

## What is Radiocarbon?

- Radiocarbon, or carbon 14, is present in all living and recently expired matter
- Anything that is more than 50,000 years old no longer has carbon 14
- One industrial application of radiocarbon dating is ASTM D6866

This discussion is a simplified introduction to radiocarbon dating. There are exceptions to the theories and relationships introduced below that are beyond the scope of this discussion.

Carbon is the basis of life and is present in all living things.

Radiocarbon, or carbon 14 (also written as  $^{14}\text{C}$ ), is an isotope of carbon that is unstable and weakly radioactive. Carbon 14 is present in all living things in minute amounts. Since it is radioactive, it gradually fades away by radioactive decay until it is all gone. Radiocarbon dating uses carbon 14 to determine the last time something (or someone) was alive.

Carbon 14 originates in the upper atmosphere of the earth and is created when neutrons originating from solar radiation bombardment collide with nitrogen in the air. A reaction occurs and a tiny number of these collisions convert nitrogen to carbon 14. This carbon 14 immediately starts to radioactively decay but is constantly being recreated. This leaves the amount in the air relatively constant.

Radiocarbon immediately reacts with oxygen in the air to form carbon dioxide ( $\text{CO}_2$ ). This carbon dioxide rapidly mixes throughout the atmosphere, where at ground level it is taken in by plants during photosynthesis. This process is constantly ongoing, so that at any point in time the amount of carbon 14 in living plants is the same as the amount of carbon 14 in the air around them.

Living plants are active components of the overall food chain. Animals eat plants and/or other animals; humans eat plants and animals. Therefore all living plants, animals, and human beings have the same amount of carbon 14 in their bodies at the same time. Their bodies are said to be in "equilibrium" with carbon 14 in the air. Although carbon 14 is radioactively decaying away in the body, it is constantly being replaced by new photosynthesis or the ingestion of food, leaving the amount relatively constant.

When a plant stops assimilating carbon dioxide or when an animal or human being stops eating, the ingestion of carbon 14 also stops and the equilibrium is disrupted. From that time forward, the only process at work in the body is radioactive decay. Eventually, all the carbon 14 in the remains will disappear. This principle applies equally to a person dying, a corn stalk being cut down, or to a soybean plant being pulled out of the ground. When they stop living, they stop taking in carbon 14 from the air around them, and the amount of carbon 14 in the remains gradually disappears.