

Warming Up to Worms

Topic Area

Biological Science - Earthworms

Introductory Statement

Students will observe earthworms and record their observations.

Math Skills

Predicting
Measuring
Comparing

Science

Observing
Comparing
Collecting data
Recording data

Extensions

Formulate other questions about earthworms. Use the following steps to guide you:

1. **Problem:** What do you wish to find out?
2. **Hypothesis:** Predict what you think might happen.
3. **Materials:** What do you need to use?
4. **Procedure:** What will you do?
5. **Results:** What happened?
6. **Conclusion:** What answers did you find?
7. **Theory:** How does it change how you think about earthworms?

Materials

earthworms (2-4 per group)
paper towels
magnifying glasses
measuring tapes, rulers

Key Question

What can we observe about the way earthworms look and behave?

Background Information

The main sense organ of worms is their skin. A worm's skin is very sensitive to moisture, temperature, touch, and light. So, the worm actually uses its skin to see, feel, and detect moisture. The worm breathes by taking air out of the moist soil directly through its skin. (Since its skin is tender, it prefers a smooth environment over a rough one.) Its skin senses light consequently worms can tell when it is day or night. Worms are nocturnal and rarely come out of the ground except at night.

Management

1. Earthworms can be bought at bait shops or in the sporting goods departments of many large discount stores. They can also be found by digging in moist soil.
2. This is meant to be an initial observation time and should take about 20-30 minutes.
3. If working in learning groups, one student can gather and return necessary materials, a second can read observation questions, a third can report the group's observations, and a fourth can report on the observations and other questions from the group.
4. Each group should have two to four worms to observe.

Procedure

1. Distribute worms and observation guides to students.
2. Follow directions on observation guides.
3. Encourage groups to discuss their results.
4. As a class, share and discuss findings.

Warming Up to Worms



Place your groups' worms on a paper towel where everyone in your group can observe them. Here are some questions to discuss as you make your observations. Have one person record the group's answers.

1. What color are the worms?

2. What shape is an earthworm? Describe it.

3. About how long are the earthworms? How did you measure them?

4. How does the worm's skin feel?

5. Is there a difference between the top side and bottom side of a worm? If there is, describe what both are like.



6. Observe your worms with a hand lens. What do you notice that you could not see before?

7. Answer yes or no to each of the following and tell what you observed.

Does an earthworm have:

Eyes? _____

Ears? _____

Legs? _____

Nose? _____

Mouth? _____

8. Can you tell which is the front end of a worm and which is its tail? Is there a difference?



Warming Up to Worms

9. Describe any other special features you notice.

10. How do worms move? Do they ever move backwards?

11. What happens when a worm meets another worm?

12. Put an obstacle in front of one of the worms?
Describe its behavior.

13. Hold a worm in your hand. What does it do?

EARTHWORMS

Earthworms are often called "Nature's Plowman" because they live in the ground and tunnel their way through the ground mixing up the different layers of the soil.

WHAT DO EARTHWORMS EAT?

Earthworms eat decayed leaves and plant material. They also swallow soil and little bits of animal material.

HOW DO EARTHWORMS MOVE?

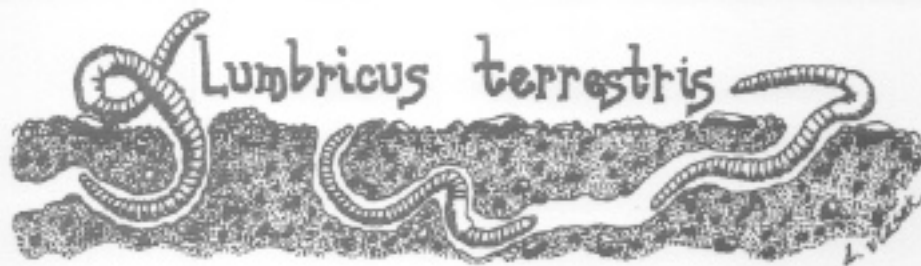
Earthworms have 2 sets of muscles:

1. Circular Muscles around each segment.
2. Long Muscles that run the length of the body.

When the circular muscles tighten, the earthworm becomes longer and thinner. When the lengthwise muscles tighten, the earthworm becomes shorter & fatter.

HOW DO EARTHWORMS HELP THE SOIL?

1. They mix up the different layers of the soil.
2. They add nutrients to the soil by depositing their waste products or "castings" into the soil.
3. They help to decompose dead plant and animal material into simpler parts that can be used again by new organisms.



The earthworm is an invertebrate which has a segmented body. The number of segments in a full-grown earthworm varies between 120 and 175. All segments, except the first which contains the mouth and the most posterior which contains the anus, are similar. The external surfaces of segments 31 to 37 are glandular and swollen. This region is called the clitellum. This is located about one third toward the front end of the worm. This clitellum means that the worm is an adult and can mate and lay eggs.

Earthworms have regenerative powers and are capable of replacing damaged or destroyed segments depending on the region.



Earthworms have to stay moist in order to breathe. They have no lungs, but take oxygen from the air right through their damp skin into the blood vessels. Carbon dioxide moves out of the body the same way. Getting dried out is fatal for an earthworm.

There are bristles on the underside of the worm called setae. There are four pair on all but the first and last segments. The bristles are made of chitin which is the same material the hard outer covering of insects is composed of. These structures help the worm dig into the soil when it moves and help cling to the sides of the burrow when predators try to pull them out.

Earthworms do have enemies even though they spend much of their time underground. Their predators include birds, frogs, centipedes, moles, and man. A protective adaptation is the worm's brownish color. This makes the worm harder to see against the soil.

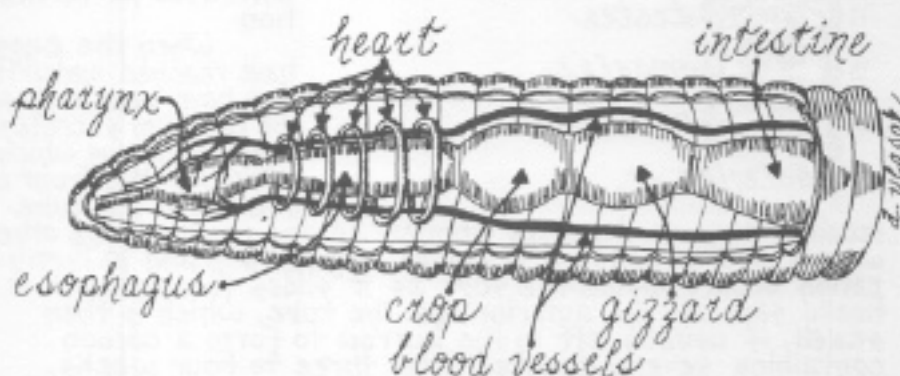


When observing the movement of the earthworm, you'll notice that one part of the worm stretches out, while another part squeezes together. This is because beneath the epidermis is a layer of circular muscle whose contraction decreases the diameter but increases the length of the body. Another muscle layer runs the length of the worm: the longitudinal muscle.

The earthworm has five pair of enlarged tubes which act as hearts. The tubes pump blood through the vessels of the earthworm's body.

As a worm eats enormous quantities of soil, it takes the decaying organic matter (parts of dead plants and animals) for its nourishment. From the pharynx, the food passes into the esophagus. There are several pairs of calciferous glands which secrete calcium carbonate into the esophagus. They function in the neutralization of acid soil as well as the elimination of excess carbonate from the blood.

From the esophagus, the food moves to the crop. The crop serves as a temporary storage place. From here, it passes on to the gizzard. Grains of sand are present here and the thick, muscular walls work the food and sand back and forth until the food is ground up.

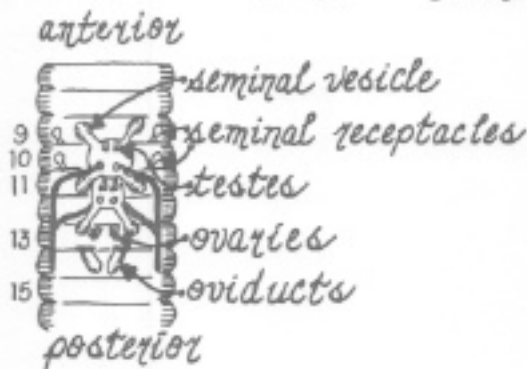


The food is then forced into the intestine, the longest section of the digestive system. The glands here secrete digestive chemicals that complete digestion and the digested food passes through the walls of the intestine and into the

bloodstream. The bloodstream circulates the digested foods to other parts of the organism.

Although the earthworm is sensitive to light and touch, it does not have sense organs. There are light-sensitive cells scattered through the skin. These cells enable the worm to distinguish between light and dark. The worm is also sensitive to vibrations, which is a useful adaptation since it's the mole's favorite food.

Boy or girl? The earthworm is actually both. It is called a hermaphrodite, because it has both ovaries and testes. The two pairs of testes are located in segments 10 and 11, counting from the anterior end, and the pair of ovaries are in segment 13. Self-fertilization cannot take place. The exchange of sperm cells between two mating worms occurs during a process called copulation. Copulation usually occurs at night during moist weather and involves a temporary union of two individuals along their ventral surfaces. A worm is old enough to lay eggs at about one year.



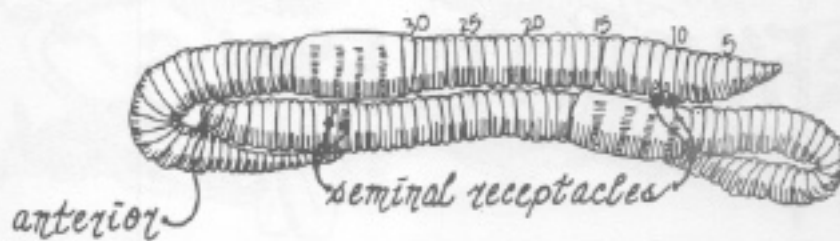
After copulation, the worms separate, each having the other's sperm stored in the seminal receptacles, until used for fertilization.

When the eggs have reached maturity and have been released, the clitellum secretes a tube of mucus which slips over the front of the worm. The tube

receives eggs as it passes segment 14, and receives the other worm's sperm cells as it passes segments 9 and 10. Fertilization occurs inside the tube as it slides forward until it finally slips off the anterior end. The tube, which is then sealed, is usually left in the burrow to form a cocoon containing several zygotes. After three to four weeks, pale, whitish wormlets crawl out as miniature adults. If the moisture and temperature are not quite right, the eggs can stay in the case for a year or more.

Because the earthworm's source of nutrition is organic matter in the soil, large





quantities of soil are eaten. The undigestible soil passes through their intestinal tract and is eliminated as "worm castings". This helps enrich the soil. Lower levels of earth are brought to the surface which improves the chemical composition. In burrowing, they are also improving farm land as air and water can enter the ground easier. The naturalist Charles Darwin once calculated that an acre of farm land may contain as many as 50,000 earthworms. In the course of a year, those worms could overturn as much as eighteen tons of soil per acre! This is of great significance to agriculture and these creatures should be appreciated for their contribution to farming.

