



Photo courtesy of the U.S. National Parks Service.

## Bio Build-up

### The Science of Food: Activity 7

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### Bio Build-up

This activity's objectives are aligned with the National Science Education Standards, specifically those related to Science as Inquiry and Physical Science. In this activity, students will discover how pollutants can be disbursed throughout a food chain. Students will make a model of a simple food chain and observe how toxins can accumulate in consumers at the top of the chain. They will count, multiply, observe patterns, and draw conclusions.

The following science concepts are addressed in this activity.

- 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.

### Student Worksheets

Student pages in the teacher's guide are provided in English and in Spanish.

### Reference

Moreno N., and B. Tharp. (2011). *The Science of Food: Teacher's Guide*. Fourth edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

### Image Reference

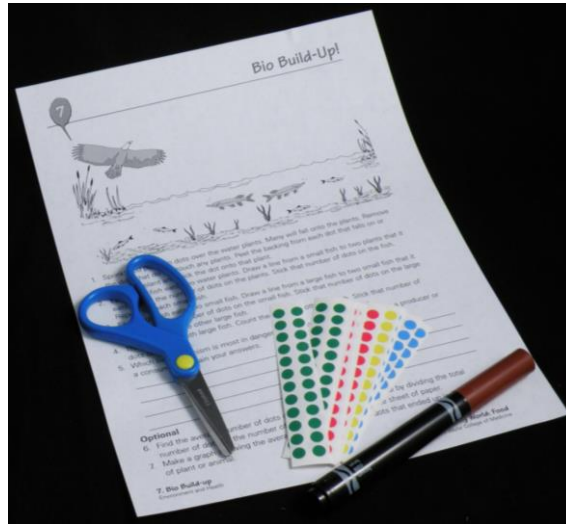
Photo courtesy of the U.S. National Parks Service.  
<http://www.nature.nps.gov/multimedia.cfm>

**Key Words**

food, food chain, food web, pollution, toxic chemicals, consumers,

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## Materials



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### Materials

Have students work in groups 2-4. But students should complete his or her own student sheet.

#### Per Group of Students

- 80 (approximately) 1/4-inch round coding labels (dots), assorted colors
- Crayons or colored markers
- Pair of scissors

#### Per Student

- Copy of "Bio Build-up!" student page

#### Setup

Glue and dried beans or un-popped popcorn can be substituted for the adhesive labels/dots.

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from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

**Image Reference**

Photo by Christopher Burnett © Baylor College of Medicine.

**Key Words**

materials list, materials needed,

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## Science Safety Considerations

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- Follow all instructions.
- Begin investigation only when instructed.
- Report accidents.
- Do not eat or drink during the experiment.
- Wash hands thoroughly after the investigation.



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### Science Safety Considerations

Students always must think about safety when conducting science investigations. This slide may be used to review safety with your class prior to beginning the activity.

#### *Safety first!*

- Always school district and school science laboratory safety guidelines.
- Have a clear understanding of the investigation in advance.
- Practice any investigation with which you are not familiar before conducting it with the class.
- Make sure appropriate safety equipment, such as safety goggles, is available.
- Continually monitor the area where the investigation is being conducted.

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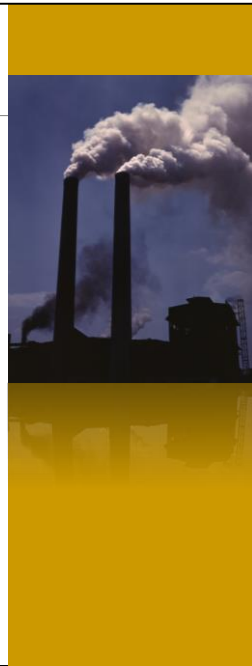
**Key Words**

science, classroom, safety, lab, laboratory, rules, safety signs,

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## What Are Pollutants?

- Are pollutants bad for us?
- What is bioaccumulation?
- What happens when producers eat pollutants?
- Are pollutants passed from producers to consumers?
- What about the next animal in the food chain?



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### What Are Pollutants?

To focus student's attention, begin this activity by asking, *What are pollutants?* Explain that pollutants are small amounts of harmful chemicals that plants and animals can take in through water, food, or soil. Tell students that pollutants can become harmful if they accumulate in our bodies (through a process called bioaccumulation).

Next, ask students to think about what might happen to pollutants taken up by producers. Ask, *Do you think these pollutants are passed on to consumers? How about the next animal in the food chain? Would they take in the pollutants too?* Tell students that they will learn what happens to pollutants in a food chain.

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### Image Reference

Photo by Alfred Palmer, public domain. U.S. Library of Congress, Digital ID fsac. 1a35072. <http://commons.wikimedia.org/wiki/File:AlfedPalmersmokestacks.jpg>

### Key Words

food, eat, eating, food chain, pollution, bioaccumulation, toxic chemicals, consumers,

producers, animal,  
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## Let's Get Started

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- Sprinkle 20 pollution dots over the water plants.
- Stick each dot touching a plant to that plant.
- Each small fish eats two water plants. Count the number of dots on the plants. Stick that number of dots on the fish.
- Each large fish eats two small fish. Count the total number of dots on the small fish. Stick that number of dots on the large fish.
- The eagle eats both large fish. Count the dots on both large fish. Stick that number of dots on the eagle.



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### Let's Get Started

In this activity, students will make a model of a simple food chain to learn what happens to pollutants in a food chain. They will discover how toxins can accumulate in consumers at the top of the food chain.

Have students use scissors to separate 20 dots from the strip (or sheet) without removing the backing. Next, have them work through the steps on the "Bio Build-up!" sheet, which depicts an aquatic ecosystem. The stickers or other markers will represent amounts of toxins consumed at each step of the food chain.

### Reference

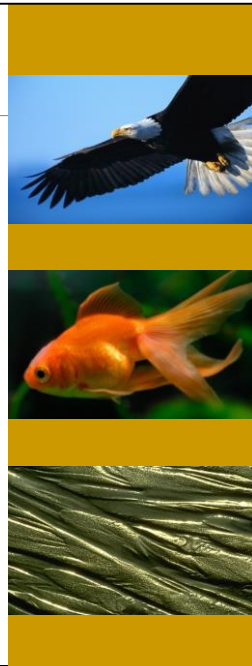
Moreno N., and B. Tharp. (2011). *The Science of Food: Teacher's Guide*. Fourth edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

### Key Words

lesson, experiment, food, bioaccumulation, food chain, toxins, consumers, producers, Bio Build-up © Baylor College of Medicine.

## Let's Talk About It

- What happened to the pollutants at the last step (“top”) 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 impact the amount of pollutants in the small and large fish?
- How could the amount of pollutants in the body of the eagle be reduced?



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### Let's Talk About It

In this activity, students make a model of a simple food chain and observe how toxins can accumulate in consumers toward the top of the chain. Students will learn that pollutants found on plants will be consumed by fish, and finally, by eagles, much higher in the food chain.

Ask students, *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 influence the amount of pollutants in the small and large fish? How could the amount of pollutants 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, a consumer, accumulated the most pollution dots.

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### Image Reference

Microsoft Office Clip Art.

**Key Words**

lesson, experiment, food, food chain, pollution, toxic chemicals, toxins, consumers, producers, bioaccumulation,

Bio Build-up © Baylor College of Medicine.

## The Science of Bioaccumulation

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- Toxins are in the water or soil where producers and primary consumers live.
- Pollutants are absorbed by organisms near the bottom of a food chain.
- Pollutants are not broken down by the body; they accumulate in an organism over its lifetime.
- Pollutants become more concentrated at each step of the food chain.
- Consumers near the top of the food chain accumulate larger amounts of pollutants than organisms lower in the chain.



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### The Science of Bioaccumulation

In this activity, students observed the following properties of food.

- **Pollutants often are absorbed by organisms near the base of a food chain.** These toxins usually are present in the water or soil in which producers (such as green plants and algae) or primary consumers (such as filter feeders in aquatic ecosystems) live and reproduce.
- **Toxic chemicals can become concentrated in the bodies of consumers, especially those near the top of the food chain.** Some chemical substances, such as pesticides and heavy metals (like mercury and lead), persist within the bodies of organisms that take them in with food. These compounds are not broken down by the body, nor are they eliminated with other waste products. Most of these substances are not harmful in trace amounts, but they can accumulate in the tissues of an organism over its lifetime. Consumers near the top of the food chain tend to accumulate larger amounts of toxic substances in their bodies, because pollutants become more concentrated at each step of the food chain.

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**Key Words**

food chain, food web, bioaccumulation, pollution, toxic chemicals, consumers, producers, concentrations, primary consumers,

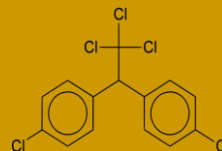
Bio Build-up © Baylor College of Medicine.

## Extensions

- Mercury, lead, and DDT are harmful chemicals that can become concentrated in the body.
- What can you find out about DDT use in the United States?
- What actions are being taken to make sure DDT does not contaminate our food sources?
- Many toxic chemicals are stored in fatty tissues. What is the role of fat in our bodies?



Mercury is a toxic metal.



DDT is a pesticide thought to harm the environment, wildlife and human health.



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## Extensions

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 associated with reduced populations of several large predatory birds and other organisms. Ask students, *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?*

Fat is created to store extra energy in our bodies when more food is taken in than is used. However, many toxic chemicals also are stored in the fatty tissues of animals' bodies. Visit the library or Internet to find more information about the role of fat in the body.

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## Image References

1. Illustration of DDT molecular structure courtesy of Lukáš Mižoch. Released into

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2. Photo of mercury © Bionerd CC-BY-SA 3.0.

[http://commons.wikimedia.org/wiki/File:Pouring\\_liquid\\_mercury\\_bionerd.jpg](http://commons.wikimedia.org/wiki/File:Pouring_liquid_mercury_bionerd.jpg)

**Key Words**

lesson, experiment, extensions, food, food chain, food web, pollution, toxic chemicals, consumers,

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