

Biology Lab Activities: Earthworm

How to use this manual

This lab manual is intended for use with the [Visible Biology](#) product.

Where to find 3D models

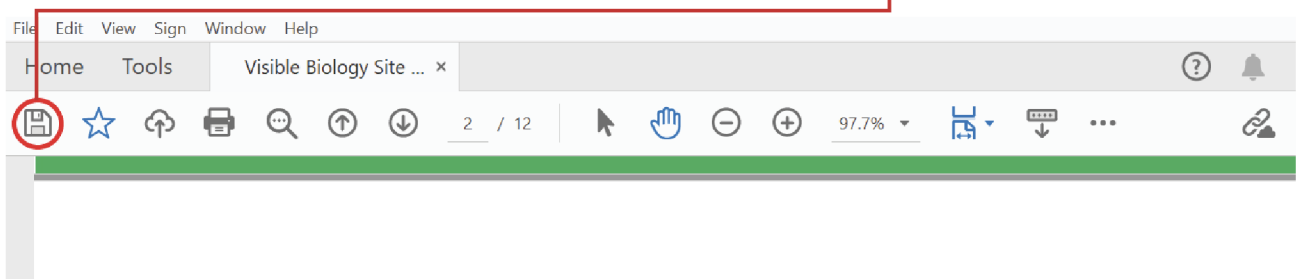
The screenshot shows the Visible Biology interface. At the top, there are navigation tabs: 'Units', 'Study', and 'My Library'. Under the 'Study' tab, there are sub-tabs: 'Flashcard Decks', 'Flashcards', 'Quizzes', and 'Lab Activities'. The 'Lab Activities' tab is circled in red. A red arrow points from this tab to a text box that says 'Under the Study section of Visible Biology, there is a Lab Activities tab.' Below the navigation tabs, there is a section titled 'Lab activities that correspond to the following views are available as PDFs.' Under this section, there is a 'Get Labs' button circled in red. A red arrow points from this button to a text box that says 'Select "Get Labs" to download the lab activities.' Below the 'Get Labs' button, there is a section titled 'Prokaryotic and Eukaryotic Cells Lab'. Under this section, there are three 3D models of cells: '1. Bacterial Cell', '2. Animal Cell', and '3. Plant Cell'. A red arrow points from these models to a text box that says 'Find the row of 3D views that corresponds to each lab manual and use the views to investigate and find answers.'

How to save answers

1. Have Adobe Reader installed on your computer.
Windows: <https://get.adobe.com/reader/>
Mac: <https://helpx.adobe.com/acrobat/kb/install-reader-dc-mac-os.html>
2. Download each lab file to your computer.



3. Open the downloaded file in Adobe Reader.
Right-click on the file. In the menu that appears, go to "Open with..." and select Adobe Reader from the submenu.
4. Type your answers into the boxes to complete the lab and select the "Save" icon to save the lab.



5. Submit your saved version of the lab to your instructor via email, dropbox, Google Drive, or however your instructor has requested.

Any questions? visiblebiology.com

Name:

Date:

Biology Lab Activities: Earthworm

Background Questions

Based on what you've learned in class, in your textbook, and from using Visible Biology, answer the following questions about the earthworm.

1. What type of body symmetry is present in earthworms?
2. The earthworm's digestive tract includes unique structures such as the _____, where food is stored and mixed, and the _____, where food is ground down by stones.
3. Earthworms are _____, meaning that each has male and female reproductive organs. They reproduce _____ with other earthworms.
4. The earthworm's closed circulatory system consists of _____ hearts (or aortic arches), the dorsal and _____ blood vessels, and other vessels that pump blood throughout their bodies.
5. Earthworms are part of the phylum Annelida. In 3–5 sentences, explain the characteristics the earthworm shares with other animals in this phylum.

Name:

Date:

Lab 1: Earthworm Structure and Function

Activity 1: Label the earthworm

1. Launch the view
 - Launch Visible Biology.
 - Navigate to Study/Lab Activities, and find the Animal Structure and Function Lab section.
 - Select view 2. Earthworm.
2. Label the image below
 - Explore the 3D model of the earthworm to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Part A: Label the external structures of the earthworm.

Word List:

Clitellum

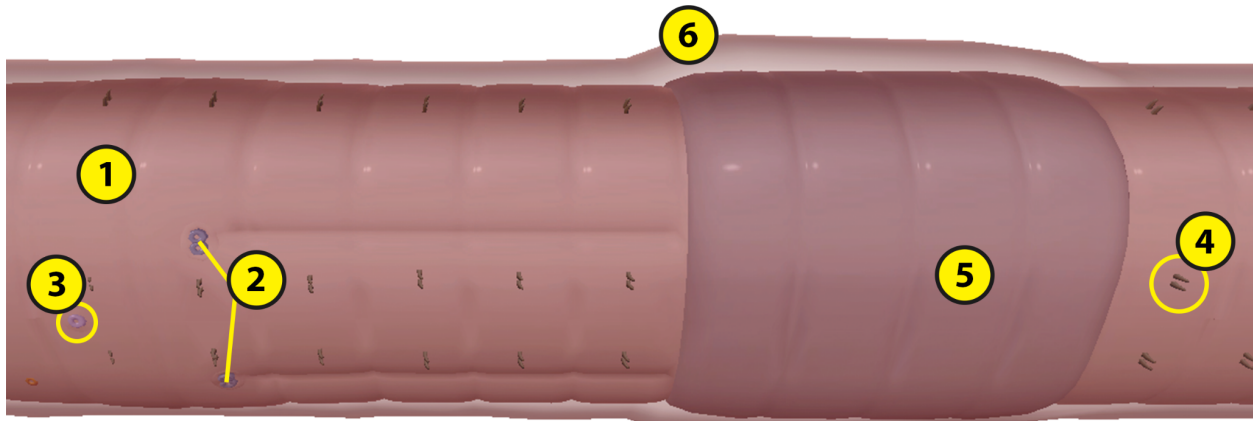
Cuticle

Epidermis

Female genital pore (aperture)

Male genital pores (apertures)

Setae



Part B: Label the internal structures of the earthworm's anterior end, near the head.

Word List:

Brain (cerebral ganglia)

Esophagus

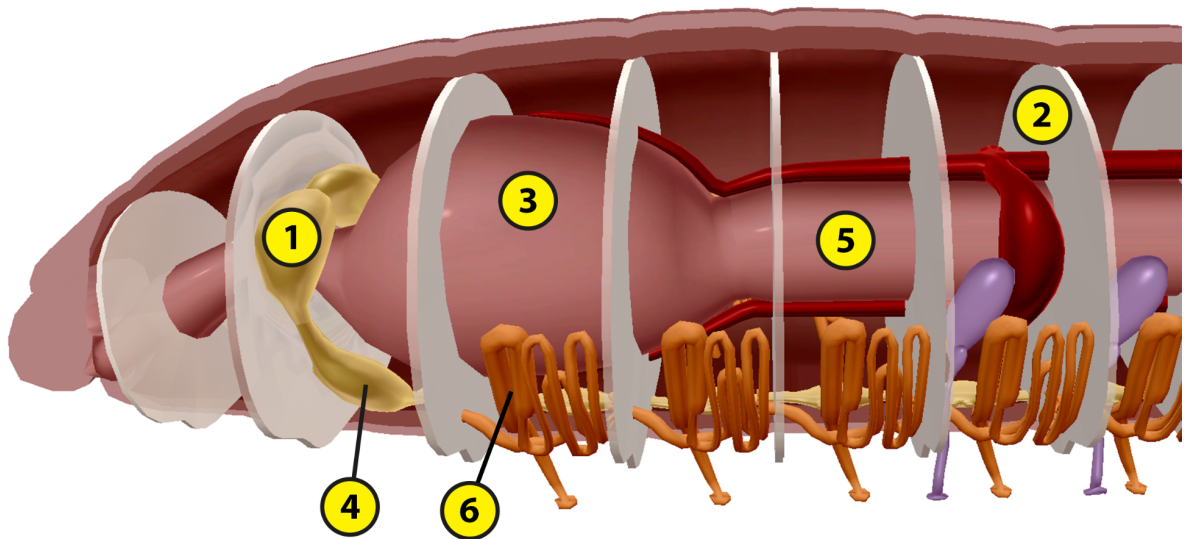
Nephridia

Pharynx

Septum

Subpharyngeal ganglion

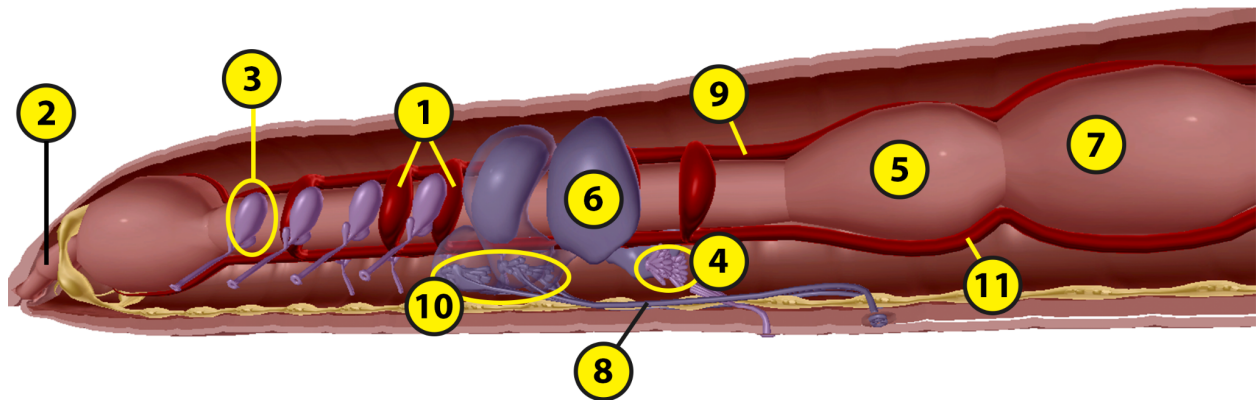
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Part C: Label the internal structures of the earthworm's anterior end, closer to the clitellum.

Word List:

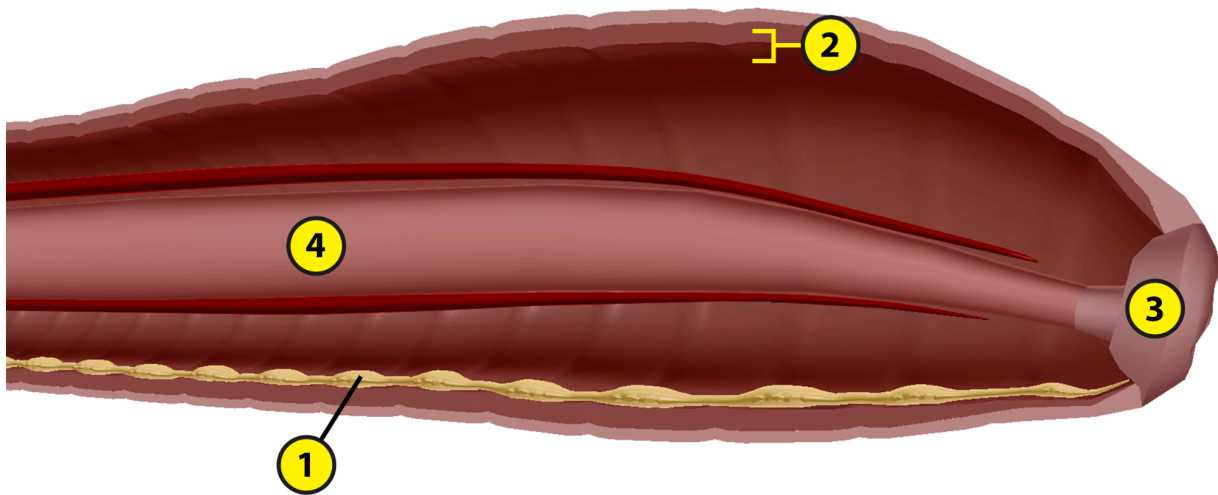
- Crop _____
- Dorsal blood vessel _____
- Gizzard _____
- Hearts (or aortic arches) _____
- Mouth _____
- Ovaries _____
- Seminal receptacle _____
- Seminal vesicles _____
- Testes _____
- Vasa deferentia (sperm ducts) _____
- Ventral blood vessel _____



Part D: Label the internal structures of the earthworm's posterior end, near the tail.

Word List:

- Anus _____
- Intestine _____
- Muscle layers _____
- Ventral nerve cord _____



Name:

Date:

Lab 1: Earthworm

Activity 2: Explore the structures of the earthworm and their functions

Refer to your labeled earthworm images from Activity 1 and the content in Visible Biology. Based on what you've learned, match each of the following structures with the brief description of its function.

Structures:

- a. Brain (cerebral ganglia)
- b. Clitellum
- c. Crop
- d. Cuticle
- e. Dorsal blood vessel
- f. Epidermis
- g. Female genital pore (aperture)
- h. Gizzard
- i. Hearts (or aortic arches)
- j. Intestine
- k. Male genital pores (apertures)
- l. Muscle layers
- m. Nephridia
- n. Ovaries
- o. Pharynx
- p. Seminal receptacles
- q. Seminal vesicles
- r. Septa
- s. Setae
- t. Subpharyngeal ganglion
- u. Testes
- v. Vasa deferentia (sperm ducts)
- w. Ventral blood vessel
- x. Ventral nerve cord

Descriptions:

- ___ This structure secretes enzymes to break down food into absorbable nutrients.
- ___ This structure allows the earthworm to breathe and navigate its environment.
- ___ These structures remove waste from the blood and coelomic fluid.
- ___ This structure is connected to the brain via the subpharyngeal ganglion.
- ___ This structure stores food before it moves through the gizzard and intestine.
- ___ These structures produce spermatogonia.

- ___ These structures project from the epidermis and help the earthworm move or anchor in place.
- ___ These structures produce the earthworm's female gametes.
- ___ These structures separate the earthworm's body into segments.
- ___ Within this structure, muscle contractions allow the earthworm to swallow food.
- ___ This structure sends and receives signals to and from the body segments via the ventral nerve cord.
- ___ These structures help the earthworm move through the soil and contract its body to be shorter or thinner.
- ___ These structures pump blood throughout the earthworm's body.
- ___ These openings release the earthworm's male gametes.
- ___ This structure pumps blood from the earthworm's posterior end to its anterior end.
- ___ This structure uses stones that collect over time to grind down its food.
- ___ This structure is composed of collagen fibers and helps the earthworm retain water and exchange gases.
- ___ This structure secretes mucus that hardens into a cocoon for the earthworm's zygotes.
- ___ These structures store the earthworm's mate's sperm to be used during external fertilization.
- ___ These structures transport mature sperm from the seminal vesicles to the male genital pores (apertures).
- ___ Spermatogonia matures into spermatozoa within these structures.
- ___ This structure connects the brain to the ventral nerve cord.
- ___ This opening on the fourteenth segment is where the earthworm's eggs are released.
- ___ This structure carries blood from the earthworm's anterior end to its posterior end.

Name:

Date:

Lab 2: Earthworm Dissection

Introduction

Earthworms are terrestrial invertebrates with bilateral symmetry. They are part of the phylum Annelida, which is characterized by body segmentation. Several adaptations help earthworms survive in their environment, including a streamlined body without limbs, muscle layers that contract to move them through the soil, and the ability to regenerate lost body segments. They breathe through their skin, diffusing oxygen into capillaries below the skin's surface. Like other animals, earthworms have a pharynx, esophagus, and intestines. However, they also have a few unique digestive structures, including the crop, where food is stored and mixed, and the gizzard, where food is ground down by stones. Another unique feature of earthworms is that they are hermaphrodites, meaning each one has male and female reproductive organs. However, earthworms reproduce sexually with other earthworms, lining up in an inverted position to exchange sperm. Earthworms are protostomes, meaning their embryos develop the mouth before the anus. Like many other animals (including vertebrates), earthworms have a brain and blood. However, instead of having one heart, they have five segmented hearts that pump blood through their bodies.

In this activity, you will examine an earthworm and learn about its external and internal structures.

Materials

- Earthworm (virtual or preserved)
- Dissecting scissors or scalpels
- Dissecting pins and probes
- Dissecting tray
- Hand lens
- Lab gloves

Dissection

Observe the external structures of the earthworm

Looking at the earthworm, you will see that its body is covered in the waxy cuticle and separated into segments. Its anterior end starts at its head/mouth and contains most of its major organs. The anus is located at the earthworm's posterior end.

1. On the earthworm's external surface, observe the following structures:
 - a. Mouth
 - b. Female genital pore (aperture)
 - c. Male genital pores (apertures)
 - d. Clitellum
 - e. Epidermis
 - f. Setae
 - g. Anus

If using the Visible Biology virtual earthworm, follow these steps

Note: In addition to using the Hide button to hide individual structures and systems of the earthworm, as outlined in the following steps, you can use the Systems Tray to toggle individual body systems on or off in the view. Within the view, you can zoom in/out or rotate the model as needed to observe the earthworm's structures.

1. First, observe the integumentary and respiratory system structures. Select any part of the earthworm to select the cuticle. After using the book icon to learn more about it, use the Hide button to remove it from the view. Select the other structures below and use the book icon to learn more about each. Once you have examined each integumentary and respiratory structure, click on front, the anterior portion of the epidermis to hide it from the view. To get a clear view of the entire internal tract of the earthworm, select and hide the front, posterior portion of the epidermis and the setae.
 - a. Cuticle
 - b. Epidermis
 - c. Setae
2. Next, observe the following muscular system structures. Select the front, anterior portion of the muscle layers and use the book icon to learn more about them. Then, select and hide the front, anterior and posterior muscle layers from the view. Select any of the septa and use the book icon to learn more about them. If you want a clearer view of the other internal body systems, you can hide the septa (or leave them on, if you want to observe which body segment contains each body structure).
 - a. Muscle layers
 - b. Septa
3. Then, observe the following digestive system structures. Select each structure and use the book icon to learn more about it. Once you have examined each digestive structure, select any of them and use the Hide button to remove the entire digestive system from the view.
 - a. Mouth
 - b. Pharynx
 - c. Esophagus
 - d. Crop
 - e. Gizzard
 - f. Intestine
 - g. Anus
4. Next, observe the following nervous system structures. Select each structure and use the book icon to learn more about it. Once you have examined each nervous structure, select any of them and use the Hide button to remove the entire nervous system from the view.
 - a. Brain (cerebral ganglia)
 - b. Subpharyngeal ganglion
 - c. Ventral nerve cord
5. Then, observe the earthworm's excretory structures, the nephridia. Select any of these structures and use the book icon to learn more about them. Once you have examined them, use the Hide button to remove the entire excretory system from the view.
6. Next, observe the earthworm's circulatory system structures. Select each of these structures and use the book icon to learn more about it. Once you have examined each circulatory structure, use the Hide button to remove the entire circulatory system from the view.
 - a. Dorsal blood vessel
 - b. Hearts (aortic arches)
 - c. Ventral blood vessel

7. Finally, observe the reproductive structures. Select each structure and use the book icon to learn more about it. Once you have examined each reproductive structure, use the Hide button to remove the entire reproductive system from the view.
 - a. Seminal receptacles (spermathecae)
 - b. Testes (you will need to select the testes sacs to read about the testes)
 - c. Vasa deferentia (sperm ducts)
 - d. Seminal vesicles
 - e. Ovaries
 - f. Oviducts
 - g. Clitellum

If using a preserved specimen, cut your earthworm to observe its internal structures

1. The earthworm should be placed with its dorsal surface facing up. The earthworm's flatter surface is its ventral surface. Locate the anterior end by identifying the mouth (covered by the prostomium, which is found on the dorsal surface). For context, the clitellum is located closer to the anterior end of the earthworm.
2. Holding the earthworm, starting at the anterior end, use dissection scissors to make a cut one third of the way down the earthworm's body toward the clitellum.
3. Put the earthworm back on the dissecting tray. Peel the left and right sides of the epidermis and muscle layers away from the interior structures and use dissecting pins to secure these outer structures onto the tray.
 - a. Observe the following layers that you cut through: Cuticle, epidermis, muscle layers, and septa
4. Observe the following internal structures:
 - a. Nervous System: Brain, subpharyngeal ganglion, and ventral nerve cord
 - b. Circulatory System: Dorsal blood vessel, ventral blood vessel, and hearts (aortic arches)
 - c. Digestive System: Mouth, pharynx, esophagus, crop, gizzard, intestine, and anus
5. From the posterior end of the earthworm, make another incision that will allow you to cut out a 2 or 3 centimeter piece of the earthworm's body.
6. On either side of the digestive tract, observe the structures of the excretory system, the nephridia.

Questions

Based on your observations during this lab activity and what you've learned about the earthworm's structures and their functions, answer the following questions.

1. The clitellum, located on the earthworm's exterior, is a part of the reproductive system. What role does the clitellum play in reproduction?

2. Why does the earthworm's skin need to be moist for it to function properly?

3. Explain how food moves through the earthworm's digestive tract.

4. How does the earthworm move through its environment?