

Chapter 4

The Organization of Life

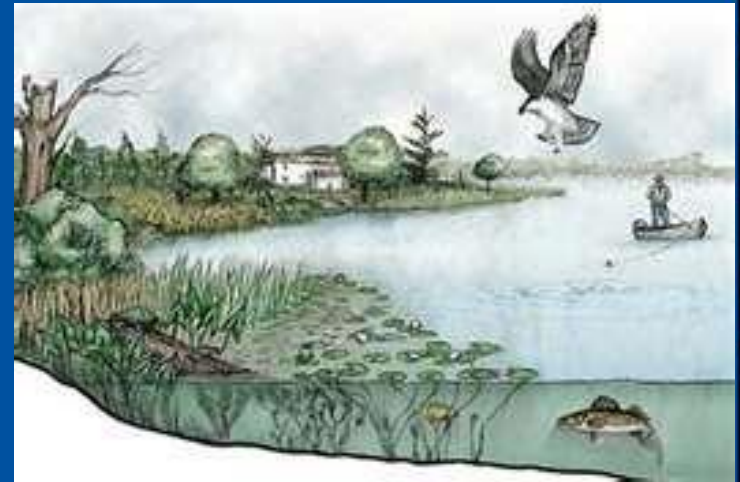
Section 1: Ecosystems: Everything is Connected

**DAY 1**

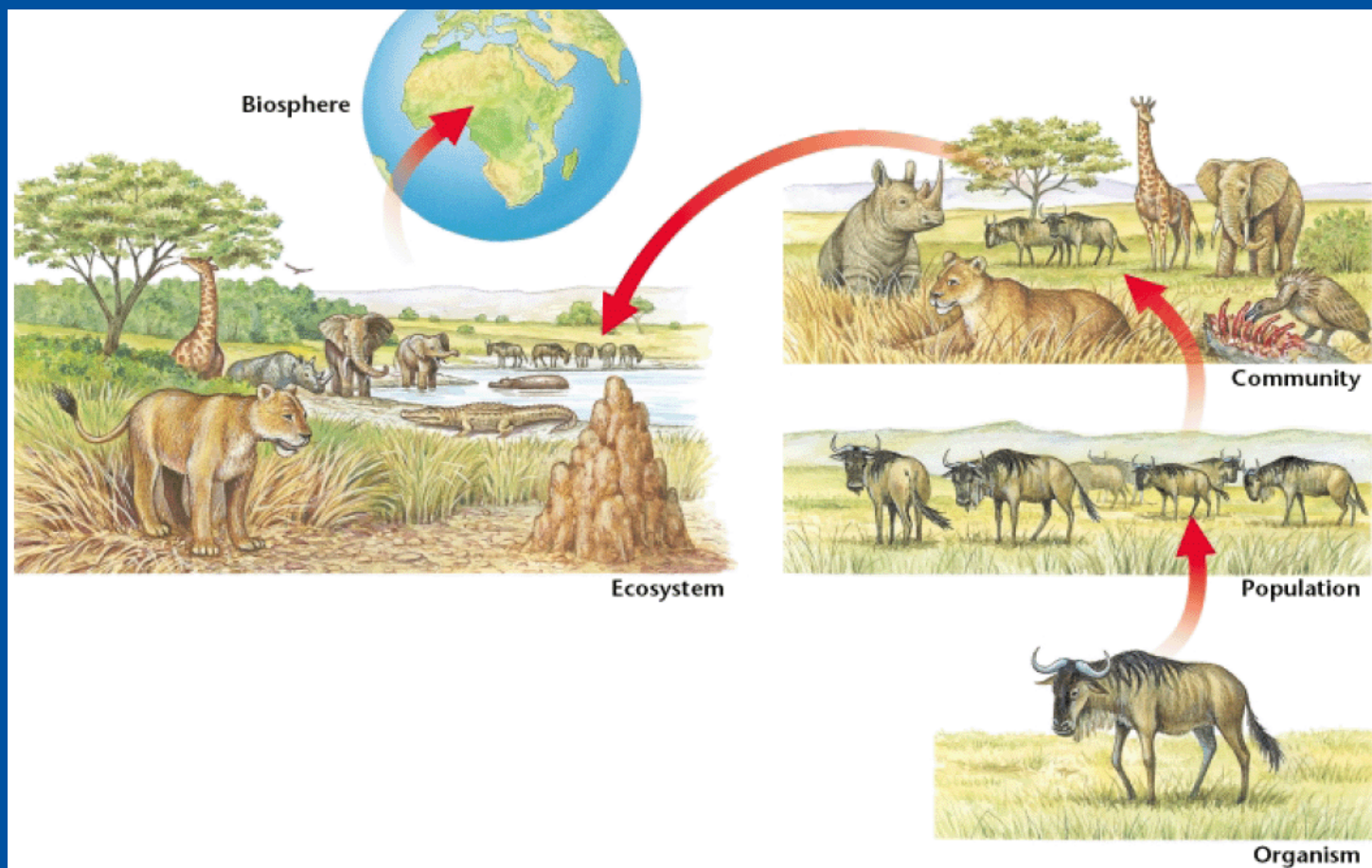


## Defining an Ecosystem

- **Ecosystems** are communities of organisms and their abiotic environment.
- Examples are an **oak forest or a coral reef.**
- Ecosystems do not have clear boundaries.
- Things move from one ecosystem to another.
- Pollen can blow from a forest into a field, soil can wash from a mountain into a lake, and birds migrate from state to state.

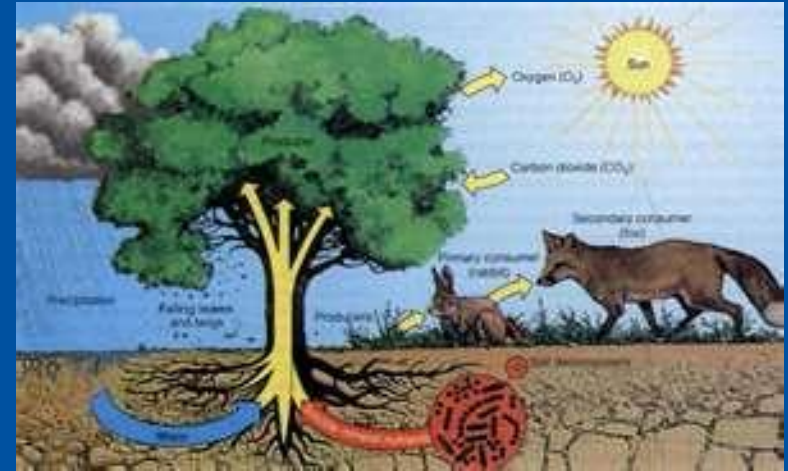


## Levels of Ecological Organization



## The Components of an Ecosystem

- In order to survive, ecosystems need five basic components:
  - **energy**
  - **mineral/nutrients**
  - **water**
  - **oxygen**
  - **living organisms**
- Plants and rocks are components of the land ecosystems, while most of the energy of an ecosystem comes from the **sun**.
- If one part of the ecosystem is destroyed or changes, the entire system will be affected.



## Biotic and Abiotic Factors

- **Biotic factors** are environmental factors that are associated with or results from the **activities of living organisms** which includes plants, animals, dead organisms, and the waste products of organisms.
- **Abiotic factors** are environmental factors that are **not associated** with the activities of living organisms which includes air, water, rocks, and temperature.
- Scientists can organize these living and nonliving things into various levels.



# What are Ecosystems?

## Ecosystems

## Organisms

- **Organisms** are living things that can carry out life processes independently.
- You are an organism, as is an ant, and ivy plant, and each of the many bacteria living in your intestines.
- Every organism is a member of a species.
- **Species** are groups of organisms that are closely related can mate to produce fertile offspring.



## Populations

- Members of a species may not all live in the same place.
- Field mice in Maine will not interact with field mice in Texas. However, each organism lives as part of a population.
- **Populations** are groups of organisms of the same species that live in a specific geographical area and interbreed.
- For example, all the field mice in a cornfield make up a population of field mice.





## Populations

- An important characteristic of a population is that its members **usually breed with one another** rather than with members of other populations
- For example, bison will usually mate with another member of the same herd, just as other flowers in the same field will usually pollinate wildflowers.



## Communities

- **Communities** are groups of various species that live in the same habitat and interact with each other.
- **Every population** is part of a community.
- The most obvious difference between communities is the **types of species** they have.
- Land communities are often dominated by a few species of plants. These plants then determine what other organisms can live in that community.



## Habitat

- **Habitats** are places where an organism usually lives.
- Every habitat has specific characteristics that the organisms that live there need to survive. If any of these factors change, the habitat changes.
- Organisms tend to be very **well suited** to their natural habitats.
- In fact, animals and plants usually cannot survive for long periods away from their natural habitat.



**YouTube!**

Ecosystem Song

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Preview 🏠

Main 🏠

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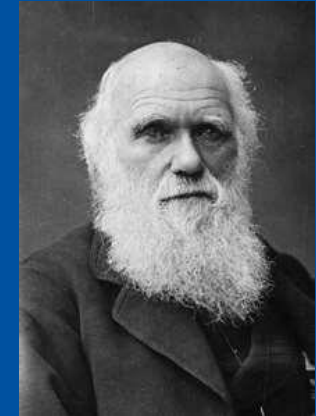
Section 2: Evolution

**DAY 1**



## Evolution by Natural Selection

- English naturalist **Charles Darwin** observed that organisms in a population differ slightly from each other in form, function, and behavior.
- Some of these differences are **hereditary**.
- Darwin proposed that the **environment exerts** a strong influence over which individuals survive to produce offspring, and that some individuals, because of certain traits, are more likely to survive and reproduce than other individuals are.



## Evolution by Natural Selection

- **Natural selection** is the process by which individuals that have favorable variations and are better adapted to their environment survive and reproduce more successfully than less well adapted individuals do.
- Darwin proposed that over many generations, natural selection causes the characteristics of **populations to change**.
- **Evolution** is a change in the characteristics of a population from one generation to the next.



## Evolution YouTube!

Bill Nye Explains





## Nature Selects

- Darwin thought that nature selects for certain traits, such as sharper claws, because organisms with these traits are **more likely to survive**.
- Over time, the population includes a greater and greater proportion of organisms with the **beneficial trait**.
- As the populations of a given species change, so does the species.



## Evolution by Natural Evolution

### Evolution by Natural Selection

1. <b>Organisms produce more offspring than can survive.</b>	In nature, organisms have the ability to produce more offspring than can survive to become adults.
2. <b>The environment is hostile and contains limited resources.</b>	The environment contains things and situations that kill organisms, and the resources needed to live, such as food and water, are limited.
3. <b>Organisms differ in the traits they have.</b>	The organisms in a population may differ in size, coloration, resistance to disease, and so on. Much of this variation is inherited.
4. <b>Some inherited traits provide organisms with an advantage.</b>	Some inherited traits give organisms an advantage in coping with environmental challenges. These organisms are more likely to survive longer and produce more offspring; they are “naturally selected for.”
5. <b>Each generation contains proportionately more organisms with advantageous traits.</b>	Because organisms with more advantageous traits have more offspring, each generation contains a greater proportion of offspring with these traits than the previous generation did.

## Nature Selects

- An example of evolution is a population of deer that became isolated in a cold area.
- Some of the deer had genes for thicker, warmer fur.
- These deer were more likely to survive, and their young with thick fur were more likely to survive to reproduce.
- **Adaptation** is the process of becoming adapted to an environment.
- It is an **anatomical, physiological, or behavioral change that improves a population's ability to survive.**



# Adaptations Explained via YouTube!

Adaptation Song

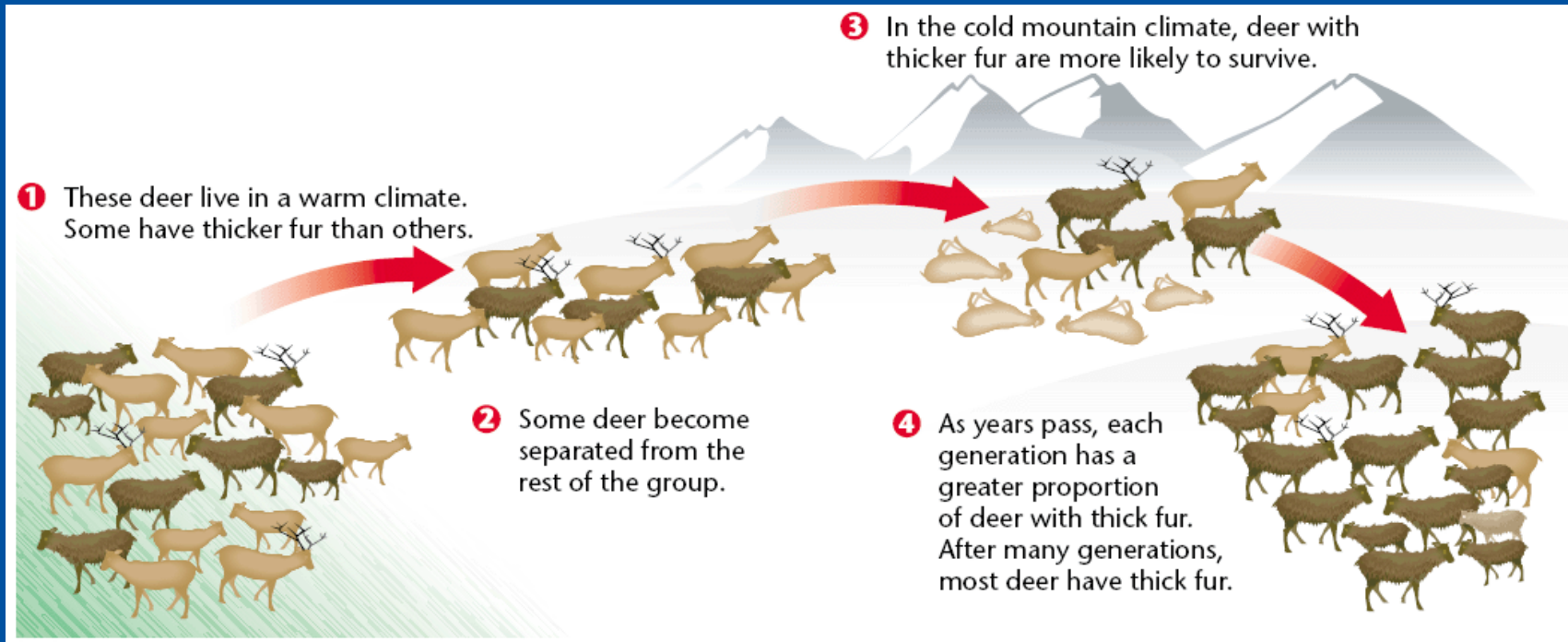


## Coevolution

- The process of two species evolving in response to long-term interactions with each other is called **coevolution**.
- An example is the **Hawaiian honeycreeper**, which has a long, curved beak to reach nectar at the base of a flower.
- The flower has structures that ensure that the bird gets some pollen on its head.
- When the bird moves the next flower, some of the pollen will be transferred, helping it to reproduce.



## Nature Selects



## Coevolution

- The honeycreeper's adaptation is a **long, curved beak**.
- The plant has two adaptations:
  - The first is the **sweet nectar**, which attracts the birds.
  - The second is the **flower structure** that forces pollen onto the bird's head when the bird sips nectar.



## Evolution by Artificial Selection

- **Artificial selection** is the selective breeding of organisms, by humans, for specific desirable characteristics.
- Dogs have been bred for certain characteristics.
- Fruits, grains, and vegetables are also produced by artificial selection.
- Humans save seeds from the largest and sweetest fruits.
- By selecting for these traits, farmers direct the evolution of crop plants to produce larger, sweeter fruit.





## Evolution of Resistance

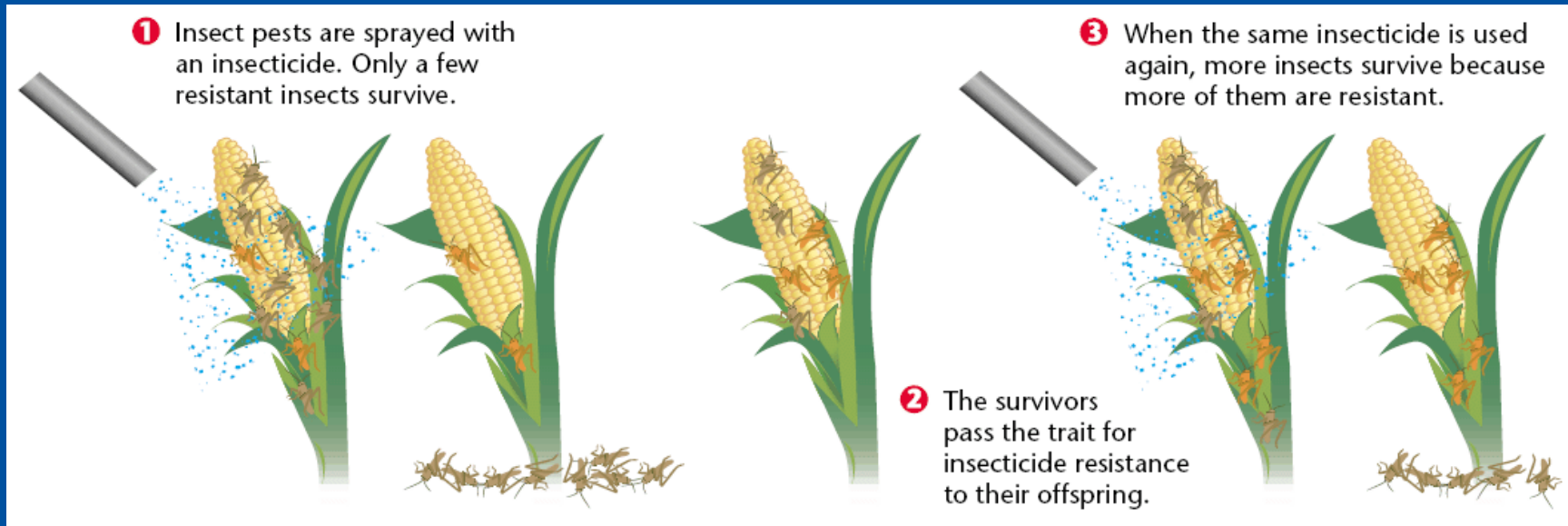
- **Resistance** is the ability of an organism to tolerate a chemical or disease-causing agent.
- An organism may be resistant to a chemical **when it contains a gene that allows it to break down a chemical into harmless substances.**
- Humans promote the evolution of resistant populations by trying to **control pests and bacteria with chemicals.**



## Pesticide Resistance

- A pesticide sprayed on corn to kill grasshoppers, for example, may kill most of the grasshoppers, but those that survive happen to have a gene that protects them from the pesticide.
- These surviving insects pass on this resistant gene to their offspring.
- Each time the corn is sprayed; more grasshoppers that are resistant enter the population.
- Eventually the entire population will be resistant, making the pesticide useless.

## Pesticide Resistance



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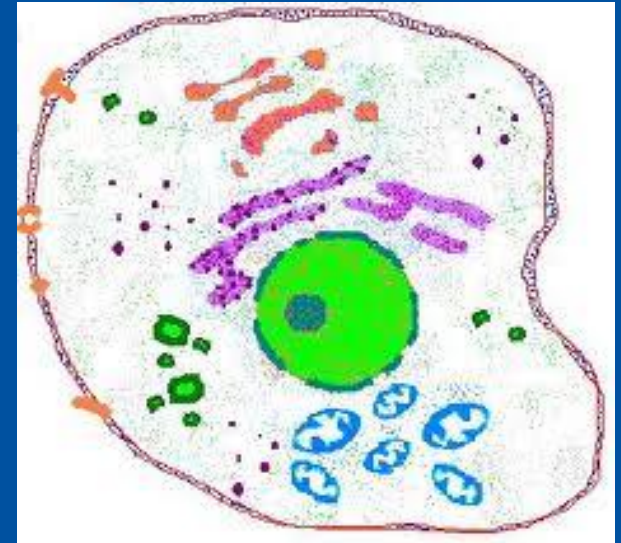
Section 3: The Diversity of Living Things

**DAY 1**



## The Diversity of Living Things

- Most scientists classify organisms into **six** kingdoms based on different characteristics.
- Members of the six kingdoms get their food in different ways and are made up of different types of **cells**, the smallest unit of biological organization.
- The cells of animals, plants, fungi, and protists all contain a **nucleus**.
- While cells of bacteria, fungi, and plants all have **cell walls**.

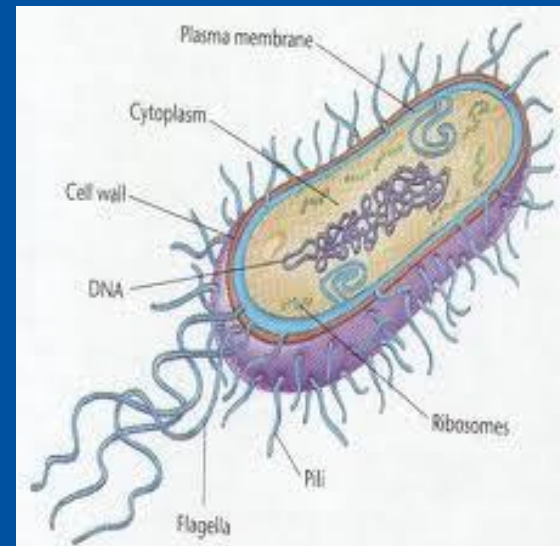


## The Kingdoms of Life

The Kingdoms of Life		
Kingdom	Characteristics	Examples
Archaeobacteria	single celled; lack cell nuclei; reproduce by dividing in half; found in harsh environments	methanogens (live in swamps and produce methane gas) and extreme thermophiles (live in hot springs)
Eubacteria	single celled; lack cell nuclei; reproduce by dividing in half; incredibly common	proteobacteria (common in soils and in animal intestines) and cyanobacteria (also called <i>blue-green algae</i> )
Fungi	absorb their food through their body surface; have cell walls; most live on land	yeasts, mushrooms, molds, mildews, and rusts
Protists	most single celled but some have many cells; most live in water	diatoms, dinoflagellates (red tide), amoeba, trypanosomes, paramecia, and <i>Euglena</i>
Plants	many cells; make their own food by photosynthesis; have cell walls	ferns, mosses, trees, herbs, and grasses
Animals	many cells; no cell walls; ingest their food; live on land and in water	corals, sponges, worms, insects, fish, reptiles, birds, and mammals

## Bacteria

- **Bacteria** are extremely small, single-celled organisms that usually have a cell wall and reproduce by cell division.
- Unlike all other organisms, bacteria lack **nuclei**.
- There are two main kinds of bacteria, **archaebacteria and eubacteria**.
- Most bacteria are eubacteria.
- Bacteria live in every habitat on Earth, from hot springs to the bodies of animals.



## Bacteria and the Environment

- Some kinds of bacteria **break down the remains and wastes** of other organisms and return the nutrients to the soil.
- Others recycle nutrients, such as **nitrogen and phosphorus**.
- Certain bacteria can convert nitrogen from the air into a form that plants can use.
- This conversion is important because nitrogen is the main component of **proteins and genetic material**.



## Bacteria and the Environment

- Bacteria also allow many organisms, including humans, to extract certain nutrients from their food.
- The bacterium, *Escherichia coli* or ***E. coli***, is found in the intestines of humans and other animals and helps digest food and release vitamins that humans need.



## Fungi

- A **fungus** is an organism whose cells have nuclei, rigid cell walls, and no chlorophyll and that belongs to the kingdom Fungi.
- **Cell walls** act like mini-skeletons that allow fungi to stand up right.
- A **mushroom** is the reproductive structure of a fungus.
- The rest of the fungus is an underground network of fibers that absorb food from decaying organisms in the soil.



## Fungi

- Fungi get their food by **releasing chemicals** that help break down organic matter, and then absorbing the nutrients.
- The bodies of most fungi are huge networks of threads that grow through the soil dead wood, or other material on which the fungi is feeding.
- Like bacteria, fungi play an important role in **breaking down the bodies of dead organisms**.

## Fungi

- Some fungi, like some bacteria, cause **disease**.
- **Athlete's foot** is an example of a condition caused by fungi.
- Other fungi add flavor to food as in blue cheese. The fungus gives the cheese both its blue color and strong flavor.
- Yeasts are fungi that produce the gas that makes bread rise.



## Protists

- **Protists** are diverse organisms that belong to the kingdom Protista.
- Some, like amoebas, are animal like. Others are plantlike, such as kelp, and some resemble fungi.
- Most protists are **one-celled microscopic organisms**, including diatoms, which float on the ocean surface,
- Another protist, ***Plasmodium***, is the one-celled organism that causes the disease malaria.



## Protists

- From an environmental standpoint, the most important protists are **algae**.
- Algae are plantlike protists that can make their **own food using the energy from the sun**.
- They range in size from the giant kelp to the one-celled phytoplankton, which are the initial source of food in most ocean and freshwater ecosystems.



## Plants

- Plants are many-celled organisms that make their own food **using the sun's energy and have cell walls.**
- Most plants live on land where they use their leaves to get sunlight, oxygen, and carbon dioxide from the air.
- Plants absorb nutrients and water from the soil using their roots.
- **Leaves and roots** are connected by vascular tissue, which has thick cell walls and serves as a system of tubes that carries water and food.

## Lower Plants

- The first land plants had no vascular tissue, and swimming sperm.
- They therefore had to live in damp places and could not grow very large.
- Their descendants alive today are small plants such as **mosses**.
- **Ferns and club mosses** were the first vascular plants, with some of the ferns being as large as small trees.





## Gymnosperms

- **Gymnosperms** are woody vascular seed plants whose seeds are not enclosed by an ovary or fruit.
- **Conifers, such as pine trees,** are gymnosperms that bear cones.
- Much of our lumber and paper comes from gymnosperms.



## Gymnosperms

- Gymnosperms have several adaptations that allow them to live in drier conditions than lower plants.
  - They can produce **pollen**, which protects and moves sperm between plants.
  - These plants also produce **seeds**, which protect developing plants from drying out.
  - A conifer's **needle-like leaves** also lose little water.



## Angiosperms

- **Angiosperms** are flowering plants that produce seeds within fruit. Most land plants are angiosperms.
- The **flower** is the reproductive structure of the plant.
- Some angiosperms, like grasses, have small flowers that use wind to disperse their pollen.
- Other angiosperms have large flowers to attract insects and birds.
- Many flowering plants depend on animals to disperse their seeds and carry their pollen.

## Angiosperms

- Most land animals are dependent on **flowering plants**.
- Most of the food we eat, such as wheat, rice, beans, oranges, and lettuce comes from flowering plants.
- Building materials and fibers, such as oak and cotton also come from flowering plants.



## Animals

- Animals cannot make their own food. They must take it in from the environment.
- Animal cells also have no cell walls, making their bodies soft and flexible.
- Some animals have evolved hard exoskeletons.
- As a result, animals are much more mobile than plants.
- All animals move around in their environment during at least one stage in their lives.

## Invertebrates

- **Invertebrates** are animals that do not have backbones.
- Many invertebrates live attached to hard surfaces in the ocean and filter their food out of the water, such as corals, various worms, and mollusks.
- These organisms are only mobile when they are **larvae**.
- At this early stage in their life they are part of the ocean's plankton.



## Invertebrates

- Other invertebrates, including squid in the ocean and insects on land, actively move in search of food.
- More **insects** exist on Earth than any other type of animal.
- Insects are successful for many reasons:
  - **they have a waterproof skeleton**
  - **can move and reproduce quickly**
  - **most insects can fly**
  - their **small size** allows them to live on little food and to hide from enemies in small places.

## Invertebrates

- Many insects and plants have evolved together and depend on each other to survive.
- Insects carry pollen from male fruit parts to fertilize a plant's egg, which develops into fruits such as tomatoes, cucumbers, and apples.
- Insects are also valuable because they eat other insects that we consider pests.



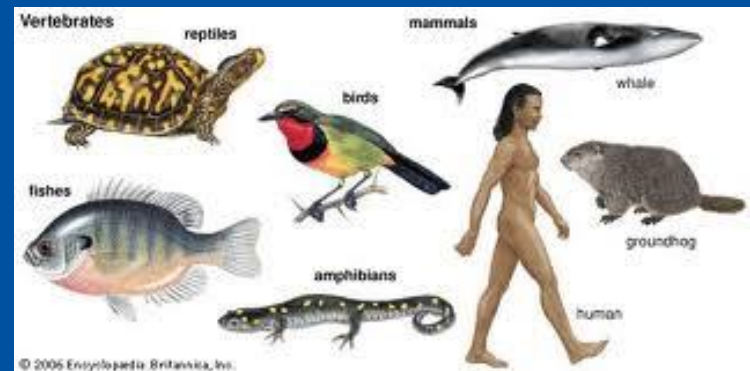
## Invertebrates

- However, insects and humans are often enemies.
- Bloodsucking insects transmit human diseases such as **malaria, sleeping sickness, and West Nile virus.**
- Insects do most damage indirectly by eating our crops.



## Vertebrates

- **Vertebrates** are animals that have a backbone, and includes mammals, birds, reptiles, amphibians, and fish.
- The first vertebrates were **fish**, but today most vertebrates live on land.
- The first land vertebrates were **reptiles**.
- These animals were successful because they have an almost **waterproof egg**, which allows the egg to hatch on land, away from predators in the water.




## Vertebrates

- Birds are **warm-blooded** vertebrates with feathers.
- They keep their hard-shelled eggs and young warm until they have developed insulating layers of fat and feathers.
- Mammals are warm-blooded vertebrates that have **fur and feed their young milk**.
- Birds and mammals have the ability to maintain a high body temperature, which allows them to live in cold areas, where other animals cannot live.

## Graphic Organizer – page 616

**Graphic Organizer** **Spider Map**  
Create the **Graphic Organizer** entitled "Spider Map" described in the Appendix. Label the circle "Kingdoms." Create a leg for each kingdom. Then, fill in the map with details about the organisms in each kingdom.



1. Draw a diagram like the one shown. In the circle, write the main topic.
2. From the circle, draw legs to represent different categories of the main topic. You can have as many categories as you want.
3. From the category legs, draw horizontal lines. As you read the chapter, write details about each category on the horizontal line.