Central Nervous System
Gross Topography

Key concepts

The nervous system is divided in to three major parts-

- **The CNS : The Brain and the spinal cord**

- **The PNS : The cranial nerves ,the spinal nerves ,the ganglia associated with the cranial and spinal nerves,and the peripheral receptor organs.**

- **The ANS : the part of nervous system involved mainly in the regulation of visceral function, its component part s are located partly within CNS and partly with in the peripheral nervous system.**

TheBrain

Historical review

- **The word brain derives from greek word bregma (the upper part of the head)**

- **The Aristotle : promoted the Egyptian cardiocentric theory.he considered the heart to be the center of the body.the brain was analogous to clouds of steam where the blood pumped by the heart is cooled .gyri and sulci were believed to be ripples on the clouds.**

Relationship between brain weight and intelligence

- **Weight =approx. : 1400gm in adult.**
- **The male brain is on average slightly heavier than the female brain, although this has no relationship to intelligence.**
- **The largest human brain on record weighed = 2850gm and came from a mentally defective individual with epilepsy.**

Protection &Meninges

The brain is protected from the external environment by three barriers :

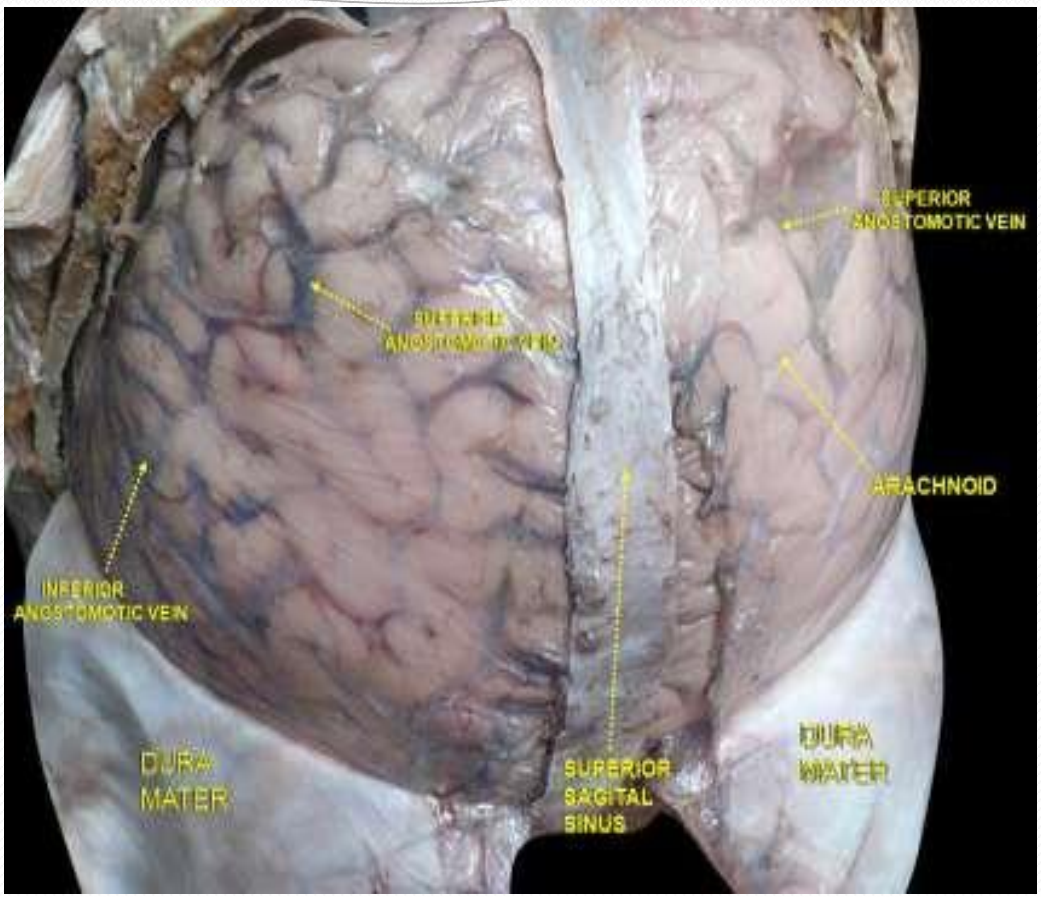
- **Skull**
- **Meninges**
- **CSF**

The Meninges are from out side to inside:

(DAP)

- **Dura mater**
- **Arachnoid**
- **Piamater**

Meninges


SUPERIOR
ANASTOMOTIC VEIN
ARACHNOID
INFERIOR
ANASTOMOTIC VEIN
DURA
MATER
SUPERIOR
SAGITAL
SINUS
DURA
MATER

Dura mater (Hard mother)

- **It is a tough ,fibrous connective tissue arranged in two layers.**

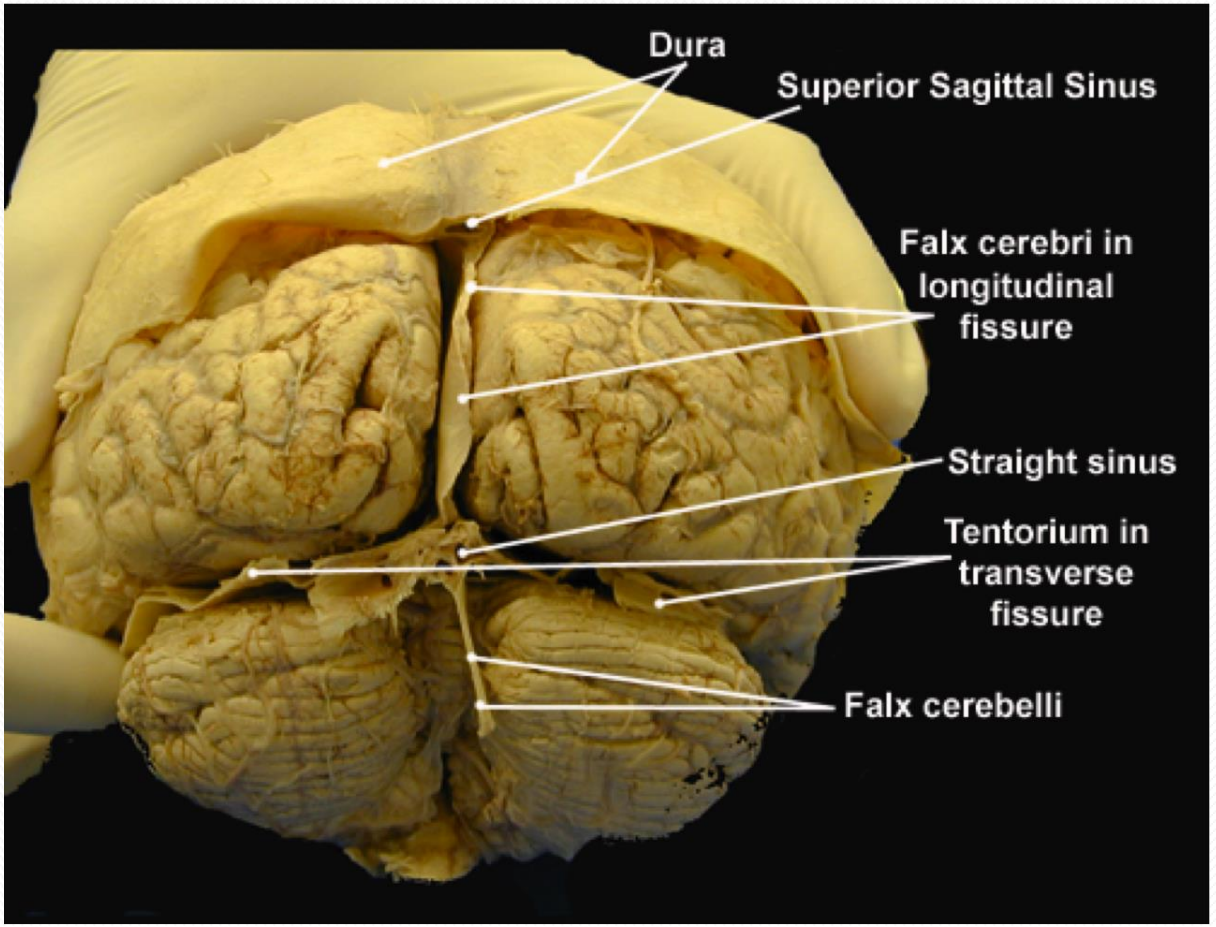
- **Outer parietal layer : It Adhers to the skull and forms its periosteum layer and inner meningeal layer is in contact with the arachnoid mater.**

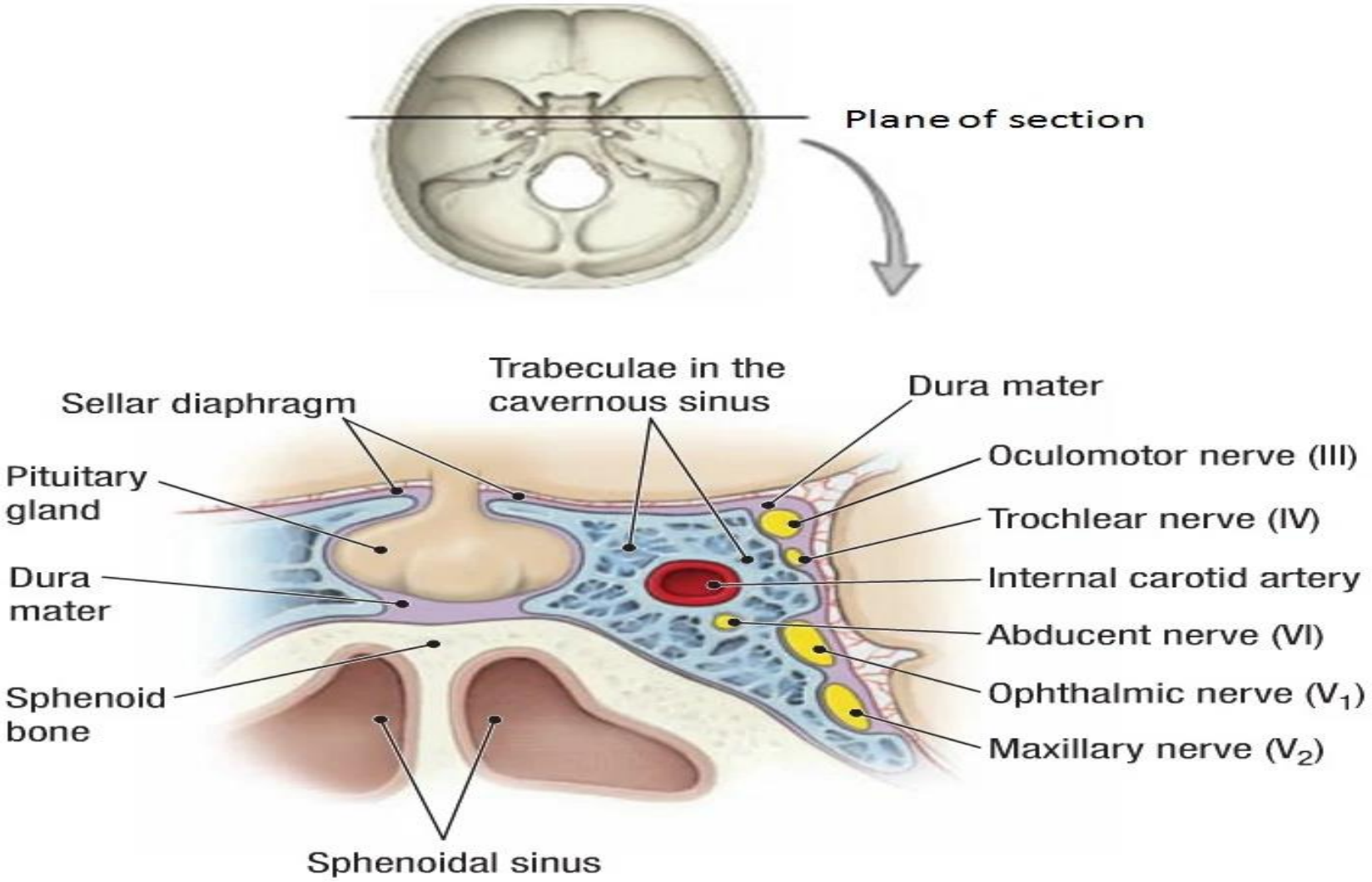
- **These are seprated only at the sites of formation of dural venous sinuses such as the superior saggital sinus.**

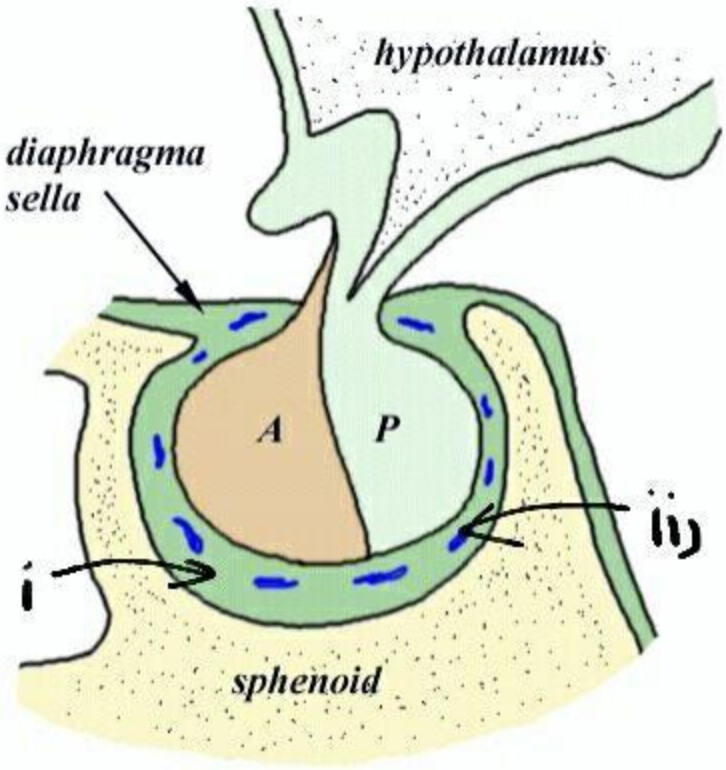
Dura mater

- **The meningeal dura mater has three major reflections which separate components of brain :**
- **The Falx cerebri : It is a vertical reflection which incompletely seprates the two cerebral hemispheres.**
- **The Tentorium cerebelli : It is a horizontal reflection between the occipital part of cerebral hemispheres and the cerebellum.**
- **The Falx cerebelli :It is a vertical reflection which incompletely seprates the two cerebellar hemispheres at the inferior surface.**

Dura mater has three reflections




Plane of section
Trabeculae in the cavernous sinus
Dura mater
Sellar diaphragm
Oculomotor nerve (III)
Pituitary gland
Trochlear nerve (IV)
Dura mater
Internal carotid artery
Abducent nerve (VI)
Sphenoid bone
Ophthalmic nerve (V_1)
Maxillary nerve (V_2)
Sphenoidal sinus


hypothalamus
diaphragma
sella
A
P
ii)
i
sphenoid

Arachnoid & Pia Mater

- **The Arachnoid mater(spider like) : It is a non vascular membrane of external mesothelium that is joined with web like trabeculae to the underlying pia mater.**

- **The Pia mater: It is a thin translucent membrane that is intimately adherent to brain substance.**
- **Blood vessels of brain are located on the pia mater.**

Meningeal spaces

(The Epidural space)

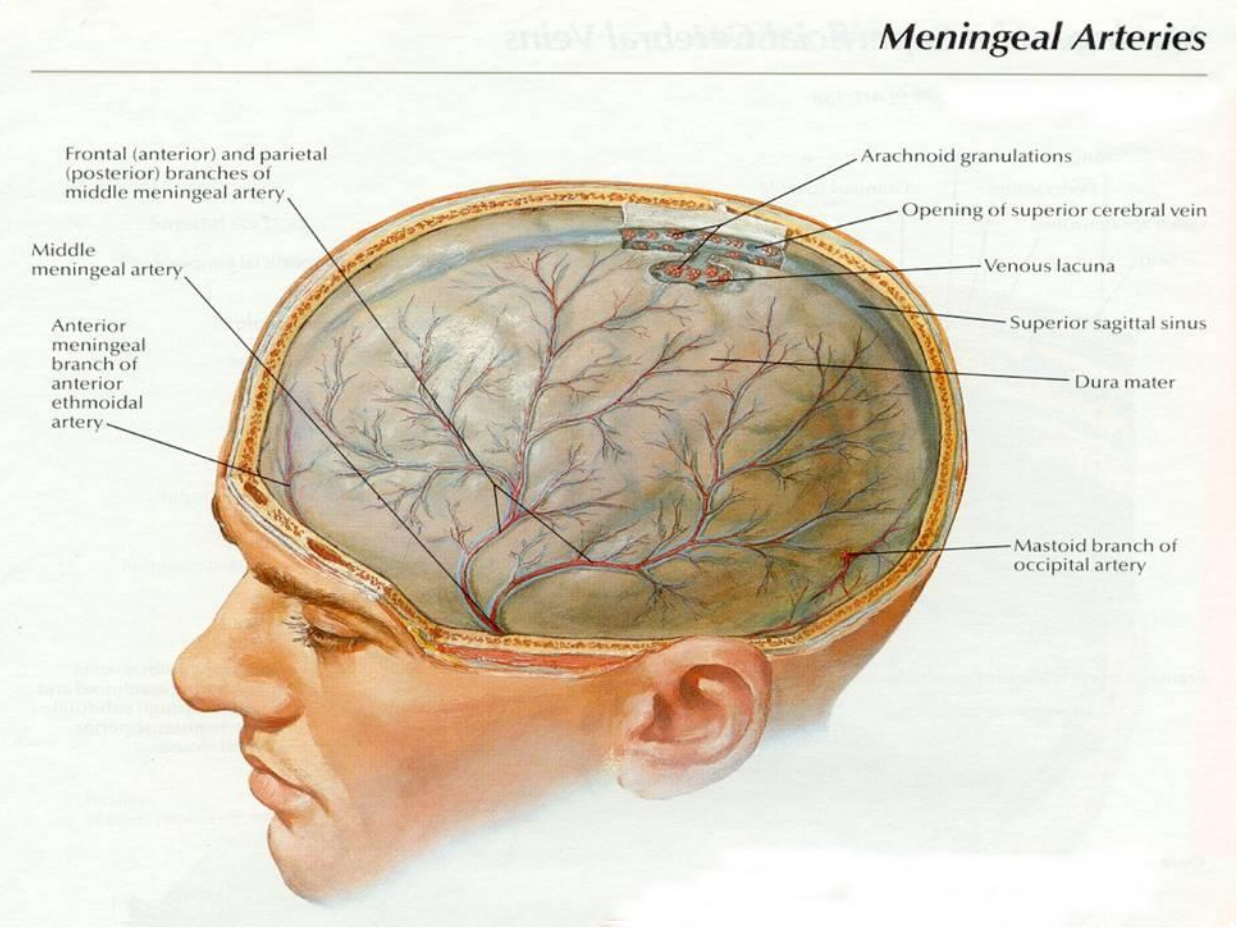
- The Epidural space : it is located between the dura mater and the bony skull.
- **Clinical-**
- **Trauma to the skull with rupture of the middle meningeal artery(branch of maxillary artery) leads to epidural haemorrhage .**
- **because of the pressure produced by a haemorrhage in a closed container such as the skull ,an epidural haemorrhage is handled as an acute,**
- **life threatening emergency calling for surgical intervention to evacuate the accumulated arterial blood in the epidural space and control the bleeding.**

Meningeal spaces

(The Subdural space)

- The Subdural space :lies between the duramater and the arachnoid mater .
- **Clinical-**
- **Trauma to the skull may rupture the bridging veins ,leading to subdural haemorrhage.**
- **This condition also calls for surgical intervention to evacuate the accumulated venous blood in the epidural space and control the bleeding.**

Meningeal Arteries



Meningeal spaces
(The Subarachnoid space)

- **It is located between the arachnoid mater and the piamater. this space contains CSF and cerebral blood vessels .**
- **Clinical-**
- **Rupture of such vessels leads to subarachnoid haemorrhage.**
- **This condition may results from trauma to the head ,congenital abnormalities in vessels ,or high Blood pressure. the subarachnoid space underlying the superior sagittal sinus contains arachnoid granulations and sites of CSF absorption into the superior sagittal sinus.**

EXTERIOR OF CEREBRAL HEMISPHERES

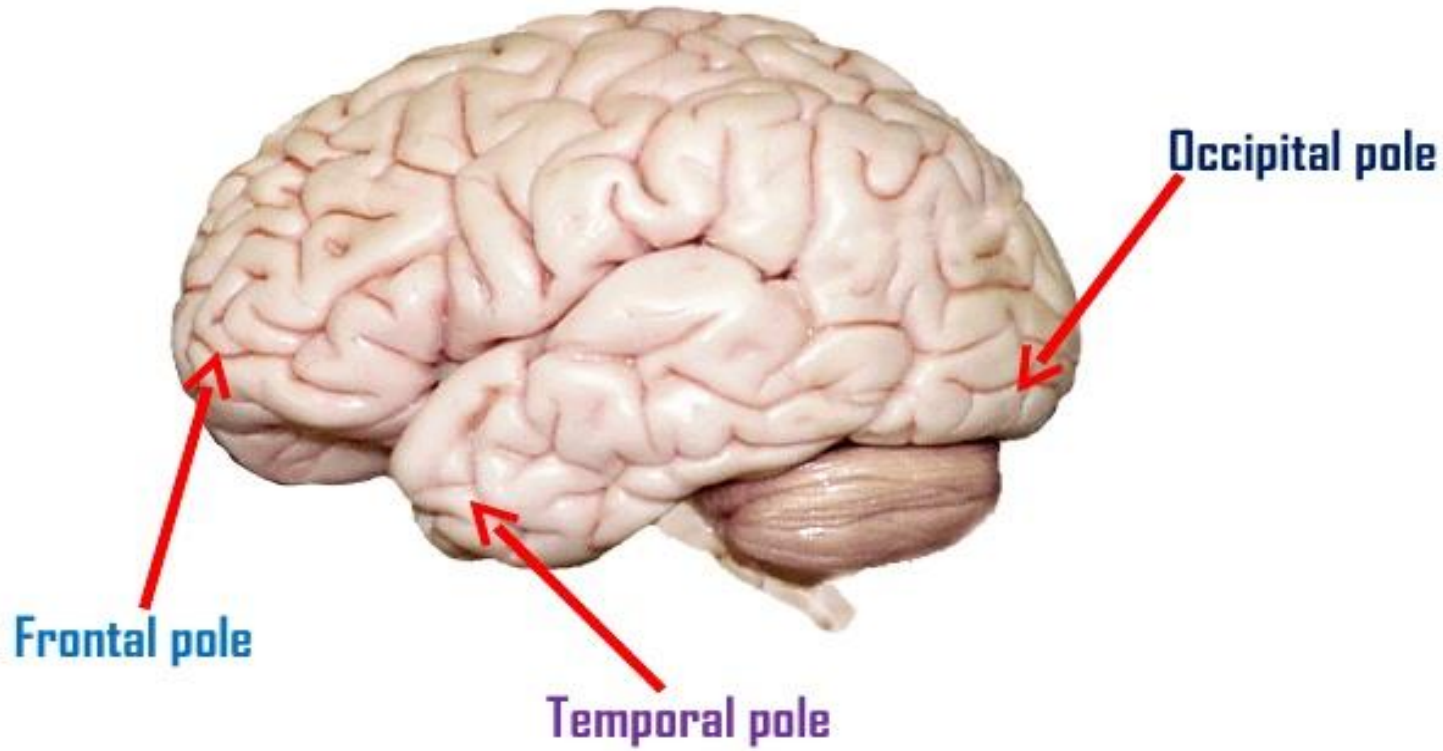
Poles –

- Frontal pole
- Occipital pole
- Temporal pole

Borders

- Superomedial
- Inferolateral-the orbital part of this border is called the superciliary border.
- Inferomedial- 1.Medial orbital 2.Medial occipital

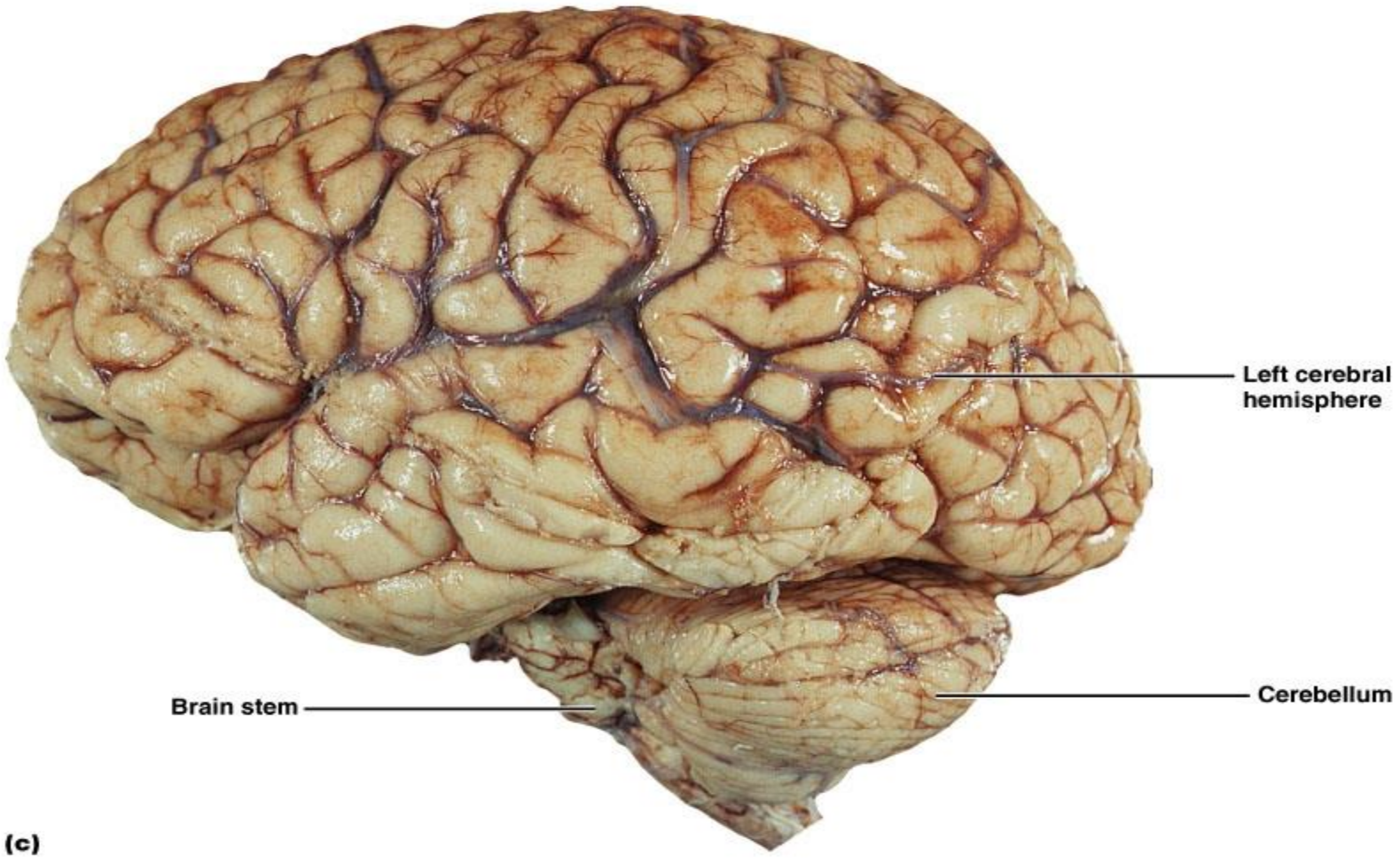
Poles of the brain



Surfaces

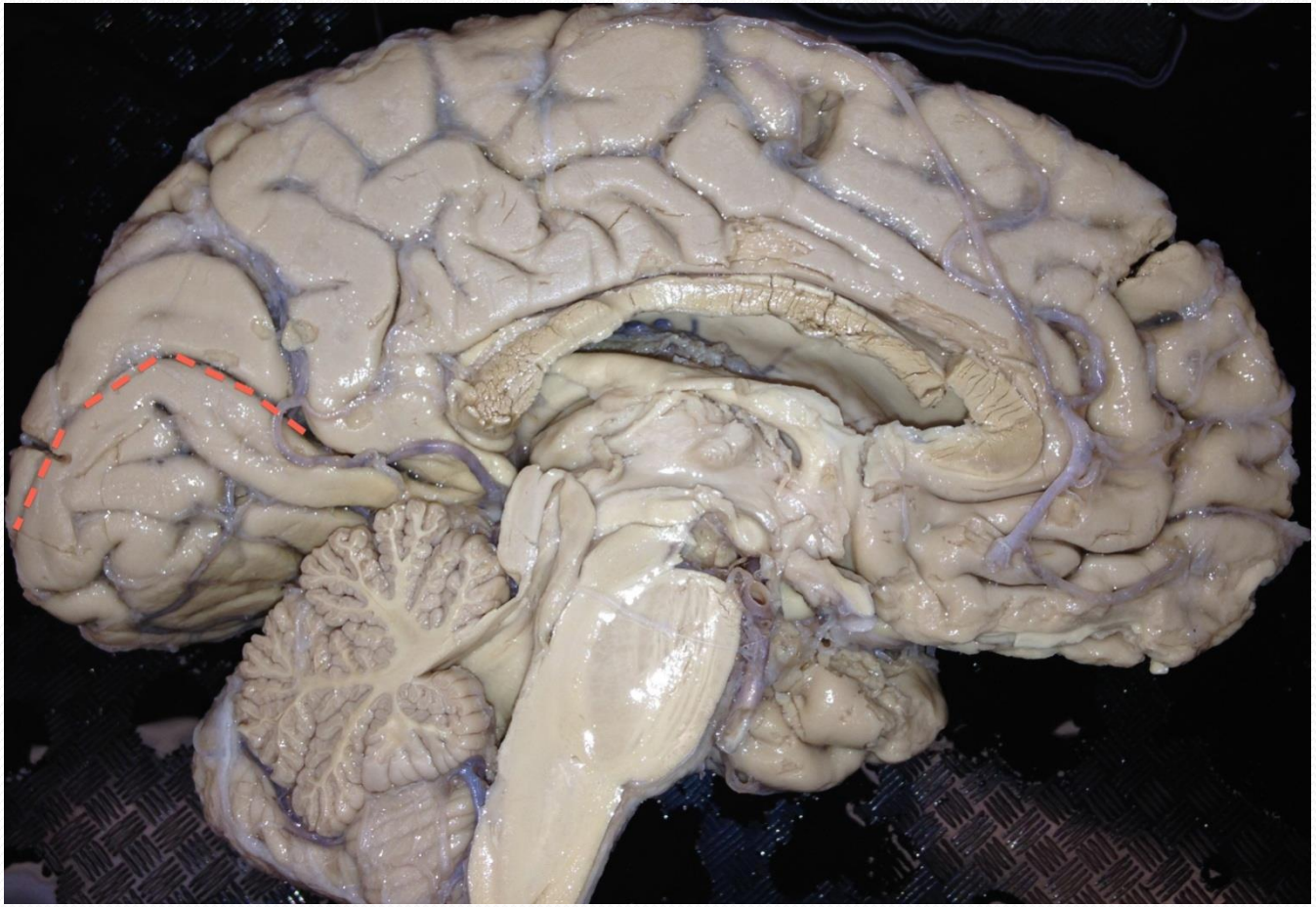
- Superolateral
- Medial
- Inferior -

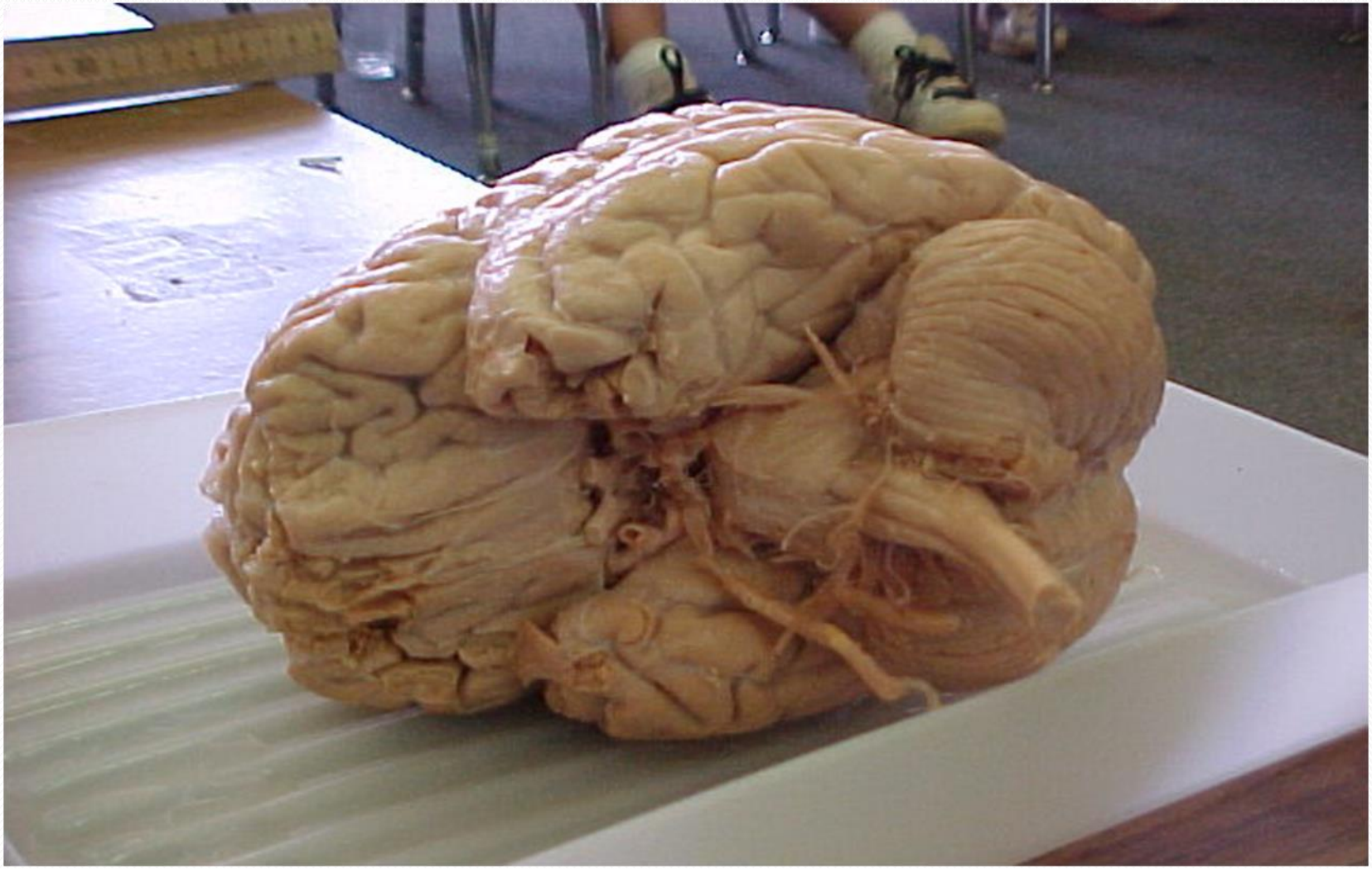
1. anterior orbital part 2.posterior tentorial



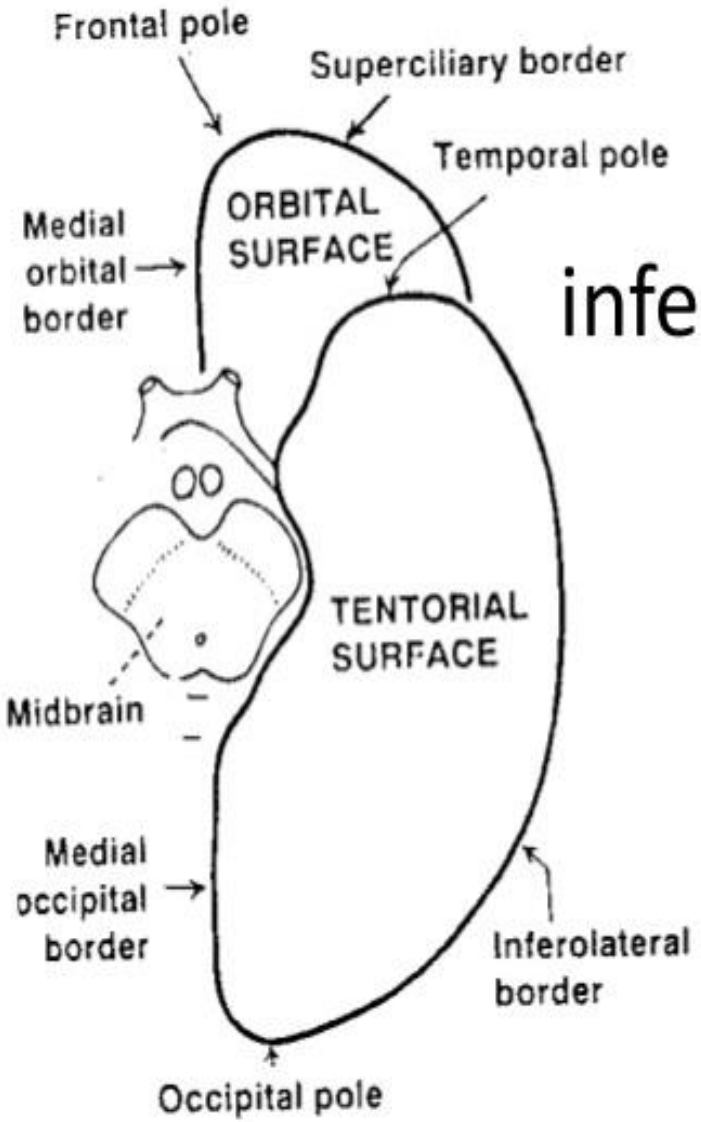
(c)

Medial surface



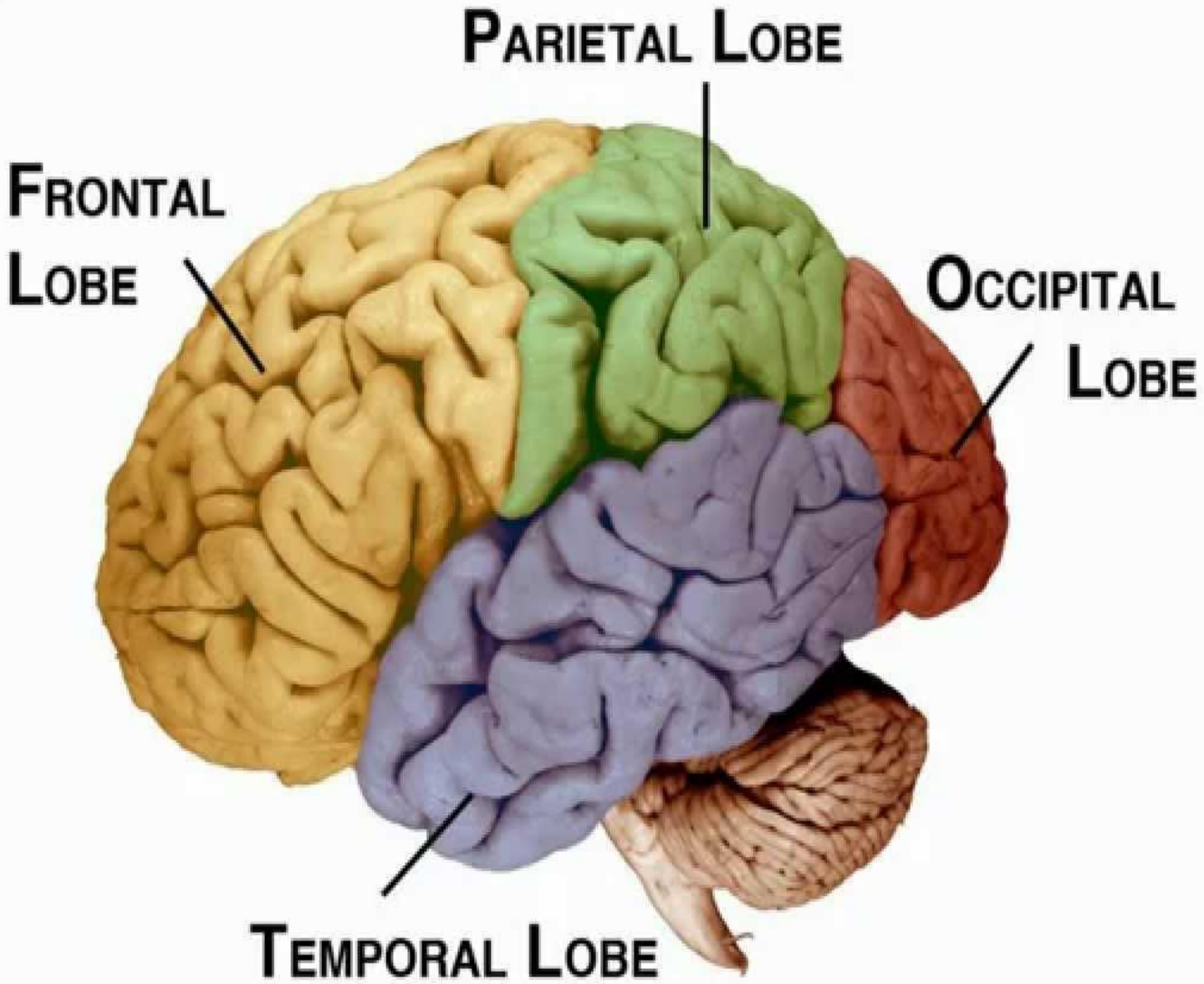


inferior surface



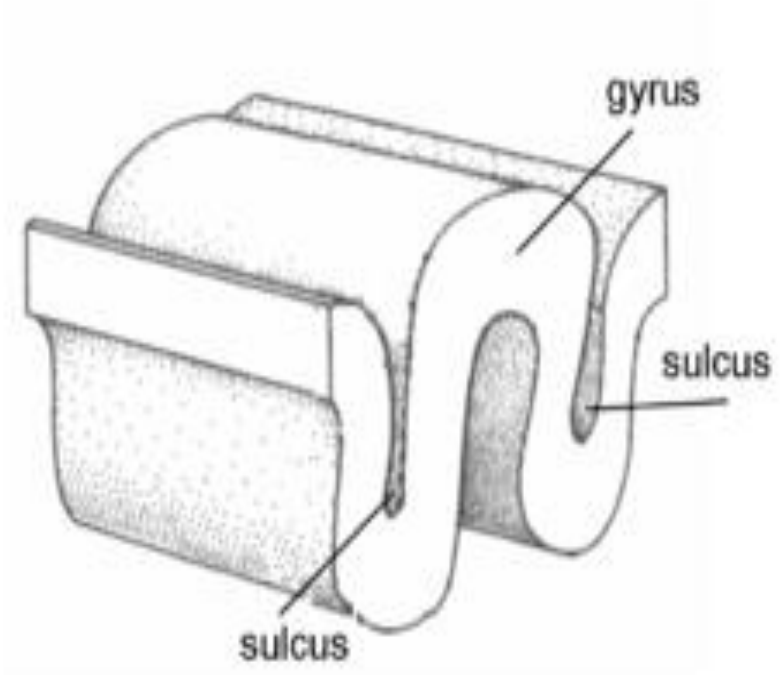
Lobes

- Frontal lobe
- Parietal lobe
- Occipital lobe
- Temporal lobe


PARIETAL LOBE
FRONTAL LOBE
OCCIPITAL LOBE
TEMPORAL LOBE

Gyri and sulcus

- **Gyrus, or its plural term gyri, is the term used for the prominent raise or outward fold in the brain.**
- **Sulcus, or sulci in plural, is the depression or the inward fold seen in the brain**
- **Folding of the cerebral cortex creates gyri and sulci which separate brain regions and increase the brain's surface area and cognitive ability.**


gyrus
sulcus
sulcus

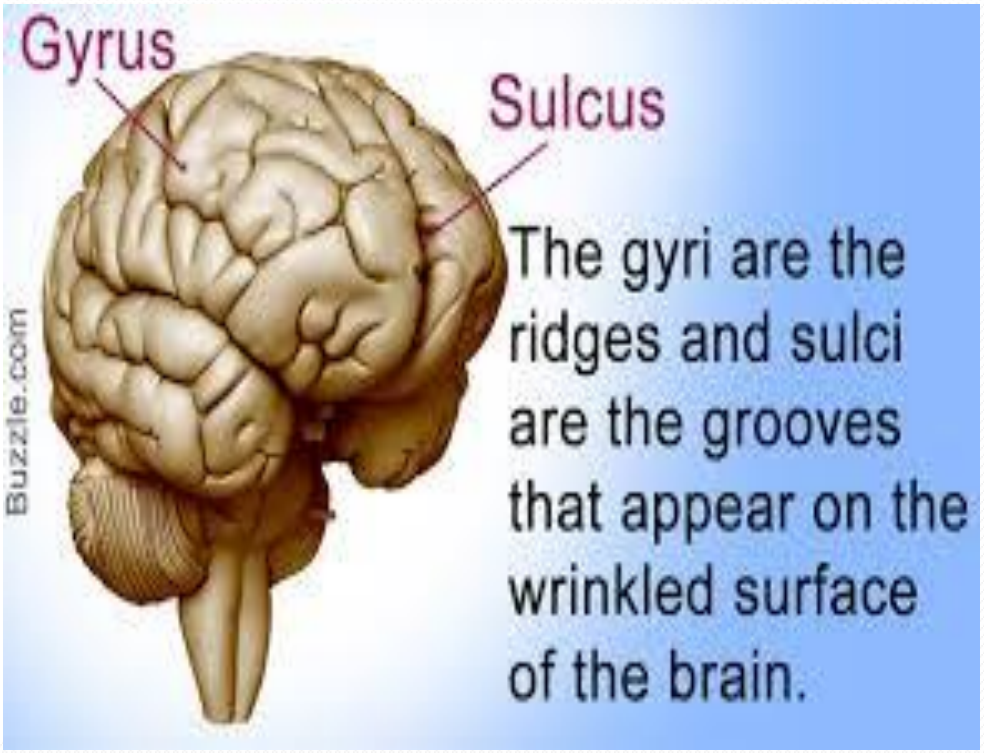
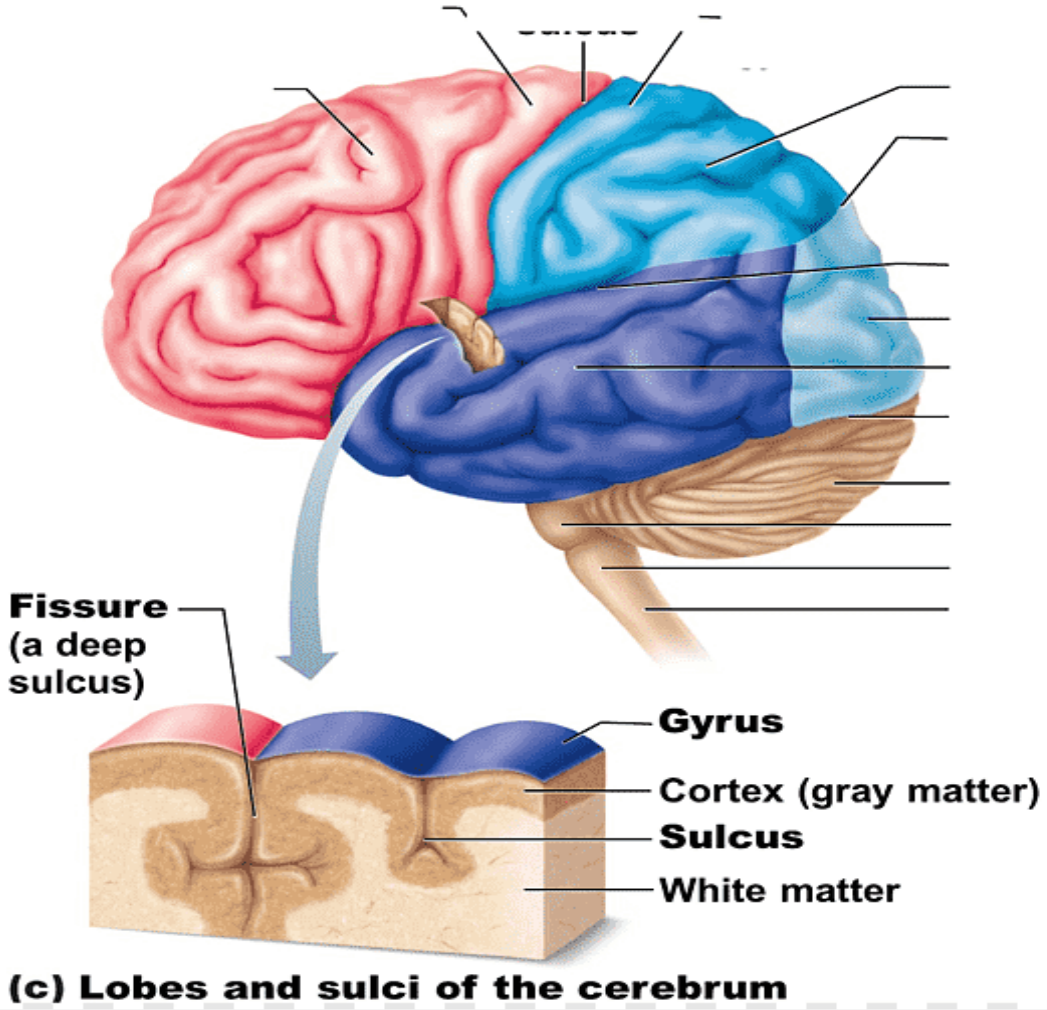
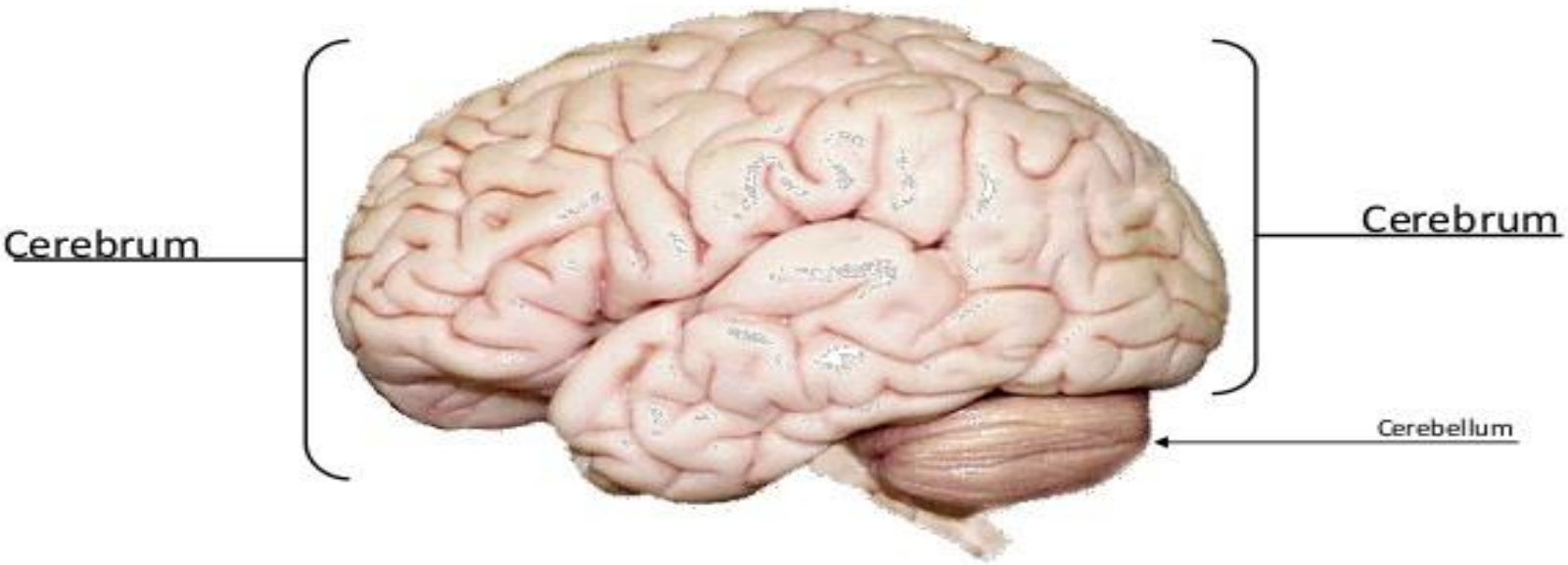

Gyrus
Sulcus
Buzzle.com
The gyri are the ridges and sulci are the grooves that appear on the wrinkled surface of the brain.

Figure 12.4c Lobes, sulci, and fissures of the cerebral hemispheres.

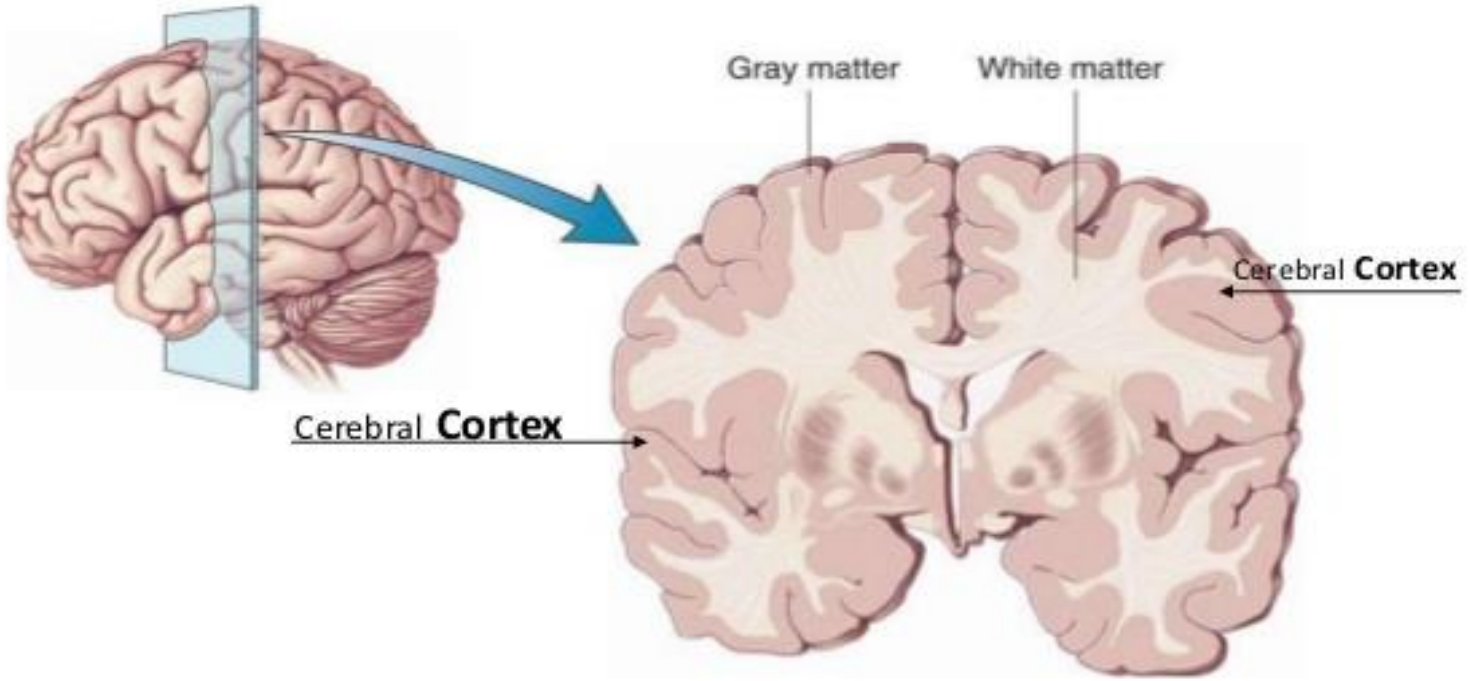


(c) Lobes and sulci of the cerebrum

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

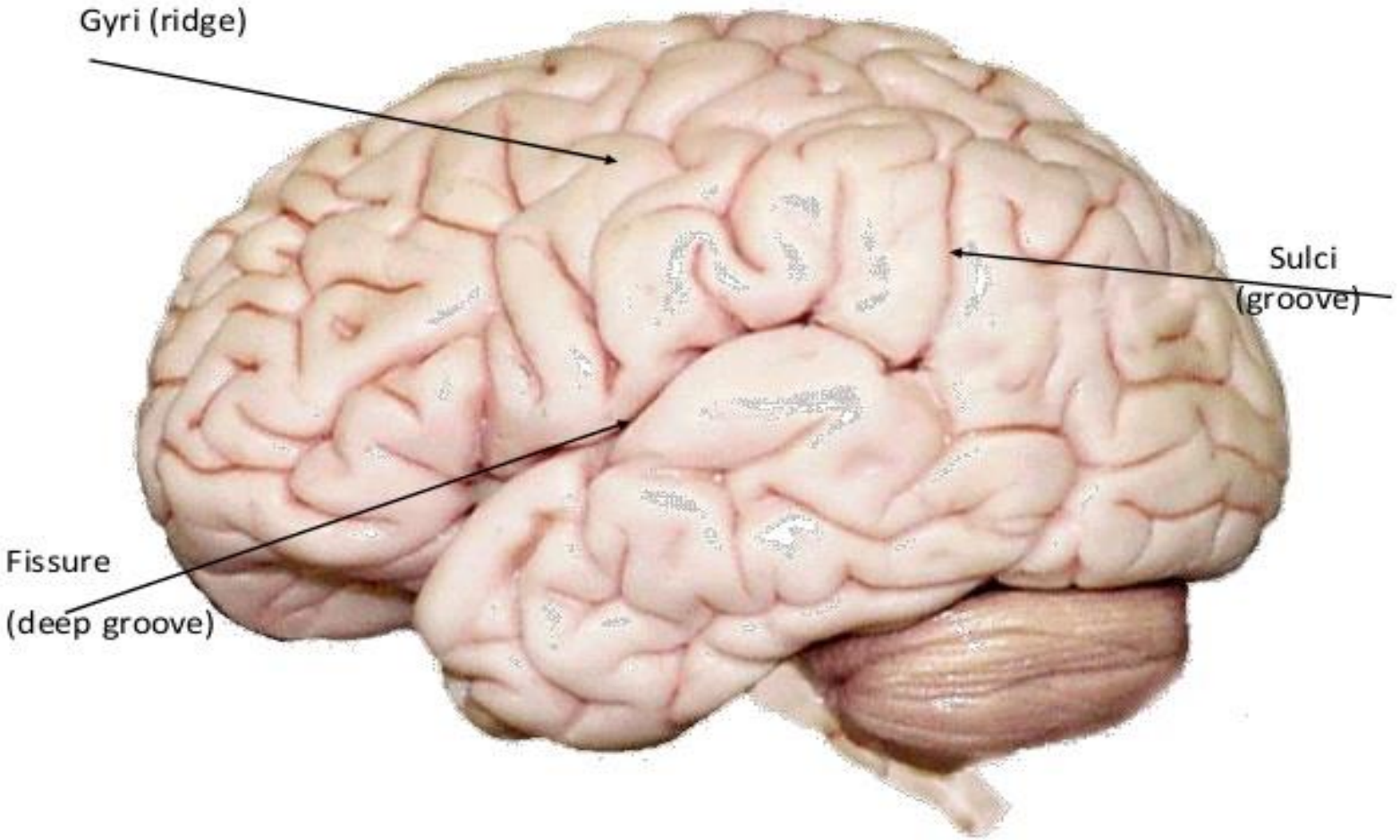


Cerebral Cortex - The outermost layer of gray matter making up the superficial aspect of the cerebrum.

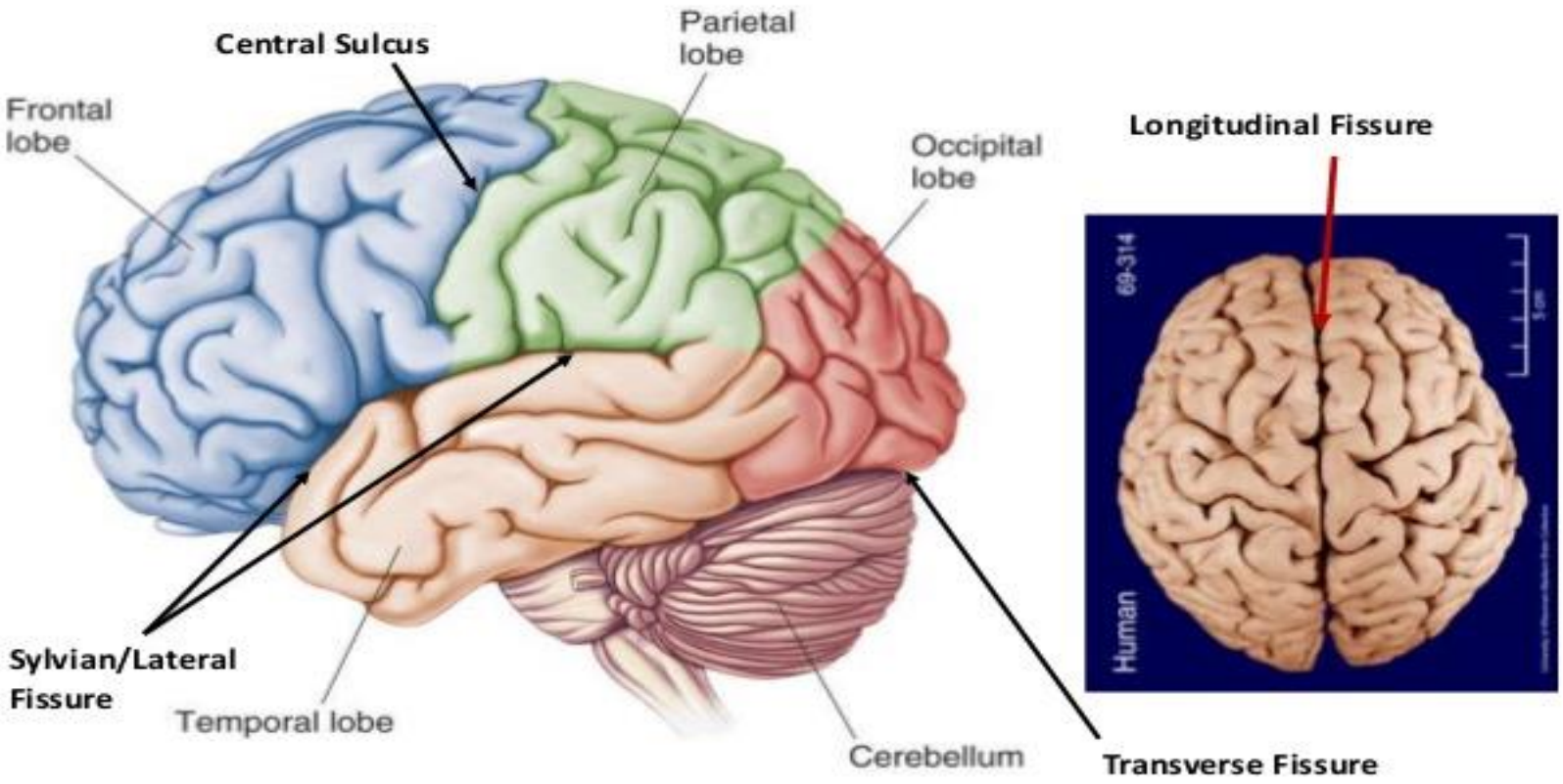


Cerebral Features:

- **Gyri** – Elevated ridges "winding" around the brain.
- **Sulci** – Small grooves dividing the gyri
  - **Central Sulcus** – Divides the Frontal Lobe from the Parietal Lobe
- **Fissures** – Deep grooves, generally dividing large regions/lobes of the brain
  - **Longitudinal Fissure** – Divides the two Cerebral Hemispheres
  - **Transverse Fissure** – Separates the Cerebrum from the Cerebellum
  - **Sylvian/Lateral Fissure** – Divides the Temporal Lobe from the Frontal and Parietal Lobes


Gyri (ridge)
Sulci
(groove)
Fissure
(deep groove)

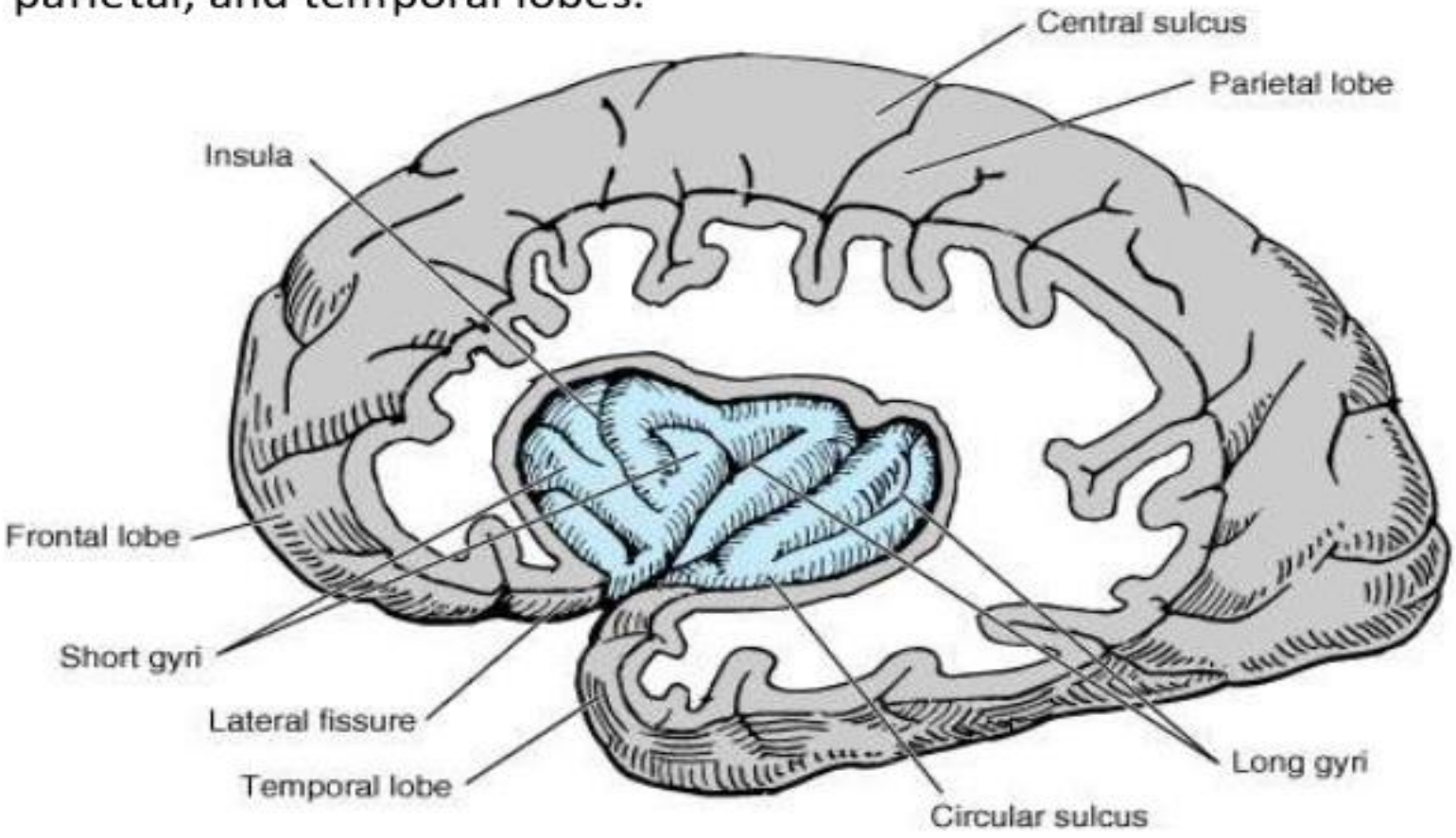
Specific Sulci/Fissures:



Main Sulci & Fissures

- **The surfaces of the cerebral hemispheres contain many fissures and sulci that separate the frontal, parietal, occipital, and temporal lobes from each other and the insula.**
- **The central sulcus (the fissure of Rolando) arises about the middle of the hemisphere, and separates the frontal lobe from the parietal lobe.**
- **The parieto-occipital fissure separates the parietal lobe from the occipital lobe.**
- **The lateral cerebral fissure (Sylvian fissure) separates the temporal lobe from the frontal and parietal lobes.**

The **insula**, a portion of cortex that did not grow much during development, lies deep within the fissure The **circular sulcus** surrounds the insula and separates it from the adjacent frontal, parietal, and temporal lobes.



INSULAR LOBE

- Lies deep in floor of sylvian fissure, overlapped by frontal, temporal and parietal.
- The **insular lobe** is thought to be involved in sensory and motor visceral functions as well as taste perception.

INSULAR LOBE

Sulci:

- Central sulcus.
- Short insular sulcus.
- Precentral sulcus.

Gyri:

- Anterior insular lobule.
- Posterior insular lobule.

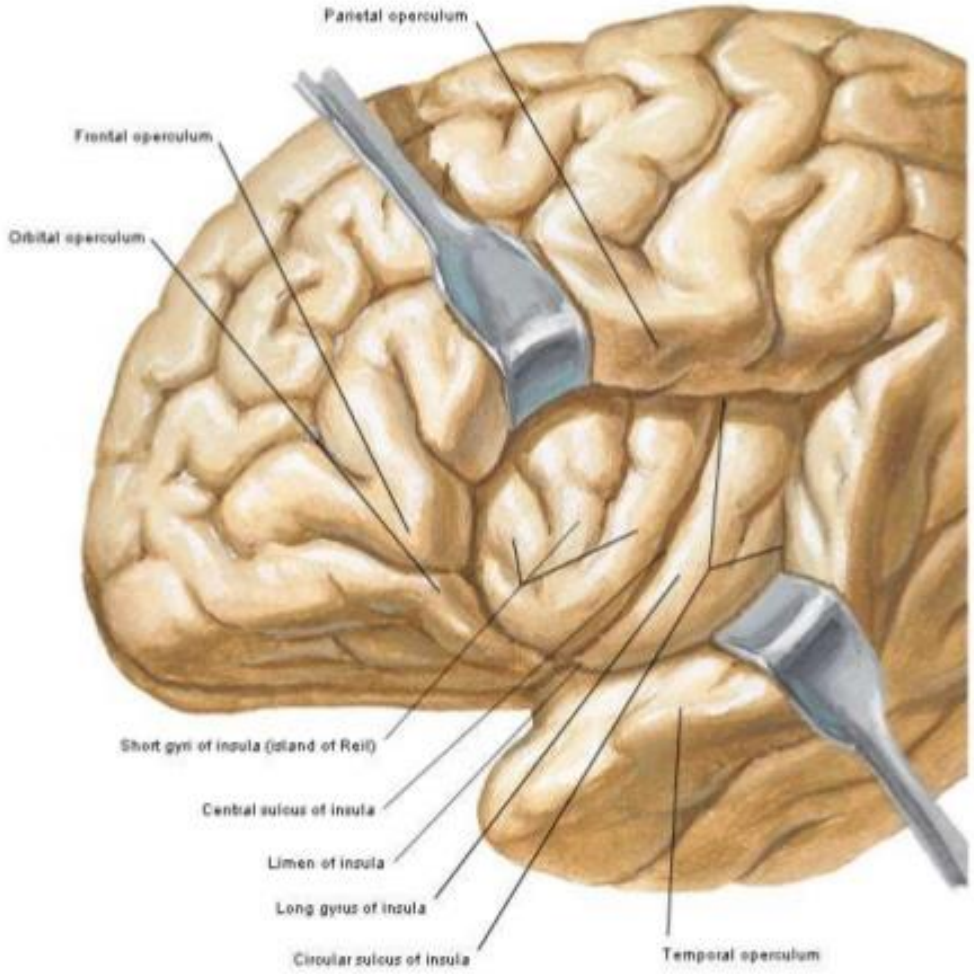
INSULAR LOBE

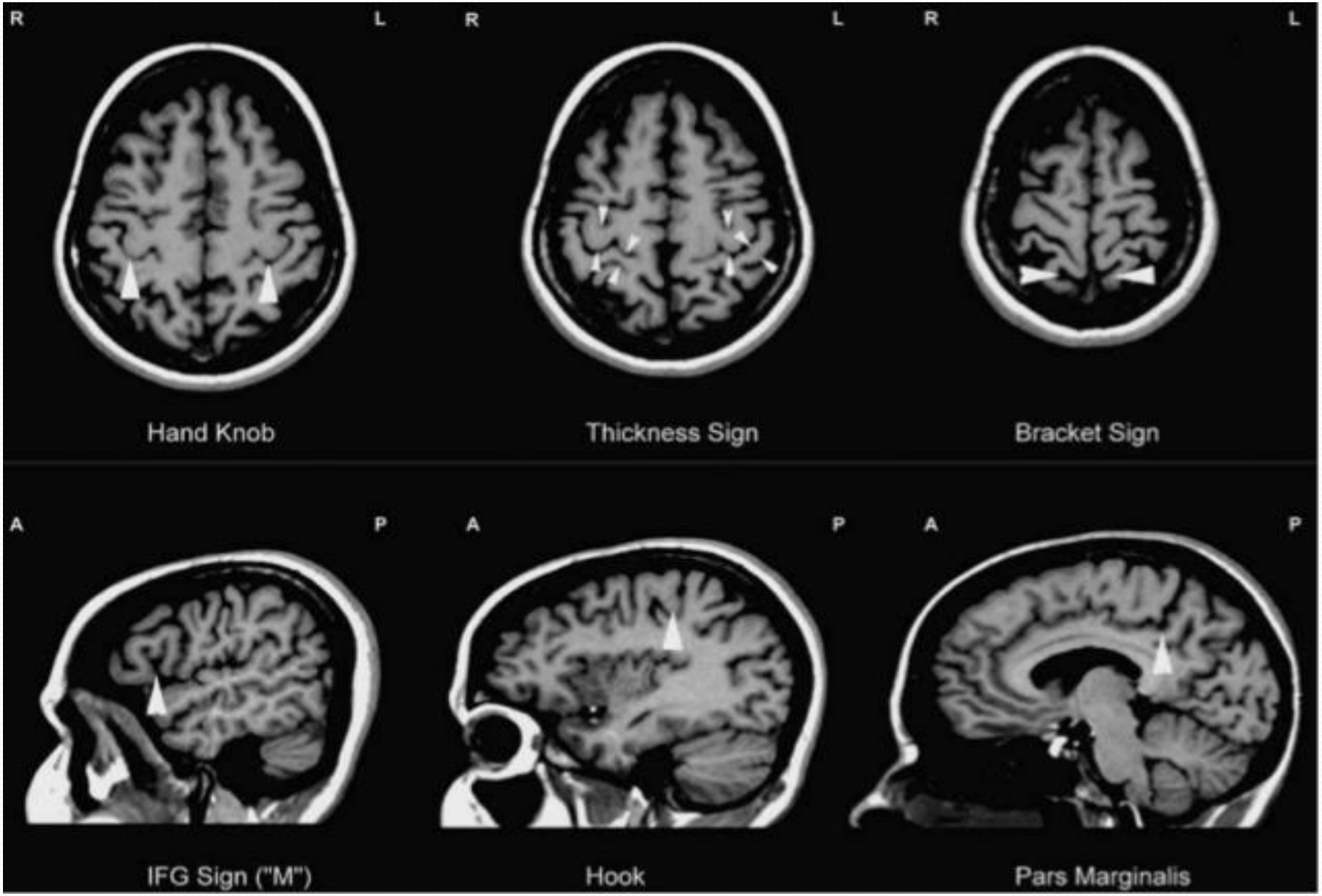
Anterior insular lobule (short insular gyri):

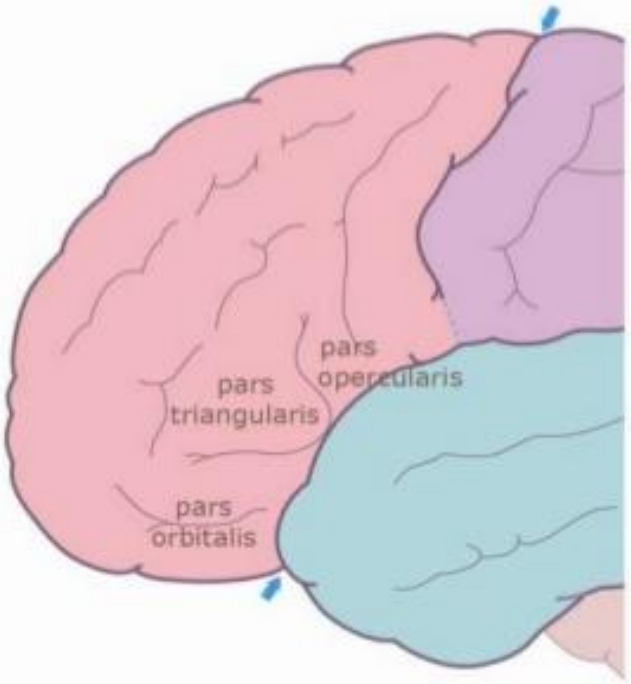
- Anterior short insular gyrus.
- Middle short insular gyrus.
- Posterior short insular gyrus.

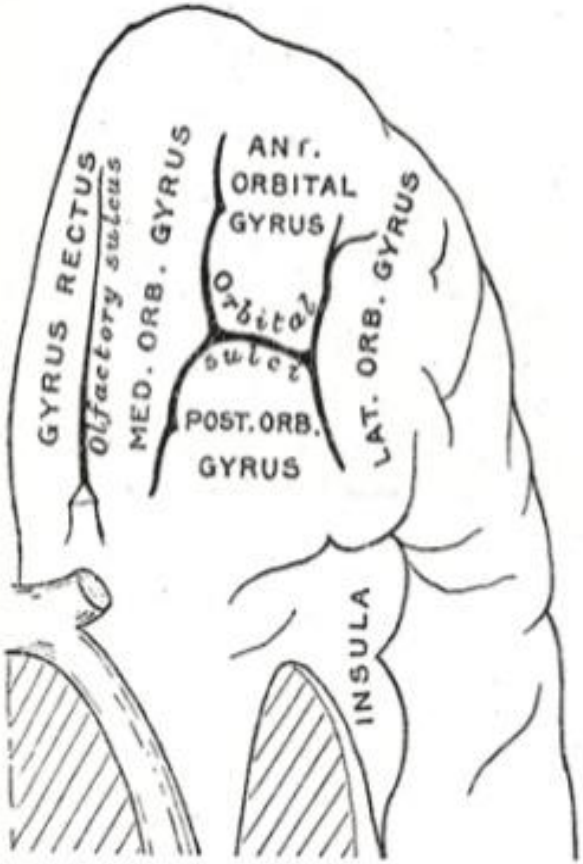
Posterior insular lobule (long insular gyri):

- Anterior long insular gyrus.
- Posterior long insular gyrus.


Parietal operculum
Frontal operculum
Orbital operculum
Short gyri of insula (island of Reil)
Central sulcus of insula
Limen of insula
Long gyrus of insula
Circular sulcus of insula
Temporal operculum


R
L
R
L
R
L
Hand Knob
Thickness Sign
Bracket Sign
A
P
A
P
A
P
IFG Sign ("M")
Hook
Pars Marginalis

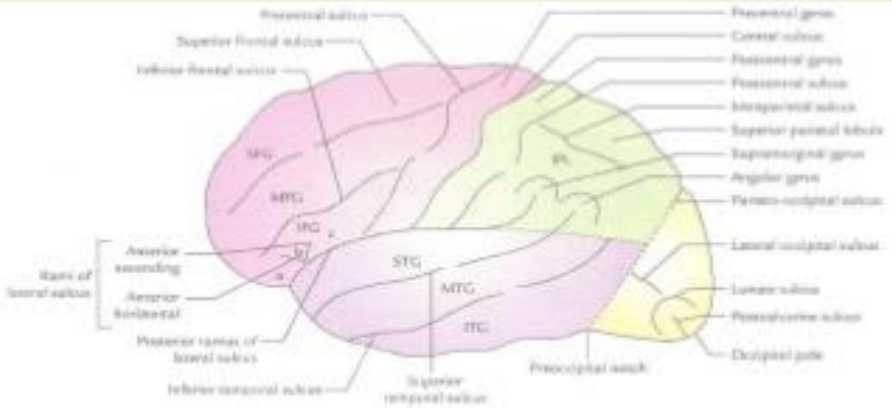

pars
opercularis
pars
triangularis
pars
orbitalis

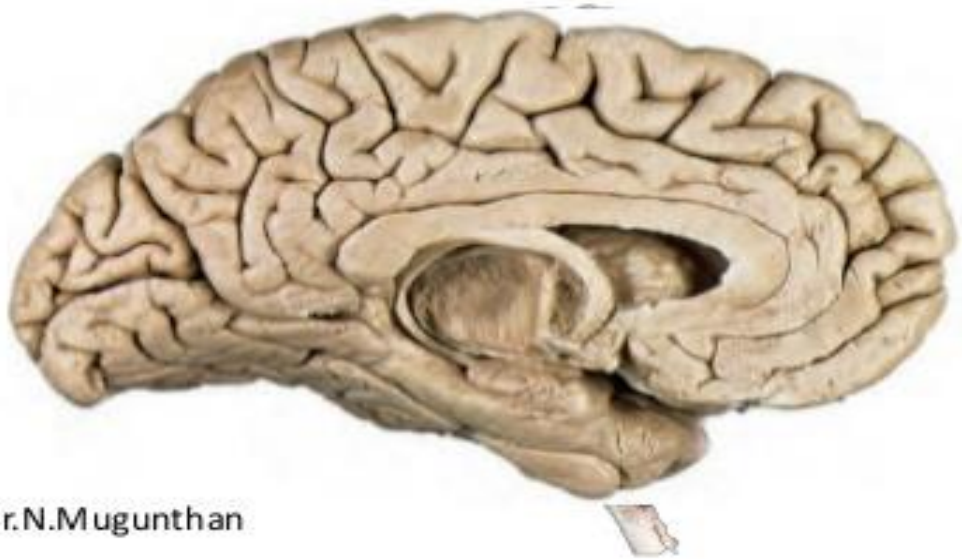

GYRUS RECTUS
Olfactory sulcus
MED. ORB. GYRUS
ANr.
ORBITAL
GYRUS
Orbital
sulci
POST. ORB.
GYRUS
LAT. ORB. GYRUS
INSULA

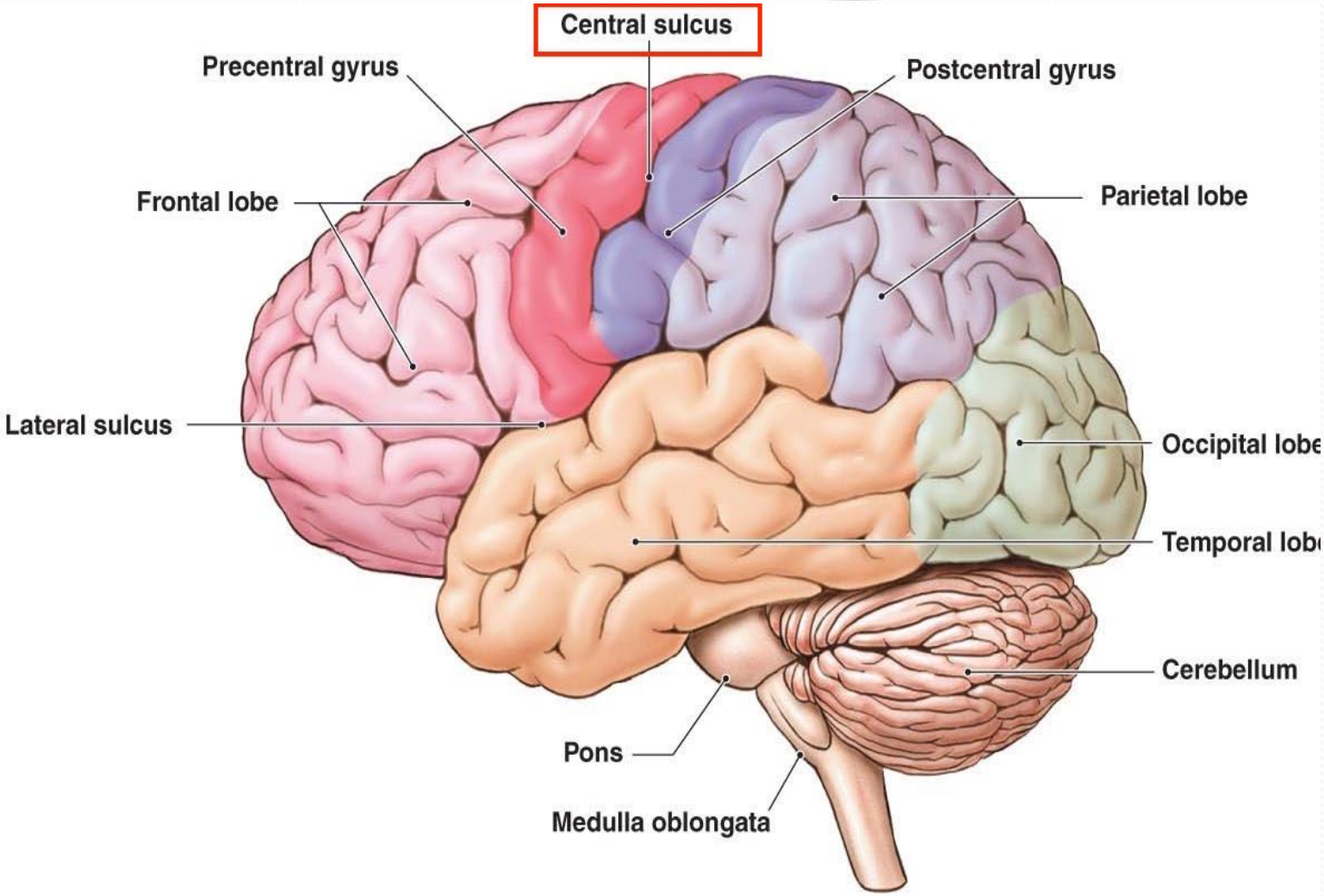
Sulci & Gyri

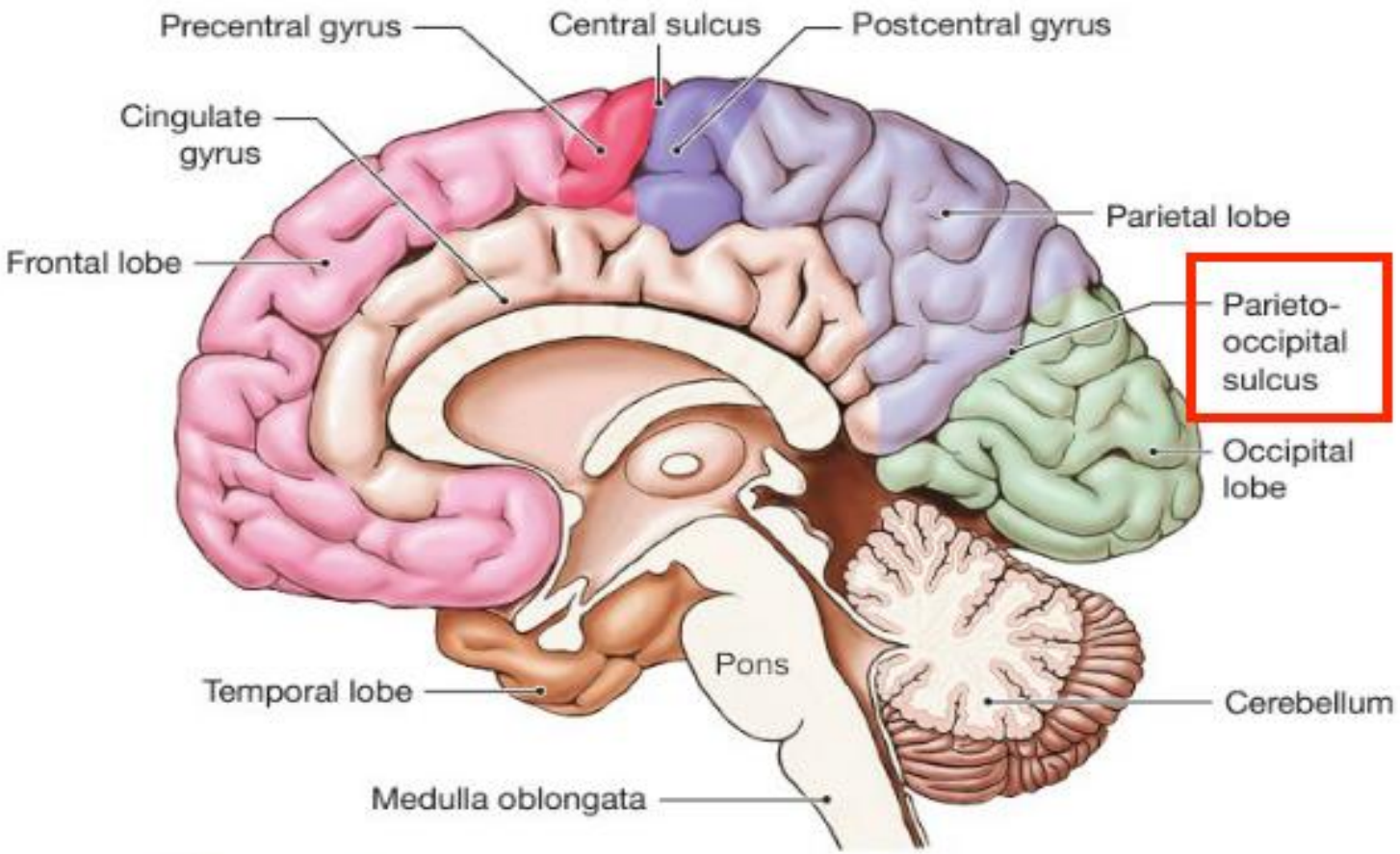
Main cerebral sulci:

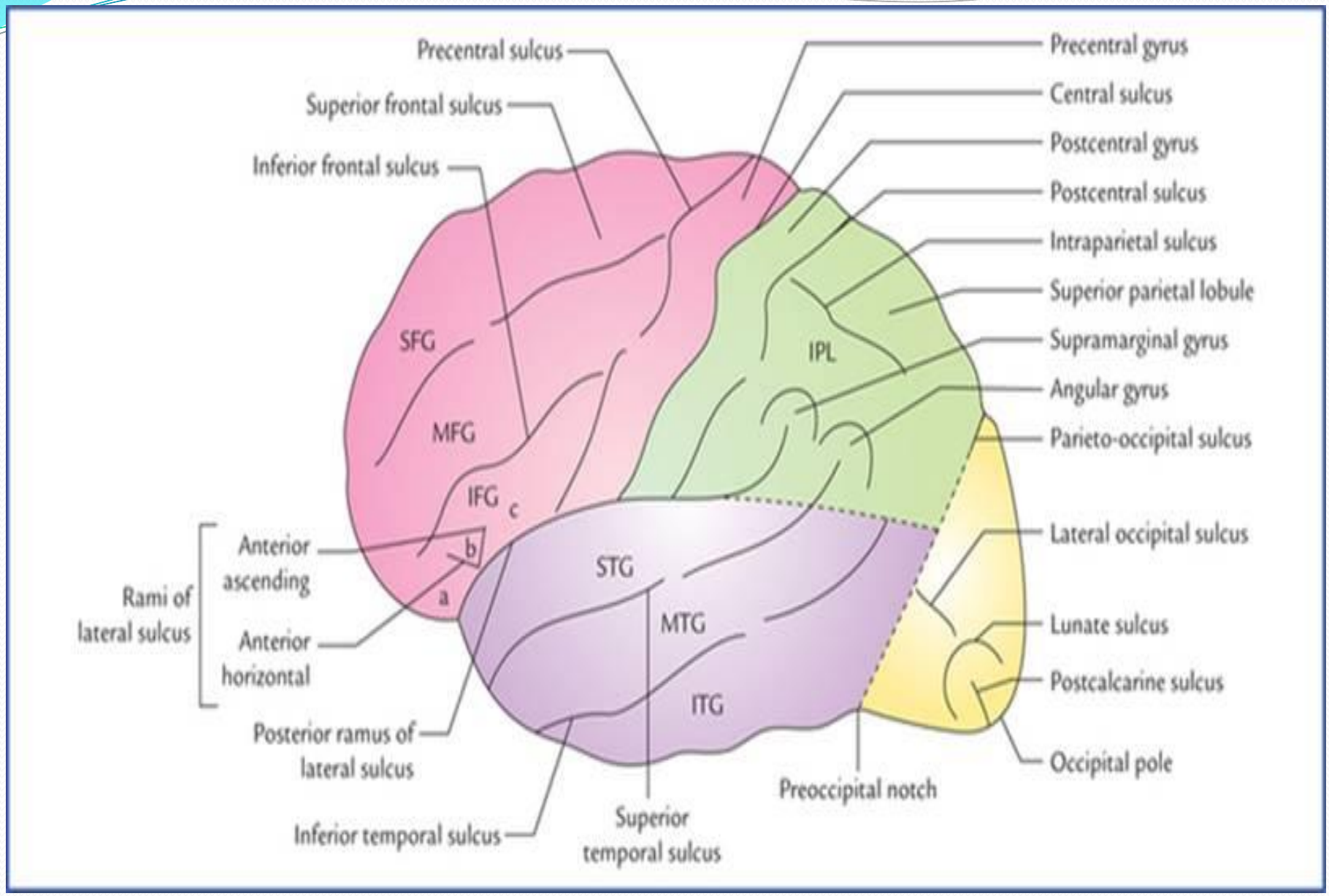
1. Lateral sulcus (Sylvius)
   - Stem & 3 rami (posterior, ascending & anterior)
2. Central sulcus (Rolando)
3. Parieto-occipital sulcus
4. Calcarine sulcus



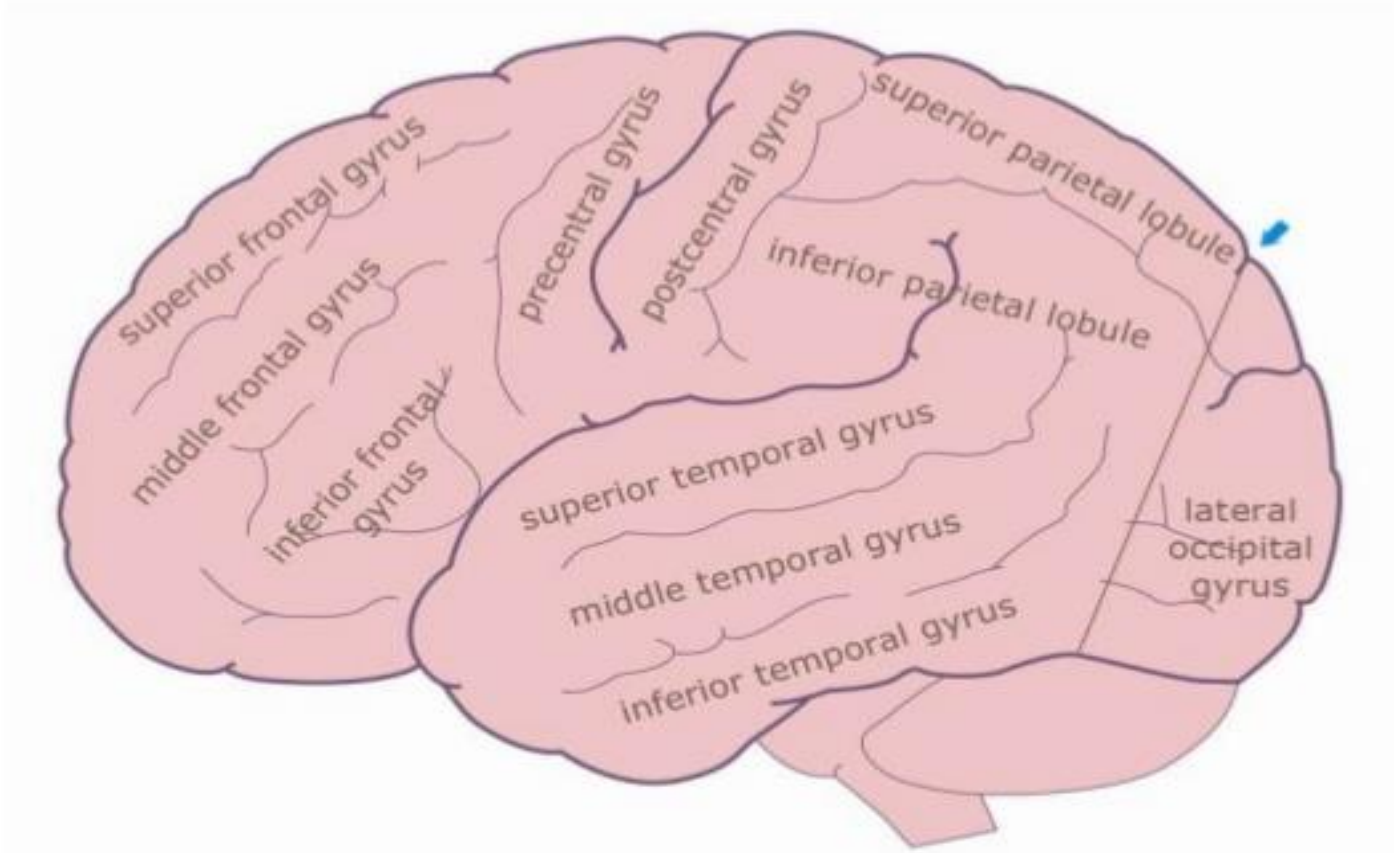





Precentral gyrus
Central sulcus
Postcentral gyrus
Cingulate gyrus
Parietal lobe
Frontal lobe
Parieto-occipital sulcus
Occipital lobe
Pons
Temporal lobe
Cerebellum
Medulla oblongata


Precentral sulcus
Superior frontal sulcus
Inferior frontal sulcus
Precentral gyrus
Central sulcus
Postcentral gyrus
Postcentral sulcus
Intraparietal sulcus
Superior parietal lobule
Supramarginal gyrus
Angular gyrus
Parieto-occipital sulcus
SFG
MFG
IFG
c
IPL
Rami of lateral sulcus
Anterior ascending
Anterior horizontal
b
a
STG
MTG
ITG
Lateral occipital sulcus
Lunate sulcus
Postcalcarine sulcus
Occipital pole
Posterior ramus of lateral sulcus
Inferior temporal sulcus
Superior temporal sulcus
Preoccipital notch

LATERAL SURFACE OF BRAIN



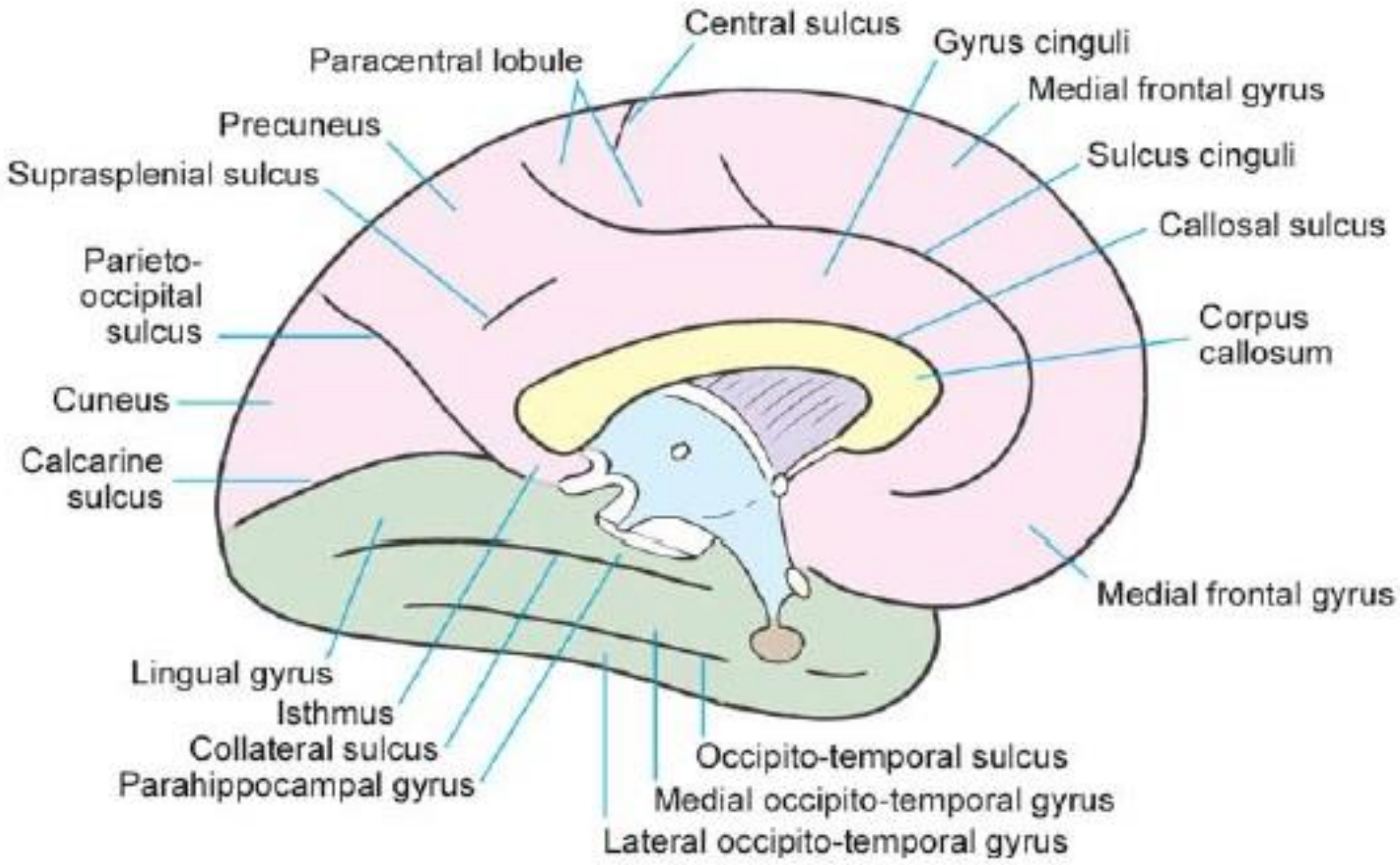
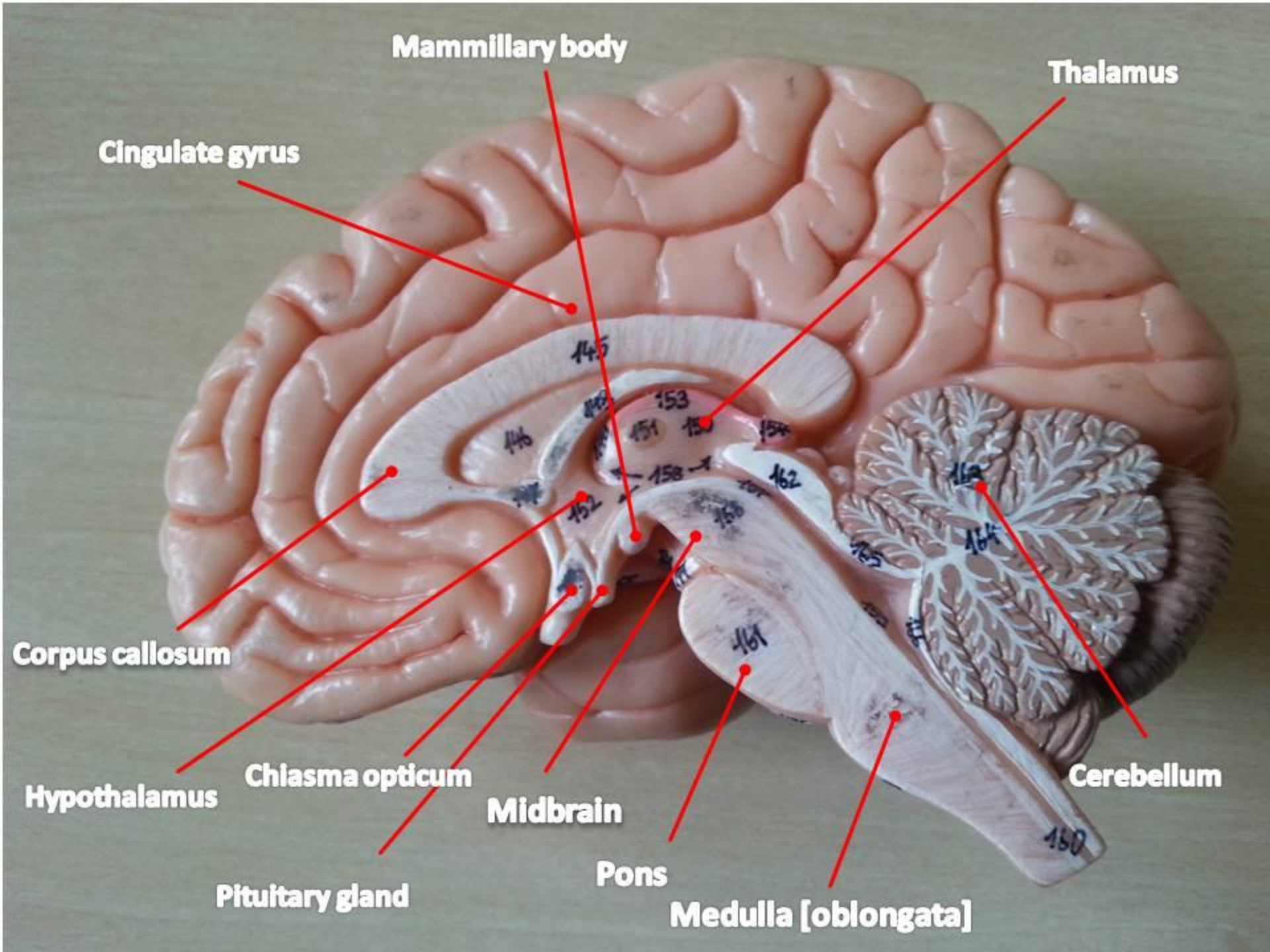
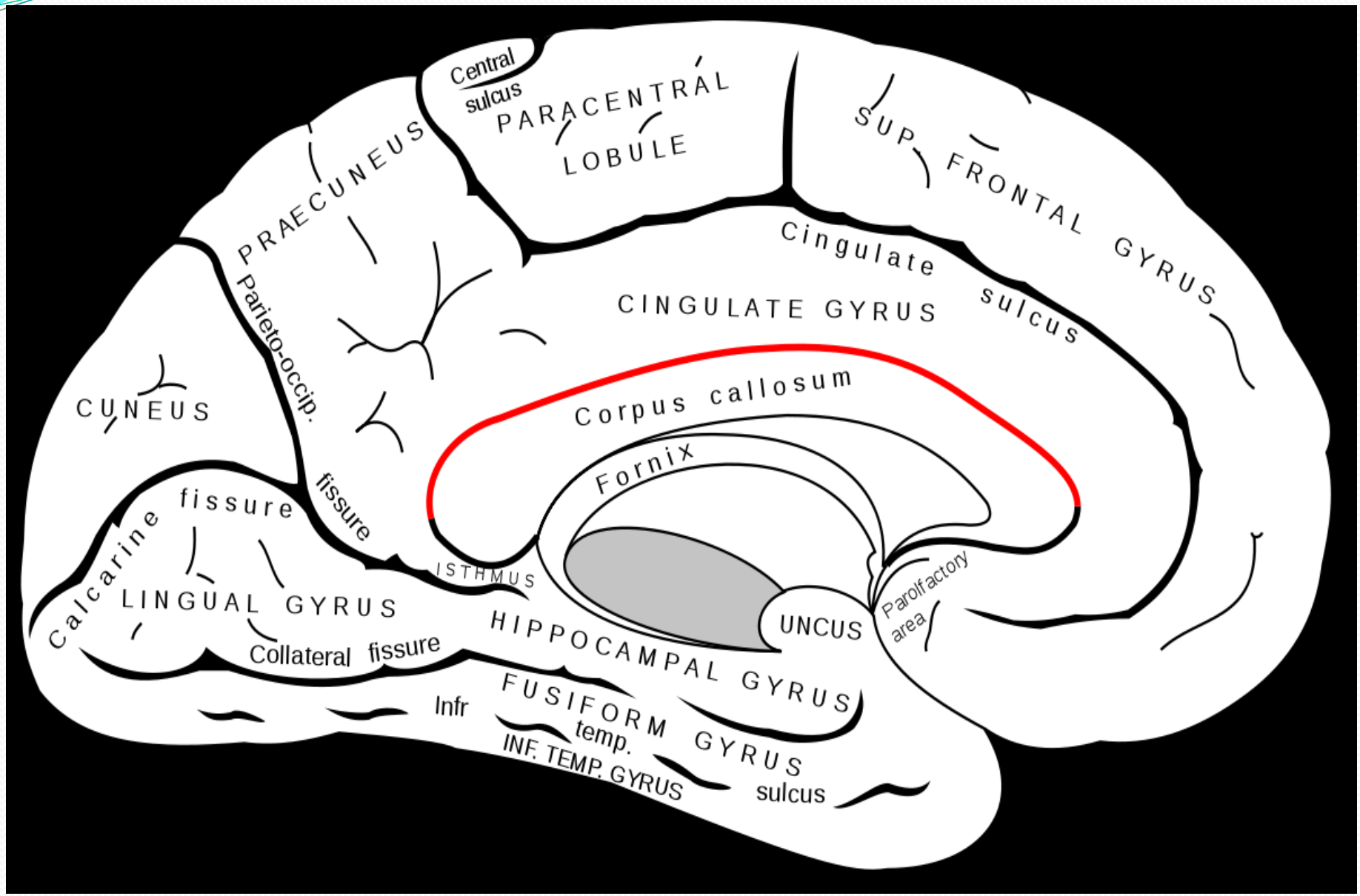


Fig. 8.5. Simplified presentation of sulci and gyri on the medial aspect of the cerebral hemisphere. The medial surface (pink) and the tentorial surface (green) are seen. The corpus callosum and some other structures connecting the two hemispheres have been cut across.


Mammillary body
Thalamus
Cingulate gyrus
Corpus callosum
Hypothalamus
Chiasma opticum
Midbrain
Pituitary gland
Pons
Medulla [oblongata]
Cerebellum


Central sulcus
PARACENTRAL LOBULE
SUP. FRONTAL GYRUS
PRAECUNEUS
Cingulate sulcus
CINGULATE GYRUS
Parieto-occip. fissure
CUNEUS
Corpus callosum
Fornix
Calcarine fissure
ISTHMUS
LINGUAL GYRUS
UNCUS
Parolfactory area
HIPPOCAMPAL GYRUS
Collateral fissure
FUSIFORM GYRUS
Infr temp.
INF. TEMP. GYRUS
sulcus


THANKS