

TOUCH-A-BRAIN

LESSON PLAN

Title: Touch-A-Brain

Setting: In Classroom

Subject: Biology - Neuroscience

Grade Level: 6-8

Time Frame: 1 Hour

Paired Dana Foundation Fact Sheets:

6th-8th Grade How Does the Brain Work?

Next Generation Science Standards:

Meets MS-LS1-1 & MS-LS1-8

STUDENT OBJECTIVES

- Utilize knowledge learned in the “Design An Imaginary Animal” lesson plan to navigate touching a sheep or human brain
- Learn how to safely and respectfully examine the organ of a previously living organism.
- Touch and identify the four different lobes and other structures of the brain.
- Feel the bumps (gyri) and grooves (sulci) on the brain and understand what purpose they serve.

BACKGROUND

This is an extension exercise, entitled “Touch-a-Brain,” and is to be coupled with the “Design an Imaginary Animal” lesson plan. This interactive plan builds on the information learned in “Design an Imaginary Animal” by giving students the opportunity to touch a real brain! Teachers will use vocabulary from “Design an Imaginary Animal” to explore different sections and areas of the brain with their hands. “Design an Imaginary Animal” is to be presented on Day 1, and this plan is to be presented the following day (Day 2). This lesson plan gives two distinct options for touching a brain: a sheep brain and/or a human brain if available in your area.

* Note: Sheep brains are obtained from animals that are processed for human food. The human brains are from donors who gave their organs for educational and research purposes.

MATERIALS

- Printed copies of 6th-8th grade Dana Foundation fact sheet, “How Does the Brain Work?”
Downloadable here: www.dana.org/factsheets/
- Gloves: SafeTouch Nitrile Exam Gloves, ASIN: B0000FKDXA, can be ordered from www.amazon.com.
- Sheep Brains can be ordered from Carolina Biological Supply Company, www.carolina.com. Order one or more of each of the following:
[1] Formalin Sheep Half Brain, Item #228730; and
[2] Formalin Sheep Brain, Dura Mater Removed, Item #228700.
- Disposable plastic plates.
- Obtaining a human brain for your classroom is not easy. Human brains are handled and stored carefully and require supervision when checked out from a medical institution. We recommend contacting a local university neuroscience department or your local Society for Neuroscience chapter:
<https://tinyurl.com/sfnchapters>.
- You can also find and contact a local neuroscientist through SfN’s Find a Neuroscientist search engine:
www.brainfacts.org/For-Educators/Find-a-Neuroscientist.

TOUCH-A-BRAIN

TEACHER BACKGROUND INFO

WHAT TO KNOW BEFORE YOU TEACH

* Note: This content is primarily for the instructor's reference; the accompanying PowerPoint presentation will be for the students.

Recall from the previous lesson plan **Design an Imaginary Animal** the following information: [Information below is true for both sheep and human brains unless otherwise noted.]

The Human Brain

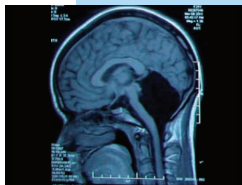
The cerebral cortex is the wrinkly outer layer of the brain that is responsible for higher cognitive thought and for processing sensory information. The wrinkles maximize the surface area of the brain, allowing for more neurons and increased connections between them.

The cortex is divided into distinct areas called “lobes” that sub-serve different functions:

- **The frontal lobe** - planning, reasoning, speech, movement, and problem-solving.
- **The temporal lobe** - important for memory and learning, hearing, and language.
- **The occipital lobe** - visual processing center of the brain.
- **The parietal lobe** - processes sensory information like touch, pressure, temperature, and pain; integrates this with motor information.

Other very important regions of the brain include the cerebellum and brain stem.

- **Cerebellum** - structure at the base of the brain that regulates balance and coordination. This area receives information from the eyes and muscles to detect where the body is relative to space (proprioception).
- **Brain stem** - also known as “the reptilian brain,” it is the most primitive part of our brain. Regulates basic functions such as breathing, heart rate, and blood pressure.



Feng Yu et al.

A woman went 24 years without realizing she did not have a cerebellum. Although she recalls being clumsy, she graduated high school and had a child. Researchers credit neural plasticity, or the brain's ability to change in response to the environment, for her miraculous ability to function as well as she did.

**DID YOU
KNOW?**

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Some other structures you might be able to see on a real brain include:

- **The Olfactory Bulb** - processes smell.
- **The Optic Nerve** - connects to the eyes and meets at the optic chiasm.
- **The Longitudinal Fissure** - separates the brain's two hemispheres or halves.
- **The Corpus Callosum** - bundle of nerve fibers that connects and allows communication between the left and right hemispheres of the brain.
- **The Ventricles** - cavities in the brain where cerebrospinal fluid, that encases and cushions the brain and spinal cord, is produced.
- **The Gray & White Matter** - the gray matter are neuronal cell bodies, dendrites, and unmyelinated axons found in the cerebral cortex. The white matter are bundles of myelinated axons found in the inner portion of the cerebral cortex.

You may notice the symmetry of structures between the two hemispheres. Although structures of both hemispheres appear to be mirror images for the most part, there does exist some asymmetry in function. This specialization of function is known as **brain lateralization**. An example of brain lateralization is the fact that language and speech abilities in the majority of humans (but not all!) is localized in the left hemisphere. In addition, we know the left side of the brain controls the right side of the body and vice versa. It's important to note, however, some of the simplistic left-brain/right-brain assumptions, often portrayed in the media, crumble when further inspected.

For example, many popular online quizzes claim they can parse out whether you are right or left brain dominant based on personality traits. However, researchers at the University of Utah (Nielsen et al. 2013) examined the brain scans of over 1000 people and found that, although some brain functions were lateralized, individuals showed no left or right dominance.

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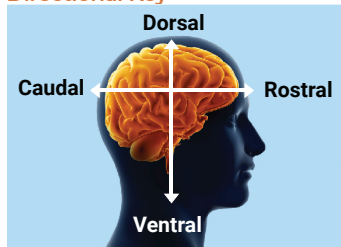
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Let's look at different views of the sheep brain you may encounter while holding it. You will notice some of the same labels in each picture, but from a different viewpoint.

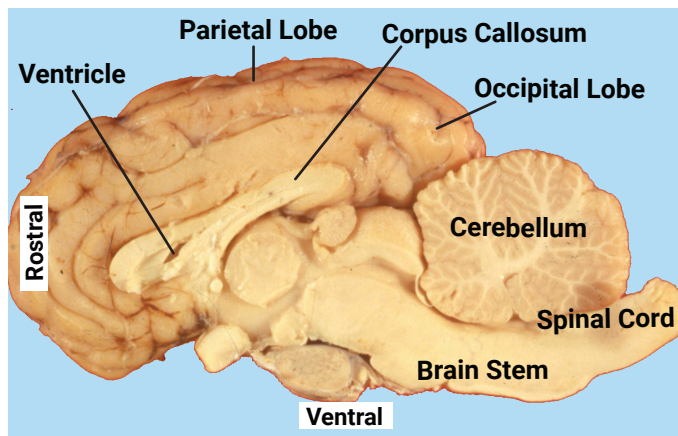
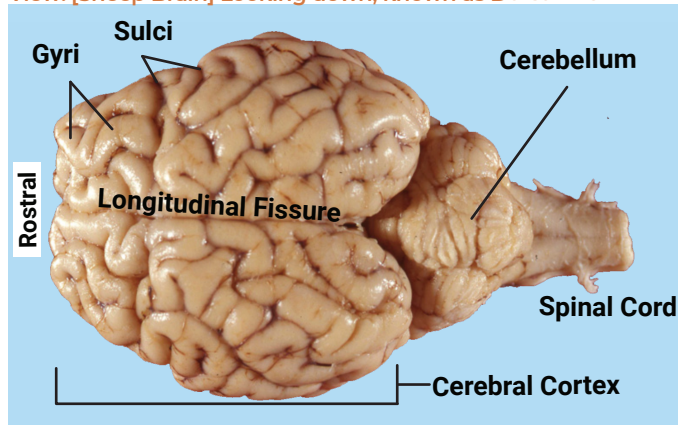
In addition, it's helpful to use the following vocabulary to orient yourself:

Dorsal = top
Ventral = bottom
Rostral = front
Caudal = back

Directional Key

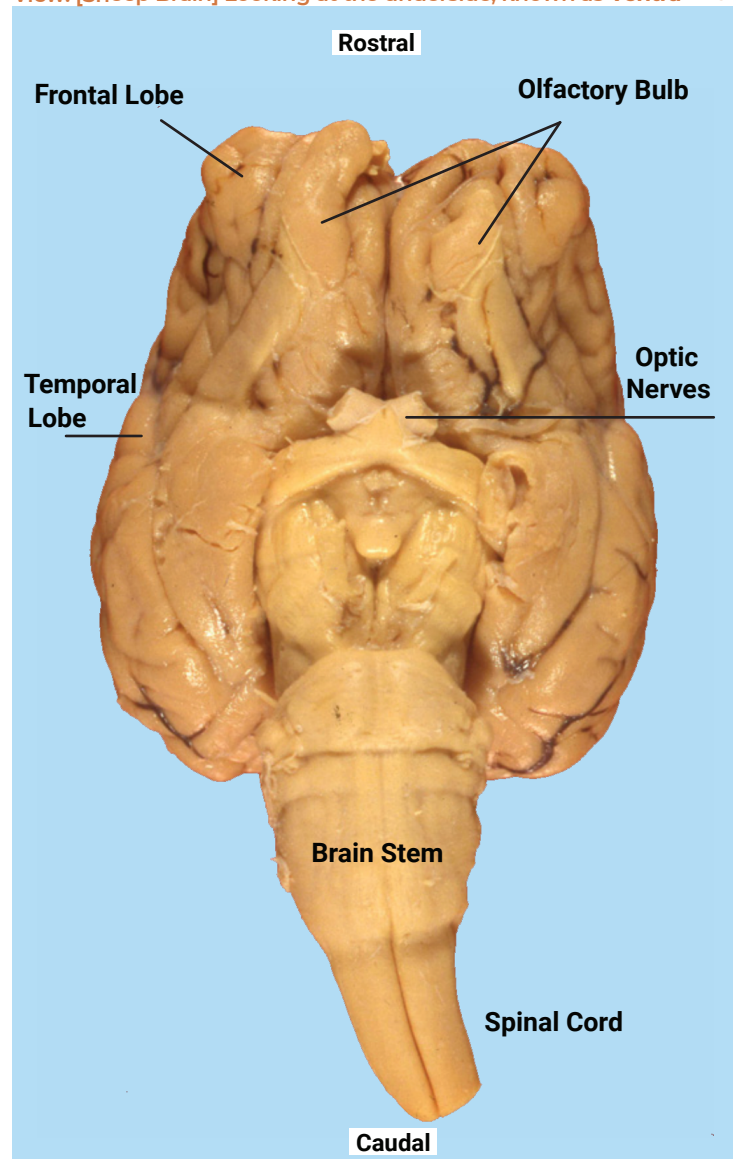


View: [Sheep Brain] Looking down, known as **Dorsal View**



View: [Sheep Brain] Looking at inside of brain via a sagittal cut, known as **Sagittal View**

View: [Sheep Brain] Looking at the underside, known as **Ventral View**



Sheep brain pictures from University of Pennsylvania School of Veterinary Medicine

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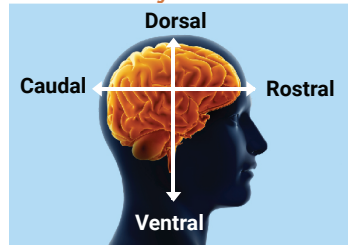
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Let's look at different views of the human brain you may encounter while holding it. You will notice some of the same labels in each picture, but from a different viewpoint.

In addition, it's helpful to use the following vocabulary to orient yourself:

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Directional Key



View: Looking at inside of human brain via a sagittal cut [Sagittal View]

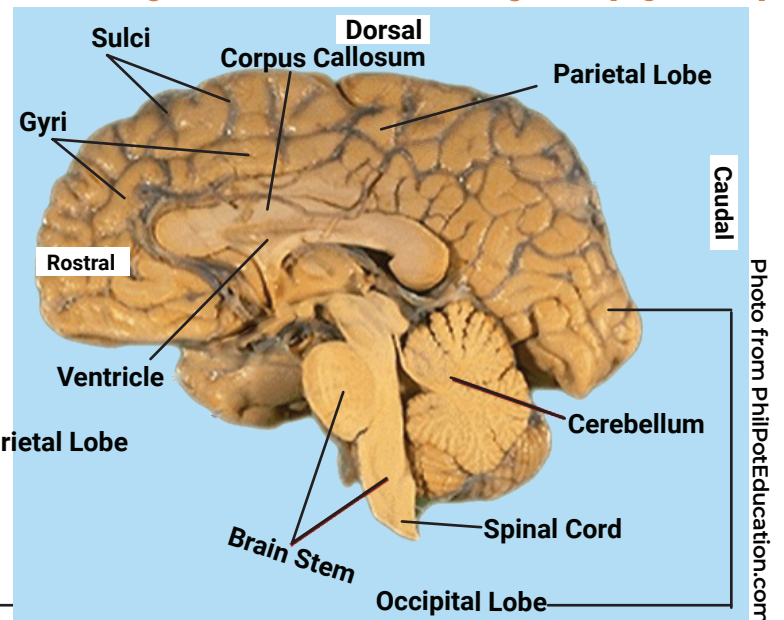


Photo from PhilPotEducation.com

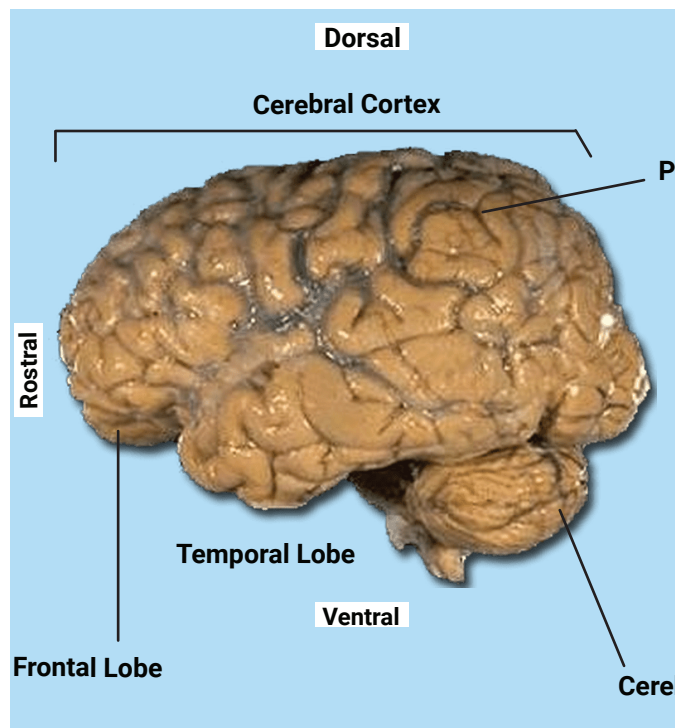
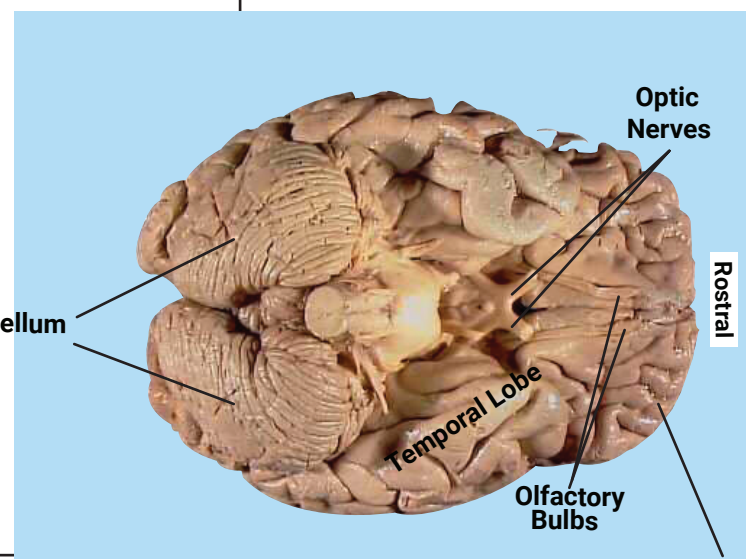


Photo from the National Institutes of Health



View: Looking at the underside of human brain [Ventral View]

TOUCH-A-BRAIN

PROCEDURE

- [1] Briefly introduce the exercise and give the accompanying PowerPoint presentation about brain structure and function (15 minutes).



- [2] As the students touch brains, be sure to tell them to be gentle. Remind them that these were once living creatures, and they should be treated with respect. Make sure students always wear gloves when touching any type of brain.
- a. Follow Steps 4-6 if you have sheep brains.
 - b. Follow Steps 7-10 if you have a human brain.



- [3] Students must wash hands with soap after class is concluded (5 minutes).



SHEEP

- [4] Have class split up into as many groups as you have facilitators or “teacher helpers” (2 minutes).



- [5] Distribute one brain per group on a plastic plate (2 minutes).



- [6] As the students view and touch the brain, be sure to point out the following structures: Cerebellum, the four Lobes, Olfactory Bulb, Brain Stem, Gray & White Matter, Ventricle, Optic Nerve, Longitudinal Fissure, Gyri, and Sulci. Remind the students what each of those structures does in the brain (20 minutes).



TOUCH-A-BRAIN

PROCEDURE

HUMAN

[7] Set up the human brain on washable or plastic plate or dish (2 minutes).



[8] Students either gather around a common table or 'supervisor of brain' holds up the brain at the front of the class.



[9] Each local 'supervisor' will have different rules about who can handle the brain, whether it's solely the supervisor or the teacher as well.



[10] As the students view the brain, be sure to point out the following structures: Cerebellum, the four Lobes, Olfactory Bulb, Brain Stem, Gray & White Matter, Ventricle, Optic Nerve, Longitudinal Fissure, Gyri, and Sulci. Remind the students what each of those structures does in the brain (20 minutes).

ADDITIONAL RESOURCES

- A video of a sheep brain dissection:

<https://www.youtube.com/watch?v=jvKsuQSB0aQ>

*The "Touch-a-Brain" activity was originally developed by Jordan Rose, MPH, Emory University; Melissa Demetrikopoulos, Ph.D., Institute for Biomedical Philosophy; and Michael Black, Ph.D., & Laura Carruth, Ph.D., Georgia State University. It has been adapted by Elizabeth Weaver, M.S. and Linda Qi Beach, Ph.D. for the Dana Foundation.