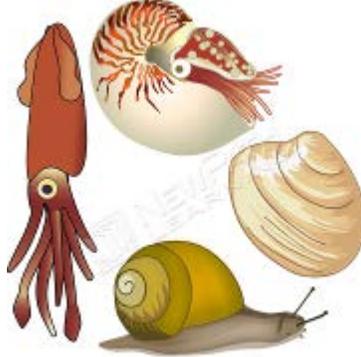


MOLLUSKS, ARTHROPODS AND ECHINODERMS

Characteristics of Mollusks

A mollusk is an invertebrate that has an un-segmented, soft body that is almost always protected by outer shells.



Snails, octopuses, clams, and oysters are all species of mollusks.

Mollusks have internal organs called the mantle.

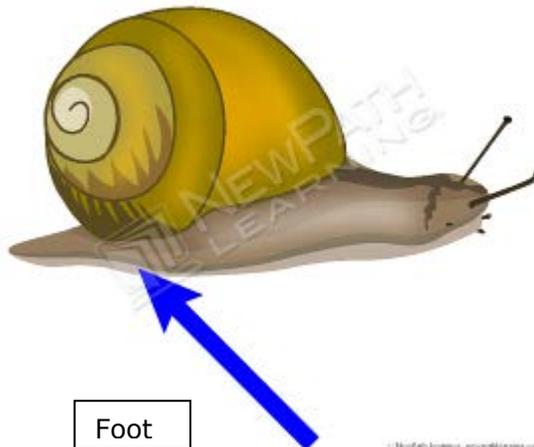


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Movement
The major muscle helps them move.

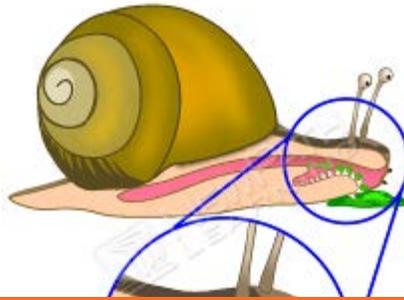


Structure

Mollusks have bilateral symmetry and internal organs that are located in one area. Some of the internal organs include a stomach, heart, reproductive organs, and a pair of kidneys.

The **kidneys** are organs that eliminate wastes produced by the cells. Most mollusks that live in a water environment have gills. **Gills** are organs that take oxygen out of water. The gills have a large supply of blood vessels that allow oxygen to diffuse across their membrane and carbon dioxide to diffuse out of the mollusk.

Mollusks also have an organ called a radula. The **radula** is a structure that is bendable and is covered in small teeth. Mollusks use the radula to draw in food and to tear it into pieces they can digest.



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Three Major Groups of Mollusks

Scientists classify mollusks into groups based on the presence of a shell, the type of shell, the type of nervous system, the type of radula, and the function of the foot. These characteristics help to place each species of mollusk into three major groups: **Gastropods**, **cephalopods**, and **bivalves**.

Gastropods

The **gastropods** are the most abundant of the mollusks, which include snails and slugs. These mollusks have no shell or a single shell.

Snails have a single shell and slugs do not have a shell at all. A gastropod has sense organs located in the head and a muscular foot that helps it to move around. The stomach of a gastropod is on the same side of the body as the foot, which is how gastropods got their name.

How Gastropods Avoid Predators

When the conditions are dry or there is a predator nearby, gastropods with shells will retreat into their shells. Some gastropods have a structure called a **trapdoor** that will close once the gastropod retreats into its shell. This seals the gastropod inside the shell until the threat is gone. Gastropods feed in many different ways. They are herbivores, omnivores and carnivores.

The Bivalve

The second major group of mollusks is the **bivalve**, which are **mollusks with two shells** that are held together by a hinge and secured by very strong muscles.

Species of bivalves include oysters, clams, and mussels. Bivalves are a unique mollusk because they are filter feeders and they do not have a radula.

Cephalopods

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Cephalopods are mollusks that adapted their feet into tentacles that surround their mouth. Examples of cephalopods include octopus, squid, cuttlefish, and the nautilus. The shells of the cephalopod species vary from not having a shell, having a small internal shell, to having an external shell.

They catch food with their tentacles, which have suckers on them that are sensitive to smell and touch. Cephalopods have the largest brain of the invertebrates which allows them to have excellent vision and the ability to learn from their environment.

Lesson Checkpoint:
What type of mollusk is a nautilus shell?

Arthropods

Arthropods are invertebrates with external skeletons, segmented bodies, and appendages. **Appendages** are structures that are jointed and attached to the body.

Most arthropods reproduce sexually and are either male or female, have an open circulatory system, and have internal fertilization. An **open circulatory system** is when the blood leaves the blood vessels and bathes the internal organs within the body. **Internal fertilization** is when the sperm and egg meet inside the body. Arthropods have a waterproof outer covering called an **exoskeleton**. The exoskeleton prevents water from evaporating and protects them from predators. The exoskeleton is made up of a material known as **chitin**. The exoskeleton of an arthropod is unable to grow as the organism grows larger.

What if the arthropod outgrows its exoskeleton? In a process known as **molting**, an arthropod will shed its exoskeleton and grow a new, larger exoskeleton. **Molting** leaves the organism vulnerable to predators.

Some arthropods, such as centipedes and millipedes, have many pairs of legs.

Other arthropods, such as insects, have six legs.

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The segmented area is the back portion of the organism. The jointed appendages of arthropods give them flexibility and a better ability to move. Appendages are also adapted to be used as tools that help the organisms feed on their prey. The appendages known as **antenna** are adapted to pick up information from the organism's environment, like smell, taste, balance, and touch.

Lesson Checkpoint: What does an arthropod do if it outgrows its exoskeleton?

Five Major Groups of Arthropods

There are five major groups of arthropods: arachnids, centipedes, millipedes, crustaceans, and insects.

Arachnids: An arachnid is an arthropod that has two body segments, the first being the head and chest and the second being the abdomen.

The **abdomen** contains the part of the digestive tract and the reproductive organs. Arachnids do not have antenna, have eight legs, and breathe through lungs that are attached to openings on the exoskeleton. Mites, scorpions, spiders, and ticks are all arachnids.

Centipedes and Millipedes: The bodies of centipedes and millipedes have a high number of segments. One pair of legs attaches to each segment of a **centipede** and two pairs of legs are attached to each segment of a **millipede**.

Crustaceans: A crustacean is an arthropod that has three pairs of appendages. Crustaceans have two or three body segments.

Crustaceans have two or three pairs of appendages attached to each body segment. They develop in water.

Metamorphosis: Metamorphosis is a dramatic change in an organism's body form during its life cycle.

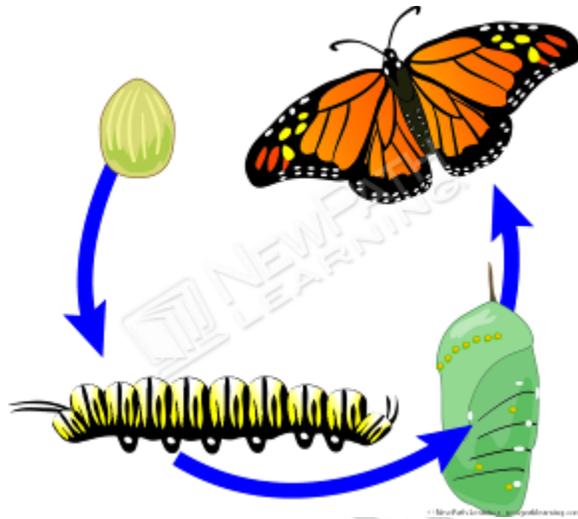
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Insects: Insects have a consistent body form between the different species. An **insect** is an arthropod with usually one or two pairs of wings, six legs, one pair of antenna, and three body sections.

The three sections are the head, thorax, and abdomen. The **thorax** is the middle section that wings are attached too. During an insect's life, it will undergo one of two different types of metamorphosis.

Complete metamorphosis consists of four stages: egg, larva, pupa, and adult. The insect will begin life in a fertilized egg, which will hatch and an insect larva will emerge. After growing dramatically, the larva will enter the third stage called the pupa. During the **pupa** stage, the larva will be encased in a protective covering where it will develop into the adult form of the insect.



Gradual metamorphosis is when the larva appears similar to the adult insect, but goes through a series of molts until it reaches the adult stage.

Once the insect reaches the adult stage, it can reproduce.



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Echinoderms

An echinoderm is an invertebrate that is radially symmetrical and lives on the floor of the ocean.

The Endoskeleton

An echinoderm has a skeleton that is internal and spiny, called an **endoskeleton**. Adult echinoderms have radial symmetry that is usually in multiples of five. Examples of echinoderms are sea stars, sea urchins, sand dollars, and sea cucumbers. Echinoderms also have an internal fluid system called a water vascular system.



Water Vascular System

The **water vascular system** is a system of tubes within the body where fluids flow to help the animal survive.

Parts of the tubes are able to squeeze together forcing the water into structures called **pedicellars**. The **pedicellars** are small structures that they help the echinoderm move.

The **tube feet** are used for gripping and capturing food.

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