

Lesson 6

Wonderful Worms!

v. 1.0.0



Topic(s)

Rot/Compost
Worms
Decomposers

Duration

Lesson Steps—45-60 minutes
Writing a Narrative—ongoing
Extension Ideas—varies

21st Century Learning Skills

- Collaboration
- Communication
- Creativity
- Critical Thinking

Grade Level(s)

Fourth and Fifth

Materials and Supplies

Students

1. *Wonderful Worms!* rubric (one per student) **Page 6**
2. *Warming Up to Worms* worksheet (one per student) **Page 7**
3. *Worms Inside and Out* handout (one per student) **Pages 8-9**
4. Informational text: select one or two pages (or equivalent) from [The Worm Guide: A Vermicomposting Guide for Teachers](#) from Cal Recycle (one per student) **goo.gl/iKHXsx**
5. Magnifying boxes or glasses (one per group)
6. Worms (one to two per group)
7. Damp paper towel (one per group)

Teachers

1. *Worm Anatomy* visual **Page 10**
2. Interactive whiteboard, document camera, or overhead projector (photocopy transparencies of visuals if needed)

SUMMARY

In this lesson, students will learn about the role of worms as decomposers by observing live red worms in groups and answering questions about worms based on their observations. Students will read grade appropriate informational text about creating a worm compost bin, in order to write a narrative of a red worm's life as a decomposer in a worm compost bin.

CORRELATION WITH STANDARDS

NEXT GENERATION SCIENCE STANDARDS

Fourth Grade

Fifth Grade

Standard and Performance Expectation

4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Disciplinary Core Ideas

LS1.A Structure and Function: Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

ESS3.C Human Impacts on Earth Systems: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

LS1.D Information Processing: Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions. (4-LS1-2)

LS2.A Interdependent Relationships in Ecosystems: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)

ESS2.C Cycles for Matter and Energy Transfer in Ecosystems: Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)

Vocabulary

Blood: The fluid in an animal's blood vessels that carries food and oxygen to the cells throughout the body.

Compost: The process or end result of living organisms digesting and reducing organic material into a dark, rich, soil amendment.

Crop: A pouch-like compartment to store food, before it is ground up, that is found in many birds and insects.

Decomposers: An organism, including fungi, bacteria and invertebrates, that breaks down organic waste.

Decomposition: The process of materials being digested and broken down into simpler substances, making nutrients more available to plants. Decomposition happens all the time in nature and in human managed systems such as compost bins.

Digestion: The process of breaking down food into small molecules that can be absorbed by the intestine and used by the body.

Esophagus: The muscular tube that leads from the pharynx to the stomach (or in some animals to the crop) and pushes food through this part of the canal.

Environment: The conditions or surroundings in which a human, plant, or animal lives.

Gizzard: A second stomach with a thick muscular lining found in birds and other animals where food is ground up. Worms sometimes store small stones in their gizzard to help grind up their food.

Heart: The muscle in animals that pumps blood through the body.

Intestine: The long tube in animals where food is digested and absorbed into the body.

COMMON CORE STATE STANDARDS

Lesson Focus Standards

Writing

W.4.3: Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.

W.5.3: Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.

Supporting Standards

Reading: Informational Text
RI.4.1, RI.4.3, RI.4.7

Writing
W.4.4, W.4.8, W.4.9

Speaking and Listening
SL.4.6

Reading: Informational Text
RI.5.1, RI.5.3, RI.5.7

Writing
W.5.4, W.5.8, W.5.9

Speaking and Listening
SL.5.6

LEARNING OBJECTIVES

Students will...

1. Observe a worm, identify and describe different parts of a worm's anatomy
2. Locate answers within grade-appropriate text
3. Write a narrative containing visual elements to detail a red worm's role as a decomposer

TEACHER BACKGROUND

Dead plants and animals are decomposed by a complex web of small organisms called "decomposers," which includes fungus, bacteria, and insects and other invertebrates (F.B.I.). Decomposers play an essential role in all food chains. Decomposition frees small molecules of fertilizers that can dissolve in the soil and be taken up by the roots of plants, and are essential for plant growth and health.

Worms are incredible decomposers. The worms used for worm composting are surface feeders called *Eisenia fetida* (pronounced eye-SEN-eeuh FE-ti-duh). They are also called "manure worms," "red wigglers," or "red worms." More than 7,000 species of worms inhabit the world, and they have always been important to ecosystems. There are a lot of interesting facts to know about a worm's biology. Their bodies are designed primarily for digestion and reproduction. They prefer dark, damp environments underground, they breathe through their skin, and their bodies are made up of 90 percent water. A worm tunnels through the soil by using a complex system of muscles that move its body segments. Each segment has bristles, called "setae," which are attached to the skin and help with movement. Worms do not have eyes or teeth. They take in food through a muscular mouth opening, and grind it using gritty soil particles held in their gizzard. Worms have five hearts and iron-rich hemoglobin-based blood. They are hermaphroditic, so each worm has both male and female sexual organs. Worms drop a cocoon from which two to four worms may hatch. Eight adult red worms can produce 1,500 offspring within six months under favorable conditions.

In backyard composting bins, worms, other invertebrates, fungus, and bacteria all play an important role. Compost returns valuable nutrients to the soil. Composting is an excellent way to demonstrate the cycle of life, which includes life, death, decomposition, and rebirth. The essential ingredients of a compost pile include the BIG FOUR: browns (carbon), greens (nitrogen), air, and water. Browns are dry or woody plant trimmings, such as wood chips, dried leaves, and straw. Browns are rich in carbon, and provide structure and air pockets in the compost pile. Greens are moist vegetable and fruit scraps, green leaves, and fresh herbivore manure. Greens are rich in nitrogen. Keep in mind that greens aren't necessarily

Organic waste: Waste made of natural materials such as food, leaves, plant trimmings, hair, paper, clothing fibers from plant or animal sources such as cotton or wool, etc.

Pharynx: The part of the canal between the cavity of the mouth and the esophagus.

Vermicompost: Compost produced in a worm composting system. It is a mixture of partially decomposed organic waste, bedding, and worm castings. When finished, it is a balanced, nutrient-rich compost for the garden.

Additional Resources

<http://www.wormendingsunlimited.com/> (Napa) Contact for information and pricing.

<http://www.sonomavalleyworms.com> Contact for information and pricing.

<http://www.growingagreenerworld.com/episode112/> A video on “the power of worms” featuring Sonoma Valley Worm Farm.

Appelhof, M. (1997). *Worms eat my garbage* (2nd ed.). Kalamazoo, Mich., USA: Flower Press.

<http://www.calrecycle.ca.gov/organics/worms/WormSupply.htm#Northern> A list of worm and worm bin suppliers in Northern California.

<http://www.wikihow.com/Make-a-Worm-Compost-System> Step-by-step instructions for setting up a worm compost system.

<http://pbskids.org/dragonflytv/show/wormfarm.html> A video and blog from PBS kids.

<http://www.newsela.com> A website containing current news articles at upper elementary and middle school reading levels. Sign-up required.

<http://www.rewordify.com> A website for translating difficult text into easier reading levels.

green, nor are browns necessarily brown. For example, used coffee grounds are an excellent source of nitrogen and are considered greens. A good compost pile will have approximately half brown materials and half green materials by volume, is moist (but not wet), and allows air to circulate. Decomposer organisms need air and water in order to break down organic matter.

There is also another kind of composting called “vermicomposting,” where red worms are kept in a bin full of moist bedding and fed food scraps, which they rapidly decompose on their own. Worm composting is often a good solution in places where space is scarce and backyard composting bins may be impractical, such as apartments. Worm composting is a fun, low-maintenance way of recycling food scraps and other organic material. Worms eat vegetative food scraps and turn them into a high-quality fertilizer known as “worm castings.” Worms can thrive in a worm composting bin as long as they have moisture, air, bedding, and food. Worm composting can be done inside or outside, requires no turning, is odorless if done correctly, and can be done in small spaces. Worm composting is most appropriate for food scraps (but no meat or dairy), as compared to larger backyard composting bins where grass clippings and other plant materials are recommended.

LESSON STEPS

Activating Prior Knowledge

1. Using a KWL chart, ask students to brainstorm questions they have about red worms and record what students “Know and Want to Know” about red worms.

Building Background

2. Discuss with the students the importance of decomposers. Decomposers play an important role in the food chain because they recycle materials back into living systems by breaking down biodegradable materials into rich compost. Without them, all life would stop because new plants would not have the nutrients needed to grow. Decomposers turn organic waste and plant debris into a rich soil amendment.
3. Ask students if they can think of other reasons why it’s important to compost our organic waste. Many students might not realize that when biodegradable materials, such as food and yard waste, end up in a landfill, they will remain there for many years because of a lack of air, moisture and microbial activity—ultimately producing excess methane, a potent greenhouse gas that harms our environment. Using decomposers, such as red worms, to decompose our food and yard waste is one way we can practice the 4Rs and help our environment every day.
4. Discuss how red worms are recyclers (because they eat organic waste like food scraps and turn it into valuable compost). Tell the students that they are going to investigate the answers to their questions about red worms by observing red worms.

Check for Understanding

5. Students will collaborate with a partner to discuss how decomposers such as red worms are necessary to sustain our environment. Provide a sentence frame, such as “Decomposers are an important part of our environment. They help us by _____. Composting is important because _____.”

Activities

6. Display the lesson rubric, and review the expectations for this lesson.

7. Organize the students into groups of four or more.
8. Distribute the *Warming up to Worms* worksheet to each group member.
9. Explain and discuss the anatomy of worms by using the *Worm Anatomy* visual.
10. Explain that all group members will participate in completing their worksheet by using their handout to help answer the questions.
11. Assign one student in each group to serve as the materials manager with the responsibility of getting and returning materials. Assign a second student in each group to serve as the reporter who will later describe the group's findings to the class. A third student will specialize in using the page *Worms Inside and Out* to help others. A fourth student is assigned the role of recorder.
12. Discuss the appropriate way to handle worms. For example, students should wash their hands before and after handling the worms, treat them with respect, be careful, etc. Write the class rules for handling on the board or a chart.
13. Ask the materials manager from each group to collect a worm on a damp paper towel and a magnifying lens.
14. Ask the groups to observe their worm using a magnifying lens and draw or sketch their worm on the worksheet.
15. Distribute the *Worms Inside and Out* handout to each student.
16. Ask the group to complete the remaining questions on their worksheet.
17. Ask the reporters from each group to share one or two answers from their worksheets. If there are any questions that remain unanswered from the KWL chart, brainstorm ways to research the answers to those questions.
18. Once you have completed reviewing their answers, use the KWL chart to record what the student learned about red worms.
19. Distribute a copy of teacher-selected page(s) from *The Worm Guide* to each student. Students will first read the text individually and silently. For a second read, the teacher or an on-level student(s) can read portions of the text aloud. Students will read the text a third time, focusing on highlighting and annotating the text to show the information that is the most important to understanding a red worm's life and contributions as a decomposer in a worm bin.

Wrap-Up

20. Students will write a narrative (one or more paragraphs) that details a red worm's life in a worm compost bin. This narrative can be from the first-person perspective of the worm or the third-person perspective (about the worm). Students will select and paraphrase the most important information learned by reading text from *The Worm Guide*. Remind students that their writing should cite evidence from the text. Point out that informational text often contains visuals to help a reader better understand what the author is explaining. Because their narrative is going to tell a story, yet also demonstrate understanding of how a red worm contributes to creating compost, their narrative will also contain visual elements to help the reader understand the information presented.
21. Allow students voice and choice in what visuals they want to add to own their narrative that would best help a reader understand the information. This could be a chart, a diagram, or even a series of photographs. Allow students to gather information from digital resources when appropriate.

22. Note: Writing a worm narrative requires students to read, take notes on and look for evidence within expository text, conduct additional research if necessary, cite sources, and plan and write the narrative. You may choose to give the assignment in stages, stopping at various points to provide additional scaffolding and direct instruction on isolated skills.
23. Depending on student and teacher preference, final products can vary from a typed piece of writing with visuals added, a PowerPoint presentation, a brochure, a magazine article, a blog entry, or a video recording.
24. Complete the “L” column of the KWL chart by brainstorming and recording what students learned about red worms. Students will collaborate with a partner using a sentence frame (e.g., “I learned that red worms ____.”) Encourage students to focus on red worms’ significance as decomposers and recyclers, rather than on low-level facts.

Extension Ideas

- Have students review the KWL chart and identify questions they have about worm behavior. Next, ask them to set up an experiment to test one of their questions about worm behavior using the scientific method.
- Follow the steps and set up a worm bin in your classroom! (See additional resources.)

REFERENCES

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- Alameda County Waste Management Authority and Recycling Board. *Doing the 4Rs – A Classroom Activity Guide to Teach Reduce, Reuse, Recycle and Rot*. 2010. Web. 18 November 2014. <<http://www.stopwaste.org/recycling/schools/curriculum-and-videos>>.
- State of California Integrated Waste Management Board (now CalRecycle). *The Worm Guide: A Vermicomposting Guide for Teachers*. June 2004. Web. Accessed 21 July 2014. <<http://www.calrecycle.ca.gov/Publications/Documents/Schools%5C56001007.pdf>>.
- City of Napa, County of Napa, and Napa Recycling & Waste Services. *Reduce, Reuse, Recycle Guide for Napa County*. 2016. Web. 19 July 2016. <<http://schools.naparecycles.org/wp-content/uploads/2016/09/Napa-Recycle-Guide-2016.pdf>>.

Wonderful Worms!

Rubric

A rubric is a scoring tool that helps you understand how your work will be evaluated. This rubric is provided to show you the expectations for your performance and engagement during the lesson based on specific tasks.

Name _____ Date _____

Task	4	3	2	1
Warming Up to Worms Worksheet (Individual)	Individual responses are detailed and complete.	Individual responses are mostly detailed and complete.	Some individual responses are complete, though others lack detail.	Individual responses lack detail or are incomplete.
Warming Up to Worms Worksheet (Group)	Students work together, fulfill their group role, follow directions, and respect the live worms.	Students work together, fulfill their group role, follow most of the directions, and respect the live worms.	Most group members fulfill their group role; group may require additional directions, or reminders.	Group has trouble working together, or does not respect the materials and/or worms.
Narrative (Individual)	Narrative contains engaging and detailed story elements such as characters, setting, and sequence of events. Additionally, student incorporates evidence from informational text to demonstrate how a red worm creates compost. Visual elements contribute to the reader's understanding of the subject matter.	Narrative contains story elements such as characters, setting, and sequence of events. Additionally, student incorporates some evidence from informational text to demonstrate how a red worm creates compost. Visual elements contribute to the reader's understanding of the subject matter.	Narrative contains some story elements such as characters, setting, and sequence of events. Student incorporates limited evidence from informational text to demonstrate how a red worm creates compost. Visual elements are missing, or do not contribute to the narrative.	Narrative lacks basic story elements. Student does not use evidence from informational text to demonstrate how a red worm creates compost. Visual elements are missing, or do not contribute to the narrative.

Wonderful Worms!

Warming Up to Worms

Name _____ Date _____

1. Draw or sketch your worm:

[Large dashed rectangular box for drawing a worm]

2. What color is the worm?

3. What shape is the worm? Describe it.

4. How does the worm's skin feel?

5. Is there a difference between the top side and the bottom side of a worm? Describe why both sides are like.

6. Can you tell where the front end of the worm is and where the tail is? How do you know?

7. Does a worm have the following:

a. Ears? Yes No

b. Eyes? Yes No

c. Legs? Yes No

d. A nose? Yes No

e. A mouth? Yes No

8. Describe the similarities of a worm's anatomy to a human's anatomy.

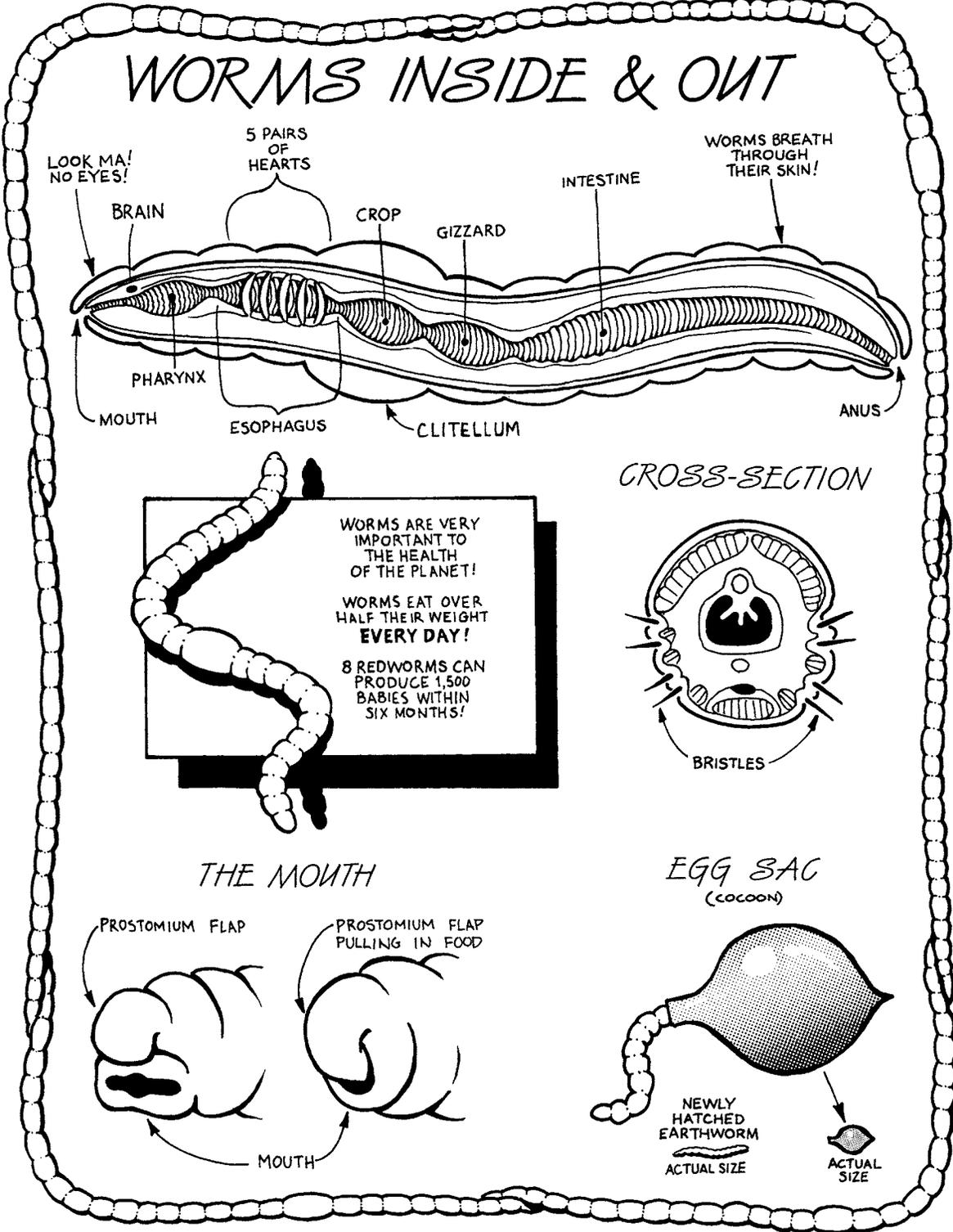
Describe the differences.

9. How does your worm move? Describe it.

10. Do you have an adult or immature worm? Describe the difference.

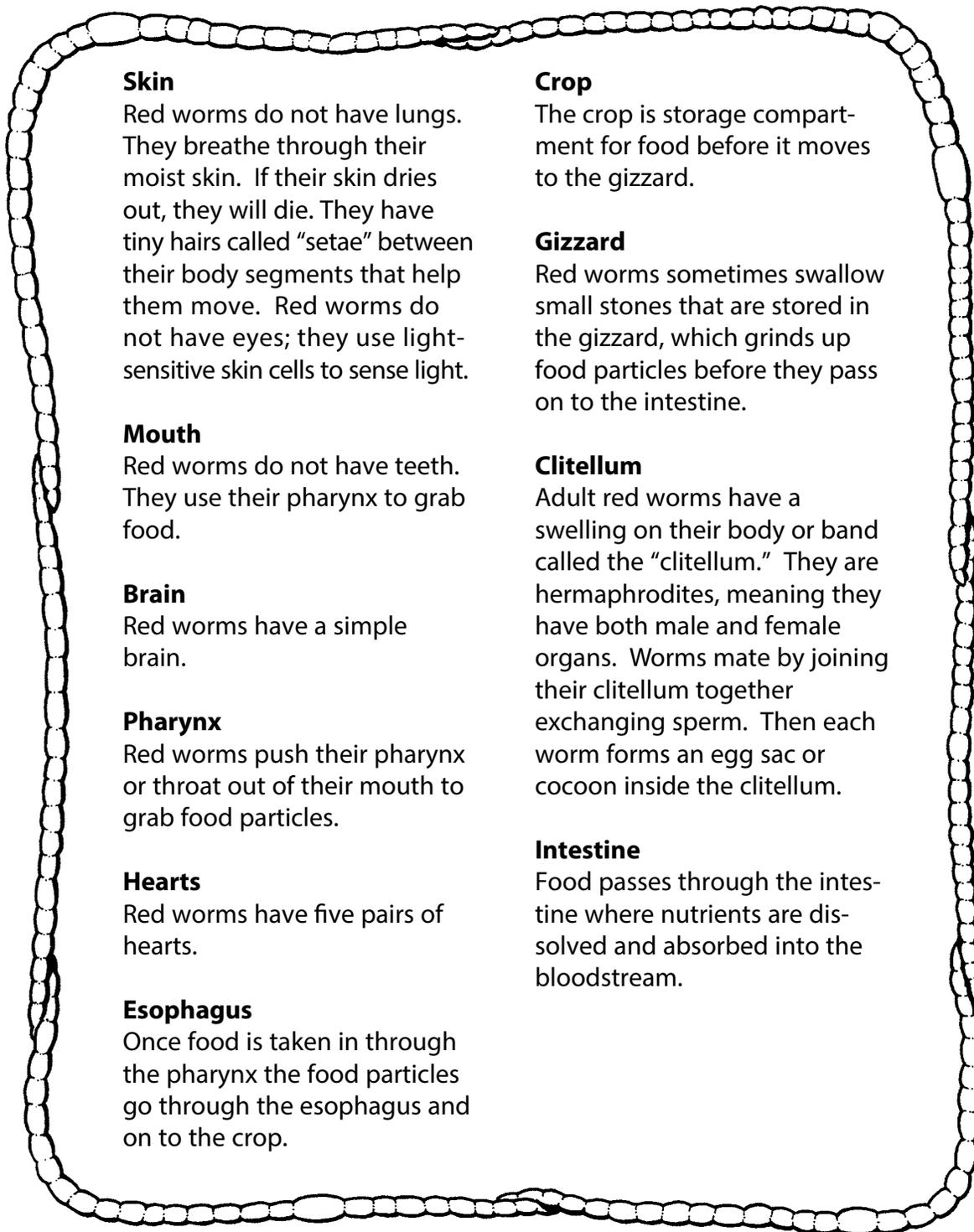
Wonderful Worms!

Worms Inside and Out



Wonderful Worms!

Worms Inside and Out

**Skin**

Red worms do not have lungs. They breathe through their moist skin. If their skin dries out, they will die. They have tiny hairs called "setae" between their body segments that help them move. Red worms do not have eyes; they use light-sensitive skin cells to sense light.

Mouth

Red worms do not have teeth. They use their pharynx to grab food.

Brain

Red worms have a simple brain.

Pharynx

Red worms push their pharynx or throat out of their mouth to grab food particles.

Hearts

Red worms have five pairs of hearts.

Esophagus

Once food is taken in through the pharynx the food particles go through the esophagus and on to the crop.

Crop

The crop is storage compartment for food before it moves to the gizzard.

Gizzard

Red worms sometimes swallow small stones that are stored in the gizzard, which grinds up food particles before they pass on to the intestine.

Clitellum

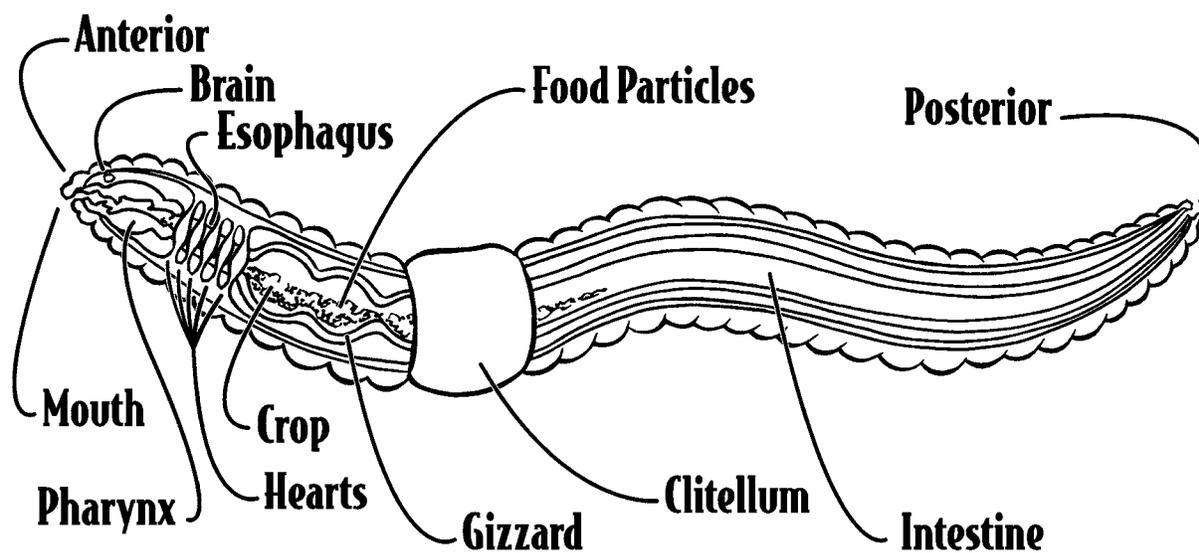
Adult red worms have a swelling on their body or band called the "clitellum." They are hermaphrodites, meaning they have both male and female organs. Worms mate by joining their clitellum together exchanging sperm. Then each worm forms an egg sac or cocoon inside the clitellum.

Intestine

Food passes through the intestine where nutrients are dissolved and absorbed into the bloodstream.

Wonderful Worms!

Worm Anatomy



ANTERIOR: The head is located at the anterior end of the worm's body. The anterior end is closer to the clitellum and usually more pointed than the posterior end. Red worms have no eyes and cannot see. They use light-sensitive skin cells at the anterior end of their body to sense light and move away from it.

BRAIN: Red worms have simple brains that help direct body movement when exposed to light.

CLITELLUM: Adult red worms have a distinct swelling called a "clitellum" located closer to the anterior end of the body. Each worm has a set of both male and female sexual organs. Two worms must join up to mix the sperm and egg. During this process, the clitellum releases a sticky secretion that holds the sperm and egg together. This secretion will eventually harden. As the worm wriggles backwards out of the hardened shell, the egg and sperm are deposited, and the secretion seals together to form a cocoon shaped like a lemon.

CROP: Red worms have a crop or storage compartment for food before it moves to the gizzard.

ESOPHAGUS: Once food is taken in through the pharynx the food particles go through the esophagus and on to the crop.

FOOD PARTICLES: Soil or organic material passes through a red worm's tube-like digestive system before it is broken down and excreted as castings or vermicompost.

GIZZARD: A red worm has a tube-like digestive system. As food particles are ingested, they enter the esophagus and may be stored in the crop before going to the gizzard. Red worms often store small rocks in the gizzard to help grind up food particles before they pass them on to the intestine.

HEARTS: Red worms have five pairs of hearts.

INTESTINES: As food passes through the intestine, nutrients are taken in and the food is digested.

MOUTH: Red worms do not have teeth. They use their highly muscular mouth, pharynx and gizzard to break up food particles. A sensitive tongue-like lobe located above the mouth called a "prostomium" is used as a sensory device.

PHARYNX: Red worms push their pharynx or throat out of their mouth to grab food particles.

POSTERIOR: The tail end of the worm.