In one direction; from the Sun through producers to consumers to decomposers. Describe ways in which organisms interact with each other and with non-living parts of the environment. Coexistence/Cooperation; Competition; Symbiosis; Mutual dependence

Also covers: 1.01, 1.02, 1.03, 1.04, 1.05, 1.06, 1.08, 1.09, 1.10, 4.02, 4.04 (Detailed standards begin on page NCA.)

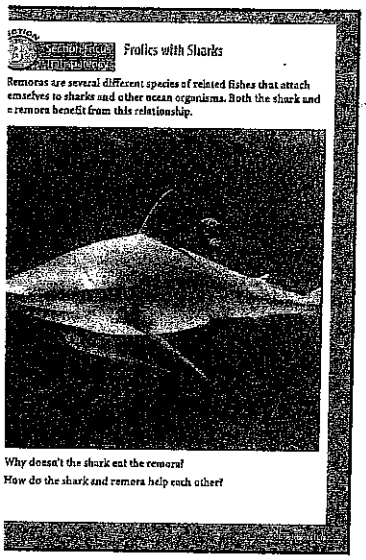
Interactions Within Communities

1 Motivate

Bellringer

INTERACTIVE CHALKBOARD PowerPoint® Presentations

Section Focus Transparencies also are available on the Interactive Chalkboard CD-ROM. L2 ELL

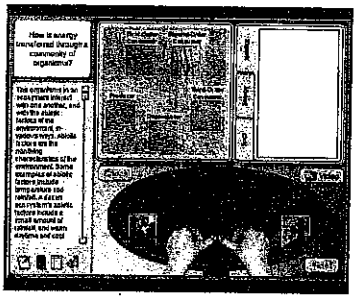


Tie to Prior Knowledge

Community Interactions Have students consider a familiar ecosystem. Ask them to name organisms that make up the community and describe interactions among these organisms. L1

Virtual Labs

Energy Transfer *How is energy transferred through a community of organisms?*



As You Read

What You'll Learn

- Describe how organisms obtain energy for life.
- Explain how organisms interact.
- Recognize that every organism occupies a niche.

Why It's Important

Obtaining food, shelter, and other needs is crucial to the survival of all living organisms, including you.

Review Vocabulary

social behavior: interactions among members of the same species

New Vocabulary

- producer
- consumer
- symbiosis
- mutualism
- commensalism
- parasitism
- niche

Obtaining Energy

Just as a car engine needs a constant supply of gasoline, living organisms need a constant supply of energy. The energy that fuels most life on Earth comes from the Sun. Some organisms use the Sun's energy to create energy-rich molecules through the process of photosynthesis. The energy-rich molecules, usually sugars, serve as food. They are made up of different combinations of carbon, hydrogen, and oxygen atoms. Energy is stored in the chemical bonds that hold the atoms of these molecules together. When the molecules break apart—for example, during digestion—the energy in the chemical bonds is released to fuel life processes.

Producers Organisms that use an outside energy source like the Sun to make energy-rich molecules are called **producers.** Most producers contain chlorophyll (KLOR uh fihl), a chemical that is required for photosynthesis. As shown in **Figure 12,** green plants are producers. Some producers do not contain chlorophyll and do not use energy from the Sun. Instead, they make energy-rich molecules through a process called chemosynthesis (kee moh SIHN thuh sus). These organisms can be found near volcanic vents on the ocean floor. Inorganic molecules in the water provide the energy source for chemosynthesis.

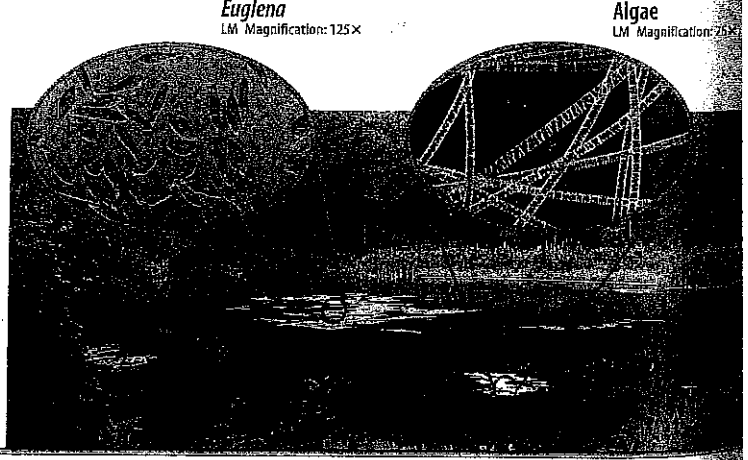


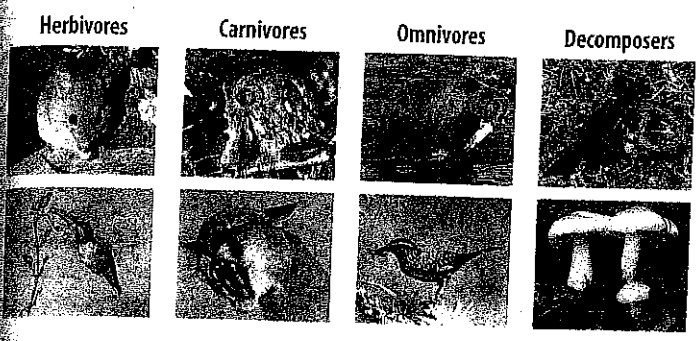
Figure 12 Green plants, including the grasses that surround this pond, are producers. The pond water also contains producers, including microscopic organisms like *Euglena* and algae.

Section 3 Resource Manager

Chapter *Fast File* Resources
- Transparency Activity, p. 46
- Enrichment, p. 32
- Directed Reading for Content Mastery, pp. 21, 22
- Reinforcement, p. 29
- Lab Worksheets, pp. 5–6, 7–8
- Lab Activities, pp. 9–11, 13–16

Reading and Writing Skill Activities, p. 49
Cultural Diversity, p. 13
Home and Community Involvement, p. 47
Lab Management and Safety, p. 71

Figure 13 Four categories of consumers are shown.
Identify *the type of consumer that a bear is. What about a mushroom?*



Consumers Organisms that cannot make their own energy-rich molecules are called **consumers.** Consumers obtain energy by eating other organisms. **Figure 13** shows the four general categories of consumers. Herbivores are the vegetarians of the world. They include rabbits, deer, and other plant eaters. Carnivores are animals that eat other animals. Frogs and spiders are carnivores that eat insects. Omnivores, including pigs and humans, eat mostly plants and animals. Decomposers, including fungi, bacteria, and earthworms, consume wastes and dead organisms. Decomposers help recycle once-living matter by breaking it down into simple, energy-rich substances. These substances might serve as food for decomposers, be absorbed by plant roots, or be consumed by other organisms.

Reading Check *How are producers different from consumers?*

Food Chains Ecology includes the study of how organisms depend on each other for food. A food chain is a simple model of the feeding relationships in an ecosystem. For example, shrubs are food for deer, and deer are food for mountain lions, as illustrated in **Figure 14.** What food chain would include you?

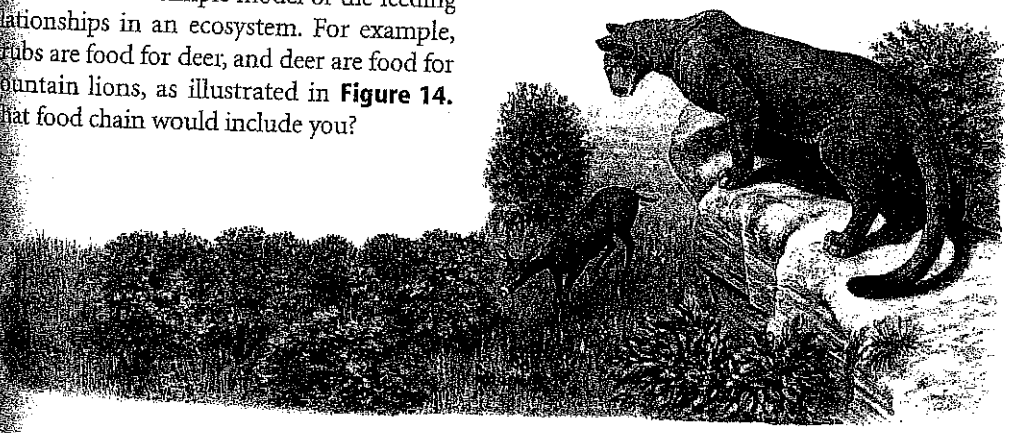


Figure 14 Food chains illustrate how consumers obtain energy from other organisms in an ecosystem.

North Carolina Objective Check

4.01: Describe the flow of energy ... in one direction ...

Which organisms consume wastes and dead organisms?

decomposers

INTEGRATE Chemistry

Glucose The nutrient molecule produced during photosynthesis is glucose. Look up the chemical structure of glucose and draw it in your Science Journal.

Text Question Answer

Accept any answer that shows a human eating food derived from a plant or animal. For example, in Figure 14, humans might replace the mountain lion, because humans eat venison.

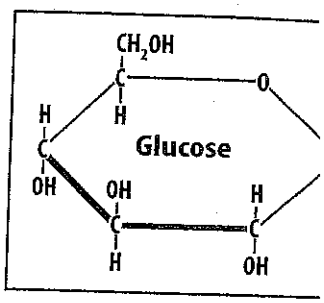
2 Teach

Caption Answer

Figure 13 bear: omnivore; mu decomposer.

INTEGRATE Chemistry

Glucose Energy for life is in the chemical bonds of o molecules such as glucose. A ecule of glucose is made of bons, 12 hydrogens, and 6 o atoms ($C_6H_{12}O_6$). The stru is as follows.



Research Have students loo the chemical structure of suc and compare it with gluc Ask students to identify wh sugar stores more energy. Su ($C_{12}H_{22}O_{11}$) stores more energy be it contains a larger number of che bonds.

Reading Check

Answer producers can make food; sumers must obtain food from o organisms

Use Science Words

Word Origin Types of consum are described by words deriv from Latin. *Vorare* means " devour," *herba* means "gras *caro* means "flesh," and *omn* means "all." Present this infc mation to students and ha them use it to explain the terr *herbivore*, *carnivore*, and *omnivor*

Activity

Lichens Bring in stones or pieces of tree bark with lichens growing on them. Have students look at the lichens using hand lenses. Then have them prepare wet-mount slides of lichen pieces and observe them using microscopes. How do the algae and fungus benefit each other? Algae make food for the fungus, and the fungus provides a habitat and moisture for the algae. L2 **Visual-Spatial**

Use an Analogy

Commensalism Challenge students to describe a human interaction that is analogous to commensalism. Possible example: A person may go through another's trash and find something useful. This is analogous to commensalism because one person benefits, while the other is neither helped nor harmed. L3

Fun Fact

Some people might say that animals are solar powered. Going back in the food chain, all energy can be traced back to producers, which make carbohydrates using the Sun's energy.

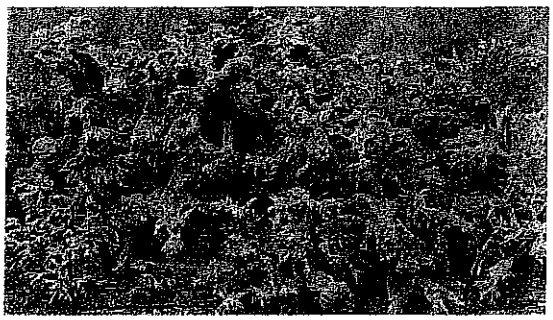
Make a Model

Food Web Have students create a display or diagram that models the food web of an ecosystem of their choice. Challenge students to include symbiotic relationships in their model. Possible answer: Fungi are fed by algae in the body of a lichen; caribou feed on lichens; human hunters eat caribou. L2

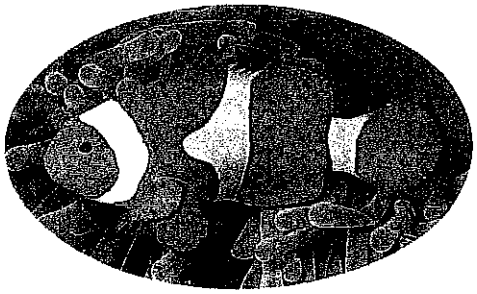
Symbiotic Relationships

Not all relationships among organisms involve food. Many organisms live together and share resources in other ways. Any close relationship between species is called **symbiosis.**

Figure 15 Many examples of symbiotic relationships exist in nature.

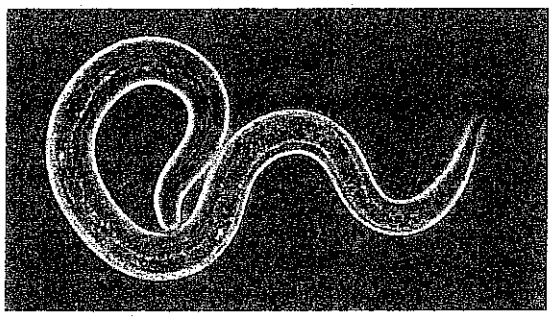


Lichens are a result of mutualism.



Clown fish and sea anemones have a commensal relationship.

LM Magnification: 128×



Some roundworms are parasites that rob nutrients from their hosts.

Mutualism You may have noticed crusty lichens growing on fences, trees, or rocks. Lichens, like those shown in **Figure 15,** are made up of an alga or a cyanobacterium that lives within the tissues of a fungus. Through photosynthesis, the cyanobacterium or alga supplies energy to itself and the fungus. The fungus provides a protected space in which the cyanobacterium or alga can live. Both organisms benefit from this association. A symbiotic relationship in which both species benefit is called **mutualism** (MYEW chuh wuh lih zum).

Commensalism If you've ever visited a marine aquarium, you might have seen the ocean organisms shown in **Figure 15.** The creature with gently waving, tubelike tentacles is a sea anemone. The tentacles contain a mild poison. Anemones use their tentacles to capture shrimp, fish, and other small animals to eat. The striped clown fish can swim among the tentacles without being harmed. The anemone's tentacles protect the clown fish from predators. In this relationship, the clown fish benefits but the sea anemone is not helped or hurt. A symbiotic relationship in which one organism benefits and the other is not affected is called **commensalism** (kuh MEN suh lih zum).

Parasitism Pet cats or dogs sometimes have to be treated for worms. Roundworms like the one shown in **Figure 15,** are common in puppies. This roundworm attaches itself to the inside of the puppy's intestine and feeds on nutrients in the puppy's blood. The puppy may have abdominal pain, bloating, and diarrhea. If the infection is severe, the puppy might die. A symbiotic relationship in which one organism benefits but the other is harmed is called **parasitism** (PER uh suh tih zum).

Differentiated Instruction

English-Language Learners Use word origins to emphasize the differences among the three types of symbiosis. Mutualism comes from the word *mutual,* which means "shared." Parasitism comes from a Greek word that means "feeding from the table of another." Commensalism means "eating from the same table." Symbiosis means "living together."

Challenge Have students research an organism that has a symbiotic relationship with another organism. Ask students to write a report or create a display that describes the niches of both the organism and its symbiotic partner. Possible topics: ants and aphids; termites and bacteria that live in the termite's digestive system; honeybees and flowers; ticks and deer L3

Niches

One habitat might contain hundreds or even thousands of species. Look at the rotting log habitat shown in **Figure 16.** A rotting log in a forest can be home to termites that eat decaying wood, ants that feed on the termites, and wolf spiders that prey on insects. Other species that live on or under the rotting log include millipedes, centipedes, and worms. You might think that competition for resources would make it impossible for so many species to live in the same habitat. However, each species has different requirements for its survival and has its own niche (NICH). An organism's **niche** is its role in its environment—how it obtains food and shelter, finds a mate, cares for its young, and avoids danger.

Reading Check *Why does each species have its own niche?*

Special adaptations that improve survival are often part of an organism's niche. Milkweed plants contain a poison that prevents many insects from feeding on them. Monarch butterfly caterpillars have an adaptation that allows them to eat milkweed. Monarchs can take advantage of a food resource that other species cannot use. Milkweed poison also helps protect monarchs from predators. When the caterpillars eat milkweed, they become slightly poisonous. Birds avoid eating monarchs because they learn that the caterpillars and adult butterflies have an awful taste and can make them sick.

INTEGRATE History

Plant Poisons The poison in milkweed is similar to the drug digitalis. Small amounts of digitalis are used to treat heart ailments in humans, but it is poisonous in large doses. Research the history of digitalis as a medicine. In your Science Journal, list diseases for which it was used but is no longer used.

North Carolina Objective Check

7.01: Describe ways organisms interact . . . : Symbiosis.

Which symbiotic relationship benefits both organisms?

mutualism

Figure 16
Different adaptations enable each species living in this rotting log to have its own niche.

Discussion

Niches The term *niche* is sometimes described as an activity that one person is good at, but others find difficult. How is this similar to the biological definition? Organisms with a particular niche often have adaptations that give them an advantage in their environment.

INTEGRATE History

Plant Poisons According to *Neal's Medical Digest* published in 1877, digitalis cured over 32 illnesses including dropsy, adenitis, bronchitis, tubercule and typhoid.

Reading Check

Answer Each species has different requirements for its survival.

IDENTIFYING Misconceptions

Plants Students may think that plants do not depend on other organisms. Refer to page F a the beginning of this chapte for teaching strategies tha address this misconception.

Visual Learning

Figure 16 Work with students to produce a food web diagram of the rotting log ecosystem. Have students describe each organism's niche as they add it to the web. Fungi and termites eat wood; insects and millipedes eat leaves; earthworms eat dead material beneath the log; spiders eat insects; birds eat spiders and millipedes. L2

Science Journal

Local Niches Have students identify organisms in local habitats that have different niches. Encourage them to research one organism and to write descriptive paragraphs in their Science Journals about how the organism survives, obtains food and shelter, finds a mate, cares for young, and avoids danger. L3

at and Niche

rials aquarium with snails,

ated Time 10 minutes

dure Ask students to describe abitat and niche of these two ium organisms.

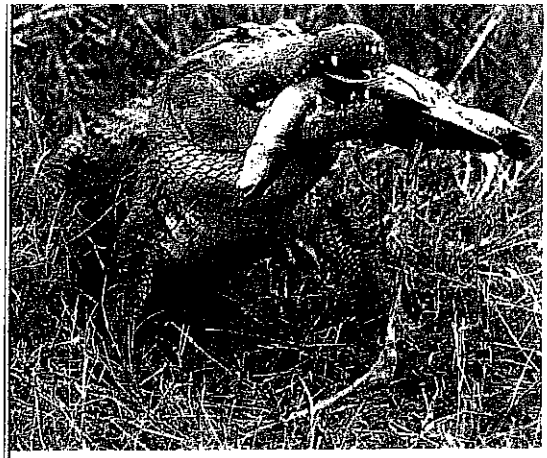


Figure 17 The alligator is a predator. The turtle is its prey.

Predator & Prey When you think of survival in the wild, you might imagine an antelope running away from a lion. An organism's niche includes how it avoids being eaten and how it finds or captures its food. Predators, like the one shown in **Figure 17**, are consumers that capture and eat other consumers. The prey is the organism that is captured by the predator. The presence of predators usually increases the number of different species that can live in an ecosystem. Predators limit the size of prey populations. As a result, food and other resources are less likely to become scarce, and competition between species is reduced.

Cooperation Individual organisms often cooperate in ways that improve survival. For example, a white-tailed deer that detects the presence of wolves or coyotes will alert the other deer in the herd. Many insects, such as ants and honeybees, live in social groups. Different individuals perform different tasks required for the survival of the entire nest. Soldier ants protect workers that go out of the nest to gather food. Worker ants feed and care for ant larvae that hatch from eggs laid by the queen. These cooperative actions improve survival and are a part of the specie's niche.

SECTION 3 REVIEW

Summary

Obtaining Energy

- All life requires a constant supply of energy.
- Most producers make food by photosynthesis using light energy.
- Consumers cannot make food. They obtain energy by eating producers or other consumers.
- A food chain models the feeding relationships between species.

Symbiotic Relationships

- Symbiosis is any close relationship between species.
- Mutualism, commensalism, and parasitism are types of symbiosis.
- An organism's niche describes the ways in which the organism obtains food, avoids danger, and finds shelter.

Explain: why all consumers depend on producers for food.

Evaluate: the significant role of decomposers in Earth's ecosystems.

Compare & Contrast: the terms *habitat* and *niche*.

Think Critically: A parasite can obtain food only from a host organism. Explain why most parasites weaken, but do not kill, their hosts.

to classify the symbiotic relationship that exists between two hypothetical organisms. Animal A definitely benefits from its relationship with Plant B. It is not clear whether Plant B benefits, is harmed, or is unaffected by its relationship with Animal A.

Assess

Y INTERVENTION

for Understanding

ersonal Have pairs of stu- brainstorm together to er the following question: might happen if all insects eliminated?

L2 Naturalist

Describe to students the of a bird or other animal s common to an ecosystem our school. Ask students to st reasons why the animal to survive there. L1

Assessment

s Have students classify the ing organisms based on ach obtains nutrition: spi- ; pig ; goat ; fungus ; . Use **Performance sment in the Science oom**, p. 121. L2

SECTION 3 REVIEW