

# FUNCTIONS OF THE CEREBRAL HEMISPHERES

## Objectives:

- ❖ Describe the **general structure** of the cerebrum and cerebral cortex.
- ❖ Identify the cerebrum, the lobes of the brain, the cerebral cortex, and its major regions/divisions.
- ❖ Describe the primary functions of the lobes and the cortical regions of the brain.

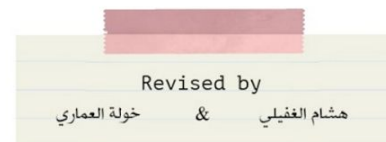
## Done by:

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### ★ References:

- 435 girls slides and notes.



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**Color index:** Important - Further explanation - Doctors Notes - Numbers.

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\*Please check out [this link](#) before viewing the file to know if there are any additions or changes.

## Introduction:

### ❖ Phineas Gage:

- **The Story:**

In 1848 in Vermont, had a 3.5-foot-long, 13lb metal rod blown into his skull, through his brain, and out of the top of his head. Gage survived. In fact, he never even lost consciousness. Friends reported a complete change in his personality after the incident. He lost all impulse control.



[The Story of Phineas Gage](#) (Duration: 11:44)

## Components of The Brain:

### 1. Telencephalon:

- a. **Cerebrum**<sup>1</sup>.

- b. **Basal Ganglia**<sup>2</sup> ( collection of grey matter situated **inside** the cerebral hemispheres ).

### 2. Diencephalon Mainly:

- a. **Thalamus** (mainly a **relay station** for sensory pathways in their way to the cerebral cortex )

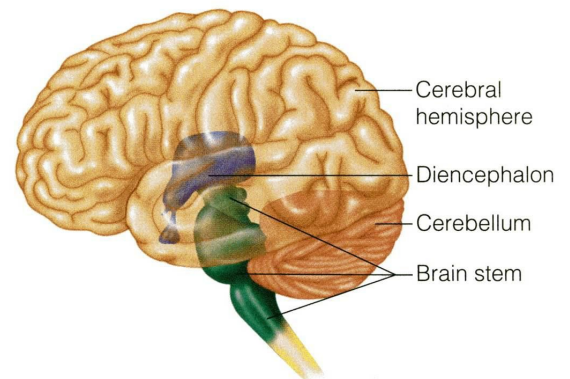
- b. **Hypothalamus** ( contains center for **autonomic** and **endocrine** control )

### 3. Brainstem:

The term “ brainstem ” is actually an anatomic rather than physiologic term , because it is easier , in terms of anatomy to group “ all CNS structures that hang between the cerebrum and spinal cord “ together . However , in terms of Physiology , the situation is more complicated , because brainstem structures are involved in many diverse & different bodily functions.

- **Parts: Midbrain - Pons - Medulla oblongata..**

- **Functions:**



<sup>1</sup> In latin it means large brain

<sup>2</sup> It is a small gland

1. Regulation of **Consciousness** , Wakefulness & Sleep.
2. **Respiratory** , **Cardiovascular** and **Gastrointestinal** control.
3. **Balance** ( Vestibular nuclei ) .
4. Moreover , it contain several **Cranial Nerve nuclei** .

#### 4. **Cerebellum.**



[Parts of the Brain](#) (Duration: 11:57)

## The Cerebrum:

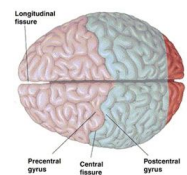
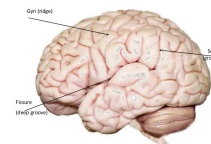
- The **largest** division of the brain. It is divided into **two hemispheres**, each of which is divided into **four lobes**.

### #Facts:

- Most people (about 90%) have the **left cerebral hemisphere dominant**, and are therefore right-handed. The remaining (around 10 %) of the population usually have their **right hemisphere dominant**, and are therefore left-handed .
- The frontal lobe of the dominant hemisphere contains Broca's area (the area for production of speech). Therefore, if a right-handed person gets a stroke involving his left cerebral hemisphere, he is likely to have **right-sided hemiplegia** ( paralysis ) and **aphasia** (loss of the power of speech).

### ❖ **Cerebral Features:**

<b>Cerebral Cortex:</b>	The <b>outermost</b> layer of gray matter making up the superficial aspect of the cerebrum.
<b>Gyri:</b>	<b>Elevated</b> ridges "winding" around the brain.
<b>Sulci:</b>	<b>Small grooves</b> dividing the gyri, <b>example:</b> - <b>Central Sulcus:</b> Divides the <b>Frontal</b> Lobe from the <b>Parietal</b> Lobe.
<b>Fissures:</b>	<b>Deep grooves</b> , generally dividing large regions/lobes of the brain, <b>examples:</b> - <b>Sylvian/Lateral Fissure:</b> Divides the <b>Temporal</b> Lobe from the <b>Frontal</b> and <b>Parietal</b> Lobes. - <b>Transverse Fissure:</b> Separates the <b>Cerebrum</b> from the <b>Cerebellum</b> . - <b>Longitudinal Fissure:</b> Divides the <b>two Cerebral Hemispheres</b>



## Lobes of the brain:

\* **Note:** Occasionally, the **Insula** is considered the **fifth** lobe. It is located **deep to the Temporal Lobe**.

### 1- Frontal lobe:

Location	Function	Cortical region	Lesion
deep to the <b>Frontal Bone</b> of the skull.	<ul style="list-style-type: none"> <li>- <b>Memory</b> Formation.</li> <li>- <b>Emotions.</b></li> <li>- <b>Decision Making/Reasoning</b></li> <li>- <b>Personality</b></li> <li>- <b>Responsible for initiation and execution of voluntary movement.</b></li> </ul>	<p style="background-color: #e6f2ff; padding: 2px;"><b>Primary Motor Cortex (Precentral Gyrus):</b></p> <p>Cortical site involved with <b>controlling movements</b> of the body.</p>	<ul style="list-style-type: none"> <li>- <b>Paralysis</b> on <b>opposite</b> side of the body.</li> <li>- <b>Aphasia</b> ( loss of ability to speak ) if lesion involves Broca's area in the dominant hemisphere.</li> <li><b>*the results*</b> the <b>ability to comprehend speech</b>, but the <b>decreased</b> motor ability (or <b>inability</b>) to <b>speak and form words</b>.</li> <li><b>*Olfactory Bulb could be affected but not that much.</b></li> </ul>
		<p style="background-color: #e6f2ff; padding: 2px;"><b>Broca's Area:</b></p> <p>Controls facial neurons, speech, and language comprehension. Located on <b>Left Frontal Lobe</b>.</p>	
		<p style="background-color: #e6f2ff; padding: 2px;"><b>Olfactory Bulb:</b></p> <p>Cranial Nerve I, Responsible for sensation of Smell.</p>	
		<p style="background-color: #e6f2ff; padding: 2px;"><b>Orbitofrontal Cortex:</b></p> <p>Site of Frontal Lobotomies<sup>3</sup>.</p>	

### Frontal Lobotomies

<u>Desired Effects:</u>	<u>Possible Side Effects:</u>
Diminished Rage	Epilepsy
Decreased Aggression	Poor Emotional Responses
Poor Emotional Responses	Perseveration (Uncontrolled, repetitive actions, gestures <sup>4</sup> , or words)

### 2- Parietal lobe:

Location	Function	Cortical region	Lesion:
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<sup>3</sup> a surgical operation involving incision into the prefrontal lobe of the brain, formerly used to treat mental illness.

Deep to the <b>Parietal Bone</b> of the skull.	- <b>Senses</b> and integrates sensation.	<b>Primary Somatosensory Cortex (Postcentral Gyrus):</b> Site involved with processing of <b>tactile</b> and <b>proprioceptive</b> information. in the <b>postcentral gyrus</b> to receive general sensations from opposite( <b>contralateral</b> ) half of the body.	- Parietal lobe is essential for our feeling of touch, warmth/heat , cold, pain , body position and appreciation of shapes of palpated objects. When damaged , the person <b>loses the ability to recognize shapes of complex objects by palpation</b> (palpation = examination of objects by touch ) . <b>"Astereognosis"</b>  - Develops Sensory Inattention on <b>opposite</b> side
	- Spatial awareness and <b>perception</b> (Proprioception - Awareness of body/ body parts in space and in relation to each other).	<b>Somatosensory Association Cortex:</b> Assists with the <u>integration</u> and <u>interpretation</u> of <b>sensations</b> relative to body position and orientation in space. May assist with visuo-motor coordination ( <b>for integration &amp; association of sensory information</b> ).	
		<b>Primary Gustatory Cortex:</b> Primary site involved with the <u>interpretation</u> of the sensation of <b>Taste</b> .	

### 3- Occipital lobe:

Location	Function	Cortical region	Lesion
Deep to the <b>Occipital Bone</b> of the Skull.	Its primary function is the <b>processing, integration, interpretation,</b> etc. of <b>VISION</b> and <b>visual stimuli</b> .	<b>1- Primary Visual Cortex :</b> This is the primary area of the brain responsible for <b>sight , recognition</b> of <b>size, color, light, motion, dimensions,</b> etc	اول مايجي في بالكم لما تشوفون هذا اللوب هو حاسة البصر تخيلو لو جاكم مريض الأطفال غالبا ويكون طاح على راسه من الجهة الخلفية السفلية اول شيء تفكرون فيه هو انه بيفقد بصره لأن الكورتكس المسؤولة عن الإبصار هي في الاوكسيبتال لوب.
		<b>2- Visual Association Area :</b> <b>Interprets</b> information acquired through the primary visual cortex.	

### 3- Temporal lobe:

Location	Function	Cortical region	Lesion
on the sides of the brain, deep to the <b>Temporal</b>	- <b>Hearing.</b> - Organization , Comprehension of language.	<b>1- Primary Auditory Cortex :</b> Responsible for <b>hearing</b>	- May lead to <b>memory impairment</b> & can be associated with <b>temporal lobe epilepsy</b> .

<b>Bones of the skull</b>	- Information Retrieval : essential for <b>memory</b> function and Memory Formation. - Contain centers of <b>taste</b> ,contribute to <b>smell</b> perception .	<b>2- Primary Olfactory Cortex :</b> <b>Interprets</b> the sense of <b>smell</b> once it reaches the cortex via the olfactory bulbs. (Not visible on the superficial cortex)	- When " <b>Wernick's area</b> " is damaged, <b>Wernick's Aphasia</b> is produce. *Language comprehension is inhibited. * Words and sentences aren't clearly understood, and sentences formation may be inhibited or nonsensical
		<b>3- Wernicke's Area :</b> <b>Language comprehension.</b> Located on the <u>Left</u> Temporal Lobe.	

**Arcuate Fasciculus:** A **white matter** tract that connects Broca's Area and Wernicke's Area through the Temporal, Parietal and Frontal Lobes. Allows for coordinated, comprehensible speech.

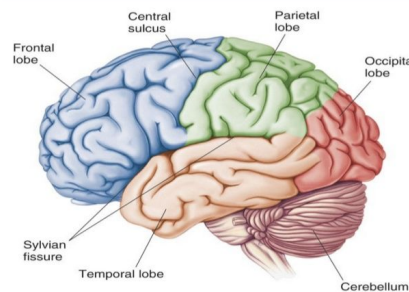
- **Damage may result in:**

**Conduction Aphasia :** Where auditory comprehension and speech articulation are preserved, but people find it difficult to repeat heard speech.

عشان تفهمون أكثر ارجعوا لمحاضرة speech

في هذا الجدول البسيط تجميع لأهم النقاط

Lobes	Main function
Frontal	Movement- memory -personality - emotion
Parietal	Sensation
Occipital	Vision
Temporal	Hearing- smell - taste - memory



## Functional Principles of the Cerebral hemispheres

1. Each cerebral hemisphere receives sensory information from, and sends motor commands to, the **opposite** side of body.
2. The 2 hemispheres have somewhat different functions although their structures are alike.
3. Correspondence between a specific function and a specific region of cerebral cortex is not precise.
4. **No functional area acts alone**; conscious behavior involves the entire cortex.

## Higher level: Prefrontal Cortex

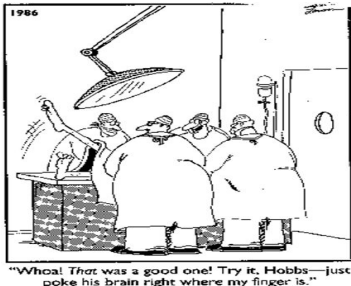
- Most complicated region, coordinates info from all other association areas.

- Important in intellect, planning, reasoning, mood, abstract ideas, judgement, conscience, and accurately predicting consequences.

فينس قيج : أول حاله درسوها في المخ هو حالة هذا الشخص بعد وفاته طلبوا أهله التشريح وعرفوا مكان الإصابة لكن حاليا نسوي ام ار اي ، لكن كمان نحاول نكتشف من قبل مانسوي الام ار أي من الأعراض ولا ليه جالسين ندرس !!

## Hemispheric Lateralization

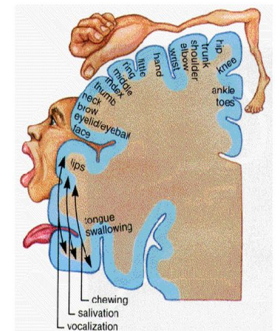
- Functional differences between left and right hemispheres.
- In most people, **left hemisphere (dominant hemisphere)** controls:
  - reading, writing, and math, decision-making, logic, speech and language (usually).
- **Right cerebral hemisphere relates to:**
  - recognition (faces, voice inflections), affect, visual/spatial reasoning, emotion, artistic skills.



Q: Assuming this comical situation was factually accurate, what Cortical Region of the brain would these doctors be stimulating?

A: **Left** Primary Motor Cortex

ليه قلنا اليسار لأن اللي تاتر الجزء الأيمن من جسمه.



This graphic representation of the regions of the Primary Motor Cortex and Primary Sensory Cortex is one example of a HOMUNCULUS.