

# Module 2.

## The Hearing System and Noise

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### Why...

In order to be able to effectively protect their hearing, students need to have a general understanding of how their hearing works. By understanding how the different parts of the ear function, students are better able to appreciate how noise may threaten to damage their hearing. Ultimately, this knowledge can also help students understand how different hearing protection methods can succeed in removing or decreasing the threat.

### What...

Module Aim: To educate students about how their hearing works, and in doing so teach them about how noise can cause damage

#### ***Students will understand:***

- How the ear and hearing system function
- How hearing may be damaged by noise

#### ***Lesson Components:***

- How do we hear? Introduction to the ear and hearing system, and its functioning
- How does noise damage hearing? A demonstration of how noise can result in damage.

#### ***Preparation***

- Ear diagram – either in picture or video format (as per below activity)
- Pipe cleaners/raw spaghetti

## How...

### 1. How Do We Hear?

#### **Description:**

Using a poster or video of the ear, the teacher explains how the ear works.

#### **Resource:**

Diagram of the ear

*Link:* <http://hear4tomorrowtest.nal.gov.au/images/conductive-loss-new.jpg>

Link to online video of the ear with audio commentary:

*Link:* <http://www.hearingcharities.org/about-hearing-loss/working-ear.html>

#### **Procedure:**

Using the diagram or video, familiarise students with the different parts of the ear (e.g. outer, middle and inner ear) and describe how sound travels through the air and ear.

- a) Sounds result from vibrations (or sound waves) in the air
- b) Sound waves travel through the air and enter the ear canal via the external part of the ear (the pinna).
- c) The sound waves travel down the ear canal to the ear drum (tympanic membrane) causing it to vibrate.
- d) The vibrations of the ear drum cause the three small bones in the middle ear (malleus - hammer, Incus - anvil, Stapes - stirrup) to vibrate. NB These are the smallest bones in the human body.
- e) The Stapes is connected to a fluid filled organ called the cochlea in the inner ear. (The cochlea has thousands of tiny sensors called “hair cells”.)
- f) The vibration continues to cause these hair cells vibrate and send signals to the brain which is interpreted as different sounds.

**NB:** The video also provides an introduction to how high noise levels can damage the ear.

## 2. What effect does noise have on our ears?

### Description:

Use household items to provide a hands-on representation of the permanent damage caused by excessive noise

### Resources:

Pipe cleaners or uncooked spaghetti

### Procedure

- Revise the importance of the small “hair cells” within the cochlear for transmitting sound information to the brain.
- Explain to students that they are going to walk through events of a day where they expose their ears (and their hair cells) to different levels of sound.
- Teacher demonstrates the activity: Have students hold the base of 4 or 5 pipe cleaners in one hand so that the pipe cleaners point upwards as a representation of some hair cells. The free hand is used to brush against the hair cells (pipe cleaners) gently if the sound is soft and more vigorously as the sound increases.

This can be conducted as a class activity with the teacher providing a “scripted day” with all students following. Or the teacher may prefer to demonstrate with an example of their day, and ask other students to give their own examples – either in pairs, groups or to the whole class.

For example,

- The day starts with quiet breakfast at home. (lightly brush hand over tops of pipe cleaners)
- Students arrive at school and gather in the playground chatting and playing. (slightly stronger movement, taking care not to bend pipe cleaners)
- The bell rings (Stronger movement –pipe cleaners may start to bend)
- It is the school swimming carnival. Sitting in the stand, while cheering for your house or team, and everyone is yelling or shouting support. (Strongest movement with some of the pipe cleaners bent over at the end)

Recap on the events chosen and the effect of the sounds on the hair cells. Demonstrate how, once bent, the hair cells do not easily recover from the damage caused by noise.

**Alternative:** If Pipe cleaners are not available, raw spaghetti can be used as a substitute. In this case the spaghetti will break as stronger “noise” is used. NB The activity may be best conducted outside

**Summary:** Explain that although the hair cells are meant to move when sound hits them (this is how we hear!), too much noise causes them to bend too far or to break. Sound (or music) is not a bad thing – but we need to make sure that we don’t have so much that it hurts us.

## Extension Activities

The emphasis of “How do we hear” is on providing students with the necessary background about the hearing system to enable them to appreciate the threat posed by noise. However, if desired this component can be expanded to create a greater focus on the ear and hearing process. Suggestions include:

- A drama/dance of parts of the ear. Get students to act out the different parts of the ear as a soundwave passes through the system.
- Build models of the ear using everyday items. E.g. a funnel may be used as the pinna and ear canal. A tambourine as the ear drum etc. The focus should be on remembering the part each section plays in processing sound rather than a realistic/visual representation of each part.

The idea of sound waves can also be explored through many activities, to suggest a few:

- Feeling the vibration of music, by holding a balloon near a speaker
- Paper cup & string “telephone”
- Experimenting with tuning forks
- Make your own “tuning fork”. Tie a fork in the centre of a approx 70cm of dental floss/cotton. Wrap each end of the cotton around your forefingers so that the fork still swings freely between them. Press forefingers with string to the small bump where the ear meets the cheek. Swing the fork on the string so it gently hits the table or another object. The vibrations of the fork will travel up the cotton and be felt/heard as a ringing noise.