Name_____

Earthworm Anatomy

Kingdom: Animalia
Phylum: Annelida "little rings"
Class: Oligochaeta "few bristles"
(*Lumbricus terrestris*)

External Anatomy

Earthworms are SEGMENTED WORMS (Annelids)
Observe the segments or METAMERES along its body.
The advantages of SEGMENTATION include:

1) allowing different body sections to expand and contract independently
2). Duplication of body organs provides insurance against injury.

Which end is up? Examine your earthworm and determine the ANTERIOR and POSTERIOR ends of your worm. Find the anterior end by locating the PROSTOMIUM, which is a fleshy flap of skin that extends over the MOUTH. It prevents dirt from entering the worm's mouth as it crawls through the soil. It can sense light/dark and vibrations. The other end of the worm's body is the posterior end, where the ANUS is located.

Determine the DORSAL and VENTRAL surfaces by feeling for the SETAE, bristle-like structures located on the VENTRAL surface. 4 PAIRS of bristles on each segment except the first and last, provide the basis for the worm's placement in the OLIGOCHAETA (meaning "few bristles") CLASS and are used for traction and prevent the worm from being pulled from the ground by a predator.

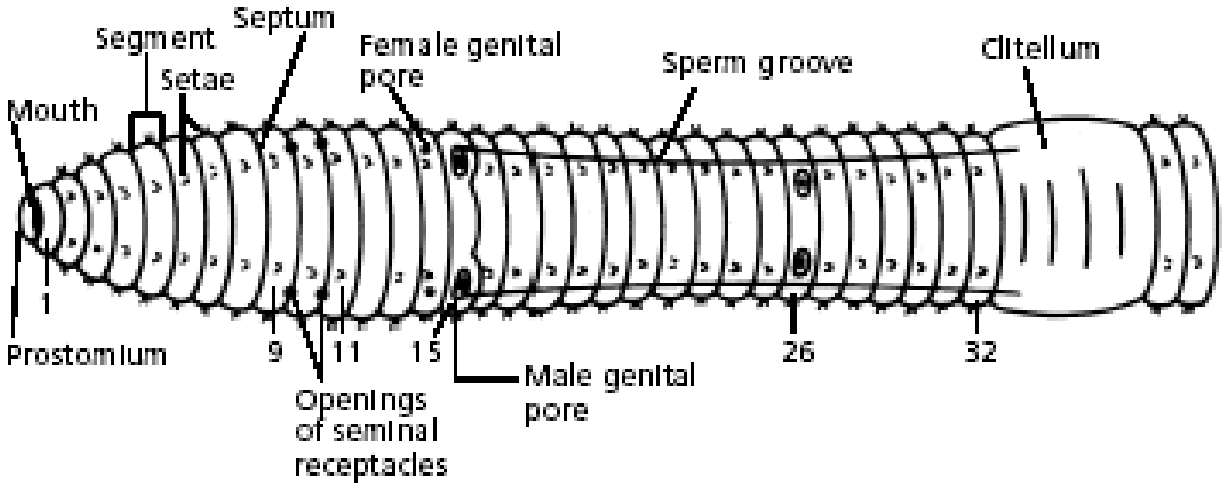
Note the swelling (between segments 33-37) of the earthworm. This is the CLITELLUM. It is closest to ANTERIOR end of worm and produces mucous for an egg capsule (cocoon) during sexual reproduction.

Locate the dark line that runs down the dorsal side of the worm, this is the DORSAL BLOOD VESSEL. The VENTRAL BLOOD VESSEL can be seen on the underside of the worm, though it is usually not as dark. Differences in coloration help the worm to blend in with its environment. Darker coloration on top helps the worm to blend in with the soil when being seen from above by a predator.

Rub your finger along the surface of the worm's skin. The thin layer that peels off is the CUTICLE, a NON-CELLULAR layer that provides protection & prevents dehydration.

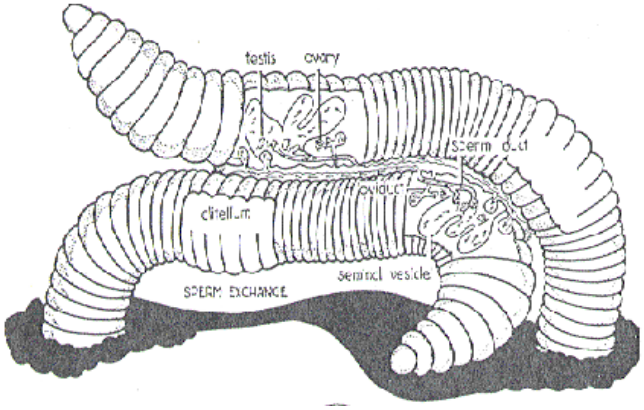
FIND THE EXTERNAL OPENINGS on the VENTRAL surface.

OPENINGS TO OVIDUCTS (segment 14)
SPERM DUCT OPENINGS (segment 15 & segment 26)
OPENINGS FOR SEMINAL RECEPTACLES (segments 9-11)
SPERM GROOVE runs from CLITELLUM to pores on segment 15.

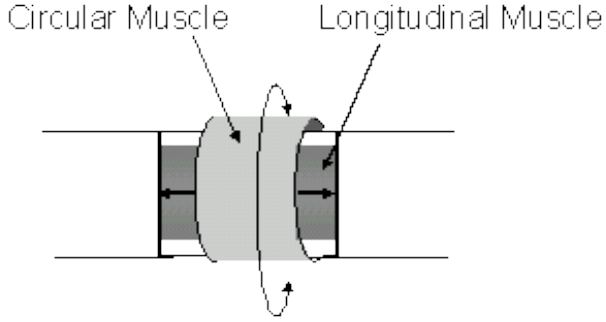


Earthworms are HERMAPHRODITES . . . each organism has BOTH MALE AND FEMALE sex organs, but they DON"T FERTILIZE THEMSELVES. They trade sperm with a partner.

Eggs are produced in the OVARIES and pass out of the body through FEMALE GENITAL PORES. Sperm are produced in the TESTES and pass out through the MALE GENITAL PORES. During mating, sperm from one worm travels along the SPERM GROOVES to the SEMINAL RECEPTACLES of another worm. Fertilization of the eggs takes place later outside the body as the mucous cocoon made by the CLITELLUM moves forward over the body, picking up the eggs of one worm and the sperm of its mate.



MUSCULAR SYSTEM



Worm skin is very thin and contains two layers of muscle which work together to help the worm crawl.

Contraction of the circular muscles elongates the animal and pushes the

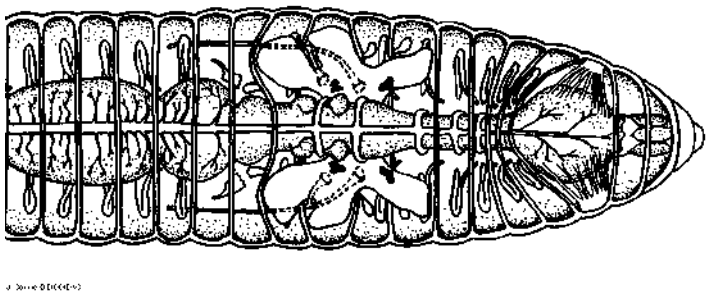
	anterior end forward. Setae grip the ground as the longitudinal muscles contract, pulling the back end of the worm forward.

INTERNAL ANATOMY

Turn the worm dorsal side up in your pan. Using a small scissors, make a shallow incision in the dorsal side of the clitellum at segment 33. Slice up the dorsal surface little by little working your way forward to segment 1.

CAUTION: Scalpels and scissors are very sharp. Report any cuts to your teacher. Be careful to only cut through skin… not through organs below.

Gently open your incision and look inside to see the dividers between the segments called SEPTA (singular; SEPTUM).



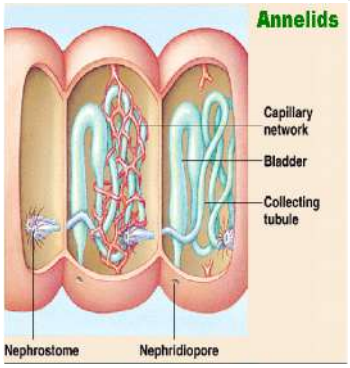
BODY CAVITY (COELOM) /SKELETAL

Earthworms are COELOMATES. They have a "true" body cavity lined on BOTH SIDES by MESODERM. Find this COELOM (See-lum) space between the outside body wall and the internal organs in the middle. The earthworm (like other annelids) has a HYDROSTATIC SKELETON. Instead of a bony skeleton, fluid in the COELOM space provides support and protection for body organs and prevents the worm from being crushed.

RESPIRATORY SYSTEM:

Notice how THIN the skin is. Earthworms DO NOT HAVE RESPIRATORY ORGANS and exchange oxygen and carbon dioxide THROUGH THEIR SKIN. Mucous glands keep the skin moist to allow gas exchange.

EXCRETORY SYSTEM:



Look also for tiny tiny tubules called NEPHRIDIA (singular; NEPHRIDIUM) A pair of these white thread-like structures is located along the dorsal body wall in each segment except the first and last. Their function is to collect and remove nitrogen waste. Worms excrete their nitrogen waste as UREA out through pores in the skin.

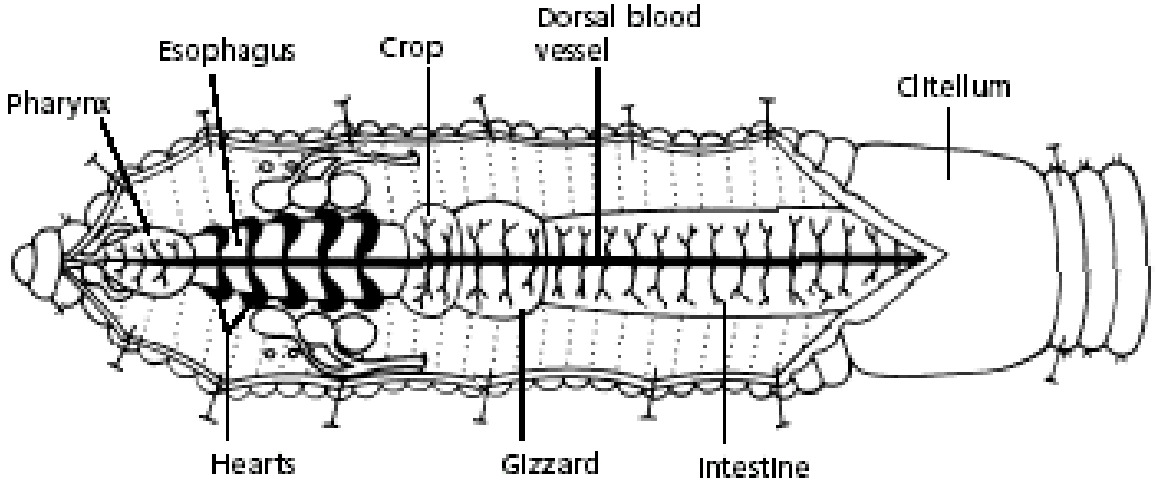
Separate the septa along the body wall using a dissecting needle and pin open the skin.

REPRODUCTIVE SYSTEM

The SEMINAL VESICLES are cream colored and located toward the anterior of the worm. These are used for producing and storing the sperm your worm makes. Smaller SEMINAL RECEPTACLES can be seen underneath. These store sperm received from other worms during mating. Both of these reproductive structures connect to the openings you saw on the ventral surface of your worm.

CIRCULATORY SYSTEM (CLOSED)

The DORSAL BLOOD VESSEL appears as a dark brownish-red vessel running along the top of the INTESTINE. The pumping organs or "HEART" of the circulatory system are the 5 AORTIC ARCHES which can be found bridging over the ESOPHAGUS (just posterior to the PHARYNX). Circulatory fluids travel from the arches through the ventral blood vessel to capillary beds in the body. The fluids then collect in the dorsal blood vessel and reenter the aortic arches. The VENTRAL BLOOD VESSEL lies underneath the digestive system and can't be seen at this time.



DIGESTIVE SYSTEM

Locate the digestive tract, which lies below the dorsal blood vessel. Refer to the diagram above to locate the following:

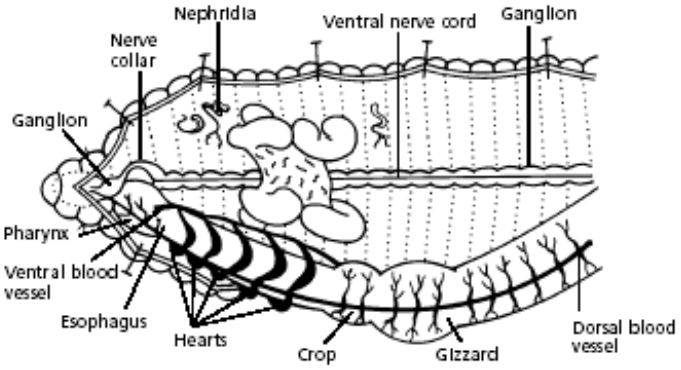
the MOUTH - takes in food.
the PHARYNX is a muscular structure located in segments 2 - 6 that sucks in food
the ESOPHAGUS is a tube which carries food from the pharynx to the crop the CROP is a thin-walled sac that holds food until the gizzard it ready to receive it
the GIZZARD is a thick-walled sac that is responsible for grinding up food
in the INTESTINE food is chemically digested and absorbed.
Indigestible material (waste) is eliminated through the ANUS.

The earthworm has several modifications to help it absorb the few nutrients found in the "not-very-nutritious" soil it eats.

1. **The TYPHLOSOLE (folded lining of the intestine) increases the surface area so more nutrients can be absorbed.**
2. **Their REALLY, REALLY LONG intestine allows food to stay in contact with intestinal lining longer so more nutrients can be absorbed.**

NERVOUS SYSTEM

A pair of CEREBRAL GANGLIA (small clusters of nerve cells in the head end above the pharynx) serve as the earthworm's brain and connect to a NERVE CORD running the length of the worm's body along the VENTRAL surface via a NERVE COLLAR



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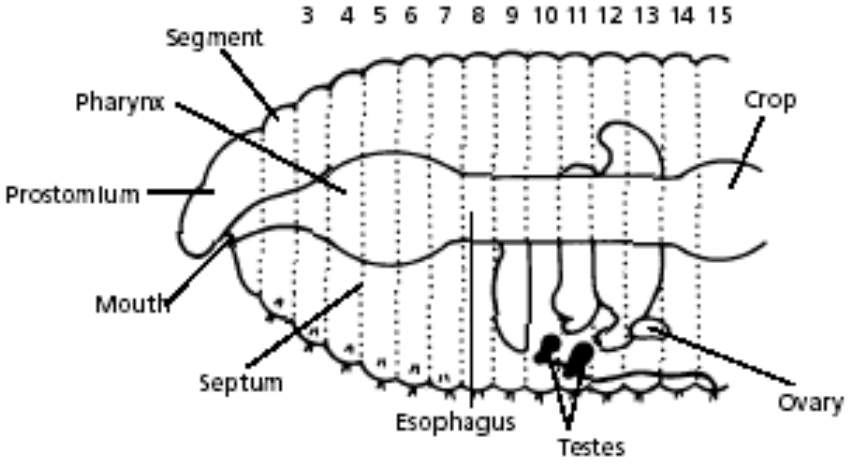
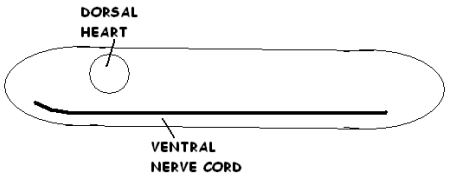
REPRODUCTIVE SYSTEM

Use the diagram below to locate and identify a pair of ovaries in segment 13. Look for two pairs of tiny testes in segments 10 and 11. To find these organs, you will again have to push aside some parts already dissected.

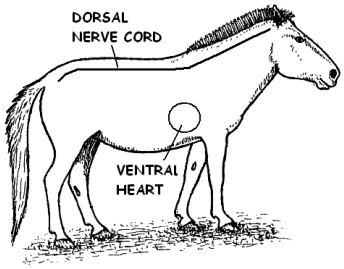


BODY DESIGN:

Notice the location of the worm's heart (aortic arches) and its nerve cord.
Most invertebrates (at least those with a heart AND nerve cord) have a VENTRAL NERVE CORD and a DORSAL HEART. This design changes in VERTEBRATES. Higher animals like YOU, have a VENTRAL HEART and a DORSAL NERVE CORD.



INVERTEBRATE BODY PLAN



VERTEBRATE BODY PLAN

EARTHWORM BENEFITS:

Earthworms play an important role in maintaining the fertility of soil:

1. **Earthworms help return nutrients to the soil by digesting and decomposing dead leaves and other organic matter.**
2. **Earthworm burrows made allow air to penetrate into the soil, bringing oxygen to plant roots.**
3. **Earthworms also loosen the soil, making it easier for roots to grow and for water to seep in.**

NAME _____

WORM LAB FOLLOW UP QUESTIONS

LATIN MEANING

KINGDOM _____

PHYLUM _____ _____

CLASS _____ _____

1. Which body part do Earthworms have that gives them their PHYLUM name *OLIGOCHAETA* meaning "few bristles"? _____

2. How does its coloration (darker on the dorsal surface) help the earthworm?
_____

3. The NEPHRIDIA in earthworms have the same function as _____ in humans.

4. Which form of nitrogen waste is excreted by earthworms? _____

5. Digestive waste exits through the _____.

6. Nitrogen waste is collected by TUBULES called _____and exits through _____.

7. Trace the parts of the digestive tract through which food passes in order starting at the mouth and ending at the anus.

mouth → _____ → _____ → _____→ _____ → _____→ anus

8. Number of openings in an earthworm's digestive system? 0 1 2

9. Earthworms are HERMAPHRODITES. Explain what that means.
_____

10. Earthworms have no bones. What acts as the skeleton in an earthworm?

_____

11. Tell 2 ways that the earthworm's digestive system is adapted for extracting as many nutrients as possible from a large amount of relatively non-nutritious food (soil)?

1._____

2. _____

12. USE the words DORSAL AND VENTRAL to compare the LOCATION of the HEART and NERVE CORD in vertebrates and invertebrates. How are they different?

INVERTEBRATES have a _____ heart and _____ nerve cord.

VERTEBRATES have a _____ heart and a _____ nerve cord.

13. COMPARE	CROP	GIZZARD
Location		
How does it feel?		
Function		

14. COMPARE	SEMINAL RECEPTACLES	SEMINAL VESICLES
Size		
Stores sperm from?		

Name the EARTHWORM part described below:

Provides traction when crawling _____

NON-CELLULAR coating that protects
skin and prevents drying out _____

Fleshy flap of skin that covers and protects the
worm's mouth and can sense light/dark _____

Carries sperm from male genital pore to clitellum _____

Openings on ventral surface for seminal vesicles _____

Divides coelom into compartments _____

Tubules that collect and excrete nitrogen waste _____

Makes sperm _____

Makes eggs _____

Stores sperm made by this worm to give away _____

Stores sperm received from other worms _____

Acts as heart to pump blood _____

Pulls food into the digestive system _____

Carries food from pharynx to crop _____

Stores soil waiting to be digested _____

Grinds food _____

Absorbs nutrients from digested food _____

Infolding INSIDE intestine to provide
surface area and increase absorption of nutrients _____

Acts as the brain _____

Makes mucous for reproduction _____

circle ALL that apply to EARTHWORMS:

Acoelom **Pseudocoelom** **Eucoelom**

Invertebrate protostomes **Invertebrate deuterostomes** **Vertebrate deuterostomes**

blastopore → mouth determinate spiral cleavage **blastopore → anus indeterminate radial cleavage**

External fertilization **Internal fertilization**

Indirect Development **Direct development**

HERMAPHRODITE **SEPARATE MALE and FEMALE SEXES**

Asexual Reproduction **Sexual Reproduction**

Open circulation **Closed circulation**

No cephalization **Cephalization**

VENTRAL nerve cord/DORSAL heart **DORSAL nerve cord/VENTRAL heart**

Asymmetry **Radial symmetry** **Bilateral symmetry**