THE CARBON CYCLE

Earth is a closed ecosystem with regards to matter. All of the atoms in Earth’s ecosystem (Earth and its atmosphere) have been here since the Earth formed, and always will be. They may rearrange into different combinations and forms, but they cannot enter or leave. We can demonstrate this by following the path of certain elements as they pass through living systems. Carbon is an element that readily combines with other elements to make organic compounds. All life on Earth is made of these carbon-based organic compounds. In the atmosphere carbon exists primarily as CO2 gas. In ecosystems, carbon is continuously cycled from the atmosphere to living things and back again through the life processes of different organisms.

The biological carbon cycle is really the story of two processes: photosynthesis and cellular respiration. Plants take in carbon dioxide from the air and use sunlight to perform photosynthesis, converting carbon dioxide from the atmosphere and water from the soil into glucose and oxygen. Organisms that can produce their own food are called autotrophs. Much of the glucose produced by autotrophs is used for cellular respiration to obtain energy for its life processes, but the rest is used to build new body tissues from carbohydrates, fats, and protein. In this way, some of the carbon plants take in from the atmosphere is stored in their tissues.

When other organisms, called heterotrophs, eat plants, they acquire the carbon stored in the plant tissues. They use much of the food for cellular respiration to obtain energy for their life activities. This breaks the organic carbon compounds down into CO2 which is released to the environment as a waste product. Carbon compounds not used directly to obtain energy are stored by heterotrophs by building new tissue. Any organic matter that a heterotroph cannot digest is eliminated as digestive waste. So, heterotrophs eliminate some carbon compounds as waste, return much of it back to the atmosphere as CO2 (where it is available again to plants), and store some in the tissues of their bodies.

Even the carbon stored in the tissues of organisms and eliminated as digestive waste is eventually recycled and returned to the atmosphere. All organisms inevitably die and all heterotrophs produce digestive waste. The bodies of dead organisms and digestive waste are food for decomposers such as fungi, worms, insects, and bacteria. Like other organisms, decomposers must obtain energy from their food through the process of cellular respiration. When they do, the carbon from digestive waste and the bodies of dead organisms is returned to the environment in the form of CO2.