

A Reference: If time: MacInvertebrate on the iMac. Not finished? Use the same computer & sign in. \_\_\_\_\_

**I. Classification of the Earthworm:**

**Kingdom Animalia:** Animals have no cell \_\_\_\_\_, are \_\_\_\_\_ trophs and \_\_\_\_\_ cellular.

**Phylum Annelida:** Annelids are segmented worms meaning their body is made up of sections and is longer than it is wide. Annelids are invertebrates that are more advanced than sponges, cnidaria (stinging animals), flatworms and roundworms. Their body has bilateral symmetry (right & left side) and has complete organ systems including a 2 opening digestive system. They resemble us in many ways.

**Scientific name:** *Lumbricus terrestris*, which means Worm \_\_\_\_\_.

It was Charles Darwin who first recognized the earthworm's importance, describing it as 'nature's plow'. By burrowing through the soil, it increases the water and air (oxygen) in the soil, which helps roots develop.

Droppings, known as castings, help in enriching the soil due to being rich in phosphorus, magnesium, calcium, and nitrogen. Since earthworms increases the fertility of the soil, they are often introduced in land that lack earthworms,

**II. External**

**A. Find the following.**

As you find each part, write a memory note so you can find the part later.

1. anterior end \_\_\_\_\_
2. posterior end \_\_\_\_\_
3. dorsal side \_\_\_\_\_
4. ventral side \_\_\_\_\_
5. segment \_\_\_\_\_
6. setae \_\_\_\_\_
7. prostomium \_\_\_\_\_
8. mouth \_\_\_\_\_
9. clitellum \_\_\_\_\_

**B. Count the segments.** Compare to another.

Yours: Theirs:

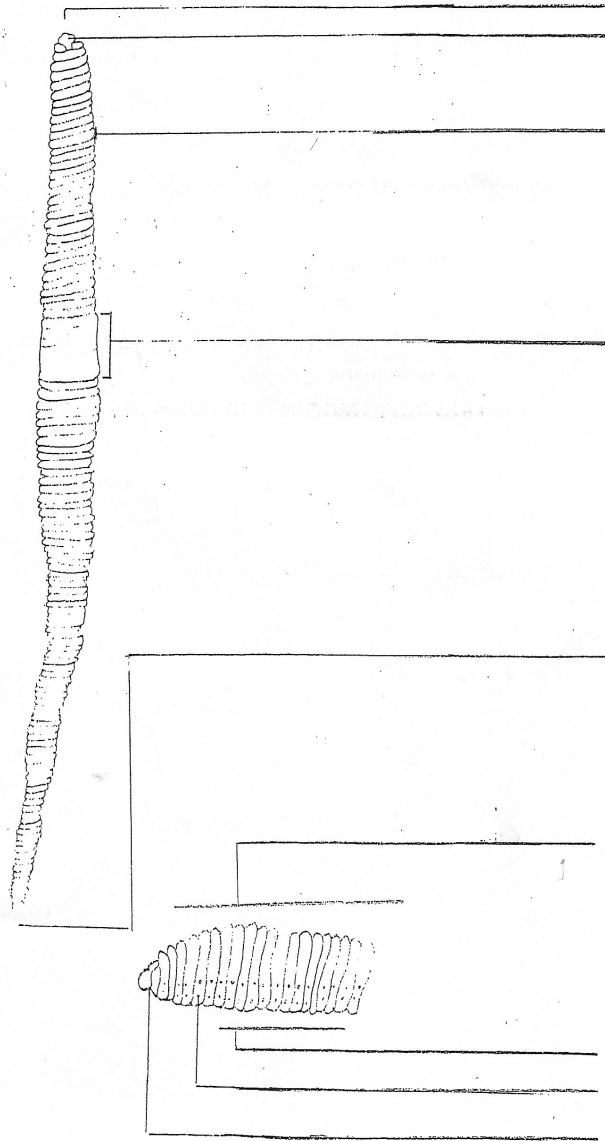
- |                                   |       |       |
|-----------------------------------|-------|-------|
| 1. Prostomium to clitellum        | _____ | _____ |
| 2. In the clitellum               | _____ | _____ |
| 3. Clitellum to the posterior end | _____ | _____ |
| 4. So the total is                | _____ | _____ |

C.

**C. Label the External Parts.**

**D. Watch Earthworm videos in ARKIVE.**

Science→Life→Animals→ARKIVE→Search  
 \_\_\_\_\_ Overview \_\_\_\_\_ Moving **Checked** \_\_\_\_\_



**Storage:**

1. Use a dry towel. Wrap burrito style:
  - a) Fold the worm once in the middle
  - b) Place worm on towel end or corner.
  - c) Fold towel up; fold sides toward the center over worm.
  - d) Roll up.
  - e) No tape.
2. Write your name on the outside while dry.
3. Dip in water.
4. Place in the bag for your class.

**III. The Dissection.****A. Preparation:**

- \_\_\_1. Place a piece of styrofoam on your desk. Fold a paper towel so it is at least 4 layers and place it on top of your styrofoam.
- \_\_\_2. Place the anterior end of your earthworm on the towel. Have dorsal side up.
- \_\_\_3. Locate the blood vessel that shows through the skin on the dorsal side (center back). Mark the blood vessel with ink. Start at the clitellum. Mark 2 cm toward the posterior.

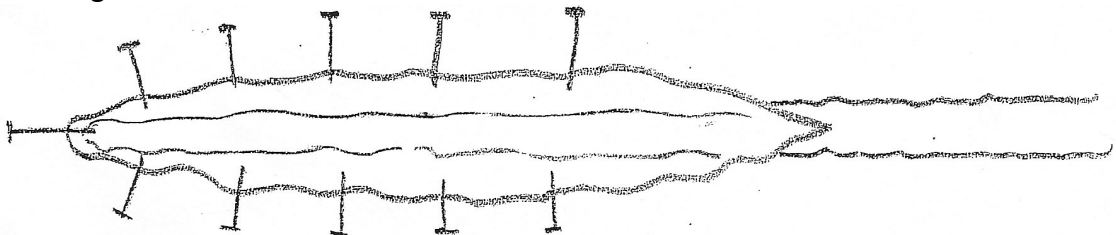
**B. The CUT and PIN.**

**READ this first! Initial at the end** of the paragraph. Your cuts must be done very carefully. Pretend that you are cutting a sock off of a very sore foot. YOUR scissors should not touch the foot. Your scissor point should not touch the internal parts or you will ruin the organs. **Cut only skin.** You Initial here: \_\_\_\_\_

- \_\_\_4. Use the very point of your scissors, point toward the ink mark and put the lower point of your scissors in the mouth. Make tiny cuts, about one segment at a time, toward the ink mark. Keep the scissors up so you cut only skin. Cut until you are about 2 cm past the clitellum
- \_\_\_5. Hold a pin **as flat as possible**, (see below) to pin through the mouth into the paper towel layers and into the styrofoam.



- \_\_\_6. Use another pin to hold the skin while you peek inside. Notice the tissue (septum) holding the skin closed. **READ ALL OF this #6 BEFORE GOING ON.** You will use a pin as a miniature knife to cut the septum tissue next to the skin to loosen the skin. **Keep the pin very close to the skin so you don't damage any organs.** Try it on a small section. Then read #7.
- \_\_\_7. Use another pin. Come in **flat from the side** to pin the loose skin to the paper towel and styrofoam. **See the image below.**
- \_\_\_8. Continue to loosen and pin small sections until the earthworm is pinned out. When done correctly, the organs of the earthworm will lay straight down the center of the worm as in the drawing below.



- \_\_\_9. Have checked. \_\_\_\_\_
- \_\_\_10. Whenever you run out of time, **UNPIN** your worm and wrap the skin around it for protection. Follow directions on the first page to wrap, label, moisten & store the worm.

**IV. The Digestive System: (Systems are made of o\_\_\_\_; organs of t\_\_\_\_, and tissues of c\_\_\_\_.)**

**A. Empty Worm:** The next page is an “empty worm” drawing. Use it for your drawings. Draw ONLY what you identify and only as directed below. **Label as you go.**

**B. Digestive Organs:**

1. The first part of the digestive system is the opening for food or the \_\_\_\_\_ **Label.**  
 2. Just past the mouth is a stringy bump. Gently touch it with the point of a pin. It should be a firm muscle. This is the pharynx. It covers from segment #\_\_ to #\_\_\_. The function of the muscular pharynx, just inside the mouth is to \_\_\_\_\_  
 3. **Draw** an outline drawing of the pharynx on the correct segments. **Label.**

4. After the pharynx are many organs. **DO NOT DISTURB THEM NOW.** The white or light gray organs are reproductive organs. The esophagus or food tube is under them.  
 5. We have an esophagus between our mouth and stomach, with the same function, which is to transport \_\_\_\_\_. Leave a **space** on your drawing. Label it **esophagus.**

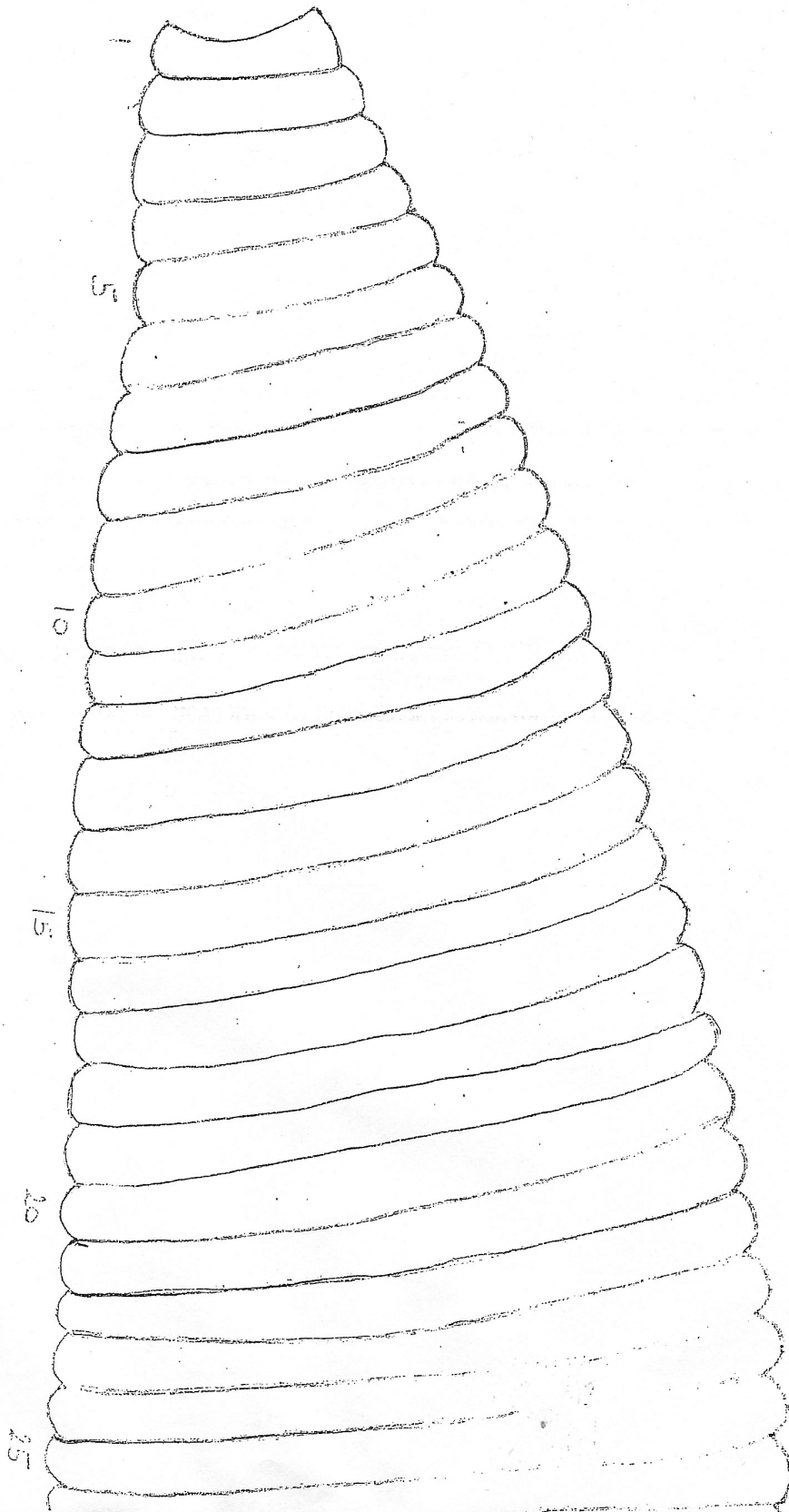
6. Past the esophagus and white organs are two rounded mounds with a brown or blue blood vessel on top. Use a pin to touch each of these mounds. One should be a thick muscle to grind food. The other is soft and for food storage. Which is first?\_\_\_\_\_.  
 7. A bird has a similar system. A bird’s crop **stores** food as it eats. The food moves on to the gizzard, where the muscle squeezes the food with tiny rocks or shells, **grinding** it.  
 8. The first mound is the \_\_\_\_\_, covering segments #\_\_ to #\_\_\_. It \_\_\_\_\_ food.  
 9. The second mound is the \_\_\_\_\_, covering segments #\_\_ to #\_\_\_. It \_\_\_\_\_ food.  
 10 **Draw** the outline of the crop and gizzard on the correct segments. **Label** both.  
 11. We have \_\_\_\_\_ to grind our food. Our \_\_\_\_\_ mixes food with digestive juice.

12. Next, and for the rest of the earthworm, is a brownish tube, the intestine. There should be a blood vessel on top. **Draw** the outline of the intestine. **Label.**  
 13. If you cut the intestine, the food looks like soil, because that is what the earthworm eats. It eats its way through the soil. The digestive juice dissolves parts of organisms (mostly dead) for food. The undigested “earth” moves on through the worm and out the anus. (If you did a perfect job of dissecting your worm, you see no “earth”. Make a cut, or look around.) **Earthworms are “Nature’s Great Cultivators and Aerators of Soil”** as their tunnels allow w\_\_\_\_\_ and a\_\_\_\_\_ into the soil—exactly what other organisms need.

14. Our food, and the earthworm’s, must be **digested** to a liquid form before it can enter the blood cells to be transported by the blood to body cells. Many tiny blood vessels (capillaries) go by the intestine to pick up food. When the food moves into the blood cells, we say it is **absorbed by blood**. When food gets to the body cells, it combines with oxygen or “burns” to get energy, which is cellular **respiration**. Anything that doesn’t get digested is moved out or **excreted** as feces (digestive or food waste). Excretion means removal of waste liquids such as sweat and urine as well as the gas, carbon dioxide, and can also be used for removal of feces.

15. Explain each process without using the term. (Do not write “to digest food”.)  
 a) Digestion \_\_\_\_\_  
 b) Absorption \_\_\_\_\_  
 c) Excretion \_\_\_\_\_  
 d) Respiration \_\_\_\_\_

"Empty Worm" Drawing Page



**V. Circulatory System, Excretory System and Respiratory System:****\_\_1. Circulatory System:**

**Watch the Earthworm Heart Video.** Science→Life→Animals Checked \_\_\_\_\_

- \_\_2. Instead of a heart, the earthworm has five pair of pumps that fit around the esophagus like 5 tiny arches. They are aortic arches. They are tiny blue or gray tear shaped. Some will be large and full of blood. Those that just pumped will be thin.
- \_\_3. Carefully use a pin to look between in front of and under the white reproductive organs. They are between the septum tissue that you cut earlier. **Draw** at least one aortic arch in the correct segment of your “empty worm” drawing. **Label.**
- \_\_4. The aortic arches connect the top or \_\_\_\_\_ blood vessel to the bottom or \_\_\_\_\_ blood vessel. The dorsal blood vessel is the one you saw through the skin. The ventral blood vessel is under the intestine. Roll the intestine aside to find the ventral blood vessel. It should be very delicate and brownish—not white. The white cord is the nerve cord that leads from the brain to every segment of the earthworm.
- \_\_5. The blood is carried to all parts of the body by tiny blood vessels called capillaries that are too small to see. Each cell is passed by a capillary. The blood in the capillary takes f \_\_\_\_\_ and o \_\_\_\_\_ to each cell.
- \_\_6. **Excretory System:** The blood also picks up wastes, including water and c \_\_\_\_\_ . There are tiny coiled nephridia (kidneys) throughout the worm that collect liquid wastes and move them out.
- \_\_7.. **Respiratory System:** Carbon dioxide-oxygen exchange (breathing) is through the skin to the blood cells in the tiny capillaries. Moist mucous on the skin traps oxygen for the blood cells to take to the body cells, which is why earthworms must always be moist.

Earthworms come out of the ground mostly at night when the air is moist. They can breath for a short time underwater, but will come up when the soil is soaked by rain. Some say they find a new place to live, others say they come up so they won't drown. In any case, many get stranded.

After the oxygen is picked up by the blood cells, capillaries (tiny blood vessels) take oxygen to each body cell. Remember, the chemical equation for RESPIRATION: Oxygen and the food combine to release e \_\_\_\_\_. W \_\_\_\_\_ and carbon \_\_\_\_\_ are also released.

**VI. Reproductive System:**

- \_\_1. Watch the Earthworm Hatching Video. Science→Life→Animals→Earthworm Hatching Video  
Have Checked \_\_\_\_\_
- \_\_2. The earthworm is an **hermpahrodite**, which means \_\_\_\_\_.
- \_\_3. Earthworms eggs must be fertilized by a different worm. Both worms lay eggs which are fertilized by sperm from another worm. The reproductive organs are the white organs around the esophagus. The clitellum secretes a substance which dries around eggs and sperm to form a cocoon. Fertilization takes place in the cocoon that holds the young while they develop in the soil.

**VII. Nervous System:**

- \_\_1. The white nerve cord is under all of the organs. Find it under the intestine. It carries messages to and from the brain.
- \_\_2. The nerve cord has large lumps called ganglia (singular is ganglion). To find them, insert a pin under the nerve cord and gently lift it slightly. Do not stretch.
- \_\_3. Use scissors to cut it 2 places, 2 cm apart. Move it to a puddle of water on your table.
- \_\_4. You should now be able to see the larger ganglia and some nerve branches. Each segment has one ganglion which is a sub-brain or “traffic cop”. **Draw 3 ganglia** on your “empty worm” beside the intestine. **Label**.
- \_\_5. Each ganglion has branches to its segment and setae. The earthworm’s muscles and setae must work together to move. The earthworm moves in a “wave” motion using its setae for \_\_\_\_\_.
- \_\_6. When the nerve cord reaches the pharynx it splits in a “Y” like a necklace and goes around to meet at the brain. The brain sits on the pharynx like 2 small headlights. Add the brain to your **drawing**. **Label**. The skin is a sense organ.
- \_\_7. The earthworms sense organs are its prostomium and its skin. You may be able to see the branches going forward from the brain to the “lip” or prostomium. What is the function of the prostomium? \_\_\_\_\_

