Digestion

Activity from The Science of Food Teacher’s Guide: From Ecosystems to Nutrition and for The Mysterious Marching Vegetables

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BioEd™
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L iving things often are classified as producers or consumers, depending on how they obtain energy and nutrients. Producers typically are able to use solar energy to make the molecules they need from relatively few substances present in the air, water and soil. On land, green plants are the primary producers. In water, some plants and many varieties of algae, bacteria and other one- to many-celled organisms (Protists) are producers. All other organisms are consumers, which live directly or indirectly on food provided by producers.

Almost all producers make the molecules they need through photosynthesis. During photosynthesis, producers absorb energy from the sun and use it to combine carbon from carbon dioxide with water to make sugars and other carbohydrates. Thanks to this amazing process, light energy from the sun is converted into chemical energy stored in the bonds between atoms that hold molecules together. Plants use the energy stored in these molecules to build other compounds necessary for life. Likewise, consumers, who cannot trap energy directly from sun, must rely on molecules manufactured by plants for food.

The general sequence of who eats whom in an ecosystem is known as a food chain. Energy is passed from one organism to another at each step in the chain. Along the way, much energy is given off as heat. In fact, about 85–90% of the total usable energy is released as heat at every step in a food chain. Most organisms have more than one source of food. The relationship among all the energy flow interactions that happen in an ecosystem usually are described as a food web.
Food must be broken down, both physically and chemically, before it can be used by the cells within an organism. The process of breaking food down into usable components is known as digestion. Within the human body, digestion begins in the mouth, where pieces of food are mechanically broken, by chewing, into smaller pieces. In addition saliva mixes with the food and begins to break it down. After food is swallowed, other components of the digestive system—stomach, small intestine, large intestine, liver and pancreas—continue the process of making food available for use by cells in the body.

The stomach serves as a powerful mixing machine in which food is combined with special chemicals (enzymes) that begin to break large food molecules into smaller ones. Food usually stays in the stomach for two to three hours, after which it passes into the small intestine, where it is combined with secretions from the liver and pancreas. These very important organs produce substances (bile from the liver and pancreatic fluid from the pancreas) that help break down fats, proteins and carbohydrates into smaller molecules. The small intestine is responsible for absorbing the nutrients released during digestion. The walls of the small intestine are covered with millions of tiny, finger-like projections called villi. These structures increase the surface area of the small intestine to facilitate the absorption of nutrients into the bloodstream.

Proteins and their building blocks (amino acids) are vital to every cell in the body. Humans are not able to make their own amino acids, so they must include protein (equivalent to 4 ounces of chicken white meat) in their daily diet. During digestion, proteins are broken down into the different amino acids of which they are made. Then the body builds new proteins from the amino acids. You might say that the amino acids are recycled!

This activity will allow students to observe how chemicals in the body begin to break down proteins.

**Setup**

You will need meat tenderizer, located in the spice section at the grocery store, and a piece of sliced turkey luncheon meat for each group. Have students conduct this activity in groups of four.

**Safety**

Have students wash hands before and after the activity. Clean work areas with disinfectant.
PROCEDURE

Session 1: Setting up
1. Let Materials Managers collect 1/2 slice of turkey luncheon meat, a plastic knife and two resealable plastic bags. Have the groups label their bags “1” and “2.” Ask students, What happens to food when you eat it? Do you think that food stays the same inside your body? Discuss students’ ideas about digestion. Mention that they will be able to explore what happens to one kind of food—turkey meat (protein)—when digestion begins.

2. Have the students in each group cut the piece of turkey in half and place one section in the bag labeled “1.” Direct them to place the other section in bag “2” and to add 1/2 teaspoon of meat tenderizer to that bag. Have them seal the bag and shake the turkey slice within the bag so that it is well coated with the tenderizer.

3. Have the students place the bags to one side of the classroom for about an hour. (If students will be making observations the following day, refrigerate the bags to prevent spoilage.) Have students write, in their journals or on a sheet of paper, what they predict will happen to the slices of turkey.

Session 2: Making observations
1. Have students observe the texture and color of the meat samples without removing them from the plastic bags. Ask, Is there anything different about the turkey that was combined with the meat tenderizer? What do you think happened?

2. Ask students to think about the changes they observed in the meat with tenderizer. Mention that the substance they added was a chemical that helps soften the muscle fibers in meat by beginning to break them down into smaller pieces.

3. Help students understand that similar substances work within their stomachs and small intestines to break down the food they eat. Have students draw or write about their observations.

4. Mention that turkey meat is a muscle. Help students understand that protein is the building block for muscles and that it is used inside each muscle cell. Protein that we eat must be broken into smaller components before it can be used by our bodies. You may want to mention that the chemical meat tenderizer also is a kind of protein. It provides another example of the variety of roles that proteins play inside plants and animals.

VARIATIONS

• Students can investigate the importance of chewing by repeating the experiment using a finely chopped piece of luncheon meat and comparing the outcomes.