



Human Brains

Lesson Plan

Objectives:

High school and middle school

1. Identify the major parts of the brain and their function.
2. Understand that the brain is responsible for behavior (everything from muscle movement, the five senses, decision making, emotions, etc.)
3. Understand how the body protects the brain (skull, dura, CSF)

Elementary school

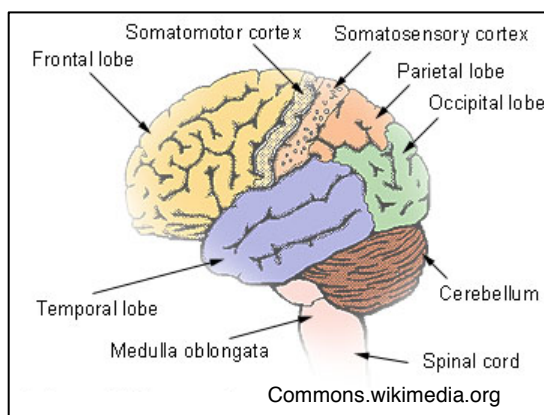
1. Understand that the brain is located inside your skull
2. Understand that the brain is responsible for behavior (everything from muscle movement, the five senses, decision making, emotions, etc.)
3. Understand that the brain has different parts that do different things (keep it simple)
4. Understand that the body protects the brain

Background information:

Depending on the age and background of the participants you may need to explain basic concepts like where the brain is located and that it is an organ just like your heart or stomach.

The background information provided below will aid the station facilitator in achieving the learning

objectives listed above:



- **Sulci** are the fissures in the brain, **gyri** are the smooth portions in between.
- There are five lobes of the brain: frontal, temporal, parietal, occipital, and limbic. Hemispheres are connected by the **corpus callosum**; In general, the right side of the body is controlled by the left side of the brain and vice versa so this communication between hemispheres is essential for normal function.
- The frontal lobe has two main functions: first the **primary motor cortex** processes motor information so that your body can carry out motor actions. The **prefrontal cortex** is the most frontal portion of the lobe and is involved in what we call **executive functions**. These are highly developed cognitive abilities that make up much of who we are. Executive functions include things like decision making, reasoning, planning, judgment, etc.
- The **parietal lobe** is involved in processing sensory information. This is where nerve impulses carrying sensations of pain, temperature, touch, and

PARTICIPATION

This station is designed for 10-12 students.

MATERIALS

- Human brains
- Specimen trays
- Absorbent pads
- Gloves
- Pointing instrument
- Paper towels
- Garbage can

TIME

- Prep: < 5 min
- Activity: 10 – 20 min

SAFETY NOTES

- Make sure students touch the brains with gloved hands only

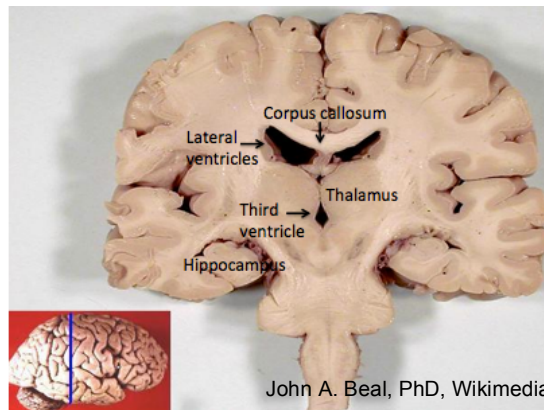
TEACHING TIPS

Probe students with questions to keep them engaged

pressure come. The motor and sensory cortices are on either side of central sulcus, so communication is fast and easy between them. The parietal lobe also has association areas to integrate vision and auditory information.

- The **temporal lobe** plays a role in hearing as well as integrating sensory information. This lobe is also responsible for speech and word recognition. **Wernicke's area** is involved in the understanding of written and spoken language. When this area is damaged, it results in difficulty comprehending language.
- The **occipital lobe** primarily processes visual information. Visual information is encoded in the eye and travels to the primary visual cortex in the occipital lobe. Cells in different parts of this lobe will respond to different visual cues, such as lines, shapes, and even faces.

- The **limbic lobe** is made of several internal structures that help to process emotional information. The limbic system is connected to prefrontal cortex, endocrine, and autonomic nervous system. The amygdala is involved in fear and reward, which plays a role in addiction. The hippocampus is integral for learning and memory processes. The cingulate gyrus is involved in error correcting. It receives input from somatosensory areas and it projects to areas that process sensory information and relays information to the hippocampus.



- The **thalamus** acts as a relay system for the brain, helping to transfer sensory and motor information that enters the brain to the cerebral cortex for further processing. This structure receives information on hearing, touch, taste, and vision.
- The **cerebellum** controls our balance and postural stability, and is involved in motor coordination. The cerebellum is also thought to be involved in affect, cognition and working memory – especially verbal, and spatial working memory, attention, verbal fluency, and possibly retrieval of encoded information. There are separate closed circuits to both frontal and motor areas.
- The **brainstem** is responsible for unconscious body functions such as respiration and heart beat. Motor and sensory information pass to and from here to the rest of the body and brain.

- The **ventricles** contain cerebrospinal fluid and connect to the central canal of the spinal cord. There are four ventricles: left and right lateral ventricles, third, and fourth ventricles. Cerebrospinal fluid is produced by the choroid plexus cells that line each ventricle. Cerebrospinal fluid surrounds and cushions the brain. The **dura** helps protect the brain and also brings blood from the brain to the heart.

The brain is inside your skull and your body protects it.

- The brain is made up of several different regions which all do different things and work together to respond to the environment (see example in the facilitating the activity section).

Facilitating the activity:

Touching the brains

Begin this station by informing students that these are real, human brains. Let them know that if they'd like to they can touch and hold the brain. Ask those students that are interested in touching the brain to put on gloves so that they are ready to handle the brain when the time is appropriate. There is no best time to allow students to handle the brain(s) – this is up to the preference of the station facilitator. It can be difficult to convey conceptual information while students are engaged in touching the brains. As a result, some like to get this part of the station out of the way in the very beginning so that the group can focus for the remainder of the activity. Others prefer to wait until the very end. Still others may find it best to allow students to pass the brain(s) around throughout the allotted time frame. Ask students to be gentle when picking up our touching the brain(s). Remind them that these brains once belonged to real people who donated their brain to science so that we can learn from it.

We recommend that students touch only whole and half brain specimens and not brain slices as these are more delicate and hard to come by.

Conveying the concepts

- There is a logical progression to talking about the brain (as outlined in background section):
 - Sulci and gyri
 - Cerebral cortex
 - Lobes of the brain
 - Limbic system
 - Thalamus
 - Cerebellum
 - Brainstem
- The body protects the brain by three major mechanisms:
 - Skull
 - Meninges (focus on dura mater)
 - Cerebrospinal fluid

- Explain how the brain reacts to the environment and our senses:
 - Visual example: Light comes into eye, detects image, sends through optic nerve through tracts carrying axons, to the thalamus for processing, to the occipital lobe (primary visual cortex), and on to secondary or association visual areas for further processing, and lastly to areas of cognition to use visual information to coordinate movements and make decisions.
- Probe students by asking questions. Use answers as a jumping off point to convey concepts (list some examples here)
- Actively use the brain to convey your concepts
 - Point out areas and their functions as you go
 - Demonstrate how the dura should fit over the brain. Explain the dura and cerebrospinal fluid protect the brain inside the skull.
 - Point out gray versus white matter

Fun facts

- If you flattened the brain out, it would be the size of a newspaper that has been opened up
- The brain has 100 billion neurons.
- The adult brain weighs 3 pounds.
- It is a myth that you use only 10% of your brain. Every area of your brain has a specific function.

Some of this information may not be appropriate for younger ages.