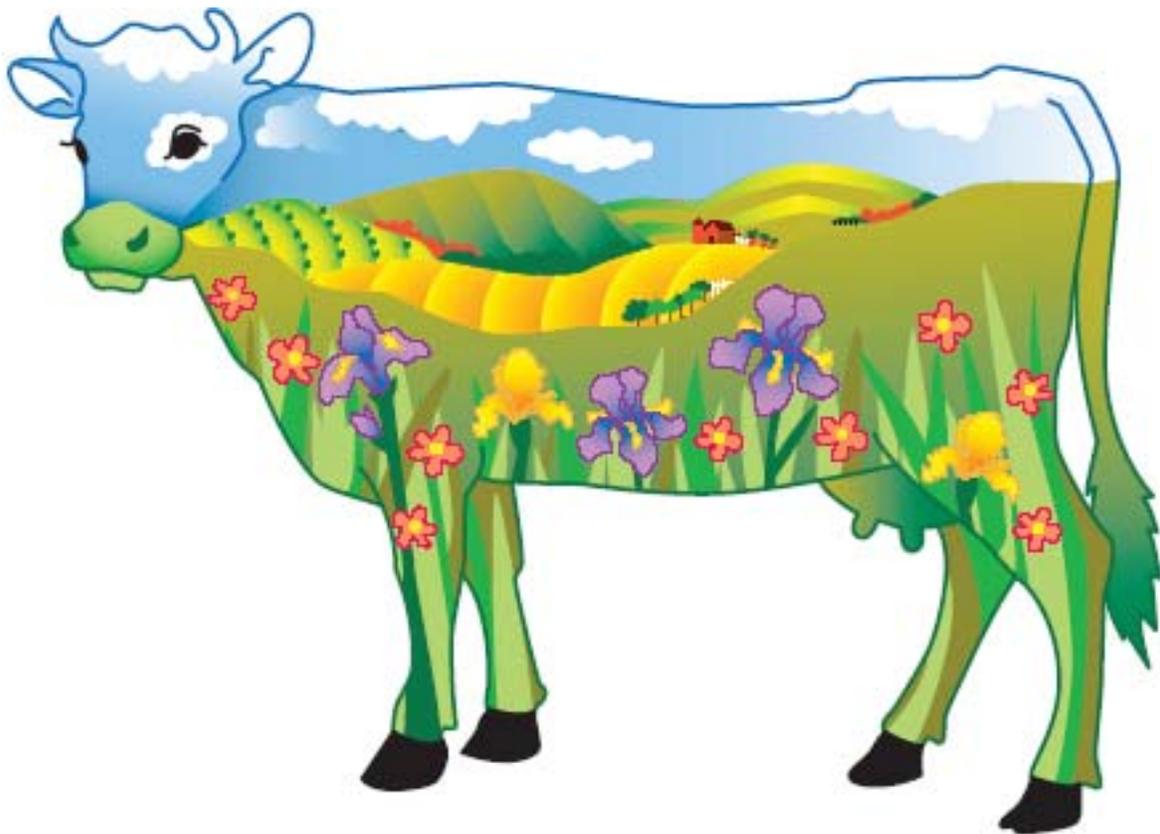


SOLE
Sciences of Life Explorations:
Through Agriculture
Grades 4 and 5



Teacher Guide
Unit: Earthworms on the Job

UNIT PLAN

UNIT TITLE

Earthworms on the Job

MONTH

January

GOAL

Students will be able to identify the anatomy of the earthworm, describe its life cycle, and recognize its habitat.

OBJECTIVES

Students will:

1. Explain information both by written illustration of the anatomy of an earthworm and orally by brief report. (NYS Learning Standard 1: Language for Information and Understanding, Elementary 2)
2. Assess peers' and adults' ideas during a discussion on worms. (NYS Learning Standard 4: Language for Social Interaction, Intermediate 1)
3. Formulate "why" questions to seek greater understanding of earthworms and the experiments they have observed. (NYS Learning Standard 1: Analysis, Inquiry, and Design, Elementary 1)
4. Organize observations of earthworm activities through preparation of simple charts. (NYS Learning Standard 1: Analysis, Inquiry, and Design, Elementary 3)
5. Construct, under teacher supervision, a model of a worm habitat using familiar materials and processes. (NYS Learning Standard 1: Analysis, Inquiry, and Design, Elementary 1- Engineering Design and Standard 5: Technology, Elementary 1)
6. Present and defend explanations of earthworm project observations so that they can be understood by peers. (NYS Learning Standard 1: Analysis, Inquiry, and Design, Intermediate 1)
7. Measure the approximate length of a worm, using charts to display the information. (NYS Learning Standard 3: Mathematics, Elementary 5)
8. Generate, realize, and analyze ideas to present the results of gathering and processing information and observations resulting from participation in an extended math, science and technology project. (NYS Learning Standard 7: Interdisciplinary Problem Solving, Elementary 2)
9. Compose geographically-oriented questions about where earthworms live, and why. (NYS Learning Standard 3: Geography, Elementary 2)
10. Identify the four major parts of the earthworm's anatomy and compare it to that of a human. (NYS Learning Standard 4: Science, Elementary 1)
11. Describe the life cycle of the earthworm. (NYS Learning Standard 4: Science, Elementary 4)

TERMS

These terms are highlighted in bold throughout the lesson pages

Castings - earthworm droppings; a great fertilizer for soil

Clitellum - the smooth, non-segmented band around an earthworm. A cocoon is formed on the clitellum when it is needed for reproduction.

Dormant - describes an inactive period in the lives of some animals and plants when bodily functions slow down dramatically

Habitat - the environment in which an organism lives; it can be small or large depending on the size of the organism or how far it travels

Hatchlings - newly born or hatched animals; generally animals that develop inside an egg

Nutrients - vitamins, minerals, fats, proteins, and other elements that living **organisms** need to grow and survive

Organisms - living plants and animals; includes a range from one-celled living creatures to large animals

Setae - the tiny, bristly, hair-like structures on an earthworm's skin that it uses to move

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real-world application work together to reduce pests such as insects, diseases or weeds.

- 1. Properly identify pests*
- 2. Learn the pest/host biology*
- 3. Sample the environment for pests*
- 4. Determine an action threshold*
- 5. Choose the best tactic*
- 6. Evaluate results*

SAFETY

There are no specific safety concerns for this unit, other than handwashing and general classroom safety practices.

Standards Matrix for this Lesson:

Standards:										
Month	Lesson	Math/Science/and Technology	English Language Arts	Social Studies	HEALTH	ARTS	Food & Fiber Literacy	CDOS	Other Languages	Interconnectedness
2	Earthworms on the job	1:7 e1	1:3, e2	3:16, e2						7:13, e2
		1:7, e3	4:5, i 1							
		1:7, i 1								
		3:9, e5								
		4:10, e1								
		4:10, e4								
		5:11, e1								

Matrix Key:

NYS Learning Standards arranged by Standard: Category, Level

e = elementary i = intermediate

Categories:

- | | |
|---|--|
| 1 Career Development | 10 Science |
| 2 Universal Foundation Skills | 11 Technology |
| 3 Language for Information and Understanding | 12 Interconnectedness: Common Themes |
| 4 Language for Literary Response and Expression | 13 Interdisciplinary Problem Solving |
| 5 Language for Social Interaction | 14 History of the United States and NY |
| 6 Communication Skills | 15 World History |
| 7 Analysis, Inquiry, and Design | 16 Geography |
| 8 Information Systems | 17 Economics |
| 9 Mathematics | |

ADDITIONAL RESOURCES

Wiggly Worms at Work by Wendy Pfeffer and Steve Jenkins ISBN: 0-06-028448

The Wonderful World of Wigglers by Julia Hand and Carolyn Peduzzi ISBN: 1-884430-01-7

Tunneling Earthworms by Suzanne Paul Dell'oro ISBN: 0822537680

<http://www.backyardnature.net/earthworm.htm>

<http://yucky.kids.discovery.com/flash/worm/pg000102.html>

<http://www.nysite.com/nature/fauna/earthworm.htm>

<http://www.uga.edu/srel/kidsdoscience/kidsdoscience-behavior.htm>

SUPPLIES AND EQUIPMENT

Modeling clay (optional)

Ruler

Shallow plastic bowl

Weight scale (postage or food scale)

Empty milk jug

Handful of earthworms (optional) or gummy worms

2 clear plastic containers, one smaller than the other

Screen or piece of nylon stocking

Rubber band

Moist soil from outside

Worms (purchased from a bait shop or dug out of the ground)

Pencil and paper

Magnifying lens

Wide, transparent straws

TEACHER BACKGROUND

Earthworms don't seem to have a lot going on in the looks department. They don't have a face, for one thing, and who knows which end is up?

Like a Farmer

Earthworms have a big impact on soil health, so they are of great economic importance. The earthworm is essentially a farmer. Before man figured out the idea of tilling the soil, this seemingly insignificant character was extremely busy. doing just that

Earthworms create tunnels that help air and water move through soil (similar to plowing and harrowing), and improve its texture for better root growth. The earthworm breaks up and grinds the soil in its gizzard (a storage compartment, located after the esophagus and crop, but before the intestine), which is stocked with grains of sand or fine gravel that act as millstones. The earthworms turn out soil of much finer texture than humans could by raking.

They organically fertilize the earth with their nutrient-rich droppings, called castings. They also keep organic matter near the surface, where it may be incorporated into the soil of the root zone. It drags dead leaves, flowers, and grasses into its burrow and buries animal bones, shells, and twigs; these actions provide food for plants. Down to the depths - sometimes several feet, but usually from twelve to eighteen inches - goes the earthworm, bringing the sub-soil to the surface. This is exactly what a farmer does when plowing deeply.

The earthworm didn't overlook the importance of drainage and the addition of amendments, factors comparatively recent in the development of soil management by man. In its stomach, it adds lime amendments, a product much used by today's farmer.

Body Parts

Earthworms can do a lot without some of the body parts we have. For example, earthworms, like other annelids, do not have a skeleton, but are full of muscles. Students may have seen earthworms moving about despite the fact they have no legs. This is where all that muscle comes in handy! The presence of tiny, bristly "hairs" called setae help the earthworm maintain its position in the ground. Have you ever wondered how an earthworm seems to be holding on when a bird is pulling on it?

Did you know that earthworms have five hearts but no lungs? They absorb oxygen through their skin.

Take students out for a walk around the school building after it has rained. Discuss the conditions earthworms like, and point out that the reason earthworms come to the surface on such occasions is because the ground below is saturated with rainwater. Since the earthworm absorbs oxygen through its skin, it would drown if it did not surface.

Defense Mechanism

With no eyes or ears, how do worms know a predator is near? They are very aware of vibrations in the ground. Earthworms are sensitive to light and will try to avoid it, because sunlight and heat dehydrate them and make it difficult to move. The website Backyard Nature (www.backyardnature.net) claims that if an earthworm's brain is removed, its behavior hardly changes!

Reproduction

Earthworms possess both male and female reproductive organs. After two earthworms mate, each one is capable of producing eggs and cocoons because each worm now has a contribution of sperm from the other. A cocoon is created on the outside of the clitellum, (the smooth, non-segmented band) and as it moves along the earthworm's body, sperm and egg are released at the appropriate time to result in fertilization. The cocoon is then left in the soil, and the earthworm embryos will either develop or remain dormant until conditions are right for survival.

How Earthworms Travel

The secret to earthworm travel lies in two things you can't see just by looking:

1. Though earthworms have no bones, their complex system of muscles enables them not only to wiggle like crazy but also to very quickly alternate between being stubby and thick, and long and slender.
2. Earthworms possess tiny, practically invisible bristles called setae, which are usually held inside their bodies. When the worms want to stay in their burrows, they jab their setae into the surrounding soil, anchoring themselves in place. This comes in handy if a bird grabs a worm's head and tries to pull it from its burrow. The setae anchor the worm so well that it may break before coming out.

Here's how these two features enable earthworms to travel:

Let's say that a worm in its burrow wants to move forward. First, using its complex musculature, it makes itself long. Then it anchors the front of its body by sticking its front setae into the soil. Now it pulls its rear end forward, making itself short and thick. Once the rear end is in place, the front setae are withdrawn from the soil, but setae on the rear end are stuck out, anchoring the rear end. Now the front end is free to shoot forward in the burrow as the worm makes itself long and slender. Then the whole process is repeated. (<http://www.backyardnature.net/earthworm.htm>)

QUESTIONS FOR STUDENTS

Where do earthworms live?

How do they move?

What do they eat?

How do they sense activity in their habitat without eyes, ears or a nose?

How is their anatomy different than other animals?

What is the life cycle of an earthworm?

INTEREST APPROACH ACTIVITIES

BUILDING A WORM HOUSE

Overview

Students learn how the earthworm's body parts enable it to move and that earthworms live in cool, dark, wet places.

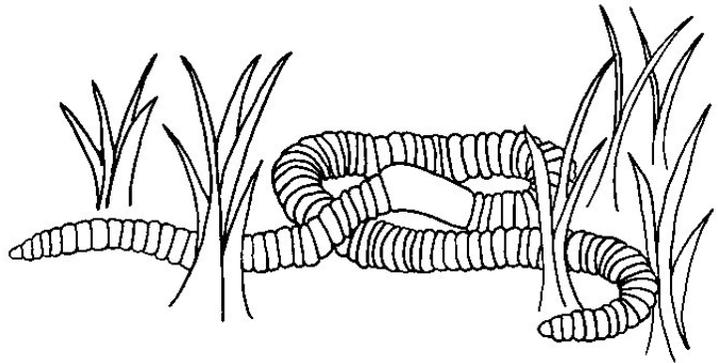
Materials

- 2 clear plastic containers, one smaller than the other
- Screen or a piece of nylon stocking
- Rubber band
- Moist soil from outside
- Worms (purchased from a bait shop or dug out of the ground)
- Pencil and paper
- Magnifying lens

Procedure

1. Place the smaller plastic container inside the larger one.
2. Fill the narrow space between the two containers with soil.
3. Place worms in the soil in the space between the containers.
4. Place screen or stocking over the top of the containers and secure with a rubber band.
5. Observe how the worms move, tunnel, and aerate the soil.

(For related activities refer to student worksheets #3 & #7)



HOW LONG IS A WORM?

Materials

- Rulers
- Worms
- Wide, transparent straws (such as milkshake straws)

Procedure

1. Each student receives one straw, one worm, and a ruler.
2. Measure the length of the worm and record it.
3. Try to get the worm to crawl inside the straw. You may need to run water through the straw to let the worm move more easily.
4. Observe how the worm moves and changes shape as it enters the straw. Record your observations.
5. Once the worm is completely inside the straw, measure it again.
6. Compare the measurements and calculate the difference in length.
7. Discuss as a class how the worm is able to grow and shrink using its muscles and adapt to many different-sized spaces

SUMMARY OF CONTENT

- I. Meet the Worm
 - A. Introduces students to ways in which earthworms improve soil (breaking down organic matter, tunneling, creating castings) and asks them to think about what they already know about earthworms.
- II. Anatomy
 - A. Mouth - front end opening
 - B. Clitellum - saddle-like smooth region near the front that creates the cocoon
 - C. Castings - waste
 - D. Segmented muscular body wall
- III. Anatomy: How Do They Move?
 - A. Earthworms move without legs, using their muscles.
 - B. Introduces the terms setae and clitellum
- IV. Anatomy and Biology
 - A. Anatomy Comparison
 - i. A reading with interesting facts about earthworms, which will help students complete their comparison list and story.
 - ii. You may wish to demonstrate how earthworms hear by using a drum, or how they move by doing the Stretch and Shrink Activity.
 - B. Biology
 - ii. Earthworms are organisms that obtain nutrients by ingesting soil and leaving castings behind.
- V. Life Cycle
 - A. Earthworms have male and female reproductive organs.
 - B. A cocoon for eggs develops outside the Clitellum.
 - C. Cocoons are dormant until it is safe for the hatchlings to emerge.

TEACHING-LEARNING ACTIVITIES

- I. Meet the Worm
 - A. Read this page individually or as a group and discuss the questions as a way to stimulate interest.
- II. Anatomy
 - A. Students may work alone or in pairs (with the option of using resources) to complete this activity, or you may choose to introduce each part and label them as you go.
- III. Anatomy: How Do They Move?
 - A. Follow the included directions to make a model of an earthworm using modeling clay, or draw one in the box, making sure to include segments and a smooth clitellum
 - B. Label the parts of the earthworm.
- IV. Anatomy and Biology
 - A. Anatomy Comparison
 - i. Listen to the reading about earthworms.
 - ii. Complete the comparison list.
 - B. Biology
 - i. Earthworms are organisms that obtain nutrients by ingesting soil and leaving castings behind.
- V. Life Cycle
 - A. Repeat the four stages of the life cycle: Egg, Cocoon, Hatchling, Adult
 - B. Earthworm hatchlings are only about 1/2" long.

SUMMARY OF CONTENT

VI. Habitat

- A. Earthworms live in a habitat of soil that contains air, moisture, and organic matter.

VII. Body to Food Ratios

- A. A math activity for students to discover who eats more food: an earthworm, or a human.

VIII. Test Your Knowledge

- A. Covers points related to anatomy, soil improvement, and the life cycle.

IX. Vocabulary

TEACHING-LEARNING ACTIVITIES

VI. Habitat

- A. Draw a habitat in one jar that Willie would not like, and one he would like in the other.

VII. Body to Food Ratios

- A. Complete this activity as a class to discover whether an earthworm or a student eats more food.

VIII. Test Your Knowledge

- A. Complete this page individually or in pairs to find out how much you learned about earthworms.

IX. Vocabulary

name _____

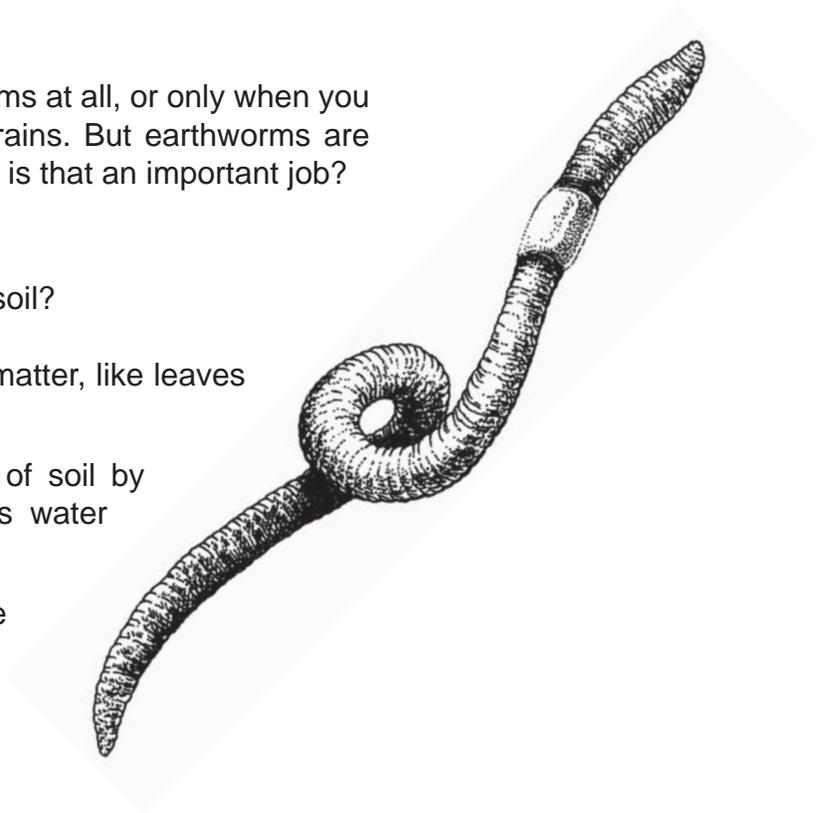
Student Lesson: Earthworms on the Job:

Meet The Worm

You may not think about earthworms at all, or only when you see them on the ground after it rains. But earthworms are very busy improving our soil. Why is that an important job?

How do earthworms improve the soil?

1. They break down organic matter, like leaves and grass
2. They improve the texture of soil by tunneling in it. This allows water and air to get into the soil.
3. Their castings are a type of fertilizer

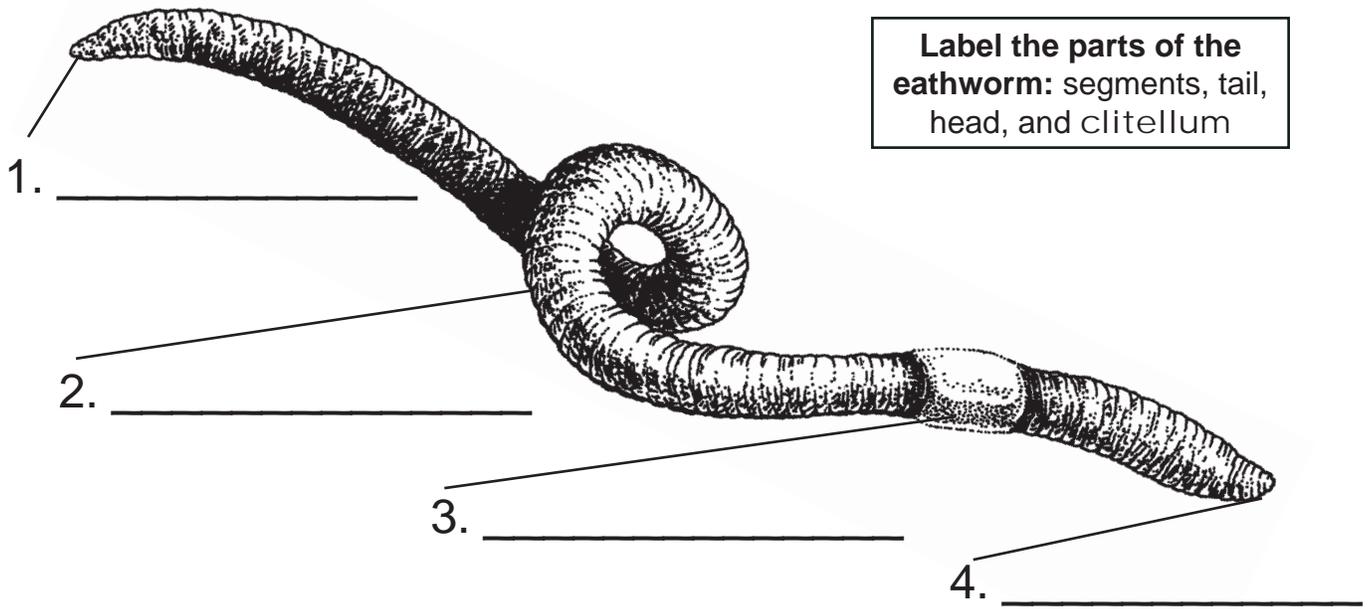


What do you know about earthworms? Circle the questions you think you already know the answer to!

- Where do we find them?
- How do they move?
- What do they eat?
- How do they see at night?
- How many hearts do they have?
- Write your own question here:

name _____

Student Lesson: Earthworms on the Job:
Anatomy, part 1



Solve these four problems. Match each answer to its letter in the key, then use those letters to fill in the boxes and reveal something you have that earthworms don't!

$12 + \underline{\quad} = 16$

$7 \times \underline{\quad} = 63$

$28 \div 14 = \underline{\quad}$

$4 \times \underline{\quad} = 28$

KEY:

1	2	3	4	5	6	7	8	9	10
A	G	T	L	U	H	S	R	E	P

ANSWER:

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
----------------------	----------------------	----------------------	----------------------

name _____

Student Lesson: Earthworms on the Job: Anatomy, part 2

How do they move?

Earthworms move pretty well, even though they don;t have legs. They are flexible and can contract and expand their bodies. They have muscles to do this. Do they have a skeleton?

Earthworms also have very tiny bristles, like hair, on their bodies called setae (pronounced SEE-TEE). Earthworms stretch forward, then use their setae to hold on. Then, they contract their muscles and pull their back ends forward.

Have you noticed how earthworms can sometimes look short and stubby, and sometimes look long and skinny? They use a lot of muscles to do that. Muscles are full of protein, which is why birds like to eat earthworms!

Head

Clitellum

Segments

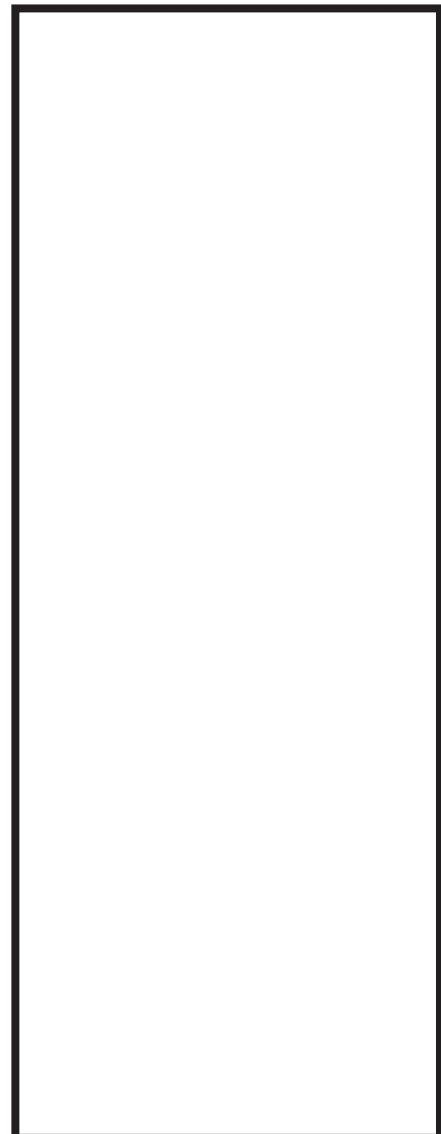
Setae

Tail

Draw an earthworm in this box. Make sure your earthworm has segments and a smooth clitellum (the clitellum is closer to the head than to the tail).

Put tiny setae along its body.

Draw a line from each word to label your worm.



name _____

Student Lesson: Earthworms on the Job: Anatomy and Biology

Anatomy

Listen to a reading about earthworms and complete the list below.

	<u>An earthworm has:</u>	<u>I have:</u>
Eyes	_____	_____
Nose	_____	_____
Hands	_____	_____
Legs	_____	_____
Hearts	_____	_____
Ears	_____	_____

Biology

Earthworms actually eat soil! They can digest the nutrients in it that humans can't. Their castings are left in the soil, and act as a fertilizer for plants. The plants get nutrients from the worms' castings, and we get those nutrients from the plants. Good soil makes good plants, and that's good for all of us!

Earthworms are just one of the soil organisms that break down organic matter in the soil, leaving behind the nutrients that plants need.

The brown earthworms you see in your soil were not always here in New York State. Many years ago, they came to North America by traveling in the soil of plants people brought by ship from Europe. We know that these non-native earthworms seem to be good for our soil. We don't know how they may have affected the worm populations that were already living here.



name _____

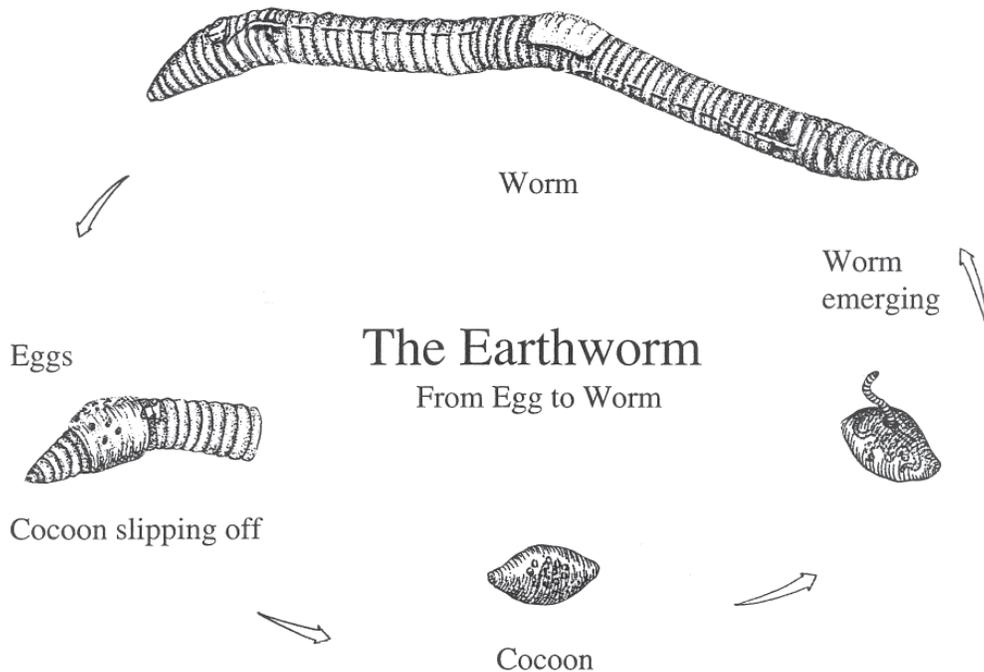
Student Lesson: Earthworms on the Job: Life Cycle

Earthworms have a life cycle that is different from most animals'. Earthworms have both male and female reproductive organs. However, it still takes two earthworms to reproduce.

After mating, a cocoon develops on the outside of the clitellum. The cocoon moves along the worm's body until the right time for an egg to be released to enter the cocoon. Then the cocoon is left in the soil.

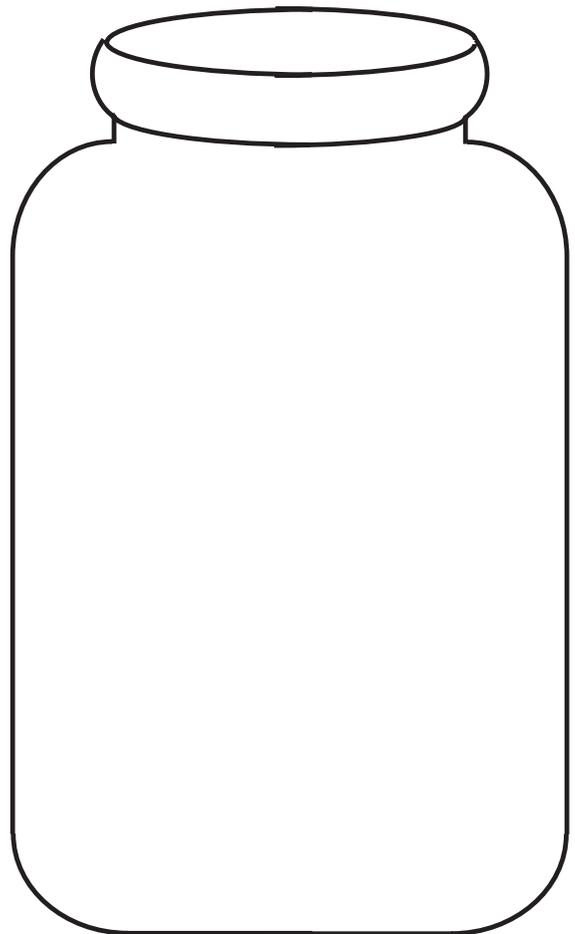
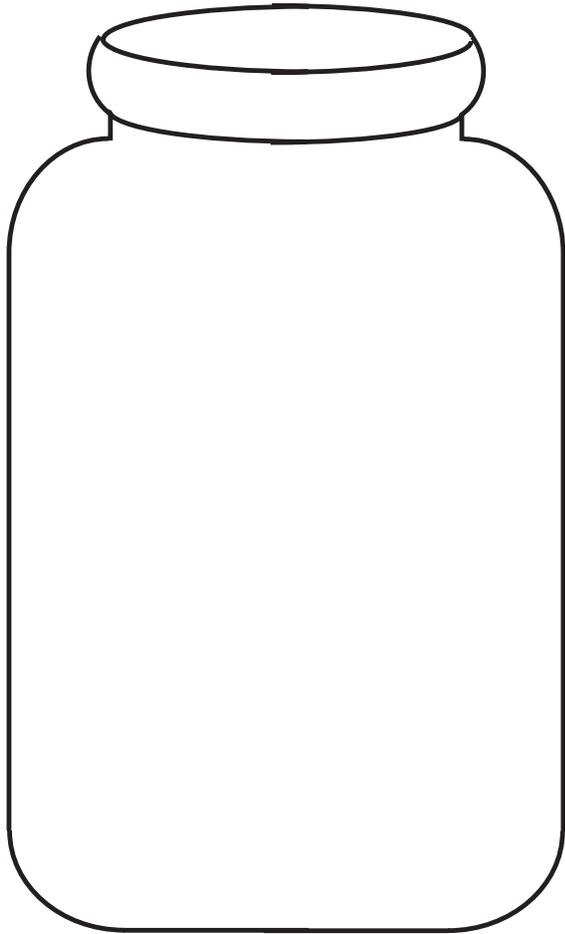
The cocoon can stay dormant for a very long time if the conditions are not good for hatchlings. The new earthworm develops inside the cocoon, changing from white to yellow to brown to red just before it is ready to hatch. It is white when it hatches, and about one half inch long.

Using a ruler, make a line on this paper that is one half inch long.



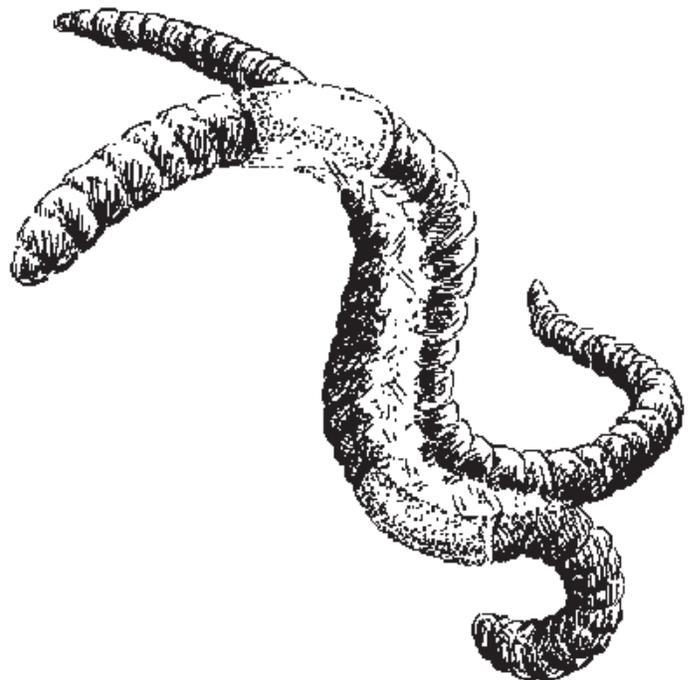
name _____

Student Lesson: Earthworms on the Job:
Habitat



Earthworms like to live in healthy soil that has air, moisture and organic matter in it. They share their environment with other soil creatures and micro-organisms, and they all work together as a team.

Show what you've learned about soil and earthworms. In one jar draw a habitat that a worm would like to live in. In the other jar create a habitat that a worm would *not* like!



name _____

Student Lesson: Earthworms on the Job:

Body to food ratios

Who eats more food, an earthworm or you? Let's do some math to find out.

You will need:

A bowl

A scale

An empty gallon milk jug

Earthworms (you can substitute gummi worms for real worms)



1. Weigh the empty bowl. 1. _____
2. Count your worms and then place worms in the bowl and weigh them together. 2. _____
3. Subtract the weight of the bowl from the weight of the bowl and worms together: (Combined weight - bowl weight = weight of worms alone) 3. _____
4. Determine the average weight of your worms. (Weight of worms \div number of worms = average weight of each worm) 4. _____
5. Earthworms eat enough food each day to equal their weight. Do you think you can do that? Write in your weight, or the average weight of your classmates 5. _____
6. Determine how many gallons of milk you would have to drink to eat as much food as an earthworm A gallon of milk weighs about eight pounds. Divide your weight or the average weight of your classmates by 8 to determine the number of gallons of milk. (Student weight in pounds \div 8 pounds = the number of gallons) 6. _____
7. Look at an empty gallon jug. Can you drink one gallon of milk in a day? How many do you have to drink to equal what an earthworm can eat? Who eats more food, you or an earthworm? 7. _____

Although an earthworm is small and light, it eats more food than you do in proportion to its size. Its ratio of body weight to food intake is huge!

name _____

Student Lesson: Earthworms on the Job
Test Your Knowledge

1. List three body parts that humans have that earthworms do not:

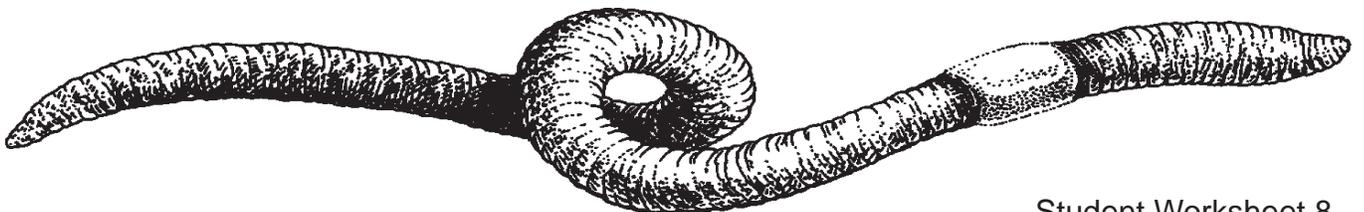
2. How do earthworms improve the soil?

3. What do we like that earthworms try to avoid? _____

4. Baby earthworms are called _____

5. Earthworms have _____ more hearts than humans do.

6. What is one new thing you learned about earthworms?



Student Lesson: Earthworms on the Job!

Vocabulary

Castings - earthworm droppings; a great fertilizer for soil

Clitellum - the smooth, non-segmented band around an earthworm. A cocoon is formed on the clitellum when it is needed for reproduction.

Dormant - describes an inactive period in the lives of some animals and plants when bodily functions slow down dramatically

Habitat - the environment in which an organism lives; it can be small or large depending on the size of the organism or how far it travels

Hatchlings - newly born or hatched animals; generally animals that develop inside an egg

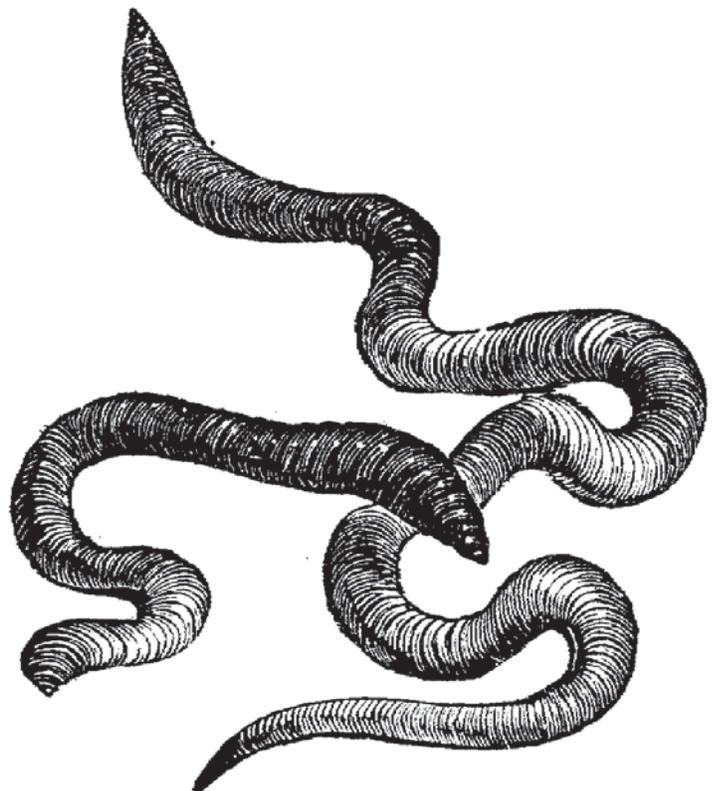
Nutrients - vitamins, minerals, fats, proteins, and other elements that living **organisms** need to grow and survive

Organisms - living plants and animals; includes a range from one-celled living creatures to large animals

Setae - the tiny, bristly, hair-like structures on an earthworm's skin that it uses to move

Integrated Pest Management is a specialized form of environmental management wherein scientific research and real-world application work together to reduce pests such as insects, diseases or weeds.

- 1. Properly identify pests*
- 2. Learn the pest/host biology*
- 3. Sample the environment for pests*
- 4. Determine an action threshold*
- 5. Choose the best tactic*
- 6. Evaluate results*



Teacher Information for Student Worksheets

Student Worksheet 1

Meet the Worm

This activity can be done in a group or individually by each student. We do recommend a group discussion, as students will be introduced to the major concepts. Ask students to volunteer to read the question they added.

Estimated time: 10 minutes.

Student Worksheet 2

Anatomy, part 1

Students can use resources to help them complete this activity on their own, or you may introduce each part and direct them to label as you go. They will have the chance to label parts a second time on their own.

Answers:

1. Head
2. Segments
3. Clitellum
4. Tail

Puzzle Solution: LEGS

Anatomy Discussion:

- The earthworm's mouth is an opening in the front end. A prostomium is a fleshy lobe that extends over the mouth.
- The clitellum is a smooth, saddle-like region closer to the front than the back of the worm. It secretes a fluid which becomes the cocoon. The cocoon will move along the earthworm's body as it provides both eggs and sperm.
- Waste leaves the body at the tail (end, anus).
- Students should recognize that although the earthworm appears smooth, it is segmented.
- The earthworm moves as it manipulates its muscular body wall.

Wormania!, an fun and entertaining video featuring catchy songs about worm anatomy and reproduction, is available at www.wormwoman.com.

Estimated time: 15 minutes

Student Worksheet 3

Anatomy, part 2

If students have access to modeling clay, each one can create an earthworm to place on his paper inside the box. Encourage students to form the clitellum by keeping it smooth, and create the look of segments by using an improvised tool. They will draw lines from each body part to its name. If students do not use clay, they can draw an earthworm in the box and label it.

Remind students they should be able to identify at least four parts of the earthworm: head, tail, clitellum, and segments. This worksheet is useful as an evaluation tool to gauge student mastery and creative expression.

Earthworms expand and contract muscles in each segment to move their bodies. They also have tiny hairs, or bristles, called setae, on each segment (except for the very first and very last). Setae also help earthworms move through soil.

Estimated time: 20 minutes

Student Worksheet 4

Anatomy

Students will listen to a reading for clues to complete the list comparing human and earthworm anatomy. Teachers (or students) may read *Wiggling Worms at Work*, or the reading provided. Note: *Wiggling Worms at Work* is a great resource to use with this activity, but it does not include a reference to the number of hearts, so you must add this into the discussion. At the bottom of the sheet, students will choose one part of anatomy such as “I cannot SEE because I do not have EYES.” They must then consider what they could do if they had five hearts, to answer the last question. Students may think literally, and say, “I could run faster” or symbolically, and say, “I would be able to love more people!”

How do earthworms know if there is trouble nearby? They feel vibrations in the ground. You can demonstrate this to students by having them put their hand on a drum and close their eyes while you lightly touch the drum head.

Students may enjoy the “Stretch and Shrink” game! This is best done in the hallway or outside. To mimic the movement of an earthworm, ask students to line up and hold the hand of the person ahead of them. The line will stretch and shrink to simulate the earthworm’s movement. The first person in line moves forward, each person following until they are stretched out at arm’s length. The last person in line must stay in place. The line will be stretched to its complete length. Then, the first person stays in place, and the rest of the line moves up till they are all standing close together. Students can repeat this action as they make their way down the hall or sidewalk.

Estimated time: 23-30 minutes

Biology

Earthworms have to eat soil to get the nutrients they need. These nutrients are found in organic matter and in the soil itself. Remember, the reason we get vitamins and minerals from our vegetables is because they get them from the soil.

Earthworms eat a large amount of food in a day. They consume their own weight! Ask students to consider what this would mean to them.

The difference between the drawing and a real earthworm is, real earthworms do not have eyes, and their mouths are very difficult to see. You may want to discuss the idea of putting human characteristics on non human organisms and objects (anthropomorphism). It’s simply done for fun!

Estimated time: 5 minutes

Student Worksheet 5

Life Cycle

Earthworms have a very interesting life cycle. The facts are presented in a simple fashion and the teacher can choose how and where to expand. Worms have both male and female reproductive organs but still must mate to produce the next generation. Both worms will create eggs and cocoons after mating. If you choose, you may focus more on the idea of a cocoon left in the soil to protect the growing earthworm. Ask students to reinforce the stages of the earthworm life cycle by repeating it: Egg, cocoon, hatchling, adult.

Estimated Time: 10 minutes

Student Worksheet 6

Habitat

Suggest to students they draw a dry, barren, hot habitat in one jar. In the other, the earthworm would like rich, dark soil, with leaves and sticks in it. They can add some other soil creatures and a plant to shade the soil.

Estimated time: 10-15 minutes

Student Worksheet 7

Body to Food Ratios

This activity gets students thinking about weight, food intake and not making assumptions! You can use real earthworms or gummy candy worms. The relative weights of real and candy worms are not important, because students will be weighing them with a scale. The important thing is that students understand the ratio of food intake to the size of the creature.

It's hard to imagine eating as much food as one's own weight, but many animals do, including the earthworm. Try to have a gallon milk jug to use for an example. Remind students that an eighty-pound student would have to drink 10 gallons of milk to equal his body weight. If you can round up 10 gallon jugs, it would be a very visual lesson!

Combined weight - bowl weight = weight of worms alone

Weight of worms / number of worms = average weight of each worm

Student weight in pounds / 8 pounds = the number of gallons

Estimated Time: 30 minutes

Optional Activity:

Using the blackboard or a large sheet of paper, have students suggest completions to the sentence "An earthworm is interesting because...." Or, expand this to a writing activity.

Student Worksheet 8

Test Your Knowledge

Answers:

1. Eyes, ears, nose, hands, legs, feet
2. They increase organic matter in the soil and therefore add **nutrients**; they tunnel allowing water and **nutrients** to enter the soil; they improve soil texture for roots; they recycle organic matter that has accumulated on top of the soil; their **castings** (droppings) are a type of fertilizer.
3. Sun, sunlight, light, heat
4. **Hatchlings**
5. Four
6. Answers will vary

Student Worksheet 8

Vocabulary provided for review

Lesson Supplements

Anatomy Comparison Reading

May be read by the teacher or a student to complete the anatomy comparison checklist on Worksheet 4

Listen carefully to some interesting facts about earthworms.

As you go about your day, you probably don't think about what's going on underground, do you? Earthworms are on the job, making soil healthy. They are under the lawn, under the park, in the garden, and tunneling through the soil around the trees. I suppose they don't think about us, either!

A famous scientist named Charles Darwin once called earthworms "soil plows." Earthworms move soil around like a plow as they burrow underground. They make places for water to move and soften the soil for plant roots. Do you ever see them on the sidewalk on a rainy day? Why do they only come out when it's wet or cloudy? Does the sunlight hurt their eyes? No; earthworms do not have eyes. The reason they don't come out in the hot sun is because it would dry up their bodies - a worm's skin needs to stay moist!

Earthworms eat organic matter like leaves and dying plants. They may have to taste things to see if they like them. You can tell if something smells good before you eat it, right? But do earthworms have noses?

They sure like to move through the soil. If you were building a tunnel, what would you use? Most people would dig with a shovel or other tools, but the earthworm can't do that. It's not because it can't find a shovel small enough, but because it has no hands! Imagine how it would feel to dig through the soil just by pushing your head forward. The earthworm actually swallows soil as it moves forward. It can take nutrients out of the soil, and it helps to move the soil! Aren't you glad you can use a shovel?

A predator is coming. The earthworm cannot see it, or smell it, or hear it. How does the earthworm know it needs to hide? An earthworm can feel the vibrations in the soil when something is close by. How does the earthworm get to safety? It runs as fast as it can, just like you do. Or does it? How many legs do you have? How many legs does an earthworm have?

So far, it doesn't seem to have many body parts, does it? But the earthworm has you beat in one category. The earthworm has five hearts!

You should now be able to compare some of the anatomy of an earthworm to some of the anatomy of a human like yourself.

