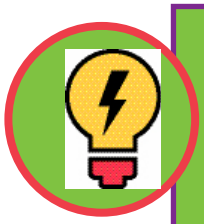
DO IT!

Sheep Brain Dissection!

Students will become familiar with the physical characteristics of the human brain by investigating a sheep brain. Sheep brains and human brains have many similarities; studying sheep brains can be a very useful way to learn about the structure of the human brain.



You'll Need

Dissection Materials

- Sheep brain
- Plastic knife and/or scissors
- Disposable plates or dissection tray
- Disposable gloves
- Brain Diagram

Label Materials

- Tooth Picks or T-pins
- Colored Pencils or Markers
- Paper and Tape/Blank address labels
- Brain Vocabulary List

Smart Start

Why do scientists use animals to learn about the brain?

Dissections are an engaging way for students to learn about anatomy

The human brain is the most complex organ in the body and difficult to study. That is why animal models such as worms, fruit flies, fish, mice, and sheep are used to help us understand how the brain works. Even though animals are not capable of many of the complex functions found in humans like speaking, moral reasoning, or complex learning skills, many of the basic structures and functions of the brain are common to all animals.

Our brains are made out of the same stuff as any other animal brain. The shape and size of human and animal brains vary, but they all work pretty much the same way. All brains are made out of neurons, cells that communicate with each other through electrical and chemical signals. All neurons work in the same way. This is why scientists can use other animals and still learn something about how the human brain works. have been slaughtered for the human food market, i.e. to produce lamb. We convert waste by- products to materials for educational use."

1. **Make dissection label flags:** Work in groups of 3 or 4 to make labels that they will use to identifying areas of the sheep brain by attaching pieces of paper to toothpicks/T-pins. Write the name of each of the parts of the brain (found on the vocabulary handout) on small pieces of paper, and then attach them to toothpicks with clear tape. Encourage the students to use their creativity to help them remember the function of the brain part (example: draw a small picture next to the name, or on the back side of the label). Groups should have their labels completed before they begin observation and dissection of the sheep brain.

2. **Observe:** Distribute gloves, plates, and brains (no knives or scissors yet). Have students make observations within their groups about the brains (before they start dissecting). Once they have had time to share observations with their small group, then invite students to share their observations with the whole group:

   - What do they notice? sections, grooves and wrinkles, size, weight, texture, etc.
   - How are sheep brains similar to human brains? Same overall structure and functions (as with most mammalian brains).
   - How are they different? Overall, sheep brains are smaller than human (about 1/10 the weight, sheep brain stem points back instead of down (because sheep walk on 4 legs, people walk upright). The proportional sizes of the sections of the brain are not the same in sheep and humans- for example, the frontal lobe of the human brain is larger than in a sheep (this is the area responsible for thinking, language, problem solving, memory, etc). Sheep have a very good sense of smell, and their olfactory bulb is much larger than a human's.

3. **Identify.** Before students start cutting into the brain, have them label parts that they can identify, using the identification pins they created and the sheep brain diagram. Make sure students flip the brain over and look at the bottom too.

4. **Dissect.** Time to cut! Students follow the steps on their dissection guide. If time allows, let students decide if their group would like to investigate further with their brain (i.e. make another dissection cut)

5. **Discuss.** What was most interesting/surprising? How are sheep brains and human brains similar/different?

6. **Clean Up.** Dispose of all dissection materials (sheep brains, plates, gloves, etc) in a double plastic trash bag. Have students wash the tables they were working on, and have them wash their hands. In most cases, you can dispose of the dissection materials as you would any other trash. However, you should check with your local solid waste authority y if applicable) to ensure that this is an

Student Dissection Guide !

Make Identification Flags: Before starting on the dissection, use the Vocabulary List to create dissection label flags.

Make Observations: Before making any cuts or trying to identify any parts, what do you notice about the sheep brain? Cerebrum, Cerebellum, Frontal Lobe, Temporal Lobe, Parietal Lobe, Occipital Lobe, Sulcus, Gyrus, Optic Chiasm, Olfactory Bulb, Pituitary Gland (may or may not be present)

1. **First Cut: Bisecting the Brain!** Make one long cut along the center of the brain, separating the two hemispheres of the Cerebrum, and bisecting the cerebellum. Your sheep brain specimen should be in two equal pieces now. (you may need to move some of the labels you have already placed in order to make this cut.)

Label parts on the interior of the brain!

- Corpus Callosum, Brainstem, Spinal Cord

2. **Second Cut**: **Investigating the Cerebrum!** Make one cut across one of the hemispheres of the Cerebrum, cutting perpendicular to your previous cut.

Label parts on the interior of the Cerebrum

- Hippocampus, White Matter, Gray Matter

3. **Third Cut: Investigating the Cerebellum!** Make one cut across one of the pieces of Cerebellum, cutting perpendicular to your previous cut.

Label parts on the interior of the Cerebellum

- White Matter, Gray Matter

Brain Vocabulary List

Youth should use the following list to make labels they will use while conducting their dissection. Labels should have the name of the part, and then a single word or sketch that helps you remember what that part of the brain is responsible for in humans.

Note: *starred brain parts are not found in the pictures below. See if you can still find them!

***Brainstem:** It is connected to the spinal cord and controls automatic activities such as breathing, coughing, sneezing, heartbeat, digestion, and swallowing. It also regulates when you feel sleepy or awake. The Medulla, Pons, and Midbrain.

Cerebellum: The cerebellum helps muscles work together to coordinate and learn movements, and to maintain balance and posture. It is responsible for reflexive movements such as blinking the eyes. It also has a role in the formation of memories for knowing how to do things like riding a bike, walking, talking, playing piano, swimming, playing baseball, etc.

***Cerebrum:** It is the largest part of the brain. It is responsible for thinking, learning, language, remembering, planning, feeling sensations, emotions, and voluntary (on command) muscle movement. The cerebrum is divided into two halves: the right and left hemisphere. The right hemisphere controls the left side of the body and performs tasks that have to do with creativity and the arts, and understanding relationships in space such as reading a map. The left hemisphere controls the right side of the body and performs tasks that have to do with logic, such as science and math, problem solving, comparing information needed to make decisions. It is also the brain's language center.

Corpus Callosum: a large bundle of nerve fibers that connects the two hemispheres of the Cerebrum. It is responsible for transmitting messages between the right and left hemispheres.

Frontal lobe: area of the Cerebrum that is important for functions that help us learn such as thinking, memory, attention, language, speech, problem-solving. The frontal lobe also controls voluntary muscle movement, impulse control, judgement and social behavior. You use your frontal lobe to make decisions, such as what to eat or drink for breakfast, and studying for a test. The frontal lobe is where your personality is formed and also allows you to speak fluently (without fault). Location: frontal and upper part of the brain.

Gray Matter: The part of the brain that looks darker in pictures. The cells in this part of the brain help us do things like think and process information. It contains most of the brain's neuronal cell bodies and other brain cells called glial cells. These glial cells provide nutrients and energy to neurons. Gray matter is mostly found on the brain surface, or cortex.

Gyrus (pl. gyri)and Sulcus (pl. sulci): The surface of the cerebrum is very wrinkled; it has folds (gyri) and grooves (sulci) that look like hills and valleys; these allow more cerebral surface tissue to fit inside our skull. A folded brain surface has a greater surface area – which means a greater power for processing information!

***Hippocampus:** a small, curved formation in the Cerebrum which is responsible for the formation of new memories, learning, and emotions

Occipital Lobe: area of the Cerebrum primarily responsible for vision. It processes the information that your eyes are sending.

Olfactory Bulb: is a structure found underneath the front of your brain just above the nasal cavity. Molecules carried through the air and into the nose bind to neurons in the moist lining of the nasal passages. These neurons send messages to the olfactory bulb to allow us to smell thousands of odors (floral, furity, spicy, burnt, putrid)

Optic Chiasm: is an X-shaped space where the optic nerves (bundle of nerve fibers that transfer visual information to the brain) from your right and left eye cross.

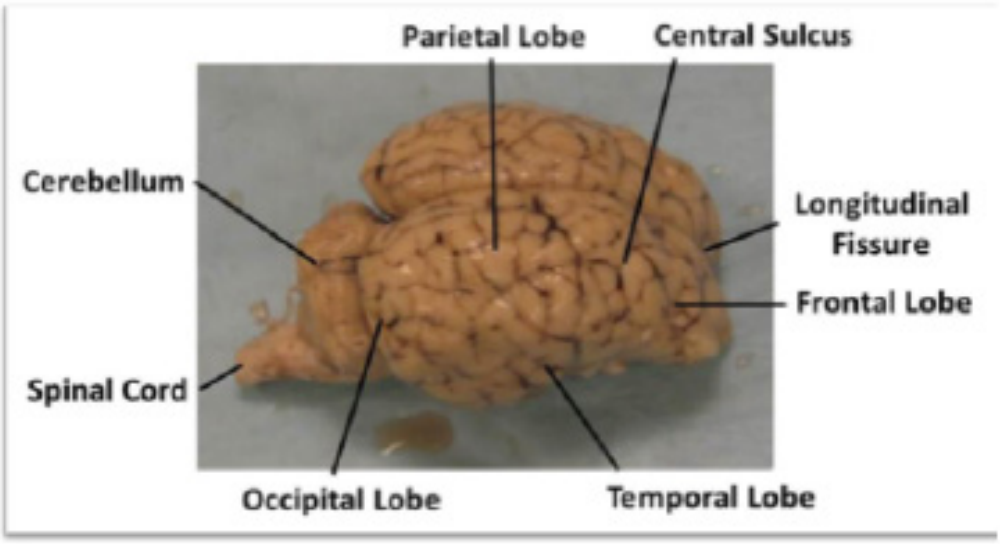
Parietal Lobe: area of the Cerebrum that processes sensory information – the information that your brain collects from your senses. It processes information about temperature, taste, touch, pain, etc.

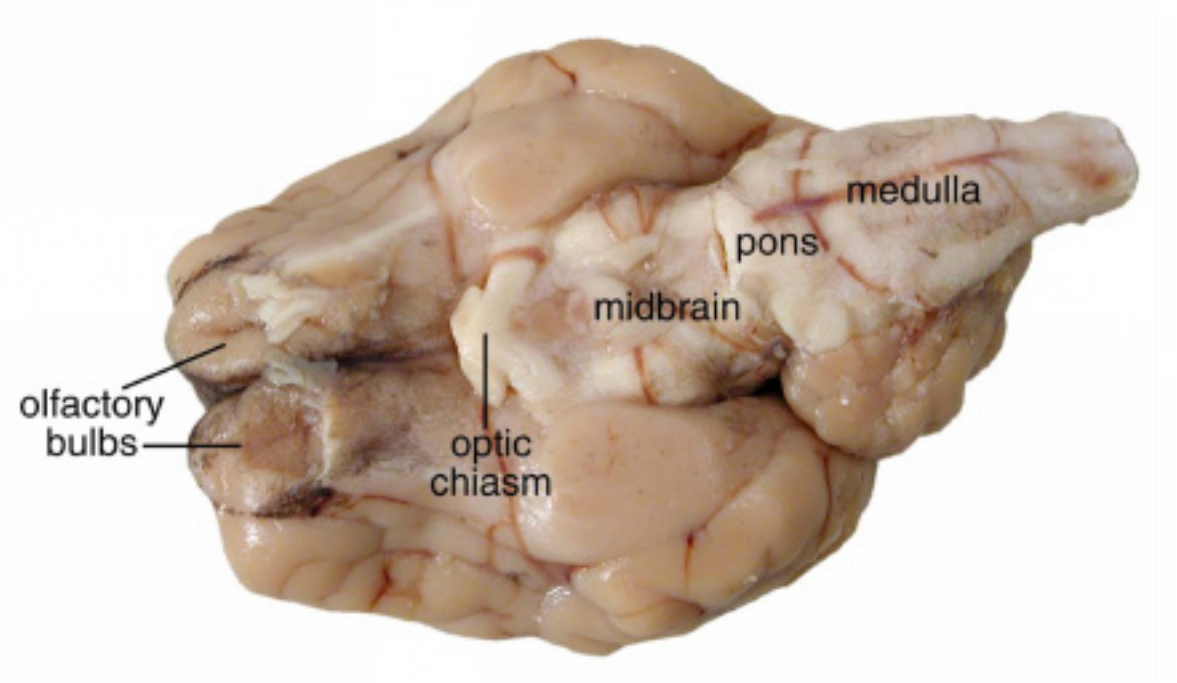
***Pituitary Gland:** is an organ the size of a small pea, located at the base of the brain. It is formed by cells that produce hormones that allow the body to react to stress.

Spinal Cord: Is a large bundle of nerves inside your spinal column. The spinal cord is very important because it is the main pathway for messages (sent by neurons) to travel between the brain and all the other parts of the body. Thanks to the spinal cord we can feel sensations like pain, and control the movements of our arms and legs.

Temporal Lobe: area of the Cerebrum important in controlling how you process sounds and use of language. This region also helps process long-term memories and also contributes to your personality, and understanding and appreciation of music and art.

***White Matter:** The part of the brain that looks lighter in pictures. White matter are the highways of the brain. They connect different parts of the brain and pass information from one part of the brain to others. It is made of nerve fibers (axons) that connect nerve cells (neurons) from one region of the brain to another. The nerve fibers are covered with myelin, a protein that contains fat. Myelin gives white matter its white color and protects the nerve fibers from injury. It also helps to improve speed and transmission of electrical nerve signals. White matter is buried deep in the brain.


Parietal Lobe
Central Sulcus
Cerebellum
Longitudinal Fissure
Frontal Lobe
Spinal Cord
Occipital Lobe
Temporal Lobe


medulla
pons
midbrain
olfactory bulbs
optic chiasm