

LESSON 2 How Do Scientists Study Living Things? =====

Objectives

When students have completed this lesson, they will be able to:

- state what is meant by biology in general and by ecology in particular;
- order, in sequence, the steps that scientists often follow in their work, from making observations to producing a conclusion;
- define CER (claim, evidence, reasoning)
- distinguish between how scientists and laypeople use the term “theory.”
- explain how scientists know that living things come from other living things.

Exploring Science / Historical Steps

Redi’s experiments were among many in the history of science that helped to dispel the belief in spontaneous generation, the idea that nonliving materials could give rise to (“generate”) living things, such as frogs, eels, and flies.

“All life from life” is one of the basic ideas in the science of biology. How, then, did the very first living things originate? As students will discover in Unit 3 Lesson 1 (“What Chemicals Make Up Living Things?”), the conditions on earth in its early history were different than they are now. It is possible that living things developed from chemical changes that took place under the conditions that existed early in the Earth’s history. Those conditions are no longer present on Earth.

The “Want more?” challenge will lead students to the famous experiment by Pasteur. Biological supply houses sell kits that support the demonstration of this simple, yet ingenious experiment. It would certainly be a good topic for discussion, or for a motivated student’s research / presentation.

Students should answer **B** to the inference question at the end of this section. Ask them how they think scientists would investigate to determine the correct answer to the question. This discussion should lead directly to the main lesson.

The Ways of the Scientist

A video showing living, moving microbes would be useful in teaching this lesson. You will probably want to save students’ observation of living microbes (with microscopes) until Unit 2.

Have students share their own experiences with the “sudden” appearance of living things such as fruit flies around over-ripe bananas. You might want to have students look at the photos of these insects on page 237. In many cases, it is not immediately obvious where organisms came from. Ask why the microscope was such a key development in demonstrating that all life comes from life.

The difference between scientists’ and laypeople’s interpretation of the word “theory” is worth clarification. A particularly good example, of course, is the theory of evolution; teachers should anticipate that some students will have been taught that evolution is “just a theory.” You might stress to students that this theory is dealt with in detail in Unit 9, and invite motivated students to view this material - particularly lessons 8, 9, and 10.

This lesson contains a good deal of information, but it is likely that students have been introduced to the scientific method previously. If you feel your students are ready to dig deeper, you might have them try the CER method. The “claim / evidence / reasoning” approach is widely used to help students analyze outcomes - or to simply think critically about stated opinions.

To Do Yourself

Store bought bread that is clearly labeled “no preservatives added” may be used instead of homemade bread. The “packaged” bread should have a label indicating that calcium propionate or some other chemical has been added as a preservative. Such preservatives slow down, but do not totally eliminate, the growth of mold.

The reproduction of molds by spores is treated in Unit 7, Lesson 2 (“How do Molds Reproduce?”). You may wish to have students refer to the illustration on page 172 to see what the microscopic “bits” of mold look like. Explain that spores have the same function as seeds do for higher plants - to start new organisms (where conditions for growth are favorable).

Questions

1. the bread with no preservative added
2. Some microscopic “bits” of mold from the air may have landed on the bread.
3. Answers will vary, but students should conclude that one of the breads contains a chemical that inhibits the growth of mold, while the other does not.

Review

Please note: I have not made the answers available online, on the small chance that a student might discover them. Of course, the answers to these questions will be included in the version of the Teacher's Guide provided to teachers who purchase the text.

Reinforce / Enrich

On my TPT store I provide a [free concise summary of the way scientists solve problems](#).

The following video provides a good overview of the key steps of the scientific method and a description of independent and dependent variables.

- [Teacher's Pet / The scientific method](#) [4:05]

From the 0:40 to 2:51 mark of the following video the narrator makes clear that the "steps" of the scientific method do not always occur in a specific sequence.

- [Study.com / The scientific method: steps, terms, and examples](#) [4:24]

The following video reinforces the basics of the CER method (claim, evidence, reasoning) for producing a conclusion. [Note: The video incorporates how pond turtles' survive in the winter - a nice foreshadowing of the unique role of water that is elaborated upon in Unit 3 Lesson 1, page 67.]

- [The Amoeba Sisters / CER in biology](#) [7:38]