

Internal Anatomy Laboratory

Obtain a freshly killed cockroach (*Periplaneta americana*) and determine its gender: four small projections (2 cerci and 2 styli) are visible on the terminal abdominal sternite of the male whereas only two projections (the cerci) are visible in the female.

Remove the legs and wings at their bases with dissecting scissors. Carefully slit the abdominal and thoracic terga longitudinally near the lateral margins of the insect, being careful not to probe too deeply with the scissors. Leave the last abdominal tergum and the head intact. Pin the insect ventral side down in a dissecting dish filled with enough tap water to cover the body. The pins should anchor your specimen securely through its margins, lateral to the slits, and should be placed at an angle so as not to obscure your vision. With forceps and insect pins, carefully remove the terga from the posterior end forwards. Use a pinpoint to separate each tergum from the underlying tissues so that only the sclerites and intersegmental membranes are removed. Leave the last abdominal tergum intact. The thoracic terga are more securely fastened by **dorso-ventral muscles**, which may have to be cut. What is the function of these muscles?

If you have not botched the dissection, a transparent median **dorsal blood vessel** should now be visible along the midline of the body. It is flanked laterally by silvery-white **tracheae** and **air sacs** of the respiratory system. In the abdomen, this dorsal blood vessel is called the **heart** – it has segmental “chambers” with intake valves (the ostia) and muscles used to pump the blood forward (toward the head). In the thorax, the blood vessel is just a simple tube called the **aorta** – there are no chambers, muscles, or valves.

Carefully pull away the heart, dorsal tracheae, and associated membranes and muscles. This should expose the translucent thoracic muscles and strips of opaque white organs, the **fat body**. Observe how the gut (digestive system) is positioned in the body. It is held in place by connective tissues and aerated by glistening tracheae. As you remove the fat body to better expose the gut, be careful not to accidentally remove other organs, especially the more translucent reproductive organs that lie alongside the gut.

Comb through the tissues just behind the head until you see the translucent **salivary glands** and **salivary reservoirs** lying along each side of the gut. The glands (and associated ducts) form branching, tree-like networks whereas the reservoirs are thin, membranous bladders resembling deflated balloons or empty condoms. After examining the salivary glands and reservoirs, cut through the digestive system just behind the head. Gently pull the foregut away from the body cavity, sever some of the tracheae and membranes that hold it in place, and pin its anterior end at an angle to the body.

The foregut includes the **esophagus**, the **crop**, and the **proventriculus**. The esophagus is just a short, narrow tube. It opens into a large, brown crop that may fill much of the space in the abdomen. The proventriculus forms a distinct conical bulge just behind the crop. Cut through the muscular wall of this gizzard-like organ and look for the hard, cuticular teeth that grind food particles before they pass through the stomodaeal valve and out of the foregut.

For the most part, the **midgut** is just a simple tube but it is the site of most digestion and absorption of nutrients. The front end of the midgut is marked by the **gastric caeca**, 6-8 finger-like processes that produce an assortment of enzymes and other secretory products.

Throughout the abdominal cavity, there are a multitude of very thin, spaghetti-like structures that are often pale yellow-green in color. These are the **malpighian tubules**. Each one helps remove nitrogenous wastes from the blood and they all empty their contents (mostly uric acid) into the digestive tract at the front end of the **hindgut**.

The rest of the hindgut is morphologically subdivided into an **ileum**, a **colon**, and a **rectum**. The anterior-most ileum is large, dark, and sculptured. The colon is shorter, lighter in color, and thinner. The rectum is just a small bulge tucked under the last abdominal tergite, but if you look carefully, you can find the six opaque rectal pads that are instrumental in removing most of the water from the fecal pellet. Cut open the hindgut longitudinally and see if you can find any intestinal parasites. At least four different phyla of invertebrates are known to live here - including nematodes, roundworms, horsehair worms, and acorn worms.

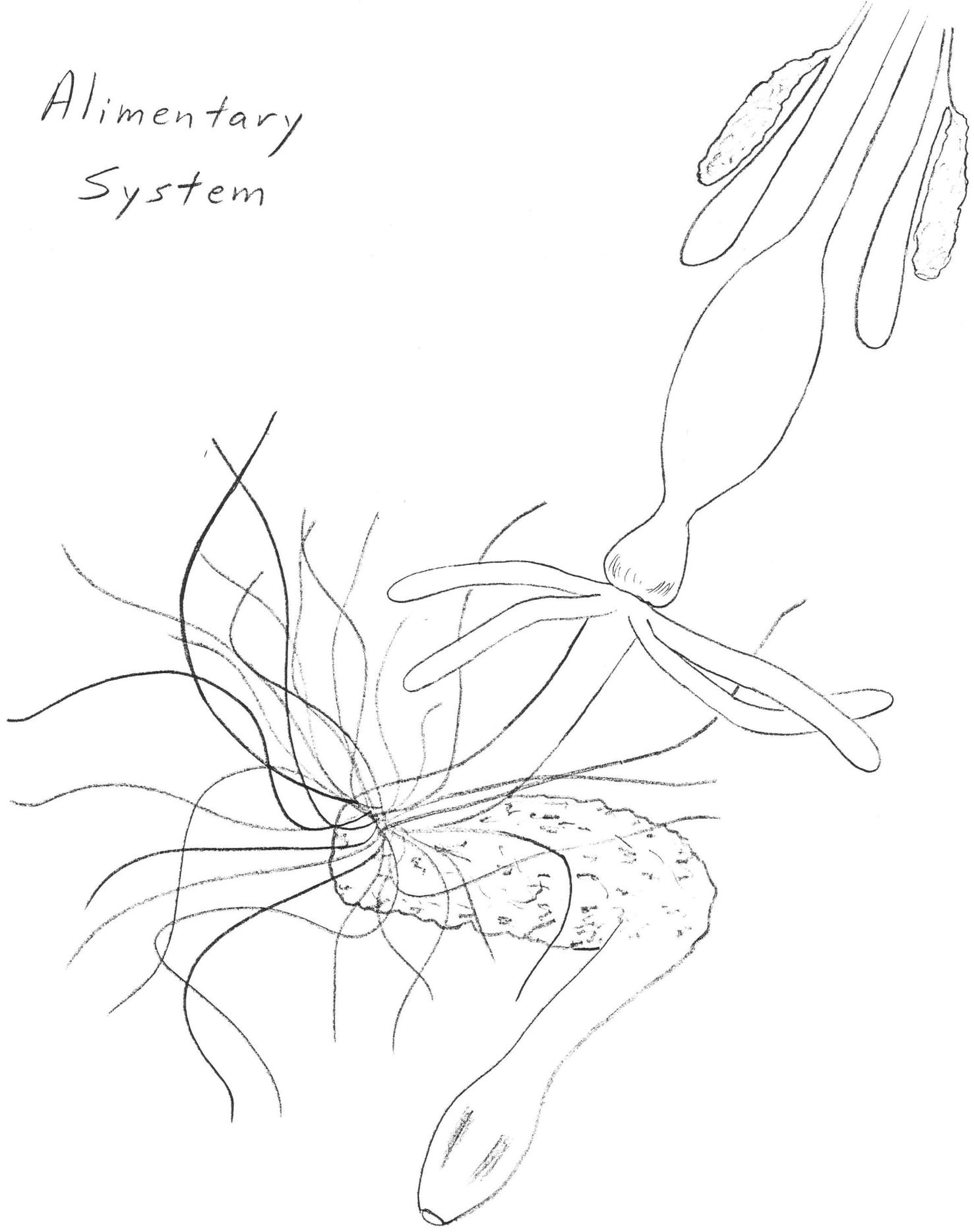
In gravid (pregnant) females, the **ovaries** are easy to find. They're filled with developing eggs and may take up a lot of room in the abdomen. Each ovary contains a dozen or so **ovarioles** and each ovariole contains a linear array of about a dozen eggs with the most mature egg nearest the base. A translucent tube, the **lateral oviduct**, emerges from the base of each ovary. The two lateral oviducts merge to form a **common oviduct** but this junction as well as the **bursa copulatrix** (or vagina) are often hard to see because they lie hidden under a part of the ventral nerve cord. The mass of female **accessory glands** is easily mistaken for fat body, but these glands are more spaghetti-like in shape and pure white in color. If you look carefully, you may be able to find the **spermatheca** buried amid the accessory glands. It's small, club-shaped, with a dark center that encases a remnant of the male's spermatophore.

In males, the **accessory glands** are a white ball of anemone-like tubules near the base of the last abdominal tergite. These accessory glands surround and obscure the **testes** and **seminal vesicles**. An **ejaculatory duct** emerges posteriorly from the accessory glands. It runs through a complex knot of muscles and sclerites until it ends in a long, hooked **aedeagus**. An **unpaired accessory gland** (similar in appearance to fat body) lies along the ventral wall of the abdomen and joins the ejaculatory duct near the base of the aedeagus.

When all the digestive and reproductive organs have been removed from the abdominal cavity, you will be able to find the **nerve cord** lying along the ventral wall of the body. It consists of **segmental ganglia** joined to one another longitudinally by **intersegmental connectives**. Use the point of an insect pin to separate the two parallel nerves within each connective. Small **peripheral nerves** extend laterally from each ganglion to innervate adjacent parts of the body.

When completed, please clean up your dissection. Pour your excess liquid into the sink and wrap the body parts in a paper towel before throwing them in the trash.

Alimentary System



Female Reproductive System



Male Reproductive System

