Section 3

Interactions Among Living Things

Reading Preview

Key Concepts

- How do an organism's adaptations help it to survive?
- What are the major ways in which organisms in an ecosystem interact?
- What are the three types of symbiotic relationships?

Key Terms

- natural selection
- adaptations • niche
- competition • predation
- predator • prey • symbiosis
- mutualism • commensalism
- parasitism • parasite • host

Target Reading Skill

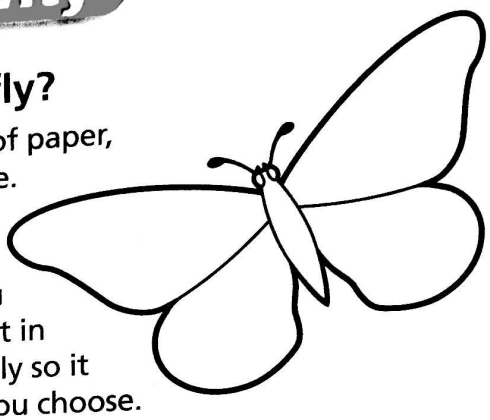
Using Prior Knowledge Before you read, look at the section headings and visuals to see what this section is about. Then write what you know about how living things interact in a graphic organizer like the one below. As you read, continue to write in what you learn.

What You Know
1. Organisms interact in different ways. 2.

What You Learned
1. 2.

Lab zone Discover Activity

Can You Hide a Butterfly?



1. Trace a butterfly on a piece of paper, using the outline shown here.
2. Look around the classroom and pick a spot where you will place your butterfly. You must place your butterfly out in the open. Color your butterfly so it will blend in with the spot you choose.
3. Tape your butterfly down. Someone will now have one minute to find the butterflies. Will your butterfly be found?

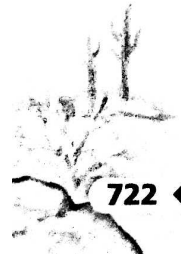
Think It Over

Predicting Over time, do you think the population size of butterflies that blend in with their surroundings would increase or decrease?

Can you imagine living in a cactus like the one in Figure 12? Ouch! You probably wouldn't want to live in a house covered with sharp spines. But many species live in, on, and around saguaro cactuses.

As day breaks, a twittering sound comes from a nest tucked in one of the saguaro's arms. Two young red-tailed hawks are preparing to fly for the first time. Farther down the stem, a tiny elf owl peeks out of its nest in a small hole. This owl is so small it could fit in your palm! A rattlesnake slithers around the base of the saguaro, looking for lunch. Spying a shrew, the snake strikes it with its needle-like fangs. The shrew dies instantly.

Activity around the saguaro continues after sunset. Long-nosed bats come out to feed on the nectar from the saguaro's blossoms. The bats stick their faces into the flowers to feed, dusting their long snouts with white pollen. As they move from plant to plant, they carry the pollen to other saguaros. This enables the cactuses to reproduce.



Adapting to the Environment

Each organism in the saguaro community has unique characteristics. These characteristics affect the individual's ability to survive in its environment.

Natural Selection A characteristic that makes an individual better suited to its environment may eventually become common in that species through a process called **natural selection.** Natural selection works like this: Individuals whose unique characteristics are best suited for their environment tend to survive and produce offspring. Offspring that inherit these characteristics also live to reproduce. In this way, natural selection results in **adaptations,** the behaviors and physical characteristics that allow organisms to live successfully in their environments.

Individuals with characteristics that are poorly suited to the environment are less likely to survive and reproduce. Over time, poorly suited characteristics may disappear from the species.

Niche **Every organism has a variety of adaptations that are suited to its specific living conditions.** The organisms in the saguaro community have adaptations that result in specific roles. The role of an organism in its habitat, or how it makes its living, is called its **niche.** A niche includes the type of food the organism eats, how it obtains this food, and which other organisms use the organism as food. A niche also includes when and how the organism reproduces and the physical conditions it requires to survive.

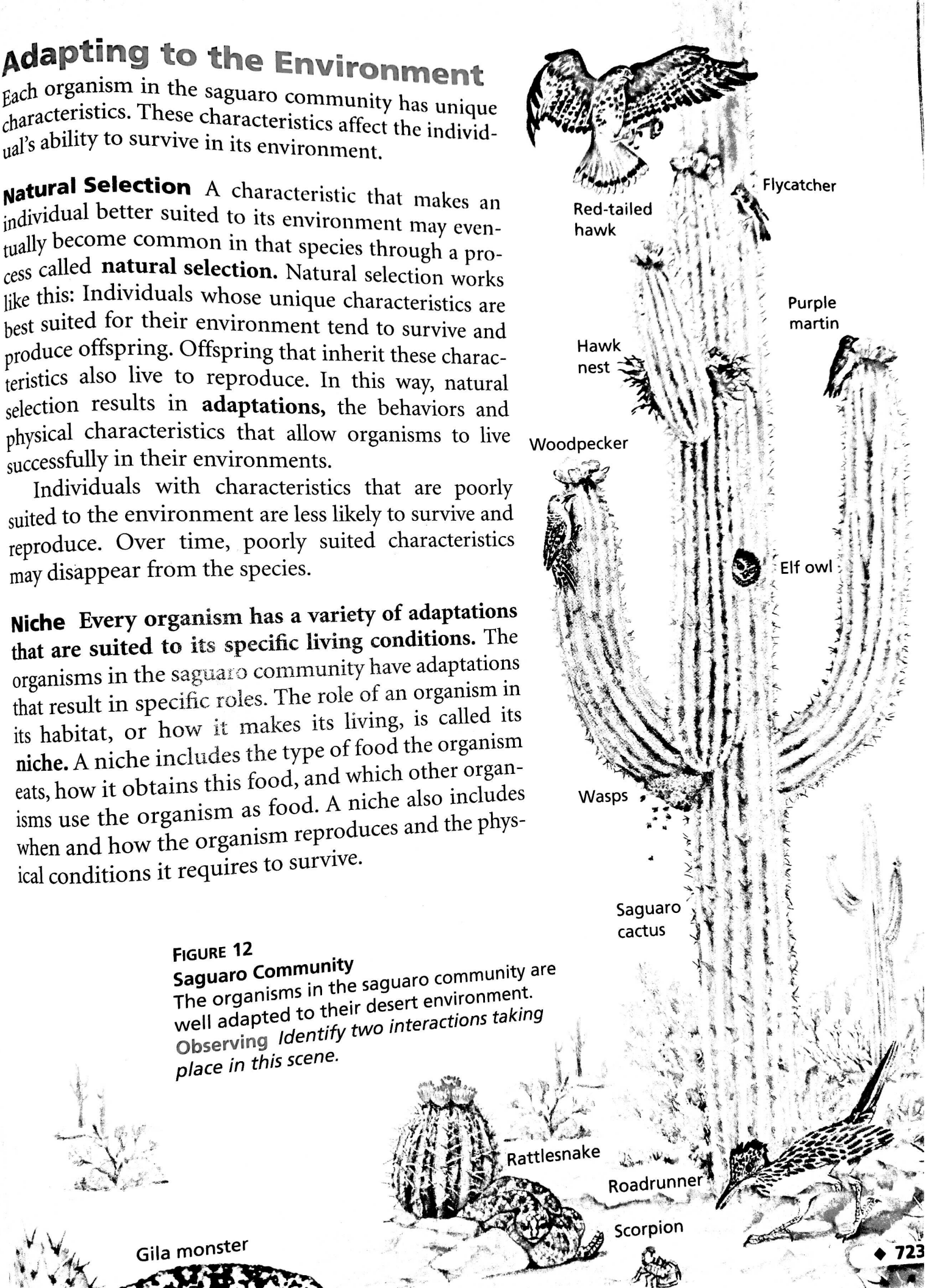


FIGURE 12
Saguaro Community
The organisms in the saguaro community are well adapted to their desert environment.
Observing *Identify two interactions taking place in this scene.*

Cape May Warbler
This species feeds at the tips of branches near the top of the tree.

Bay-Breasted Warbler
This species feeds in the middle part of the tree.

Yellow-Rumped Warbler
This species feeds in the lower part of the tree and at the bases of the middle branches.

FIGURE 13
Niche and Competition
Each of these warblers occupies a different niche in its spruce tree habitat. By feeding in different areas of the tree, the birds avoid competing for food.
Comparing and Contrasting
How do the niches of these three warblers differ?

Competition

During a typical day in the saguaro community, a range of interactions takes place among organisms. **There are three major types of interactions among organisms: competition, predation, and symbiosis.**

Different species can share the same habitat and food requirements. For example, the roadrunner and the elf owl both live on the saguaro and eat insects. However, these two species do not occupy exactly the same niche. The roadrunner is active during the day, while the owl is active mostly at night. If two species occupy the same niche, one of the species will eventually die off. The reason for this is **competition,** the struggle between organisms to survive as they attempt to use the same limited resource.

In any ecosystem, there is a limited amount of food, water, and shelter. Organisms that survive have adaptations that enable them to reduce competition. For example, the three species of warblers in Figure 13 live in the same spruce forest habitat. They all eat insects that live in the spruce trees. How do these birds avoid competing for the limited insect supply? Each warbler "specializes" in feeding in a certain part of a spruce tree. This is how the three species coexist.

Reading Checkpoint **Why can't two species occupy the same niche?**

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predation

A tiger shark lurks below the surface of the clear blue water, looking for shadows of albatross chicks floating above. The shark spots a chick and silently swims closer. Suddenly, the shark bursts through the water and seizes the albatross with one snap of its powerful jaw. This interaction between two organisms has an unfortunate ending for the albatross.

An interaction in which one organism kills another for food is called **predation.** The organism that does the killing, in this case the tiger shark, is the **predator.** The organism that is killed, in this case the albatross, is the **prey.**

The Effect of Predation on Population Size Predation can have a major effect on the size of a population. Recall from Section 2 that when the death rate exceeds the birth rate in a population, the size of that population usually decreases. So if there are many predators, the result is often a decrease in the size of the population of their prey. But a decrease in the number of prey results in less food for their predators. Without adequate food, the predator population starts to decline. So, generally, populations of predators and their prey rise and fall in related cycles.

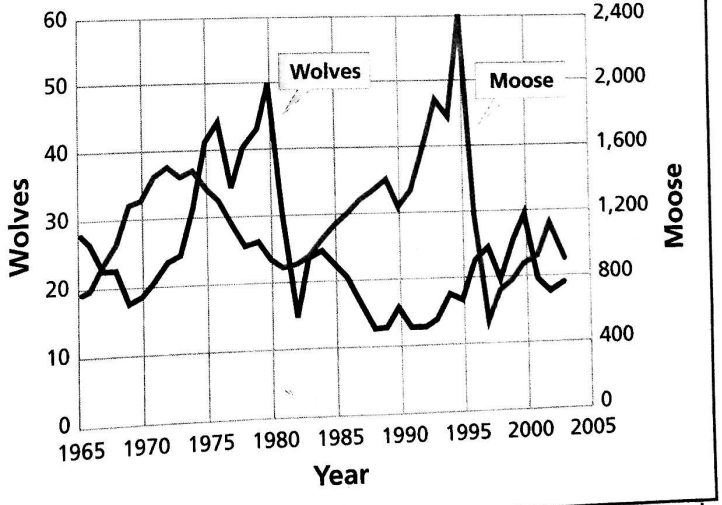
FIGURE 14
Predation
This green tree python and mouse are involved in a predator-prey interaction.

Math Analyzing Data

Predator-Prey Interactions

On Isle Royale, an island in Lake Superior, the populations of wolves (the predator) and moose (the prey) rise and fall in cycles. Use the graph to answer the questions.

Wolf and Moose Populations on Isle Royale



1. **Reading Graphs** What variable is plotted on the *x*-axis? What two variables are plotted on the *y*-axis?
2. **Interpreting Data** How did the moose population change between 1965 and 1972? What happened to the wolf population from 1973 through 1976?
3. **Inferring** How might the change in the moose population have led to the change in the wolf population?
4. **Drawing Conclusions** What is one likely cause of the dip in the moose population between 1974 and 1981?
5. **Predicting** How might a disease in the wolf population one year affect the moose population the next year?

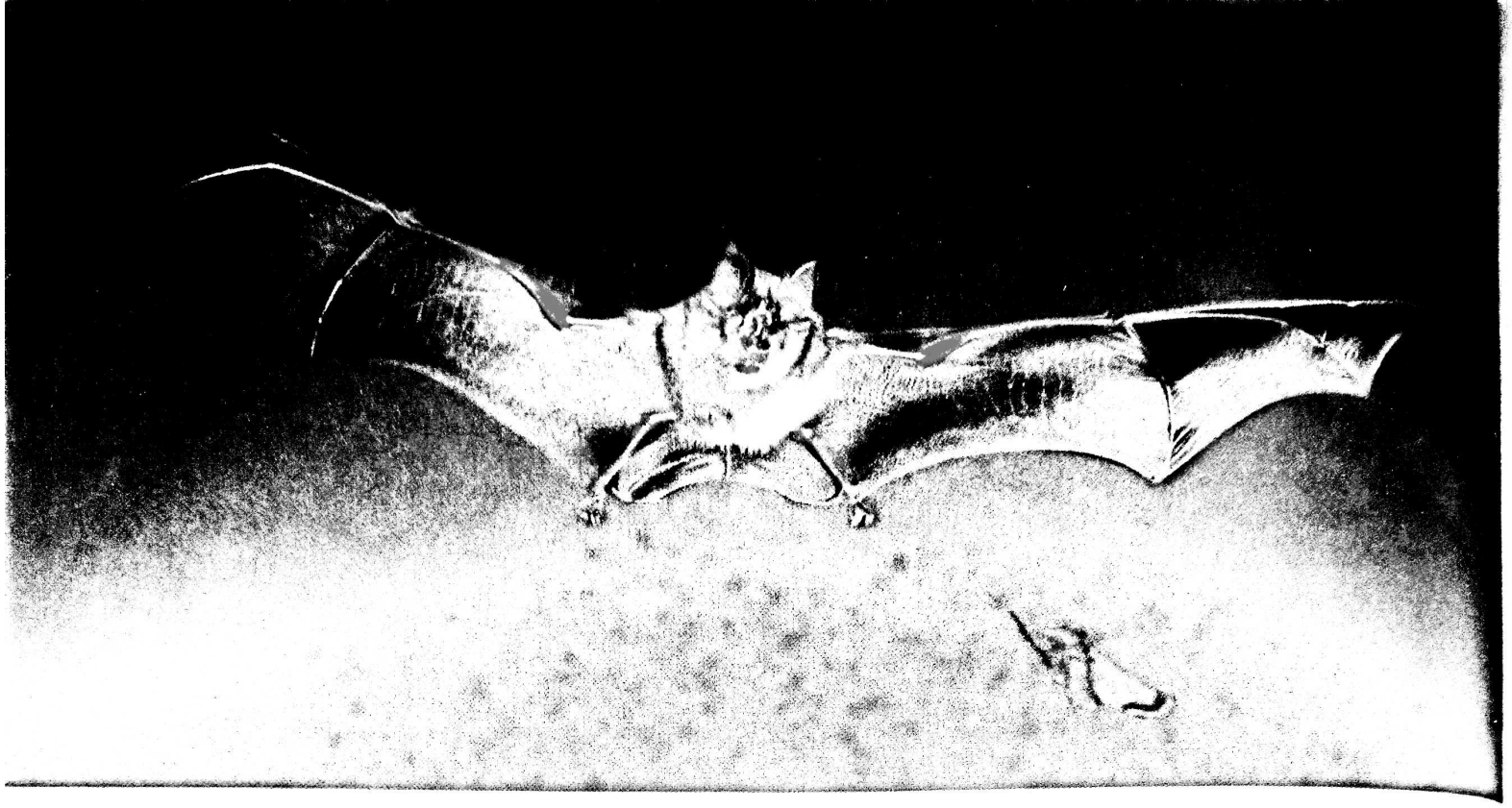


FIGURE 15
Predator Adaptations
This greater horseshoe bat has adaptations that allow it to find prey in the dark. The bat produces pulses of sound and locates prey by interpreting the echoes.
Inferring *What other adaptations might contribute to the bat's success as a predator?*

Predator Adaptations Predators have adaptations that help them catch and kill their prey. For example, a cheetah can run very fast for a short time, enabling it to catch its prey. A jellyfish's tentacles contain a poisonous substance that paralyzes tiny water animals. Some plants, too, have adaptations for catching prey. The sundew is covered with sticky bulbs on stalks—when a fly lands on the plant, it remains snared in the sticky goo while the plant digests it.

Some predators have adaptations that enable them to hunt at night. For example, the big eyes of an owl let in as much light as possible to help it see in the dark. Insect-eating bats can hunt without seeing at all. Instead, they locate their prey by producing pulses of sound and listening for the echoes. This precise method enables a bat to catch a flying moth in complete darkness.

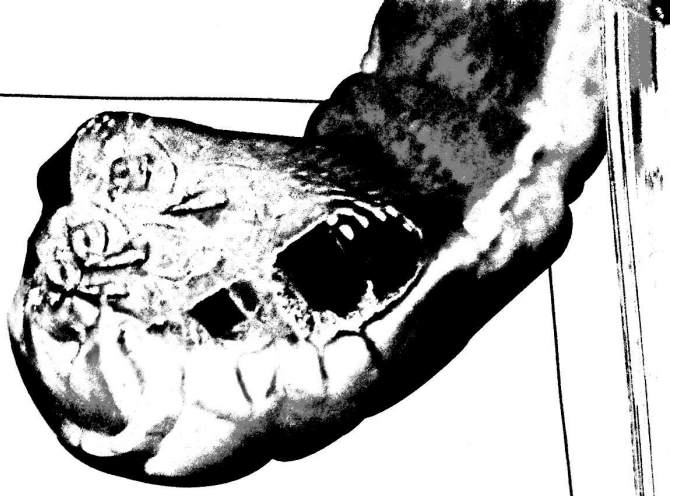
Prey Adaptations How do organisms avoid being killed by such effective predators? Organisms have many kinds of adaptations that help them avoid becoming prey. The alertness and speed of an antelope help protect it from its predators. And you're probably not surprised that the smelly spray of a skunk helps keep its predators at a distance. As you can see in Figure 16, other organisms also have some very effective ways to avoid becoming a predator's next meal.

Reading Checkpoint **What are two predator adaptations?**

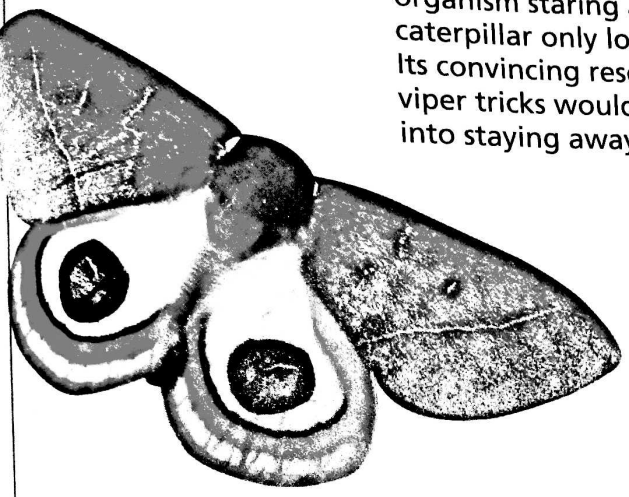
FIGURE 16

Defense Strategies

Organisms display a wide array of adaptations that help them avoid becoming prey.

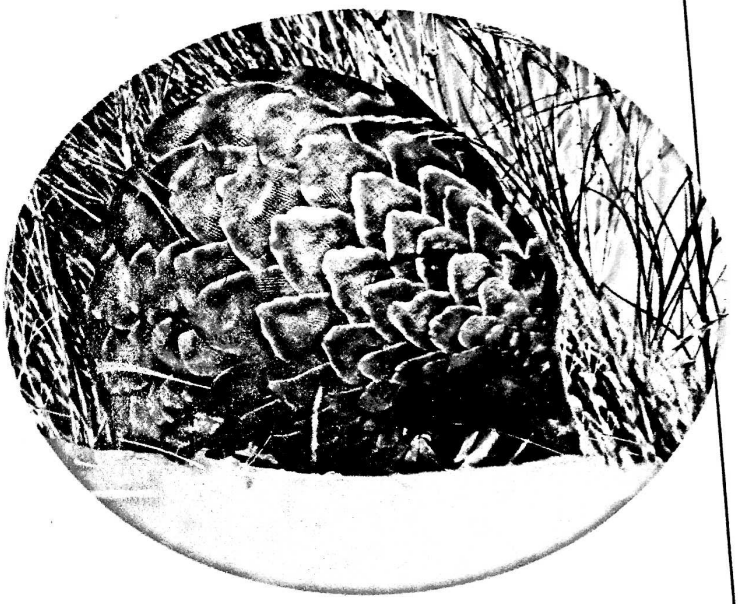


Mimicry ▶
If you're afraid of snakes, you'd probably be terrified to see this organism staring at you. But this caterpillar only looks like a snake. Its convincing resemblance to a viper tricks would-be predators into staying away.



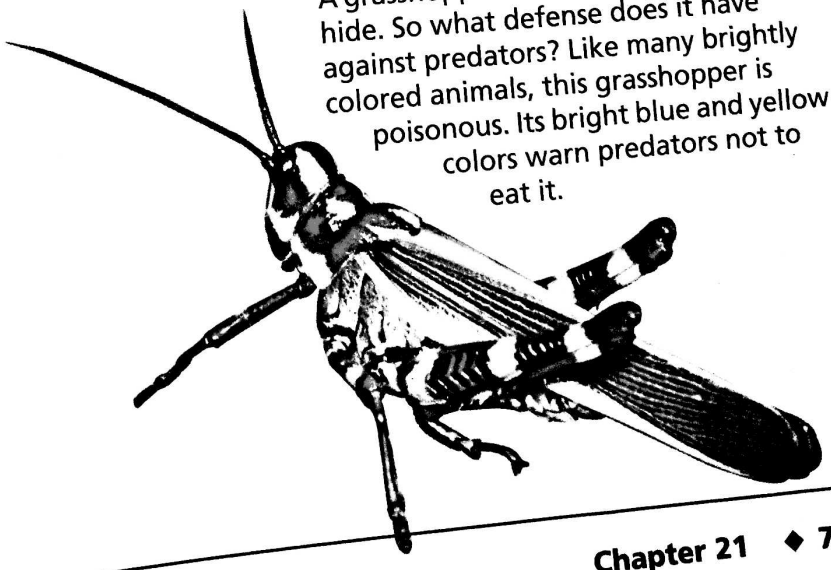
False Coloring ▲
If you saw this moth in a dark forest, you might think you were looking into the eyes of a large mammal. The large false eyespots on the moth's wings scare potential predators away.

Protective Covering ▼
Have you ever seen a pine cone with a face? This organism is actually a pangolin, a small African mammal. When threatened, the pangolin protects itself by rolling up into a scaly ball.



Camouflage ▲
Is it a leaf? Actually, it's a walking leaf insect. But if you were a predator, you might be fooled into looking elsewhere for a meal.

▼ Warning Coloring
A grasshopper this brightly colored can't hide. So what defense does it have against predators? Like many brightly colored animals, this grasshopper is poisonous. Its bright blue and yellow colors warn predators not to eat it.



Lab zone Skills Activity

Classifying

Classify each interaction as an example of mutualism, commensalism, or parasitism. Explain your answers.

- A remora fish attaches itself to the underside of a shark without harming the shark, and eats left-over bits of food from the shark's meals.
- A vampire bat drinks the blood of horses.
- Bacteria living in cows' stomachs help them break down the cellulose in grass.

Symbiosis

Many of the interactions in the saguaro community you read about are examples of symbiosis. **Symbiosis** (sim bee OH sis) is a close relationship between two species that benefits at least one of the species. **The three types of symbiotic relationships are mutualism, commensalism, and parasitism.**

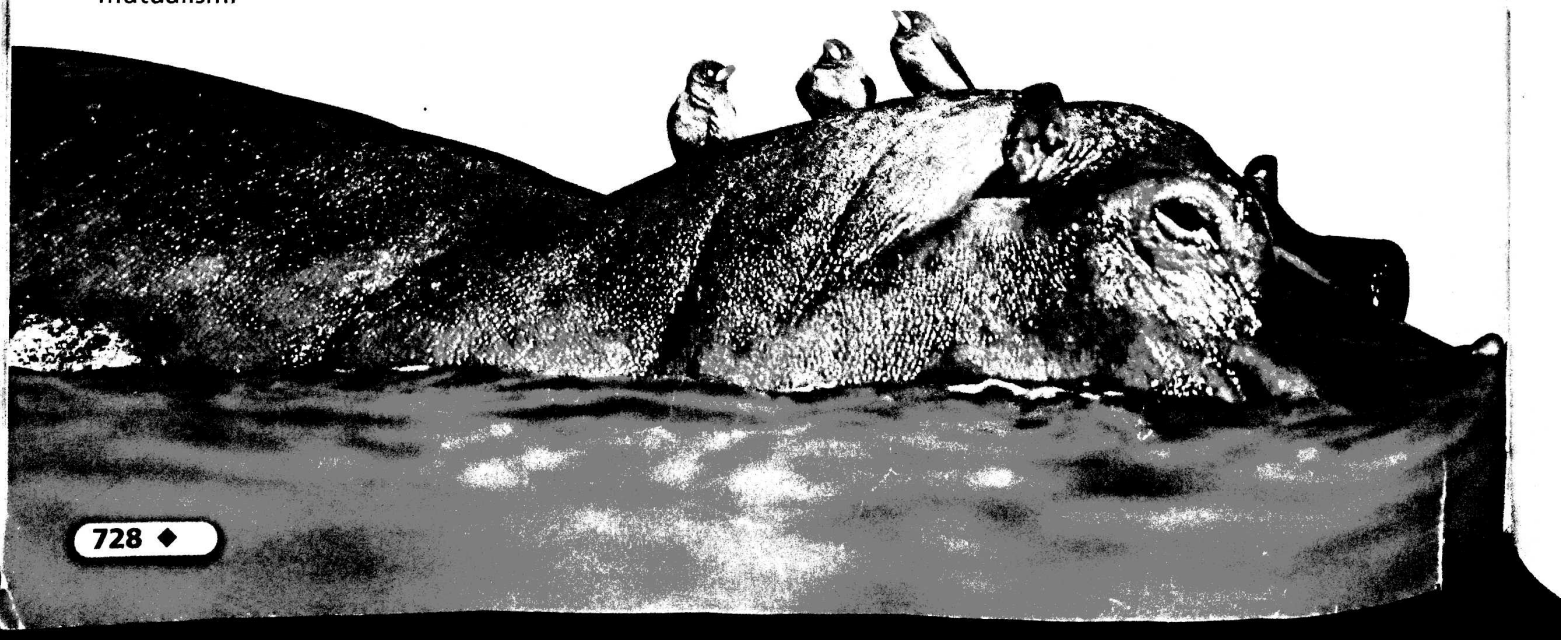
Mutualism A relationship in which both species benefit is called **mutualism** (MYOO choo uh liz um). The relationship between the saguaro and the long-eared bats is an example of mutualism. The bats benefit because the cactus flowers provide them with food. The saguaro benefits as its pollen is carried to another plant on the bat's nose.

In some cases of mutualism, two species are so dependent on each other that neither could live without the other. This is true for some species of acacia trees and stinging ants in Central and South America. The stinging ants nest only in the acacia tree, whose thorns discourage the ants' predators. The tree also provides the ants' only food. The ants, in turn, attack other animals that approach the tree and clear competing plants away from the base of the tree. To survive, each species needs the other.

Commensalism A relationship in which one species benefits and the other species is neither helped nor harmed is called **commensalism** (kuh MEN suh liz um). The red-tailed hawks' interaction with the saguaro is an example of commensalism. The hawks benefit by having a place to build their nest, while the cactus is not affected by the hawks.

Commensalism is not very common in nature because two species are usually either helped or harmed a little by any interaction. For example, by creating a small hole for its nest in the cactus stem, the elf owl slightly damages the cactus.

FIGURE 17
Mutualism
Three yellow-billed oxpeckers get a cruise and a snack aboard an obliging hippopotamus. The oxpeckers eat ticks living on the hippo's skin. Since both the birds and the hippo benefit from this interaction, it is an example of mutualism.



parasitism **Parasitism** (PA ruh sit iz um) involves one organism living on or inside another organism and harming it. The organism that benefits is called a **parasite,** and the organism it lives on or in is called a **host.** The parasite is usually smaller than the host. In a parasitic relationship, the parasite benefits from the interaction while the host is harmed.

Some common parasites are fleas, ticks, and leeches. These parasites have adaptations that enable them to attach to their host and feed on its blood. Other parasites live inside the host's body, such as tapeworms that live inside the digestive systems of dogs, wolves, and some other mammals.

Unlike a predator, a parasite does not usually kill the organism it feeds on. If the host dies, the parasite loses its source of food. An interesting example of this rule is shown by a species of mite that lives in the ears of moths. The mites almost always live in just one of the moth's ears. If they live in both ears, the moth's hearing is so badly affected that it is likely to be quickly caught and eaten by its predator, a bat.

Reading Checkpoint **Why doesn't a parasite usually kill its host?**

FIGURE 18
Parasitism
Ticks feed on the blood of certain animals. Classifying *Which organism in this interaction is the parasite? Which organism is the host?*

Section 3 Assessment

Target Reading Skill Using Prior Knowledge
Review your graphic organizer and revise it based on what you just learned in the section.

Reviewing Key Concepts

1. a. Defining What are adaptations?
   b. Explaining How are a snake's sharp fangs an adaptation that helps it survive in the saguaro community?
   c. Developing Hypotheses Explain how natural selection in snakes might have led to adaptations such as sharp fangs.
2. a. Reviewing What are three main ways in which organisms interact?
   b. Classifying Give one example of each type of interaction.
3. a. Listing List the three types of symbiotic relationships.
   b. Comparing and Contrasting For each type of symbiotic relationship, explain how the two organisms are affected.
   c. Applying Concepts Some of your classroom plants are dying. Others that you planted at the same time and cared for in the same way are growing well. When you look closely at the dying plants, you see tiny mites on them. Which symbiotic relationship is likely occurring between the plants and mites? Explain.

Lab zone At-Home Activity

Feeding Frenzy You and your family can observe interactions among organisms at a bird feeder. Fill a clean, dry, 2-liter bottle with birdseed. With paper clips, attach a plastic plate to the neck of the bottle. Then hang your feeder outside where you can see it easily. Observe the feeder at different times of the day. Keep a log of all the organisms you see near it and how they interact.