Food and Nutrition

A Science A–Z Life Series

Word Count: 2,052

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Food and Nutrition

Written by Katherine Follett

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nutrients substances in food or soil that organisms need to live, stay healthy, and grow (p. 16)

omnivore an animal that eats both plants and animals (p. 9)

oxygen an invisible, odorless gas essential for life that makes up part of the air (p. 7)

photosynthesis the process by which plants convert energy from the Sun into food (p. 5)

protein organic nutrients used by the body to grow and to repair cells (p. 19)

respiration the process by which cells produce energy from stored sugars (p. 7)

vitamins organic nutrients required in small amounts for health and normal growth (p. 20)

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KEY ELEMENTS USED IN THIS BOOK

The Big Idea: Humans are like other organisms in that we need food to survive. Food is the fuel that powers us. Plants use photosynthesis to make their own food, while animals eat plants, other animals, or both. Plants and animals both use the process of respiration to convert food into energy. In animals—including humans—food breaks down as it travels through the digestive system, releasing nutrients and energy. To be healthy, we need to consume a balance of various organic and inorganic nutrients. Knowing which nutrients the body needs and in what proportions in our diet, as well as which foods contain those nutrients, are all important for maintaining our health.

Key words: agriculture, breathe, carbohydrate, carbon dioxide, carnivore, cell, chlorophyll, consumer, decomposer, diet, digestion, digestive system, energy, enzyme, esophagus, fiber, food, food chain, glucose, herbivore, inorganic, lipid, liver, mineral, molecule, nutrient, nutrition, omnivore, organic, oxygen, pancreas, photosynthesis, plants, producer, protein, respiration, saliva, small intestine, soil, stomach, sugar, sunlight, villi, vitamin, water, water vapor

Key comprehension skills: Compare and contrast
Other suitable comprehension skills: Cause and effect; classify information; main idea and details; identify facts; elements of a genre; interpret graphs, charts, and diagrams

Key reading strategy: Retell
Other suitable reading strategies: Ask and answer questions; connect to prior knowledge; summarize; visualize; using a table of contents and headings; using a glossary and boldfaced terms

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Glossary

carbohydrates organic nutrients, including sugars and starches, that can provide an organism with energy (p. 17)

carbon dioxide an invisible, odorless gas that is used during photosynthesis and given off as a waste product during respiration (p. 5)

carnivore an animal that only eats other animals (p. 9)

chlorophyll a material in green plants that can turn water, air, and sunlight into food (p. 5)

digestion a series of chemical reactions that break food down into forms that the body can use (p. 11)

energy the power to do work, make a change, or move objects (p. 4)

enzymes proteins that speed up a chemical reaction in the body (p. 12)

fiber a food substance that cannot be digested but which helps the process of digestion (p. 19)

herbivore an animal that only eats plants (p. 9)

lipids fats and oils (p. 18)

minerals inorganic nutrients required in small amounts for health and normal growth (p. 20)

Conclusion

You have learned that both plants and animals must turn food into energy. Plants make their own food, while animals (including humans) have to eat food. Luckily, your body turns food into energy without you even thinking about it. But you do need to give some thought to which foods you should eat.

Proteins, carbohydrates, lipids . . . your body needs many things to stay healthy. How do you know what to eat? The most important thing is to eat a wide *variety* of foods. Try to avoid too much fat, such as from red meat, fried foods, and butter. It is also best to avoid eating too much simple sugar, such as from candy and desserts. Fruits, vegetables, whole grains, and lean meats are healthy foods that give your body everything it needs!

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What Needs Food?

All living things need **energy**. They need it to live, to do all the things they do each day, and to stay healthy. Living things get this energy from food. In this book, you will learn about two very important processes: how living things *get food* and how living things *use food for energy*.

Before reading on, think about how plants get food and how they use it for energy.

All living things need food to survive.

By now, you can tell that eating the right combination of foods is very important! Actually, you might be able to live without food for a month. However, you would only last about a week without *water*.

More than half your body mass is water. Almost every chemical reaction in your body requires water. Saliva is mostly water. Blood is about 83 percent water. Experts say you need about two liters (10.5 glasses) of water per day to stay healthy. You get a lot of that water from the food you eat. But the best way to get enough water is by simply drinking clean water. Doing so is especially important when the weather is hot and when you are sweating.

Vitamins are chemicals that do important jobs in your body. For example, they help your eyesight, teeth, and skin. You do not need large amounts of vitamins, but you can become ill if you do not get enough of them.

Many foods and drinks contain a variety of vitamins. For example, carrots contain vitamin A, and oranges contain vitamin C.

Inorganic Nutrients

Minerals are important nutrients. Living things do not produce them, although plants and animals do contain them. Plant roots soak up minerals from the soil. Animals get minerals by eating those plants or by eating the animals that ate the plants.

Minerals found in foods include salt, zinc, iron, copper, calcium, and potassium. Too little calcium can cause bone problems. Your blood uses iron to carry oxygen. Salt is in your sweat, blood, and tears. You only need a small amount of most minerals. But your body cannot make minerals, so you must get them from your food.

Some people take pills for extra vitamins and minerals.

How Do Plants Get Food?

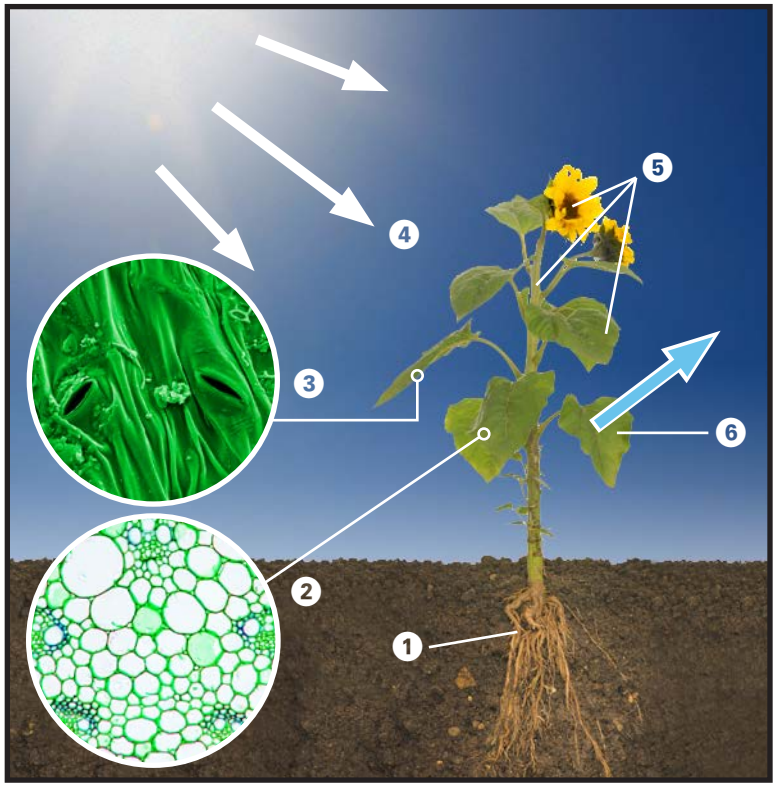
Plants and animals get the energy they need in different ways. Animals get energy by eating food. But plants do not eat. Plants *make* their own food in a process called **photosynthesis**.

During photosynthesis, plants make a simple kind of sugar. This becomes their food source. You may think that plants get their food from the soil, but they don't. Green plants contain **chlorophyll**, which absorbs sunlight and uses that light energy to make the sugar. Plants also use a gas called **carbon dioxide**, which is found in the air. The carbon dioxide gets absorbed through tiny holes that are mainly found on the bottom of a plant's leaves. Plants make food by combining sunlight, carbon dioxide, and water.

It is true that soil does not provide plants with food. But soil does supply plants with water and minerals, which are both absorbed through the roots. Water and minerals are important during photosynthesis.

Study the diagram of a plant on page 6. It explains the steps of photosynthesis that take place inside green plants.

Photosynthesis in Green Plants



1. Roots absorb water and minerals. The plant transports the water to the plant's cells.
2. The cells contain a green pigment called *chlorophyll*. Chlorophyll can capture the Sun's energy and use it.
3. The plant takes in carbon dioxide from the air through tiny holes on the bottoms of its leaves.
4. The leaf cells use the Sun's energy to break down the carbon dioxide and water. They convert the chemicals into a simple sugar, which is the plant's food.
5. The plant uses some of the sugar it makes. It stores the rest in its leaves, stem, roots, and other parts.
6. Oxygen gas is given off as a waste product when sugar is made. The leaves release the oxygen back into the air through the tiny holes.

Another type of nutrient is **protein**. Your body needs certain proteins to build and repair cells and to keep your whole body strong and healthy.

Protein comes in many forms. You can get protein from animal foods such as eggs, cheese, milk, meat, and fish. You can also get it from many plant foods, such as wheat, rice, oats, nuts, seeds, dry peas, and beans. Vegetarians, who don't eat meat, rely on foods from plants to get the protein they need.

Eat meat, eggs, dairy, and nuts for protein.

Fiber is also a very important part of a healthy diet. Fiber is a substance that your body cannot digest. Why would you need something that you cannot digest? Fiber helps food pass through your digestive system easily. Fresh fruits and vegetables, beans and peas, and whole-grains are all good sources of fiber.

Some foods, like these, contain healthy fats.

The next type of nutrient is **lipids**, which are fats and oils. Rub a peanut on a piece of paper and you'll see an oily stain. Nuts, meats, and some other foods contain lipids. Lipids contain a lot of energy. Ounce for ounce, lipids have twice as much stored energy as carbohydrates.

All healthy bodies need a certain amount of fat. Your body uses lipids to store extra food under your skin as fat. Fat helps keep your body warm. Oils keep your skin and hair healthy. Some types of fat are important to eat, while others can be harmful. Too much body fat can be unhealthy. Fatty foods may end up stored as extra fat on your body. And too much fat can be bad for your heart.

These foods are tasty, but they are high in unhealthy fats—and low in many other nutrients.

In the formula below, the left side explains what plants *use* during photosynthesis. The right side explains what plants *produce* during photosynthesis. The arrow is like an equal sign.

Photosynthesis Formula

water + carbon dioxide + light → sugar (food) + oxygen

How Do Plants Use Food for Energy?

After photosynthesis, the plant has sugar it can use for energy. Some of that energy remains stored inside the plant's leaves, stem, fruit, roots, and other parts. The plant uses the rest of the energy to grow by making new cells.

The plant then breaks down the sugar in a different process, which is called **respiration**. Respiration is the opposite of photosynthesis. This time, the plant takes in **oxygen** from the air. The oxygen reacts with the sugar, creating the energy the plant needs in order to live. During respiration, water and carbon dioxide are also produced. They are released back into the air.

Plants perform photosynthesis when the Sun is shining. But plants can perform respiration in either the dark or the light. The next formula explains what plants *use* (on the left) and what they *produce* (on the right) during respiration.

Respiration Formula

sugar (food) + oxygen → energy + carbon dioxide + water vapor

To review, plants *make* their own food during photosynthesis. Plants *use* that food for energy during respiration. Photosynthesis can only happen in the light. Respiration can happen in the dark or the light. All living things use respiration. Plants also use photosynthesis. Use this chart to compare the two processes.

PHOTOSYNTHESIS	RESPIRATION
produces food	uses food
stores energy	releases energy
uses water	uses sugar *(glucose)*
uses carbon dioxide	uses oxygen
produces sugar *(glucose)*	produces water vapor
produces oxygen	produces carbon dioxide
occurs in sunlight	occurs in the dark or light
used mainly by plants	used by all living things

Try This

You can prove that plants give off water vapor during respiration. Seal a bag over a few leaves of a living plant for a few days and see what happens.

Organic Nutrients

Your body gets most of its energy from **carbohydrates**. Carbohydrates break down in your body, releasing sugars that your cells use for energy. Carbohydrates come in two types: *simple carbohydrates* and *complex carbohydrates.*

Sugars are simple carbohydrates. Desserts, fruit, and soda all contain sugar. You digest simple carbohydrates quickly because their molecules are already small. But if you don't use that energy by being active, your body may store some of it as fat. Too much sugar in your diet can also cause disease.

Complex carbohydrates include *starches.* Starches are long chains of sugar molecules bound together. They are found in potatoes, rice, whole grains, beans, corn, and other vegetables. Complex carbohydrates digest much more slowly because your body must break apart the starches. These foods give your body a steadier supply of energy throughout the day. Which kind of "carbs" do you think doctors suggest you eat more of?

Food, Nutrition, and Health

Food has chemicals that provide you—and all living things—with the energy to move, grow, and heal. The useful chemicals in food are called **nutrients**. Your body needs many kinds of nutrients to maintain good health. Different kinds of foods have different kinds of nutrients. So it is important to eat a wide variety of foods to get all the nutrients you need.

Nutrients that come from living things are called *organic nutrients. Inorganic nutrients* are not produced by living things. As you read on, think about whether you eat enough of each nutrient.

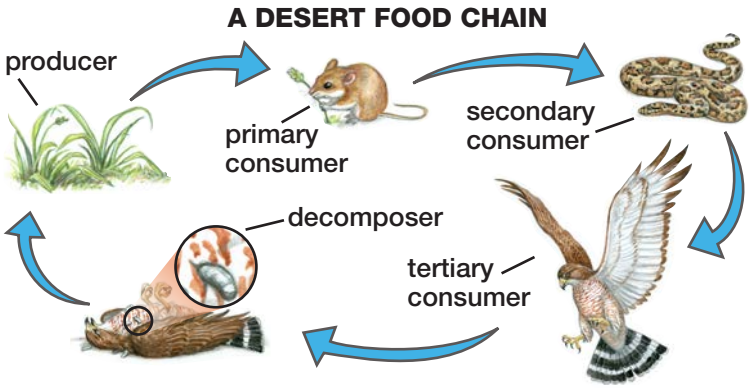
How Do Animals Get Food?

Unlike plants, animals cannot make their own food. They must take food into their bodies by eating. Animals eat in three main ways. Can you guess what they are?

An **herbivore**, such as a zebra, eats only plants. A **carnivore**, such as a lion, eats other animals, including zebras. An **omnivore**, such as a warthog, eats both plants and animals.

Think About It

Think of ten wild animals. How would you group them as herbivores, carnivores, and omnivores?



Plants and animals all belong to food chains. Food chains often start with green plants, which produce food. Herbivores take the energy stored in plants by eating them. Carnivores eat other animals. In this way, energy is passed through a food chain.

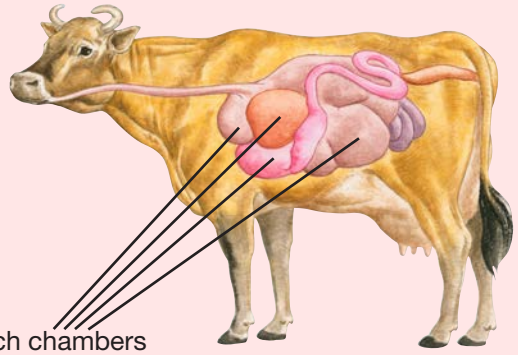
Agriculture

How do you get your food? Someone probably produces it for you. Growing crops and raising animals for food is called *agriculture*, or farming. Long ago, agriculture involved backbreaking work that took a very long time. By the 1800s, it became faster with the use of steam- and gas-powered machines. Today's advanced machines allow farmers to harvest their crops even faster.

So Many Stomachs!

Cows, camels, and giraffes each have a stomach divided into as many as four chambers. Each section works like its own stomach. Why so many?

These animals eat grass, which takes a long time to digest. But since predators hunt them, they have to eat and run. So they store food in the first chamber of the stomach. Later, when things are calmer, the animals can bring up the partially digested food from the first stomach and chew it some more. Sometimes it looks as if cows are chewing gum. They are chewing food from their first stomach again. This extra chewing helps break down tough grass, which they digest in the other sections of their stomach.



Now the apple you ate hours ago has been totally digested. It was broken down into molecules, and it entered your bloodstream. One of the main molecules in an apple is sugar. (Remember, the apple tree made sugar during photosynthesis and stored it in the fruit.) Your blood brings the sugar to your cells, which is where respiration takes place. Just as in plants, respiration is how you get energy! You use this energy to move, stay warm, and do all the things you do.

The blood carries leftover water vapor and carbon dioxide to your lungs so you can breathe them out. Any leftovers from the food you ate will keep traveling through the rest of the digestive system and leave the body as waste.

WOWSER!

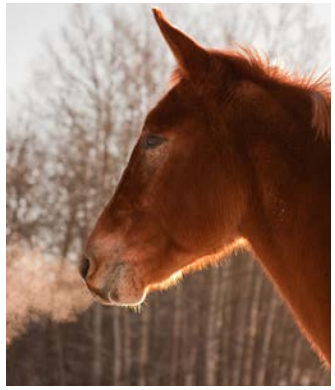
The small intestine is only called "small" because it's narrow. It can be 7 meters (23 ft.) long—as long as a truck!

How Do Animals Use Food for Energy?

There it sits—a nice, juicy apple loaded with energy. That energy can help you walk, run, and breathe. How does your body get the energy out of that apple? By eating it, of course! Like other animals, humans break down the food we eat during a process called **digestion**.

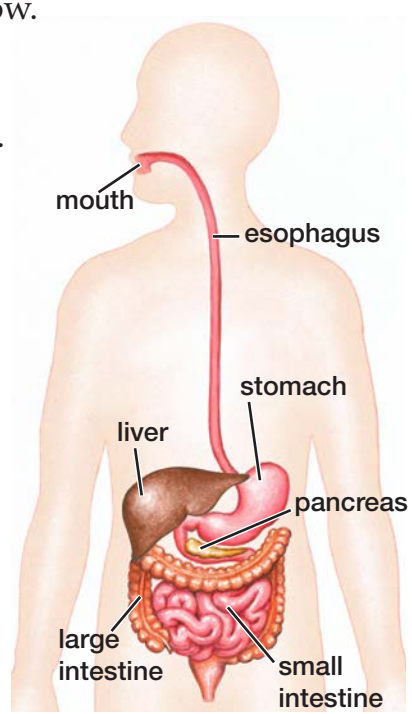
Your digestive system works like an assembly line, but in reverse. It takes apart food, piece by piece, until it is in its smallest parts, called *molecules.* Then your blood carries the molecules to all your cells, which gives you energy.

Earlier, you learned that plants take in oxygen and mix it with their own food to get energy. Then plants give off water vapor and carbon dioxide. A similar thing happens inside animals during respiration. Animals take in oxygen and mix it with the food they ate to get energy. When they breathe out, animals give off water vapor and carbon dioxide. The water vapor is what makes an animal's breath feel wet.



Food's Journey Through the Human Body

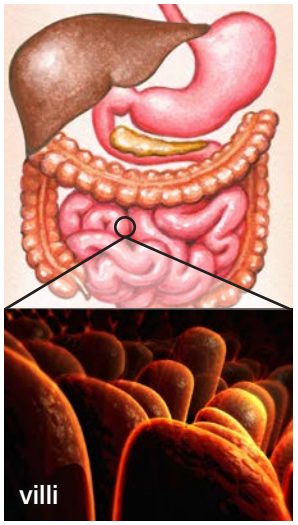
Let's look at the human digestive system. When you eat an apple, your food begins a long journey. It starts in your mouth, where your teeth tear off a piece of apple and grind it up. The *saliva* in your mouth adds moisture and some special chemicals called **enzymes**. Your entire digestive system has enzymes. They speed up chemical reactions during digestion. In your mouth, the enzymes make the apple soft and easier to swallow.



Next, you swallow the mushy bite of apple. The food travels down your *esophagus,* the tube that connects your mouth to your stomach. Strong muscles push the food all the way down until it reaches your stomach.

The bite of apple has reached your stomach. The inside of your stomach makes two kinds of chemicals: enzymes, which you learned about before, and gastric juices. Have you ever tasted a lemon? It's sour! Lemon juice is acidic. Gastric juices are also acidic, but they're stronger than lemon juice. Your stomach moves the food around. The gastric juices and enzymes mix with the bite of apple and break it down. Now the apple is in tiny pieces.

Next, the food moves to your small intestine. Once there, other organs, such as your liver and pancreas, get involved. These organs add more enzymes and other digestive chemicals to the mixture in your small intestine.



The apple has finally been broken down into molecules you can use for energy. The inside of your small intestine is covered with tiny fingerlike structures called *villi.* Blood flows through the villi, picks up the food molecules, and brings them to your body's cells.