



Bio Build-up

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

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BioEdSM

Teacher Resources from the
Center for Educational Outreach at
Baylor College of Medicine

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The activities described in this book are intended for school-age children under direct supervision of adults. The authors and Baylor College of Medicine cannot be responsible for any accidents or injuries that may result from conduct of the activities, from not specifically following directions, or from ignoring cautions contained in the text.

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extoxnet.orst.edu/tibs/bioaccum.
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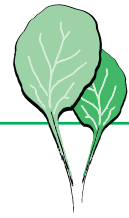
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Food Safety and Nutrition

Environment and Health Basics



Food affects health and well-being in two important ways. First, we require appropriate amounts of different kinds of foods to supply the energy and nutrients we need for daily activities and for growth and maintenance of our bodies. Second, food can contain contaminants that can make us sick.

Carbohydrates, fats and proteins are our main sources of energy. Our bodies also need protein to maintain muscles and carry out many functions inside cells. Small amounts of



vitamins and minerals also are necessary.

Food becomes available for use by the body through the process of digestion. Digestion breaks down large food molecules into smaller ones that can be transported and used by the body.



Many Americans eat too much refined sugar and unhealthy fats. Examples of foods with little nutritional value, or with too many added calories, are soft drinks, chips, greasy fried foods, candy and snack cakes. A diet that has a lot of “junk” foods is harmful

in two ways. First, it does not provide all of the vitamins, minerals and other substances needed for growth and health. Second, a diet with many sweets and fatty foods often delivers too many calories. When a person eats more calories than he or she uses up through movement and exercise, the body stores the excess energy as fat. Excess body weight can contribute to a number of serious health problems, such as type 2 diabetes, heart disease and stroke.

How foods are grown and prepared also is important. Plants and animals can take in small amounts of pollutants (harmful chemicals) from water, food or soil. These pollutants can accumulate in the bodies of other living organisms that eat the smaller plants or animals—a process known as bioaccumulation. Food also can be spoiled by bacteria. Most bacteria that cause food-related illnesses are spread because hands and food preparation areas are not kept clean or because food is not kept at the proper temperature.



Simple actions, such as washing hands before eating or preparing food, help to reduce the possibility of spreading bacteria or other harmful substances to food.

CHILDREN'S ENVIRONMENTAL HEALTH

Children are particularly susceptible to contaminants in food and in the environment. Because their bodies are still growing and because they eat more fruits and vegetables (which may contain chemical residues) relative to their body weights, children are more vulnerable to the harmful effects of substances such as lead and pesticides. However, many researchers believe that a healthy diet, which provides recommended amounts of vitamins and minerals, may help protect children from potentially harmful chemicals.

AVOIDING SUGARY DRINKS

Many soft drinks have around 10 teaspoons of sugar in a 12-ounce can. These drinks, which have little nutritional value, contribute to the nationwide epidemic of overweight and obesity.



CONCEPTS

- Pollutants often are absorbed by organisms near the base of a food chain.
- Toxic chemicals can become concentrated in the bodies of consumers, especially those near the top of the food chain.

OVERVIEW

Students will make a model of a simple food chain and observe how toxins can accumulate in consumers at the top.

SCIENCE, HEALTH & MATH SKILLS

- Counting
- Multiplying
- Observing patterns
- Drawing conclusions

TIME

Preparation: 5 minutes

Class: 30 minutes

MATERIALS

Each student will need:

- 80 (approx.) 1/4-in. round color coding labels (dots), asst. colors
- Crayons or colored markers
- Pair of scissors
- Copy of "Bio Build-up!" sheet

Many pollutants in the environment become introduced in very small amounts into organisms near the base of the food chain. These pollutants usually are present in the water or the soil in which producers, such as green plants and algae, or primary consumers, such as filter feeders in aquatic ecosystems, live and reproduce. Pesticides that are applied directly to plants also can be introduced into the food chain.



Unit Links

The Mysterious Marching Vegetables

Story, p. 25–26;

Science box, p. 25

Some chemical substances, such as pesticides and heavy metals (like mercury and lead), persist within the bodies of the organisms that take them in with food. These compounds are not broken down by the body, nor are they eliminated with other waste products. While most of these substances are not harmful in trace amounts, they can accumulate in the tissues of an organism over its lifetime. In addition, consumers near the top of the food chain tend to accumulate larger amounts of toxic substances in their bodies, because the pollutants become more concentrated at each step of the food chain. The actual amounts of toxins accumulated in the bodies of top consumers depend on their food sources and choices.

SETUP

As an alternative, glue and dried beans or unpopped popcorn can be substituted for the adhesive labels/dots.

Have students work in groups of 2–4 to share materials.

PROCEDURE

1. Let the Materials Managers collect adhesive dots (or alternative items) for their group (approx. 80 dots per student). Each student should complete his or her own "Bio Build-up!" sheet.
2. Ask students to think about what might happen to pollutants taken up by producers. *Would the pollutants be passed on to consumers? How about the next animal in the food chain? Would they have the pollutants too?* Tell the students that they will have an opportunity to find out what might happen to pollutants in a food chain.
3. Have students use a pair of scissors to separate 20 dots from the strip (or sheet) without removing the backing. Next, have them work through the steps described on the Bio Build-up! sheet, which depicts an aquatic ecosystem. The stickers or other markers will represent amounts of toxins consumed along each step of the food chain.
4. Once students have completed the activity, ask, *What happened to the pollutants at the last step of the food chain? Did the*



large fish have more or less pollutants than the plants at the beginning of the food chain? Did the amounts of pollutants in the plants at the beginning make a difference in the small and large fish? How could the amount of pollutants in the body of the eagle be reduced? In general, which kinds of organisms are most at risk of accumulating toxins in their bodies—producers or consumers? Students will have observed that the eagle accumulated the most pollution dots.

QUESTIONS FOR STUDENTS TO THINK ABOUT

- In addition to mercury and lead, the pesticide, DDT, is another chemical that can become concentrated in the body tissues of animals near the top of the food chain. The presence of DDT in food chains has been related to reduced populations of several large predatory birds, among other organisms. *What can you find out about DDT use in the U.S. and about the actions taken to make sure it does not become concentrated in food sources for people and animals?*
- Many toxic chemicals are stored in fatty tissues in the bodies of animals. Fat is created to store extra energy when more food is taken in than is used. See what you can find out about the role of fat in the body by checking the library or the Internet.

MERCURY IN THE FOOD CHAIN

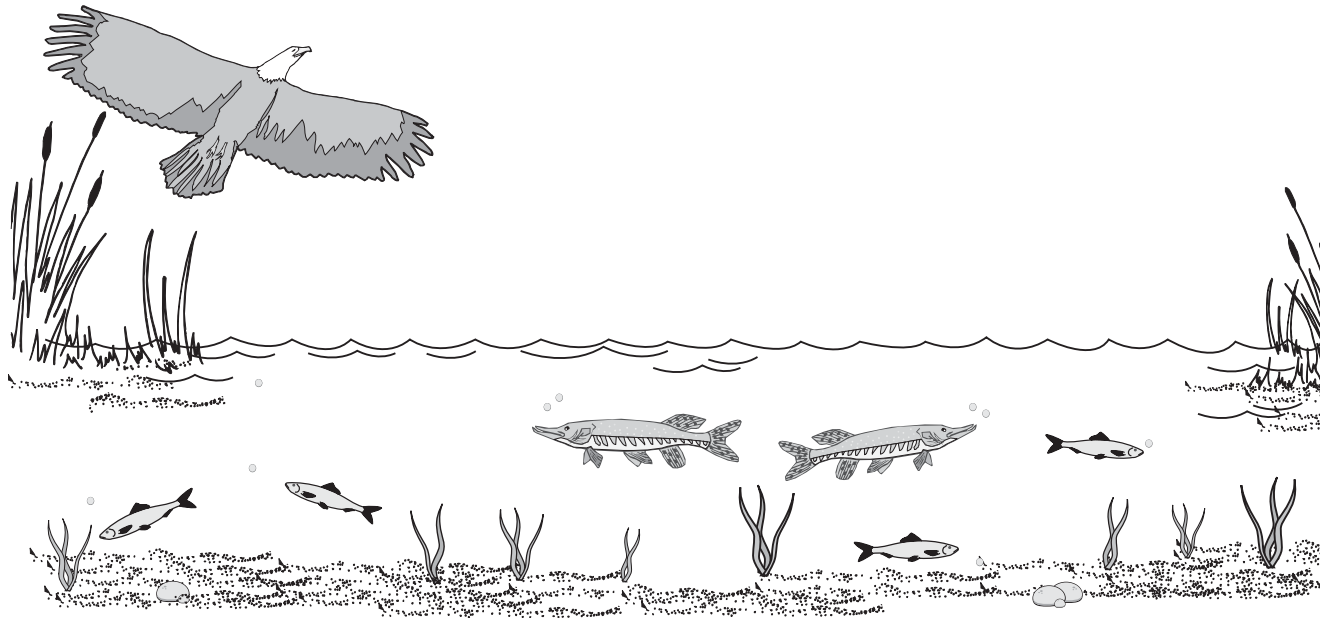
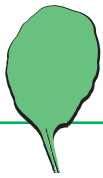
Mercury, a toxic metal, also is the only metal that is liquid at room temperature. It is used in the manufacturing of thermometers, barometers, fluorescent lights, electrical switches and batteries, among other things. When mercury is present in lakes, it becomes transformed by bacteria into a compound that can be dissolved in water. In this form, it can enter the food chain. It ends up in seafood, which, in turn, can be eaten by people. Mercury can damage the nervous system.

BIOACCUMULATION

Bioaccumulation occurs when a chemical becomes more and more concentrated as it moves up through a food chain. For example, a typical food chain include algae eaten by a water flea eaten by a minnow eaten by a trout and finally consumed by a human being.

A study on DDT showed that where soil levels contained 10 parts per million (ppm), DDT reached a concentration of 141 ppm in earthworms and 444 ppm in robins.

Source: Extension Toxicology Network, USDA.

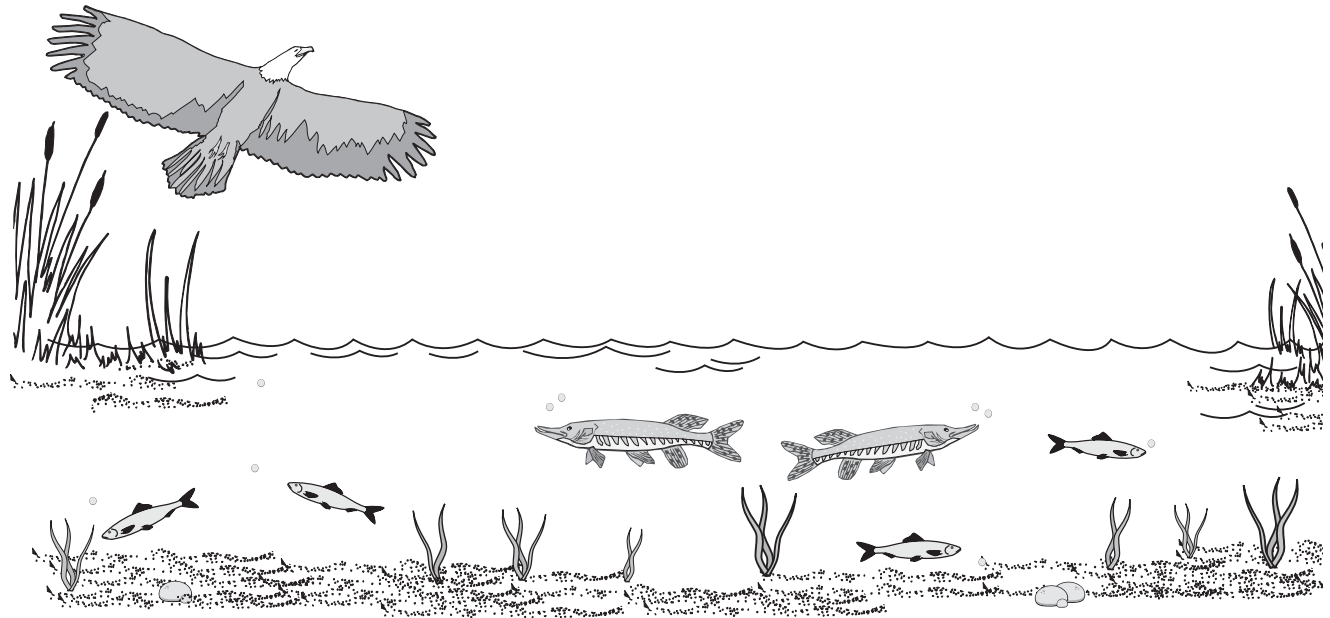
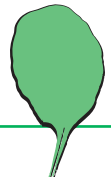


1. Sprinkle 20 pollution dots over the water plants. Many will fall onto the plants. Remove the dots that do not touch any plants. Peel the backing from each dot that falls on or touches a plant and stick the dot onto that plant.
2. Each small fish eats two water plants. Draw a line from a small fish to two plants that it eats. Count the number of dots on the plants. Stick that number of dots on the fish. Repeat for each small fish.
3. Each large fish eats two small fish. Draw a line from a large fish to two small fish that it eats. Count the number of dots on the small fish. Stick that number of dots on the large fish. Repeat for the other large fish.
4. The eagle eats both large fish. Count the dots on both large fish. Stick that number of dots on the eagle.
5. Which living organism is most in danger of being harmed by pollution? Is it a producer or a consumer? Explain your answers.

Optional

6. Find the average number of dots on each kind of plant or animal by dividing the total number of dots by the number of individuals. Use a separate sheet of paper.
7. Make a graph showing the average number of pollution dots that ended up in each kind of plant or animal.

¡Amontonamiento Biológico!



1. Distribuye 20 circulitos de contaminación sobre las plantas acuáticas. Varios circulitos caerán sobre las plantas. Remueve los circulitos que no tocan ninguna planta. Quita el papel adherido a todos los circulitos que tocan una planta y pégalos en esas plantas.
2. Cada pez se come dos plantas. Dibuja una línea para conectar uno de los peces pequeños a dos plantas. Cuenta el número de circulitos en las plantas y pega el mismo número de circulitos en el pez. Repite para cada pez pequeño.
3. Cada pez grande se come dos peces pequeños. Dibuja una línea para conectar uno de los peces grandes a dos pequeños. Cuenta el número de circulitos en los peces pequeños y pega el mismo número de circulitos en el pez grande. Repite para el otro pez grande.
4. El águila se come a los dos peces grandes. Cuenta los circulitos en los dos peces grandes. Pega el mismo número de circulitos en el águila.
5. ¿Cuál organismo tiene más riesgo de enfermarse por causa de la contaminación? ¿Es un productor o un consumidor? Explica tus respuestas.

Opcional

6. En otra hoja, calcula el número promedio de circulitos adquiridos por cada tipo de planta y animal. Divide el número total de circulitos por el número de individuos.
7. Haz una gráfica para representar el número promedio de circulitos de contaminación que adquirió cada tipo de organismo.