8th Grade

for Utah SEEd Standards

Utah State Board of Education OER
2019-2020

8.3.2 Cellular Respiration

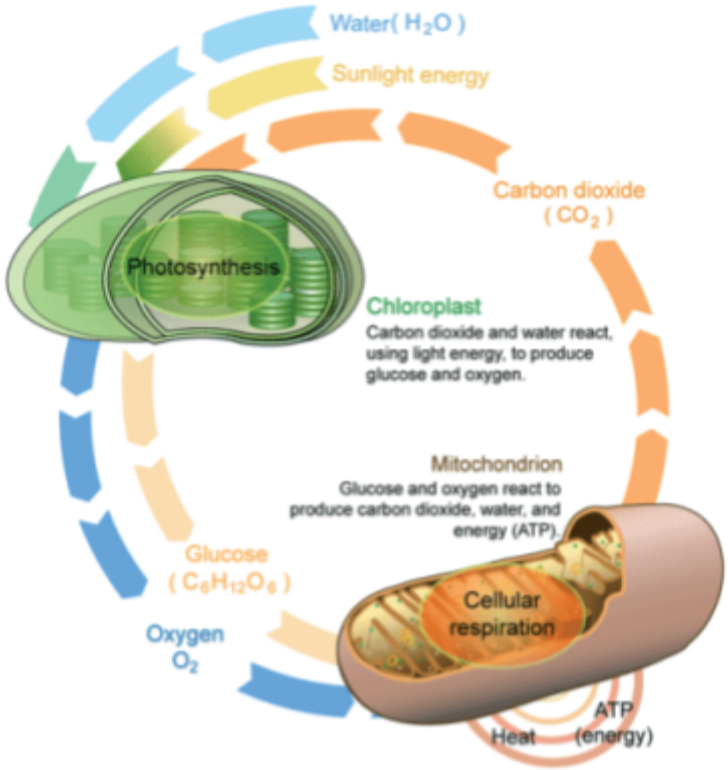
Develop a model to describe how food is changed through chemical reactions to form new molecules that support growth and/or release energy as matter cycles through an organism. Emphasis is on describing that during cellular respiration molecules are broken apart and rearranged into new molecules, and that this process releases energy.

In this section, focus on matter and energy. Within a natural system, the flow of energy drives the motion and/or cycling of matter.

What is Cellular Respiration?

Cellular respiration is how cells of living things, including plants, break down glucose in order to release the chemical energy stored in the sugar. The chemical equation for cellular respiration is:

Glucose + Oxygen → Carbon Dioxide + Water



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Adapted by Gayle Dowdle

If you compare this with the last section you will notice it is the opposite of photosynthesis. The forms of energy are different though. Photosynthesis uses light to create chemical energy in sugar, cellular respiration breaks down the chemical energy found in sugars and converts it to mechanical and heat energy for the organism's use.

Why Food is Important

Living organisms need energy to live and they need matter to grow. Cellular respiration provides for both needs. During the digestion of food (carbohydrates, fats, proteins) the molecules are broken down to form new molecules that support growth and/or release energy as matter cycles through the organism. Proteins from your food are broken into smaller pieces and then are used to build up your muscles and to support a complex assortment of cellular functions. The phrase “you are what you eat” is quite true in that the matter in the food you eat becomes the matter that your body is made of. It also means that you are consuming whatever the plant or animal consumed prior to you eating it.

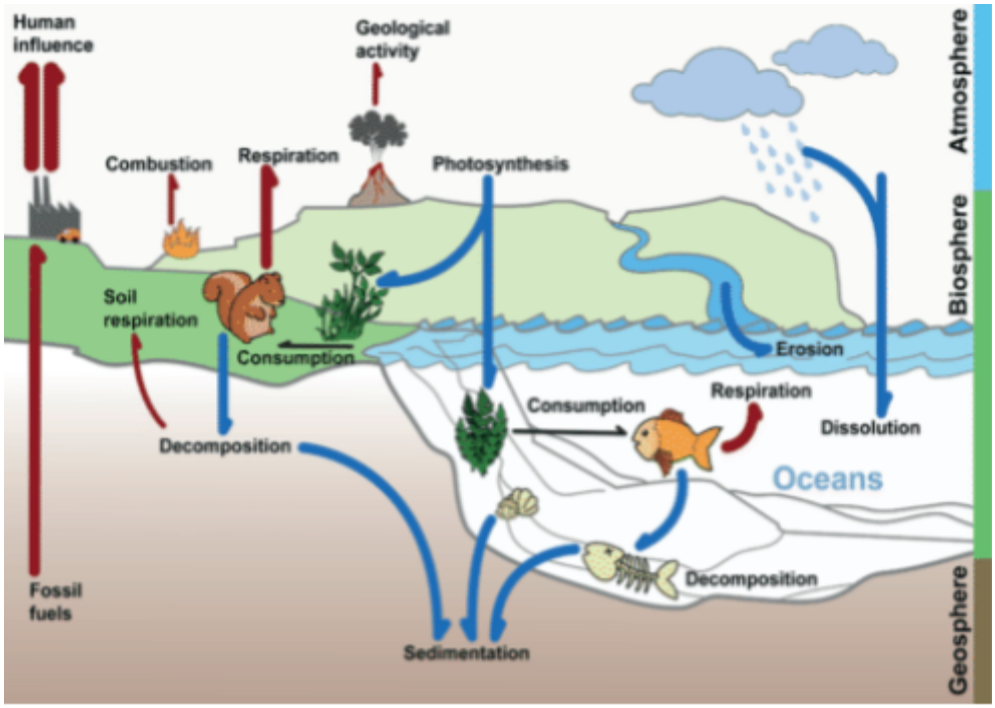
8.3.3 Carbon Cycle & Ecosystems

Ask questions to obtain, evaluate, and communicate information about how changes to an ecosystem affect the stability of cycling matter and the flow of energy among living and nonliving parts of an ecosystem. Emphasize describing the cycling of matter and flow of energy through the carbon cycle.

In this section, focus on stability and change and matter and energy. Small changes in one part of a system might cause large changes in another part and the flow of energy can be tracked as energy flows through a natural system.

The Carbon Cycle

Carbon is the element that acts as a building block for many compounds necessary for life. But do organisms make their own carbon? No! Carbon must be recycled from other living organisms, things like sedimentary rocks, the atmosphere, and other parts of the ecosystem. Exactly how does carbon get recycled and move through the ecosystem?



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The Carbon Cycle. Carbon moves from one source to another in the carbon cycle.

Flowing water can slowly dissolve carbon in sedimentary rock. This carbon often ends up in the ocean. Once in the ocean carbon can be stored for thousands of years or more. Although oceans and sedimentary rock are major sources for stored carbon, carbon is also stored for different lengths of time in the atmosphere, in living organisms, and as fossil fuel deposits found in the earth. These are all parts of the carbon cycle, which is shown in the figure above.

Carbon in Carbon Dioxide

Carbon cycles quickly between organisms and the atmosphere where carbon exists primarily as carbon dioxide (CO_2). Carbon dioxide cycles through the atmosphere by several different processes, including those listed below.

- Living organisms release carbon dioxide during cellular respiration. (Carbon dioxide is breathed out.)
- Photosynthesis removes carbon dioxide from the atmosphere and uses it to make chemicals like glucose.
- Carbon dioxide is given off when dead organisms and other organic materials decompose.
- Burning organic material, such as fossil fuels, releases carbon dioxide.
- Carbon cycles slowly through geological (earth) processes. Carbon may be stored in sedimentary rock for millions of years.
- When volcanoes erupt, they release carbon dioxide that was stored in the mantle.
- Carbon dioxide is released when limestone is heated during the production of cement.
- Ocean water releases dissolved carbon dioxide into the atmosphere when water temperatures rise.
- Carbon dioxide is also removed when ocean water cools and dissolves more carbon dioxide from the air.

Because of human activities, there is more carbon dioxide in the atmosphere today than there has been for the past hundreds of thousands of years. Burning fossil fuels has released great quantities of carbon dioxide into the atmosphere. Cutting forests and clearing land have also increased carbon dioxide into the atmosphere. These activities reduce the number of photosynthetic organisms that remove carbon dioxide from the air. In addition, clearing often involves burning, which releases carbon dioxide that was previously stored in plants.

Flow of Energy in Ecosystems

What is the source of energy for almost all ecosystems?

The sun supports most of Earth's ecosystems. Plants convert light energy from the sun to the chemical energy found in food. The energy stored by producers is passed to consumers, scavengers, and decomposers as each organism obtains food.

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Food Chain

The set of organisms that pass energy from one organism to the next is described as a food chain in the next figure. It is a simplified version of how energy and matter move in an ecosystem. The arrows show the direction the energy and matter move.

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Food Web

A food web recognizes that most organisms eat many different things. Food webs are food chains that interconnect with each other. All organisms depend on two global food webs. The aquatic food web is based on phytoplankton as the producer and the land food web is based on plants that grow on dry land. How are these two webs interconnected? Birds or bears that live on land may eat fish, which connects the two food webs. Humans are an important part of both of these food webs; we are at the

top of a food web since nothing eats humans as a regular source. That means that humans are the top predators.

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This image shows a food web of the Arctic Ocean. Which organisms would be affected if you took out the arctic cod? How would those organisms be affected?

Matter Cycles and Energy Flows

Matter cycles, this means that it is used over and over again. In the carbon cycle, matter, in the form of carbon, is recycled again and again. Carbon can move from the atmosphere into both living and non-living things, such as rocks and oceans, and then back into the atmosphere. The big idea is that matter is reused; matter cycles through ecosystems.

Energy does not cycle. It is converted from one form to another but it is not recycled. The energy that comes from the sun does NOT return to the sun; it is not recycled. Instead energy flows which is to say that it moves from one form to another. In the carbon cycle energy flows from the sun through plants, as chemical energy, through animals, and eventually into the atmosphere in the form of heat.

Disrupting the Cycle and Flow

Actions have consequences; causes have effects. John Muir said, "When we try to pick anything out by itself, we find it hitched to everything else in the universe."

Nothing in nature exists in isolation!

Changes to an ecosystem affect the stability of cycling matter and the flow of energy among living and nonliving parts of that ecosystem. Consider a forest that has been clear cut which means that all of the big trees were removed. The cycling of carbon through that forest ecosystem would be significantly impacted; it would influence both the ecosystem's living and nonliving components. The living things that relied on the trees for food would be denied their carbon and energy source and the carbon in the atmosphere would increase as a result of decreased photosynthesis.