

## **“TOO LOUD, TOO LONG!” (30 minutes)**

Adapted from “Bend It, Break It” Dangerous Decibels Educator Resource Guide published by the Oregon Health & Science University, Center for Healthy Communities, Oregon Prevention Research Center through funding from the Centers for Disease Control and Prevention (CDC1 U43 DP00002401).

**Section:** Your Safety (Save Your Hearing)

### **Preparation and Planning**

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#### **Investigative Questions:**

- How do loud sounds damage our hearing?
- What steps can we take to prevent or reduce damage to our hearing from noise in our environment?

#### **Learning Objectives:**

In this activity, teachers will present information to increase students’ knowledge about the permanent hearing damage that can occur from loud sounds and the simple ways to protect their hearing.

#### **Relevant Standards:**

This activity fulfills science and health education standards.

#### **Activity:**

Students use pipe cleaners to understand the impact of loud sounds on the delicate hair cells of the inner ear. Suggested grade levels: elementary and middle school.

#### **Safety:**

Observe normal classroom safety procedures for this module.

### **Teacher Background and Content**

#### **Supporting Data**

- According to data collected by the CDC, nearly one in five school-aged children in the U.S. (ages 12 to 19 years) in 2005-2006 has hearing damage that is likely caused by excessive noise exposure (Shargorodsky, et. al. 2010).
- At some time during their young lives, 97% of 273 third graders surveyed had been exposed to at least one source of loud noise (Blair, et al., 1996).
- Another study found elementary school students reported listening to music (50%) and television (40%) at a loud volume (Chermak, Curtis, & Seikel, 1996).
- Of those students who did participate in noisy activities, an average of only 12% reported using earplugs while engaged in these activities.

### **Lesson Content**

#### **Overview**

- Although everyday sounds typically do not damage hearing, many children participate in activities that produce harmful sound levels, such as attending loud sporting events, movie theaters, and music concerts, and being too close to someone using power tools (lawnmowers, leaf blowers, etc.). Repeated exposure to these sound levels over time will cause hearing loss. Loud sound (noise) can damage

sensitive parts of the ear, causing ringing or buzzing in the ear (tinnitus), and hearing loss. Repeated exposure to loud noise affects how well you hear later in life and how quickly you develop hearing problems, even after exposure has stopped. However, noise-induced hearing loss can be almost completely prevented with simple precautionary measures.

### **Main Messages**

#### **Noise contributes to hearing loss.**

Both a one-time exposure to extreme loud sound and listening to loud sounds for a long time can cause hearing loss.

- Hearing loss can result from a single loud sound (like firecrackers) near your ear.
- More often, hearing loss can result over time from damage caused by repeated exposures to loud sounds.
- The louder the sound, the shorter the amount of time it takes for hearing loss to occur. The longer the exposure, the greater the risk for hearing loss (especially when hearing protection is not used or there is not enough time for the ears to rest between exposures).

Loud noise is particularly harmful to the inner ear (cochlea). It can damage cells and membranes in the cochlea.

- Listening to loud noise for a long time can overwork hair cells in the ear, causing these cells to die.
- The hearing loss progresses as long as the exposure continues.
- Harmful effects might continue even after noise exposure has stopped.
- Damage to the inner ear or auditory neural system is generally permanent.

#### **Noise-induced hearing loss can be almost completely prevented with simple precautionary measures.**

- The best way to protect your hearing from noise is to avoid noisy activities.
- When you can't avoid loud noise, use hearing protection. Hearing protection devices reduce the level of sound entering your ear, but they do not block out sound completely. Hearing protection that does not fit properly will not protect your hearing.

### **Ideas and Behaviors Common among Students**

#### **Activity**

#### **Ideas and Behaviors Common among Students.**

This activity offers information from the literature on ways your student may already think or act with regard to exposure to loud sounds in their environment.

**Summary:** Students use pipe cleaners to understand the impact of loud sounds on the delicate hair cells of the inner ear. Suggest grade levels: elementary and middle school.

#### **Materials:**

- Ear anatomy diagrams
- Pipe cleaners
- Music source
- Pictures of healthy and damaged inner ear hair cells (below)

- Pencils and paper for students to reproduce what they learned
- Pictures of hearing protection devices (earplugs, earmuffs)

### **Lesson Instructions**

Review the 3 parts of the ear (outer ear, middle ear, inner ear) and describe how sound is transmitted through the ear to the brain.

Optional video available at: [www.noisyplanet.nidcd.nih.gov/kids-preteens/journey-of-sound-video](http://www.noisyplanet.nidcd.nih.gov/kids-preteens/journey-of-sound-video)

1. Point out the pinna; tympanic membrane (eardrum); the ossicular chain: malleus (hammer), the incus (anvil) and the stapes (stirrup); the cochlea; and the auditory nerve.

Interesting fact: “The middle ear bones are the smallest bones in your body.”

2. Tell the students that they will be creating a model of the tiny hair cells inside the cochlea of the inner ear.

**Interesting fact:** “The inside of the snail-shaped cochlea is lined with about 18,000 microscopic hair cells. All of the hair cells in your inner ear would fit onto the head of a pin.”

3. Show a picture of healthy inner ear hair cells.

### **Activity**

1. Begin the demonstration by placing 3-5 pipe cleaners in your hand as though they were a bunch of flowers. Turn on soft music and gently move your hand over the top of the pipe cleaners to the rhythm of the music to show how hair cells move. You can say your arm is like the auditory nerve, sending impulses up to your brain.
2. Give students their own set of pipe cleaners. Have the students move their hand over the pipe cleaners gently moving them from side to side without damaging them.
3. Slightly turn up the volume of the music and have the students move the pipe cleaners a little more. Continue to turn up the volume and have the students move their hands more and more vigorously so the pipe cleaners bend over and perhaps even start falling out of their hands.
4. Ask students whether their model still looks like the photo of the healthy hair cells. Show them the photo of the damaged hair bundle.
5. Ask students to try to “fix” their pipe cleaners so that they stand straight again. Explain to students that the hair cells cannot be fixed and, when permanently damaged, they can die. Tell them this is what causes hearing loss from: listening to loud sounds for too long.

### **Practice and Review**

1. Ask the students to draw a picture of the ear and to reproduce what healthy and damaged bundle of hair cells look like.
2. Have the class list sounds and places that can be very loud. (e.g., music players, garden tools, cafeterias, sporting events, concerts, movie theaters, fireworks).
3. Describe and have the students draw the 3 ways to prevent noise induced hearing loss:
  - Turn it down!
  - Protect your ears! (show hearing protection devices)
  - Walk away!

### **Evaluation:**

Complete the following for each student.

### Performance Descriptors

Performance Descriptor	Possible Score
Student participated in the pipe cleaner activity.	up to 5 points _____
The student described or drew a picture of the ear, correctly labeling the parts of the ear.	up to 5 points _____
The student described or drew a picture of what healthy and damaged hair cells look like.	up to 5 points _____
The student listed sounds and places that can be very loud.	up to 5 points _____
The student described or listed the 3 ways to prevent noise-induced hearing loss.	up to 5 points _____
<b>Total Points</b> (Maximum 25)	_____

### Helpful Resources

- Centers for Disease Control and Prevention: [www.cdc.gov/hearingloss](http://www.cdc.gov/hearingloss)
- NIOSH Hearing Protector Device Compendium: [www.cdc.gov/niosh/topics/noise/hpdcomp](http://www.cdc.gov/niosh/topics/noise/hpdcomp)
- Noisy Planet: [www.noisyplanet.nidcd.nih.gov](http://www.noisyplanet.nidcd.nih.gov)
- Dangerous Decibels: <http://dangerousdecibels.org>

### Text Correlations

Glencoe, *Teen Health*, YOUR BODY SYSTEMS, Chapter 1 Your Body Systems, Lesson 2 Your Nervous System.  
Glencoe, *Teen Health*, HEALTH DURING THE LIFE CYCLE, Chapter 2 Personal Health Care, Lesson 4 Protecting Your Eyes and Ears.

### Relevant Standards

*National Science Education Standards*

Content Standard A, Grades K-4: Science as Inquiry

Standard for Science as Inquiry sets the criterion that students should be able to use simple equipment and tools to gather data and extend the senses.

As a result of activities, all students should develop

- Abilities necessary to do scientific inquiry
- An understanding about scientific inquiry

Content Standard F, Grades 5-8: Science in Social and Personal Perspectives

Personal Health

- Safety and security are basic needs of humans. Safety involves freedom from danger, risk, and injury. Security involves feelings of confidence and lack of anxiety and fear. Student understandings include following safety rules for home and school, preventing abuse and neglect, avoiding injury, knowing when and how to ask for help, and when and how to say no.
- The potential for accidents and the existence of hazards impose the need for injury prevention. Safe living involves the development and use of safety precautions and the recognition of risk in personal decision making. Injury prevention has personal and social dimensions.

### Risks and Benefits

- Risk analysis considers the type of hazard and estimates the number of people who might be exposed and the number likely to suffer consequences. The results are used to determine the options for reducing or eliminating risks.
- Individuals can use a systematic approach to thinking critically about risks and benefits.
- Important personal and social decisions are made based on perceptions of benefits and risks.

### *National Health Education Standards*

#### Standard 1:

Students will comprehend concepts related to health promotion and disease prevention to enhance health.

Relevant performance indicators for grades 3-5:

- Describe the relationship between healthy behaviors and personal health.
- Describe ways in which safe and healthy school and community environments can promote personal health.
- Describe ways to prevent common childhood injuries and health problems.

Relevant performance indicators for grades 6-8:

- Describe ways to reduce or prevent injuries and other adolescent health problems.
- Explain how appropriate health care can promote personal health.
- Describe the benefits of and barriers to practicing healthy behaviors.
- Examine the potential seriousness of injury and illness if engaging in unhealthy behaviors.

#### Standard 5:

Students will demonstrate the ability to use decision-making skills to enhance health.

Relevant performance indicators for grades 3-5:

- Identify health-related situations that might require a thoughtful decision.
- List healthy options to health-related issues or problems.
- Choose a healthy option when making a decision.
- Describe the outcomes of a health-related decision.

Relevant performance indicators for grades 6-8:

- Determine when health-related situations require the application of a thoughtful decision-making process.
- Distinguish between healthy and unhealthy alternatives to health-related issues or problems.
- Choose healthy alternatives over unhealthy alternatives when making a decision.

#### Standard 7:

Students will demonstrate the ability to practice health-enhancing behaviors and avoid or reduce health risks.

Relevant performance indicators for grades 3-5:

- Identify responsible personal health behaviors.
- Demonstrate a variety of behaviors to avoid or reduce health risks.

Relevant performance indicators for grades 6-8:

- Explain the importance of assuming responsibility for personal health behaviors.
- Demonstrate behaviors to avoid or reduce health risks to self and others.

### **References**

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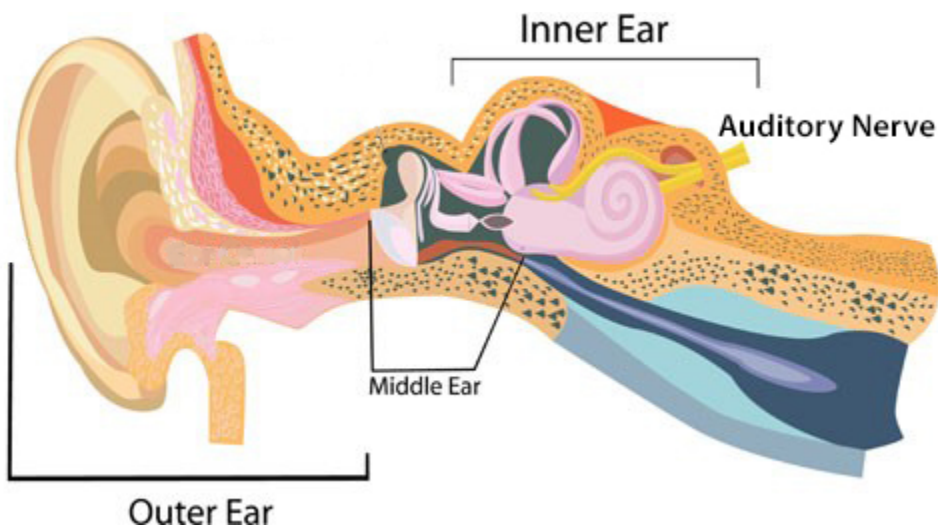
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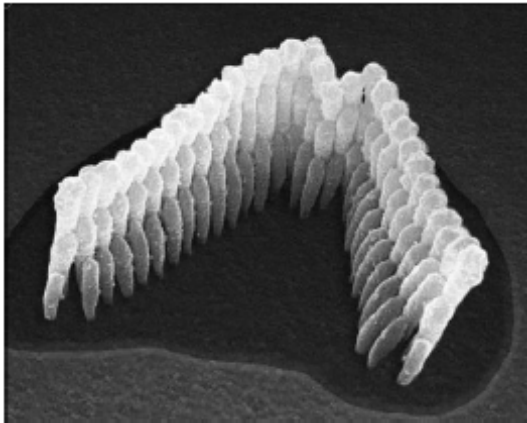
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### Usable Graphics:

#### Ear Anatomy



Healthy Inner Ear Hair Cells



Damaged Inner Ear Hair Cells

