

Lab

Earthworm Dissection

Pre-Lab Discussion

The earthworm, *Lumbricus terrestris*, belongs to phylum Annelida. The word Annelida means “ringed” and refers to a series of rings or segments that make up the bodies of the members of this phylum. Internally, septa, or dividing walls, are located between the segments. There are more than 100 segments in an adult worm. The earthworm, sometimes called a night crawler, has nearly all the organ systems found in higher animals - integumentary, muscular, digestive, circulatory, excretory, reproductive, and nervous systems. Since the earthworm has a more highly developed nervous system than the animals you have studied previously, you would expect it to have better coordinated responses. Although the animal lacks eyes and ears, its skin has receptors for light and vibrations. The earthworm has a small “brain” in the anterior region and nervous tissue called ganglia in each body segment.

Biologists have numbered each segment of the earthworm’s body starting at the anterior end. Locating various parts and organs of the earthworm is easy because each body part is basically repeated within each particular segment. Therefore, if you know which segment contains which organ, you will be able to locate that organ in the same segment in any earthworm.

Purpose

In this laboratory you will become acquainted with an earthworm’s external and internal features.

Materials

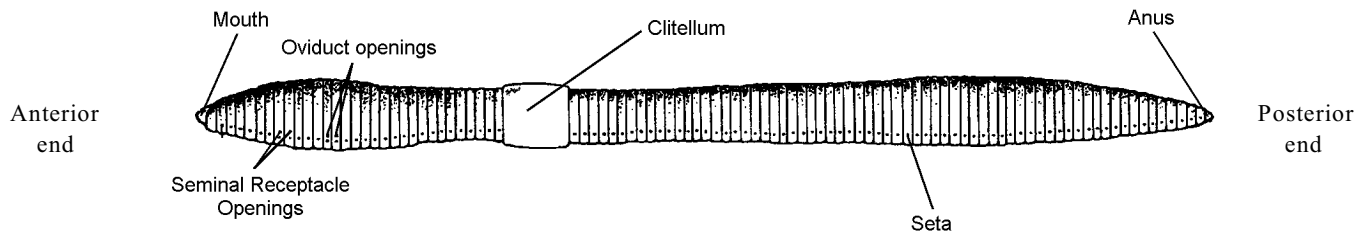
Preserved earthworm	Scalpel
Dissection tray	Probe
Dissection pins	Hand lens or dissecting scope
Forceps	Scissors

Procedure

Part A. External Anatomy of the Earthworm

1. Obtain all the materials listed for this dissection and place them at your laboratory work area. Place the earthworm lengthwise in the dissection tray.
2. Locate the anterior (mouth), the posterior (anus), the dorsal (top), and the ventral (bottom) areas of the earthworm as shown in Figure 1.

Figure 1



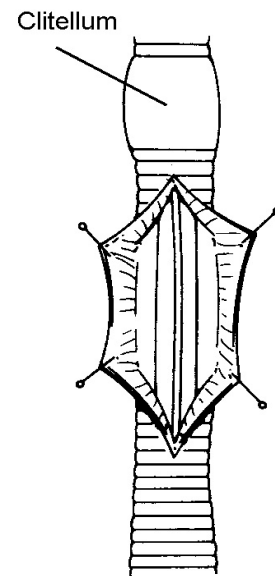
3. Gently rub your fingers along the ventral and dorsal surfaces to find where the **setae**, or bristles, are located. Each segment, except the first and last segment, has four pair of these tiny bristles.

- Observe the thick, unsegmented band near the anterior end of the earthworm. This structure, called the **clitellum**, secretes the cocoon for the fertilized eggs during reproduction.
- Use a hand lens to help locate the mouth and anus.
- The openings to the **seminal vesicles** are found on segments 9 and 10. The **oviducts** are located on segment 14 and the **sperm ducts** will be on segment 15.
- Excretory pores** may be found in each segment but they are extremely small and very difficult to see.

Part B. Examining the Internal Anatomy of the Earthworm

- Place the earthworm in the dissection tray with its dorsal side up. Obtain two pins to secure the earthworm to the dissecting tray. Place one pin at the anterior end and the other pin at the posterior end.
- Begin the dissection by inserting your scissor tip posterior to the clitellum, slightly to the right or left of the middle as shown in Figure 2. Make a very shallow cut, one that only cuts through the earthworm's skin and muscle. Be careful that you do not cut into the internal organs as you make this incision. Continue cutting a straight line from the clitellum to the anus. Use the tip of your probe to cut the septa in each segment on the dorsal and lateral body wall. By cutting the septum in each segment you will be able to spread the skin of the earthworm apart. Pin the earthworm in place on the dissection tray.

Figure 2



Securely pin the earthworm in place on the dissection tray by inserting the pins as shown in Figure 2. Now you are ready to locate the earthworm's organ systems as will be discussed in the following steps.

3. Digestive system.

The digestive system consists of a specialized food handling tube running from the mouth to the anus. Refer to Figure 3 to assist you in locating the digestive structures. Find the **prostomium** or upper lip that partly covers the mouth. The mouth opens into the **pharynx** located in segments 2 - 5. The **esophagus** is located in segments 6 - 14 and leads to the **crop** found in segments 15 - 16. The **gizzard** connects to the **intestine** which starts at segment 19. The intestine continues through the remaining segments and ends at the anus located in the last segment. In the process of digestion, food enters through the muscular mouth and pharynx to be temporarily stored in the crop. The food is ground up with grains of sand in the gizzard. In the intestine, enzymes are secreted that chemically digest the ingested food. The undigested food and other materials, like soil, leave through the anus. Gently probe the crop and gizzard to check the difference in thickness of the walls.

4. Circulatory System.

The circulatory system consists of five **aortic arches** found on the top of the esophagus in segments 7 - 11. These muscular blood vessels pump blood from the **dorsal blood vessel** found lying along the dorsal surface of the intestine. The aortic arches pump blood through the **ventral blood vessel** found on the ventral surface of the digestive system. Within the vessels is hemoglobin containing dissolved oxygen that is obtained via diffusion through the earthworm's skin. Carbon dioxide is released into the environment by diffusion. The earthworm lacks a respiratory system.

5. Reproductive system.

Each earthworm is hermaphroditic, containing both male and female sex organs. The reproductive system includes the following structures: **Seminal vesicles** containing the testes that make sperm are found in segments 9 - 13. The seminal vesicles are white organs attached to both sides of the esophagus. The **seminal receptacles** are smaller white organs found on the ventral side of segments 9 and 10. The seminal receptacles receive sperm when the earthworm copulates and stores it until needed to fertilize its own eggs. The **ovaries** produce eggs and are located under the seminal receptacles. The ovaries are very thin and may be difficult to find.

6. Nervous system.

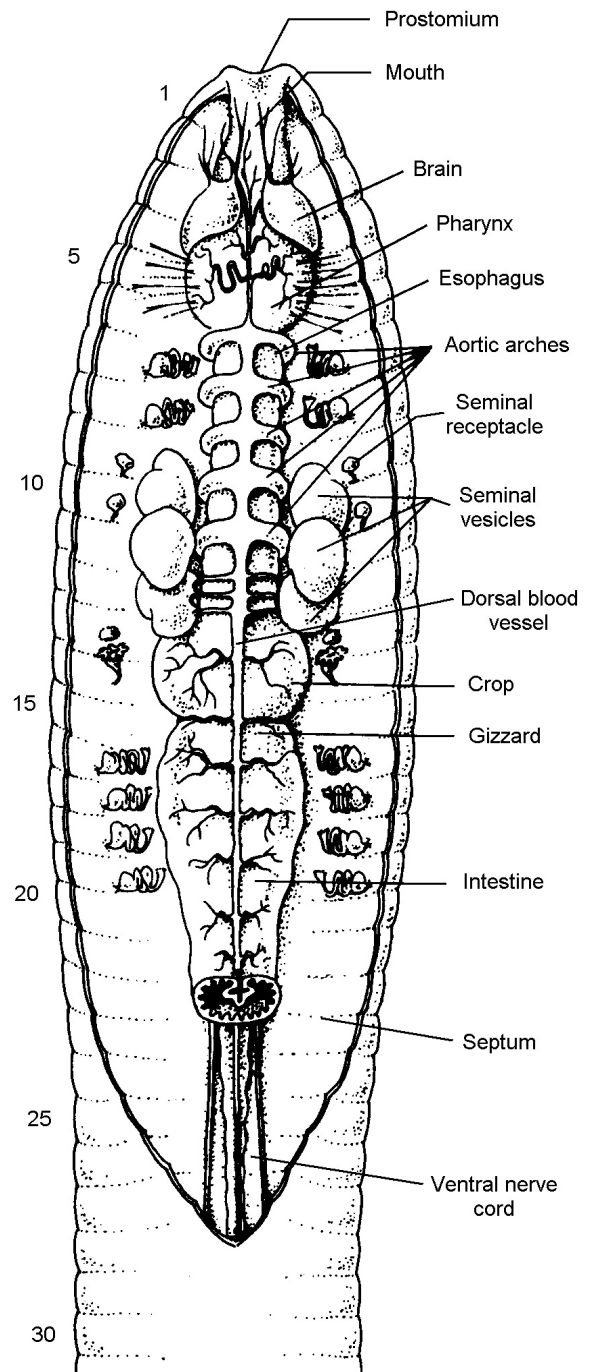
The nervous system consists of a mass of nerve cells called a **ganglia**. This primitive brain appears as white tissue on both sides of the pharynx, in segment 3. The brain is connected to the **ventral nerve cord** in segment 3. The ventral nerve cord is a thin greyish white "thread-like" structure found on the ventral surface of the coelom and runs to the last segment on the earthworm. By cutting away a portion of the intestine the ventral nerve cord can be found.

7. Excretory system.

The excretory system includes many paired organs called **nephridia** found in each segment except the first 3 and the last. The nephridia collect the waste from the liquid in each compartment of the coelom. Waste is then expelled out of the earthworm through **excretory pores**. Use a hand lens to locate these structures.

8. Listen carefully to the cleanup instructions provided by your instructor.

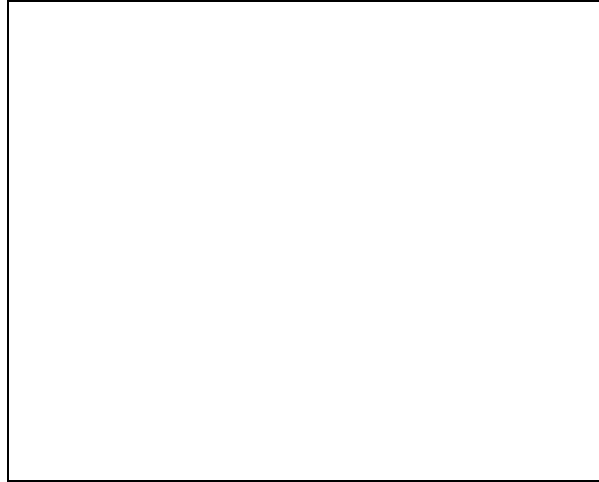
Figure 3



Observations

1. Why does the ventral surface feel bristly?
2. How many bristles are on each segment?
3. What are the two main openings in the earthworm's body?

4. How does the internal segmentation compare with the external segmentation?
5. Draw a cross section of an earthworm through the intestine. Label the *body wall*, *coelom*, *intestinal wall*, *intestinal opening*, and the *typhlosole*.



6. Describe the dorsal vessel, aortic arches, and the ventral vessel.

Analysis and Conclusion

1. What advantage does hermaphroditism have for slow moving organisms such as earthworms?
2. In what way does the internal structure of the earthworm show development of a specialized head end?
3. Describe the tube within a tube body structure in an earthworm?
4. How do you think the bristles on each segment function in locomotion?
5. In order to survive, an earthworm requires a moist skin. Why is it that their skin must be moist?