

Standard Set 2. Life Sciences

2. All organisms need energy and matter to live and grow. As a basis for understanding this concept:

2.a. *Students know* plants are the primary source of matter and energy entering most food chains.

2.b. *Students know* producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs and may compete with each other for resources in an ecosystem.

2.c. *Students know* decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals.

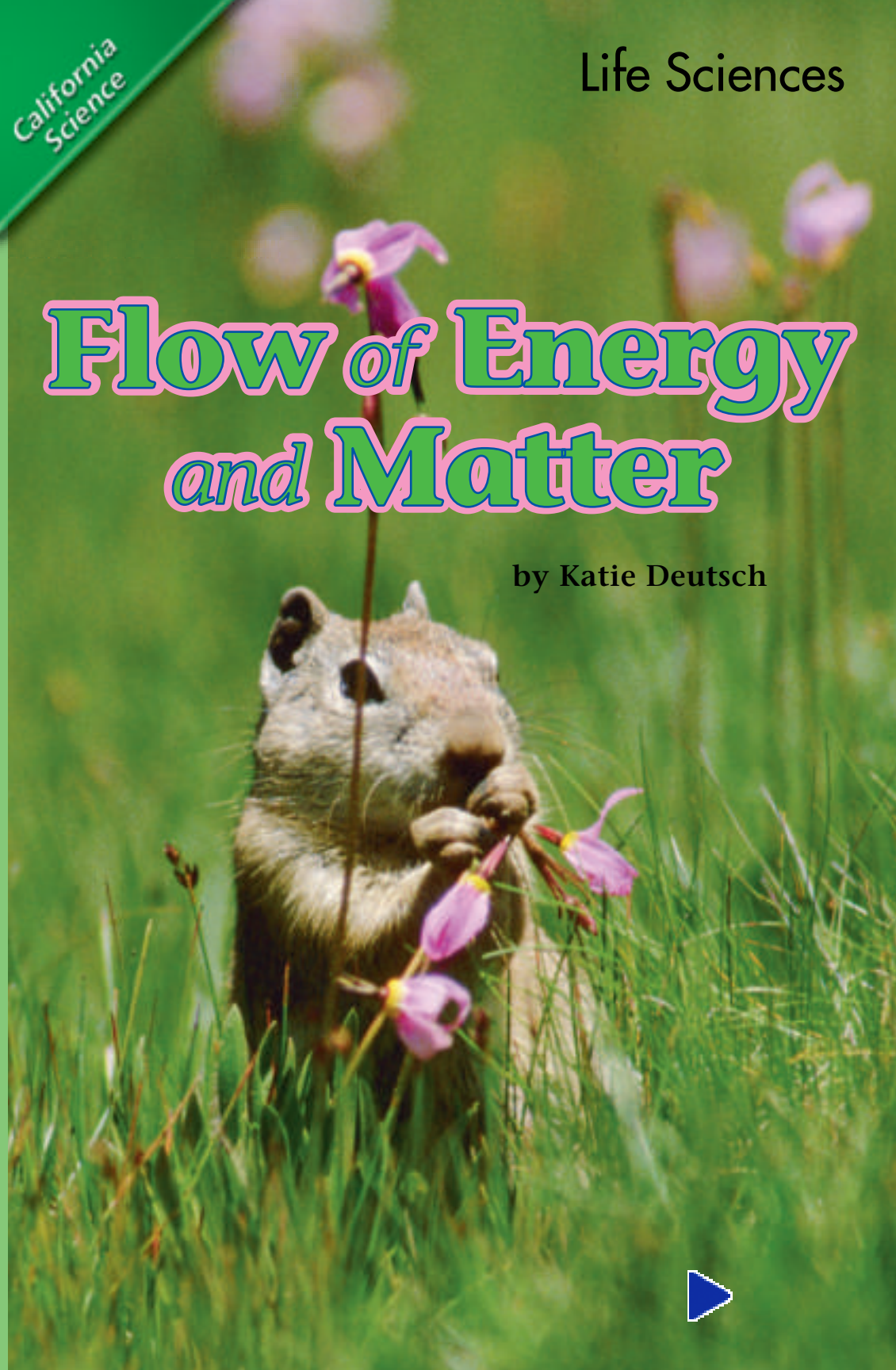
Standard Set 3. Life Sciences

3. Living organisms depend on one another and on their environment for survival. As a basis for understanding this concept:

3.d. *Students know* that most microorganisms do not cause disease and that many are beneficial.

Flow of Energy and Matter

by Katie Deutsch



| Genre | Comprehension Skill | Text Features | Science Content |
|------------|---------------------|---|----------------------------|
| Nonfiction | Follow Instructions | <ul style="list-style-type: none"> • Captions • Diagrams • Call Outs • Glossary | The Roles of Living Things |

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Vocabulary

carnivore
 consumer
 decomposer
 ecosystem
 food chain
 food web
 herbivore
 microorganism
 omnivore
 producer

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How does energy flow?

Energy in Living Things

An **ecosystem** is all the living and nonliving things in an environment and the many ways they interact. One kind of ecosystem is a redwood forest.

All living things need water, nutrients, and enough space. They need temperatures that let them grow and make young living things.

All of these things take energy. Living things use energy to grow and to stay alive.

A redwood tree lives in a forest ecosystem.



Sources of Energy

Where does all this energy come from? Most of it comes from the Sun. The Sun's energy flows through all living things in an ecosystem. The energy changes form as it flows through an ecosystem.

The flow of energy starts in plants. Green plants use energy from the Sun to change carbon dioxide and water into food and oxygen. This is called *photosynthesis*. Plants live and grow on the food they make. Some of the energy is stored in the roots, leaves, and fruits of the plant. Plants are called **producers** because they make their own food. Green plants are the only producers in most ecosystems.



This plant uses energy from the Sun to make food.





How Energy Flows

People and animals must get energy by eating, or consuming, plants or other animals. **Consumers** are living things that eat other living things as food.

The Sun's energy is stored in plants. When animals eat plants, they get that energy. **Herbivores** are animals that eat plants. Animals use the energy they get from eating to live and grow. Some energy gets stored in their bodies.

Carnivores are animals that eat other animals. As one animal eats another, the stored energy flows from one to the other. Some animals are **omnivores**. They eat both plants and other animals. *Scavengers* eat dead and decaying plants and animals.

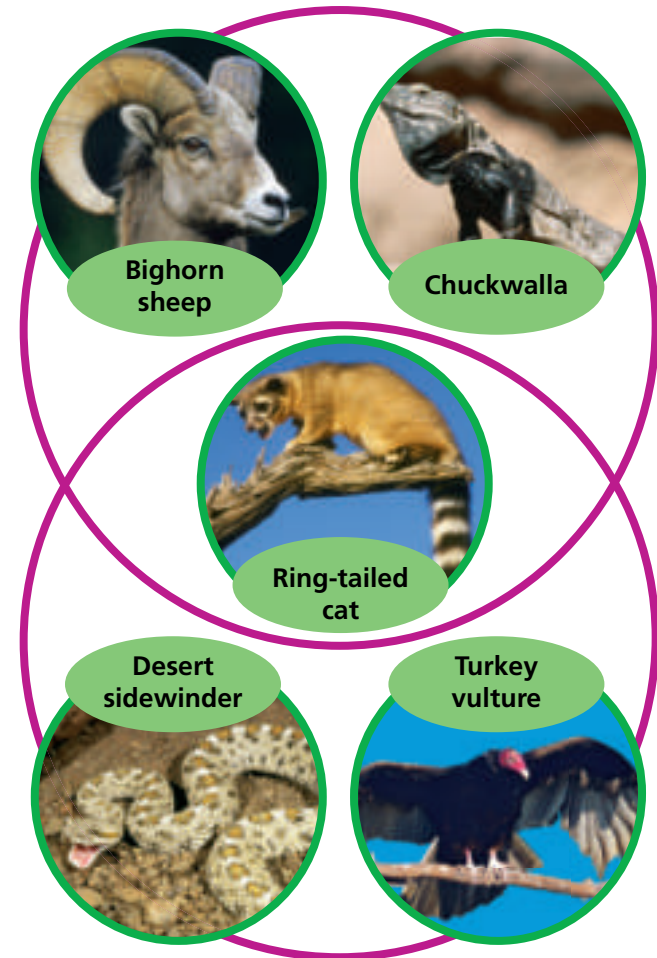
This turkey vulture scavenges for animals that have already died.



Plants and animals leave wastes. They also die.

Decomposers are organisms that break down plant and animal waste and remains. Some insects, fungi, and bacteria are decomposers.

Look at the diagram of the Mojave Desert ecosystem. The bighorn sheep and chuckwalla are herbivores, while the ring-tailed cat is an omnivore. The desert sidewinder is a carnivore, and the turkey vulture is a scavenger.





How does matter flow?

A redwood forest has a lot of *biomass*. Biomass is the mass of living matter. Plants give the energy and the biomass that most other living things need.

Along with sunlight, plants also take in carbon, nitrogen, oxygen, and hydrogen. They get these elements from the soil, air, and water. They use them to make their living parts. When animals eat plants, energy and matter go from the plants to the animals.

In a **food chain**, organisms transfer energy by eating and being eaten. Look at the food chain shown on this page and the next. Which living things are producers? Which are consumers?



Energy comes into the food chain as sunlight.

Meadow grasses and other plants are producers.



Energy and matter flow from plants to animals such as mice. They are primary consumers.



Golden eagles are secondary consumers.



Links in a Food Chain

A food chain's first link is a producer. The producer in nearly all ecosystems is a plant.

Mice and golden eagles are part of this food chain. Mice also eat the grasses' seeds. Mice are first or *primary* consumers in this food chain. They get energy and matter from the grasses.

A *predator* is an animal that hunts other animals for food. The hunted animals are its *prey*. The golden eagle is a predator. The mice are its prey. A predator gets its energy and matter from eating its prey.

Food chains may have consumers at different levels. The golden eagle is at the top of this food chain. Animals at the top of a food chain have few predators.

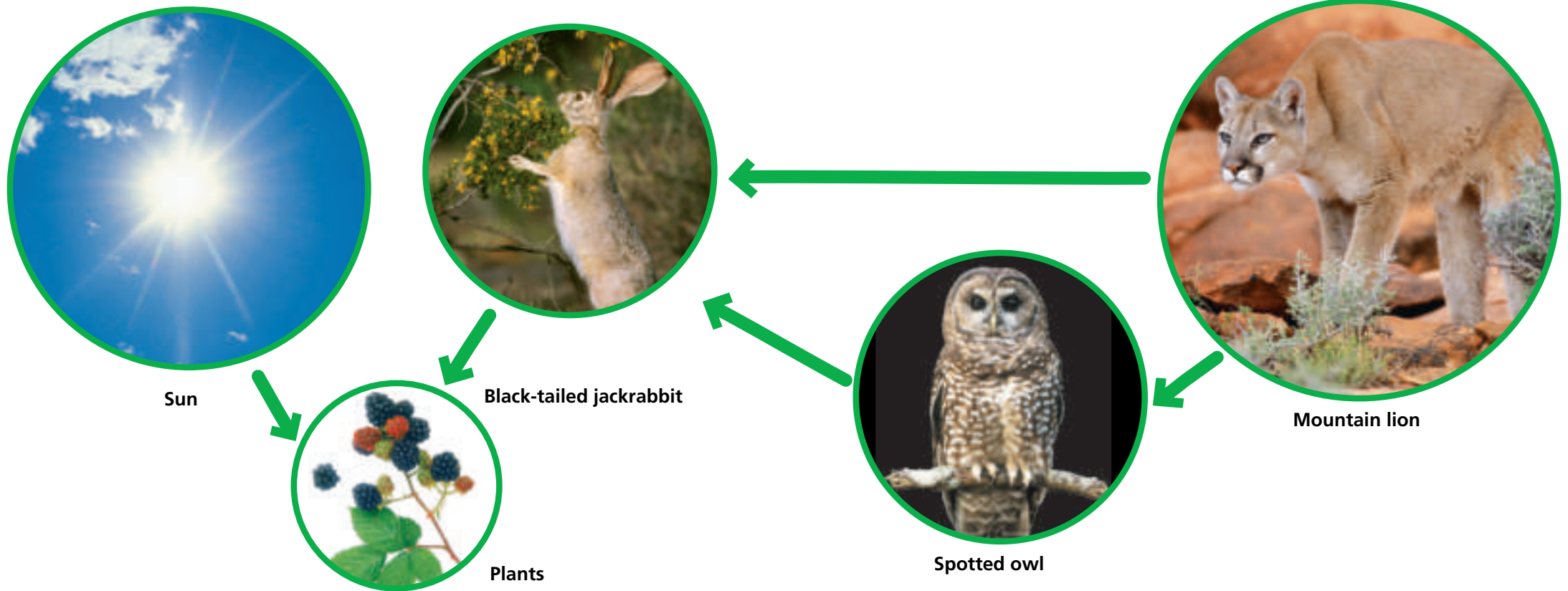


Food Webs

Many food chains cross and connect in one ecosystem. A **food web** is a system of overlapping food chains. Energy and matter flow through the many branches of a food web.

What's Missing

This picture leaves out a big part of an ecosystem. Decomposers break down dead plants, animals, and their wastes. The decomposers return matter to the soil and air. Then the producers can use it all over again.



Changing Food Webs

What would happen if the ecosystem suddenly had fewer mountain lions? More black-tailed jackrabbits would survive. In fact, more herbivores of all kinds would live.

More herbivores would mean more food for spotted owls. Also, more plants would be eaten. This would lead to fewer plants, and soon, fewer herbivores.

All living things depend on other living things to live. A change in a food web affects all parts.





What are decomposers?

The Role of Decomposers

Ecosystems need decomposers. Without them, an ecosystem's nutrients would get used up. Everything would die.

Decomposers break down wastes and dead plant and animal material. They live on the food energy that can still be found in these materials. They return nutrients to the soil and water. Living things then use those nutrients.

Recycling Dead Matter

Decomposers return resources to the air and soil as they eat dead material. As they eat, decomposers make space for new living things.



Decomposers are breaking down this saguaro cactus.



Types of Decomposers

Did you ever find a brown spot on a peach? Decomposers make these spots. Slugs, earthworms, and flies are decomposers that are big enough to see. Bacteria and fungi are decomposers that are too small to see. A living thing too small to see without a microscope is called a **microorganism**.

Decay in Ecosystems

Rot, or decay, is part of any ecosystem. If things never rotted, dead organisms and wastes would pile up. Nutrients would not be returned to the ecosystem.

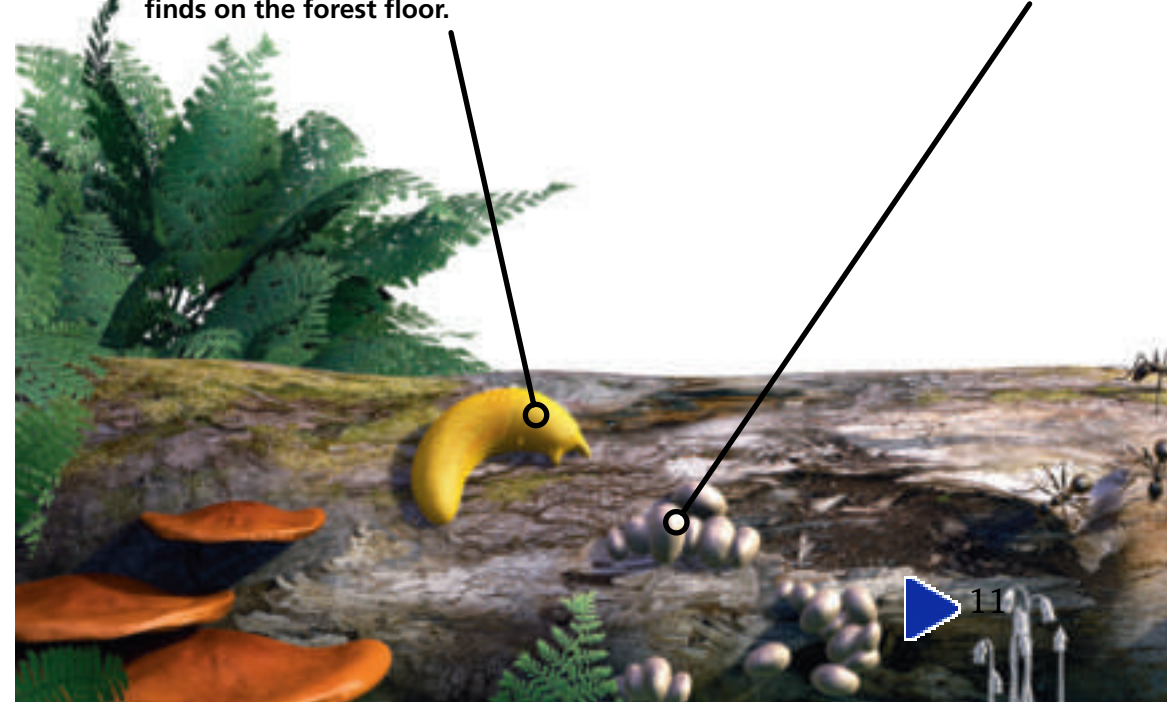
A warm temperature, water, and oxygen speed up decay. Scavengers such as insects also help the decomposers by feeding on dead plants and animals.



The banana slug is a decomposer. It eats material it finds on the forest floor.



Slime mold decomposes matter and eats bacteria.





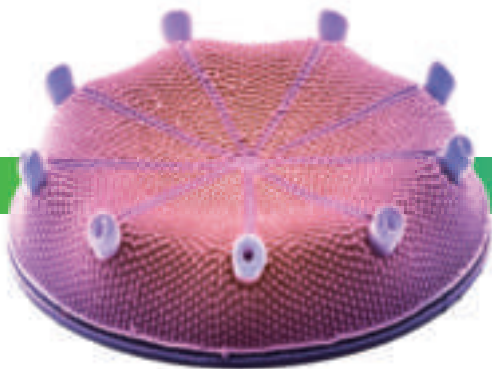
What is the role of microorganisms?

Microorganisms

Microorganisms live in the air, soil, and water. Some are on your skin and inside your body. Most of them won't hurt you. Many help living things survive.

There are far more tiny life forms in an ecosystem than ones you can see! Tens of thousands of tiny protists may float in a liter of pond water! Many protists have only one cell. Some, such as algae, make their own food. Protists are the basic producers in food webs in the waters on Earth. Other protists clean the water by eating other microorganisms.

Diatoms, such as the two shown here, are producers. These microorganisms have hard cell walls.

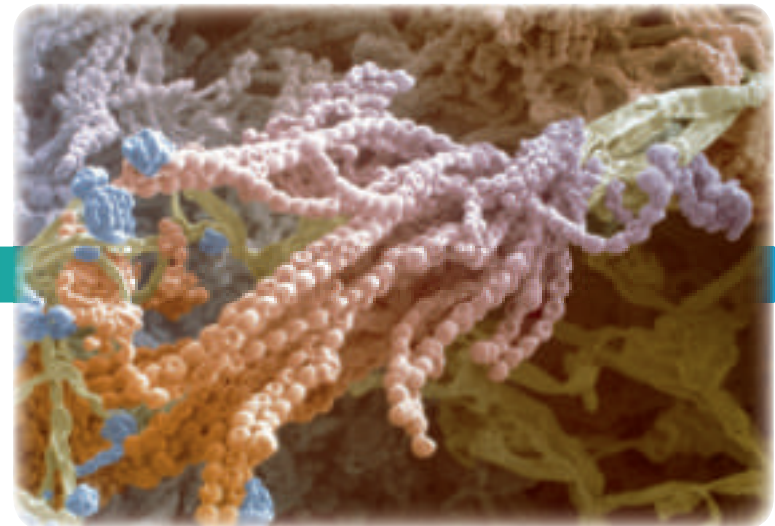


Other Helpful Microorganisms

You have many helpful microorganisms in your body. Bacteria in your intestines help you digest your food. They also crowd out bacteria that could make you sick. You can get helpful bacteria by eating certain dairy products. Herbivores such as cows have bacteria in their stomachs and intestines. Bacteria help the animals digest the plants they eat.

Have you seen blue-green mold on a rotting orange? This is *Penicillium* mold. In 1928, the Scottish scientist Alexander Fleming realized that *Penicillium* mold makes an antibiotic. Antibiotics kill some of the bacteria that can make you sick. Since this discovery, antibiotics have been used as medicine. Other kinds of *Penicillium* are used to make some cheeses.

This is what a *Penicillium* fungus looks like if you view it through a microscope.



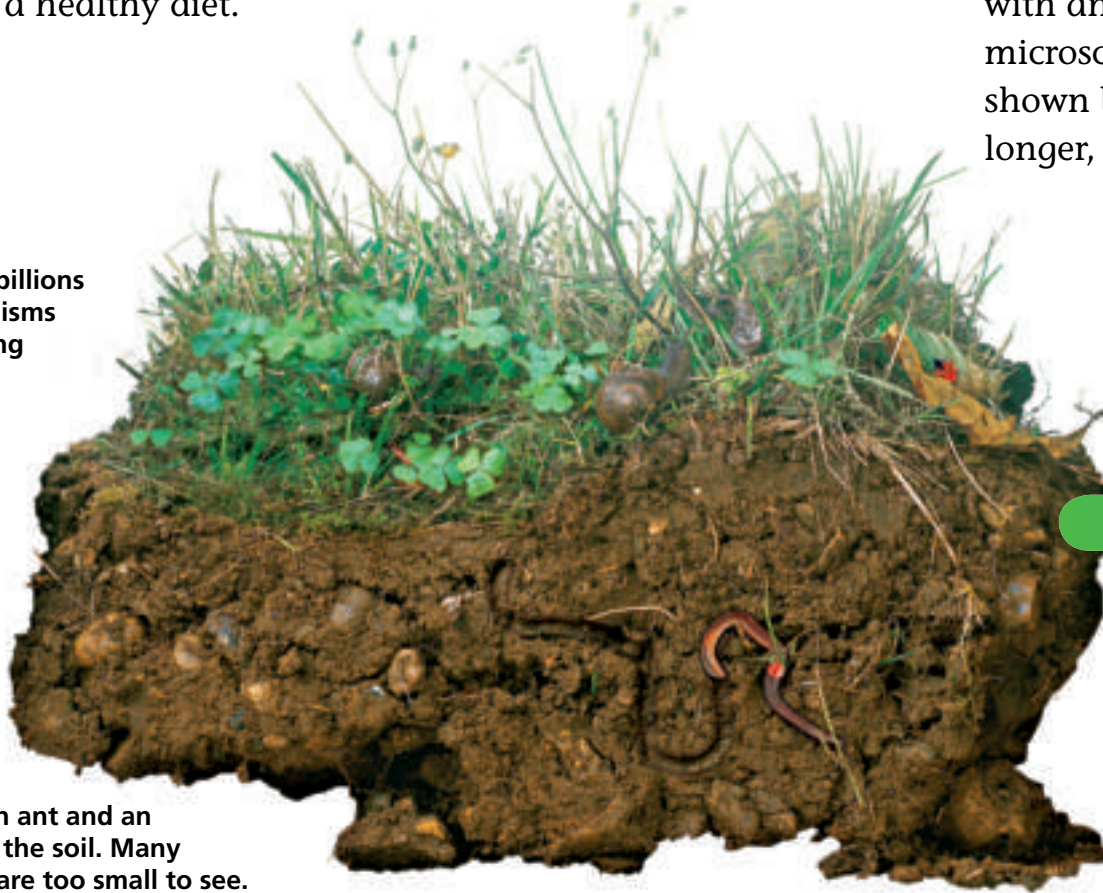


Microorganisms at Work

As you can see, fertile soil is full of insects. It also holds lots of microorganisms. Just one liter of dirt can have up to 1 trillion bacteria, 10 to 100 million protists, and thousands of worms!

Some bacteria in the soil make a natural fertilizer. They change the element nitrogen into a compound that plants use to grow. Plants use this compound to make proteins. All living things need proteins. Proteins are part of a healthy diet.

Topsoil holds billions of microorganisms and other living things.



You can see an ant and an earthworm in the soil. Many decomposers are too small to see.



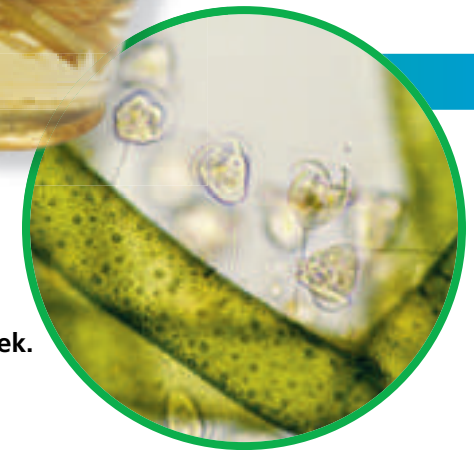
Observing Microorganisms

You cannot see microorganisms with just your eyes. But you can see them if you use a microscope.

The picture below shows microorganisms you might be able to grow and observe. To grow microorganisms, scientists mix hay or dried grass with the same amount of both pond water and distilled water. They keep the mixture at room temperature in a dark room. After a few days scientists sample the mixture with an eyedropper. If you looked at the sample in a microscope, you might see some of the microorganisms shown below. If the mixture was kept in the dark for longer, more kinds of microorganisms might appear.



A mixture of hay and grass can be used to grow microorganisms.




These tiny protists appeared in the mixture after a week.



Glossary

| | |
|----------------------|--|
| carnivore | an animal that eats other animals |
| consumer | a living thing that eats other living things for food |
| decomposer | an organism that breaks down wastes and remains of other organisms |
| ecosystem | the living and nonliving things and the ways they interact in an environment |
| food chain | the transfer of energy and matter from one living thing to another by eating and being eaten |
| food web | a system of overlapping food chains in which energy and matter flow through many branches |
| herbivore | an animal that eat plants |
| microorganism | a living thing too small to be seen without a microscope |
| omnivore | an animal that eats both plants and animals |
| producer | a living thing that makes its own food |

What did you learn?

1. What happens during photosynthesis?
2. What do scavengers do?
3. What is biomass?
4. **Writing in Science** You learned about Alexander Fleming and his work with *Penicillium*. Using an encyclopedia and other sources of information from your library-media center, write a paragraph that includes more details about the work Fleming did with *Penicillium*.
5.  **Follow Instructions** Suppose one of your classmates does not understand what decomposers are and what their role is in ecosystems. Write instructions that will help your classmate understand decomposers and what they do.