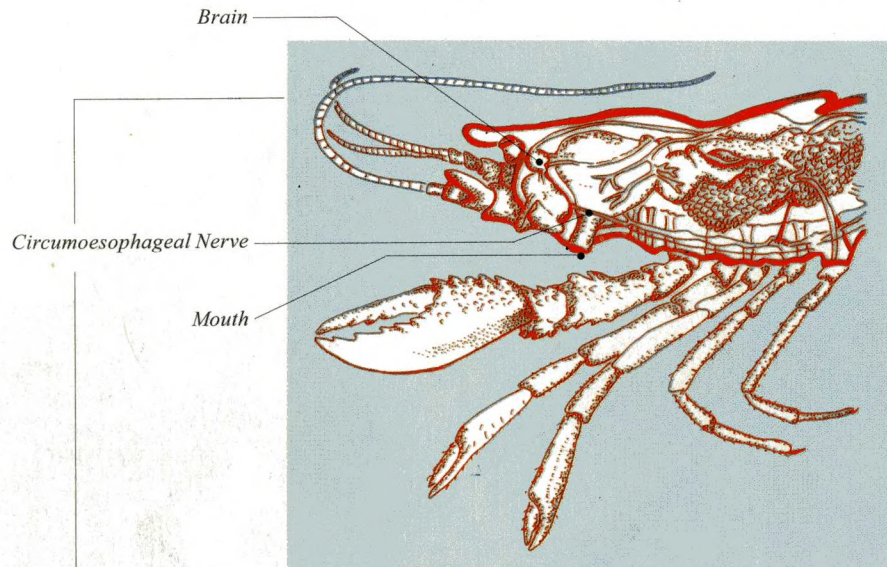


An Illustrated Dissection Guide To The...

Crayfish



by David H. Hall

An Illustrated Miniguide to the Dissection of the Crayfish

Introduction

The common crayfish belongs to the phylum Arthropoda, which is the largest phylum in number, species, and diversity. The phylum includes the insects which are by far the most numerous of the animal groups. The Arthropoda are related to the Annelids (the phylum that includes the earthworm) and these two phyla share the following features:

1. Both groups are metameric although in some arthropod groups such as ticks the metamerism is greatly reduced.
2. The nervous systems are constructed from the same basic plan. Which is: the brain is located cranially and dorsally but is followed by a ventral nerve cord with a ganglionic swelling in each segment.
3. Primitive arthropods show paired appendages for each segment which can be compared with the paired parapodia (or setae in the earthworm) of each metamere in the Annelids.

Despite these similar characteristics between the two phyla, there are very distinct differences between the groups. Arthropods are characterized by having a hard, protective body covering: the exoskeleton. Along with this skeleton, the muscles for movement had to change from the simple body musculature of the earthworm (for example) to a complex series of specialized muscles. The circulatory system has gone from the Annelid closed type to an open system where blood is allowed to flow through the open body cavities or sinuses. The heart in Arthropods generally has changed from the dorsal vessels of the Annelids to a single distinct heart. For a more detailed discussion of the relationships between the two phyla, the student should refer to an invertebrate text such as Barnes, 1980.

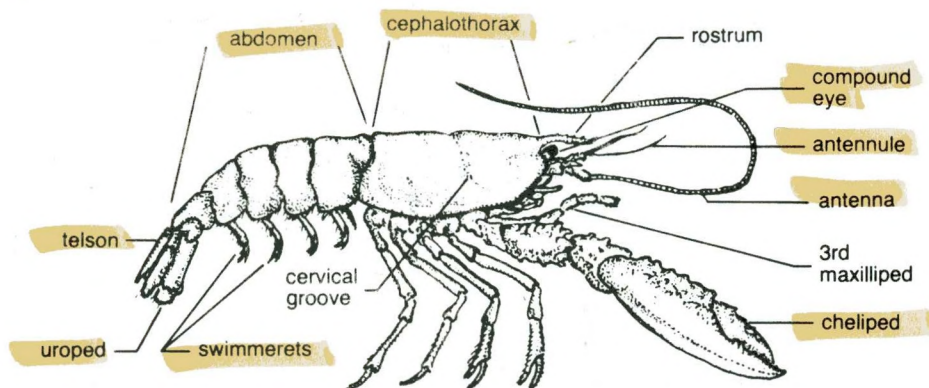


Figure 1. External features.

The Arthropoda can be divided into two large groups or subphyla: The Chelicerata (including the spiders, horseshoe crabs, scorpions) and the Mandibulata which is the largest group (it includes the Crustaceans such as our Crayfish, the insects, centipedes and millipedes).

Dissecting the crayfish involves careful cutting away of the hard exoskeleton. To do this properly, the student should work with a pair of good dissecting scissors and forceps. In order to keep your specimen from drying and to keep tissues pliable, we recommend that the specimen be sprayed with Delta-Sol. Delta-Sol is a non-toxic, odorless preservative which allows one to work on the specimen with bare hands. It also prevents molding and eliminates the irritating odors of formalin.

External Features (Figure 1)

The body of the Crayfish is divided into two parts: the Cephalothorax and the Abdomen. The Cephalothorax contains the major limbs, mouth and sensory organs. The Crayfish has ten major limbs (hence the order name decapoda — ten legged). The Abdomen is a segmented, muscular, 'tail' that is largely a locomotor structure. On the underside of the Abdomen are the swimmerets which are used in slow swimming movements. The exoskeleton is composed mostly of chitin, a tough substance which also makes up the human fingernail. In decapods, calcium deposits are made within the exoskeleton. In order to grow, the crayfish must shed or molt the old exoskeleton. For a short period after the molt, the crayfish body is soft and defenseless until it completes the secretion of a new, larger exoskeleton. The large pair of forelimbs with the well developed pinchers are the Chelipeds. There also are two pairs of antenna, and a well developed compound eye on the end of a movable eyestalk. There are three maxilliped pairs in the region of the mouth which are touch sensors and hold food while eating.

Beginning the Dissection

1. Place the Crayfish in a dissecting pan, and, with scissors, remove the legs and swimmerets by cutting through the joint near the body.
2. With forceps, grasp the lower, caudal edge of the carapace and cut, with scissors, dorsally until you have reached the top of the underlying gills. At this point, cut cranially to the cervical groove, and then follow the groove ventrally. Cut back caudally along the edge of your starting point.
3. Remove this section of the exoskeleton and view the gills which have been exposed. The gills are the feather-like structures and are closely associated with the joints joining the legs to the Cephalothorax. The chambers which contain the gills are called the branchial chambers. Water enters caudally and is pumped over the gills to exit at the cranial end.

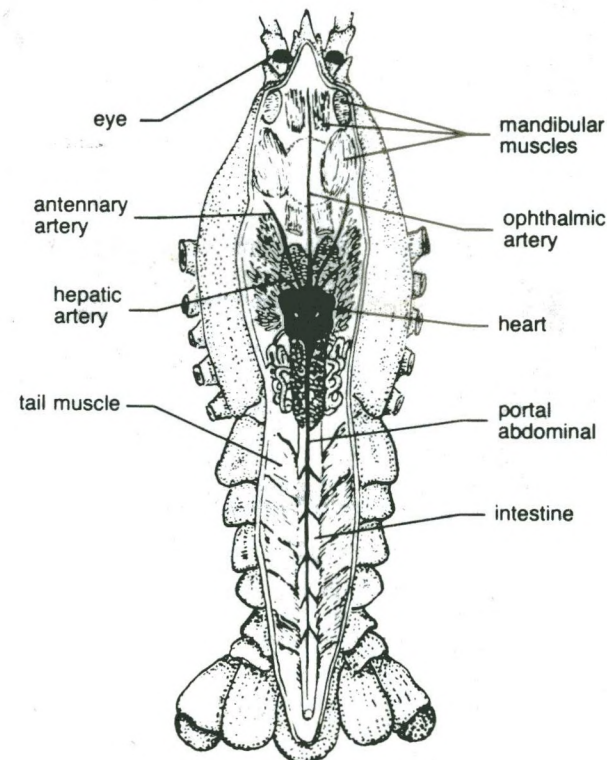


Figure 2. Dorsal view of internal organs.

4. Place your crayfish on a tray dorsal side up. Look at *Figure 2* to see what sections of the carapace to cut away. Lift up the carapace section with forceps before cutting, and remember, cut very shallowly to avoid cutting into the organs underneath. Now locate the internal organs in your specimen as shown in *Figure 2*.

Heart — This is saddle-shaped organ that is basically a muscular sac. There are three pairs of ostia (small openings with valves) along the length that allow blood to enter the heart from the surrounding sinus. The heart itself is within the pericardial sinus.

Major Arteries — Five major arteries go out from the cranial end of the heart. These are: The Ophthalmic artery which arises at the cranial end and supplies blood to the head and esophagus. Antennary arteries arise on either side of the Ophthalmic artery where they connect to the heart. These arteries extend cranially to supply blood to the stomach, antenna, green glands and cranial muscles. A pair of Hepatic arteries arise from the caudal end of the heart and supply the digestive glands with blood. The Dorsal abdominal artery is the large vessel which goes caudally straight back from the heart. This vessel supplies blood to the limb and tail muscles in addition to supplying blood to the intestine. The arteries divide into smaller vessels and capillaries, but the crayfish has no veins to return the blood to the heart. Instead, the blood is returned by a series of spaces or sinuses.

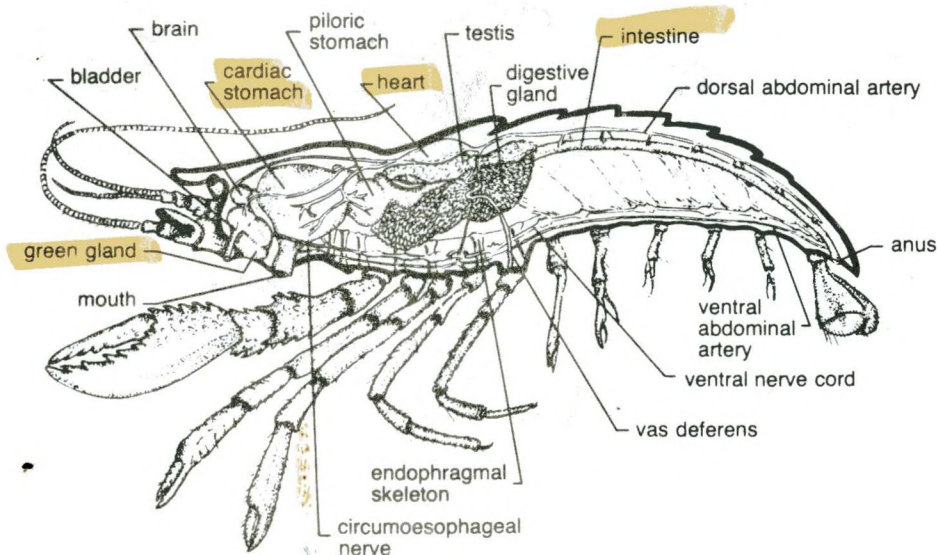


Figure 3. Lateral view of internal organs.

Continuing the Dissection

1. Lay your specimen on one side in the dissecting tray. With scissors, cut away the exoskeleton just above the appendage joints.
2. Cut caudally from the first limb joint to the first abdominal segment. From this point, cut up dorsally to the dorsal cut.
3. Cut the cranial end just behind the eye to the mouth. Carefully remove the exoskeleton pieces you have freed until you have exposed the internal organs as shown in *Figure 3*.

Identify the Following:

Brain — Located just caudal to where the eyestalks join the body. This is a small, lobed, white organ which is connected to the ventral nerve cord by a pair of Circumoesophageal nerves which pass on either side and around the esophagus.

Bladder — A thin-walled storage bladder that stores liquid waste which is released via a duct under each antenna.

Green Gland — The organ which removes fluid wastes from the blood. The gland is greenish in color.

Cardiac Stomach — Here food is ground up by small bony ossicles ('teeth') which make up the gastric mill. With this mill the crayfish does not need to chew its food completely.

Pyloric Stomach — Separated from the cardiac stomach by a constriction which contains a filter that allows only fine food particles through. The enzymes from the digestive gland are added to the food in the pyloric stomach.

Digestive Gland — This is the crayfish's liver and pancreas; it produces the enzymes needed to break down the ingested food.

Intestine — Here is where the dissolved food is absorbed into the blood stream while waste is moved down and collected as feces to be expelled through the anus.

Sex Organs — Either the male testis or the female ovaries are located underneath the heart. *Figure 4* shows each of the organs. The testis release sperm via the vas deferens through a genital pore at the base of the last walking appendage. The eggs are released via the oviduct through a genital pore located at the base of the third walking leg.

Ventral Nerve Cord — This is the crayfish's spinal cord. Note that along its length are swellings from which arise nerves which go away from the ventral cord. Each body segment or metamere has its own ganglia (swelling). In order to view the entire nerve cord, it is necessary to cut away the endophragmal skeleton which is located below the intestinal tract in the Cephalothorax. The endophragmal skeleton projects inward

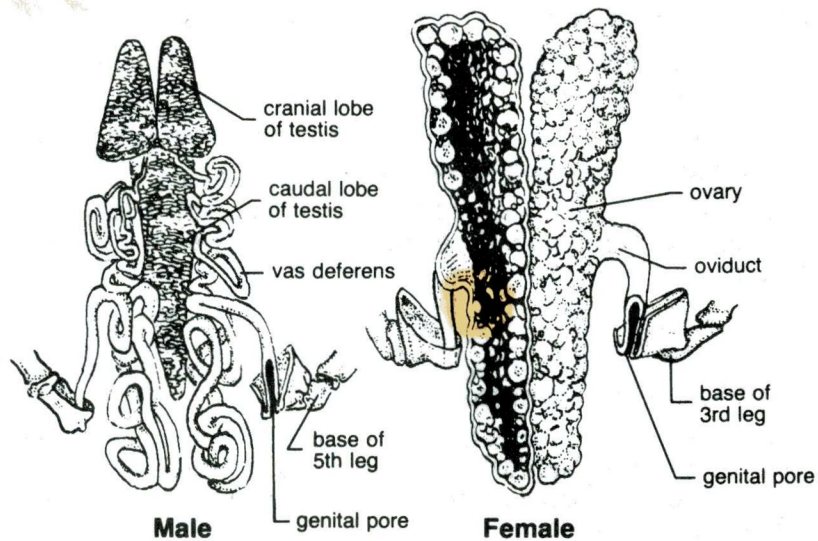


Figure 4. Reproductive organs of the crayfish.

from the sternal plates and provides the anchoring for the limb muscles. Trace the nerve cord to the subesophageal ganglion and the circumesophageal commissure by which the nerve cord passes around the esophagus.

Natural History

Crayfish are active generally after sunset and before sunrise. This form of activity is called crepuscular. During these periods the crayfish forages for food which consists of snails, tadpoles, insects and decaying organic matter. Crayfish make burrows within overhanging banks and in stream bottoms; often they have entrances which open to the ground surface. Mating usually takes place in the fall. The female stores the males sperm in a fold of cuticle (exoskeleton) between the last two pairs of walking legs called the seminal receptacle. The sperm is stored throughout winter and is used to fertilize the eggs when they are laid the following spring. From 100 to 600 eggs can be laid by a single female. The female carries the eggs underneath her abdomen and aerates them with currents produced by her swimmerets.