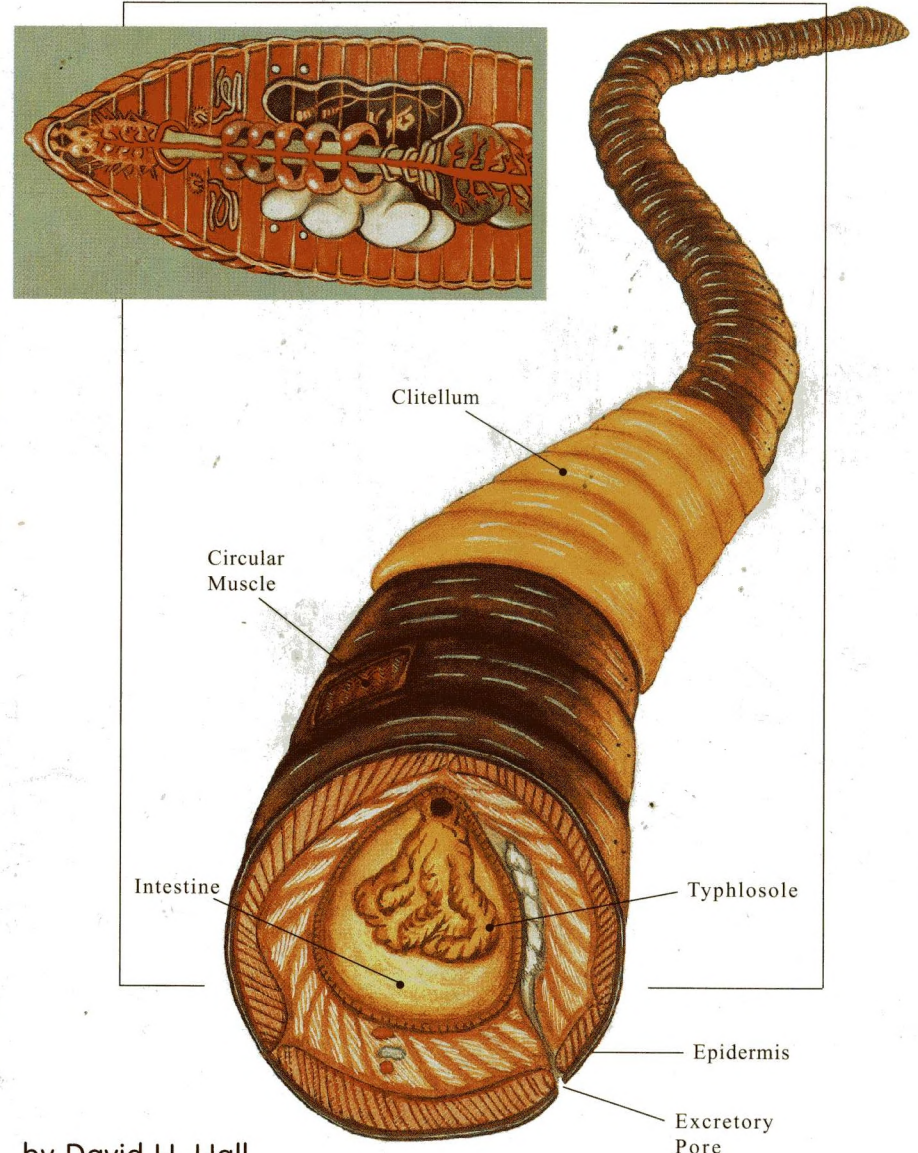


An Illustrated
Dissection Guide
To The...

Earthworm



by David H. Hall

An Illustrated Mini Dissection Guide
to the Earthworm
by David Hall
Illustrated Glen Folsom

Cover designed and illustrated by
Anne Gondor

Copyright © 1999

Published by
RANACO
Tucson, Arizona
Printed in USA
UNICOM 1999

The Earthworm

I. Introduction

The earthworm (*Lumbricus terrestris*) is often the first animal dissected by biology students. Because the earthworm lacks both an external and internal skeleton, dissection is comparatively easy. However, carelessness will destroy the specimen. The earthworm is an excellent representative of annelid anatomy. In addition, the earthworm has many organs and structures found in other “higher” invertebrates such as grasshoppers and crayfish.

In order to do the dissection, the following materials are needed:

1. 10-15 insect pins, gauge 00 to 2, (standard T-pins are too thick and cause tears).
2. A #3 scalpel with a #11 blade.
3. A waxed bottom dissection tray.
4. A hand lens or a dissection scope.
5. 2 earthworm specimens.
6. A pair of fine tipped forceps.
7. A teasing needle.
8. Examination gloves.
9. A pair of sharp, fine pointed scissors.

Earthworms belong to the phylum: *Annelida*. All annelids are characterized by having the following features:

1. Body divided into segments or metameres known as somites.
2. Well developed Cephalization (sense organs concentrated at the anterior or "head" end).
3. An elongate body.
4. Closed circulatory system with hemoglobin and amebocytes.

II External Anatomy

Begin by identifying the features pointed out in *Figure 1*. Find out which side is the Dorsal or top end. The **Dorsal** side is darker and feels smooth. The **Ventral** side is lighter and has a rough feel caused by projections called **setae**. These bristles are associated with muscles that can push the setae out or retract them. Setae aid in providing traction for locomotion. Note the body segments or **metameres**. Each metamere is similar with almost all body organs repeated within. The metameres are separated from each other by membranes called **septa**. Identify the **clitellum**. It is the light-colored, smooth, cylindrical structure closer to one end of the worm (segments 31 to 37). The clitellum is a glandular organ that produces mucus for copulation and secretes the cocoon into which the eggs are deposited. Eggs emerge from paired oviducts, small openings on the ventral surface of somite 14. Sperm ducts are on somite 15.

Locate the **Anterior** or "head" end of the worm. This is the end closest to the clitellum. At the tip of the anterior end is the **mouth**. A hand lens can be used to look at the mouth more carefully. The opposite end of the worm is the **caudal** end. The Anus is where digestive wastes are expelled.

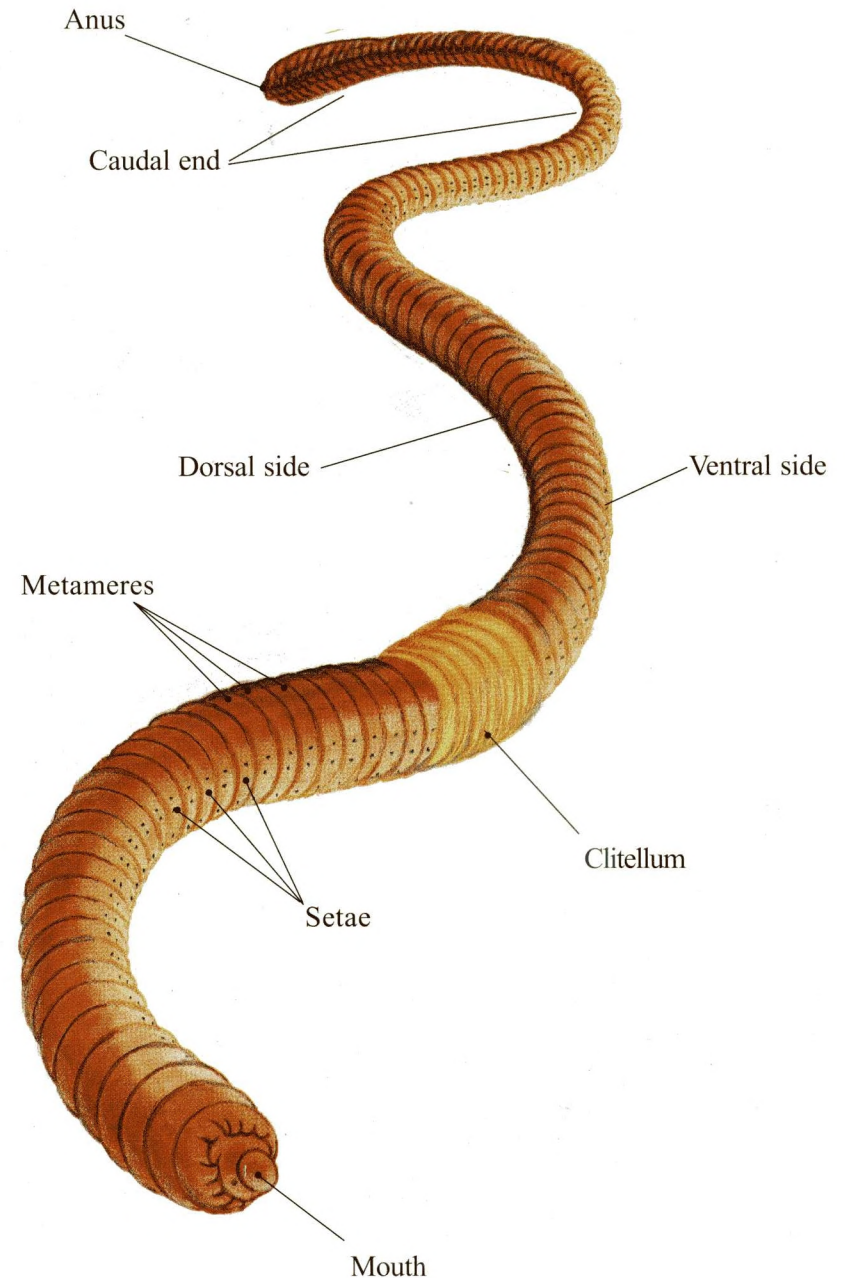


Figure 1. External anatomy.

III The Dissection and Internal Organs

1. Lay the worm on the dissecting tray so that the dorsal side of the animal is up. Place two pins through the sides of the 3rd segment back from the mouth and one through the caudal end.

2. With a sharp pointed scalpel blade or scissors make an incision from the clitellum down the middle to the mouth. You do not want to cut farther than 1/16 inch deep into the worm. Just cut far enough to open the body cavity or **coelom**. Be patient!

3. Now make a cut down each side of the clitellum toward the ventral side. Grasp the skin edge from these incisions with forceps and carefully separate the septae, which hold the digestive tract in place, away from the body wall. Work your way toward the mouth, pinning the muscular body wall down and away from the internal organs. Now compare your dissected worm with the one in *Figure 2* and find the following:

Aortic arches—There are five pairs of Aortic Arches located around the esophagus from segments 7 to 11. These arches pump blood throughout the worm in a closed circulatory system consisting of the large dorsal and ventral blood vessels, connecting vessels and capillaries. If your worm has been injected with latex, the color will help identify these structures.

Seminal Vesicles—These are large, light-colored, oval structures that contain the sex organs. Earthworms are both male and female, a condition known as hermaphroditic.

Crop—A thin-walled swelling in which the food is stored temporarily before entering the gizzard.

Gizzard—This is a muscular organ that uses particles of soil to help grind up food for digestion.

Intestine—This long tube is where the food is digested and nutrients are absorbed.

Dorsal Blood Vessel—A large blood vessel that runs on top of the digestive tract.

Cerebral Ganglion—Located at the cranial tip of the worm. This is the animal's brain.

Protonephridia—A pair is located in each somite except for the first three and the last. They filter nitrogenous wastes and empty to the outside through nephridiopores.

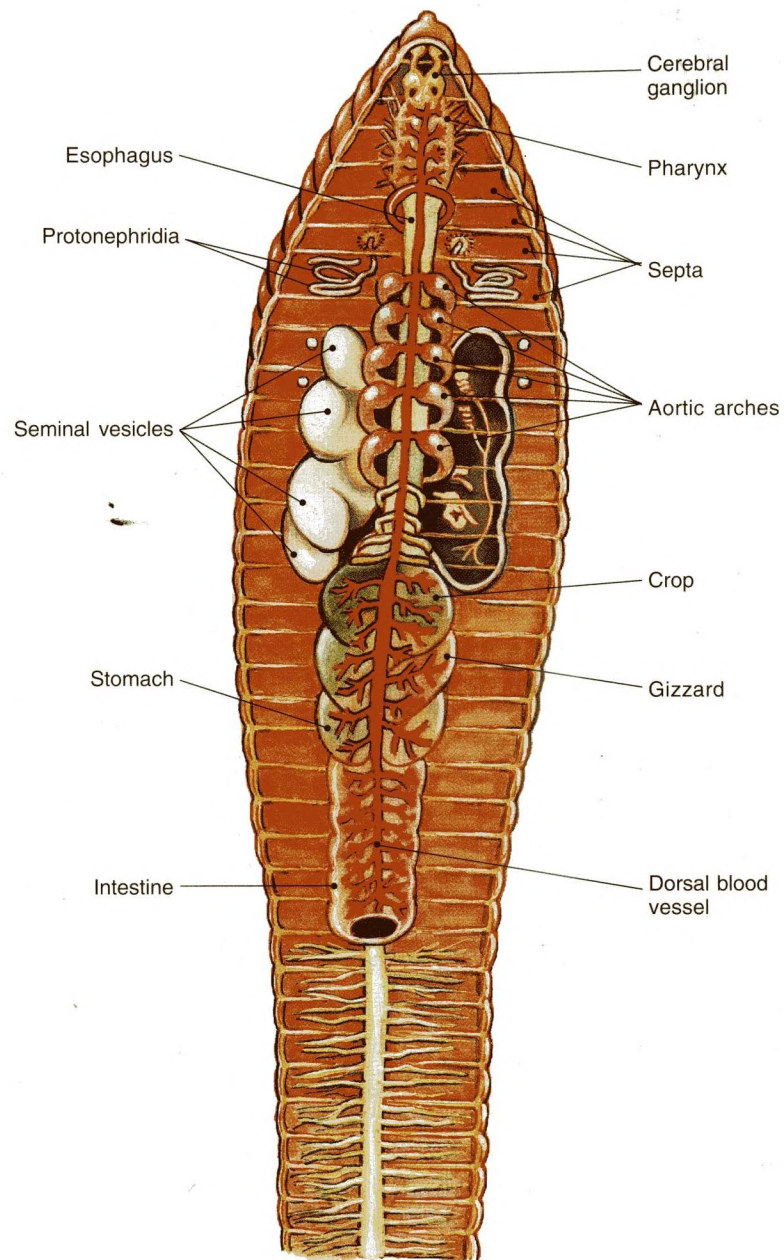


Figure 2. Internal organs.

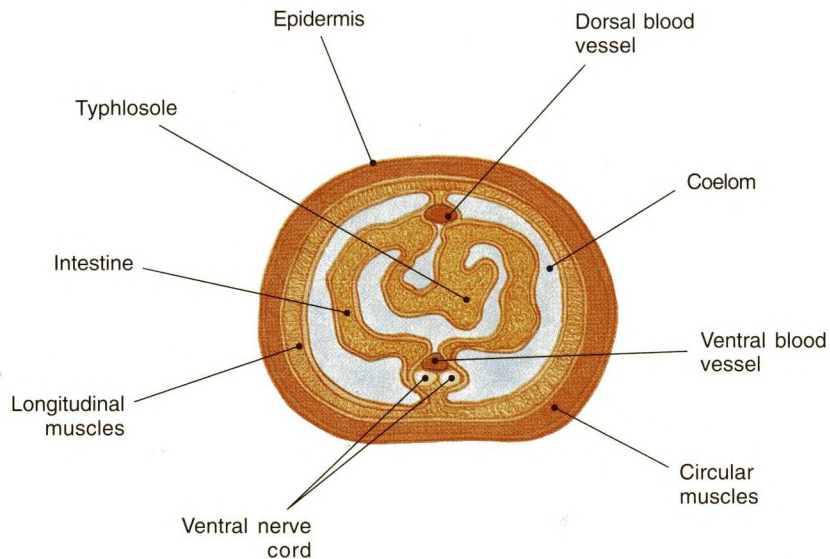


Figure 3. Cross section of a segment posterior to the clitellum.

4. Now with a new worm repeat steps 1 through—on the ventral side. This exposes the ventral nerve cord, a long thread-like structure with extensions going away dorsally. This is the equivalent to the vertebrate spinal cord except in vertebrates the spinal cord is on the dorsal side. Also note the ventral blood vessel.

5. Separate one metamere from the caudal end of a worm so you have a cross-cut disk. Observe this under magnification and compare it to Figure 3. Note the following:

Coelom—This is the body cavity filled with the coelomic fluid that acts as a hydraulic skeleton to support the body, much as the air in a balloon supports the balloons' rubber skin.

Typhlosole—This is a ridge or fold hanging inside the intestine from the dorsal side. It enlarges the surface area of the intestine which increases the efficiency in absorbing food.

Natural History

Earthworms (*Lumbricus terrestris*) are burrowers and are found in large numbers within soils with high amounts of organic matter such as pastures. This is because the organic matter within the soil (leaf, litter, animal waste, etc.) is food for the worm. Soil moisture is an important factor in determining good earthworm habitat. Earthworms have no respiratory organs. They obtain oxygen by diffusion through their moist skin. When the skin dries, oxygen cannot diffuse into the worm, causing death. Earthworms have adapted to survive moderately dry soil periods by slowing down their body functions (this period is known as diapause). As much as 70% of the worm's body fluid may be lost during this period before it dies. If the worm survives the dry period, it can quickly reabsorb water and resume activity.

Although earthworms have both male and female sex organs they still mate with other worms. During this mating both worms exchange sperm for use in fertilizing their own eggs.

Although the earthworm exhibits the major characteristics of the class Oligochaete there are many variations. Some of the important variants are as follows:

The members of the family **Aeolosomatidae** are microscopic oligochaetes which are exclusively fresh water worms. They reproduce asexually and feed on algae.

The family **Tubificidae** contains the tubifex worms (sometimes called "bloodworms" due to their bright red pigmentation) that are popular as fish food. These fresh water worms can be seen on the muddy bottoms of ponds and streams and occur in large wiggling clumps. Tubifex worms wave their cranial ends back and forth collecting floating detritus which is then ingested.

The family **Enchytraeidae** includes both aquatic and terrestrial species. They are up to 25mm long and are whitish in appearance. The relatively common *Enchytraeus albidus* lives under debris along the seashore.

For more information on earthworms, consult the following references:

Barnes, R.D. 1980 *Invertebrate Zoology*. Saunders, Philadelphia. An excellent general text.

Dales, R.P. 1963 *Annelids*. Hutchinson, London 200pp. A technical volume which is a valuable resource.

For almost a century the earthworm has been the invertebrate specimen for classroom dissection. Ideal for the classroom because of its ready availability, low cost and its phylogenetic position. Chromic injected earthworms are no longer offered due to the chromium-ion waste-water hazard resulting from their use. Earthworms are sold with the clitellum a large glandular swelling that is responsible for forming the cocoon for the fertilized eggs. Earthworms are internally injected with preservative. Single injected worms have the dorsal blood vessel and hearts injected with red latex.