

A Piece of Your Mind: Brain Anatomy Teacher Pages Activity 1A

Activity Objectives:

Using diagrams of the brain, students will be able to:

- Observe the basic anatomy of the brain and its components
- Identify the parts of the brain
- Identify major lobes of the cerebral cortex
- Observe a portion of the spine, spinal cord, and spinal nerves
- Relate structure to function in the brain

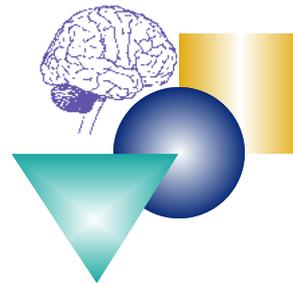
Activity Description:

In this introductory activity, students will read a description of the parts of the human brain and begin to associate structure with function. It is important to orient students to the layout of the brain, which will further assist them in becoming familiar with structures and functions of the brain. Students will color-code a brain diagram and complete a note-taking activity intended to introduce each part of the brain and define its area and basic function. After students have read the description of the parts of the human brain, you may opt to show them a **PowerPoint™** slideshow (included online with this lesson). The fact that each part of the brain is complex and carries out many functions is a concept meant to begin with this lesson but ultimately understood through the combination of lessons presented in this unit.

Students will pre-read the student text *A Piece of Your Mind: Brain Anatomy*. Therefore it is suggested that the teacher make a class set of this text. Teachers can use the **PowerPoint™** (provided online with this activity) to allow students to complete *A Piece of Your Mind: Brain Anatomy*. Each student will need a copy of the student processing out pages. A good way for the teacher to demonstrate cross-sections of the cerebrum would be to take an oblong fruit, such as an apple, and cut it lengthwise. This would show the students that the brain is divided into two hemispheres; each side is similar.

Activity Background:

The brain is the center for all thought processes and nearly all regulatory function in the human body. The brain directly or indirectly controls every aspect of the living body such as voluntary and involuntary motor control, enzyme and hormone production, and immune system responses. Much of what we know today about the function of the brain comes from the imaging technologies that use scanning instruments to look at brain structure and function.



Activity Overview



THE BRAIN: A Brief Overview

The brain may be divided into many parts, see *Figure 1 Brain Anatomy*; therefore a multitude of anatomy textbooks subdivide the brain into varying levels of complexity depending on the target audience of the book. For the purpose of this unit, four (4) parts will be defined. They are the *Cerebrum*, *Diencephalon*, *Cerebellum*, and *Brain Stem*. It is important for students to remember that each part of the brain is responsible for controlling a specific combination of activities within the body. For example, the *cerebrum* controls processes that require conscious thought, sensation, and voluntary movement. At the same time it is important for students to keep in mind that while the cerebrum is performing functions, it is also communicating and working with other areas of the brain such as the cerebellum. While this communication occurs, the *cerebellum* regulates balance and coordination. Many areas of the brain work together and/or independently to maintain body functions. This occurs through a complex network of interconnecting neural pathways, and is the focus of current research in brain mapping.

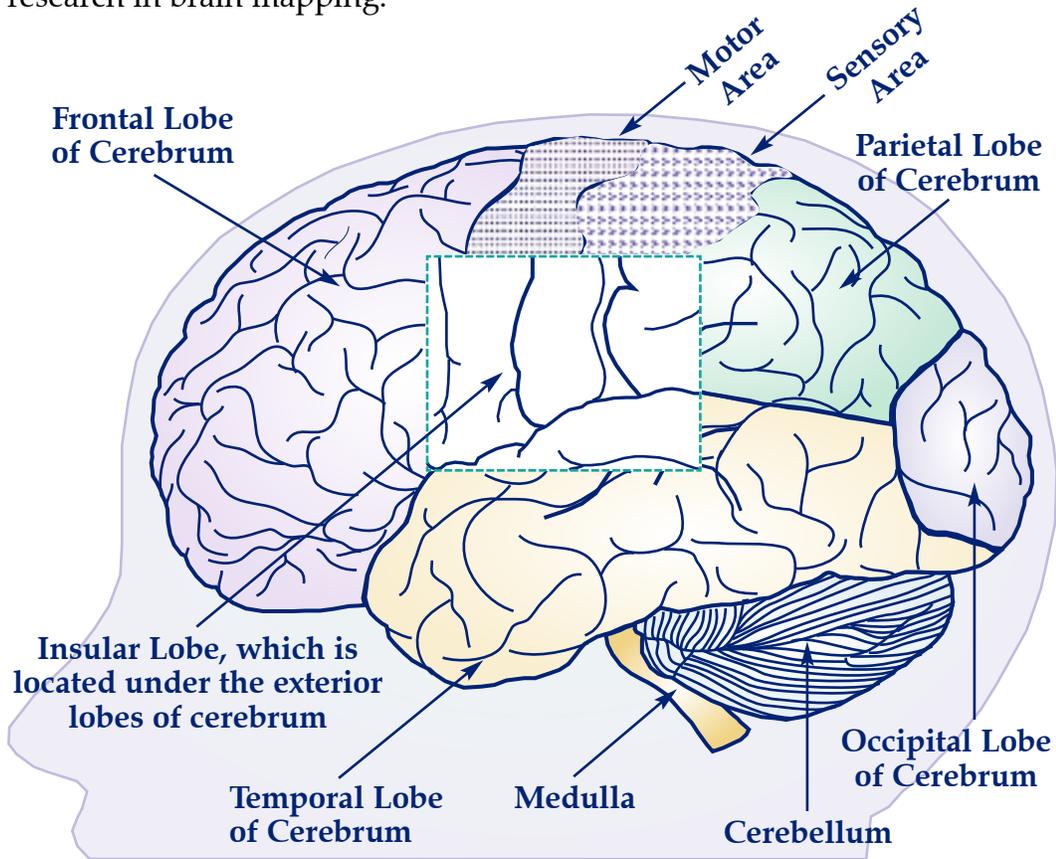
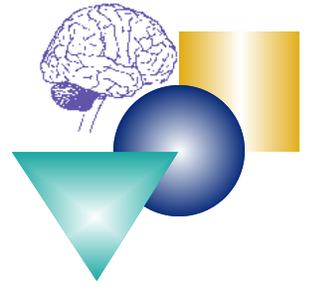


Figure 1 Brain Anatomy

THE CEREBRUM

The largest area of our brain, the cerebrum accounts for approximately two-thirds of the total volume of brain. If it were possible to unfold the cerebrum, it would encompass an area nearly half a square meter in size. The external morphology (form and structure) of the Cerebrum has a convoluted surface, allowing for an increased surface area to volume ratio, thus allowing more neurons in a tighter space, resulting in expanded functioning of the complex neural pathways. The outermost layer of



Activity Overview Continued



the Cerebrum is called the Cerebral Cortex, and is only 1/4 inch thick. High level human functions such as thought, memory, emotions, personality, voluntary movement and reasoning are controlled and regulated here. The Cerebrum is divided into two halves, called hemispheres. The hemispheres are separated by a deep split, however, the two halves communicate with each other and the rest of the brain through a network of connecting nerve tissue. Each hemisphere is divided into 5 lobes:

1. **Frontal Lobe:** responsible for thinking and creativity. The motor area is located within the frontal lobe.
2. **Parietal Lobe:** regulates memory of objects and their uses, and directions. Also located in this lobe is the Sensory Area, which receives many of the sensory messages such as touch, pain and temperature from the rest of the body and routes them to the correct area of the brain.
3. **Temporal Lobe:** regulates hearing, speech, and memory.
4. **Occipital Lobe:** nerve impulses from the eyes are received, where the brain translates them into images.
5. **Insular Lobe:** this lobe is located beneath the other four lobes, and cannot be seen without pushing aside the frontal and temporal lobes. Scientists are not sure what functions this lobe control, but some studies indicate it is related to controlling behavior related to feelings of pleasure.

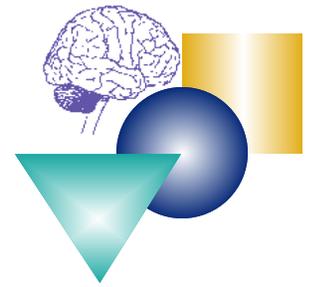
DIENCEPHALON

The Diencephalon is located below the two hemispheres of the cerebrum and above the brain stem. This area of the brain can be divided into two major parts, the thalamus and hypothalamus. The thalamus is associated with transmitting sensory impulses and the hypothalamus is associated with maintaining homeostasis in the body by controlling temperature, sleep, appetite, and some emotions.

CEREBELLUM

The cerebellum, or “little brain”, is similar to the cerebrum in its external morphology. It also has two hemispheres highly convoluted on the surface, or cortex. This structure is associated with regulation and coordination of movement, posture, and balance. It is also believed to play a role in cognitive development. It is located below the rear part of the cerebrum, right behind the brainstem. The cerebellum represents 11% of the brain’s weight and contains more neurons than any other part of the brain. (Neurons form connections and patterns in the brain by transmitting information using chemical signals.) The cerebellum is so tightly folded that its surface area is about the same as one of the hemispheres of the cerebrum.

The cerebellum is known to hold the memory of automated movements and other skills that require little attention to detail once learned. This allows the brain to attend to other mental activities, thus allowing for greater cognitive functioning.



Activity Overview Continued



It is traditionally believed that the cerebellum is purely involved with motor control, however there is evidence to support the idea that the cerebellum contributes to cognitive processing and control of emotions.

Brain Stem

The brain stem is located below the Diencephalon and connects to the spinal cord, which is found inside the vertebrae of the spine. It can be divided into three structural parts:

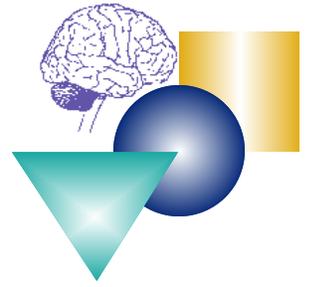
1. **MIDBRAIN:** This area forms the upper part of the brain stem and functions to control and regulate various reflex actions such as those involved in the eyes, such as in the process of reading.
2. **PONS:** This area is located below the midbrain and is composed of nerve fibers that connect the two halves of the cerebellum to the brain stem. The name “pons” means bridge as it is a bridge to these parts of the brain. The pons plays an important role in connecting the cerebellum with the rest of the nervous system, and is vital for integrating such involuntary actions as breathing.
3. **MEDULLA OBLONGATA:** Located below the Pons, this region of the brain stem directly connects to the spinal cord. It contains a collection of nerve fibers that include motor fibers extending from the cerebrum. These fibers cross each other in this area of the brain stem and results in the right half of the brain controlling the left side of the body and the left half of the brain controlling the right side of the body. The Medulla Oblongata contains vital clusters of nerves involved in respiration, heartbeat and blood pressure.

Materials:

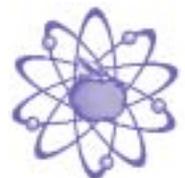
- Class set of *Student Pages*
- Set of *Brain Anatomy Worksheets* for each student (included after the *Student Pages*)
- Colored pencils for each group of (2) students
- Scissors to cut out brain flaps
- Glue or tape to glue brain flap
- Slide show included online with this activity (optional)

Management Suggestions:

All materials should be available at the beginning of the activity. Two sided copies can be made to conserve paper. To further save paper, teachers can make a class set (one per student) of the background information for students to read. Each student will need a copy of the worksheets.



Activity Overview Continued



LESSON 1
ACTIVITY 1A

The Brain: It's All In Your Mind

Suggested Modifications:

For students needing more assistance, provide copy of slide show (available online with this activity). Also, fill in the note taking sheet so students need only to color the brain as the slide show progresses.

Suggested Extensions:

Students could role play different areas of the brain and their functions, having others in the class guess their structure.

There is a subsequent unit on brain imaging that builds on this unit. The *Brain Imaging Activity* explains the history and development of imaging techniques. It includes images of brain scans and explanation of how scientists have used this technology to learn more about the brain.

Activity 1B Make Up Your Mind: Brain Cap builds on this activity, with students labeling parts of the brain based on this lesson to build a model of the brain. **Activity 1B Make Up Your Mind: Brain Cap** can also serve as an assessment.

References Used:

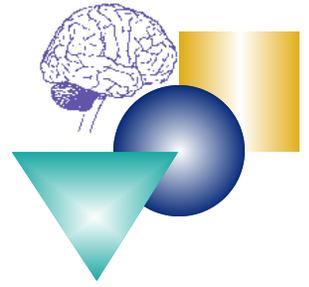
Cohen, BJ. (2005). Memmler's structure and function of the human body 8th ed. Baltimore, MD: Wolters Kluwer Health/Lippincott William & Wilkins.

Teacher Resource:

A Piece of Your Mind: Brain Anatomy

Online slideshow posted at:

<http://teachhealthk-12.uthscsa.edu/curriculum/brain/brain.asp>.



Activity Overview Continued



LESSON 1
ACTIVITY 1A

The Brain: It's All In Your Mind