

# Classifying Organisms

Hundreds of years ago, people arranged organisms into groups based on how they looked and behaved. For example, birds and butterflies were grouped together because they had wings and could fly. Today, scientists know that birds and butterflies cannot be grouped together. They discovered new evidence that allowed them to arrange organisms in a new way, in which birds and butterflies belong to different groups.

## How Are Organisms Classified?

### Learning Point

1. Explain how and why scientists classify organisms.

**Classification** is the process of arranging organisms into groups based on their similarities. When you arranged the pictures of organisms into groups, you were classifying them. Scientists classify organisms based on similarities in structures, both inside and outside the body. Whales were once considered to be very large fish because they live in water, swim, and have flippers. Today they are classified in the same group as dogs. Both dogs and whales have lungs, give birth to live young, and feed their young milk.

Classification helps scientists identify an unfamiliar organism. It also helps scientists determine if organisms are related to each other. Classifying and naming each kind of organism help scientists in different parts of the world avoid confusion when identifying and discussing specific organisms.



*The humpback whale is classified as a mammal although it may look and behave like a fish.*



*These masked butterfly fish are classified as fish. They breathe with gills instead of lungs and lay their eggs in water.*

# Kingdom Plantae

Plants are multicellular organisms that use sunlight to make food by photosynthesis. Plants cannot move from one place to another, but they can grow toward light and water. If you have ever observed a vine, you know that some plants support themselves by wrapping their stems around objects.

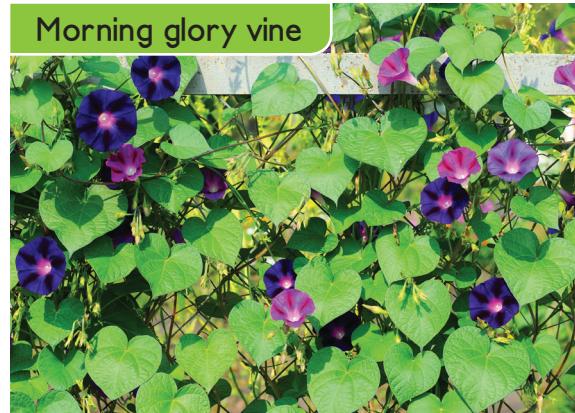
## Learning Point

4. Describe the main characteristics of plants.

Horsetail



Morning glory vine



*Horsetail and morning glory are both plants. They may look different, but they share many characteristics.*

*Vines can climb along some of the objects they touch.*

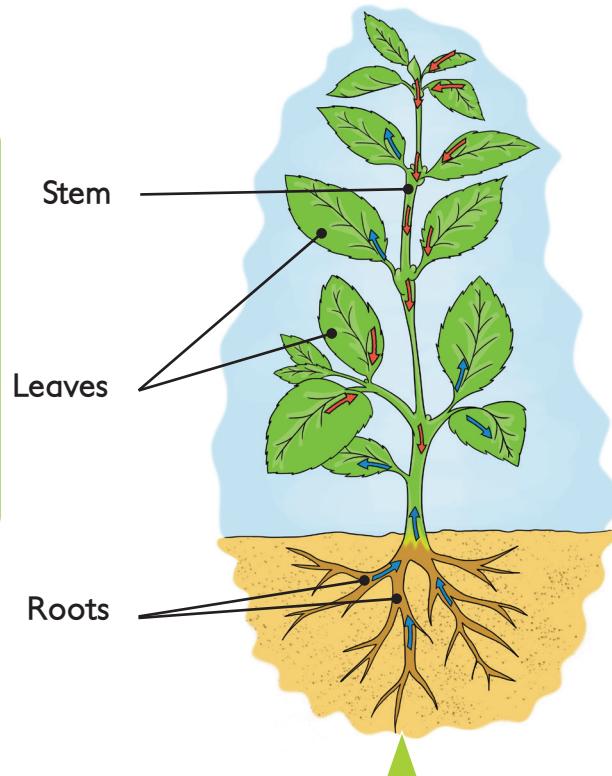


A **vascular plant** has tubes that transport water, minerals, and food. Xylem and phloem are tubes that make up a plant's vascular system. Plants that have no vascular system are called **nonvascular plants**. Such plants are usually very small and move materials directly between cells.

## Key

→ Food is transported from leaves to other parts of the plant.

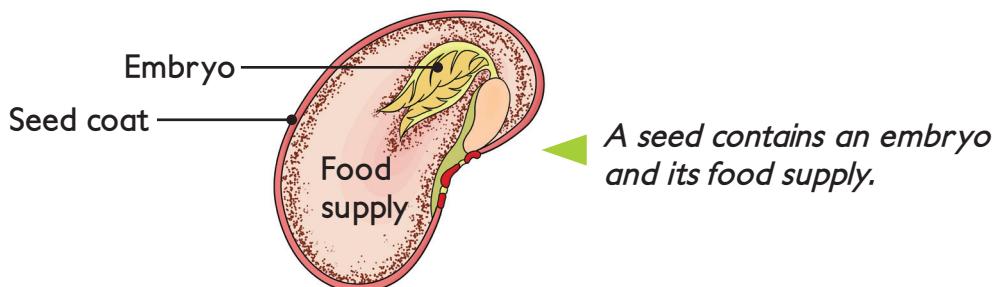
→ Water and nutrients are transported from roots up to other parts of the plant.



*The vascular system allows plants to transport food, water, and minerals to all its parts.*

Plants reproduce by seeds or spores. A **seed** is a structure that contains an embryo, which is a small developing plant, and its food supply. The seed is surrounded by a seed coat. The seed sprouts, or starts to grow, when water becomes available and the temperature is suitable.

A **spore** is a small reproductive cell that grows into a multicellular organism. Spores have a coating that protects them, but they do not contain embryos or stored food.



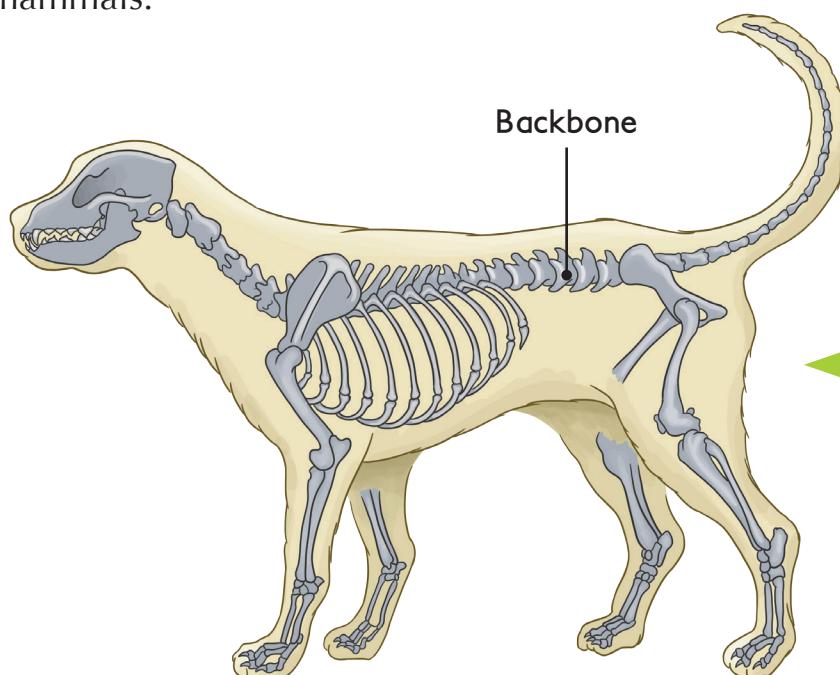
# Kingdom Animalia

An animal is a multicellular organism that gets energy by eating other organisms or substances made by other organisms.

Scientists classify the organisms of the animal kingdom into two main groups: vertebrates and invertebrates. A **vertebrate** is an animal that has a backbone. The backbone is part of the animal's internal skeleton. The skeleton supports the animal and allows it to move. As an animal grows larger, its skeleton grows larger, too. Vertebrates include fish, birds, reptiles, amphibians, and mammals.

## Learning Point

5. Describe the main characteristics of animals.



*A backbone is part of a vertebrate's internal skeleton. The skeleton gives the animal its shape, supports it, and helps it move.*



*Amphibians have thick, moist skin.*



*Reptiles have dry, scaly skin.*

An **invertebrate** is an animal with no backbone. Because they have no internal skeleton for support, most invertebrates are small. They support their bodies with hard coverings or shells. Invertebrates include insects, snails, spiders, crabs, and scorpions.



*Insects have six legs and two antennae. They shed their hard outside covering as they grow.*



*A snail has a soft body and a hard shell. It has tentacles and eyes that sense the surroundings.*



*Spiders have eight legs.*



*Crabs have five pairs of legs. The first pair is made of pincers. Crabs have an extremely hard covering called a carapace.*

**Describe** two different ways that plants move material inside their bodies.

**Describe** how vertebrates support their bodies compared to invertebrates.

# Heredity and Inheritance

## Inherited Traits



### Learning Point

1. Identify and describe inherited traits.

An **inherited trait** is a trait that is passed on from parent to offspring. The traits you observed in the Explore activity are physical traits. Physical traits are traits that describe body parts. Most physical traits are inherited. The shape and color of a daisy flower are inherited physical traits; the number of legs on an insect is inherited, too.

The inherited traits of offspring resemble those of their parents. An acorn from an oak tree will grow into another oak tree with the same kind of leaves as the parent tree. It will not grow into another kind of tree with different leaves. The shape of the oak leaf is an inherited trait.



*Oak trees and elm trees both inherit the shapes of their leaves from their respective parents.*

Like physical traits, behaviors can also be inherited. A behavior describes how an organism acts. A sea turtle lays its eggs in the sand on a beach and then swims back into the ocean. When the eggs hatch, the baby turtles head for the water and swim away. No one teaches them how to do this behavior. It is inherited.

*Crawling to the ocean after hatching is an inherited behavior in sea turtles.*



## Acquired Traits

Not all traits are inherited; some can be acquired. An **acquired trait** is a trait that is picked up through learning or from the environment.

Physical traits that are acquired are not passed to offspring. Some traits are acquired from the environment in which an organism lives. For example, a green leaf may turn brown if it is exposed to too much sun. However, the plant's offspring will not inherit its brown leaves.



### Learning Point

- Explain how traits can be acquired.

*The bending of this tree is an acquired trait caused by the blowing wind.*

Other kinds of behavioral traits are acquired through learning. For example, a dog learns to catch a flying disc by practicing the trick over and over. People learn to speak a language by hearing and practicing it.



*The ability to catch a flying disc is an acquired trait.*

## Physical Adaptations



### Learning Point

3. Illustrate physical adaptations in animals and plants.

A trait or a behavior that helps an organism survive in its environment is called an **adaptation**.

Some adaptations help animals obtain food. For example, snakes have jaws that can come unhinged, allowing them to swallow their food whole.



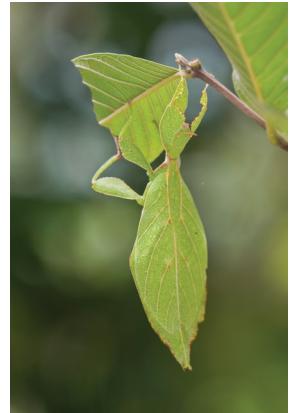
*Snakes can open their mouths very wide to swallow their food.*

Owls have fringed wings that allow them to fly in silence. This way, they can sneak up on their prey.



*Owls' wings allow them to fly silently and surprise their prey.*

Other adaptations help animals hide to avoid enemies. **Mimicry** is a kind of adaptation in which an organism looks like another organism. Mimicry helps an organism survive by frightening away or fooling its predators.



*These organisms are not leaves but two different insects. They use mimicry to look like leaves and avoid being seen by their predators.*

**Camouflage** is an adaptation that helps an animal blend into its environment and avoid being seen by its enemies.



*Can you find the insect in this picture? It is camouflaged against the tree trunk.*



*A lizard is camouflaged against rocks in a desert to hide from its predators.*

Plants have physical adaptations, too. Plants living in dry environments have adaptations to store water. For example, a barrel cactus has a thick, fleshy stem that stores water. Other plants living in dim places have large leaves to capture more sunlight.



*Barrel cacti store water in their stems. The stems also have chlorophyll to perform photosynthesis.*



*Plants on the forest floor have large leaves to capture sunlight.*

Other adaptations are important for plant reproduction. Dandelion seeds are attached to parachute-like structures that are easily carried by the wind. This adaptation allows the plant seeds to travel over long distances and reach new areas. Some flowers have colors and patterns that guide insects to them. While feeding on nectar in the flower, insects deposit pollen that stuck to them while visiting other flowers.



*The markings on this pansy are an adaptation that helps guide insects to the flower.*



*Dandelion seeds can fly in the air.*

## Behavioral Adaptations

In addition to physical adaptations, an organism's behavior can also be an adaptation. Both plants and animals show behavioral adaptations that help them survive and reproduce in their environments.

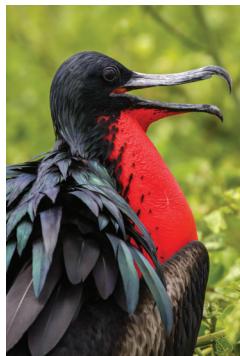
For example, the praying mantis insect tries to frighten away its enemy by making itself look bigger. The male frigate bird shows his readiness to mate by puffing out his chest.

### Learning Point

4. Illustrate behavioral adaptations in animals and plants.



*To scare its predators away, the praying mantis tries to make itself look bigger and frighten them.*



*A male frigate bird has a distinctive red pouch, which it inflates during the breeding season to attract females.*

Plants also have some behaviors that help them survive. For example, a plant left near a window will grow toward the light. This behavior helps the plant collect more sunlight to perform photosynthesis and produce more food.

*A houseplant placed near the window will bend toward the light.*



**Define** inherited trait and acquired trait.

**Analyze** your ability to ride a bike. What kind of trait is it? What factors affect this trait?

**Explain** how camouflage helps an organism survive.

Fish that live in the ocean are adapted to salty water. **Infer** how these fish would be affected if you placed them in a freshwater aquarium in your home.

# Renewable and Nonrenewable Energy

## Fossil Fuels



### Learning Point

1. Define fuel and explain how fossil fuels form.

A **fuel** is a natural resource that provides energy. The most commonly used fuels are fossil fuels. Fossil fuels are natural resources. Fossil fuels formed over millions of years. These fuels formed from the buried remains of decayed plants and animals.



*Oil and gas are fossil fuels. They are removed from the ground.*



*Coal is a fossil fuel. It is removed from mines.*

## Nonrenewable Energy

**Nonrenewable energy** is energy that comes from resources that cannot be restored over a short time. Fossil fuels provide nonrenewable energy.

Fossil fuels are burned to provide energy. This energy is used in homes, cars, and many factories. Fossil fuels are used to produce electricity. Oil, coal, and natural gas are three types of fossil fuels.

### Learning Point

2. Identify types of fossil fuels that give nonrenewable energy.



*Natural gas is a fossil fuel used to heat water and food.*

*Oil is a fossil fuel used in cars.*



*Coal is a fossil fuel used in factories to produce heat and electricity.*



## Fossil Fuels and Pollution

### Learning Point

- Explain how fossil fuels cause air, land, and water pollution.

**Pollution** is the addition of harmful substances to the environment.

Fossil fuels pollute air. Burning fossil fuels releases harmful substances into the air. Fossil fuels can pollute land and water, too. A ship carrying fossil fuels might leak. The leak causes the surrounding water and shore to become polluted. In this way, many living things are harmed or even killed.

*Factories burn fossil fuels and pollute the air.*

*Cars pollute the air.*

*A leaking ship, carrying oil, pollutes the seawater and harms living things.*

*Water pollution affects all living things.*

## Renewable Energy

**Renewable energy** is energy that comes from renewable sources. The sun, water, and wind are renewable sources of energy. Renewable sources of energy will not run out. Solar energy, hydropower, and wind power are examples of renewable energy. Renewable energy is nonpolluting.

### Learning Point

- Identify sources of renewable energy and explain their importance.

## Solar Energy

Solar energy is energy that comes from the sun. Solar energy is used to heat water and to produce electricity. Solar water heaters and solar panels are placed on the roofs of many houses.

### Learning Point

- Define solar energy and list some ways it is used.



*Solar panels gather energy from sunlight and change it into electricity.*

*Sunlight heats the water of solar water heaters.*



### Learning Point

6. Explain what hydropower is and how it is produced.

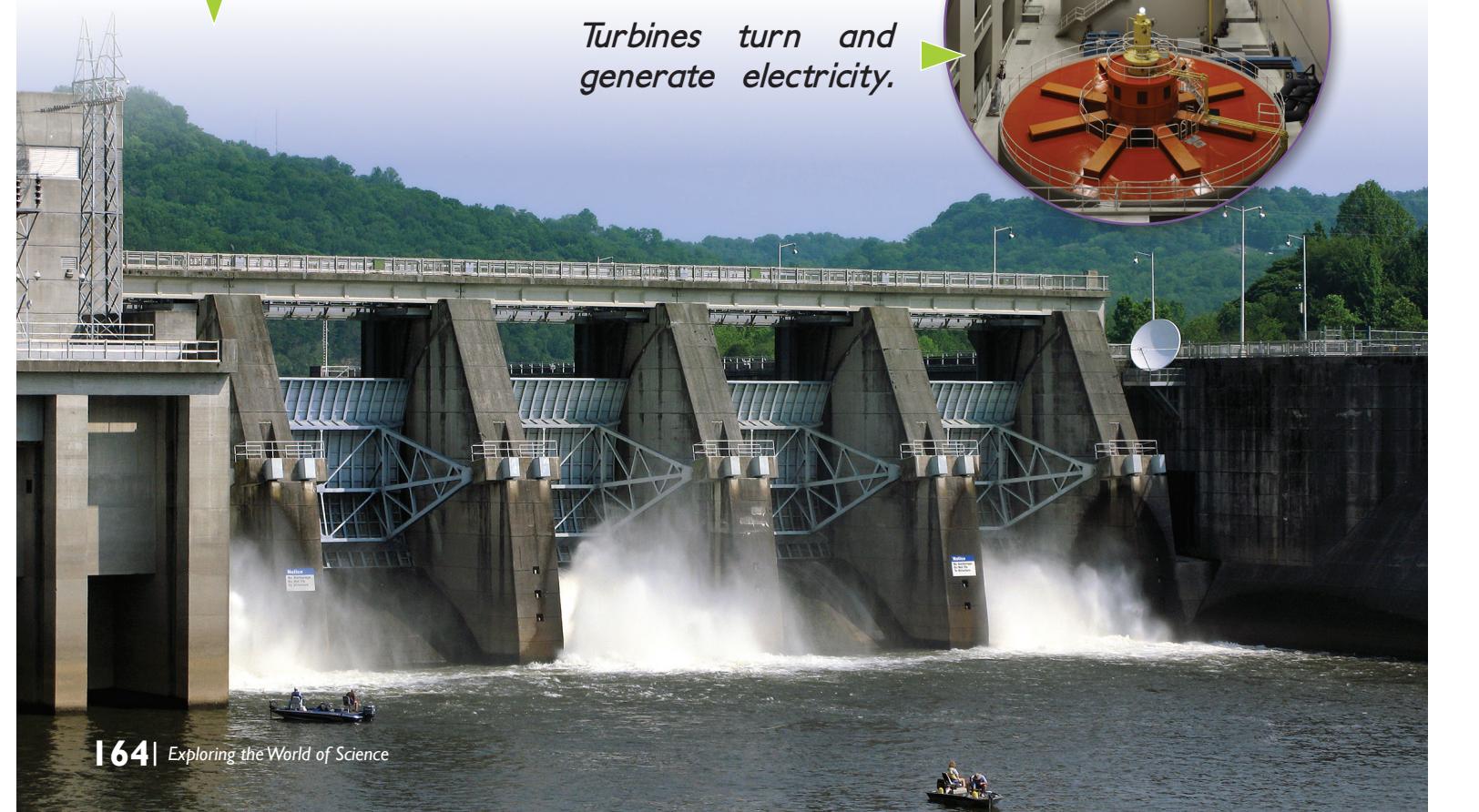
## Hydropower

Hydropower is energy produced by flowing water. To make use of hydropower, people build dams across rivers. Water collects behind river dams and then falls from a height, and turns turbines. The turbines turn like a wheel. The turbines are connected to generators that turn as well. The generators produce electricity.

*Water from a height turns this water wheel. Similarly, turbines turn when water falls on them.*

River dam

*Turbines turn and generate electricity.*



# Wind Energy

Wind energy is energy produced by the wind. Wind can turn turbines, which can turn generators. Generators then produce electricity. A wind farm has turbines that turn when the wind blows.

## Learning Point

7. Explain what wind energy is and why it is used.



*The electricity from these turbines can be used in houses or industry.*

## Summary

Most of the energy used on Earth is nonrenewable. Fossil fuels are sources of nonrenewable energy. Renewable energy is provided by the sun, water, or wind. Renewable resources will not run out soon and are nonpolluting.

## Discussion

1. **Identify** the uses of three types of fossil fuel.
2. **Define** pollution. Give an example of how air can become polluted.
3. **List** three renewable sources of energy.
4. **Compare and contrast** renewable energy and nonrenewable energy.