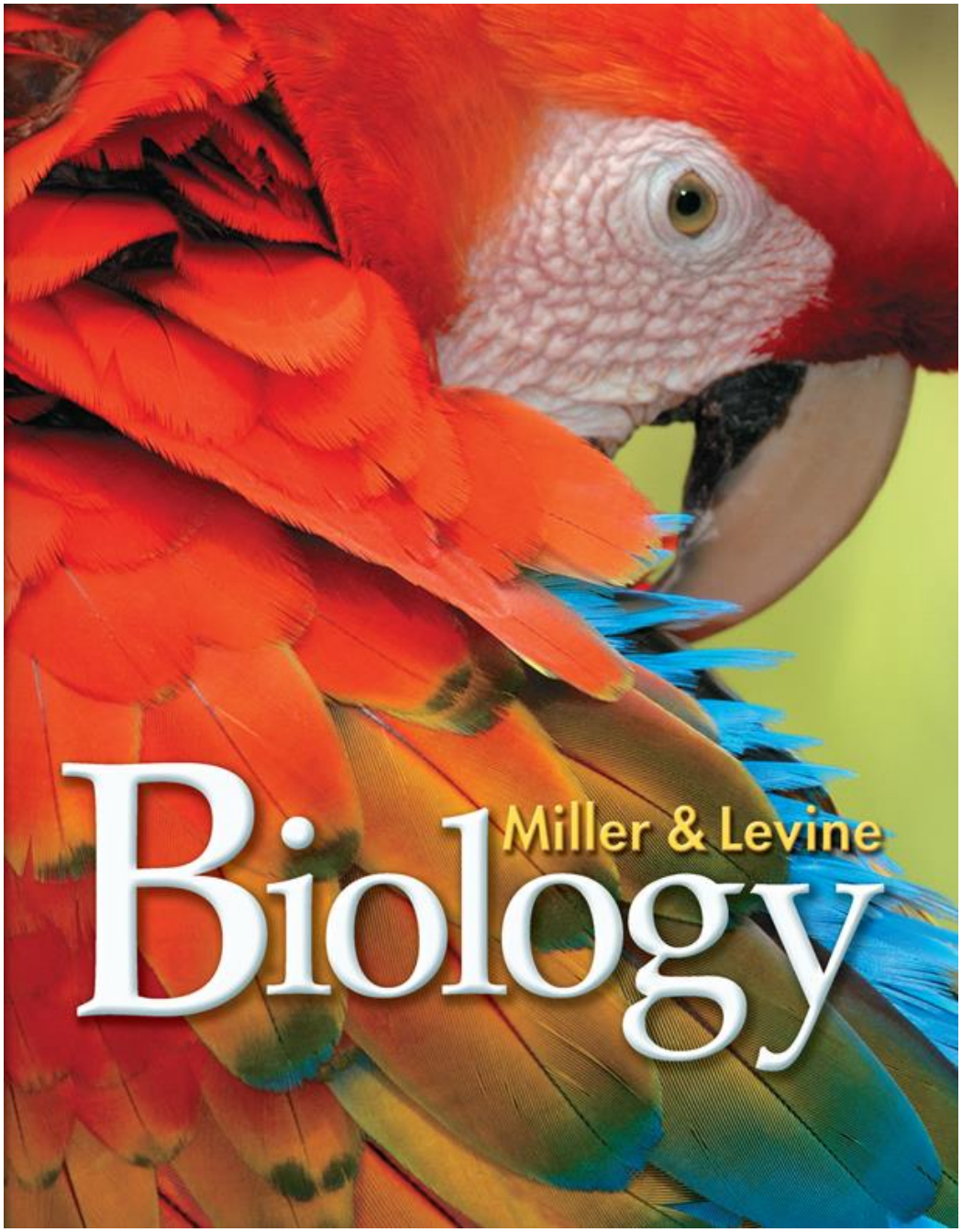


Lesson Overview

3.1 What Is Ecology?

Studying Our Living Planet

- What is ecology?
- What are biotic and abiotic factors, and how do they interact with the environment?
- What are producers and consumers and how are they related to each other?

Studying Our Living Planet

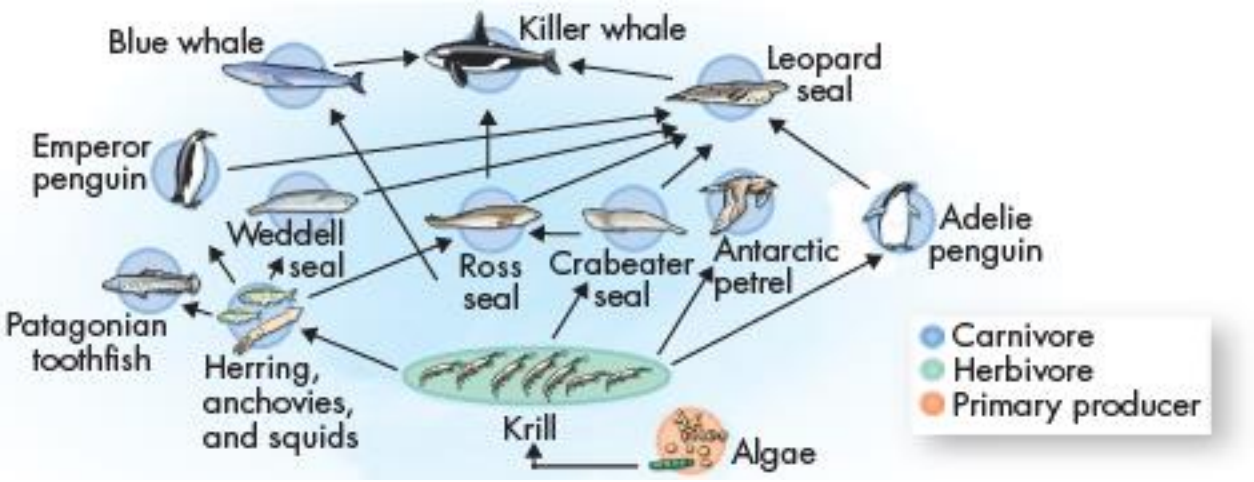
The **biosphere** consists of all life on Earth and all parts of the Earth in which life exists, including land, water, and the atmosphere.

The biosphere extends from about 8 km above Earth's surface to as far as 11 km below the surface of the ocean.

The Science of Ecology

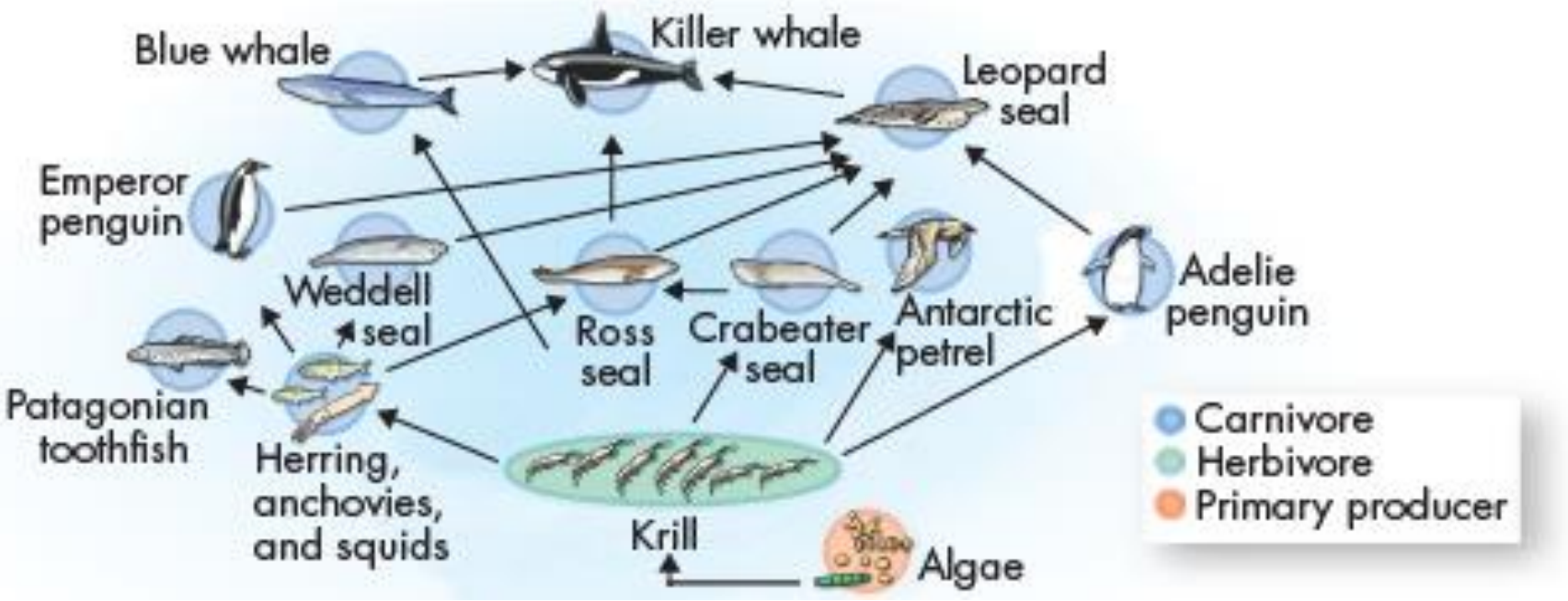
Ecology is the scientific study of interactions among and between organisms and their physical environment.

Interactions within the biosphere produce a web of interdependence between organisms and the environments in which they live.



The Science of Ecology

Organisms respond to their environments and can change their environments, producing an ever-changing biosphere.



Levels of Organization

Ecological studies may focus on levels of organization that include the following:

1. **Individual**—individual organism

2. **Population**—a group of individuals that belong to the same species and live in the same area

3. **Community**—an assemblage of different populations that live together in a defined area

4. **Ecosystem**—all the organisms that live in a place, together with their physical environment

Levels of Organization

5. **Biome**—a group of ecosystems that share similar climates and typical organisms

6. **Biosphere**—our entire planet, with all its organisms and physical environments

Levels of Organization

Biotic Factors

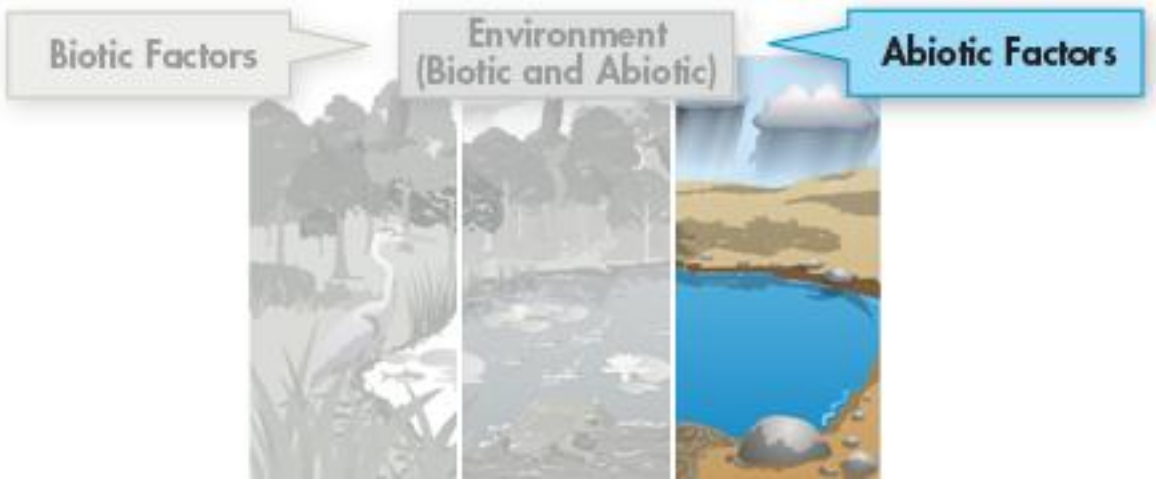
A **biotic factor** is any living part of the environment with which an organism might interact, including animals, plants, mushrooms and bacteria.

Biotic factors relating to a bullfrog might include algae it eats as a tadpole, the herons that eat bullfrogs, and other species competing for food or space.

Abiotic Factors

An **abiotic factor** is any nonliving part of the environment, such as sunlight, heat, precipitation, humidity, wind or water currents, soil type, etc.

For example, a bullfrog could be affected by abiotic factors such as water availability, temperature, and humidity.



Ecological Methods

- What methods are used in ecological studies?

- Regardless of their tools, modern ecologists use three methods in their work:
  1. observation,
  2. experimentation, and
  3. modeling.

Each of these approaches relies on scientific methodology to guide inquiry.

Observation

Observation is often the first step in asking ecological questions.

Questions may form the first step in designing experiments and models.

Experimentation

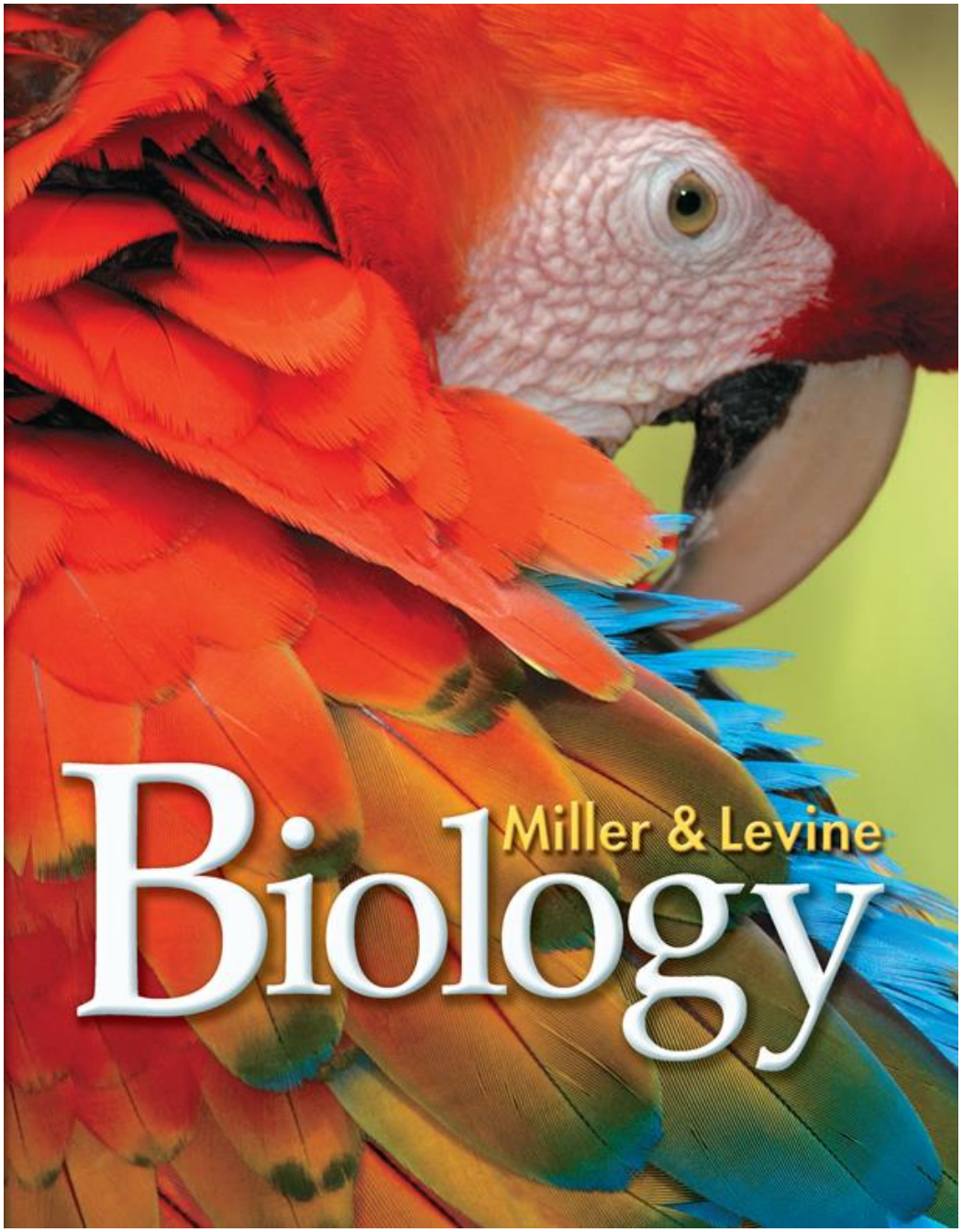
Experiments can be used to test hypotheses.

An ecologist may set up an artificial environment in a laboratory or greenhouse, or carefully alter conditions in selected parts of natural ecosystems.

Modeling

Many ecological events occur over such long periods of time or over such large distances that they are difficult to study directly.

Ecologists make models to help them understand these phenomena.



Lesson Overview

3.2 Energy, Producers, and Consumers

THINK ABOUT IT

At the core of every organism's interaction with the environment is its need for energy to power life's processes.

Where does energy in living systems come from? How is it transferred from one organism to another?

Primary Producers

- What are primary producers?

- Primary producers are the first producers of energy-rich compounds that are later used by other organisms.

Primary Producers

Organisms need energy for growth, reproduction, and metabolic processes.

No organism can create energy—organisms can only use energy from other sources.

Primary Producers

For most life on Earth, sunlight is the ultimate energy source.

For some organisms, however, chemical energy stored in inorganic chemical compounds serves as the ultimate energy source for life processes.

Primary Producers

Plants, algae, and certain bacteria can capture energy from sunlight or chemicals and convert it into forms that living cells can use. These organisms are called **autotrophs.**

Autotrophs are also called **primary producers.**

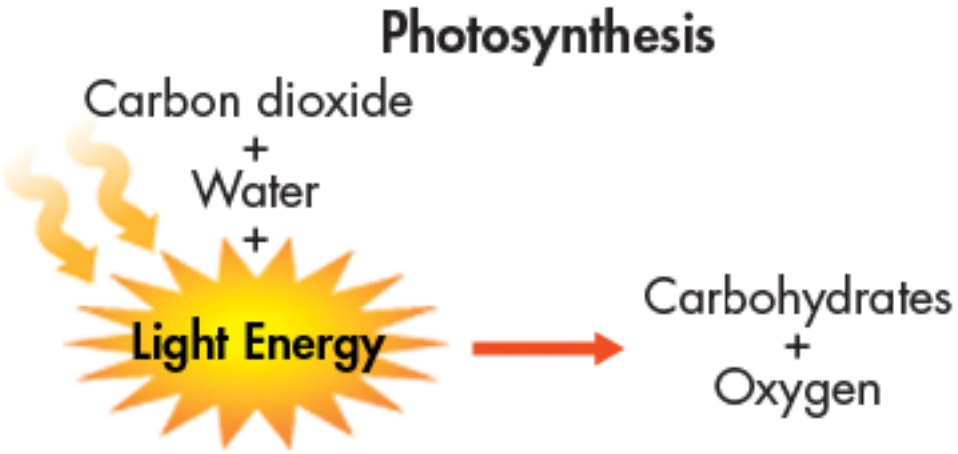
Primary Producers

Primary producers store energy in forms that make it available to other organisms that eat them, and are therefore essential to the flow of energy through the biosphere.

For example, plants obtain energy from sunlight and turn it into nutrients that can be eaten and used for energy by animals such as a caterpillar.

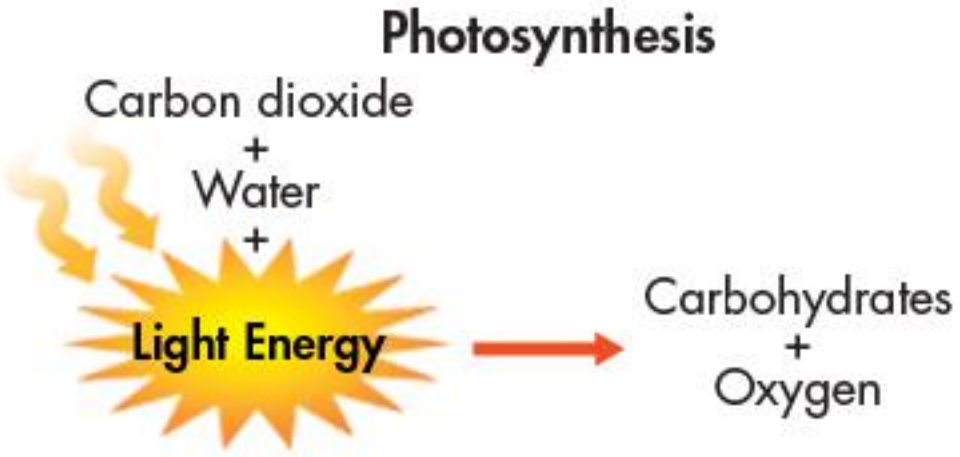
Energy From the Sun

The best-known and most common primary producers harness solar energy through the process of photosynthesis.



Energy From the Sun

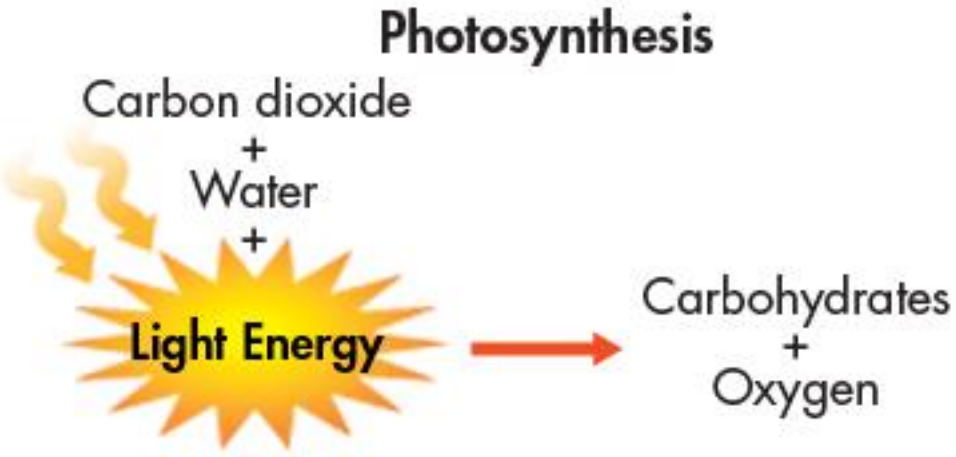
Photosynthesis captures light energy and uses it to power chemical reactions that convert carbon dioxide and water into oxygen and energy-rich carbohydrates. This process adds oxygen to the atmosphere and removes carbon dioxide.



Energy From the Sun

Plants are the main photosynthetic producers on land. Algae fill that role in freshwater ecosystems and the sunlit upper ocean.

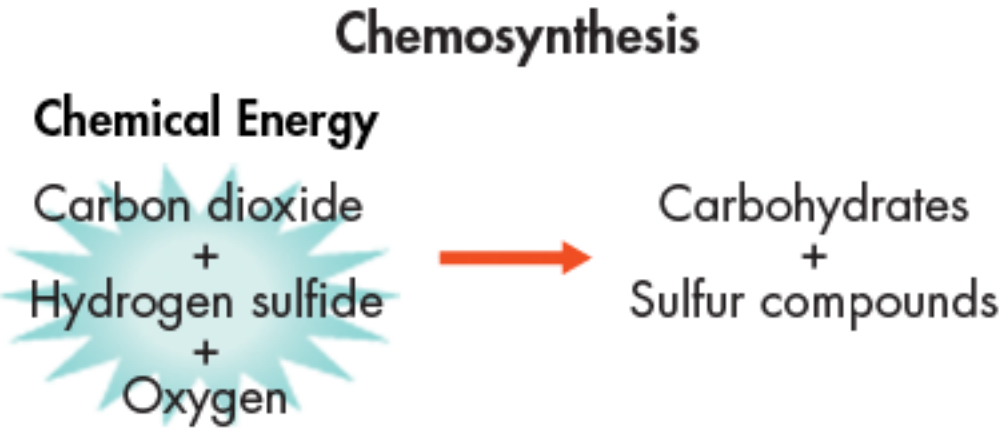
Photosynthetic bacteria, most commonly cyanobacteria, are important primary producers in tidal flats and salt marshes.



Life Without Light

Deep-sea ecosystems depend on primary producers that harness chemical energy from inorganic molecules such as hydrogen sulfide.

The use of chemical energy to produce carbohydrates is called **chemosynthesis.**



Consumers

Organisms that rely on other organisms for energy and nutrients are called consumers.

How do consumers obtain energy and nutrients?

Consumers

Organisms that must acquire energy from other organisms by ingesting in some way are known as **heterotrophs.**

Heterotrophs are also called **consumers.**

Consumers are classified by the ways in which they acquire energy and nutrients…

Types of Consumers

Carnivores kill and eat other animals, and include snakes, dogs, cats, and this giant river otter.

Catching and killing prey can be difficult and requires energy, but meat is rich in nutrients and energy and is easy to digest.

Types of Consumers

Scavengers, like a king vulture or hyena, are animals that consume the carcasses of other animals that have been killed by predators or have died of other causes.

Types of Consumers

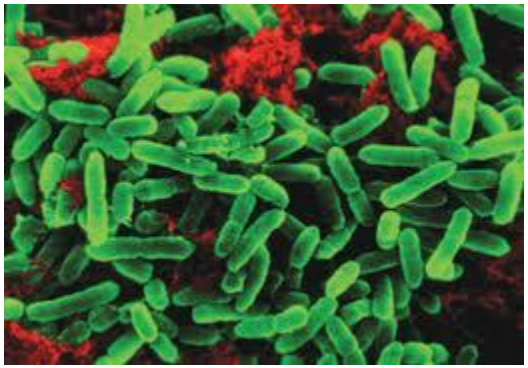
Herbivores, such as a military macaw, obtain energy and nutrients by eating plant leaves, roots, seeds, or fruits. Common herbivores include cows, caterpillars, and deer.

Types of Consumers

Omnivores are animals whose diets naturally include a variety of different foods that usually include both plants and animals. Humans, bears, and pigs are omnivores.

Types of Consumers

Decomposers, such as bacteria and fungi, feed by chemically breaking down organic matter. The decay caused by decomposers is part of the process that produces detritus—small pieces of dead and decaying plant and animal remains.



Types of Consumers

Detritivores, like giant earthworms, feed on detritus particles, often chewing or grinding them into smaller pieces. Detritivores commonly digest decomposers that live on, and in, detritus particles.

Beyond Consumer Categories

Categorizing consumers is important, but these simple categories often don't express the real complexity of nature.

For example, herbivores that eat different plant parts often differ greatly in the ways they obtain and digest their food.

Beyond Consumer Categories

In addition, organisms in nature often do not stay inside the categories we put them in.

For example, some carnivores will scavenge if they get the chance. Many aquatic animals eat a mixture of algae, bits of animal carcasses, and detritus particles.

It is important to expand upon consumer categories by discussing the way that energy and nutrients move through ecosystems.