

Chapter 28 Arthropods and Echinoderms**Summary****28-1 Introduction to the Arthropods**

Phylum Arthropoda includes animals such as crabs, spiders, and insects. Arthropods have a segmented body, a tough exoskeleton, and jointed appendages. An exoskeleton is a tough external body covering. An arthropod exoskeleton is made from protein and a carbohydrate called chitin. All arthropods have appendages with joints (places that bend). Appendages are structures such as legs and antennae that extend from the body wall.

The evolution of arthropods—by natural selection and other processes—has led to fewer body segments and highly specialized appendages for feeding, movement, and other functions. Most living arthropods have only two or three segments. Living arthropods have specialized appendages such as antennae, walking legs, wings, and mouthparts.

Arthropods include herbivores, carnivores, and omnivores. Most terrestrial arthropods breathe through a network of branching tracheal tubes that extend throughout the body. Most aquatic arthropods have gills. Arthropods have an open circulatory system. Most terrestrial arthropods dispose of nitrogen-containing wastes using saclike organs called Malpighian tubules. Terrestrial arthropods have internal fertilization. Aquatic arthropods have internal or external fertilization.

When arthropods outgrow their exoskeletons, they undergo periods of molting. During molting, an arthropod sheds its entire exoskeleton and manufactures a larger one to take its place.

28-2 Groups of Arthropods

Arthropods are classified based on the number and structure of their body segments and appendages—particularly their mouthparts.

Crustaceans—subphylum Crustacea—include crabs, shrimps, lobsters, crayfishes, and barnacles. Crustaceans typically have two pairs of antennae, two or three body sections, and chewing mouthparts called mandibles. Crustaceans with three body sections have a head, a thorax, and an abdomen. The thorax lies just behind the head and houses most of the internal organs. In crustaceans with two sections, the head and thorax are fused, forming a cephalothorax.

Chelicerates—subphylum Chelicerata—include horseshoe crabs, spiders, ticks, and scorpions. Chelicerates have mouthparts called chelicerae and two body sections. Nearly all chelicerates have four pairs of walking legs. Horseshoe crabs are the oldest living arthropods. The arachnids—class Arachnida—include spiders, mites, ticks, and scorpions. Spiders are the largest group of arachnids. Spiders spin strong webs by forcing liquid silk through spinnerets, organs that contain silk glands.

Uniramians—subphylum Uniramia—include centipedes, millipedes, and insects. Uniramians have jaws, one pair of antennae, and unbranched appendages. Centipedes have a few to more than 100 pairs of legs. Most body segments have one pair of legs each. Centipedes are carnivores. Millipedes have two, not one, pairs of legs per segment. Millipedes feed on dead or decaying plant material.

28-3 Insects

Insects have a body divided into three parts—head, thorax, and abdomen. Three pairs of legs are attached to the thorax. A typical insect has a pair of antennae, a pair of compound eyes, and two pairs of wings. Compound eyes are made of many lenses, and they detect minute changes in color and movement.

Insects have three pairs of appendages used as mouthparts, including a pair of mandibles. Insect mouthparts are a variety of shapes.

The growth and development of insects usually involve metamorphosis, which is a process of changing shape and form. In incomplete metamorphosis, the immature forms of insects look very much like adults. The immature forms are called nymphs. Nymphs gradually acquire adult structures. Insects such as bees, moths, and beetles undergo complete metamorphosis. These insects hatch into larvae that look and act nothing like adults. A larva changes into a pupa, the stage in which the larva changes into an adult.

Insects are known for their destructive effects. Termites destroy wood, and mosquitoes bite humans. Yet insects are also beneficial to humans. For example, insects pollinate many crops.

Insects communicate using sound, chemical, and other types of signals. Pheromones are specific chemical messengers that affect behavior or development in other individuals of the same species.

Ants, bees, termites, and some of their relatives form complex associations called societies. A society is a group of animals of the same species that works together for the benefit of the whole group.

Echinoderms have an endoskeleton, which is an internal skeleton. Most adult echinoderms exhibit five-part radial symmetry. Echinoderm larvae exhibit bilateral symmetry. Echinoderms are deuterostomes—an indication that echinoderms and vertebrates are closely related.

Echinoderms have a system of internal tubes called a water vascular system. The water vascular system is filled with fluid. It carries out many essential body functions in echinoderms, including respiration, circulation, and movement. It opens to the outside through a sievelike structure called a madreporite. In sea stars, the madreporite connects to a ring canal. From the ring canal, five radial canals extend along body segments. Attached to each radial canal are hundreds of tube feet. A tube foot is a structure that operates much like a suction cup. In most echinoderms, waste is released as feces through the anus. Most echinoderms move using their tube feet. Echinoderms reproduce by external fertilization.

Classes of echinoderms include sea urchins and sand dollars, brittle stars, sea cucumbers, sea stars, and sea lilies and feather stars. Echinoderms are common in a variety of marine habitats.

28–4 Echinoderms

Phylum Echinodermata consists of animals such as sea stars, sea urchins, and sand dollars. Echinoderms are characterized by spiny skin, a water vascular system, and suction-cuplike structures called tube feet.