

CHAPTER 24

A Closer Look at Arthropods

Summary of Key Concepts

Concept 24.1 Arthropods are the most numerous and diverse animals. (pp. 524–527)

Members of the phylum Arthropoda, called *arthropods*, have segmented bodies, with distinct groupings of segments. Many arthropods have three distinct segment groupings: head, thorax, and abdomen. The head has eyes, mouthparts, and antennae. The middle section, called the *thorax*, has legs and wings. The abdomen has reproductive parts. The parts attached to a segment are called appendages. An arthropod’s appendages bend at joints, and thus are called *jointed appendages*. The arthropod body is covered by a hard external skeleton called an *exoskeleton*. The exoskeleton contains a polysaccharide called *chitin*. As an arthropod grows, it must sometimes shed its old exoskeleton and secrete a new one. This process is called *molting*.

Arthropods have an open circulatory system. The nervous system is made up of a brain and a nerve cord. All along the nerve cord are clusters of nerve cell bodies called *ganglia*. Most arthropods have *compound eyes*, which are eyes with many lenses. Aquatic arthropods have gills that function in gas exchange. Most land-dwelling arthropods have *tracheae*, chitin-lined tubes that lead from the internal body to the outside. Tracheae allow the exchange of gases through holes in the exoskeleton called *spiracles*.

Fossils show that the first arthropods evolved in the sea about 560 million years ago. Early examples of arthropods are the trilobites, which are now extinct. Today, there are five main groups of arthropods. Horseshoe crabs are spiderlike arthropods that live in the sea. Another group that lives mostly in aquatic environments is the *Crustaceans*, including lobsters, crabs, crayfish, shrimp, and barnacles. The majority of arthropods live on land. *Arachnids* include spiders, scorpions, mites, and ticks. *Insects* include beetles, ants, grasshoppers, and many others. Myriapods, which have many more legs than insects, include centipedes and millipedes.

1. What are the general characteristics of arthropods? _____

2. What are the five main groups of living arthropods? _____

Concept 24.2 Arachnids include spiders and scorpions. (pp. 528–529)

Arachnids have two body sections and four pairs of legs. The two body sections are the cephalothorax and the abdomen. The *cephalothorax* is made up of a fused head and thorax. On the cephalothorax, arachnids have two pairs of mouthparts. *Chelicerae* are fanglike mouthparts used to paralyze prey with poison. *Pedipalps* are mouthparts used to handle prey.

Almost all arachnids live on land, and they have adaptations to help them keep water in their bodies. *Malpighian tubules* are excretory structures that

remove wastes from the fluid in the body cavity without losing much water. Arachnids also have *book lungs*, respiratory structures that contain many flaps of tissue, which provide a large surface area for gas exchange.

There are three main subgroups of arachnids. Spiders are generally hunters or weavers. To weave webs, spiders use silk that is spun into fibers by organs called *spinnerets*. Scorpions are nighttime hunters that live mainly in deserts. The tip of a scorpion's tail bears a poisonous stinger. Mites and ticks are small, often microscopic arachnids. Many are parasites that suck sap from plants or blood from mammals, but most are free-living.

3. What are the general characteristics of arachnids? _____

4. What are the three main groups of arachnids? _____

Concept 24.3 Crustaceans are the most common aquatic arthropods.
(pp. 530–531)

The decapods include lobsters, crabs, crayfish, and shrimp. Most of these crustaceans have four pairs of walking legs and one pair of pincers (claws). Most decapods are marine animals, though crayfish live in fresh water and some tropical crabs live on land. Decapods have two main body sections: a cephalothorax and an abdomen. A decapod's exoskeleton is harder than that of many other arthropods because it is reinforced with calcium carbonate (limestone). The portion of the exoskeleton that covers the back of the cephalothorax forms a shield called a *carapace*. Decapods and other crustaceans have two pairs of antennae attached to the head. Decapods also have hard mouthparts called *mandibles* that bite and grind food.

Crustaceans other than decapods include barnacles, copepods, and isopods. Barnacles are marine crustaceans with calcium carbonate shells. Barnacles stick to rocks and other surfaces. Copepods, which are very small, feed mainly on phytoplankton, and they are a food source for fishes and other marine organisms. Most isopods are marine crustaceans. Isopods also include land-dwelling pill bugs, sometimes called wood lice.

5. What are the characteristics of decapods? _____

6. In what habitats would you likely find barnacles, copepods, and isopods?

Concept 24.4 Insects play major roles in terrestrial environments.
(pp. 532–537)

Insects have three main body parts: head, thorax, and abdomen. Insects have three pairs of walking legs, and they usually have one or two pairs of wings attached to the thorax. Insects have Malpighian tubules that serve in excretion and a tracheal system that transports gases through the body. Insects typically have compound eyes and one pair of antennae. Antennae detect chemical signals released by other insects. Signals released by the same

species, called pheromones, help attract mates. Insects have a great variety of mouthparts, and most have wings in adulthood. Flight is one key to the great success of insects.

Many insects undergo one of two types of metamorphosis. In incomplete metamorphosis, the change from juvenile to adulthood is not very dramatic. For example, juvenile grasshoppers look like miniature adults. In complete metamorphosis, the adult stage looks and functions very differently than the larval stage. Insects such as butterflies undergo complete metamorphosis. Typically, the larva is specialized for eating and growing, and the adult is specialized for moving and reproducing. Between the larval stage and the adult stage, the insect becomes a *pupa*, a stage in which the insect becomes inactive.

Humans depend on insects. Insects pollinate many flowering plants. Insects break down organic matter, producing new soil and recycling nutrients. Insects are also carriers of diseases that affect humans.

The field of biology dedicated to classifying and understanding insects is called *entomology*. One challenge for entomologists is to solve problems caused by pest insects. One method is to use insects to fight insects, which is an example of *biological control*.

7. What are the general characteristics of insects? _____

8. What is the main difference between incomplete metamorphosis and complete metamorphosis? _____

Reading Skills Practice

Interpreting illustrations By looking carefully at labeled diagrams in textbooks, you can help yourself better understand what you have read. Look carefully at Figure 24-3 on page 525. Then, use what you see to write a paragraph that describes the general anatomy of a terrestrial arthropod.

Vocabulary Review and Reinforcement

In 1–8, fill in the blanks with the appropriate terms from the chapter.

1. The eyes of arthropods, with many lenses, are called _____.
2. The fanglike mouthparts used by arachnids to paralyze prey with poison are called _____.
3. The hard external covering on an arthropod is called a(n) _____.
4. The crustacean mouthparts that bite and grind food are called _____.
5. All along an arthropod's nerve cord are clusters of nerve cell bodies called _____.

6. A spider spins silk into fibers with organs near the end of the abdomen called _____.
7. An insect that undergoes complete metamorphosis becomes a(n) _____ between the larval and adult stages.

In 8–10, complete the table by writing the correct group name in the first column to match the examples of arthropods in the second column.

MAJOR GROUPS OF ARTHROPODS

| Group | Examples |
|-----------|---|
| 8. _____ | Spiders, scorpions, mites, ticks |
| 9. _____ | Lobsters, crabs, crayfish, shrimp, barnacles |
| 10. _____ | Beetles, ants, grasshoppers, butterflies, dragonflies |

WordWise

Answer the questions by writing the Key Terms in the blanks. Then put the numbered letters in order to find the hidden Key Term. Write a definition for the hidden Key Term.

1. What are the chitin-lined tubes that lead from the internal parts of an arthropod’s body to the outside?

 1
2. What is the polysaccharide that makes up an arthropod’s exoskeleton?

 2
3. What is the process by which an arthropod sheds its old exoskeleton and secretes a larger one?

 3
4. What is the portion of the exoskeleton that covers the back of the cephalothorax in crustaceans?

 4
5. What are the holes in the exoskeleton that allow for the exchange of carbon dioxide and oxygen?

 5
6. What is the fused head and thorax in an arachnid?

 6

Key Term: _____
 1 2 3 4 5 6

Definition: _____
