Hemispheres of the Brain

The brain is divided up into hemispheres and then lobes.

<table>
<thead>
<tr>
<th>Left hemisphere:</th>
<th>Right Hemisphere:</th>
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<tbody>
<tr>
<td>controls movement and sensation in the right side of the body; verbal and logical functions including language (listening, reading, speaking, and writing); thought and memory involving words</td>
<td>controls movement and sensation in the left side; nonverbal and intuitive functions - putting information together to make up an entire picture; recognizing oral and visual patterns and designs (music/art); expressing and understanding emotions</td>
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Lobes of the Brain

**Frontal Lobe:** Organization & regulation (attention, processing, decision-making, initiation, etc.)

- Location: Located just behind your forehead.
- Recent research has shown that the frontal lobe may not fully develop until a person’s mid-20s. Some of the frontal lobe’s primary functions are organization, attention, planning, self-control, emotional regulation, judgement, and initiation. This lobe is where we look at the pros and cons of a situation, and with that information perform problem solving and appropriate decision-making. Individuals with injury to the frontal lobe may appear impulsive, have difficulty regulating their emotions, or perhaps be perceived as having lack of motivation because of difficulties with concentration, initiation, and planning ahead.

**Parietal Lobe:** Integrating sensory information

- Location: Located at the top of the head
- What takes information from the environment to piece it together, make sense of, and take action. Injury to the parietal lobe can cause a loss of sensory integration – everything you taste, hear, touch, see, etc. You can see that this would prove vital to understanding when interacting with individuals who have sustained a brain injury. How they process the environment around them may be different. Any sort of buzzing, sirens, flashing or flickering of lights, loud noises, sudden or unanticipated movement...
can be heightened or overload the individual. When this happens, it can make the process of taking in any additional information extremely challenging. Removal of these potential distractors can prove essential in increasing attention.

**Temporal Lobe**: Memory, language, hearing

- **Location**: Located on both sides of the head
- **Primarily responsible**: for language, hearing, and memory. Injury to this area of the brain can result in difficulty speaking, understanding words, or challenges with memory to include understanding, storing, and retrieving new information. This can make learning, piecing together a timeline, and following directions a demanding task for some individuals with a brain injury, particularly in a crisis or unfamiliar situation.

**Occipital Lobe**: Visual Processing

- **Location**: Back of the brain
- **The primary visual center**: of the brain, assembling and processing visual information. Injury can result in difficulty processing and integrating vision, movement, and other senses. When an individual falls and hits the back of their head, they often see “stars,” because this part of the brain has been stimulated. Some people may lose the ability to process an entire side of their vision. Awareness of any visual challenges and positioning yourself appropriately can be very important.

**Other Parts of the Brain**

**Brain Stem**: Arousal, breathing, heart rate

- **Connecting the brain and spinal cord**: injury to the brain stem can often result in a coma or death due to its roles in the vital life functions of arousal, breathing, heart rate, etc.

**Motor & Sensory cortex**: Movement and senses (sight, sounds, touch, taste)

**Cerebellum**: Coordination & balance

- **Located at the base of the brain**: the cerebellum can result in slurring of speech and difficulty with voluntary fine motor movement, coordination, and balance – results similar to individuals who are intoxicated because of a substance. It is important to be mindful of this comparison as it may be easy to jump to assumptions based on someone’s outward appearance or actions.

**Limbic system**: Fight or flight, reward pathway, emotions

- **The structures of the limbic system buried deep within the brain and involved in our behavioral and emotional responses**, especially when it comes to behaviors we need for survival: feeding, reproduction and caring for our young, and fight or flight responses. The limbic system is comprised of a couple of structures within the brain:
  - **Thalamus, hypothalamus** - production of important hormones and regulation of thirst, hunger, mood etc.
- Basal ganglia - reward processing, habit formation, movement and learning
- Hippocampus - episodic memories are formed and catalogued to be filed away in long-term storage across other parts of the brain. Connections made in the hippocampus also help us associate memories with various senses (the association between Christmas and the scent of gingerbread would be forged here). The hippocampus is also important for spatial orientation and our ability to navigate the world.
- Amygdala - central role in our emotional responses, including feelings like pleasure, fear, anxiety and anger. The amygdala also attaches emotional content to our memories and the extent to which emotions are stored with memories (memories that have strong emotional meaning tend to stick).

Makeup of the Brain

Neurons are the communicating agents within the brain. All sensations, movements, thoughts, and feelings are a result of chemical signals (or neurotransmitters) produced between these cells. Neurons cannot communicate alone, however. Glial cells are like a warm blanket for the neurons, making neurons communicate at lightning speed. Recently scientists found out that glial cells are actually more in number than neurons in the brain. Therefore, if glial cells are affected through a brain injury, one’s processing speed may be compromised and neurons may not be nourished to thrive. Neurons meet at a place called the synapse. The neurons, neurotransmitters, synapses, and glial cells act as a circuit to transmit information throughout the brain at rapid rates. However, these circuits can be damaged at the cellular level due to a lack of oxygen, excessive bleeding, swelling/pressure within the skull, or the tearing of neurons due to their long structure. The result can be chemical changes within the brain or functional changes affecting physical, cognitive, emotional, behavioral, and social capacities.

After injury to the brain, there are two mechanisms whereby functional improvement may occur. These are recovery and compensation. These concepts outlined by the Who Health Organization can relate to change at the neural, behavioral, or activity levels. Just because a part of the brain may be injured, there is potential for physical and cognitive rehabilitation based on these principles and neuroplasticity – the brain’s capacity to change and adapt as the result of interactions with environment. This "re-wiring" of the brain can make it possible for an undamaged area to complete functions previously managed by a damaged area. Tasks then become like having to take an indirect flight to get from point A to point B in an airplane – it may take longer and be a little frustrating, but in the end, the result is similar and may cost less. All that we as humans do – eating, thinking, socializing, moving, planning - has a cost, and that cost is energy or the ability to complete actions. After a brain injury, the cost of energy to complete tasks that were once easy may be significantly higher. For some, compensation strategies such as assistive technology, calendars, alarms, lists, and more can be helpful in completing daily tasks, reducing mental or physical fatigue, and helping with establishing routines.