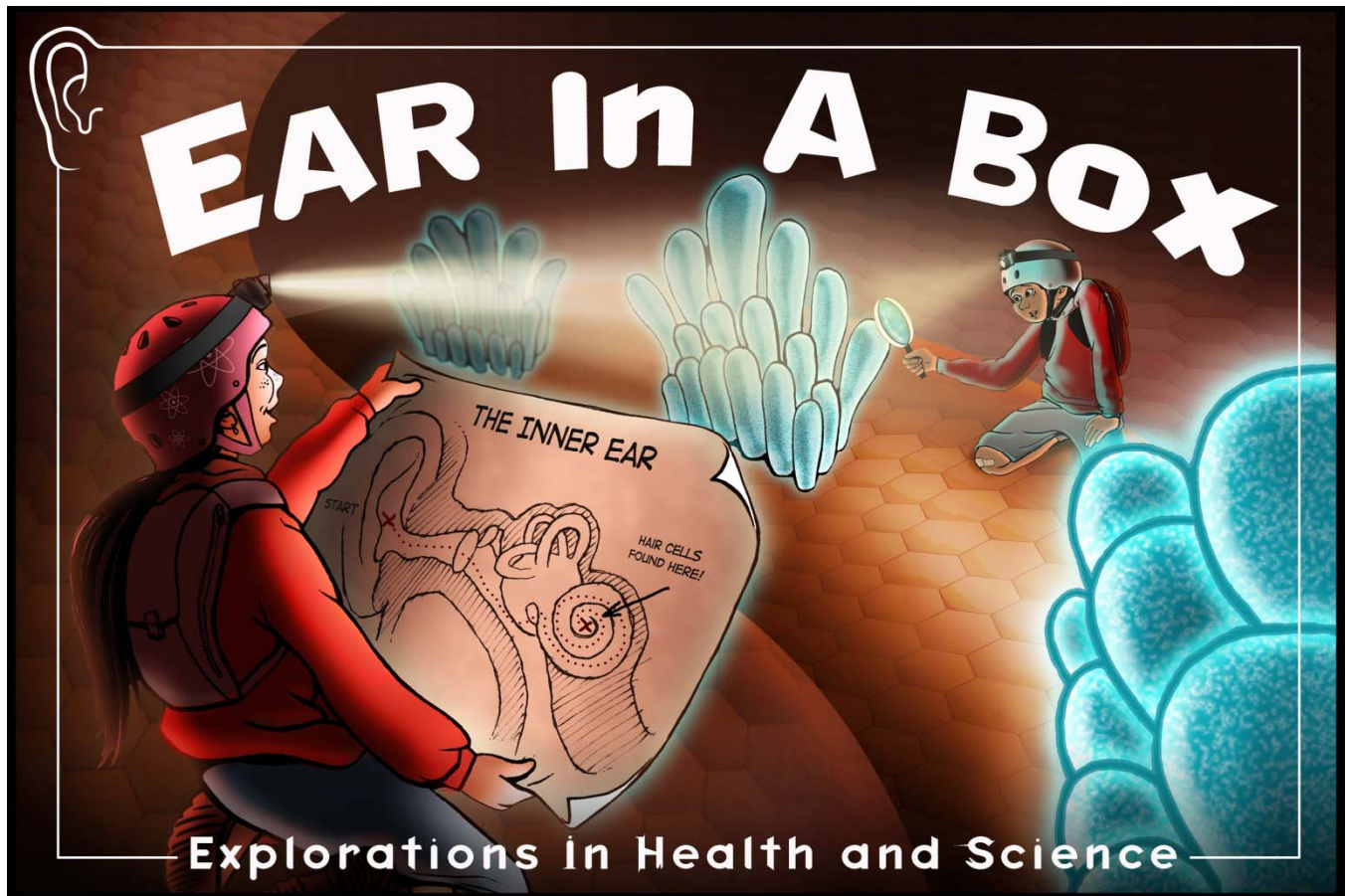


Teacher Handbook



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Welcome to the AHEC “In-A-Box” curricula, created by scientists and educators at Oregon Health & Science University to support Oregon teachers and students with science and health instruction and activities!

We look forward to your feedback as we launch In-A-Box so that it can be improved from year to year. Other boxes available are: Eye In-A-Box, Guts In-A-Box, Brain In-A-Box, and Expedition Northwest In-A-Box.

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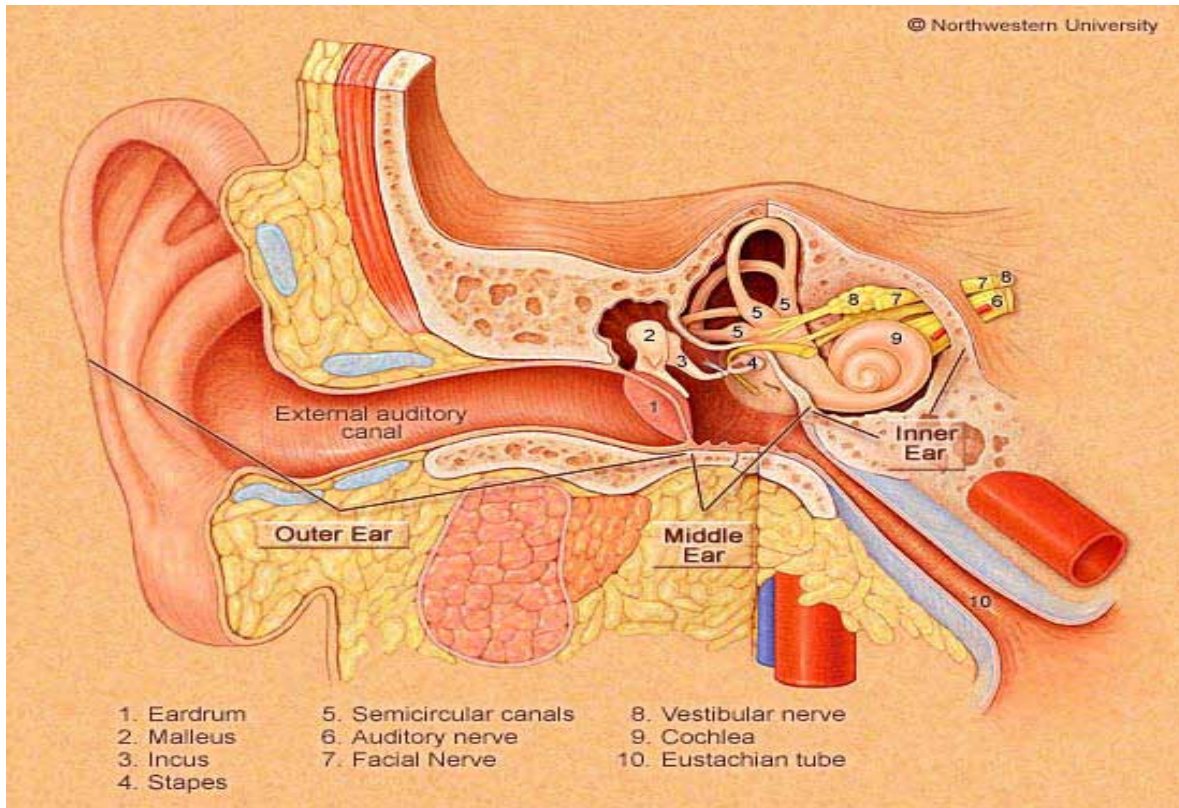
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How to Use the Box...

Background for hearing: Before we investigate the many different problems individuals can have with hearing, here is how natural hearing works-

1. Sound waves enter the ear canal and travel to the eardrum
2. These waves cause the eardrum to vibrate, sending the bones in the middle ear into motion.
3. This motion is converted into electric impulses by tiny hair cells inside the inner ear (cochlea).
4. The impulses are sent to the brain, where they are perceived by the listener as sound.



More in-depth description of hearing and the ear can be found in the NIH binder pages 25-42

Lesson Structure:

Time as listed below = 1 ½ hours. Alternative schedule structures can include: showing the film days prior to the activities and guest speaker or having the guest speaker and film prior to lesson activities.

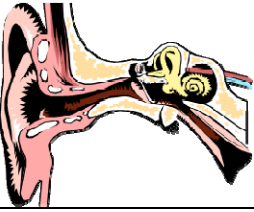

Activity	Time	Materials
OHSU film of interviews- Ear In-A-Box	40 minutes	DVD player
Health Professional Guest speaker	15 minutes	
Student pre activity survey	5 minutes	Surveys in box
Station Activities: 10 – 15 minutes each	50 -75 minutes	Station envelopes & box artifacts
Student and teacher post survey	5 minutes	Surveys in box
Lesson extensions	Up to three	




	weeks	
NIH <i>How the Brain Understands what the Ear Hears</i> - 5 complete lessons with standards, resources, and templates. Each lesson lists time needed.		Binder includes reproducibles
Dangerous Decibels video of classroom activities for different ages and six activities with standards, resources, and templates		DD player, video and various materials
Country Doctors video	60 minutes	DVD player
Research projects about the ear or hearing		Web resources for students

Set Up:

1. A DVD player is needed
2. Pre-survey (in Box) students - 5 minutes
3. Show the *Ear In-A-Box* film- 40 minutes
4. A local health professional (the “ambassador”) arrives with knowledge of the lesson structure and their role as guest speaker.
5. Professional/resident tells their story of pursuing health science: who their team is and how their uses science & technology to help people – 10 minutes
 - a. Students can ask questions about the professional’s career or journey to it - 5-minutes.
 - b. "Science is about asking questions and solving problems."

Station Content and Objectives

Stations 1-2	Activity	Resources	Lesson Objective
Ear Anatomy 	Students view each other’s ears for identification labeling	Ear Model, otoscope, and ear template sheet for recording.	To identify visible and hidden parts of the ear using professional equipment.
Dangerous Decibels 	Measuring sound levels in decibels	Sound meter Hair dryer Pipe cleaners	To learn about safe levels of sound vs. those levels which cause permanent damage to hearing.

<p>You are the Professional</p> 	<p>Assume the role of a health professional and make decisions for the patient</p>	<p>Scenario, Role, and Treatment cards</p>	<p>To learn the many roles involved in health science, to make team decisions, and to problem solve.</p>
<p>Hearing Loss</p> 	<p>Listening for pitch and sound variation</p>	<p>Piano Hearing aids Hearing aid pictures</p>	<p>The difference between pitch and sound and our unique hearing abilities and inabilities.</p>
<p>How Sound Works</p> 	<p>Identifying the steps in the hearing pathway.</p>	<p>Ear anatomy chart Individual cards</p>	<p>To learn how sound passes through the ear, turning from sound waves to electrical energy that the brain recognizes as “sound.”</p>

Station 1 – Ear Anatomy

In pairs, the students observe each other’s ears using the otoscope, recording what they see on the template of ear anatomy. Rotating students can record what they observe while also disassembling the ear model and marking the parts of the ear on their template and station notes page.

Teacher Notes:

The otoscope has a light- advise students to handle it carefully and read the directions included. The ear model has two removable parts; please keep these with the model.

Station 2 – Dangerous Decibels

Students first learn to use the sound meter- instructions are attached to it. **Pipe cleaner “hair cells”** - hold a few straight up like a bunch of flowers; tell students these are like our hair cells. Brush your hand across the tops of the pipe cleaners, allowing them to bend, and explain that as loud noises such as fireworks or explosions pass through our ears, the hair cells bend. Students can see how the pipe cleaners never can fully regain an erect position, the same is true of the hair cells in our ears; hearing is damaged when this happens.

Have them look at the thermometer of safe vs. dangerous sound levels. Using the sound meter, have students start by measuring their own talking voices and then check where the levels are on the thermometer. Then have them turn on the hair dryer and measure the level of sound on both low and high power. If a student has an iPod, that volume can be measured as well.

Teacher Notes:

Get acquainted with the sound meter and the terms used to measure sound (in the Glossary). There are instructions on the sound meter and a demonstration on the Dangerous Decibels Video (Sound Level Meter). Reinforce the idea of permanent hearing loss from dangerous decibel levels with the pipe cleaner analogy.

Station 3- You Are the Professional!

Students read about the hypothetical patient on the card. At the bottom right are roles of professionals who likely would work with this patient. On the back is the team who would likely work together to help this patient. Divide the group by the number of roles and have them read what that professional does with any new patient. On the station notes sheet, have the role groups write their recommendations for this patient once they agree on a plan.

Teacher Notes:

Keep the Treatment plan cards separate until students are done with their recommendations. The treatment plans are what professionals at OHSU said they would do with those patient scenarios. This can be distributed after students distribute their recommendations. For younger students, have the whole group choose one role and then agree on a recommendation plan. One student can be the scribe, one can share with the class, and one can read the professional treatment plan at the end.

Station 4- Hearing Loss

Roll up piano - this specially reconstructed piano (we disabled selected pitches) shows how hearing certain tones can be lost while other tones remain audible. The questions for students are the following 1) how to differentiate loudness from pitch and 2) how people can lose their ability to hear either.

Teacher notes: Be sure that students understand the difference between pitch and loudness. From NIH, "Loudness is related to the amplitude of the sound wave; pitch is related to its frequency (the number of vibrations per second). Humans do not hear all pitches equally well. The loudness of very low and very high pitched sounds must be increased to detect them. A healthy sense of hearing is characterized by an ability to recognize a wide spectrum of pitches. Hearing loss may involve failure to detect specific pitches. Loudness is described using words such as loud and soft, whereas pitch is described by words such as high and low. The low pitch keys on the left of the piano keyboard and the high pitched keys on the right can be played softly or loudly. Students understand "loudness" innately. But pitch is more difficult; demonstrate a high and low note for them.

Station 5 – How Sound Reaches the Brain

Students will read about the “transduction” of energy as sound changes from vibration energy to electrical energy in the cochlea. They will look at the anatomy of the ear as well as descriptions of how each part turns sound into signals; then they will put the individual ear anatomy cards into order of how these messages reach the brain.

Teacher Notes: Hold onto the answer key for the order of the cards until the team is finished with their analysis.

Options for Different Grade Levels

- Research projects can take shape from the biological questions asked or the career roles discussed.
- The group decisions can proceed through a drafting process for speech, debate, or written presentation for a later date.
- Utilize any of the National Institute of Health (NIH) extension lessons about hearing and sound. There are five inquiry-based real life scenario lessons covering topics from language, communication, sound, hearing, and hearing loss. There are assessment tools, associated web sites for extension activities, and many more resources for research.
- Use web links (under Resources) with students to research or explore further activities about hearing and the ear.

Oregon Content Standards

Oregon-specific content standards are included for all NIH *How Your Brain Understands What Your Ears Hear* lesson material.

Health Education -

HE.05/08 HS-03 Analyze influences on health and well-being.

HE.05/08.HS.06 Use a decision-making model that will enhance health and well- being.

Science-

4.2L.1 Describe the interactions of organisms and the environment where they live.

5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.

6.2L.1 Describe the relationships and interactions between and among cells, tissues, organs, and organ systems.

6.3S.2 Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.

8.2P.2 Explain how energy is transferred, transformed, and conserved.

8.4D.1 Define a problem that addresses a need, and using relevant science principles investigate possible solutions given specified criteria, constraints, priorities, and trade-offs.

Social Science-

SS.08.SA.05 Consider two or more outcomes, responses, or solutions; identify their strengths and weaknesses; then conclude and justify which is the best.

Career Related Learning Standards -

CS.PS.02 Identify alternatives to solve problems.

CS.PS.04 Select and explain a proposed solution and course of action.

CS.TW.02 Demonstrate skills that improve team effectiveness (shared decision- making).

Oregon Skill Sets -

Health Research and Biotechnology - knowledge and skills

HSR05.01 Demonstrate understanding of how health care systems, organizations, and professions interconnect to affect quality health care.

HSR07.01 Demonstrate an understanding of the roles and responsibilities of individual members working in a health care team, including how interrelationships can affect the quality of health care delivered.

Restocking and Ordering

The Ear Box needs to be returned to the AHEC education coordinator for restocking, but we encourage you to share this resource with your fellow teachers. Pass along your AHEC Education Coordinator's phone or e-mail for ordering. In-a-Box from AHEC also offers Eye In-A-Box, Guts In-A-Box, Expedition Northwest In-A-Box, and Brain-In-A-Box for grades 4-8.

Supplementary resources- You may keep your box for up to three weeks if you would like to explore the video *Country Doctors*, utilize the NIH lessons, follow the web links (under Resource section) for student activities, etc.

Box Contents

Please use your Contents Check Sheet as you repack the Box for return. Some items are replenishable, and AHEC will do this. Please be sure all other materials are checked off and in the box.

- Five station envelopes with instructions and resources:

Station 1: Ear model & otoscope.

Station 2: Dangerous Decibels wheel, thermometer, sound meter, hair dryer, and pipe cleaners

Station 3: 3 Patient scenario cards, 3 role cards, 3 professional treatment cards

Station 4: Roll up piano, hearing aids,

Station 5: 8 ear anatomy cards

- Student pre and post surveys - these help us to evaluate the effects of In-A-Box curriculum and are to be placed in the box at completion.
- Teacher feedback form- Please fill this out at the conclusion of your use. Include it with the In-A-Box.
- NIH Curriculum – *How Your Brain Understands What Your Ear Hears*- Complete set of five lessons with resources, student worksheets, and Oregon-specific content standards.

Artifacts:

Country Doctors video- This one-hour long PBS video was made in rural Oregon about the need for local health care providers.

Blueprint for Health poster of the ear

Ear model- with laminated reference card.

Ear In-A-Box poster- This is a gift for your classroom.

Books: *Ears and Eyes*, *Hearing*, and *Hearing (Sense and Sensors)* - ages 9-12

Hearing aids-

Roll up Piano

Otoscope with attachments

Hair dryer

Sound meter

Resources

<http://www.pbs.org/wnet/soundandfury/lesson1.html>

Sound and Fury site on PBS for lesson material on senses, the deaf culture, cochlear implants, and more.

<http://faculty.washington.edu/chudler/bigear.html>

Neuroscience for Kids site about the ear and sound – anatomy, physiology etc. Lessons, quiz, experiments, and virtual tour of the ear.

<http://www.dangerousdecibels.org/>

Dangerous Decibels site. The teacher guidebook with lessons is downloadable from the education and outreach link.

<http://faculty.washington.edu/chudler/chhearing.html>

Hearing experiments and lessons for K-12 students.

<http://faculty.washington.edu/chudler/hearing.html>

Our sense of hearing. Experiment: locating sound sources. Lesson plans (3 x 45 minutes).

<http://www.teachersdomain.org/resources/tdc02/sci/life/reg/animalhear/index.html>

A Nova short video on how animals hear and how their hearing helps them to survive.

<http://www.nidcd.nih.gov/health/education/>

The National Institute of Deafness and Communication Disorders (from NIH)

Teacher and student activities which include: videos, the NIH curriculum *How Your Brain Understands What the Ear Hears*, “How Loud is too Loud?” interactive, and much more.

Family Involvement Ideas

- Invite families to view *Country Doctors* video to learn about rural health care needs.
- Ask students to invite any relatives to class who have hearing loss, so that they can tell their story to the class.
- Ask students to invite any relatives to class who work with loud noise routinely to share how they protect their ears.

Glossary

Amplification - the act or result of amplifying, enlarging, or extending.

Audiologist - a specialist in audiology - the study of hearing disorders, including evaluation of hearing function and rehabilitation of patients with hearing impairments.

Auditory Nerve - The nerve that carries electrical signals generated by sound from the inner ear to the brain.

Cochlea - a spiral-shaped cavity forming a division of the internal ear in humans and in most other mammals.

Cochlear Implant - an electronic apparatus that allows people with severe hearing loss to recognize some sounds (especially speech sounds), and that consists chiefly of a microphone and receiver, a processor that converts speech into electronic signals, and an array of electrodes that transmit the signals to the auditory nerve in the inner ear.

Congenital - a condition present at birth, whether inherited or caused by the environment.

Decibel - The unit of measure commonly used to describe the loudness of sounds in our environment. Based on a logarithmic scale in which an increase of 20 decibels (20 dB) indicates an increase in sound loudness by a factor of 10, 40 dB indicates increasing by a factor of 100 and 60 dB indicates increasing by a factor of 1000.

dB - A measure of sound intensity (abbreviation for decibel).

Frequency - The number of times a sound wave vibrates per unit of time. Frequency is expressed in hertz (Hz), a unit of measurement equal to one cycle per second.

Hair Cells - Microscopic cells within the inner ear that have tiny, finger-like projections on top. These "hairs" are moved back and forth by the pressure wave in the inner ear fluid. Motion of the hairs leads to the activation of nerves, and it is the electrochemical impulses in these auditory nerves that are transmitted to the brain causing hearing sensations.

Hertz - A unit of frequency used to measure wave vibrations; one Hertz (1 Hz) is one complete cycle per second. The unit of measure is named after Heinrich Hertz, German physicist.

Interpreter - a person who provides an oral translation between speakers who speak different languages.

Intervention services- services provided by the school district for children from birth to three years that are at high risk for disabilities or delays.

Mutation - the act or process of changing; the term is usually applied to genetic changes within a cell.

NIH- National Institutes of Health

NIHL- Noise induced hearing loss- irreversible hearing loss caused by exposure to loud impulse sounds or to less intense sounds for an extended period of time. Loud noise levels damage hair cells of the inner ear.

Occupational therapist - Occupational therapists (OTs) help people improve their ability to perform tasks in their daily living and working environments. They work with individuals who have conditions that are mentally, physically, developmentally, or emotionally disabling. O.T.s also help their patients to develop, recover, or maintain daily living and work skills.

Otolaryngologist - an ear, nose & throat doctor.

Pathologist - a doctor who specializes in medical diagnosis; the science or the study of the origin, nature, and course of diseases.

Pediatric - the branch of medicine concerned with the development, care, and diseases of babies and children.

Pitch - the degree of height or depth of a tone or of sound, depending upon the relative rapidity of the vibrations by which it is produced. High-pitched sounds are those with relatively high sound frequencies (e.g. above 1000 cycles per second) while low-pitched sounds are generally those with relatively low sound frequencies (e.g. 200 cycles per second or lower).

Sound Wave - A longitudinal wave of motion, spread through oscillating molecules, initiated by a vibrating surface or by a sudden, rapid force (as in an explosion). In the case of sound waves, the molecules do not actually move to a new location, instead each set of molecules "bumps" the molecules next to it, progressively transferring motion to new sets of molecules further and further away from the sound source until the wave motion dies out.

Speech therapist - a therapist who treats speech defects and disorders.

Tinnitus - a ringing or similar sensation of sound in the ears.

Triage - the process of sorting victims to determine medical priority in order to increase the number of survivors.