

LABORATORY EXERCISE 18: Excretory and Respiratory Systems

Excretory System:

The Malpighian tubules or excretory organs, named after the 17th century Italian microscopist Marcello Malpighi who *may* have discovered them, are closely associated with the hindgut, and their secretory products (that is, secreted into the tubule lumen) enter this part of the alimentary tract, usually just behind the pyloric sphincter. Examine a whole mount of a Malpighian tubule, stained to show epithelial nuclei. Then study a slide of cockroach midgut (“mesenteron”) or of roach or grasshopper alimentary canal (longitudinal section), and locate a cross-sectional view of a representative Malpighian tubule. Draw (Drawing #33) this tubule in cross section, **labeling** epithelial cells, nuclei, lumen, muscle, trachea (if present), and striated border (see Gillott, fig. 18.1 and 18.2).

Respiratory System:

Using a newly killed specimen of any cockroach species (but preferably a blaberid roach like *Blaberus* or *Gromphadorhina*), perform a dissection in exactly the manner described in the lab exercise on the alimentary canal, EXCEPT cut in from the **ventral** surface of the body. You are looking for the tracheal air sacs, together with the major lateral and dorsal longitudinal connectives of the tracheal system. Since most of the sacs are closely associated with the dorsal septum of the roach’s body, you may remove most of the internal organs that you see without fear of screwing things up; this includes the whole digestive system. Be very careful as you near the dorsal septum just below the heart (“above” the heart in this ventral view). Clear out all fat body, etc., revealing the network of tracheal tubes and sacs intact. Make a schematic drawing (Drawing #34) of your handiwork, from prothorax to abdominal terminalia, correctly placing the tracheal system within an outline of the roach’s body with numbered body segments; also indicate the position of the spiracles in your drawing, with their relationship to the tracheal system. **Label:** air sacs, spiracles, lateral tracheal trunks, dorsal tracheal trunks, and any transverse connectives that you see.

Study the following demonstrations:

1. Stained tracheae (high/dry magnification). Make a drawing (Drawing #35), showing nuclei and taenidia.
2. Injected trachea and associated spiracle. Examine under the dissecting scope, first the outer surface, then the inner. Note the radiation of tracheae from the spiracle.
3. Spiracles. Note lips and any filtering hairs or spines.
4. Tracheal gill of mayfly nymph (Ephemeroptera). Fine tracheae penetrate the base of the filaments. The air system is closed -- apneustic.
5. Rectal gill of dragonfly nymph (Odonata, suborder Anisoptera). Tracheae are red and black.
6. Nymph of damselfly, showing closed tracheal system characteristic of insects with tracheal gills.