

# How Do Trees Grow So Huge Without Eating?

Human babies get about 20 centimeters taller in their first year of life. That's a lot of growth! Humans, like all animals, use molecules from food in order to grow. It's not surprising, then, that babies spend a lot of their time eating. Most newborn babies eat about every two hours to get enough of the molecules from food that they need to grow so fast. Humans continue to grow taller through their teenage years. In fact, your body is using molecules from food to grow right now, even as you read this.

As amazing as human growth may be, it's nothing compared to plant growth. An apple tree can grow up to 60 centimeters in a year, and grows until it is about 6 meters tall! That means an apple tree grows much more quickly—and, of course, much larger—than any human. But apple trees are nowhere near the biggest trees on Earth. The world's biggest tree, a giant sequoia in Sequoia National Park, is about 84 meters tall and weighs about 2,000 tons! Trees don't eat like humans do, so how can they possibly grow so huge? Where do they get the matter they need to grow without eating?

Some people might think that trees and other plants get all the matter they need to grow from the soil. Plants do take in important molecules from the soil, but most of the matter for plant growth comes from somewhere else. If you plant a tree in a pot, the soil doesn't disappear as the tree grows. Trees don't grow by eating soil! Amazingly, trees, like all plants, make the



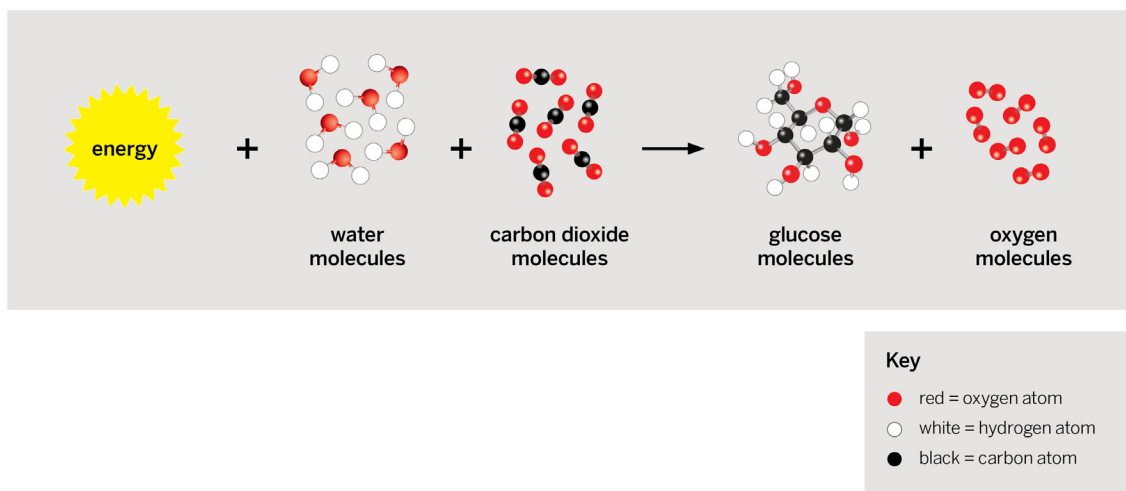
**Giant sequoias can grow more than 80 meters tall!**

molecules they need for growth using atoms from the water and air around them. Even the giant sequoia that's as tall as a 25-story building is made mostly of atoms from water and air!

Plants take in molecules from water and air around them to make different molecules that can be used for energy and growth. Inside plant cells, a chemical reaction takes place. Using energy from sunlight, water molecules and carbon dioxide molecules from the air are rearranged to form glucose

and oxygen molecules. This process is called photosynthesis. All plants can perform photosynthesis, and so can algae and some kinds of bacteria. Plants use the glucose produced during photosynthesis to release energy, but they also use it to build larger molecules that make up their leaves, stems, and roots. This means that much of the huge tree trunk of the giant sequoia is made up of atoms that came from glucose, and those atoms originally came from water and air.

## Photosynthesis

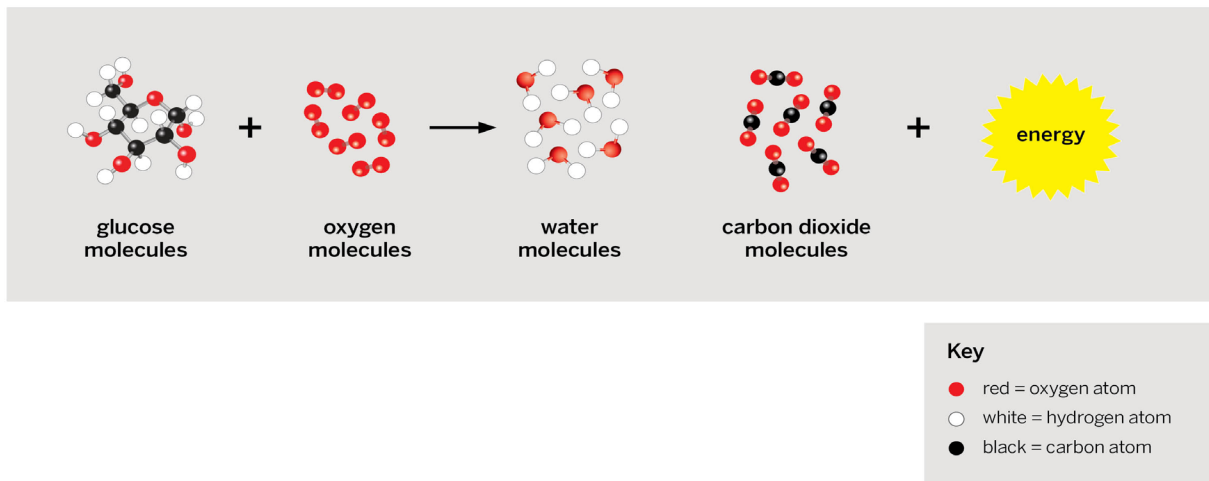


Using energy from sunlight, the atoms that make up carbon dioxide and water are rearranged to form glucose and oxygen. This reaction is called photosynthesis.

Plants can get the carbon dioxide they need for photosynthesis from the air and water around them, but how did that carbon dioxide get there? You might be surprised to know that some of the carbon dioxide came from you. Imagine you are standing next to an apple tree. Inside the cells of the apple tree, photosynthesis is taking place. Amazingly, the apple tree can get some of the carbon dioxide molecules it needs for photosynthesis each time you exhale. That's because another chemical reaction is happening inside your cells. It's called cellular respiration, and it is basically the opposite of photosynthesis. Inside the cells of your body, glucose molecules from food and oxygen

molecules from the air rearrange to form new molecules. The atoms that make up glucose and oxygen rearrange to form molecules of carbon dioxide and water, releasing energy. When you exhale, you breathe out carbon dioxide produced in your cells during cellular respiration. Humans are not the only organisms that release carbon dioxide: almost all organisms (including plants!) perform cellular respiration. However, just by breathing, you contribute to the carbon dioxide in the atmosphere that plants use—along with water and energy from the sun—to make glucose and oxygen during photosynthesis.

## Cellular Respiration

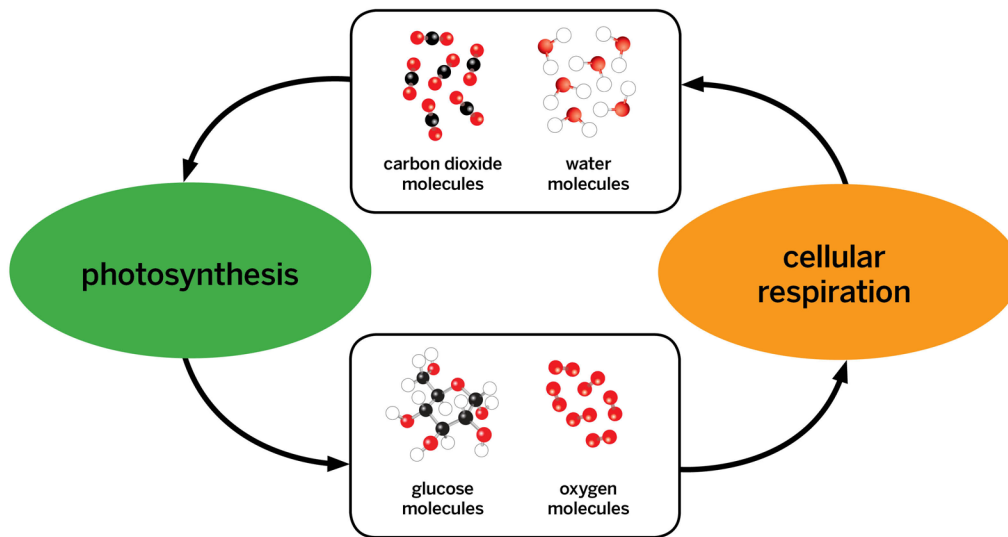


During cellular respiration, the atoms that make up glucose and oxygen molecules rearrange to form carbon dioxide and water molecules, releasing energy.

Let's return to the apple tree again: imagine that you reach up and pick an apple. You take a bite, and as you digest the apple, your body breaks down molecules from the apple to get smaller glucose molecules. Your cells use glucose from the apple and oxygen from the air for cellular respiration, and they release carbon dioxide and water. You breathe out the carbon dioxide, and the tree takes in that carbon dioxide from the air. The cycle starts over: the tree uses the carbon dioxide for photosynthesis, producing more oxygen and more glucose that it can use to grow more apples.



An apple tree can grow 60 centimeters in a year!



The materials needed for photosynthesis are made during the process of cellular respiration, and the materials needed for cellular respiration are made during the process of photosynthesis. That means some of the atoms in a tree may have come from you!