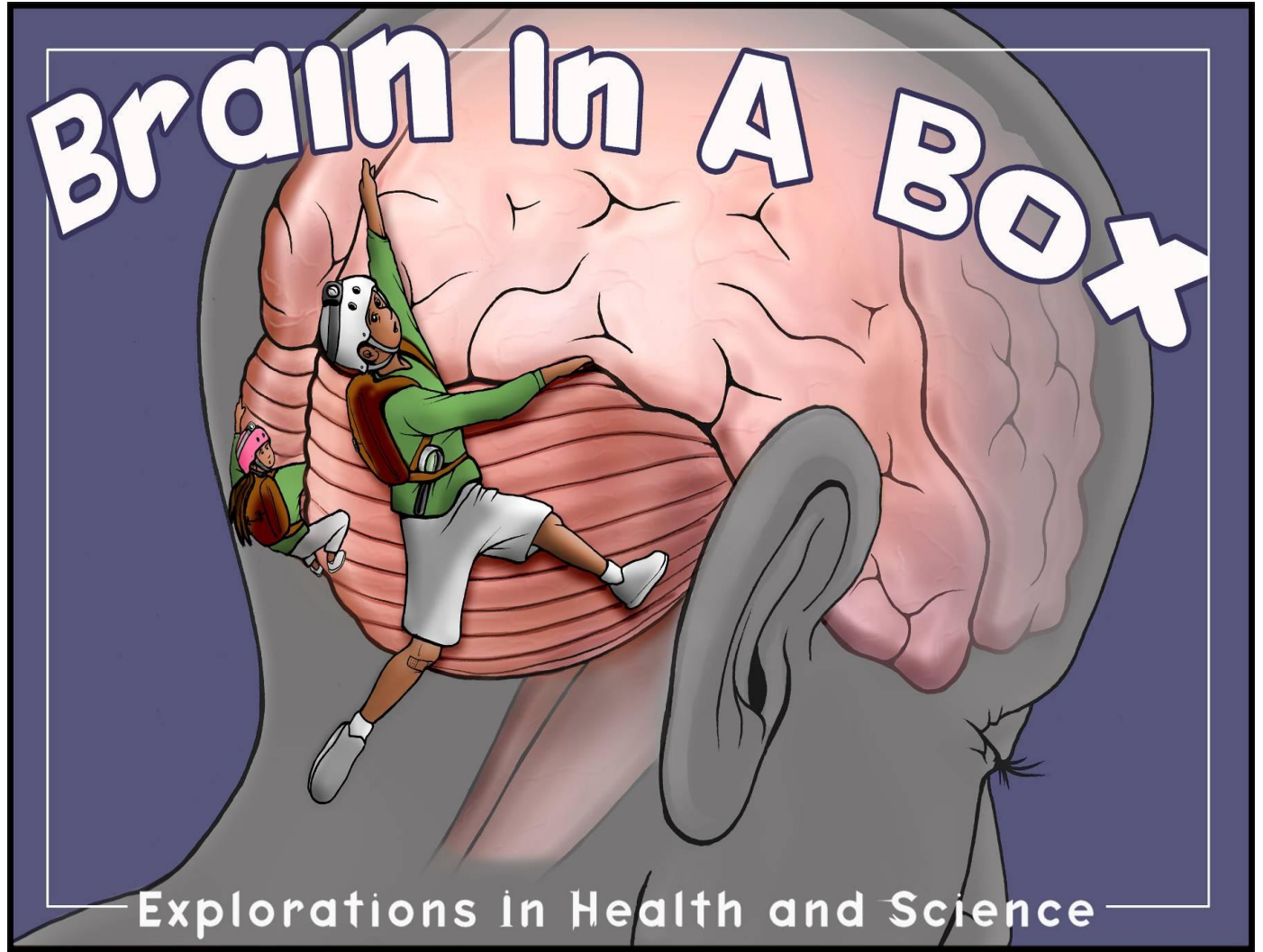


Teacher Handbook



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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!

We look forward to your feedback as we launch In-A-Box so that it can be improved from year to year. Be sure to investigate our other Boxes: Eye In-A-Box, Ear In-A-Box, Expedition Northwest In-A-Box, Bones and Muscles In-A-Box, and Guts In-A-Box.

Funding for In-A-Box curricula was made possible by the Howard Hughes Medical Institute grant and relies on your feedback and student surveys for future support.

Oregon Area Health Education Centers (AHEC) Program office

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Goals of the Program

In this program students learn:

- to identify parts and properties of the brain and understand the function of these parts
- about scientific discovery and the impact of technology on scientific research
- about brain plasticity and the structure and function of neurons through childhood and into adolescence
- how the brain has unique potential for learning new skills
- about our sense of identity and how it is contained within the brain; how self empowerment is important; and how brain damage can alter personality

Background to Brain Development

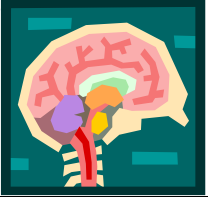




There is considerable background information in the *Brain Facts* Book in the Box. There is also a hand out on the Adolescent Brain and the Growth vs. Fixed Mindset.

Lesson Structure

The lesson consists of a visit from a health professional, a DVD and activity stations. If prearranged, the Box is delivered by a local health care professional (the “ambassador”). A DVD player is needed. The presentation will take approximately 60-90 minutes and can be split into shorter sections if desired.

1. Pre survey the students (survey is in the box). You may want to group the students ahead of time so the students are evenly divided among the 5 stations.
2. Local scientist tells his/her story about pursuing health/science career; who his/her team is; and how he/she uses science and technology at work (10 minutes)
3. Set up the DVD player.
4. Set up the stations around the room.
5. Give each student a *station notes* sheet to record their responses at each station.
6. Students can then ask questions about the professional’s career and/or journey to it.
7. The “Bill Nye Brain” DVD is played with background information about brain anatomy. (25 minutes)
8. Each group is assigned a station. The activities are self explanatory using the materials provided. The artifacts from the box are used at the stations. (10-15 minutes each)
9. A post survey is completed by each student – (5 minutes)
10. The box contents, surveys and a teacher feedback sheet are returned to the AHEC education coordinator by mail or as arranged.

Station Content and Objectives

Stations 1-5	Activity	Resources	Lesson Objective
<p>Brain Exploration</p> 	<p>Observe and touch different brain models and answer questions</p>	<p>Models</p>	<p>Observe and draw comparisons about the size and properties of the brain</p>
<p>Brain Discoveries</p> 	<p>Read stories, act out outcomes and decipher scans</p>	<p>Stories, pictures and scans</p>	<p>Show how technology advances medicine</p>
<p>Brain Connections</p> 	<p>Build a neuron. Connect a neuron. Interpret pictures of real neurons.</p>	<p>Pipe cleaners + rope float neuron set up</p>	<p>Introduce structure and function of a neuron. Introduce pruning and neurotransmitters</p>
<p>Brain Business</p> 	<p>Experiments that highlight the areas of the cerebral cortex and their varied functions</p>	<p>4 game sleeves, stop watch, and charts of Multiple Intelligences</p>	<p>Introduce areas of the cerebral cortex and their varied functions</p>
<p>Brain Growth</p> 	<p>Rat experiment Scenarios about situations and thinking that affect the brain</p>	<p>Rat cage pictures, and brain growth game</p>	<p>Introduce the idea of a growth mindset</p>

Station 1 – Brain Exploration

In pairs, the students observe and manipulate a model (diseased) brain, a cross section brain and an animal brain. The objectives are for the students to learn about the properties of the brain and to identify the four parts and their functions. The following questions appear on the question cards:

Cross Section Brain Model

1. Find the cerebral cortex, the cerebellum, the brain stem and the spinal cord on the brain model and diagram.
2. Look at the *Hand Signal Cards* to figure out what each area does.
3. Do the hand signals help you to remember the brain regions?

Animal Brain

1. Which animal has a brain like this?
2. How is it different from your brain?
3. How is it similar to your brain?

Diseased Brain

1. Do you know anyone who has had a brain injury or disease?
2. How were they affected?
3. How do you protect your brain from injury?

Teacher Notes:

Cross Section Brain Model: *The soft model shows more detail than the four sections students must identify. They identify the four attributes: cerebral cortex, cerebellum, spinal cord, and brainstem by looking at the model and at the description of the four sections.*

Animal Brain – *This is a sheep brain. The use of this is optional and can be avoided if appropriate.*

Diseased Brain– *This brain shows several pathologies on half and a normal brain on the other half. The pathologies are labeled on the enclosed card.*

Station 2 – Brain Discoveries

In pairs, the students read the story of Phineas Gage, H. M. and look at a brain scan. The objective of this activity is to learn about how we used to learn about the brain and with the advent of scanning, how this has changed. The following questions appear on question cards:

Story of H.M.

1. What area of the brain did the surgeon remove? What does that area do?
2. What were the benefits of H.M.'s surgery?
3. Imagine you met H.M and then a few days later you bumped into him again. In pairs, act out what might happen.

Phineas Gage

1. What area of the brain was damaged?
2. What does this area do?
3. How do you think Phineas changed after the accident?

Brain Scans

1. How have brain scans changed how doctors are able to look at a patient's brain?
2. Look at the scans- what are the colors for?

Teacher Notes:

Before scanning was available doctors would have to wait until after death to look at their patient's brain. Scanning has made it possible to look at patients' brains while they are living. Both stories provide information to answer the questions. The Brain scan card provides details about an MRI scan.

Station 3 – Brain Connections

Students each make a model of a neuron using pipe cleaners. There are graphics included which give information about pruning and growth of neurons at different stages of development as well as the role of neurotransmitters.

Grades 5 & 6

1. What are neurons for?
2. How do they do their job?

When more time is available and for further demonstration: the pool float neuron activity

1. How are messages sent along the neuron and between neurons?
2. Students each take a position of holding a “dendrite”, “the synaptic terminal”, or the “cell body”. The golf balls are tossed by one student to the dendrites and across to the synaptic terminal while one student pushes the pool float across the rope simulating a neurotransmission (message).

Teacher Notes:

Each group of students makes a neuron and learns that neurons connect to send messages around the brain. If you would like each student to make a neuron, you will need more pipe cleaners (five per student). The older students learn that signals along the neuron are sent by electrical impulses and between the neurons the messages are transmitted by neurotransmitters. In cases like alcoholism the neurotransmitters are blocked from traveling and build up in the body to provide a ‘pleasure response’. In some diseases, such as Parkinson’s and Schizophrenia, there is a lack of dopamine or a surplus of dopamine (a neurotransmitter). Pruning takes place in adolescence when some connections are lost and others strengthen.

Station 4 – Brain Business

Students have a chance to do self explanatory activities which highlight the variety of brain areas and their functions. Students are introduced to Gardiner’s Theory of Multiple Intelligences. The following questions appear on question cards:

1. At the Attention Station, which was harder, Test 1 or Test 2?
2. Why?
3. At the Memory Station, which was easier, Game 1 or Game 2?
4. Why?
5. Do you think the puzzles at the Language Station were easy to solve? How many students in your group thought they were hard to solve?
6. Why?
7. Ask several students to describe in one word, how they felt when they saw Picture 1 at the Emotion Station. Repeat the question for Picture 2. As students provide responses, ask them why they felt the way they did.
8. What does today’s lesson have to do with the brain?”

9. Point out the variation in the results at each station. What do they think this means?

Teacher Notes:

This activity helps the students to understand that different areas of the cerebral cortex tackle different functions. The students will learn that their brains are unique and have different strengths. Older students need to know that their brains have areas of multiple intelligences and the some areas are stronger, for them, than others. Depending on their experiences they can strengthen areas. Brain plasticity means readily changing and adapting as a result of new learning opportunities.

Station 5 – Brain Growth

This station introduces the students to Morris Water Maze Research. The research shows how neurons in mice showed more growth when the mice were put in stimulating environments. The students are asked to think about their environment and to write down, related to this research, the toys and people that enrich their environment.

Teacher Notes:

Marion Diamond did experiments using rats to test the effect of enriched and impoverished environments. She tested different variables and measured brain growth by staining neuron cells and measuring the length of the dendrites. She found that the environments had an effect on brain growth (see student information). If you have older students or more time, students can graph the number of dendrite connections by holding the circle grid over each dendrite picture and marking the number of crossings on the graph. Copies of the blank graph will need to be made.

Options for different grade levels

The activities are suitable for grades 4th through 8th. Stations 3 and 5 have extension activities suggested to develop a deeper understanding. With all of the activities it is important that the teacher (and the ambassador if applicable) observe and question the students appropriately.

The NIH lessons provide many opportunities for further research.

The pool float neuron activity may be left out with younger students.

Oregon Content Standards

A complete set of Oregon specific content standards for the NIH curriculum is inside the binder front cover. Content standards for the station activities are on the master In-A-Box standards check sheet.

Regarding the scientific inquiry component of the curriculum, please refer to the NIH, *Brain: our Sense of Self* curriculum for a comprehensive guide to the learning opportunities provided for the students.

Assessment Options

Student station notes can be collected for assessment at the conclusion of station activities.

Ordering and Restocking

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

Supplementary Resources

The Brain In-A-Box links very well with health information on injury prevention, learning, disease, injury, addiction and sleep. Learning about the adolescent brain is a particularly good way of educating students about the unique way it matures and how that relates to their everyday decisions. Here are just a few resources to further extend students' understanding of these topics.

Resources

Neuroscience for Kids; student centered site put together by Eric Chudler from the University of Washington www.neuroscienceforkids.org

The Dana Foundation has many resources for learning about the brain. This is the link for student use and lesson plans: <http://dana.org/resources/brainykids/>

Think First: program about injury prevention and brain and spinal cord care. Free curriculum for all grade levels is available as well as educational visits. www.thinkfirst.org

The National Institute of Environmental Health Sciences- brain teasers, riddles, and puzzles for students: <http://kids.niehs.nih.gov/braint.htm>

The Brain Connection has information, images, and games-
<http://brainconnection.positscience.com/library/?main=explorehome/main>

Kids' Health- information for students about the brain and brain health:
<http://kidshealth.org/kid/htbw/brain.html>

National Geographic brain information! Disease, anatomy, stimulation, and photo gallery of the brain. <http://science.nationalgeographic.com/science/health-and-human-body/human-body/brain-article.html>

This site links to many other brain sites for students <http://42explore.com/brain.htm>

Box Contents

Bill Nye Brain DVD– Informational DVD that introduces the students to anatomy, function and

properties of the brain. Pay special attention to the indoor soccer field segment and making connections in the old house. They relate closely to activities 1 and 3 respectively.

Bill Nye Brain Curriculum- Many fun lessons.

Country Doctors video – An hour long DVD created by OPB about the need for health professionals in rural Oregon. This is more suited to a parent night or for older students.

Books: *Aha! Hmm?*, *Brain*, (ages 9-12) and *Brain Facts* (ages 12 +)

Station Envelopes – Marked on the front of each envelope is the contents and the artifact items needed.

Student/Teacher Surveys – pre and post- these help us with our evaluations. Please place in the box upon completion or mail directly to our Portland office.

NIH curriculum – Brain: Our Sense of Self – station 4 activities have been taken from this. There are five lessons with resources for further instruction and research. Oregon content standards are printed and placed in the front cover pocket for these five lessons.

Your Brain and Nerves Poster

Brain In-A-Box poster- This is yours to keep!

It's Mindboggling! Publication by the Dana Alliance – Student centered material with information and games. These are yours to keep.

Artifacts

Cross Section Brain Model – shows the students the areas of the brain. The main areas we concentrate on are the cerebral cortex, the cerebellum, the brainstem and the spinal cord.

Sheep Brain – These brains must be kept in the sealed bag and not opened by students.

Diseased Brain Model – This brain shows a healthy half and a diseased half with pathologies: tumors, a hematoma (from injury), alcoholism, Alzheimer's, an aneurism, migraine, multiple sclerosis, Parkinson's disease and stroke.

Pool Float Model – used to illustrate messages moving along and between neurons.

Jell-O brain mold – makes a realistic brain you can eat – great attention grabber. Follow the Jell-O directions using the evaporated milk.

Family Involvement Ideas

Many families are affected by neurological disease or brain injury – invite relatives to share their stories.

Ask Think First to visit the classroom to talk about using your mind to protect your body, injury prevention, conflict resolution, and alcohol use.

Show the *Country Doctors* video about the need for rural health care workers in Oregon. This video is about 60 minutes.

Talk about the notion of a “Growth Mindset” with parents.

Glossary

Brainstem – The area at the base of the brain that controls many basic life functions such as heartbeat and breathing.

Cerebellum – The area of the brain that controls many aspects of movement, including balance and learned skills.

Cerebrum – The majority of the human brain

Cortex - In humans, the thin outer layer of the cerebrum responsible for most high-level thought and sensory perception.

Dendrite – A thin branch typically shorter than an axon that carries impulses toward the cell body of a neuron.

Hemisphere – Either the left or the right side of the cerebrum.

Myelin – A protective covering of protein and fat that surrounds axons and speeds impulse transmission in some neurons.

Nerve cell – see neuron.

Neuron – A cell that carries the nerve impulse, consisting of a cell body, an axon, and many dendrites.

Neurotransmitter – Any one of 150 or more chemicals released from an axon that crosses the synapse and initiates an impulse in another neuron: more generally, any naturally produced chemical that affects the action of the brain or nervous system.

Pruning – The elimination of synaptic connections that are not used.

Synapse – Collectively, the end of one axon, a synaptic cleft, and the end of a dendrite.