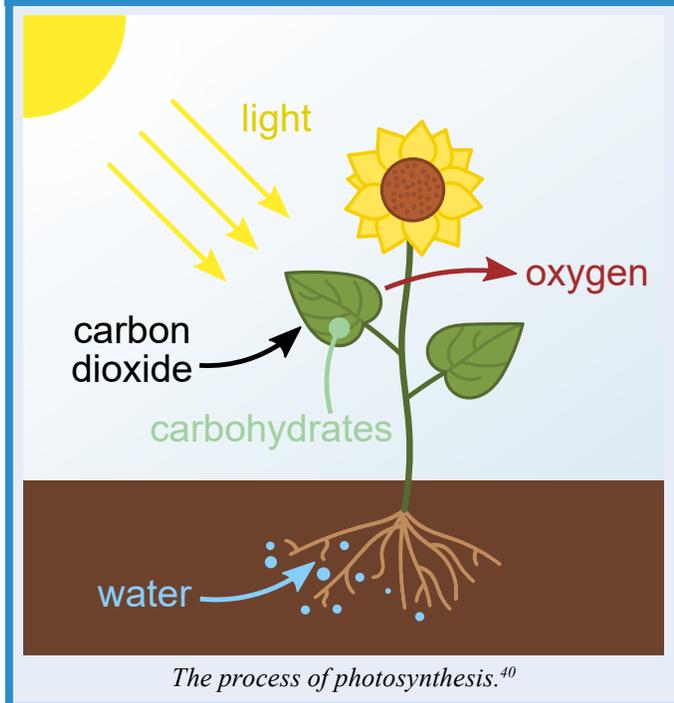
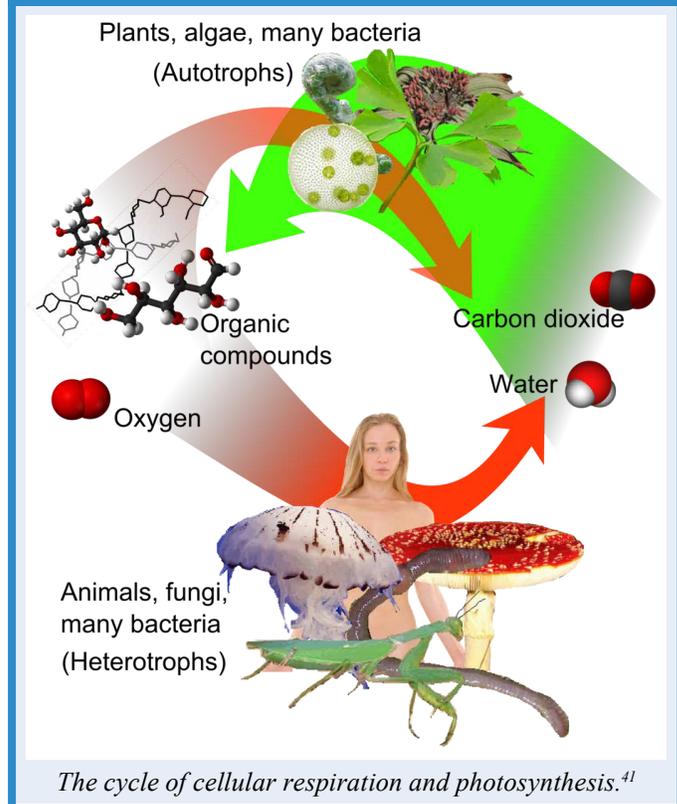


**FIGURE 2–2**

energy to live. Energy can be made by **photosynthesis** or by **chemosynthesis**. Photosynthesis is the process by which organisms convert sunlight energy into food energy. Organisms that are capable of conducting photosynthesis and producing their own food are called **autotrophs** or “self-feeders.” In the ocean, seaweeds, unicellular algae, and bacteria are the most common and important autotrophs, and these organisms are also called **primary producers**. Primary producers synthesize organic molecules from inorganic substances through photosynthesis or chemosynthesis.

Plants, algae, cyanobacteria, phytoplankton, and some other organisms conduct photosynthesis by using light energy from the sun to synthesize the carbohydrate glucose from carbon dioxide and water. First, photosynthetic organisms absorb sunlight, or solar energy, with photosynthetic pigments. The most common photosynthetic pigment on Earth is chlorophyll, which often gives photosynthetic organisms a green color. Seaweeds (marine algae) often have other pigments, such as carotenoids or phycobilins, which give them different colors like red or brown. After solar energy is captured by chlorophyll and other pigments, it is converted into chemical energy in the form of ATP (adenosine triphosphate). ATP is a common high-energy molecule based on adenosine, a precursor to DNA and RNA. ATP, in

**FIGURE 2–3**

combination with carbon dioxide ( $\text{CO}_2$ ) and water ( $\text{H}_2\text{O}$ ), is used to make glucose. Glucose is then used as an energy source to synthesize other organic compounds. A byproduct of photosynthesis is oxygen gas ( $\text{O}_2$ ). The majority of the oxygen on Earth is produced from photosynthetic organisms.

Chemosynthesis is the production of food from energy released by inorganic molecules in the environment. Chemosynthesis uses an inorganic molecule, such as hydrogen sulfide or methane, to produce glucose. Bacteria are common chemosynthesizers. For example, bacteria at hydrothermal vents use hydrogen sulfide in combination with carbon dioxide and water to make glucose.

Many organisms are not capable of producing their own food; thus, they must obtain energy from organic matter produced by autotrophs. These organisms are called **heterotrophs**. Both heterotrophs and autotrophs perform **cellular respiration** to utilize the energy originally obtained by photosynthesis. In the process of cellular respiration, sugars can be broken down using oxygen—a process called aerobic respiration—while carbon dioxide and water are byproducts. When the glucose is broken down, and oxygen is