

I have a sweet tooth for caramel corn...it's one of my favorite snacks. I have a friend who goes for chocolate-covered raisins. Those are both popular snack foods. We eat snack foods when we are a little hungry in the afternoon or maybe at a movie or sporting event.

Snacking is one way we get food, but serious feeding usually takes place at meals—breakfast, lunch, and supper. That might turn out to be cereal, fruit, or eggs in the morning and a sandwich, bowl of soup, or maybe a slice of pizza for lunch. For supper it might be a salad, plate of pasta, some enchiladas, chicken and potatoes, or a bowl of stew with bread. With meals and snacks, it seems like we are eating something just about all the time. Why is that?

We eat to live. Everybody has to eat. For that matter, every animal has to eat to live. Food is the source of two essential elements of life—things that we need to stay alive and healthy. They are energy and chemical building blocks.

Building blocks are matter. That is, they are made out of atoms and are solid "stuff." Building blocks are carbon-based chemicals used to make body tissues, heal injuries, and replace worn parts. Building blocks come from the fats, proteins, and carbohydrates in

food. Without building blocks you couldn't grow or mature as you get older, and you couldn't replace hair or discarded skin cells.

Energy is not matter; it is not made of atoms. Energy is the drive that gets things done. Some familiar forms of energy are heat, light, sound, and electricity. Energy is needed to do all the things that living organisms do. Energy is needed to move, talk, digest food, keep warm, think, grow, and feel. Energy is the drive that keeps the machinery of life running.

### How Do Chemicals and Energy Get into Food?

Food is the source of matter and energy for all organisms. But not all organisms eat food. How can some organisms get the benefits of food without eating it? The answer is simple. Some organisms make food right in their own cells. Organisms that make their own food are called **autotrophs** (*auto* = self; *troph* = feed). Autotrophs are self-feeders.

Autotrophs make food from water, carbon dioxide, and light. The process is called **photosynthesis** (*photo* = light; *synthesis* = putting things together). The autotrophs of this planet are the plants, some protists (including algae), and some bacteria. These photosynthetic organisms never need to eat



other organisms to survive. They just make food by photosynthesis, bonding carbon atoms together to make sugar molecules. Below is the equation that shows how six water molecules ( $\text{H}_2\text{O}$ ) and six carbon dioxide molecules ( $\text{CO}_2$ ) are changed into a glucose molecule (sugar) with energy from light. Note that six molecules of oxygen ( $\text{O}_2$ ) are also released.



The sugar molecules (food) are rich in energy from sunshine and loaded with atoms to use as building blocks. The photosynthetic organisms use the food they manufacture to get the energy and building blocks they need to live. Plants never eat ham sandwiches, algae never eat enchiladas, and photosynthetic bacteria never eat fruit. They don't have to.

### How the Other Half Lives

Humans are not autotrophs. We can't make our own food. The same is true for all the other animals, the fungi, most protists, and most bacteria. But all organisms need food, so the ones that don't make their own food eat the ones that do. Organisms that eat other organisms are called **heterotrophs** (*hetero* = other; *troph* = feed).

Humans get their food in thousands of different forms. The great majority of people in the United States get food at grocery stores and restaurants. The caramel corn, pizza, and chicken mentioned earlier are familiar to just about everyone, but where did they come from before they arrived at the store? And what autotroph made the food in the first place? It's fun to find out. And when you trace any food back to its source, it all starts with plants or plantlike organisms. Always.

Let's follow the paths that led to a pepperoni pizza (do you like that with anchovies?). The main ingredients are bread dough, tomato sauce, cheese, and pepperoni sausage. Start with the dough...that's a short path. The pizza dough is bread, made from wheat flour. Wheat flour is made by milling (grinding) the seeds of the wheat plant, a kind of grass. So the crust is a part of the pizza that comes fairly directly from a plant source.

Tomato sauce is made by grinding tomatoes to a pulp and cooking them with a few seasonings. The sauce is a part of the pizza that comes fairly directly from the fruit of the tomato plant.

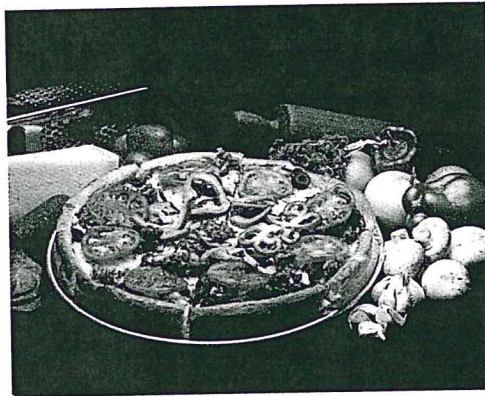
Cheese is processed from milk. Milk comes from cows. Cows need to eat to live, just like we do. Cows don't eat pizza and chocolate-covered raisins; they eat grass and other plants. The milk is produced by the cows that eat plants to survive. The nutrients in milk come from the food value of the grass eaten by the cows. The cheese comes indirectly from the grass eaten by the cows. If there is no grass, there are no cows, and therefore no cheese for our pizza.

Pepperoni is made from the ground-up muscle of cattle and pigs. In order to have the spicy Italian sausage, there had to be livestock to butcher. The livestock grew to market size by eating plants, probably grasses and grain seeds like corn and millet. The plants nourish the animals that provide the meat that is made into pepperoni for the pizza.

Did you order anchovies? The case of these little fish is different, but only slightly. Anchovies don't eat plants, as do cows and pigs. Anchovies are animals that eat other

animals. The animals they eat are tiny free-swimming critters called zooplankton. But what do the zooplankton eat? They eat even smaller plantlike organisms called phytoplankton. What makes them plantlike is that they can make their own food by photosynthesis, just like plants. So the anchovies eat little animals that eat tiny plants to survive. The anchovies arrive on your pizza because of the food value in the microscopic phytoplankton floating in the sea, making food.

You eat to get the energy in food. Where does your energy come from when you eat that pizza slice? The crust and sauce have a



bit of energy that wheat and tomato plants captured from the Sun. The cheese and sausage come from animals that ate plants that captured the Sun's energy. The anchovy filet comes from an animal that ate an animal that ate the tiny phytoplankton that captured the Sun's energy.

Life runs on energy from the Sun. The Sun's energy is captured in food by photosynthetic organisms. Can you figure out how the Sun's energy got into caramel

corn and chocolate-covered raisins? What's *your* favorite food? How did the Sun's energy get packaged into that food?