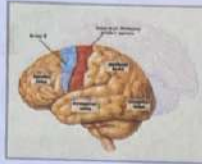


Lecture:



Speech Disorder and Localization of Cerebral Functions

Dr. Eyad M. Hussein

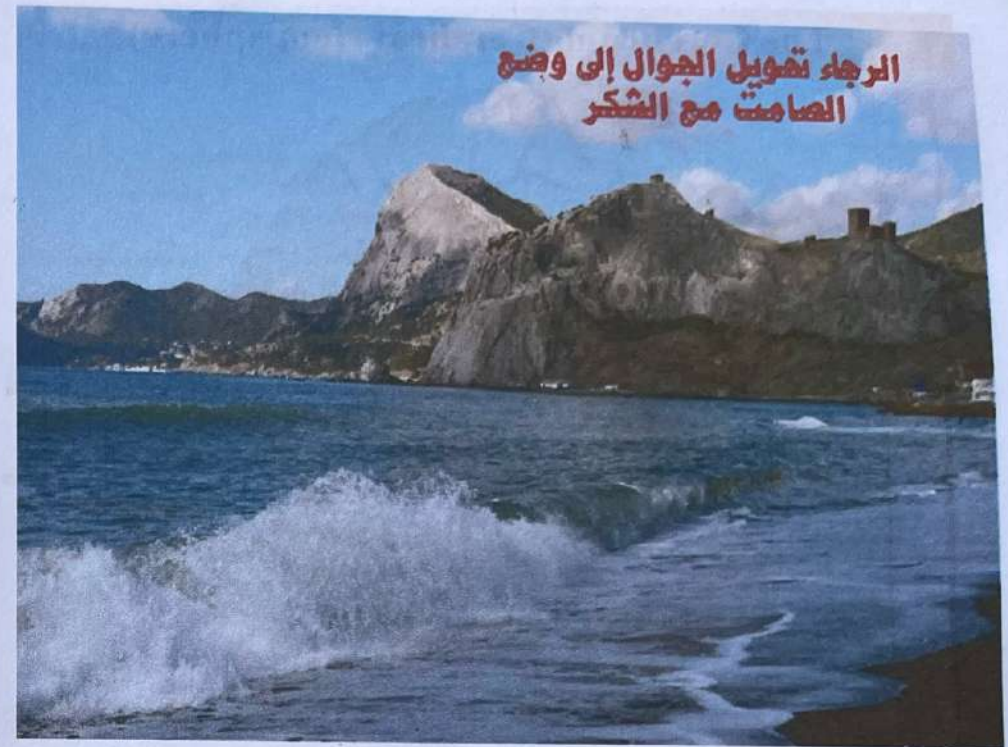
MD, Ph.D of Neurology
Consultant in Neurology Department,
Nasser Hospital,
Assistant Professor,
Faculty of Medicine, Islamic University
Faculty of Dentistry, University of Palestine

The Cerebrum (Cerebral Hemisphere)

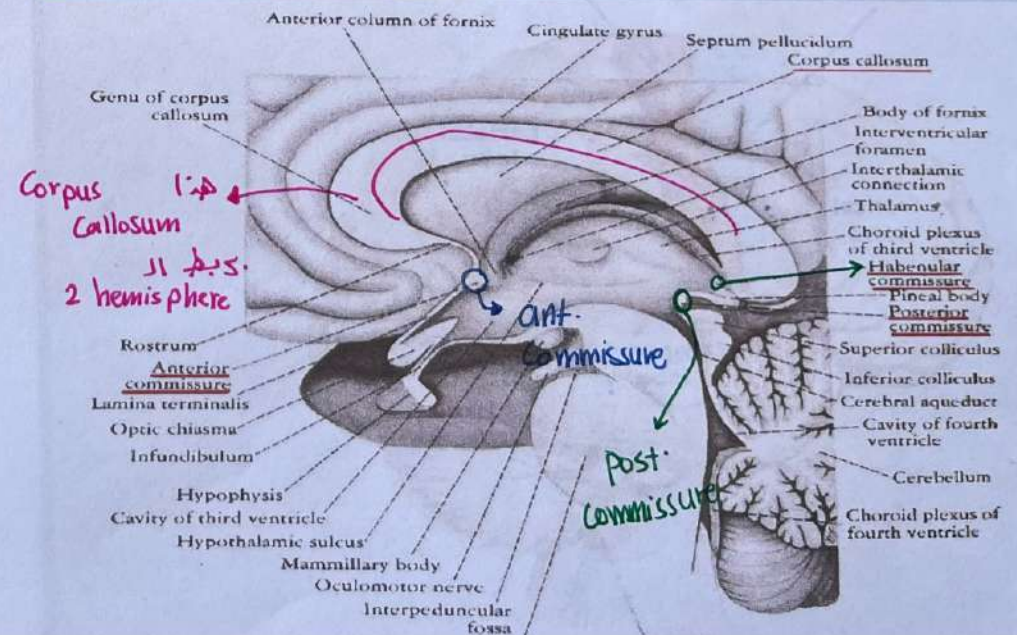
Site: occupies most of cranial cavity and it is the large part of the brain.

The cerebrum formed of two cerebral hemispheres, connected to each other by:

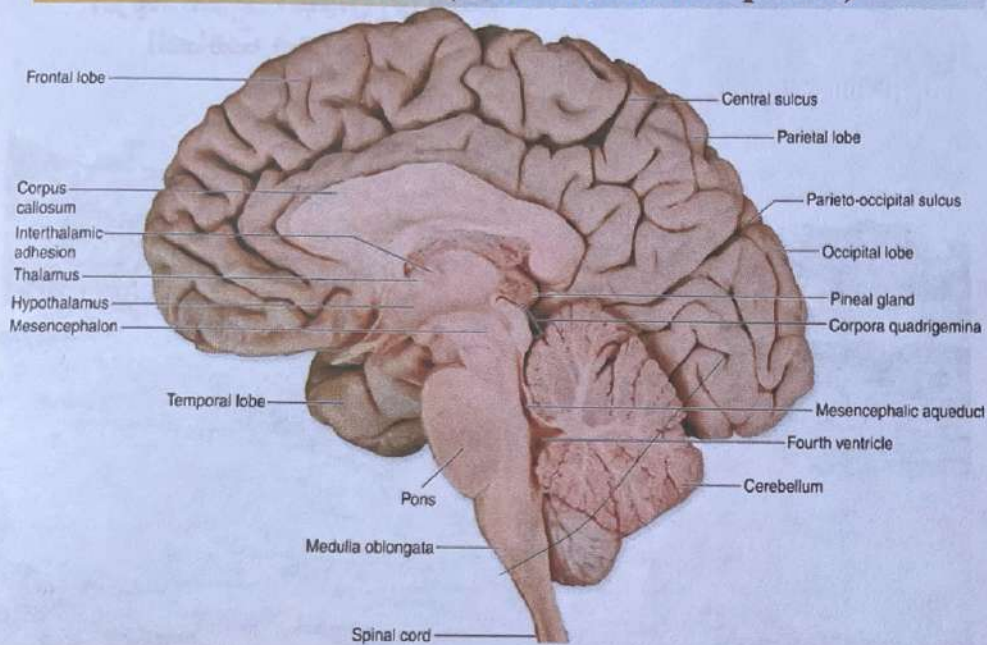
- ✓ 1. The corpus callosum.
- ✓ 2. Right and left cerebral peduncles: connected to upper part of the brain stem.
- ✓ 3. Anterior, posterior & habenular commissures



The Commissural Fibers

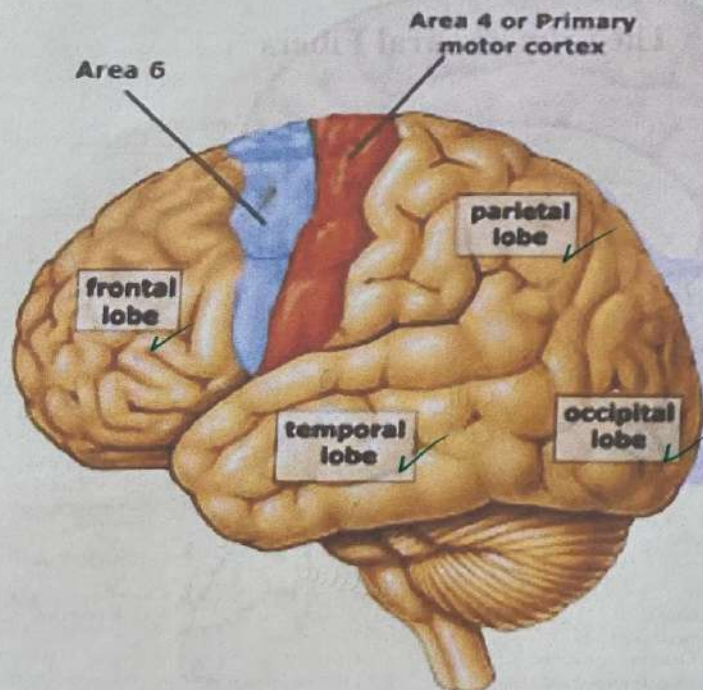


The Cerebrum (Cerebral Hemisphere)



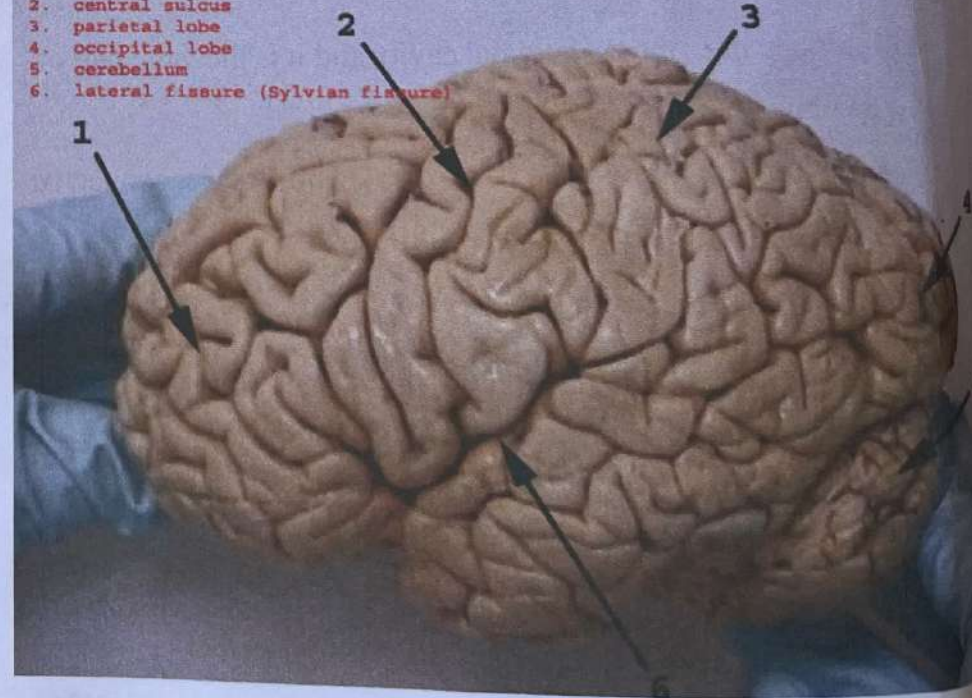
Lobes of Each Cerebral Hemisphere

- ✓ • Frontal lobe
- ✓ • Parietal lobe
- ✓ • Temporal lobe
- ✓ • Occipital lobe



Lobes of Each Cerebral Hemisphere

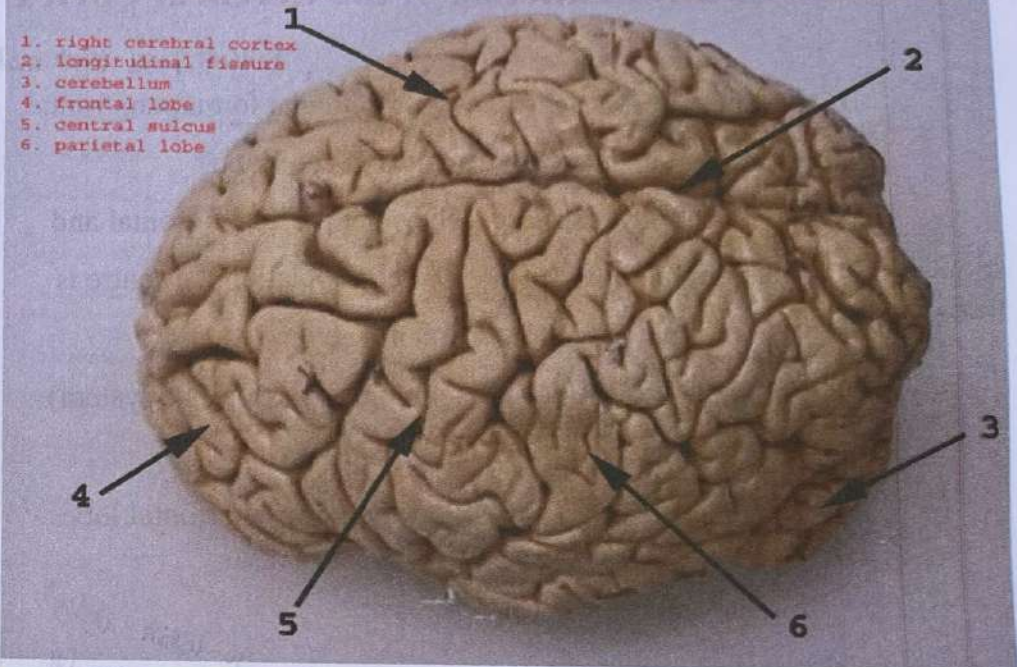
1. frontal lobe
2. central sulcus
3. parietal lobe
4. occipital lobe
5. cerebellum
6. lateral fissure (Sylvian fissure)



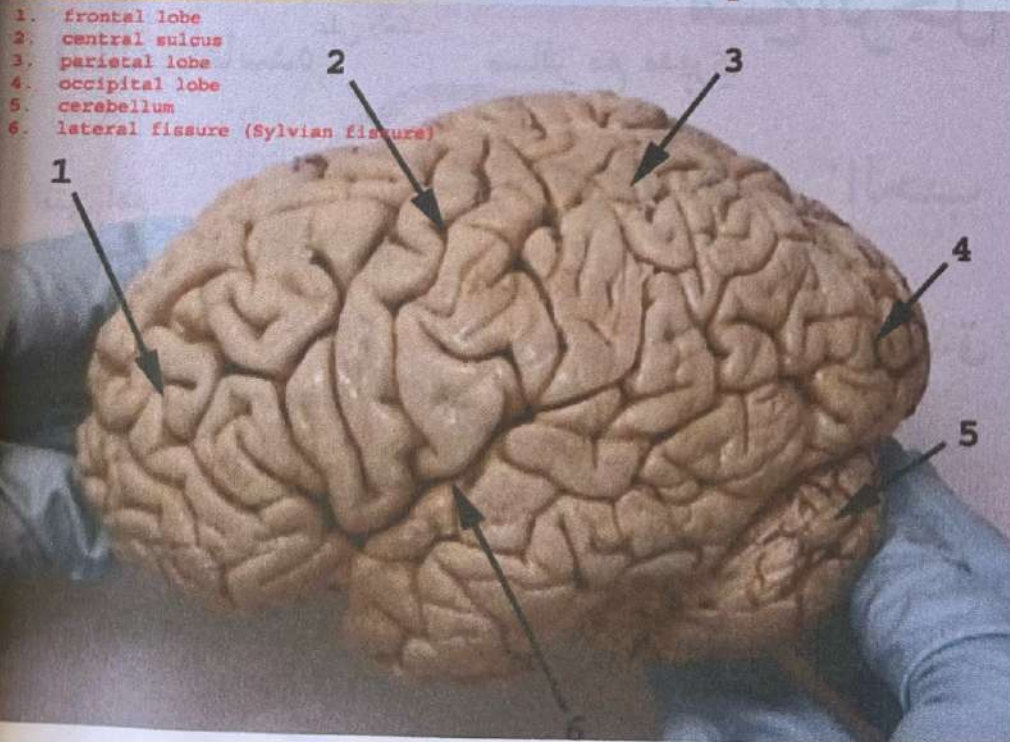
Sulci of Each Cerebral Hemisphere

1. ^{↑ median} **The longitudinal fissure:** divides the cerebrum into two hemispheres. القسم أو cerebrum جزئيه
2. **The central sulcus (Roland sulcus):** it separates the frontal lobe (infront) from parietal lobe (behind).
3. **The lateral sulcus (Sylvian sulcus):** between frontal and parietal lobes (above) and temporal lobe (below).
4. **The parieto-occipital sulcus:** it found mainly on the medial surface of the hemisphere between parietal and occipital lobes.

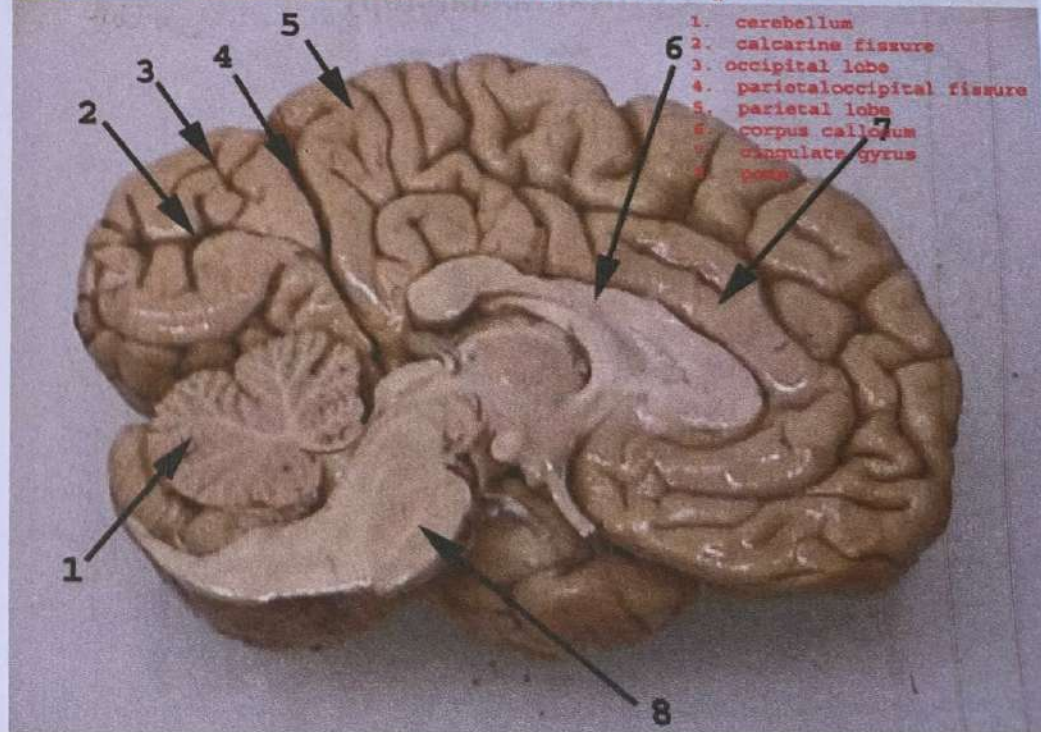
Sulci of the Cerebral Hemisphere



Sulci of the Cerebral Hemisphere



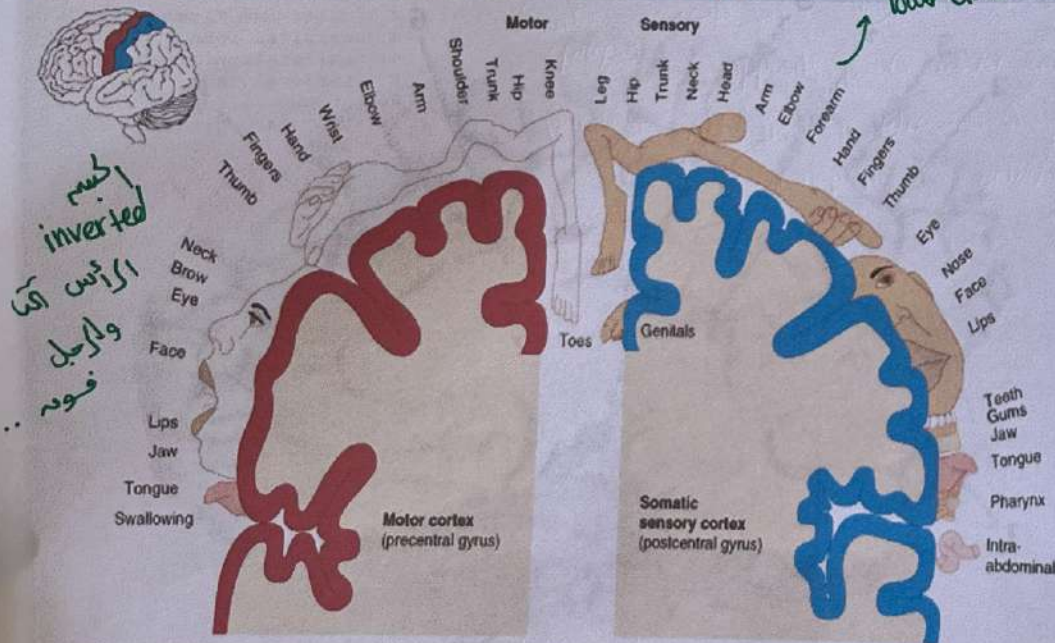
Sulci of the Cerebral Hemisphere



Integrative Function of the Cerebral Cortex

1. **Consciousness:** (brain stem-reticular formation, frontal, temporal and deep structures of cerebrum). *reticulospinal tract medial + lat.*
2. **Use of language:** speech center present in frontal and temporal lobes (in 90-95% of population the centre is present in the left hemisphere). *dominant hemisphere*
3. **Emotions:** frontal and temporal lobes (limbic system).
4. **Memory:** frontal and temporal lobes
5. **Orientation, thinking and intelligence:** frontal lobe.

Cortical Somatotopy



Internal Structures of the Cerebral Hemispheres

The cerebral hemispheres consists of :

1. **Gray Mater (outer):** composed of nerve cells (cerebral cortex). The cells of each area has specific functions.
2. **White Mater (inner):** composed of nerve fibers conducting impulses to and from the cortex.
3. **Basal Ganglia:** there are several groups of nuclei situated at various levels within the white mater.
4. **Lateral Ventricle:** the cavity of the cerebral hemisphere.

٢, ٨: ٢

مخ الرجل



. بقولهم الملتزم ركزوا حابي شلة

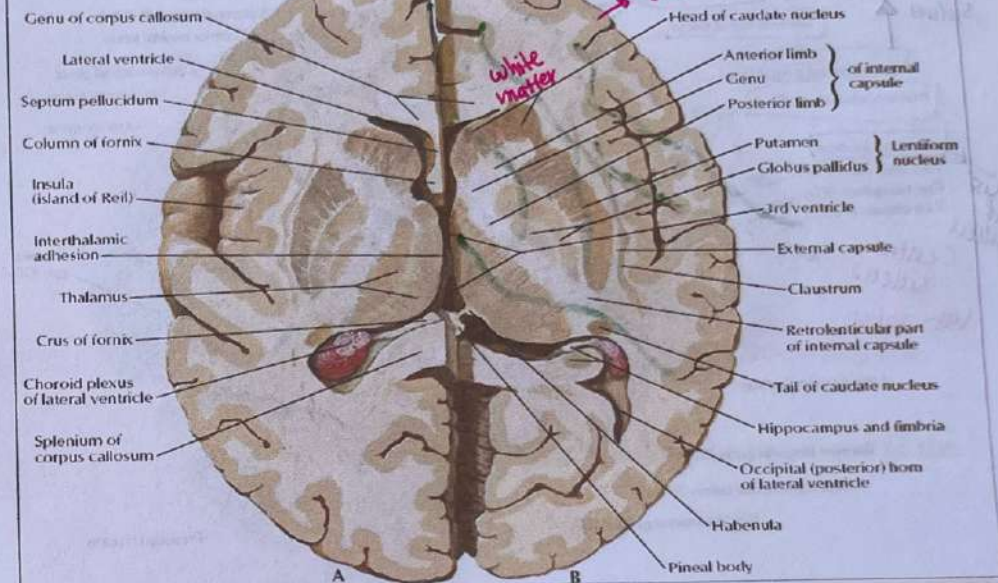
مخ المرأة



الدكتور: ↑ لاحظوا مركز الفقه مركز التفكير

Internal Structures of the Cerebral Hemispheres

Horizontal sections through cerebrum



The Frontal Lobe

The Important Sulci of the Frontal Lobe:

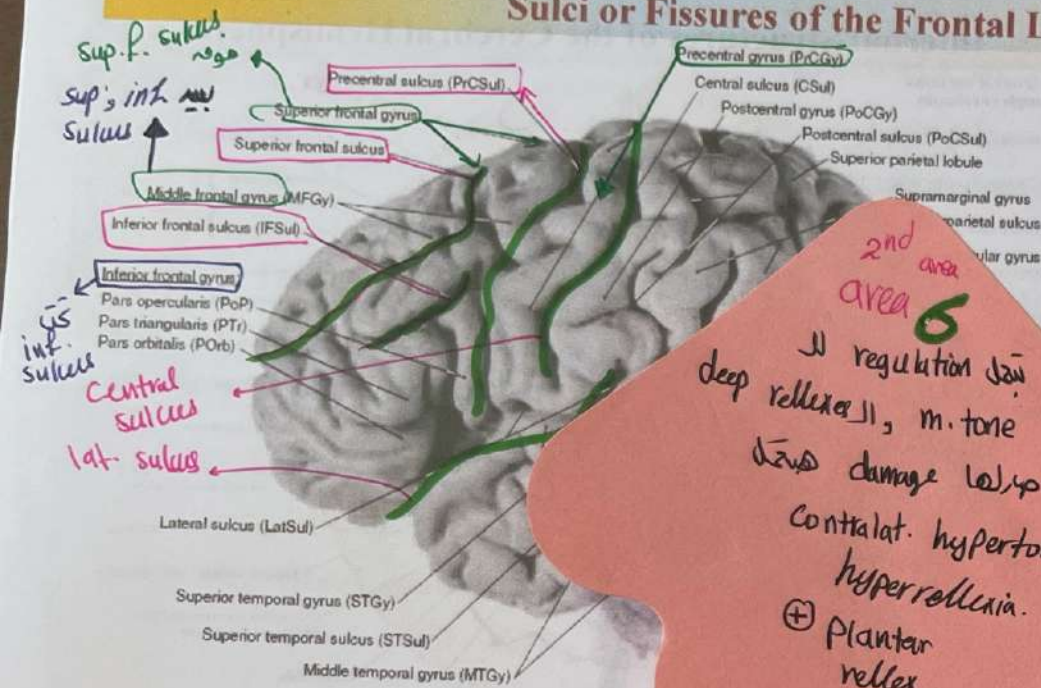
1. The precentral sulcus.
2. The superior frontal sulcus.
3. The inferior frontal sulcus.

♥ Frontal lobe located in front to central sulcus and above lateral sulcus

The Important Gyri of the Frontal Lobe

1. The **precentral gyrus**: lies between the central and precentral sulci.
2. The **superior frontal gyrus**: lies above the superior frontal sulcus.
3. The **middle frontal gyrus**: lies between the superior and inferior frontal sulci.
4. The **inferior frontal gyrus**: lies below the inferior frontal sulcus.

Sulci or Fissures of the Frontal Lobe



The Important Functional Areas of the Frontal Lobe

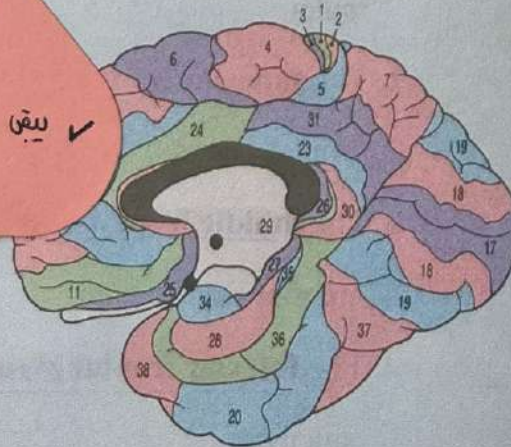
Areas	Site	Function	Lesion
Primary motor area (4)	Precentral gyrus	Voluntary motor activity of opposite 1/2 of the body	Irritative: contralateral motor Jacksonian fit Destructive: contralateral motor paresis usually affecting one limb (monoplegia)
Secondary motor (Premotor) area (6)	Anterior part of precentral gyrus	Gives <u>extrapyramidal fibers</u>	Contralateral muscle hypertonia & exaggerated deep reflexes +ve plantar reflex
Frontal eye conjugate (8)	Middle frontal gyrus	Voluntary conjugate deviation of eyes to opposite side	Irritative: conjugate deviation of eyes to the opposite side Destructive: conjugate deviation of eyes to the same side.
Area (45) = Pars triangularis = exner area	Inferior frontal gyrus in <u>dominant hemisphere</u>	Motor center of <u>writing</u>	Agraphia: the pt. is unable to express ideas in written words
Brocca's area (44)	Inferior frontal gyrus in <u>dominant hemisphere</u>	Motor center of <u>speech</u>	Motor (expressive or Brocca's or verbal) aphasia: the pt. unable to express idea in spoken words
Prefrontal Areas (9, 10, 11 & 12)	Anterior pole	Higher center of <u>memory</u> , <u>orientation, thinking and intelligence</u>	Amnesia (impaired of memory), Dementia , Sphincters dysfunction, Loss of personal hygiene

Areas of Cerebral Cortex

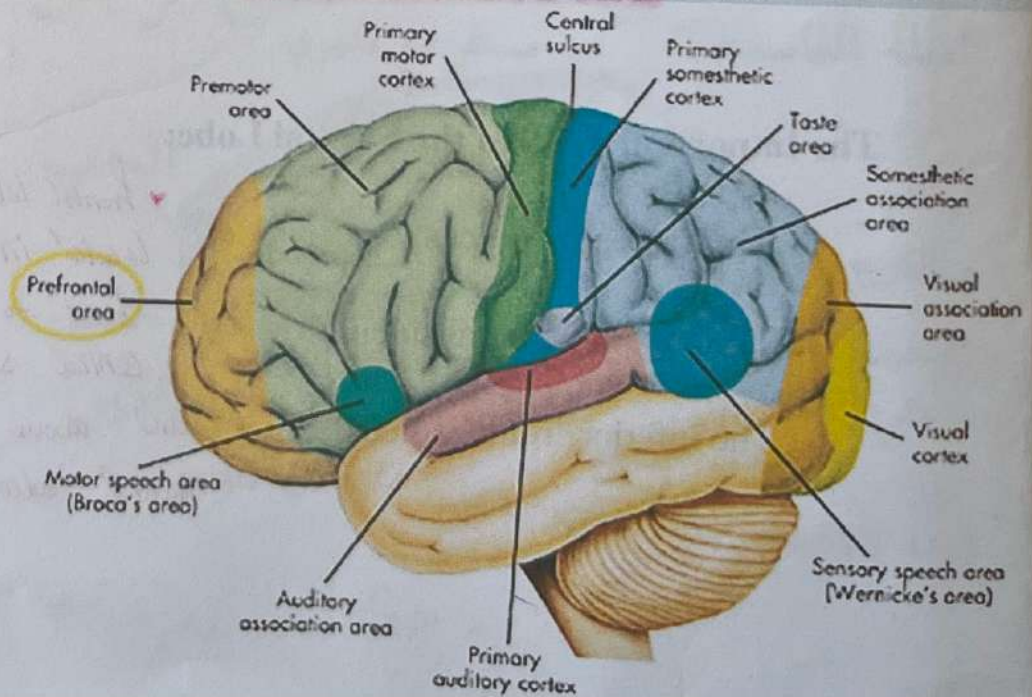
area 8

Local epilepsy
opposite side of motor convolution
Paralysis of area 4
monoplegia or hemiplegia

area 8
IF. حثاف العين
Rt
IF
eye deviation
destruction
area IF
area 8



Areas of the Frontal lobe



The Parietal Lobe

The Important Sulci of the Parietal Lobe:

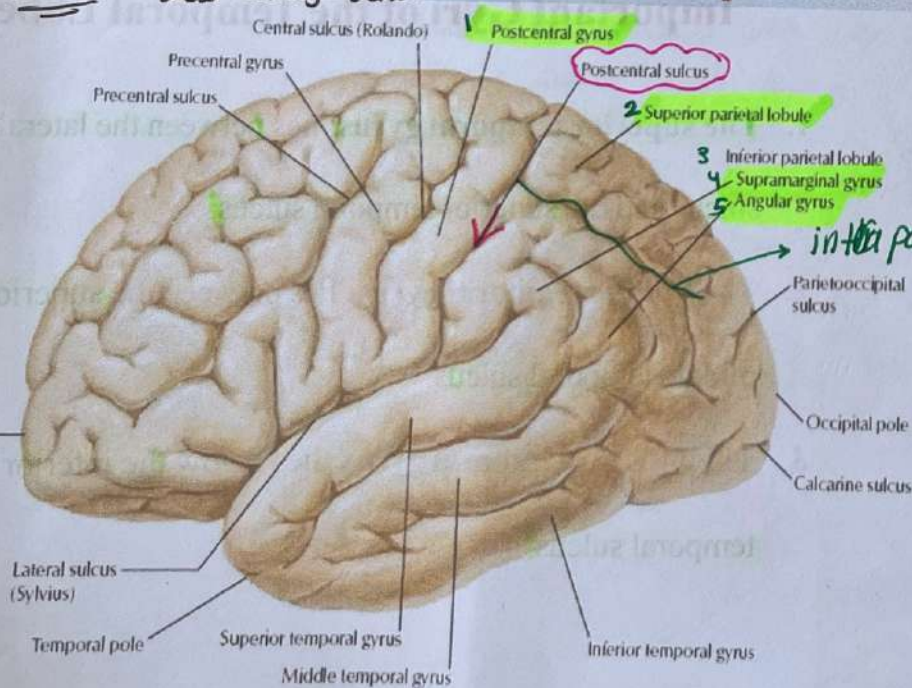
1. The postcentral sulcus.
2. The intraparietal sulcus.

Important Gyri of the Parietal Lobe

1. The postcentral gyrus: its the main gyrus of parietal lobe, lies between the central and postcentral sulci.
2. The superior parietal gyrus: lies above the intraparietal sulcus.
3. The inferior parietal gyrus: lies below the intraparietal sulcus.
4. The supramarginal gyrus: small gyrus surrounding the upper end of lateral sulcus.
5. The angular: small gyrus surrounding the upper end of the superior temporal sulcus.

وتخيفتها تستلم الاحساس من النصف الجسم العاكس لوجاهه راسه على irritation الحاله
 Tingling, numbness, خذلان, Contralateral Local sensory deficit

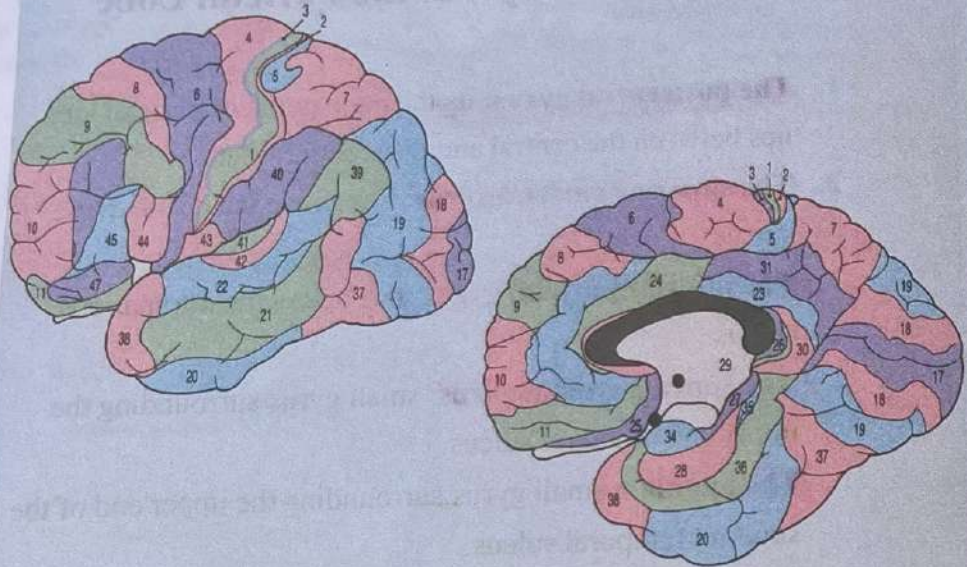
Sulci of the parietal lobe



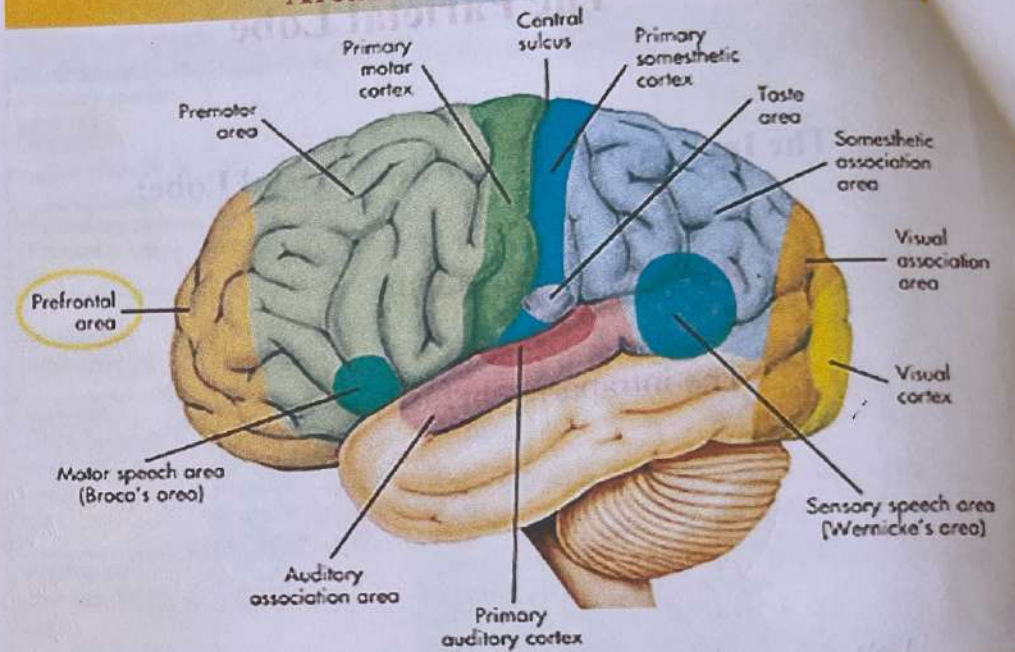
The Important Functional Areas of the Parietal Lobe

Areas	Site	Function	Lesion
Primary sensory area (1,2,3)	Post central gyrus	Perception of cortical sensation from opposite 1/2 of the body	Irritative: contralateral sensory Jaksonian fit Destructive: contralateral sensory loss, usually affecting one limb
Areas 5 & 7	Superior parietal gyrus	Knowing the meaning of the sensations felt (steriognosis) in absence of sens. loss	Asteriognosis: inability to recognize the felt objects نقدش عين الاشئ وهو مخرب عينه
Angular gyrus, area (39)	Surround the upper end of superior temporal sulcus in dominant hemisphere	Visual psychic area for speech (recognition of letters & numbers).	Visual aphasia (alexia): the pt. can not read because he does not understand letter & number (word blindness) على الكلام
Supramarginal gyrus, area (40)	Surround the upper end of lateral sulcus	Associative area and center for complex movement .	Jargon's aphasia Apraxia: inability to perform complex motor activity in absence of paresis, sensory loss and incoordination

Areas of Cerebral Cortex



Areas of the Parietal lobe



The Temporal Lobe

The Important Sulci of the Temporal Lobe:

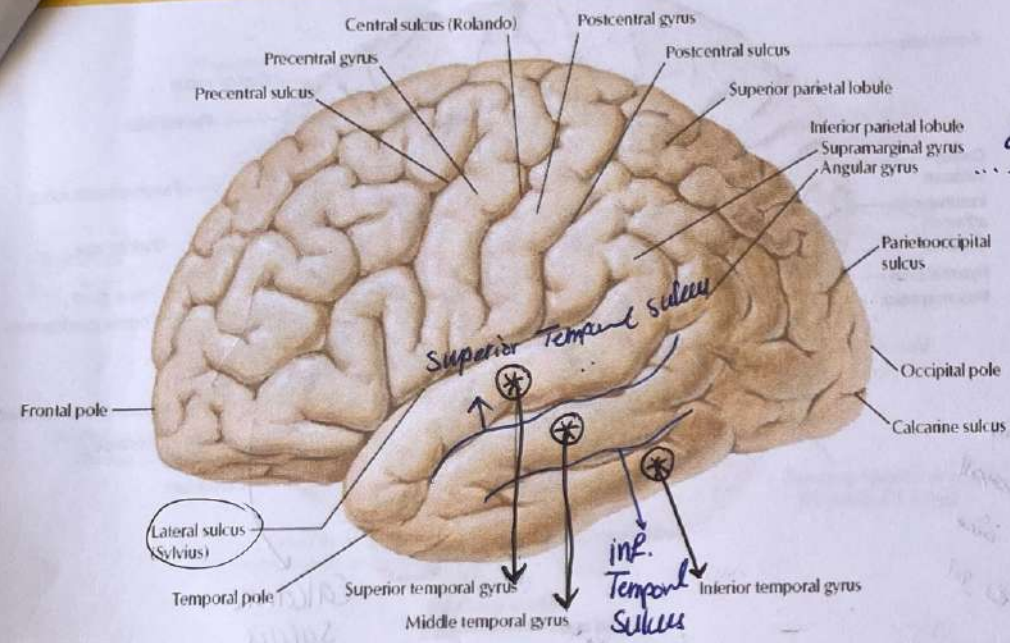
- ✓ 1. The superior temporal sulcus.
- ✓ 2. The inferior temporal sulcus.

Important Gyri of the Temporal Lobe

1. **The superior temporal gyrus:** lies between the lateral sulcus and the superior temporal sulcus.
2. **The middle temporal gyrus:** lies between the superior and middle temporal sulcus.
3. **The inferior temporal gyrus:** lies below the inferior temporal sulcus.

سوقها من غير عصبون

The Important Gyri of the Temporal Lobe



The Important Functional Areas of the Temporal Lobe

Areas	Site	Function	Lesion
Primary auditory area (area 41, 42)	In the superior temporal gyrus	Auditory sensory area	Irritative: aud. hallucination Destructive: Unilateral lesion of temporal lobe does not cause deafness as the sense of hearing is bilaterally represented
Sensory speech area or Wernicke's center (area 22)	In the superior temporal lobe of dominant hemisphere	Auditory association area (recognition & recall of sounds)	Auditory agnosia (sensory or Wernicke's aphasia): the pt. hears but does not understand sound
Limbic system	Uncus and hippocampus in the medial and inferior surface of the temporal lobe	Uncus: sense of smell Hippocampus: mood & memory	a. Uncus: Irritative: olfac. hallucination Destructive: Unilateral lesion of temporal lobe does not cause anosmia as the sense of smell is bilaterally represented b. Hippocampus: Temporal epilepsy and amnesia to recent events

فالسبع موجود

لأنه ال Ear لا يتلقى الإشارة على كلا both Temporal area ، فلو حارب احدهما لا يبقى فالسبع موجود

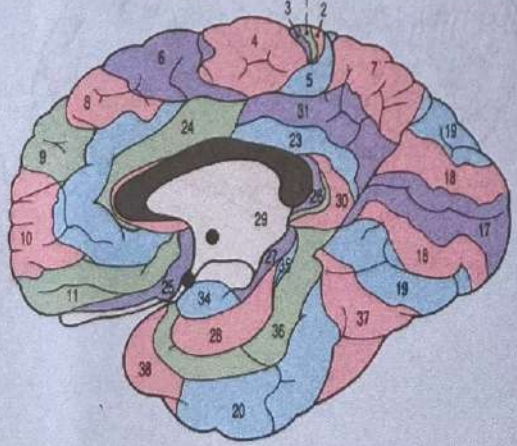
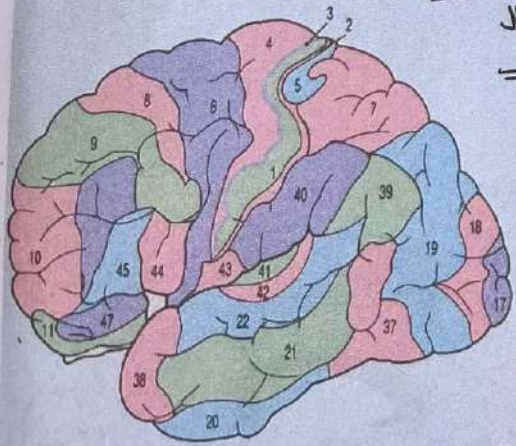
Temp lobe : Stroke لوعار

منش هفقد خلاص النسم ، لأنه باخذ من both hemisphere

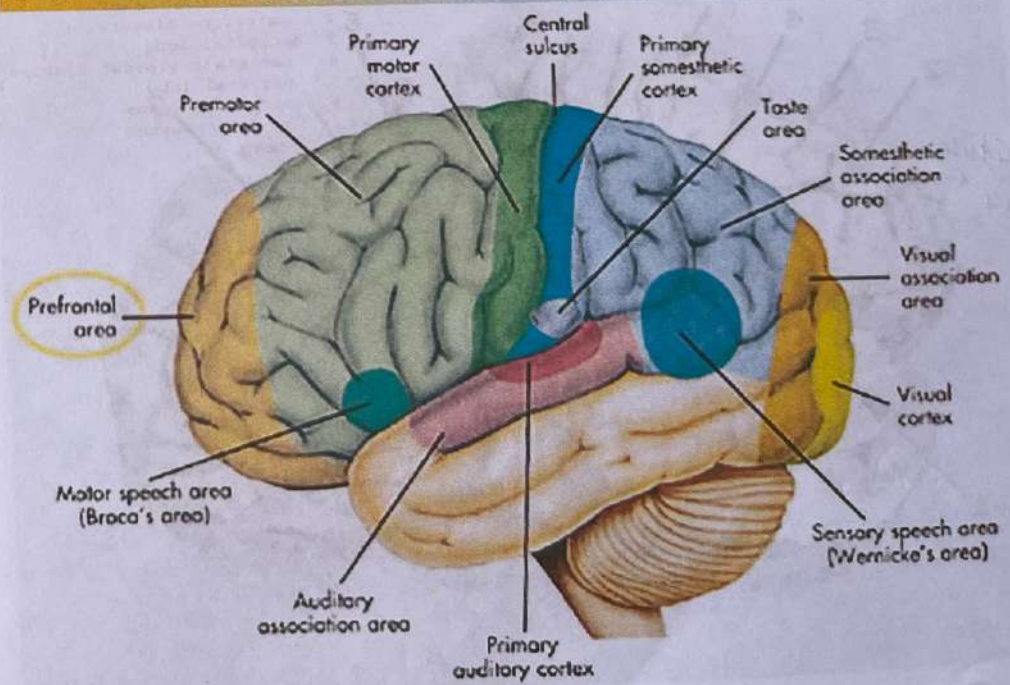
Temporal epilepsy = Complex partial epilepsy

Areas of Cerebral Cortex

Area 41, 42 : واحة ناك كيناهالان ، تحت انا
أعطت ال 14 area 22 ، وهاه هتجال
وهيقم الصوت فنمعت شو مالي
فنبلي ل 4 area 44
لتود عليه " الحرافه "



Areas of the Temporal Lobe

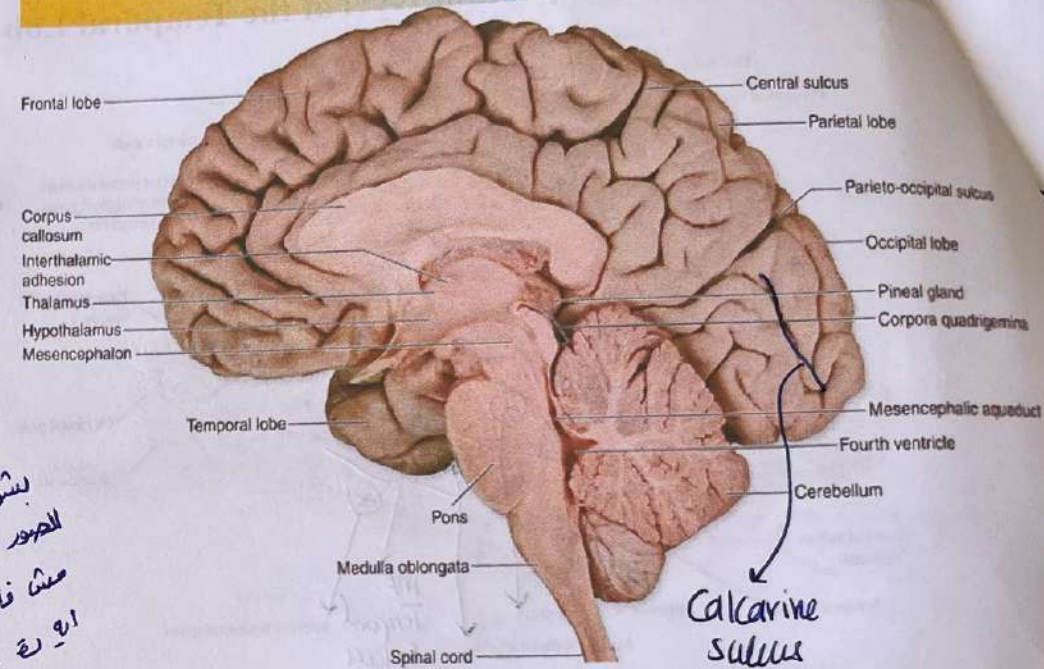


The Important Functional Areas of the Occipital Lobe

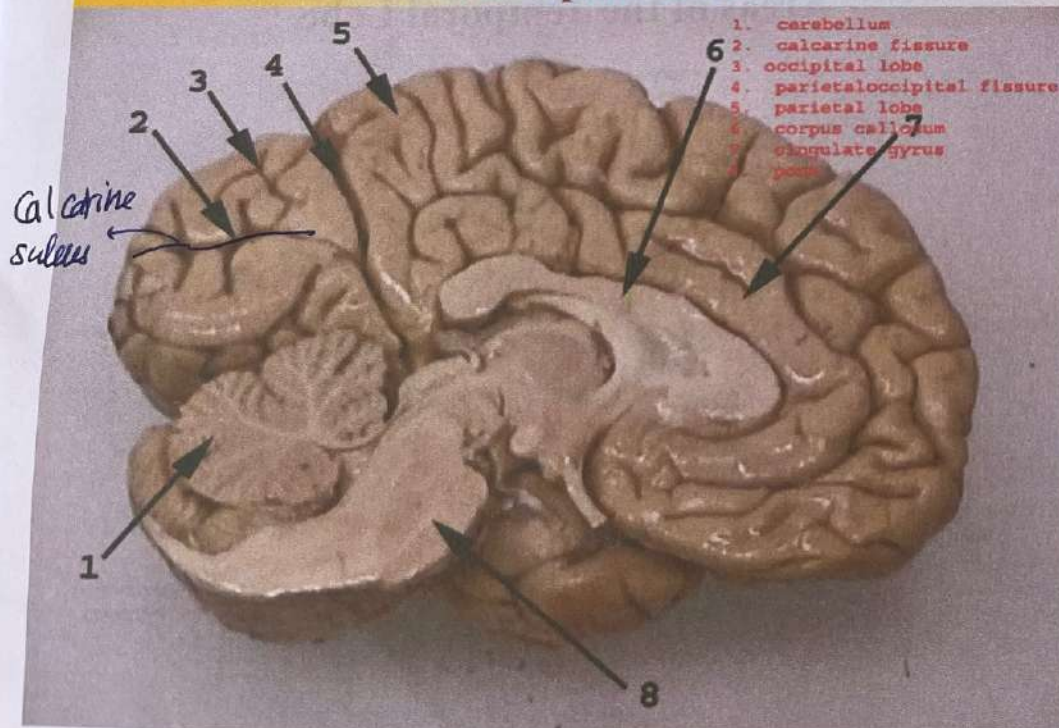
Areas	Site	Function	Lesion
Primary visual sensory area (17)	Posterior medial part of occipital lobe (surrounds calcarine sulcus)	Visual sensory area (perception of visual impulses)	Irritative: visual hallucination Destructive: contralateral homonymous hemianopia with macular sparing
Secondary (psychic) visual area (18, 19)	Anterior to area 17 in dominant hemisphere	Visual association area (Recognition & recall of image).	Visual agnosia: patient can see but does not recognize objects

بشون
للصور بيت
مش فاهم
او رة ...

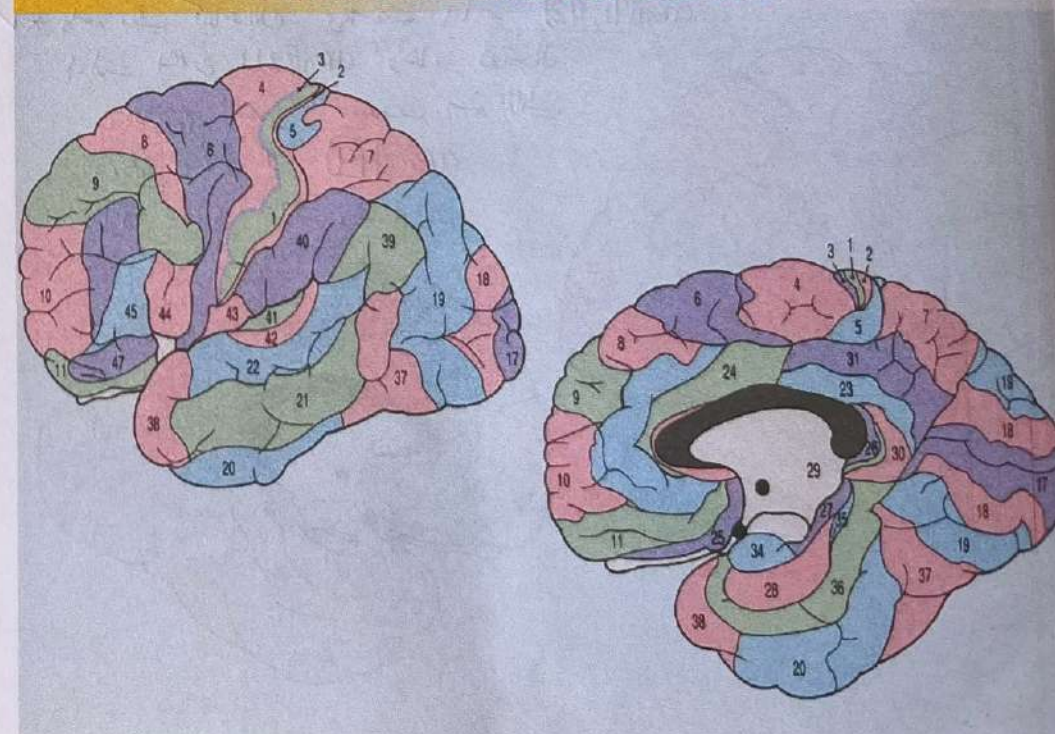
The Occipital Lobe



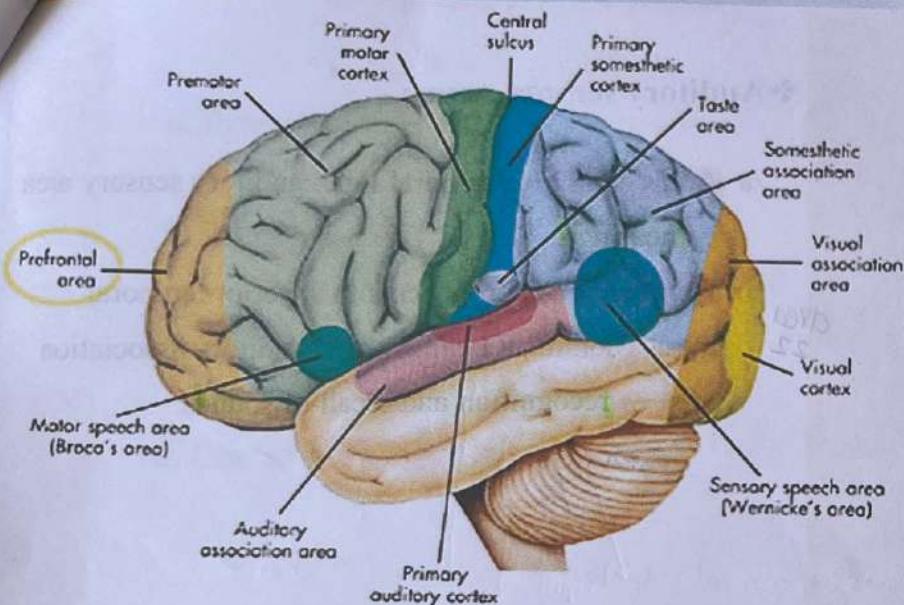
The Occipital Lobe



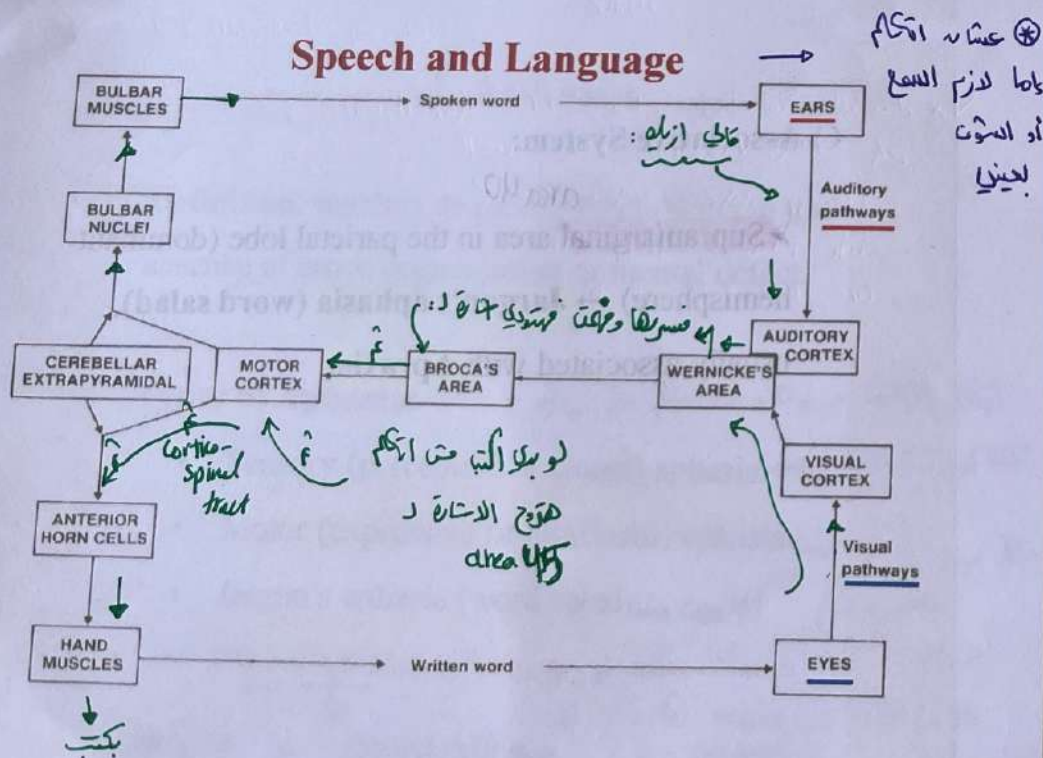
Areas of Cerebral Cortex



Areas of the Occipital Lobe



Speech and Language



Speech Disturbances

The process of speech involves two stages:

- ✓ I- Speech formulation.
- ✓ II. Speech articulation.

I. Speech Formulation

A. Sensory system

- Visual sensory area. ✓
- Auditory sensory areas. ✓

B. Motor system.

C. Associative system.

II. Speech Articulation

- A. Pyramidal tract. → Cortico spinal Tract, Corticobulbar Tract
- B. Extrapyramidal tract.
- C. Cerebellum.
- D. Cranial nuclei of 5, 7, 9, 10, 11, 12 cranial nerves. muscle fibers

I. Speech Formulation

A. Sensory System

❖ Visual sensory area:

- a. Area 17 of occipital lobe: visual sensory area → reception of visual impulses.
- b. Areas 18 & 19 of occipital lobe in dominant hemisphere: visual psychic area → Recognition of images.
- c. Area 39 of the parietal lobe in dominant hemisphere: visual psychic area → Recognition of letters.

B. Motor System

- Area 44 (Brocca's area) in inferior frontal gyrus (dominant hemisphere): motor speech center.
- Area 45 (Exner's area) in inferior frontal gyrus (dominant) hemisphere: writing center.

❖ Auditory sensory areas:

- a. Areas 41, 42 of temporal lobe: auditory sensory area → hearing.
- b. Wernicke's center presents in superior temporal gyrus (dominant hemisphere): auditory association area → recognition and recall of sounds.

area 22

area 40

C. Associative System:

- Supramarginal area in the parietal lobe (dominant hemisphere) → Jargon's aphasia (word salad), usually associated with Apraxia.

II. Speech Articulation

- Pyramidal tract
- Extrapyramidal tract , basal nuclei
- Cerebellum
- Cranial nuclei (5, 7, 9, 10, 11, 12)

I. Aphasia

Definition: inability to speech formulation in the absence of sense organs lesion or mental defect.

Types of Aphasia:

- Sensory (perceptive or fluent) aphasia. → area 22
- Motor (expressive or nonfluent) aphasia. →
- Jargon's aphasia (word salad). → area 40
- Global aphasia. → in stroke in main branch

motor + Sensory aphasia

middle cerebral artery

area 44

Types of Speech Disturbances

I. Aphasia.

⇒ Formulation

II. Dysarthria.

⇒ articulation

I. Sensory (Perceptive) Aphasia

A. Visual:

- Visual agnosia** → lesion in areas 18 & 19 : the patient see but does not recognize object.
- Visual alexia** (word blindness) → lesion in area 39: The patient see but does not recognize letters and numbers.

B. Auditory:

- Auditory agnosia** (Wernicke's or perceptive aphasia) → lesion in Wernicke's center: The patient hears but does not understand sound.

C. Conduction aphasia: refers to a syndrome of fluent aphasia with impaired repetition, frequent paraphasic errors but relatively preserved comprehension. Patients often try repeatedly to correct their errors. This syndrome may be observed during recovery from a Wernicke aphasia

area 44 , area 22

II. Motor or Expressive Aphasia

1. **Verbal (Brocca's or expressive) aphasia** → lesion in Brocca's area or area 44. The patient can not express his ideas in spoken word but the patient understand what ever told him.

2. **Writing aphasia (agraphia)** → lesion in Exner's area or area 45. The patient can not express his idea in writing.

Global aphasia: Sensory aphasia + Motor aphasia

IV. Jargon's Aphasia

area 40 ← مشكلة د

➤ The patient can speak but the words are meaningless and have no relation to each other (word salad).

➤ This condition usually associated with **apraxia** (inability to perform complex motor activity in absence of paralysis, sensory, or coordination loss).

✓ الكلام سلة بكلمات لا معنى لها

منه ريل بيده الكلمات

✓ تفقد المهارات الحركية التي اكتسبها حياته بدلالة هيفقه

II. Dysarthria

لعنة بالكلام

Definition: difficulty in articulation with normal formulation (i.e. normal speech center)

It might be due to:

1. Bilateral pyramidal lesion (**pseudobulbar palsy**).
2. Lower motor neuron lesion of cranial nerves concerned with speech:

- a. **Nuclear:** True bulbar palsy. (stroke in brainstem)
- b. Nerves: Lesion in 5, 7, 9, 10, 11, 12 cranial nerves.
- c. Neuromuscular: Myasthenia.
- d. Muscles: myopathy.

3. Multiple sclerosis.

4. Cerebellar lesions.

5. Parkinson's disease and parkinsonian syndromes.

منه عندى muscle rigidity

منه عندى oropharyngeal muscle rigidity

Other Types of Speech Disorders

→ hoarsness

1. **Aphonia (dysphonia):** phonation is lost but articulation is preserved, hence the patient talks in a whisper.

Causes of dysphonia:

- a. Organic causes: due to disease of the larynx or the nerve supply of vocal cord (**recurrent larynx nerve lesion**), **bulbar syndrome**.
- b. Functional cause: conversion disorder.

2. **Palatalia:** repetition of the last sentence or words of the patient's own speech. It occurs in **extrapyramidal** lesions.

3. **Echolalia:** repetition of the last sentence or words that the patient hears. It occurs in severe dementia.

4. **Mutism:** absence of any attempt at oral communication (in bilateral frontal lobe or third ventricle lesion)

5. **Anomic (nominal, amnesic) aphasia:** difficulty naming familial object or persons.

لسمع وفهم
لكن
يفهم
لكن
لا يستطيع
الكلام

Broca's ← اى مشكلة بالظهور من عند

عند صوت
فجوع
لغير فلوقة

aphonia

✓ قد تكون
dysphonia
1st symptom of
thyroid cancer
ويظهر حينئذ
recurrent laryngeal N.
أو عند إصابة الحنجرة
recurrent
laryngeal N.

mutism

• يمكن أن تكون لاجبة
psychogenic Trauma
أو بسبب lesion في
frontal lobe
أو Ventricle

anomic

فإنه لا يمكن عارفاً أنه لا كتابة
بسبب تآكل في عارفاً هذا
الذي أكبر من تآكل في

Palatalia

يخزل في استخوانه
وحدة ، يتقوله ويبدأ
(الحركة) استئصال (الحركة)
المرضى يتقوله أثناء حاله بقوله
(حاله) بعيداً آخر
في سنده