

Arthropods

Reading Preview

Key Concepts

- What are the four major groups of arthropods and what are their characteristics?
- How do crustaceans, arachnids, and centipedes and millipedes differ?

Key Terms

- arthropod • exoskeleton
- molting • antenna
- crustacean • metamorphosis
- arachnid • abdomen

Target Reading Skill

Asking Questions Before you read, preview the red headings. In a graphic organizer like the one below, ask a *what* or a *how* question for each heading. As you read, write the answers to your questions.

Characteristics of Arthropods

Question	Answer
What is an arthropod?	

FIGURE 7

A Spider at Work

This spider wraps its prey, a grasshopper, in silk. Both animals are arthropods.

Lab
zone

Discover Activity

Will It Bend and Move?

1. Have a partner roll a piece of cardboard around your arm to form a tube that covers your elbow. Your partner should put three pieces of tape around the tube to hold it closed—one at each end and one in the middle.
2. With the tube in place, try to write your name on a piece of paper. Then try to scratch your head.
3. Keep the tube on your arm for 10 minutes. Observe how the tube affects your ability to do things.

Think It Over

Inferring Insects and many other animals have rigid skeletons on the outside of their bodies. Why do their skeletons need joints?



At dusk near the edge of a meadow, a grasshopper leaps through the grass. Nearby, a hungry spider waits in its web. The grasshopper leaps into the web. It's caught! As the grasshopper struggles to free itself, the spider rushes toward it. Quickly, the spider wraps the grasshopper in silk. The grasshopper cannot escape. Soon it will become a tasty meal for the spider.

The spider and grasshopper are both **arthropods**, or members of the arthropod phylum (phylum Arthropoda). Animals such as crabs, lobsters, centipedes, and scorpions are also arthropods.



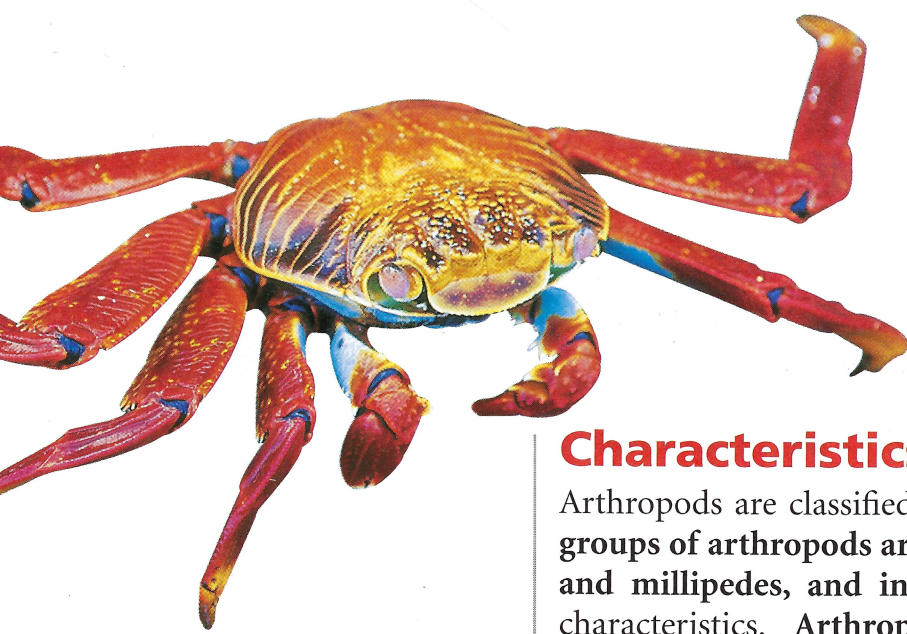


FIGURE 8

Arthropod Characteristics

This Sally lightfoot crab shows the tough exoskeleton, the segmented body, and the jointed appendages that are characteristic of arthropods.

Characteristics of Arthropods

Arthropods are classified into four major groups. The major groups of arthropods are crustaceans, arachnids, centipedes and millipedes, and insects. All arthropods share certain characteristics. Arthropods are invertebrates that have an external skeleton, a segmented body, and jointed attachments called appendages. Wings, mouthparts, and legs are all appendages. Jointed appendages are such a distinctive characteristic that arthropods are named for it. *Arthros* means “joint” in Greek, and *podos* means “foot” or “leg.”

Arthropods share some characteristics with many other animals, too. They have bilateral symmetry, an open circulatory system, and a digestive system with two openings. In addition, most arthropods reproduce sexually.

Outer Skeleton If you were an arthropod, you would have a waterproof covering. This waxy covering is called an **exoskeleton**, or outer skeleton. It protects the animal and helps prevent evaporation of water. Water animals are surrounded by water, but land animals need a way to keep from drying out. Arthropods may have been the first animals to live on land. Their exoskeletons probably enabled them to do this because they keep the arthropods from drying out.

As an arthropod grows larger, its exoskeleton cannot expand. The growing arthropod is trapped within its exoskeleton, like a knight in armor that is too small. Arthropods solve this problem by occasionally shedding their exoskeletons and growing new ones that are larger. The process of shedding an outgrown exoskeleton is called **molting**. After an arthropod has molted, its new skeleton is soft for a time. During that time, the arthropod has less protection from danger than it does after its new skeleton has hardened.



FIGURE 9

A Molting Cicada

This cicada has just molted. You can see its old exoskeleton hanging on the leaf just below it.

Applying Concepts Why must arthropods molt?

Comparisons of the Largest Arthropod Groups				
Characteristic	Crustaceans	Arachnids	Centipedes and Millipedes	Insects
Number of body sections	2 or 3	2	2	3
Pairs of legs	5 or more	4	Many	3
Pairs of antennae	2	None	1	1

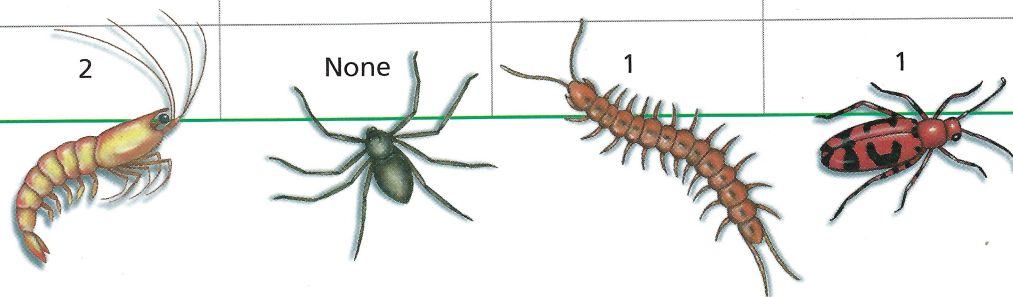


FIGURE 10
Members of the largest arthropod groups differ in several characteristics. **Interpreting Tables** Which group of arthropods has no antennae?

Segmented Body The bodies of arthropods are segmented. A segmented body plan is easiest to see in centipedes and millipedes, which have bodies made up of many identical-looking segments. In fact, their bodies look something like the bodies of earthworms. You can also see segments on the tails of shrimp and lobsters. In some groups of arthropods, several body segments become joined into distinct sections. An arthropod may have up to three sections—a head, a midsection, and a hind section.

Jointed Appendages Just as your fingers are appendages attached to your palms, many arthropods have jointed appendages attached to their bodies. The joints in the appendages give the animal flexibility and enable it to move. If you did the Discover activity, you saw how important joints are for allowing movement. Arthropod appendages tend to be highly specialized tools used for moving, obtaining food, reproducing, and sensing the environment. For example, arthropods use legs to walk and wings to fly. In addition, most arthropods have appendages called antennae (singular *antenna*). An **antenna** is an appendage attached to the head that contains sense organs.

Diversity Scientists have identified more species of arthropods—over one million—than all other species of animals combined! There are probably many others that have not yet been discovered. Look at Figure 10 to compare some characteristics of the four major groups of arthropods.

 **Reading Checkpoint** What does an antenna do?

Go Online

For: Links on arthropods
Visit: www.SciLinks.org
Web Code: scn-0222

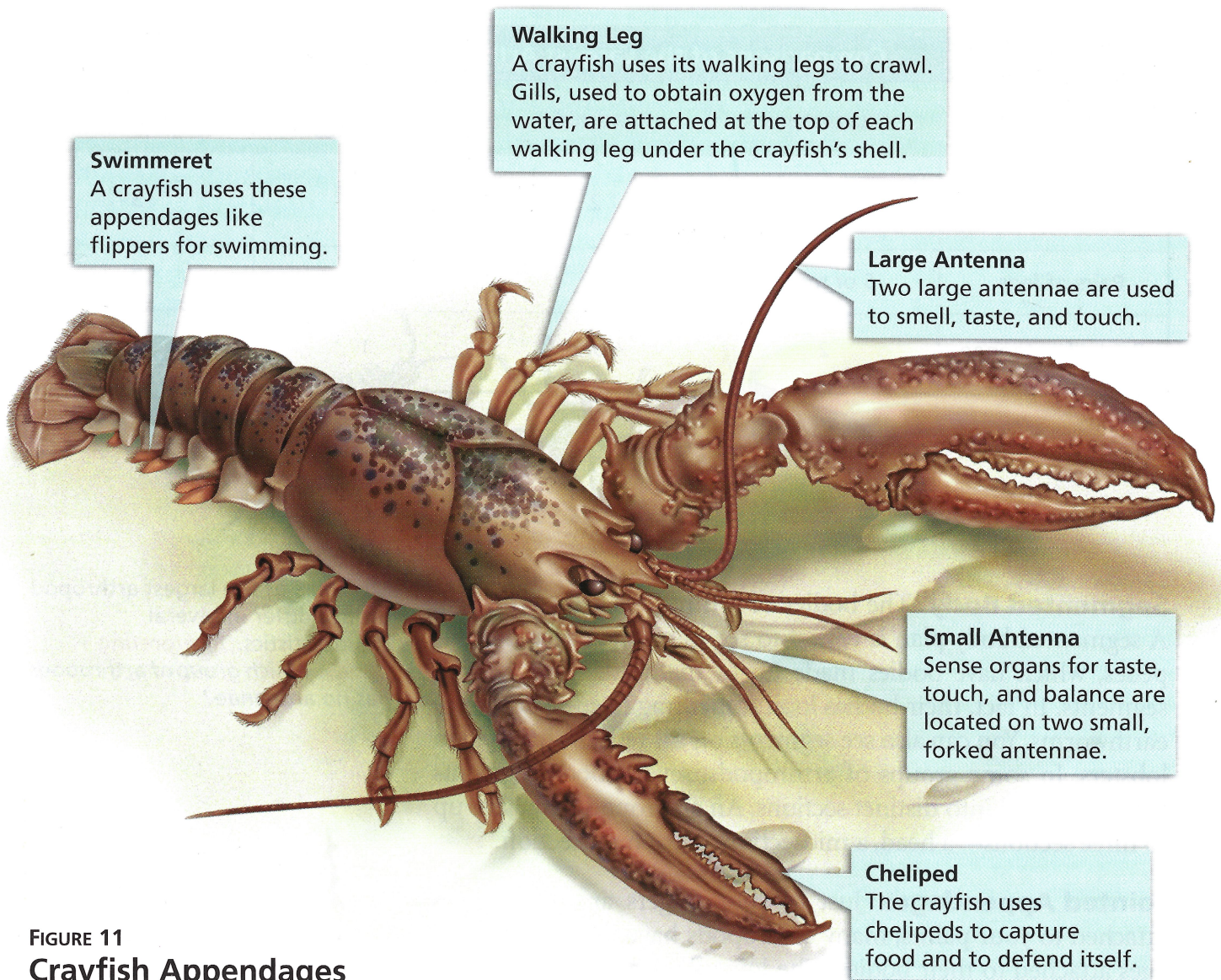


FIGURE 11
Crayfish Appendages

A crayfish's appendages are as varied as the tools on a Swiss army knife. The appendages are adapted for different functions.

Interpreting Diagrams *What functions do the chelipeds serve?*

Crustaceans

If you've ever eaten shrimp cocktail or crab cakes, you've dined on **crustaceans** (krus TAY shunz). Crayfish and lobsters are other familiar crustaceans. Crustaceans thrive in freshwater lakes and rivers, and even in puddles that last a long time. You can find them in the deepest parts of oceans and along coastlines. A few, like the pill bug, live in damp places on land.

Body Structure Crustaceans share certain characteristics. A **crustacean is an arthropod that has two or three body sections, five or more pairs of legs, and two pairs of antennae.** Each crustacean body segment has a pair of legs or another type of appendage attached to it. The various types of appendages function differently, as you can see in Figure 11.

The appendages attached to the head of a crayfish include two pairs of antennae that are used for smelling, tasting, touching, and keeping balance. The crayfish uses most of its leg appendages for walking. However, it uses its first pair of legs, called chelipeds, for obtaining food and defending itself.

Obtaining Oxygen and Food Because crustaceans live in watery environments, most have gills to obtain oxygen. The gills are located beneath the shell of a crustacean. Water containing oxygen reaches the gills as a crustacean moves along in its environment.

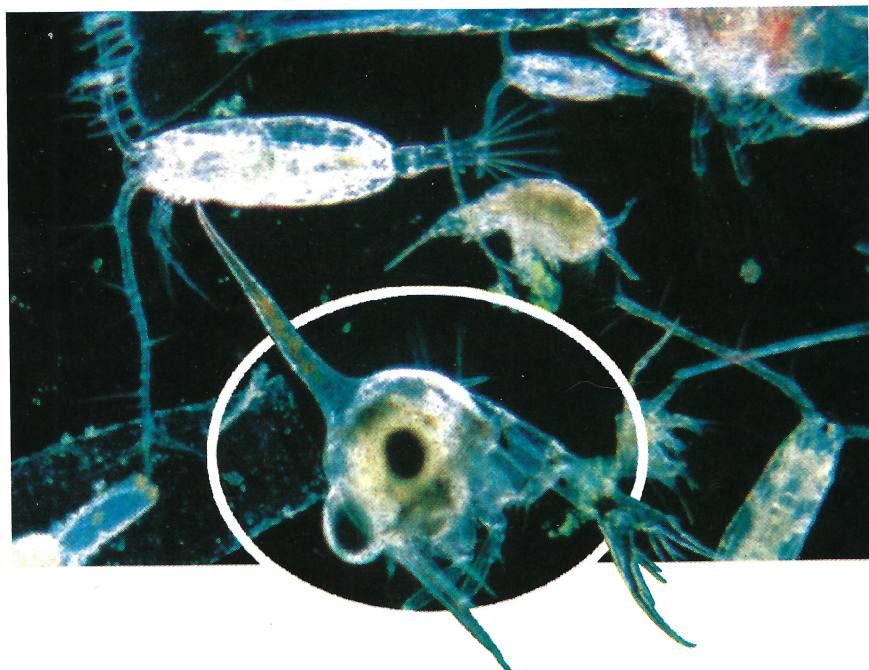
Crustaceans obtain food in many ways. Some are scavengers that eat dead plants and animals. Others are predators, eating animals they have killed. The pistol shrimp is a predator with an appendage that moves with such force that it stuns its prey. Krill, which are shrimplike crustaceans that live in cold ocean waters, are herbivores that eat plantlike microorganisms. In turn, krill are eaten by predators such as fishes, penguins, seals, and even great blue whales, the world's largest animals.

Life Cycle Most crustaceans, such as crabs, barnacles, and shrimp, begin their lives as microscopic, swimming larvae. The bodies of these larvae do not resemble those of adults. Crustacean larvae develop into adults by **metamorphosis** (met uh MAWR fuh sis), a process in which an animal's body undergoes dramatic changes in form during its life cycle.



Reading Checkpoint

What organs does a crustacean use to obtain oxygen?

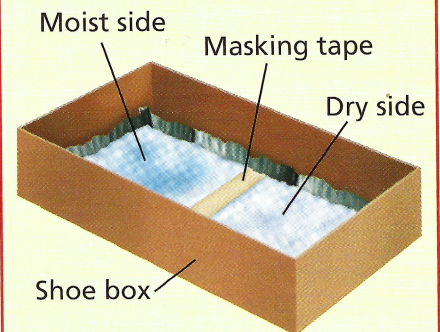



Lab zone

Try This Activity

Pill Bugs—Wet or Dry?

1. Line a box with aluminum foil. Tape down two paper towels side by side in the box. Tape a strip of masking tape between the two towels. Moisten one of the paper towels. Keep the other towel dry.



2.  Put ten pill bugs on the masking tape. Then put a lid on the box.
3. After 5 minutes, lift the lid and count the pill bugs on the dry towel, the moist towel, and the masking tape. Record your results in a data table.
4. Repeat Steps 2 and 3 two more times. Then average the results of the three trials. Wash your hands after handling the pill bugs.

Interpreting Data Do pill bugs prefer a moist or a dry environment?

FIGURE 12

Crab Larva

This larva of a crab floats in the ocean with other microscopic animals.

FIGURE 13

Red Knee Tarantula

This red knee tarantula lives in an underground burrow. The spider uses fangs to inject venom into its prey.



Arachnids

Spiders, mites, ticks, and scorpions are the **arachnids** (uh RAK nidz) that people most often meet. **Arachnids are arthropods with two body sections, four pairs of legs, and no antennae.** Their first body section is a combined head and midsection. The hind section, called the **abdomen**, is the other section. The abdomen contains the reproductive organs and part of the digestive system.

Spiders Spiders are probably the most familiar, most feared, and most fascinating kind of arachnid. All spiders are predators, and most of them eat insects. Some, such as tarantulas and wolf spiders, run down their prey. Others, such as golden garden spiders, spin sticky webs to trap their prey.

Spiders have hollow fangs through which they inject venom into their prey. Spider venom turns the tissues of the prey into mush. Later the spider uses its fangs like drinking straws, and sucks in the food. In spite of what some people might think, spiders rarely bite people. When spiders do bite, their bites are often painful but not life-threatening. However, the bite of a brown recluse or a black widow may require hospital care.

FIGURE 14

Dust Mite

This microscopic dust mite feeds on dead skin and hair shed by humans. **Classifying** *Would you describe the mite as a carnivore, scavenger, or filter feeder? Why?*



Mites If chiggers have ever given you an itchy rash, you've had an unpleasant encounter with tiny arachnids called mites. Chiggers and many other mites are parasites. Ear mites, for example, give dogs and cats itchy ears. Mites are everywhere. Even the cleanest houses have microscopic dust mites. If you are allergic to dust, you may actually be allergic to the exoskeletons of dust mites. In addition to living in dry areas, mites also live in fresh water and in the ocean.



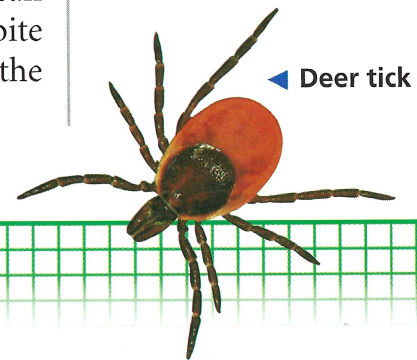
What kind of arachnid is a chigger?



FIGURE 15
Scorpion
 A scorpion is a carnivore that injects venom from a stinger at the end of its abdomen.

Scorpions Scorpions live mainly in hot climates, and are usually active at night. During the day, scorpions hide in cool places—under rocks and logs, or in holes in the ground, for example. At the end of its abdomen, a scorpion has a spinelike stinger. The scorpion uses the stinger to inject venom into its prey, which is usually a spider or an insect.

Ticks Ticks are parasites that live on the outside of a host animal's body. Nearly every kind of land animal has a species of tick that sucks its blood. Some ticks that attack humans can carry diseases. Lyme disease, for example, is spread by the bite of an infected deer tick. You can see an enlarged deer tick to the right. In reality, a deer tick is just a few millimeters long.



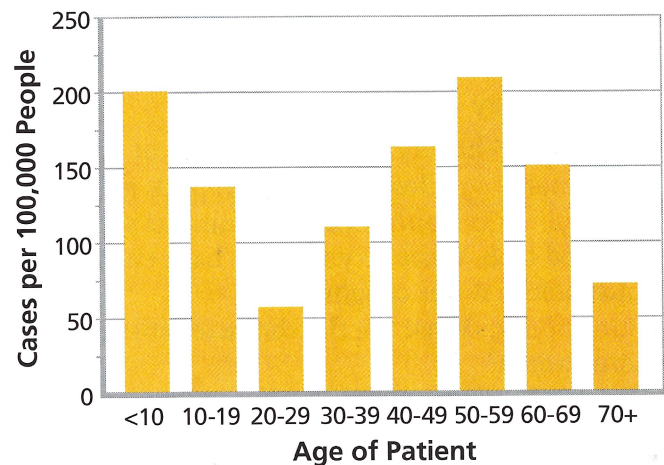
Math Analyzing Data

Lyme Disease Cases

The graph shows the numbers of cases of Lyme disease by age group reported by Connecticut during one year. Use the graph to answer the questions.

- Reading Graphs** What variable is plotted on the y-axis? What does the first bar tell you?
- Interpreting Data** Which age group is least at risk for Lyme disease? Explain.
- Interpreting Data** Which two age groups are most at risk?
- Calculating** Suppose a particular school in Connecticut has 1,000 students ranging in age from 10 to 19. About how many of these students would you expect to get Lyme disease per year?

Age Distribution of Lyme Disease Cases





Centipede



Millipede

FIGURE 16

Centipede and Millipede

Both centipedes and millipedes have many pairs of legs.

Interpreting Photographs How many pairs of legs does each segment of the centipede have?

Centipedes and Millipedes

Centipedes and millipedes are arthropods with two body sections and many pairs of legs. The two body sections are a head with one pair of antennae, and a long abdomen with many segments. Centipedes have one pair of legs attached to each segment. Some centipedes have more than 100 segments. In fact, the word *centipede* means “hundred feet.” Centipedes are swift predators that inject venom into their prey.

Millipedes, which may have more than 80 segments, have two pairs of legs on each segment—more legs than any other arthropod. Though *millipede* means “thousand feet,” they don’t have quite that many legs. Most millipedes are scavengers that graze on partly decayed leaves. When they are disturbed, millipedes can curl up into a ball, protected by their tough exoskeleton. Some will also squirt an awful-smelling liquid at a potential predator.

Section 2 Assessment

Target Reading Skill Asking Questions Use the answers to the questions you wrote about the headings to help you answer the questions below.

Reviewing Key Concepts

- Naming** What are the major groups of arthropods?
 - Summarizing** How are all arthropods alike?
 - Applying Concepts** Some restaurants serve soft-shelled crab. What do you think happened to the crab just before it was caught?
- Identifying** What are the characteristics of a crustacean?
 - Reviewing** Describe the body structure of an arachnid.
 - Comparing and Contrasting** How are centipedes and millipedes alike? How are they different?

Writing in Science

Observation Write about an arthropod that you have observed. Describe details about its physical appearance, its movements, and any other behaviors that you observed.