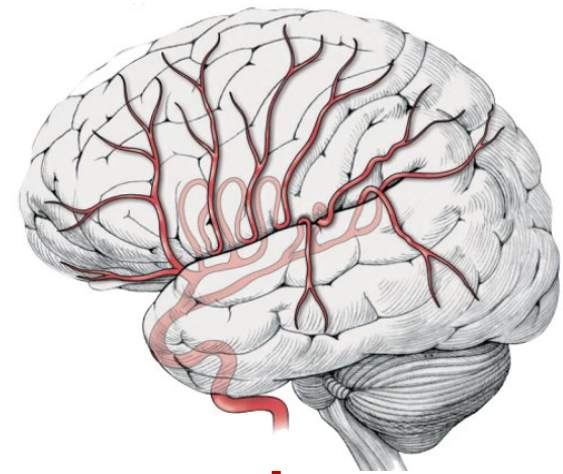


Lecture:



Anatomy of Cerebral Hemispheres - I

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الرجاء تحويل الجوال إلى وضع
الصامت مع الشكر



Morphological Subdivisions of the Brain

- It contains 86-100 billion neurons.
- The adult brain weight is about 1300 – 1500 g .
- The brain reaches full size about 18 year age.
- It is formed of:
 - Cerebrum:
 - Is the largest part of the brain that located above the tentorium cerebelli and orbit.
 - It consists of two cerebral hemispheres connected together by the corpus callosum.

2. Cerebellum:

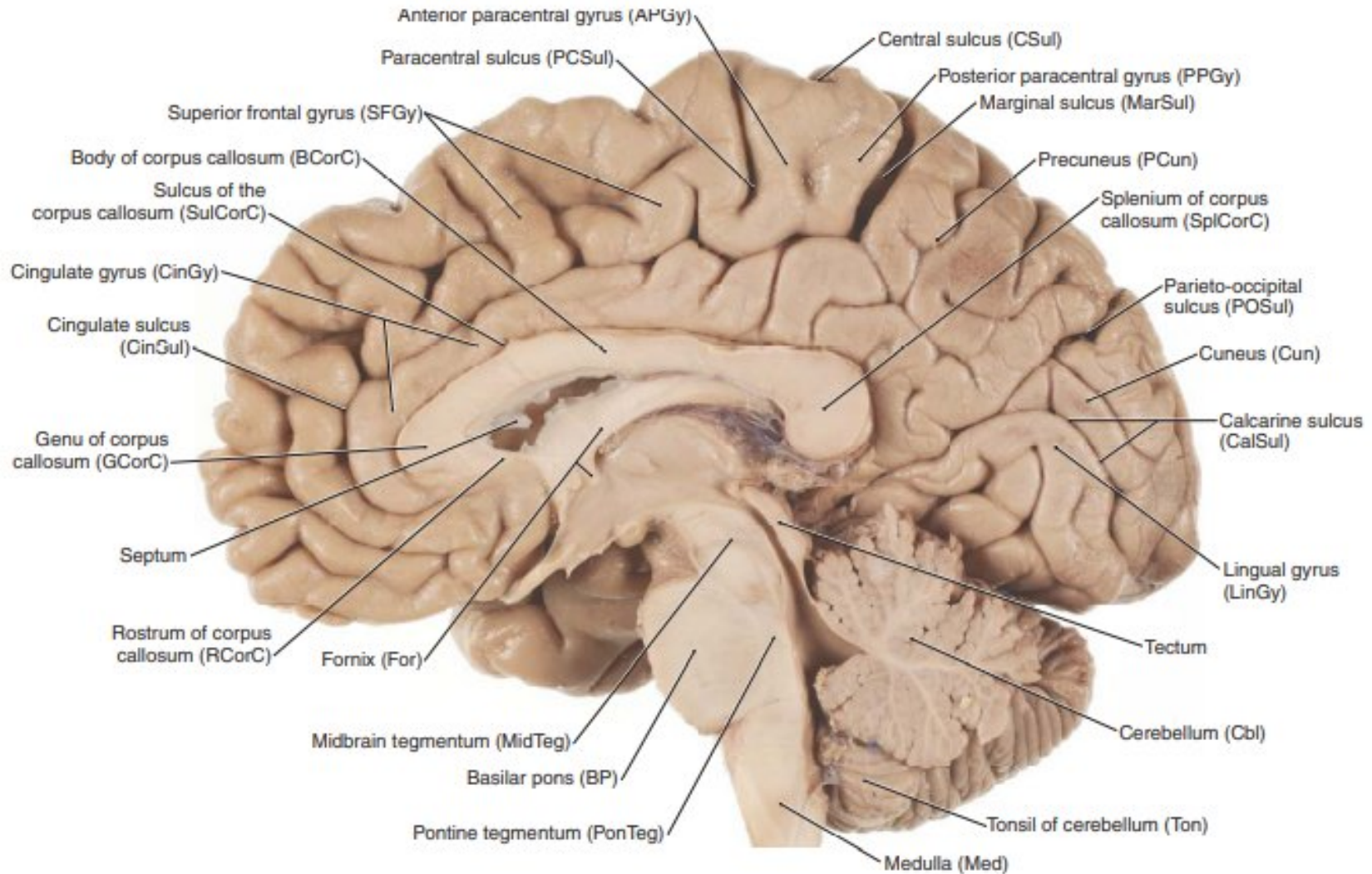
- Is a large mass of brain tissue which located in the posterior cranial fossa below the tentorium cerebelli and behind brain stem.

3. Diencephalon:

- Is located between the two cerebral hemispheres and
above the midbrain.

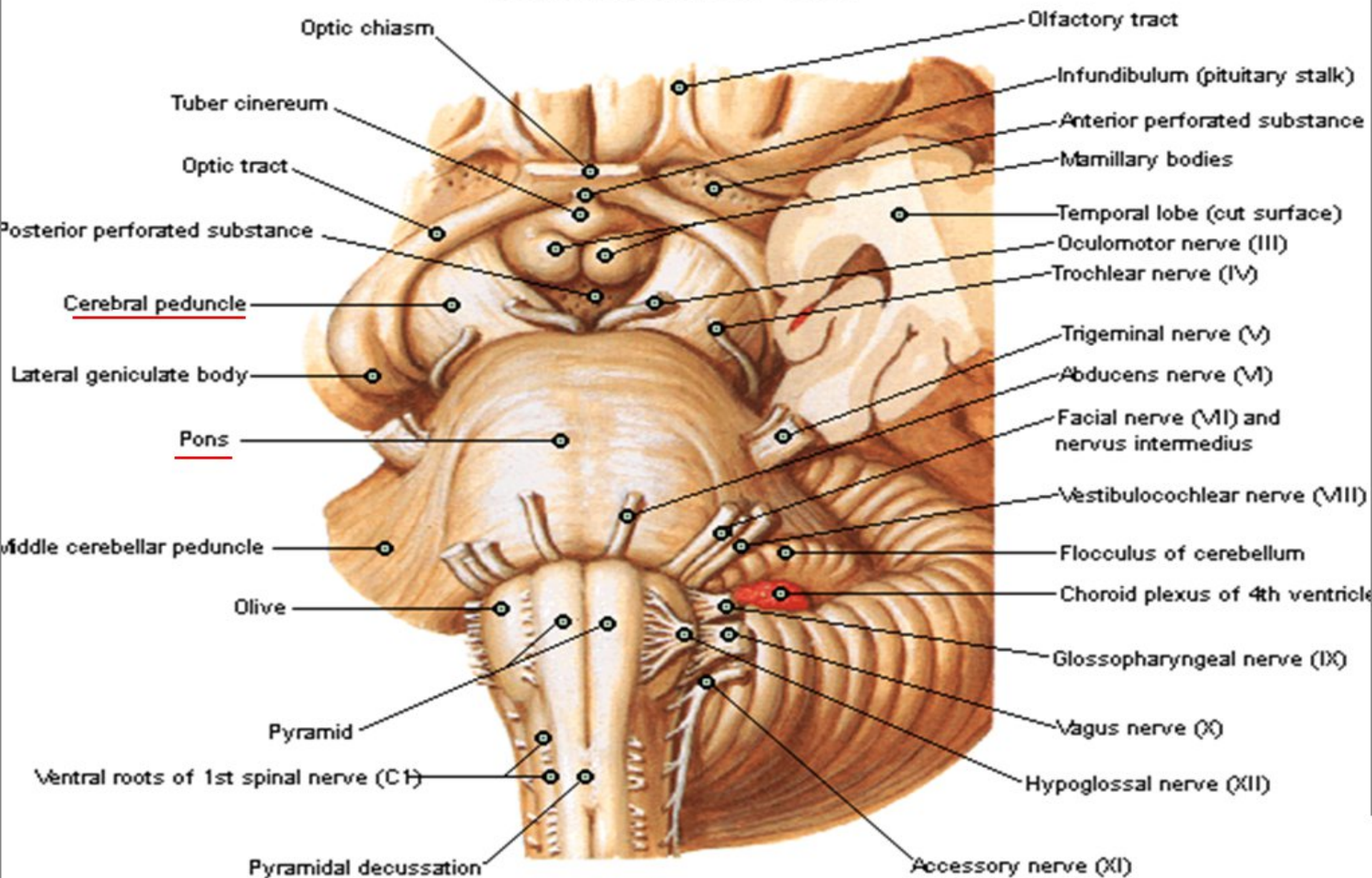
4. Brain Stem:

- Is the part of brain located below the diencephalon and in the front of the cerebellum.
- Is connected the cerebellum by three pairs of cerebellar
peduncles.
- Connects the two cerebral hemispheres with the
spinal
cord.
- It consists of three parts, from below upwards:
 - a. Medulla oblongata
 - b. Pons
 - c. Midbrain



Brainstem

Anterioinferior View





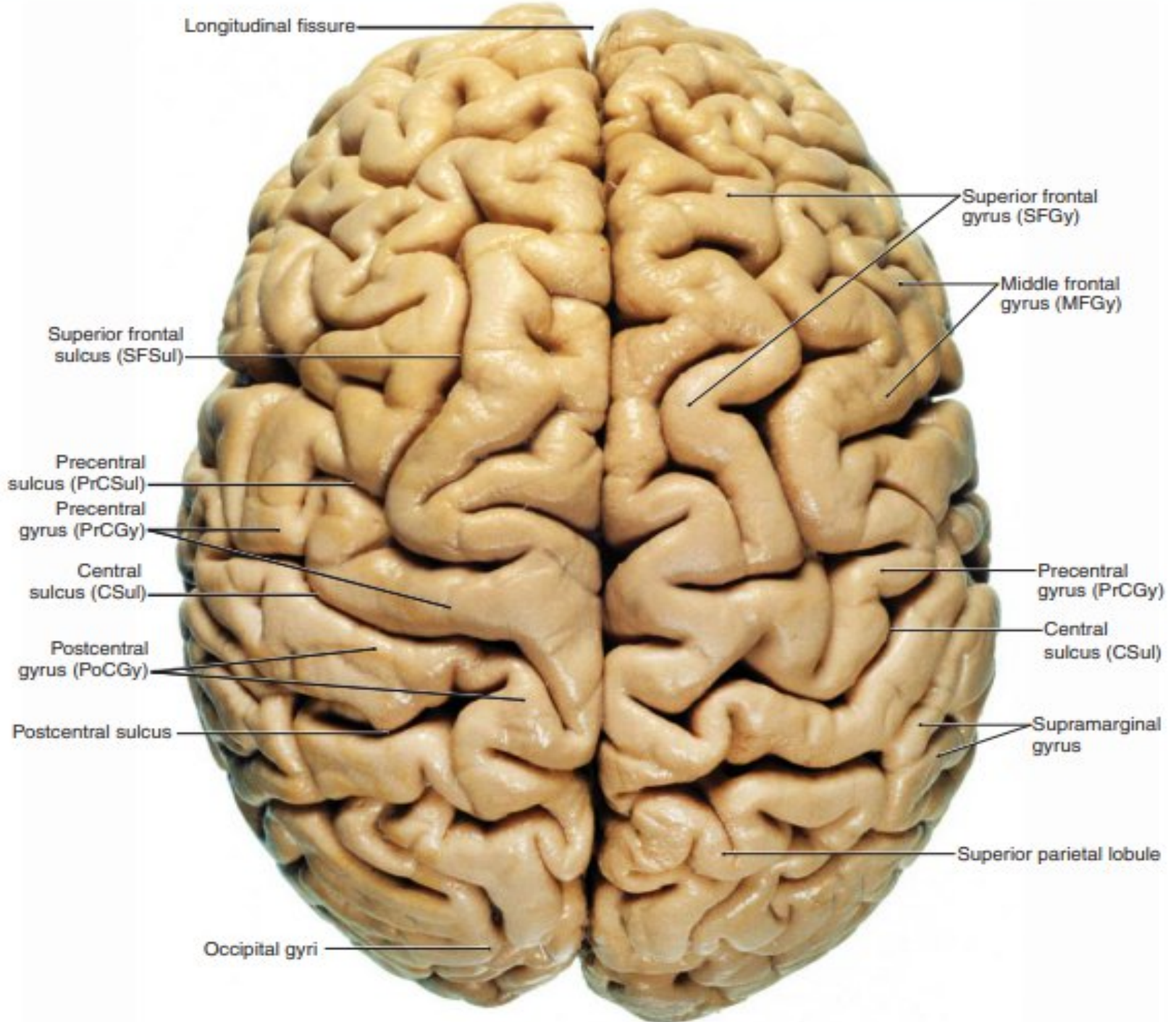
Site: occupies most of cranial cavity and it
The Cerebrum (Cerebral Hemisphere)

is the

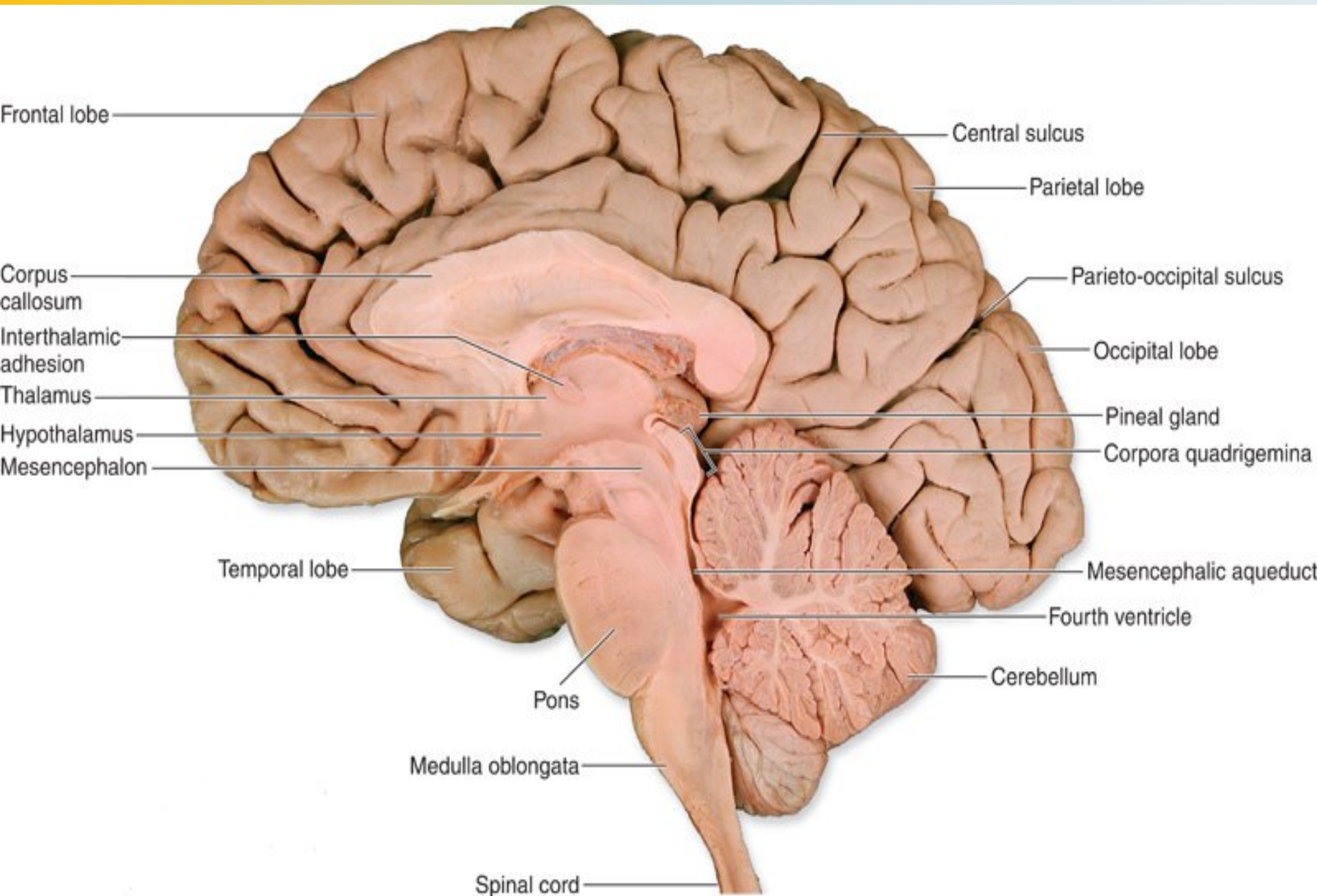
largest part of the brain.

The cerebrum is divided into right and left cerebral hemispheres and separated by **the**

longitudinal cerebral fissure and the falx cerebri.



The Cerebrum (Cerebral Hemisphere)



Cerebral Hemispheres

- Contains 20 billion nerve cells.
- Consists of the **Neocortex(90%)** and the **Allocortex(10%)**.
 - ✓ **A. Neocortex(Isocortex)**:the large area of the cerebral cortex about 90%Contains six-layered cortex.
 - ✓ **B. Allocortex(Heterocortex)**:smaller area of cortex about 10 %. Contains 3 layers and includes:
 1. **Archicortex**:includes the hippocampal formation (hippocampus and dentate gyrus).
 2. **Paleocortex**:includes the olfactory cortex.
 3. **Periallocortex**:transitional zone between the

The Layers of the Cerebral Cortex

1. Molecular layer:

- ✓ The most outer or superficial layer deep to the pia mater.

2. External granular layer:

- ✓ It contains a large number of **small pyramidal cells**.

3. External pyramidal layer:

- ✓ Gives rise to **association and commissural fibers**.

4. Internal granular layer:

- ✓ Receives **thalamocortical fibers** from the thalamic nuclei.
- ✓ Receives **visual input** from the lateral geniculate body.

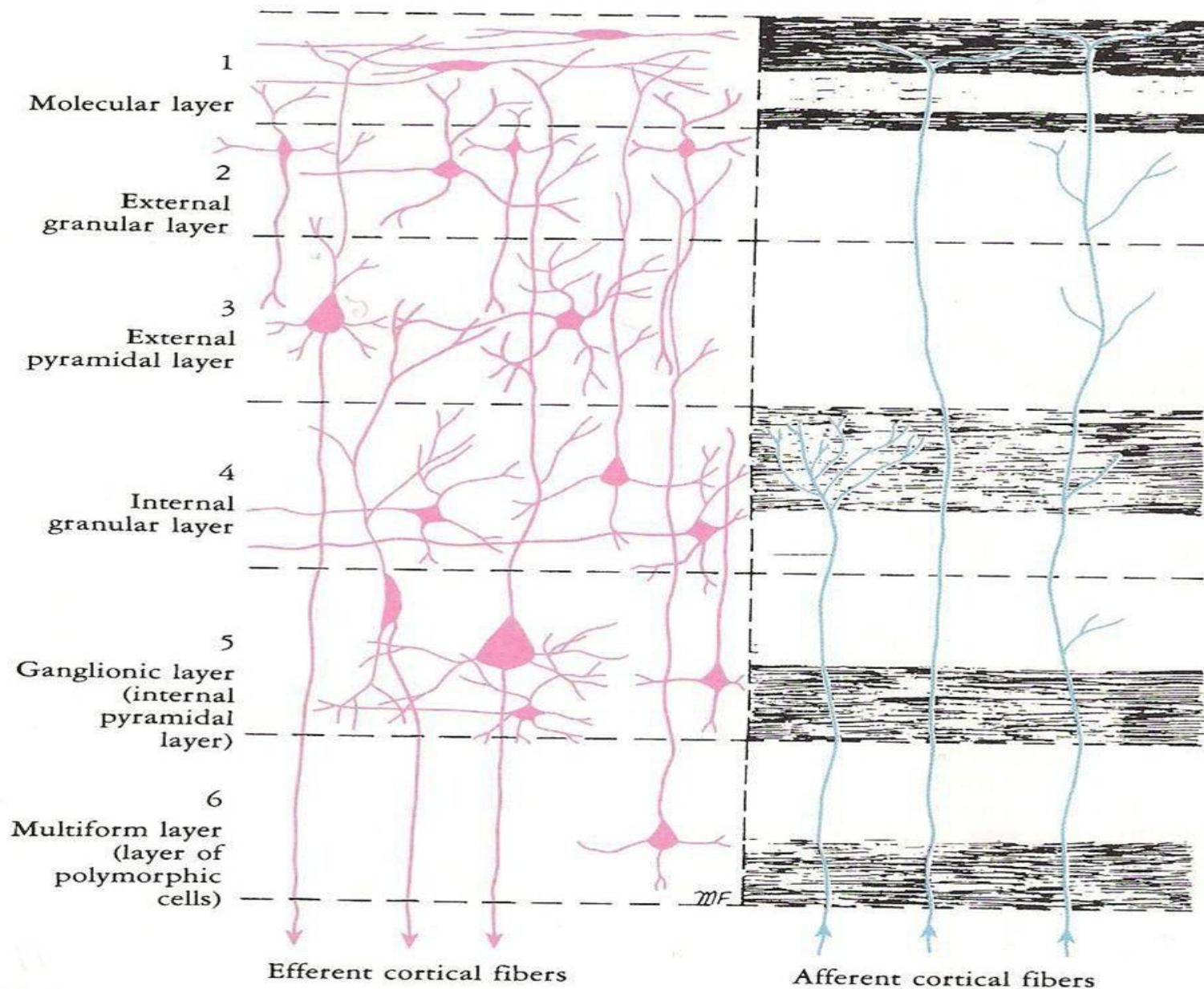
5. Internal pyramidal layer:

- ✓ Gives rise to **corticobulbar, corticospinal, and corticostriatal fibers.**
- ✓ Contains the **giant cells of Betz** that are found only in the motor cortex (area 4) of the precentral gyrus and the anterior paracentral lobule.

6. Multiform layer:

- ✓ The deepest layer of the cortex.
- ✓ It gives rise to **projection, commissural, and association fibers.**
- ✓ The major source of **corticothalamic fibers.**

The Layers of the Cerebral Cortex



Betz cells

The Functions of the Cerebral Cortex

- Motor Functions.
- Sensory Functions.
- Higher cortical functions.

External Feature of the Cerebrum

Each cerebral hemisphere has:

Three surfaces.

Three poles.

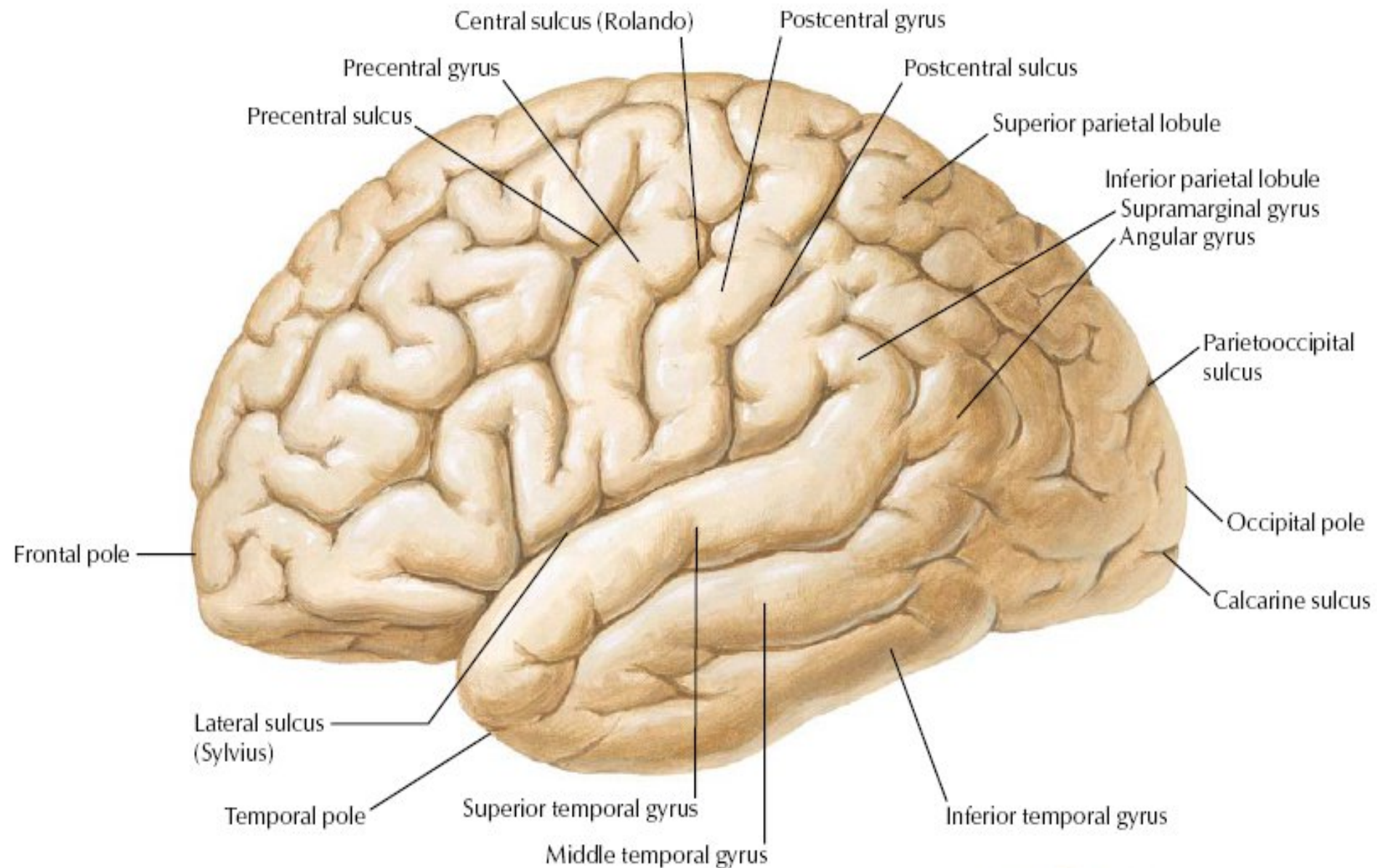
Five borders.

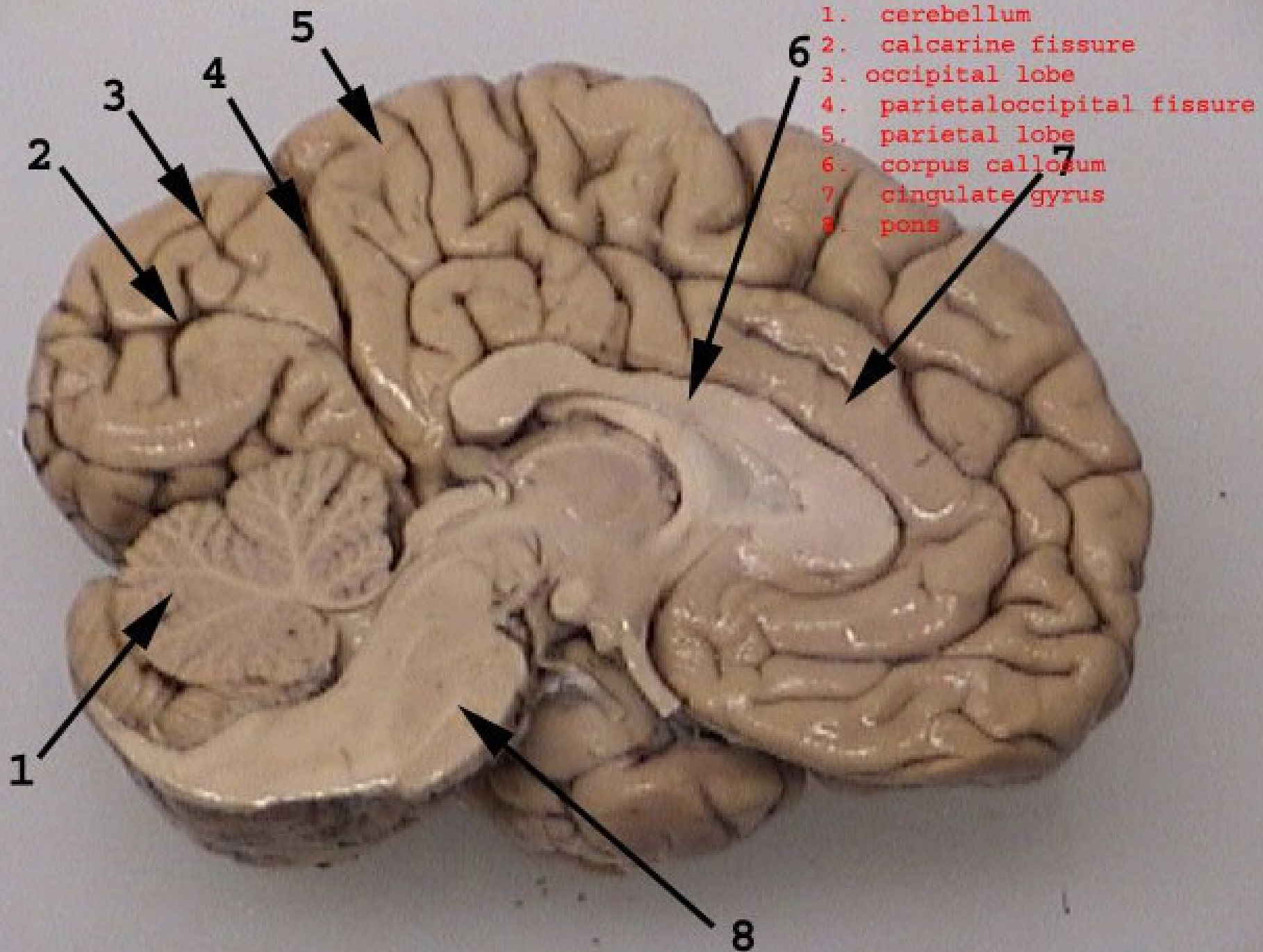
Each cerebral hemisphere has 3 surfaces.

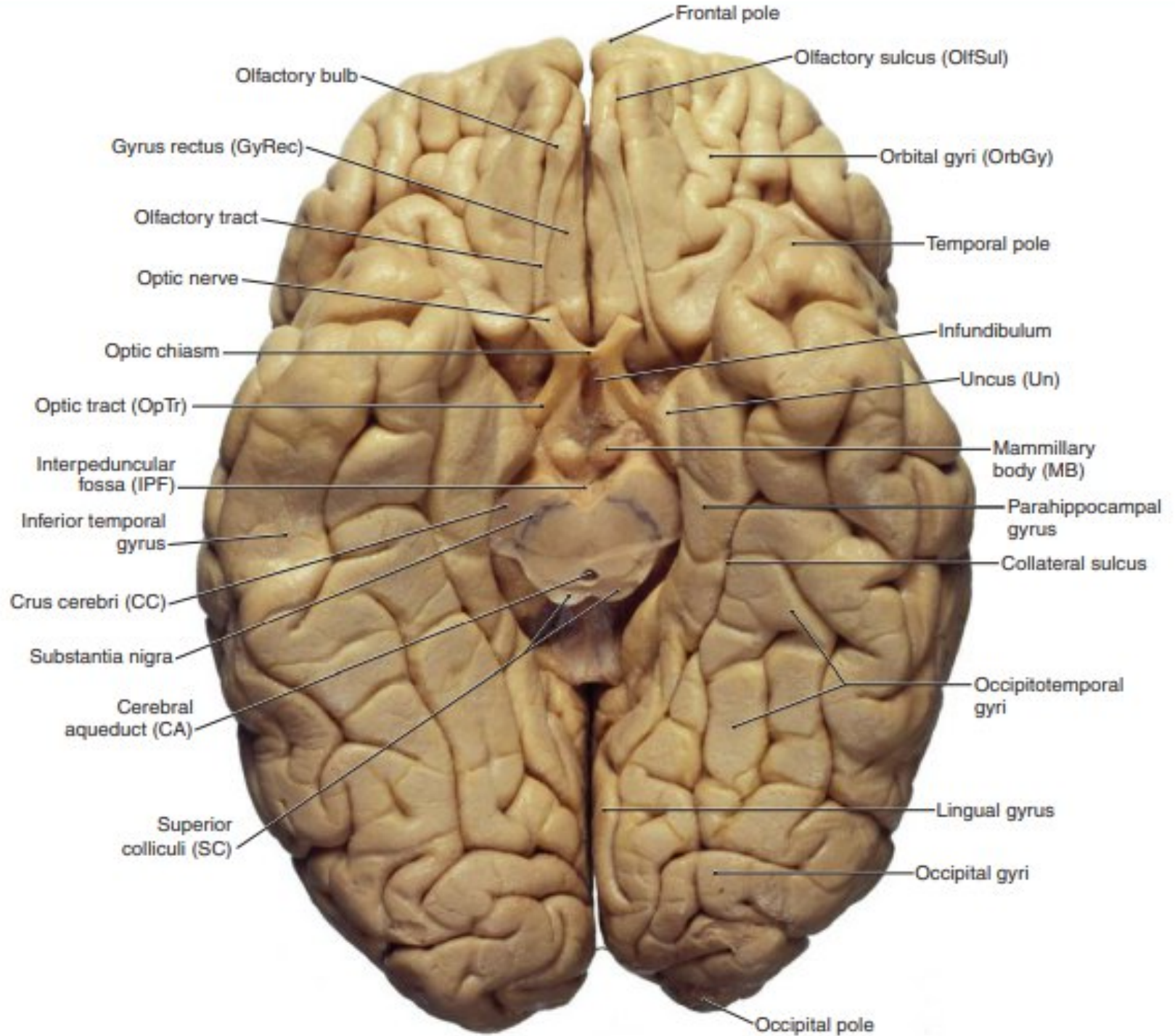
Surfaces of Each Cerebral Hemisphere

- **Lateral (superolateral) surface** is directed upwards and laterally.
- **Medial surface**: it is separated from the medial surface of the other cerebral hemisphere by the **median longitudinal fissure**.
- **Inferior surface** is divided by the stem of the lateral sulcus into two parts:
 - **Anterior part** or **orbital surface** of the frontal lobe.
 - **Posterior part** or **tentorial surface** of the

Surfaces of Each Cerebral Hemisphere







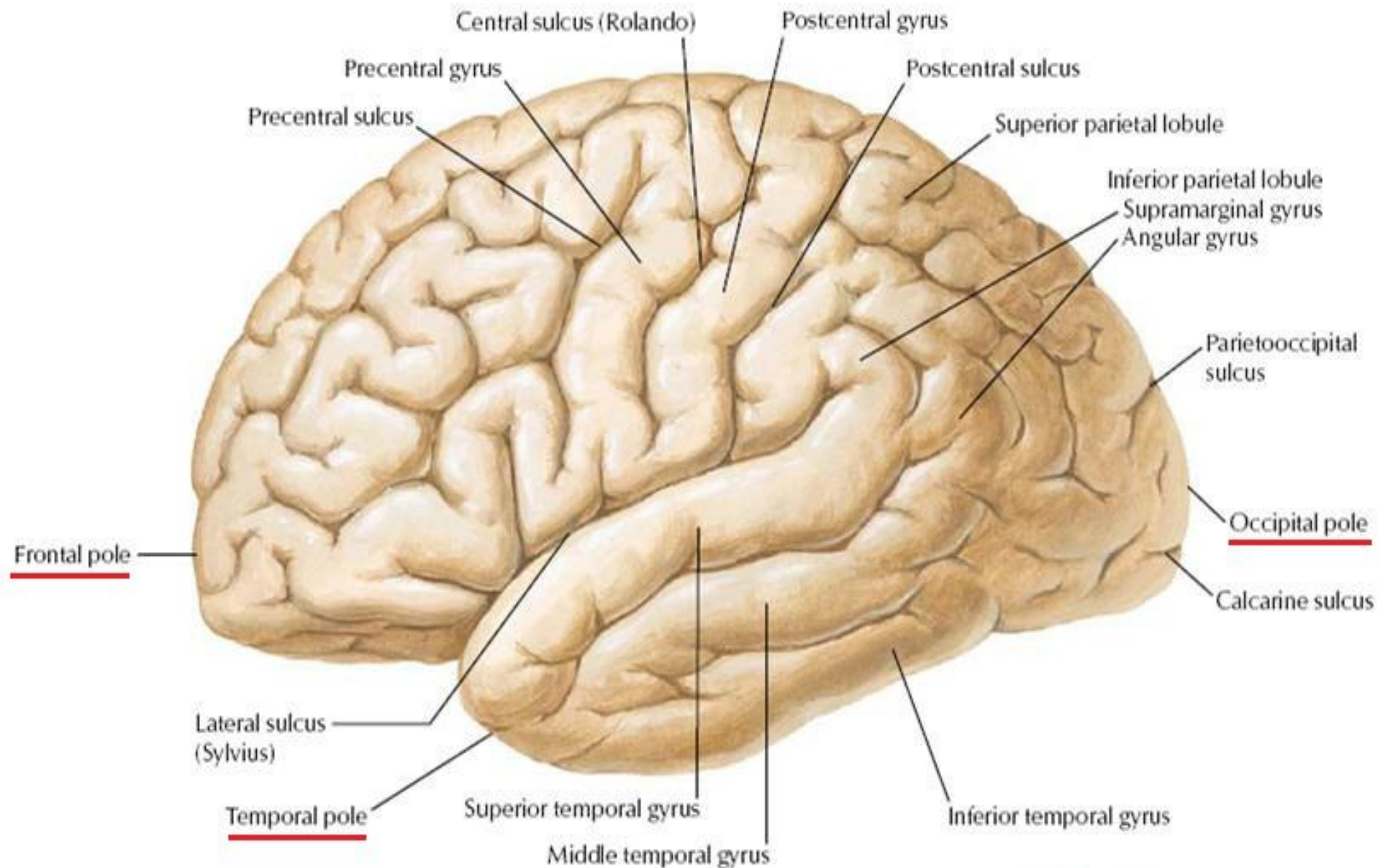


Each cerebral hemisphere has 3 poles:

Poles of Each Cerebral Hemisphere

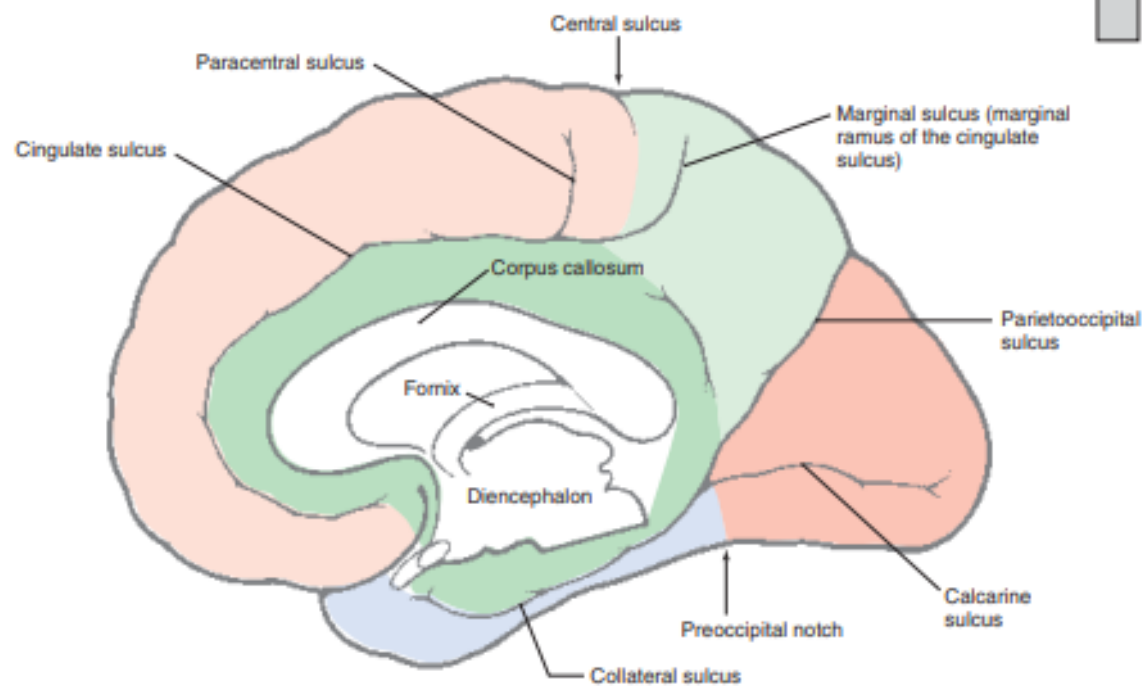
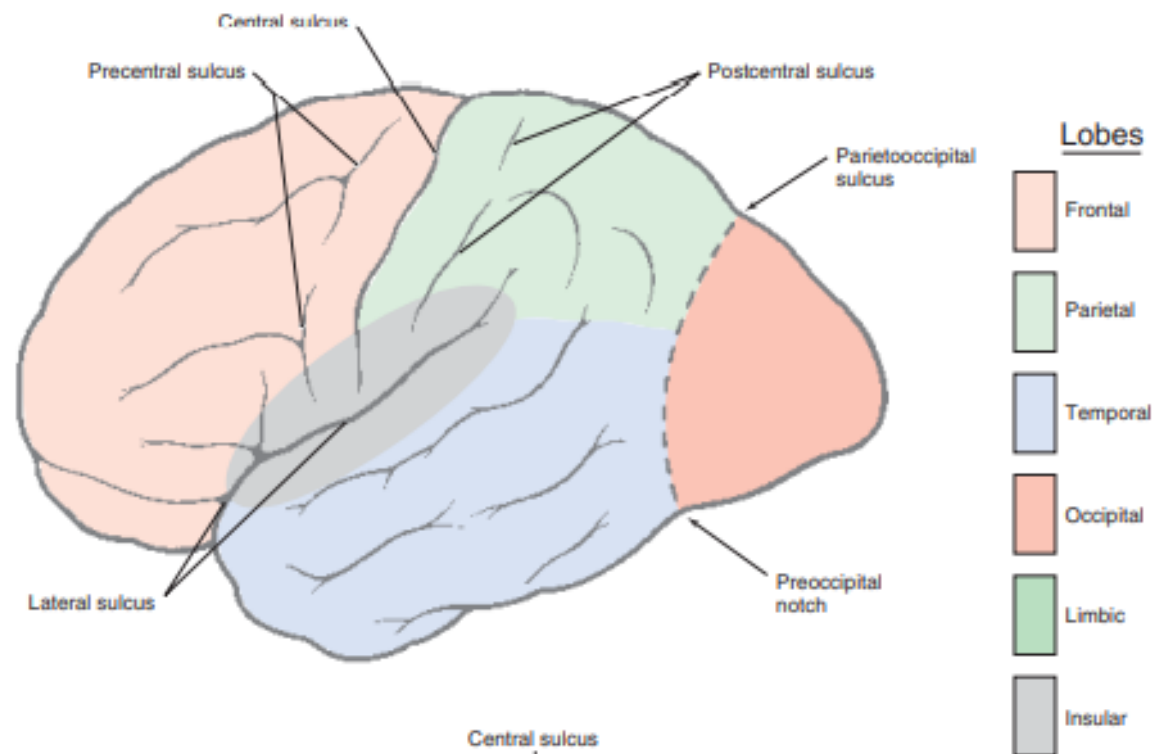
1. **Frontal pole:** at the anterior end of the frontal lobe.
2. **Temporal pole:** at the anterior end of the temporal lobe.
3. **Occipital pole:** at the posterior end of the occipital lobe.

Poles of Each Cerebral Hemisphere



Lobes of Each Cerebral Hemisphere

- The surface of each cerebral hemisphere is divided by **three main sulci or fissures** into four lobes (which have been given the names of the skull bones under which they lie).
- These four lobes are:
 - Frontal Lobe.
 - Parietal Lobe.
 - Temporal Lobe.
 - Occipital Lobe.
 - Insular Lobe.
- Each surface of lobes is divided by sulci into gyri



- **The median longitudinal fissure** divides the cerebrum into two hemispheres.
- Each cerebral hemisphere is divided by sulci (grooves) into lobes.

1. **The central sulcus (Roland sulcus)** it separates the

frontal lobe (in front) from parietal lobe (behind).

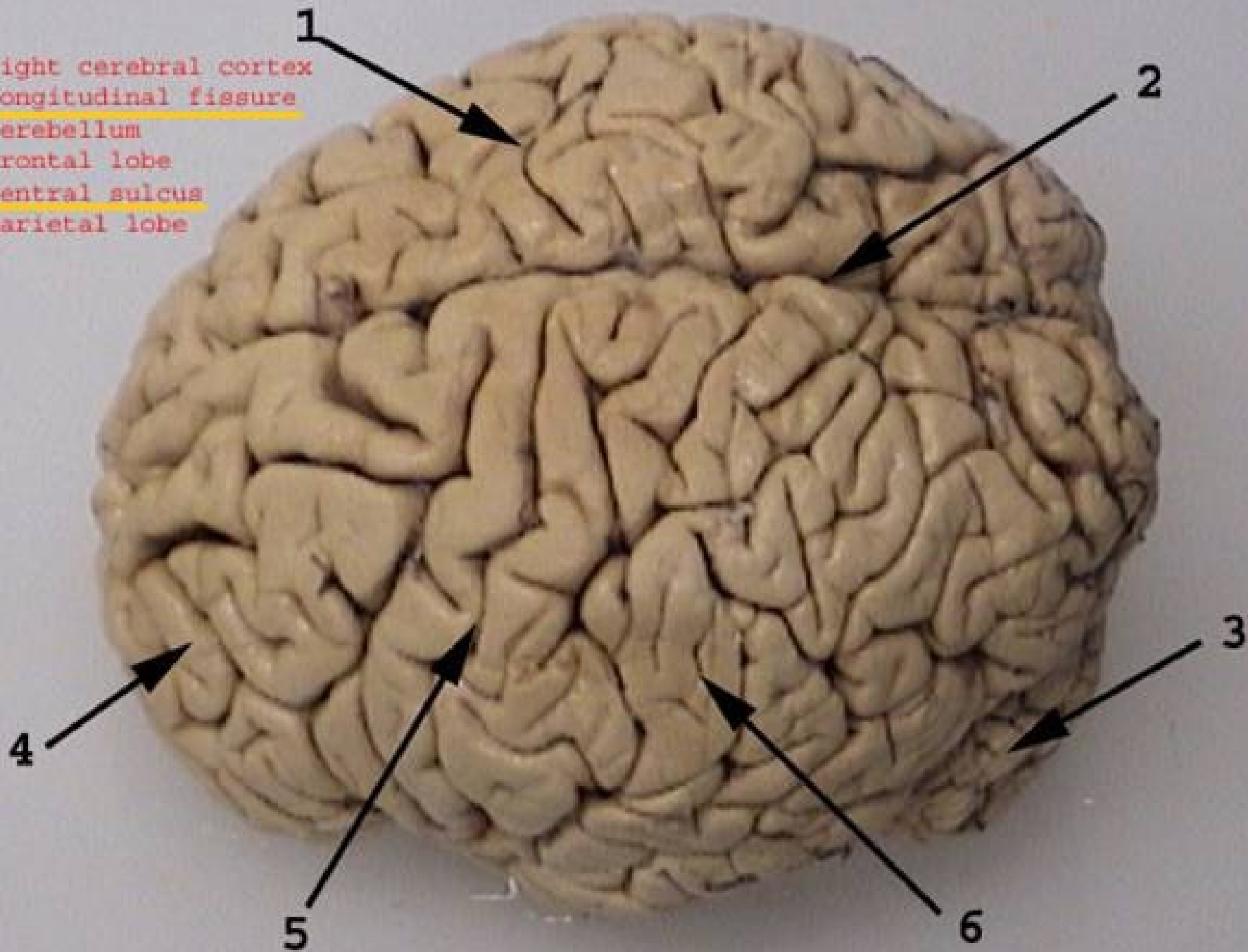
2. **The lateral sulcus (Sylvian sulcus)** between frontal

and parietal lobes (above) and temporal lobe (below).

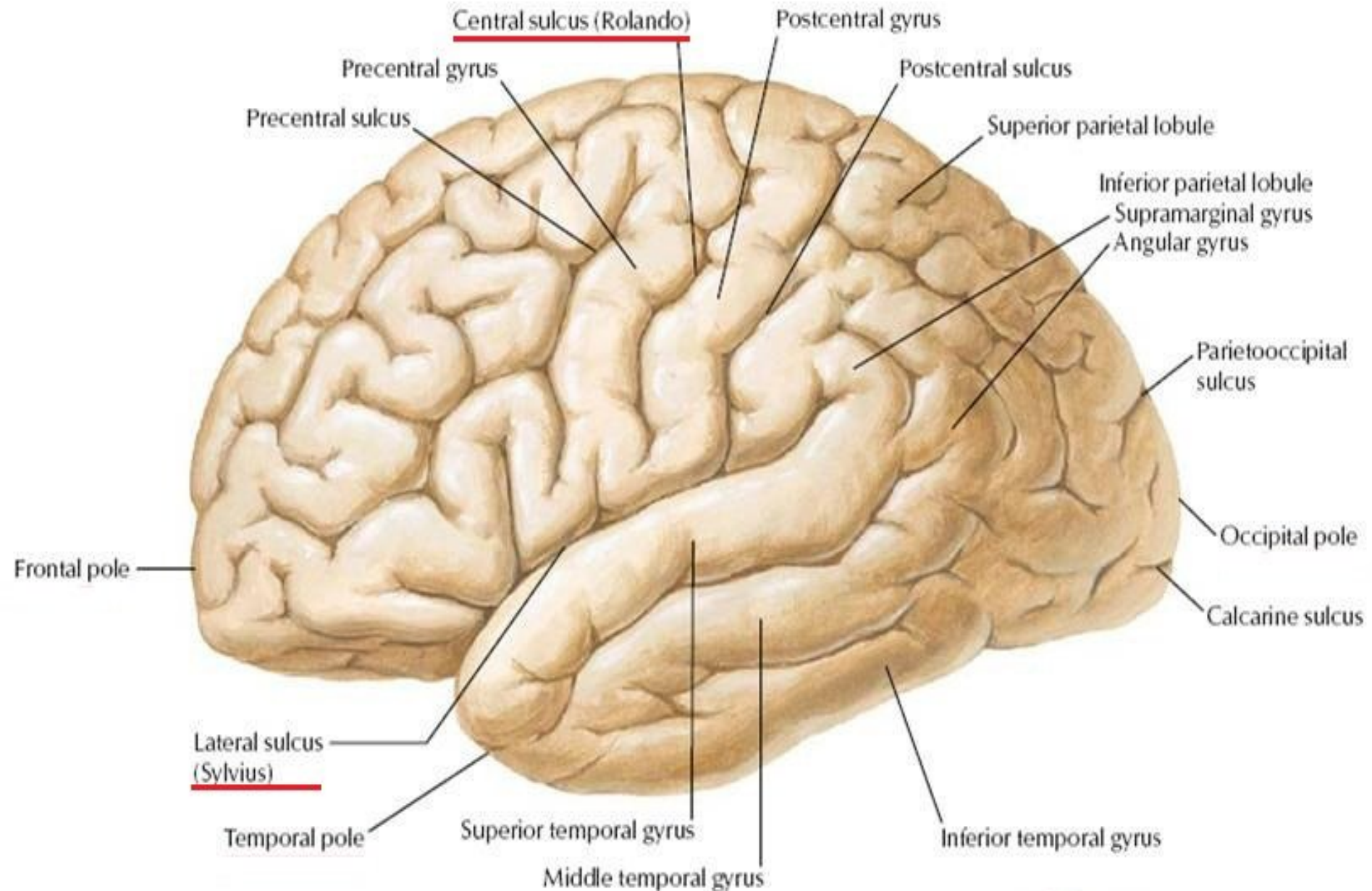
3. **The parieto-occipital sulcus** it found mainly on the

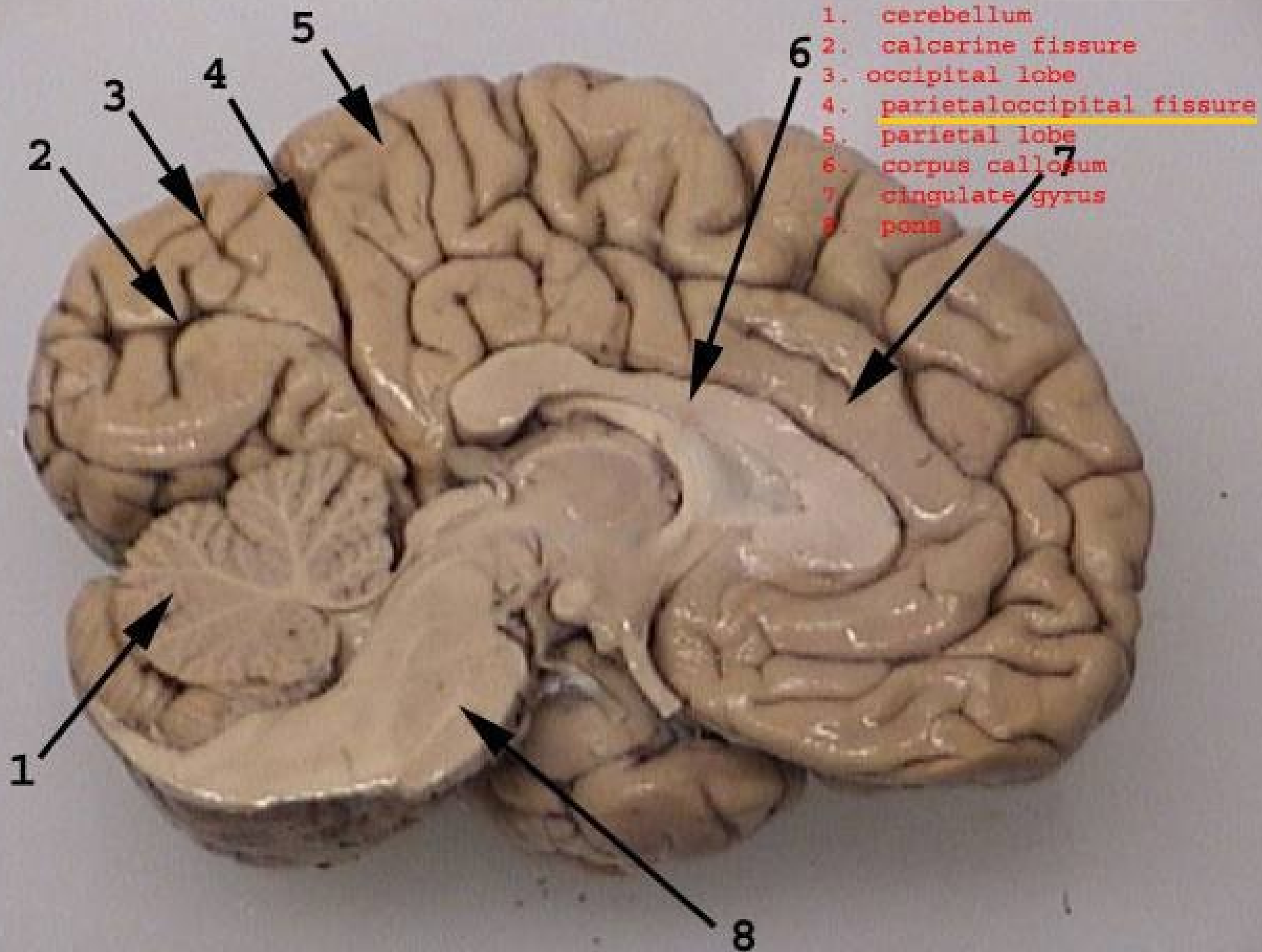
medial surface of the cerebral hemisphere

1. right cerebral cortex
2. longitudinal fissure
3. cerebellum
4. frontal lobe
5. central sulcus
6. parietal lobe



Sulci of Each Cerebral Hemisphere



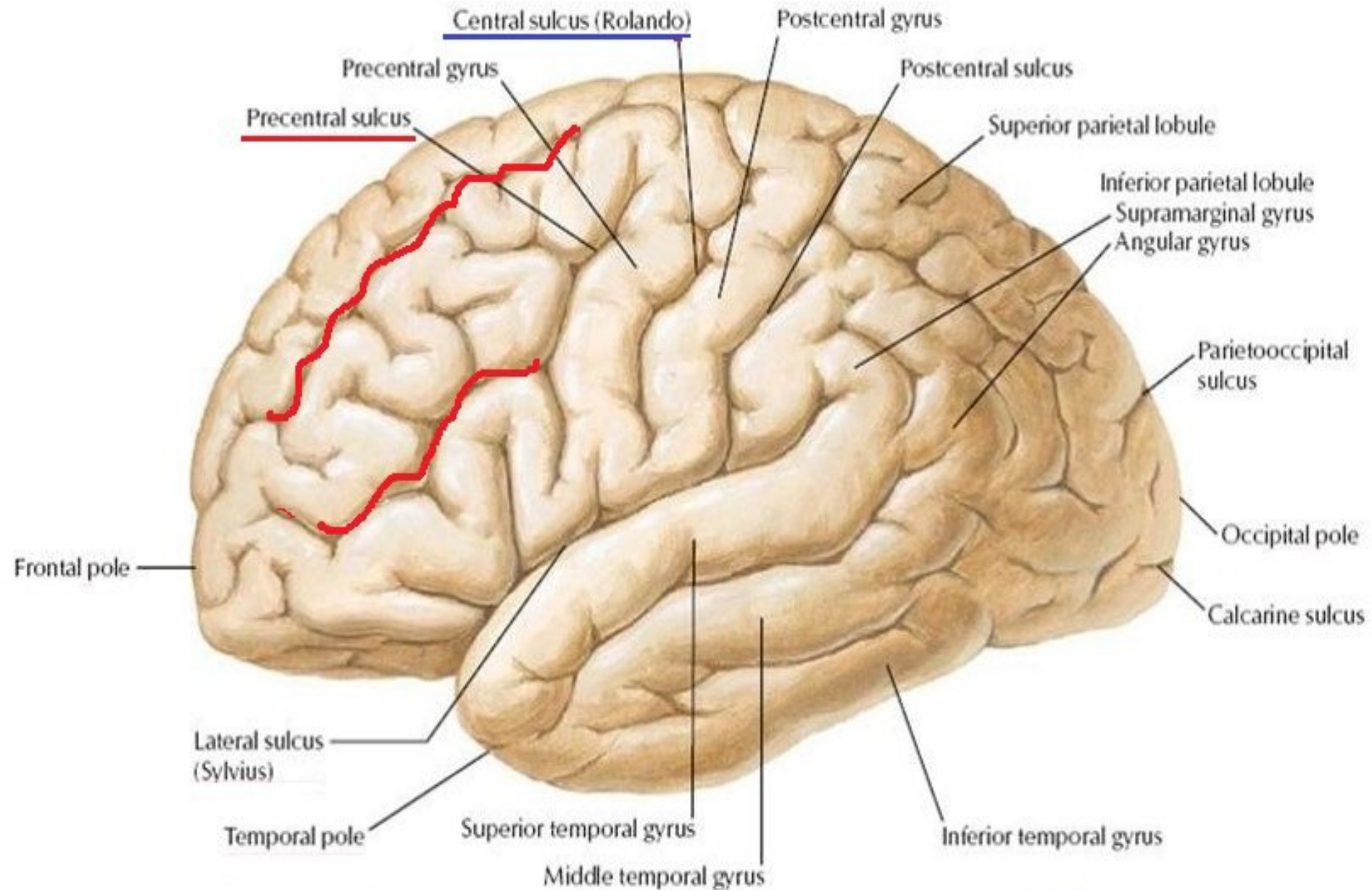


The Important Sulci of Frontal Lobe

The important sulci of frontal lobe are:

- **The precentral sulcus** it present in front of the central sulcus.
- **The superior frontal sulcus** present in front of the precentral sulcus (superior part of the frontal lobe).
- **The inferior frontal sulcus** present in front of the precentral sulcus (inferior part of the frontal lobe).

Sulci of the Frontal Lobe

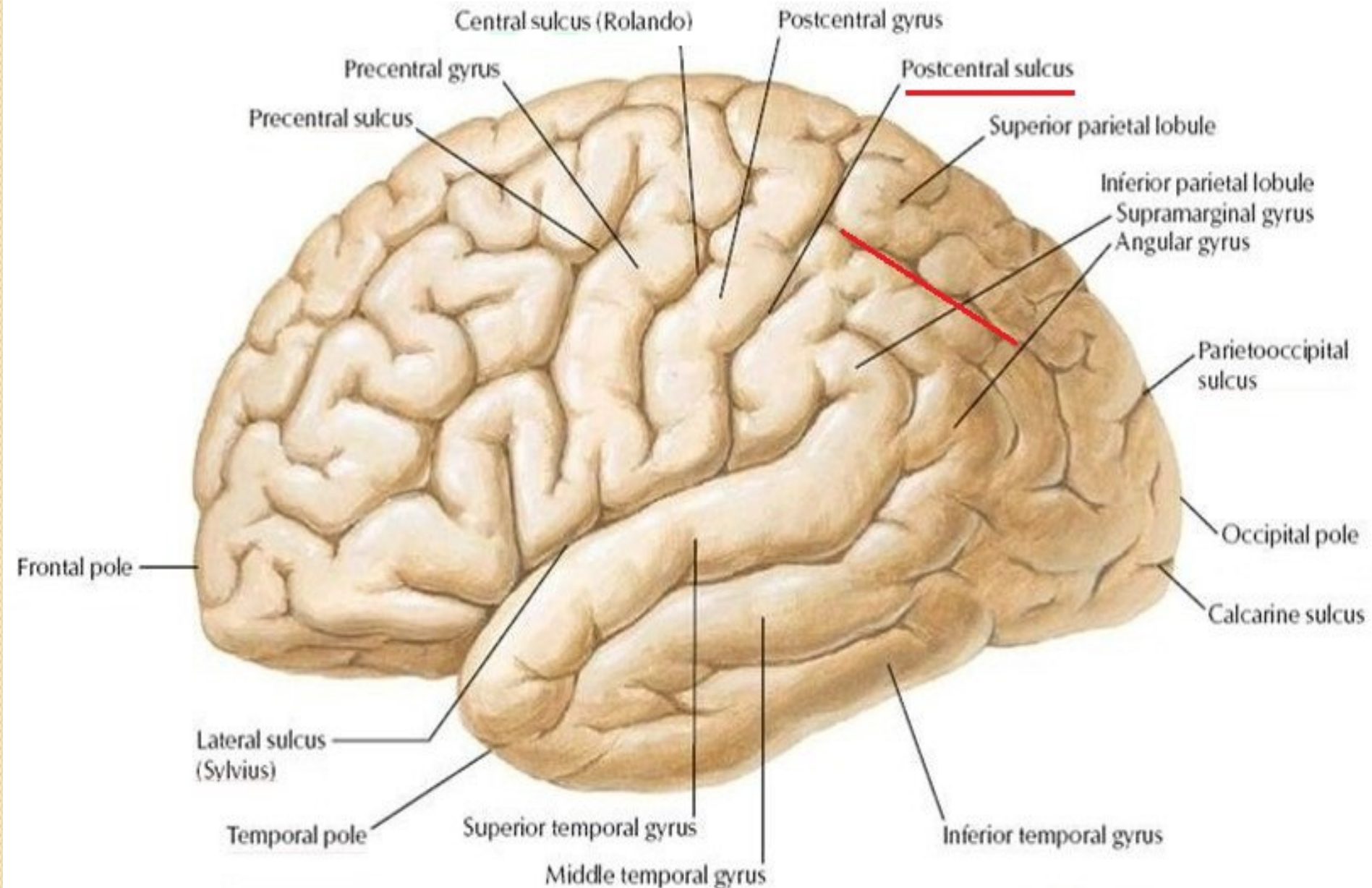


The Important Sulci of Parietal Lobe

The important sulci of parietal lobe are:

- The postcentral sulcus: it is present behind the central sulcus.
- The intraparietal sulcus.

Sulci of the Parietal Lobe

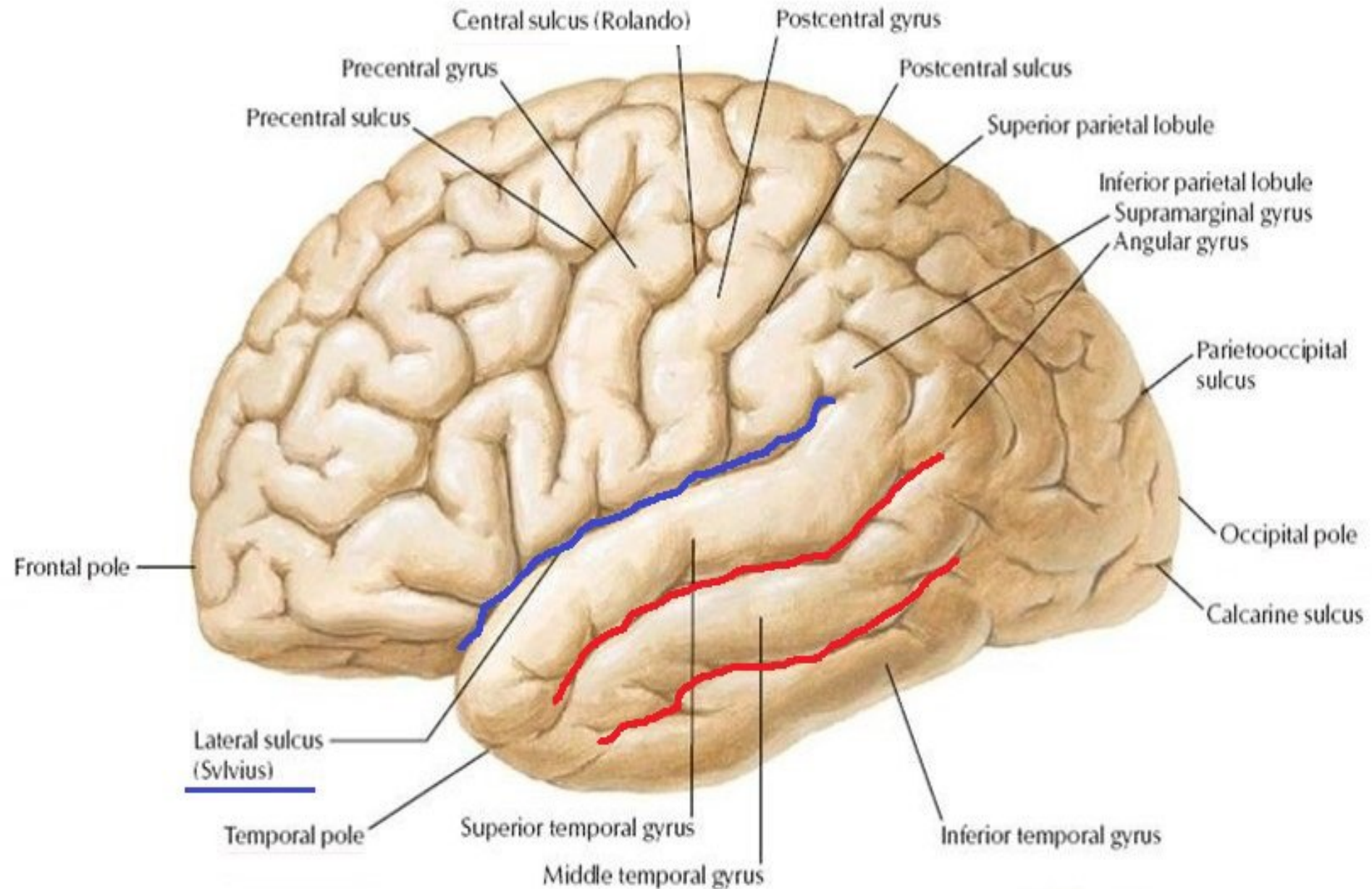


The Important Sulci of Temporal Lobe

The important sulci of temporal lobe:

- The superior temporal sulcus below the lateral sulcus.
- The inferior temporal sulcus.

Sulci of the Temporal Lobe

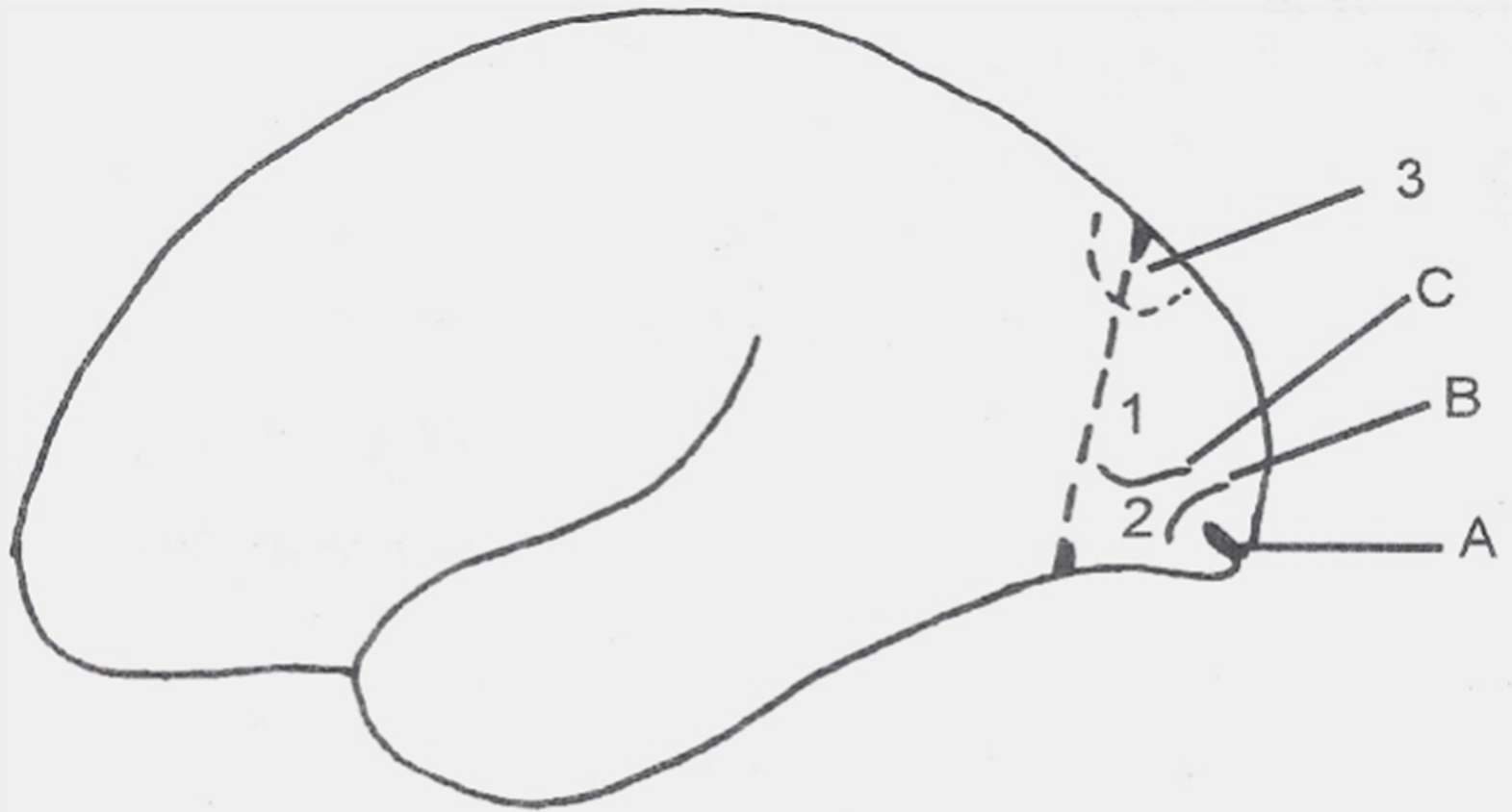


The Important Sulci of Occipital Lobe

The important sulci of occipital lobe:

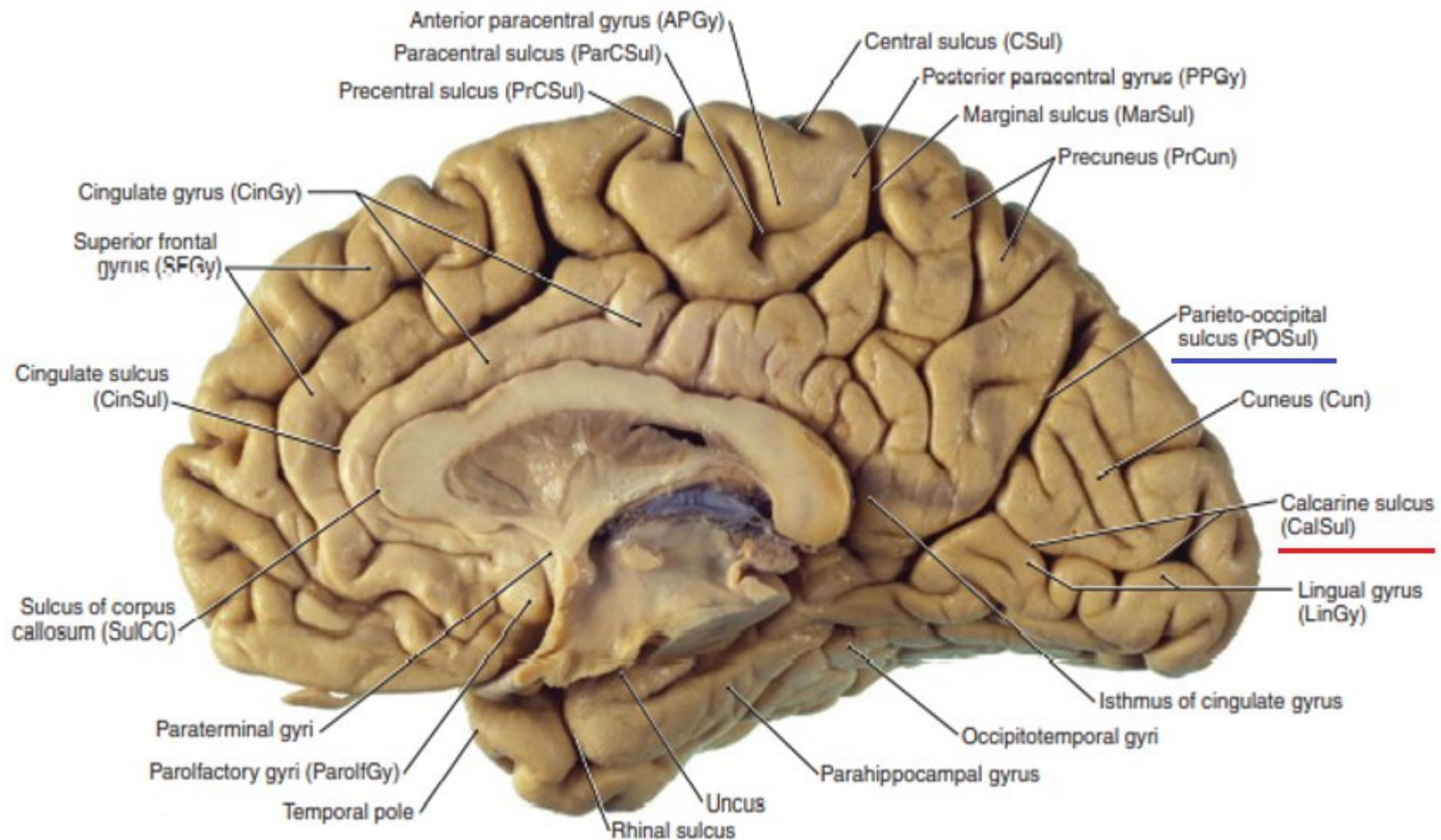
- **The calcarine sulcus**: lies on the medial surface of the occipital lobe.
- **The lateral occipital sulcus** is a short horizontal sulcus running on the lateral surface of the occipital lobe.
- **Lunate sulcus**: is a curved short vertical sulcus in the occipital pole.

Sulci of the Occipital Lobe

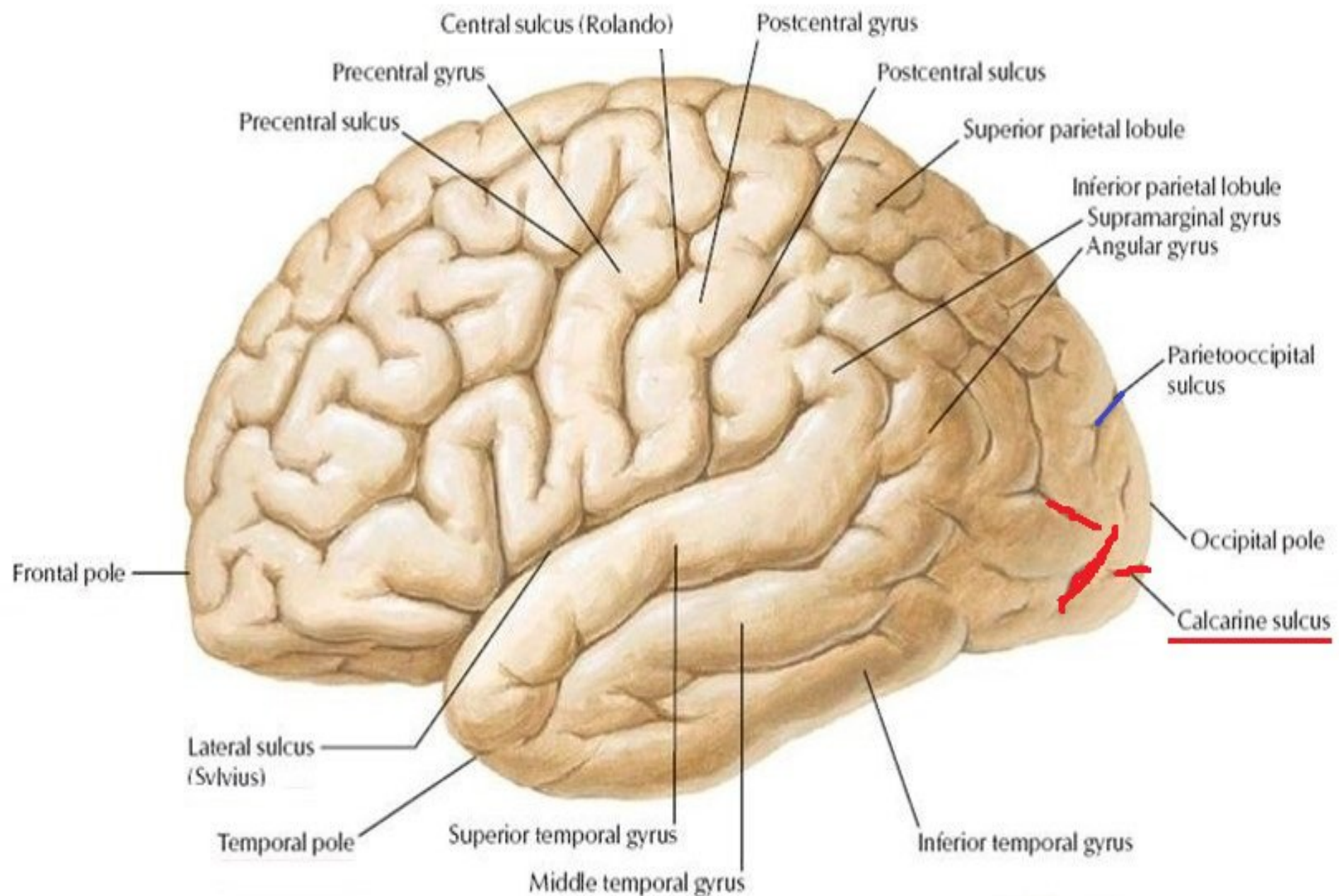


- A : Posterior end of calcarine sulcus.
- B : Lunate sulcus.
- C : Lateral occipital sulcus.
- 1 : Superior occipital gyrus.
- 2 : Inferior occipital gyrus.
- 3 : Arcus parieto – occipitalis.

Sulci of the Occipital Lobe



Sulci of the Occipital Lobe



Other Sulci of Cerebral Hemisphere

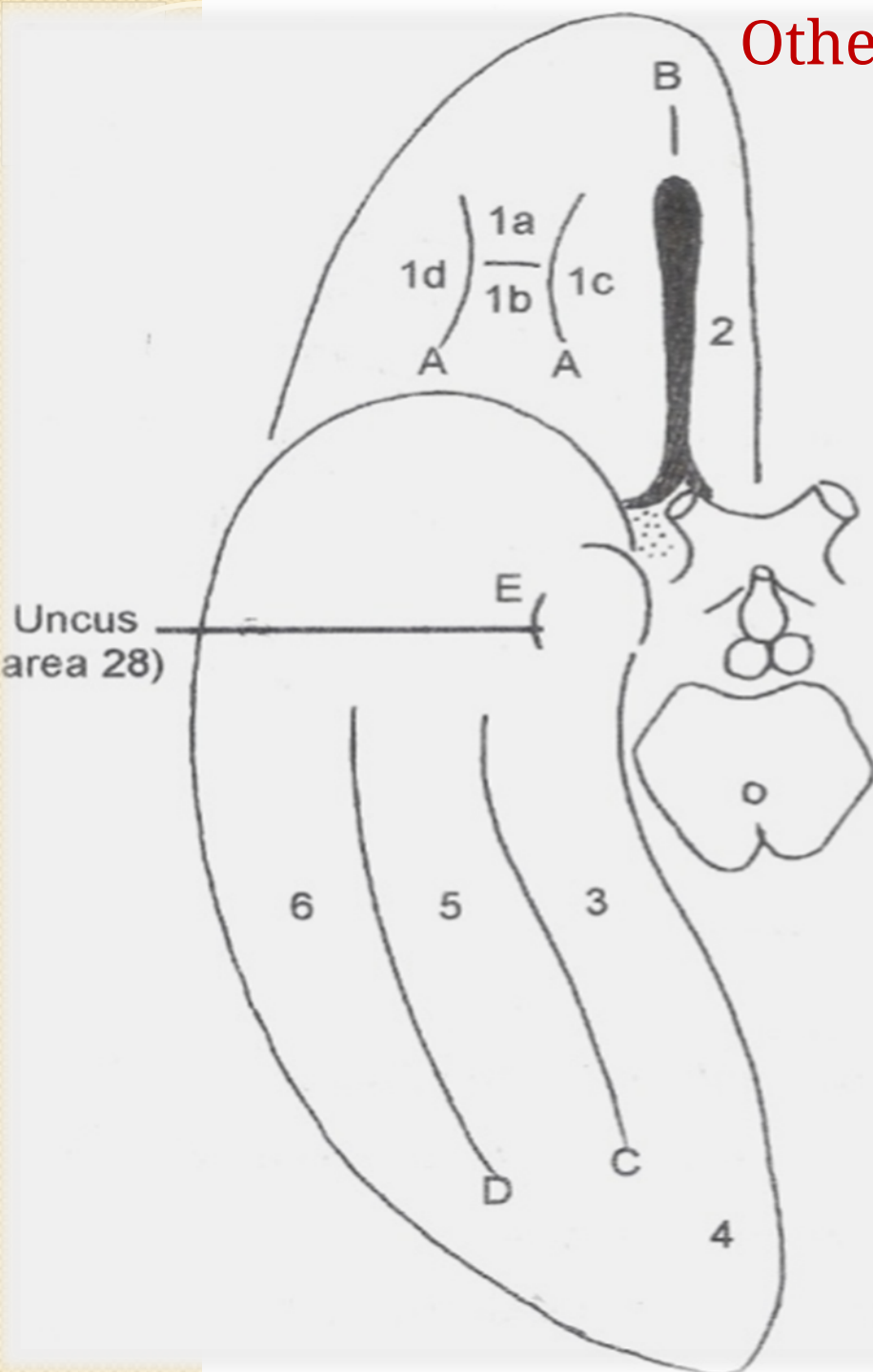
Sulci of the inferior surface of the cerebral hemisphere:

- **Orbital sulcus** is an H-shaped irregular sulcus.
- **Olfactory sulcus** is a longitudinal sulcus “medial to orbital sulcus”
- **Collateral sulcus** is the deep longitudinal sulcus extending from the occipital pole to the temporal pole.
- **Rhinal sulcus** in line of collateral sulcus and lies lateral to the uncus.
- **Occipitotemporal sulcus** is the longitudinal sulcus that runs lateral to the collateral sulcus.

Sulci of the medial surface of cerebral hemisphere:

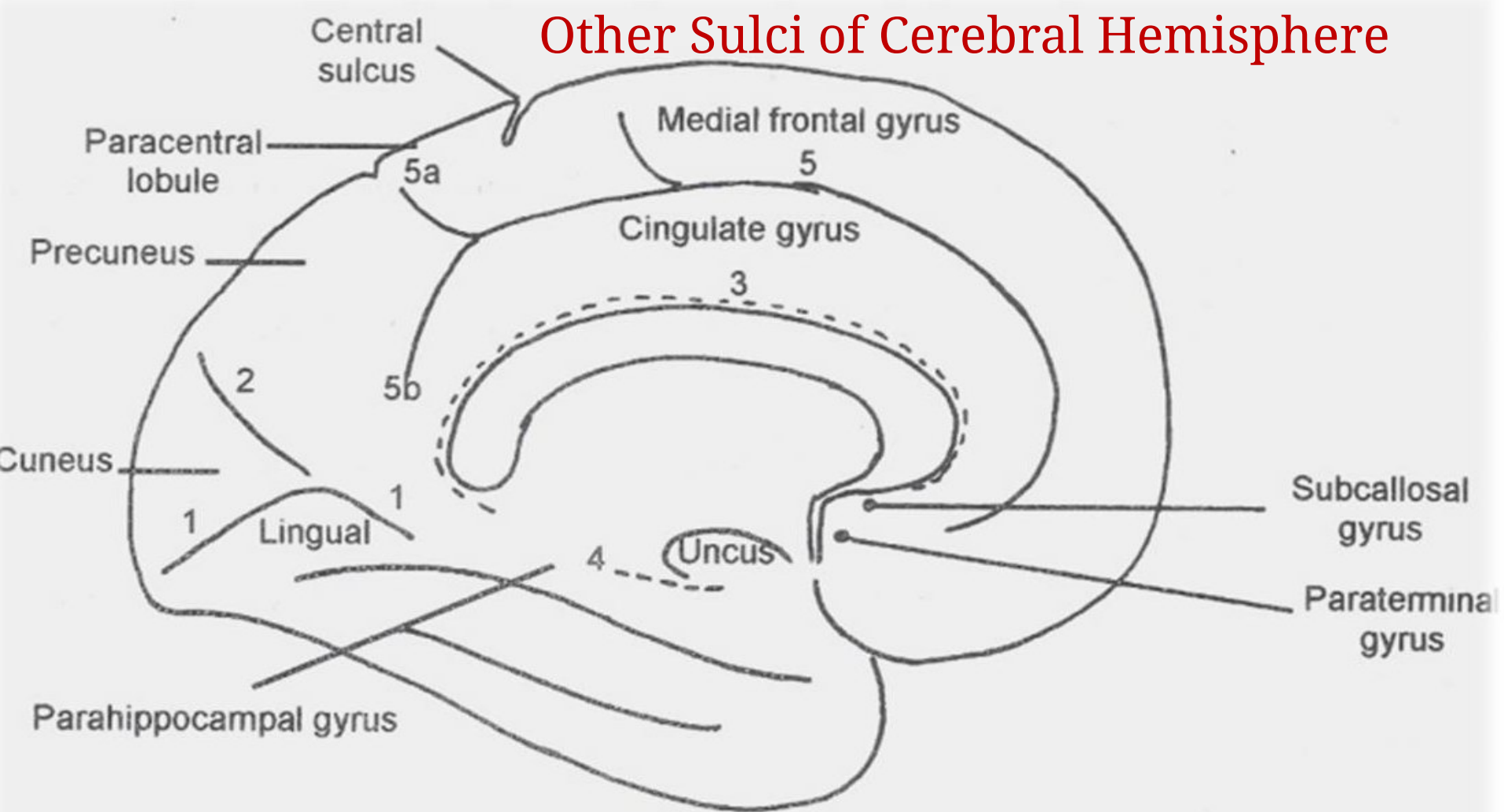
- **Callosal sulcus** is present just above the corpus callosum.
- **Cingulate sulcus** above the cingulate gyrus.
- **Hippocampal sulcus** between the uncus and parahippocampal gyrus.

Other Sulci of Cerebral Hemisphere



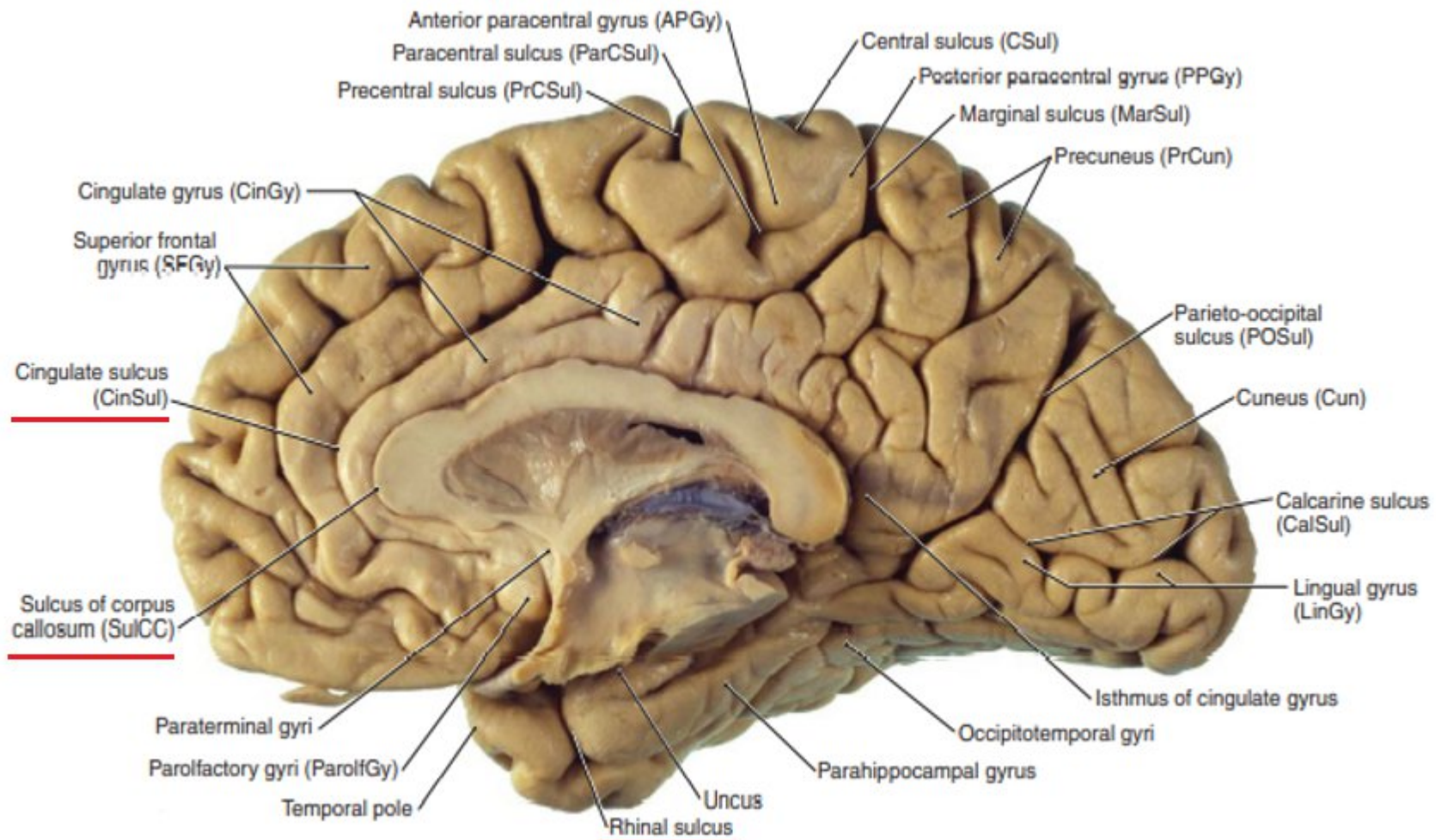
- | | | |
|----|---|---------------------------------|
| A. | : | Orbital sulcus. |
| B. | : | Olfactory sulcus. |
| C. | : | Collateral sulcus. |
| D. | : | Occipitotemporal sulcus. |
| E. | : | Rhinal sulcus. |
| 1. | : | Orbital gyri. |
| 1a | : | Anterior. |
| 1b | : | Posterior. |
| 1c | : | Medial. |
| 1d | : | Lateral. |
| 2. | : | Gyrus rectus. |
| 3. | : | Parahippocampal gyrus. |
| 4. | : | Lingual gyrus. |
| 5. | : | Medial occipitotemporal gyrus. |
| 6. | : | Lateral occipitotemporal gyrus. |

Other Sulci of Cerebral Hemisphere



- 1 : Calcarine sulcus.
- 2 : Parieto-occipital sulcus.
- 3 : Callosal sulcus.
- 4 : Hippocampal sulcus.
- 5 : Cingulate sulcus.
- 5a Marginal ramus.
- 5b Subparietal ramus.

Other Sulci of Cerebral Hemisphere



1. Frontal lobe

Boundaries on the lateral surface of C.H.:

It is present in front of the central sulcus and above the lateral sulcus.

Boundaries on the medial surface of C.H.:

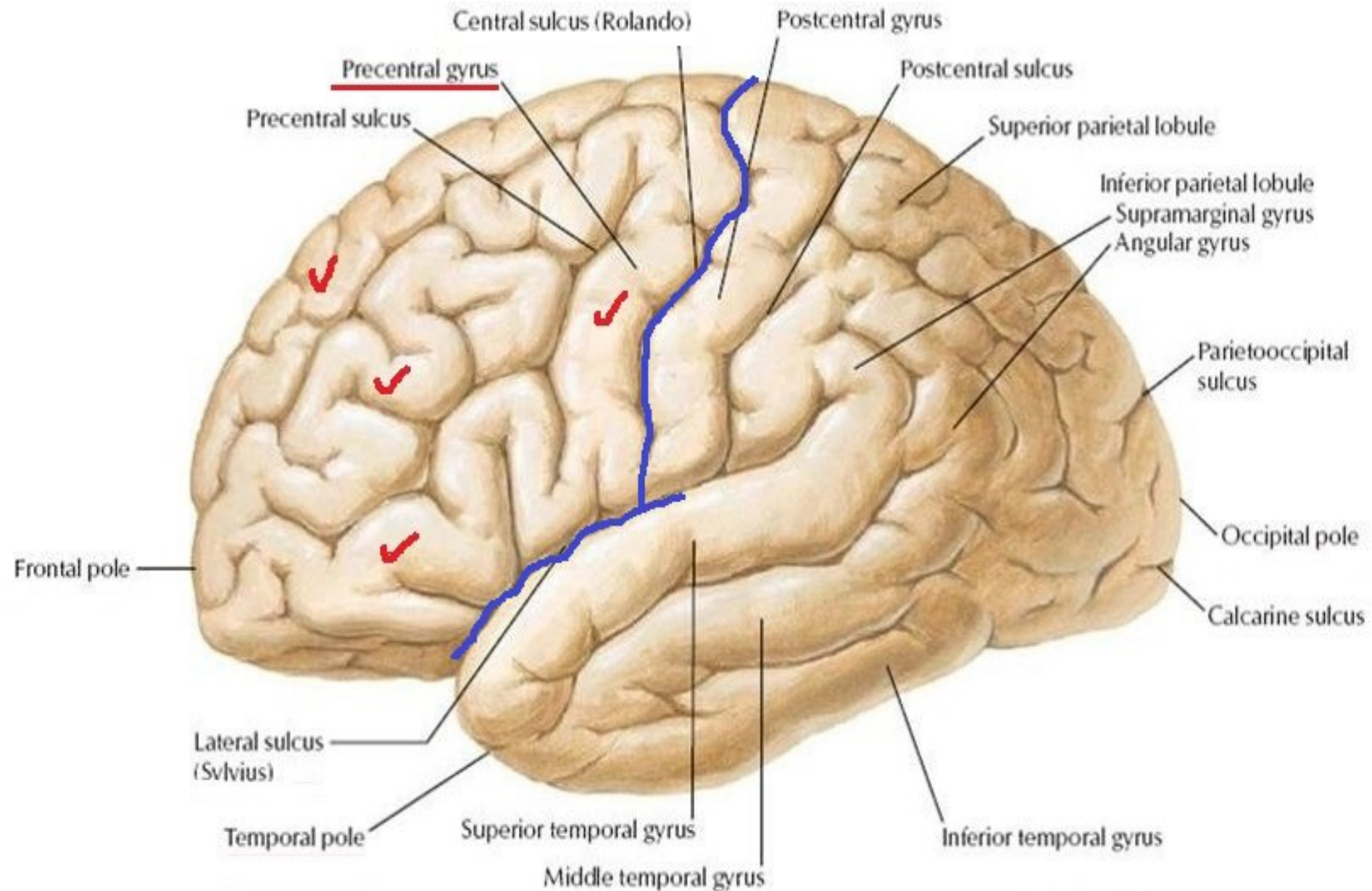
It is present in front of a line connecting the upper end of central sulcus at the superior border with the splenium of the corpus callosum.

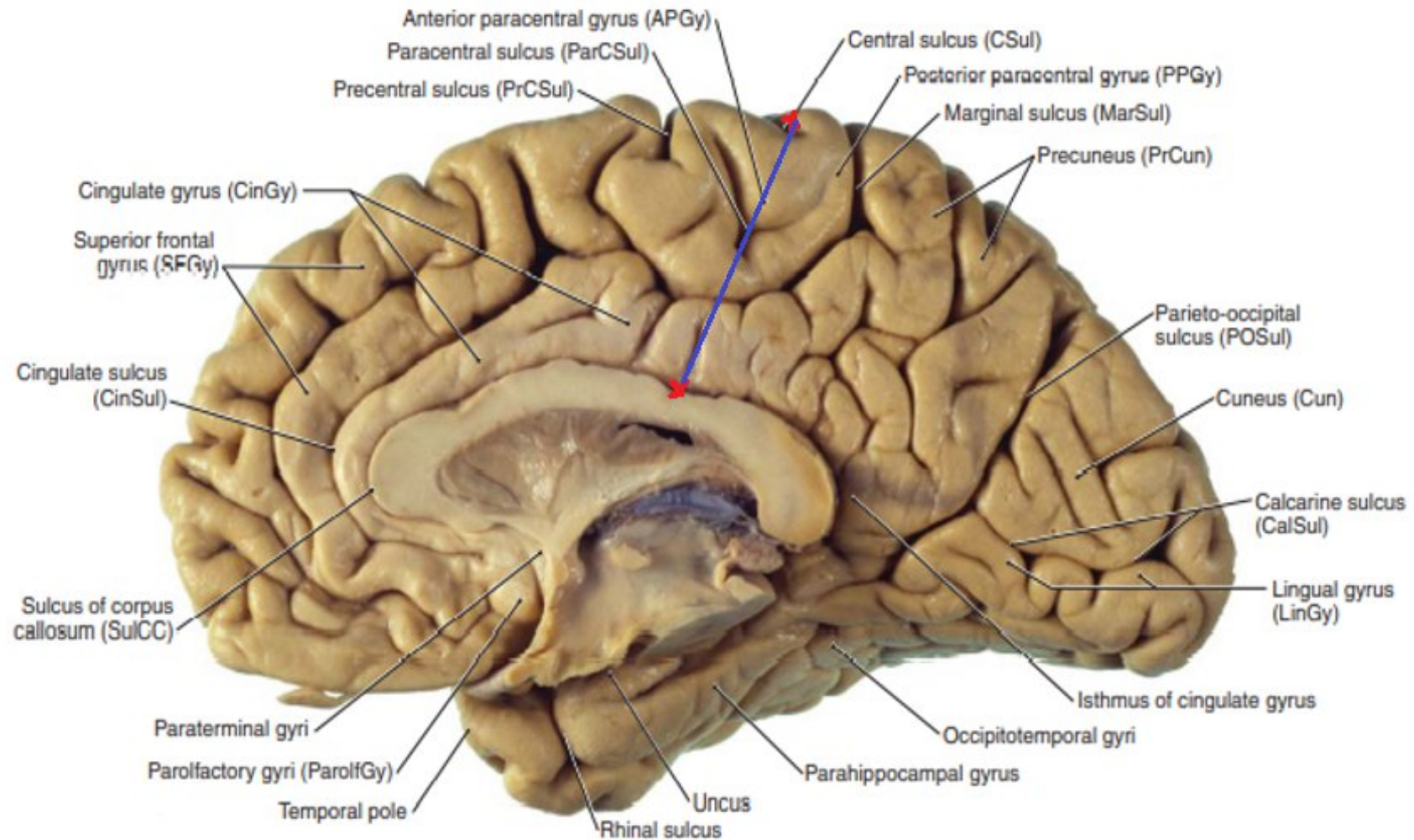
Boundaries on the inferior surface of C.H.

The Important Gyri of Frontal Lobe

- The precentral gyrus between the central and precentral sulci.
- The superior frontal gyrus above the superior frontal sulcus.
- The middle frontal gyrus between the superior and inferior frontal sulci.
- The inferior frontal gyrus below the inferior frontal sulcus.

The Important Gyri of Frontal Lobe





2. Parietal lobe

Boundaries on the lateral surface of C.H.:

- ★ Anteriorly central sulcus.
- ★ Posteriorly: a line connecting the upper end of parieto-occipital sulcus with the preoccipital notch (3-4 cm in front of the occipital pole).
- ★ Inferiorly posterior ramus of the lateral sulcus.

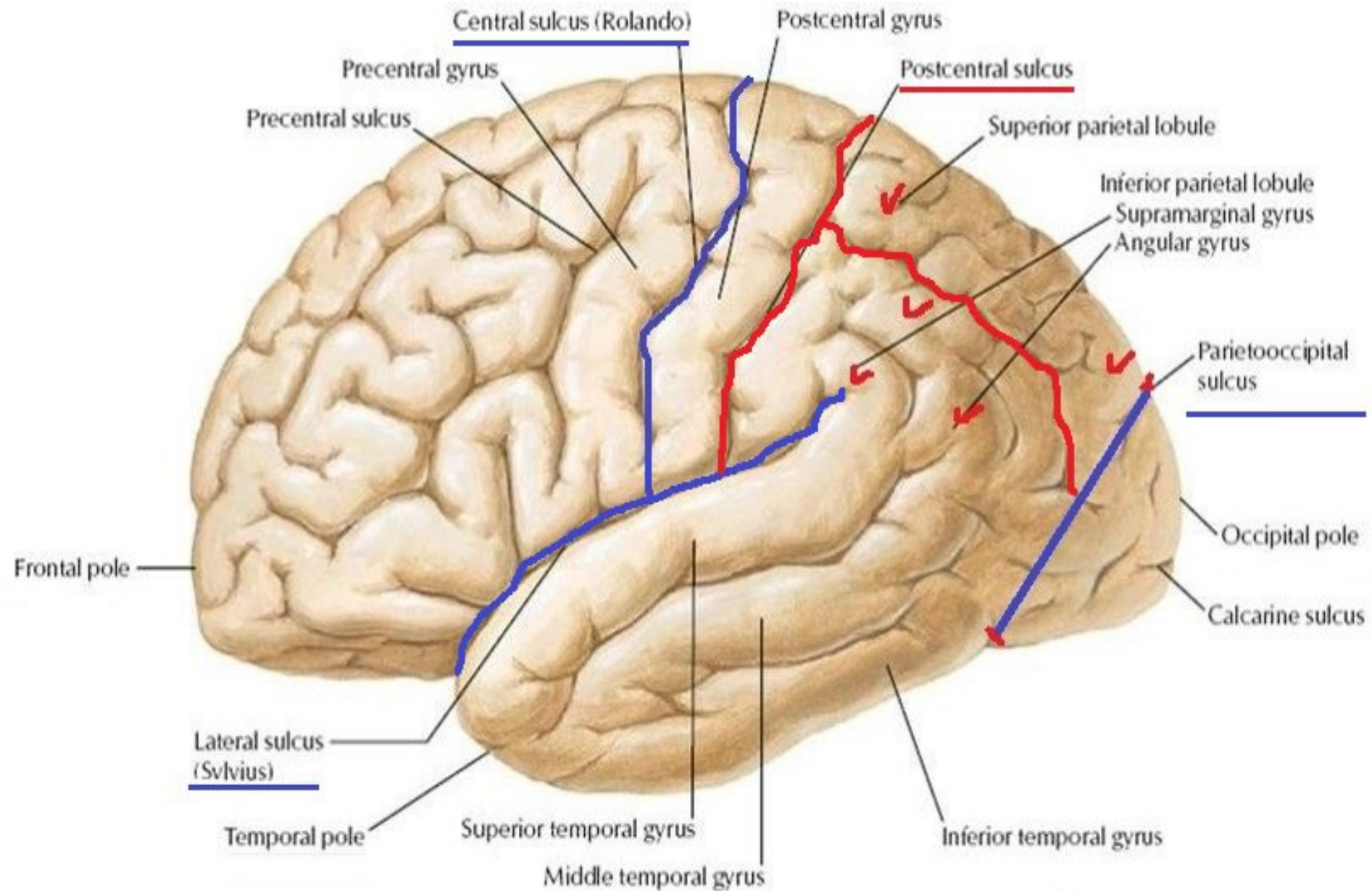
Boundaries on the medial surface of C.H.

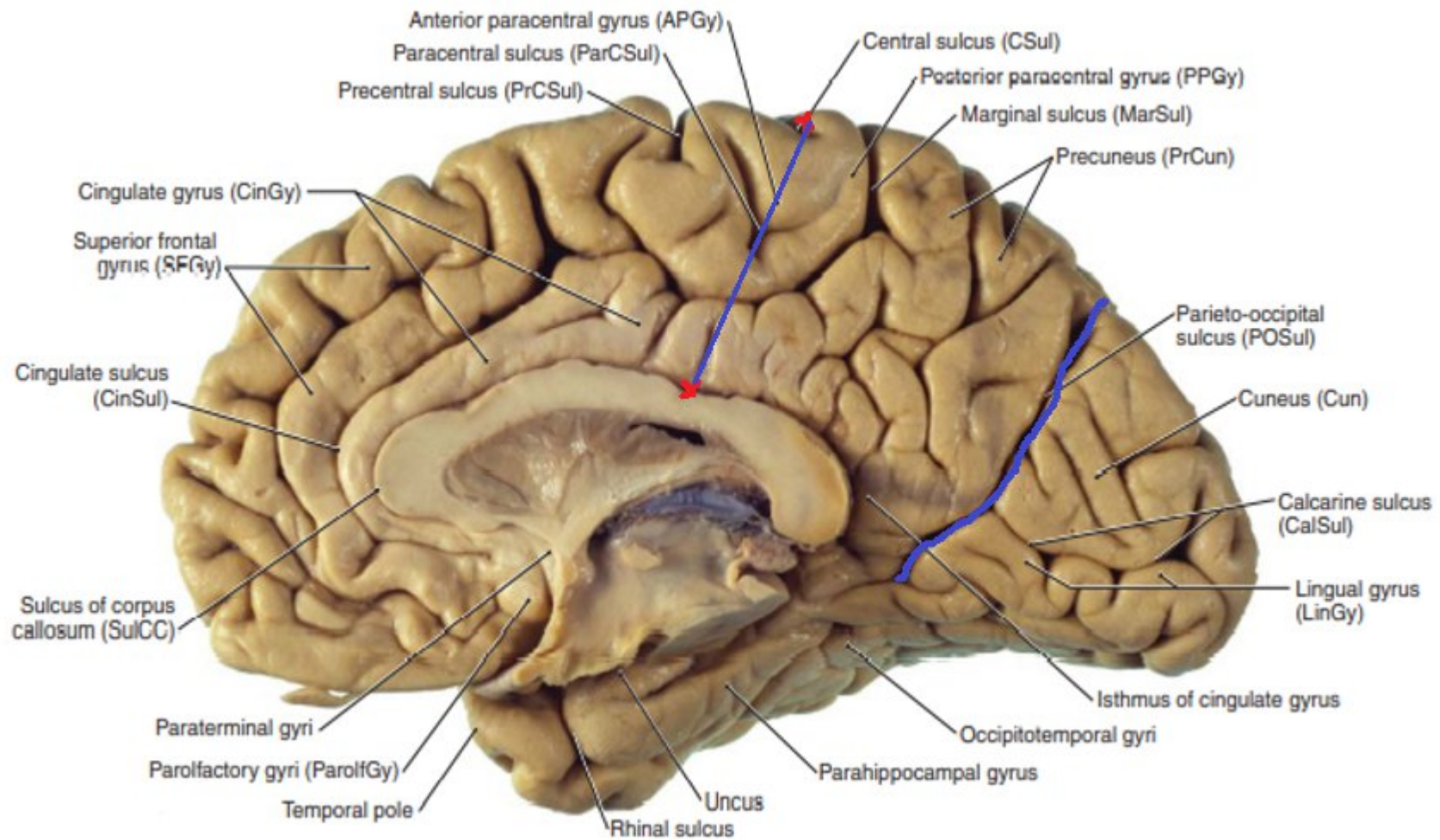
- ★ Anteriorly a line connecting the upper end of the central sulcus at the superior border with the splenium

Important Gyri of Parietal Lobe

- **The postcentral gyrus** is the main gyrus of parietal lobe, between the central and postcentral sulci.
- **The superior parietal gyrus** above the intraparietal sulcus.
- **The inferior parietal gyrus** below the intraparietal sulcus and contains:
 - **The supramarginal gyrus** small gyrus surrounding the upper end of lateral sulcus.
 - **The angular** small gyrus surrounding the upper end of the superior temporal sulcus.
- **Arcus parieto-occipitalis gyrus** surrounds the upper end of the parieto-occipital sulcus on the superiolateral

The Important Gyri of Parietal Lobe





3. Temporal Lobe

Boundaries on the lateral surface of C.H.:

★ Posteriorly: a line connecting the upper end of parieto-occipital sulcus with the preoccipital notch.

★ Superiorly: posterior ramus of the lateral sulcus.

Boundaries on the inferior surface of C.H.

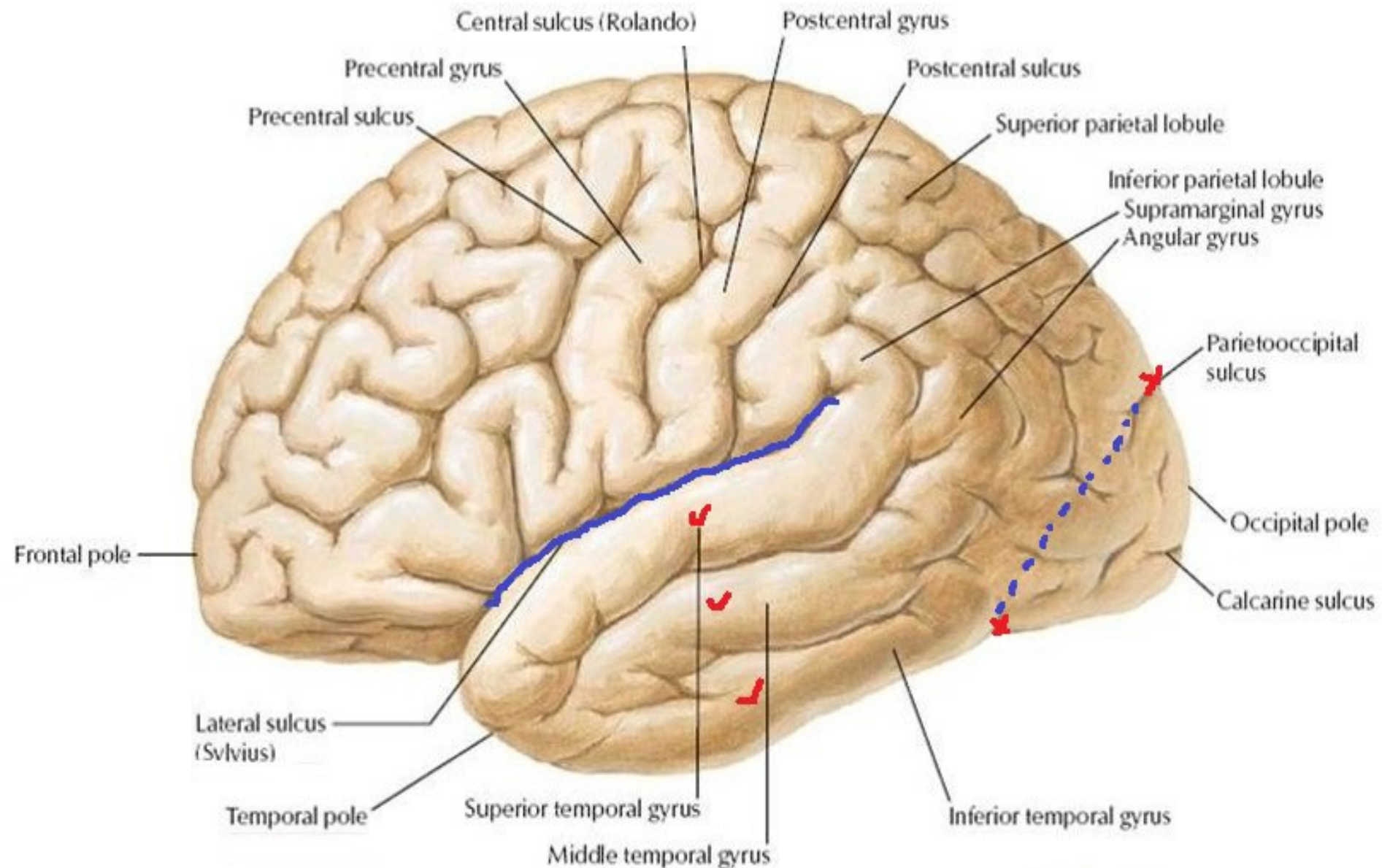
★ Anteriorly: the stem of lateral sulcus.

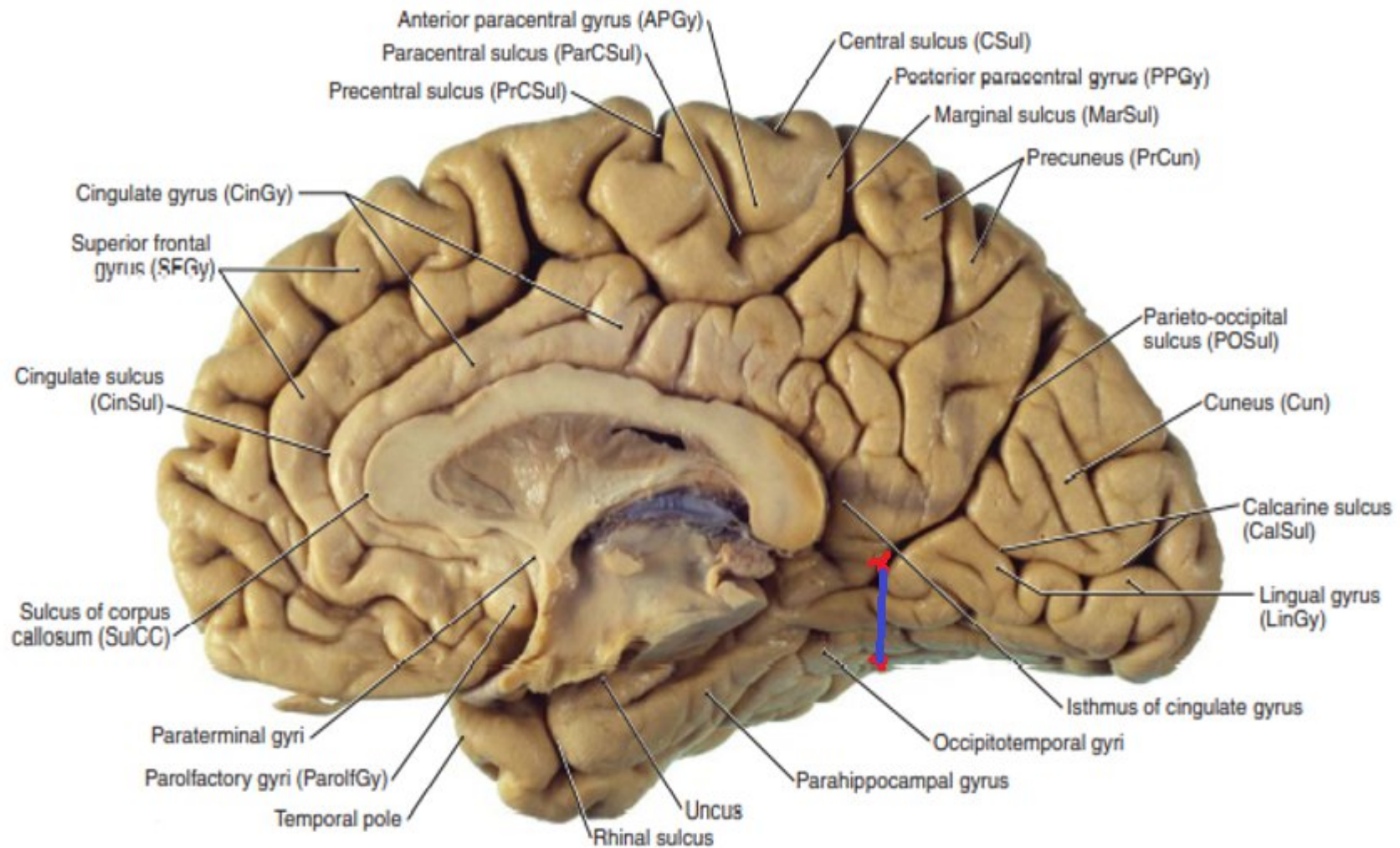
★ Posteriorly: a line connecting the lower end of

Important Gyri of Temporal Lobe

- The superior temporal gyrus lies between the lateral sulcus and the superior temporal sulcus.
- The middle temporal gyrus lies between the superior and inferior temporal sulcus.
- The inferior temporal gyrus lies below the inferior temporal sulcus.
- Transverse temporal gyrus of Heschl: found within the lateral sulcus (extends from the superior temporal gyrus toward the medial geniculate body).

Important Gyri of Temporal Lobe





4. Occipital Lobe

Boundaries on the lateral surface of C.H.:

It present behind a line connecting the upper end of

parieto-occipital sulcus with the preoccipital notch.

Boundaries on the medial surface of C.H.:

It present behind parieto-occipital sulcus.

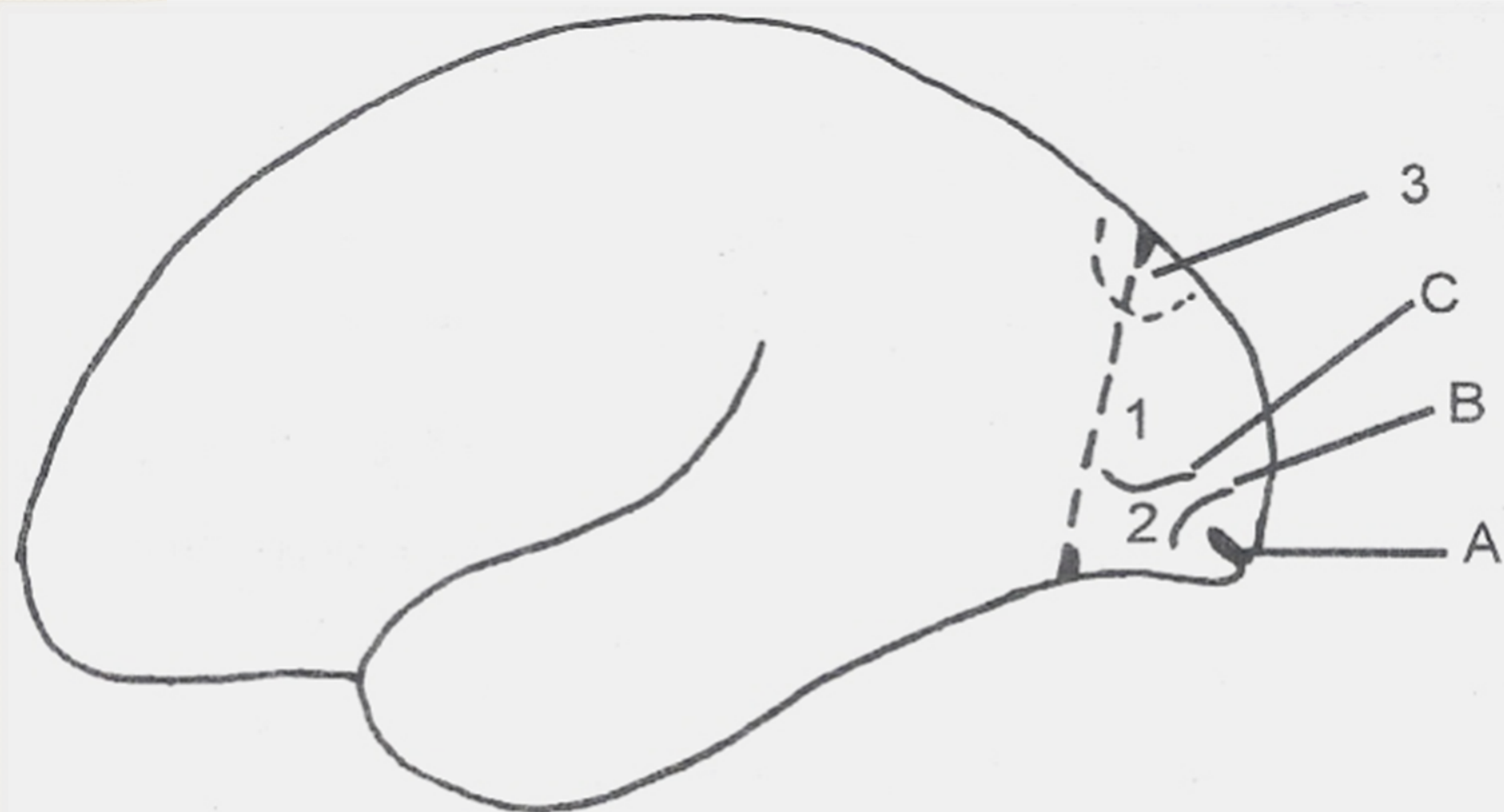
Boundaries on the inferior surface of C.H.:

Present from a line connecting the lower end of
parieto-

occipital sulcus with the preoccipital notch to

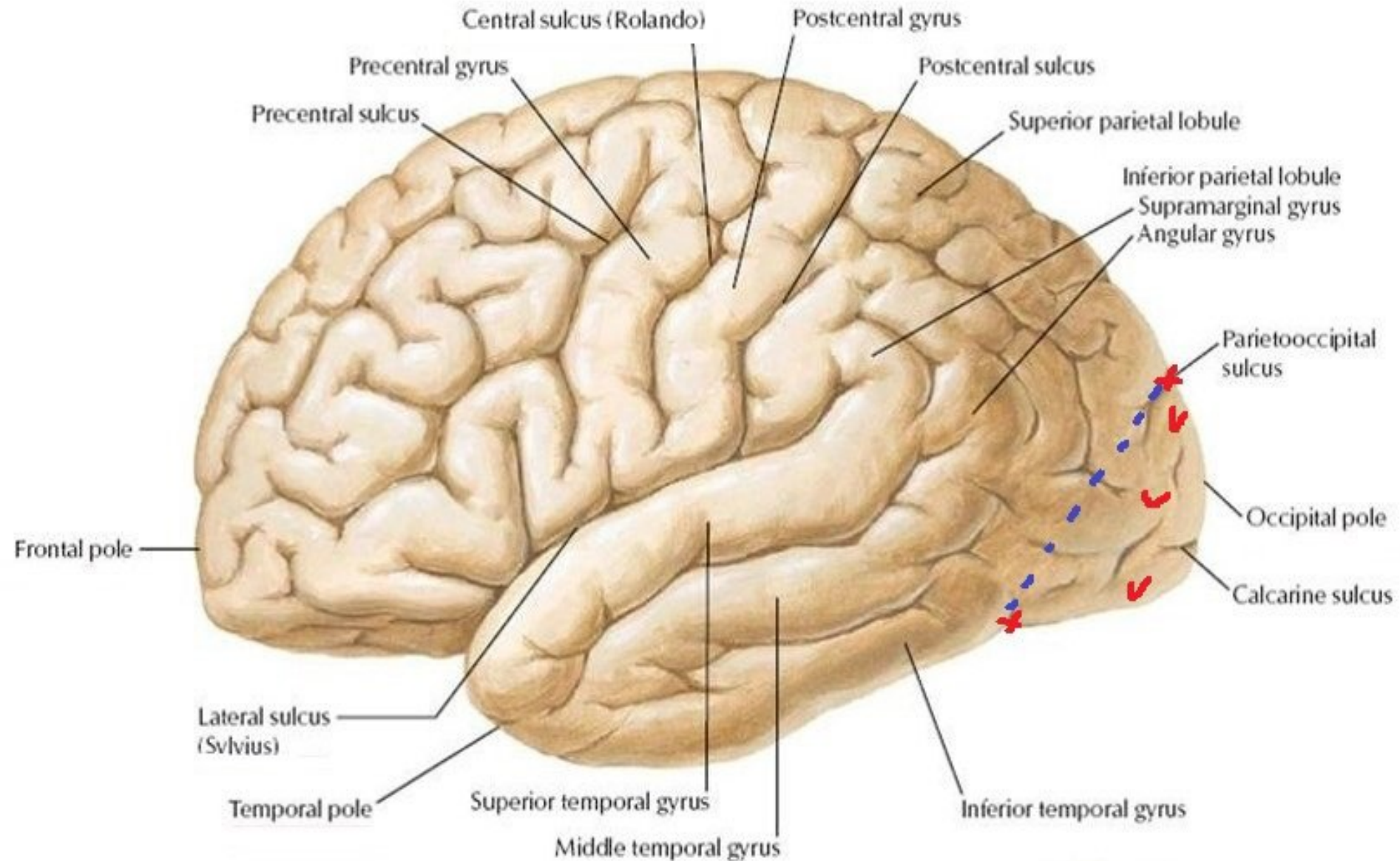
Important Gyri of Occipital Lobe

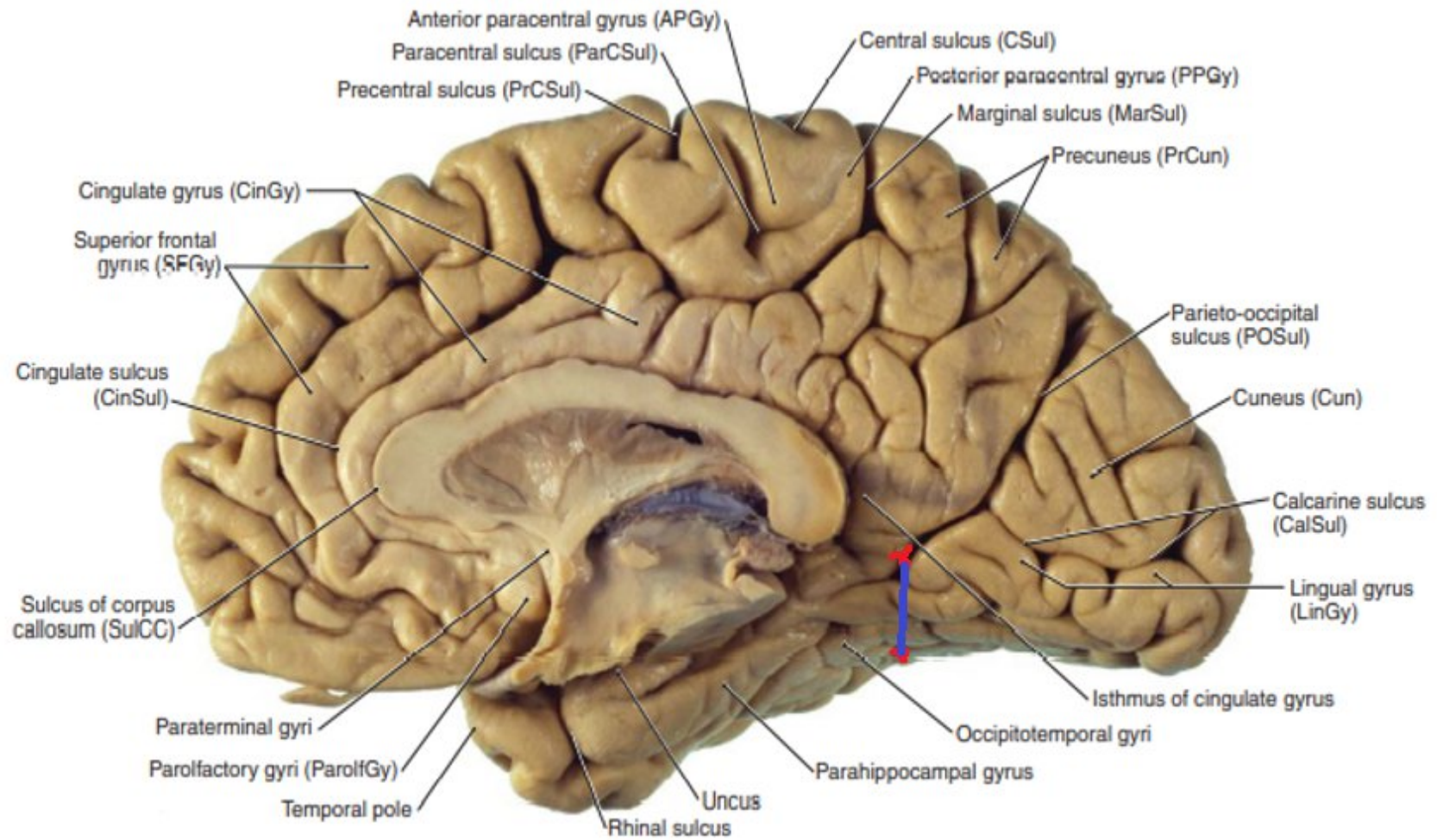
- The superior occipital gyrus above the lateral occipital sulcus.
- The inferior occipital gyrus below the lateral occipital sulcus.
- Arcus parieto-occipitalis gyrus surrounds the termination (upper end) of the parieto-occipital sulcus.

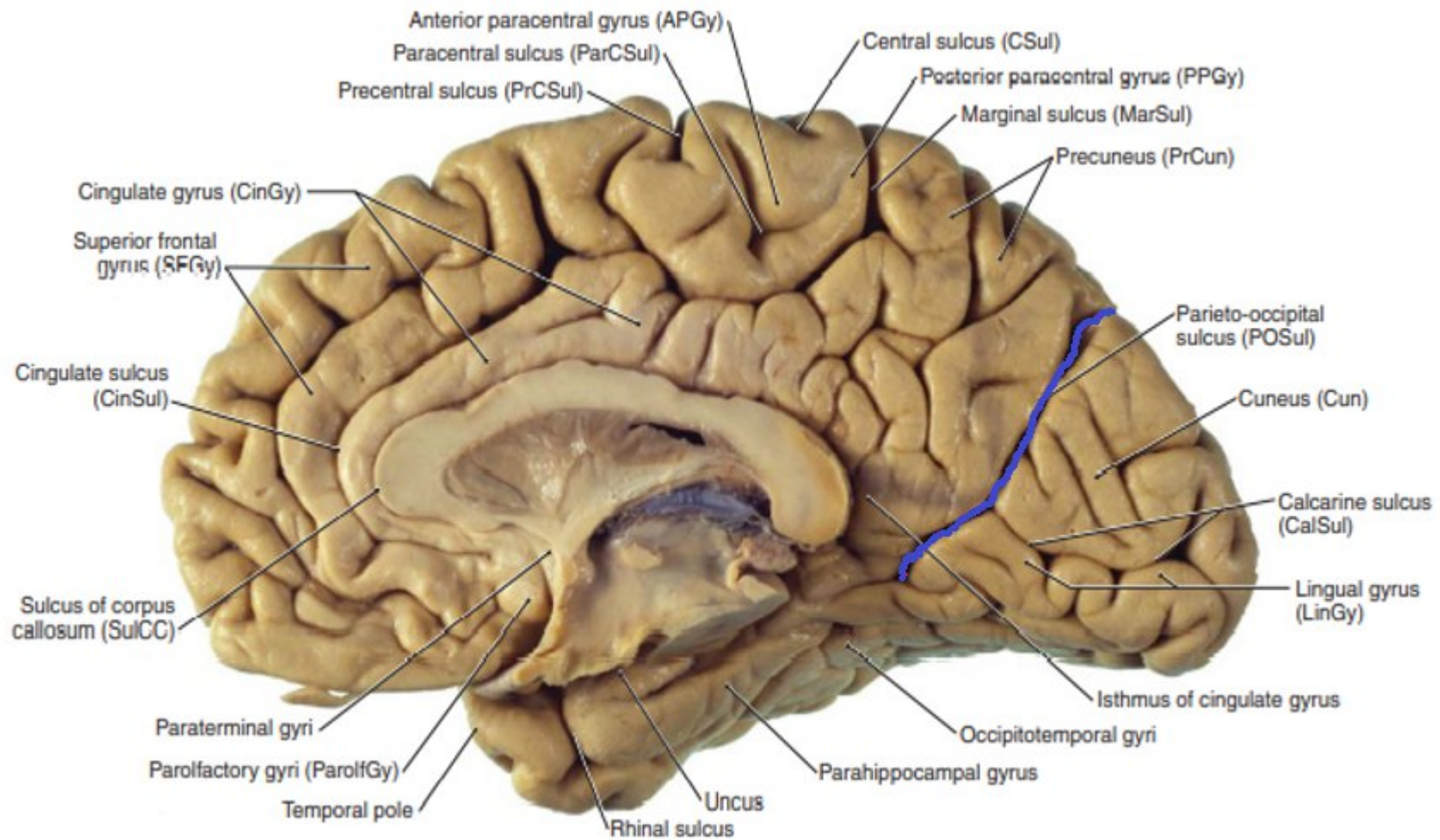


- A : Posterior end of calcarine sulcus.
B : Lunate sulcus.
C : Lateral occipital sulcus.
1 : Superior occipital gyrus.
2 : Inferior occipital gyrus.
3 : Arcus parieto – occipitalis.

Important Gyri of Occipital Lobe





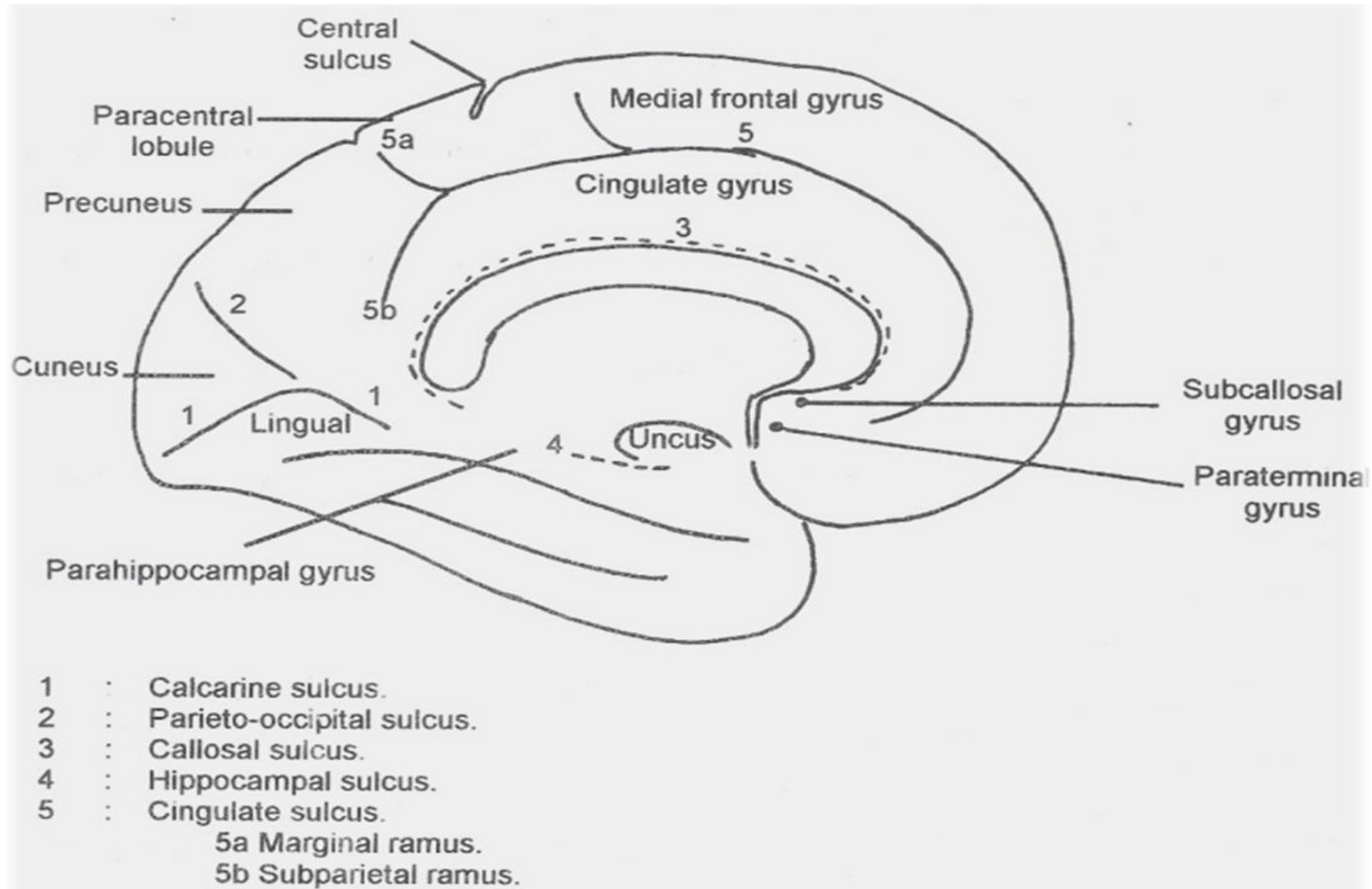


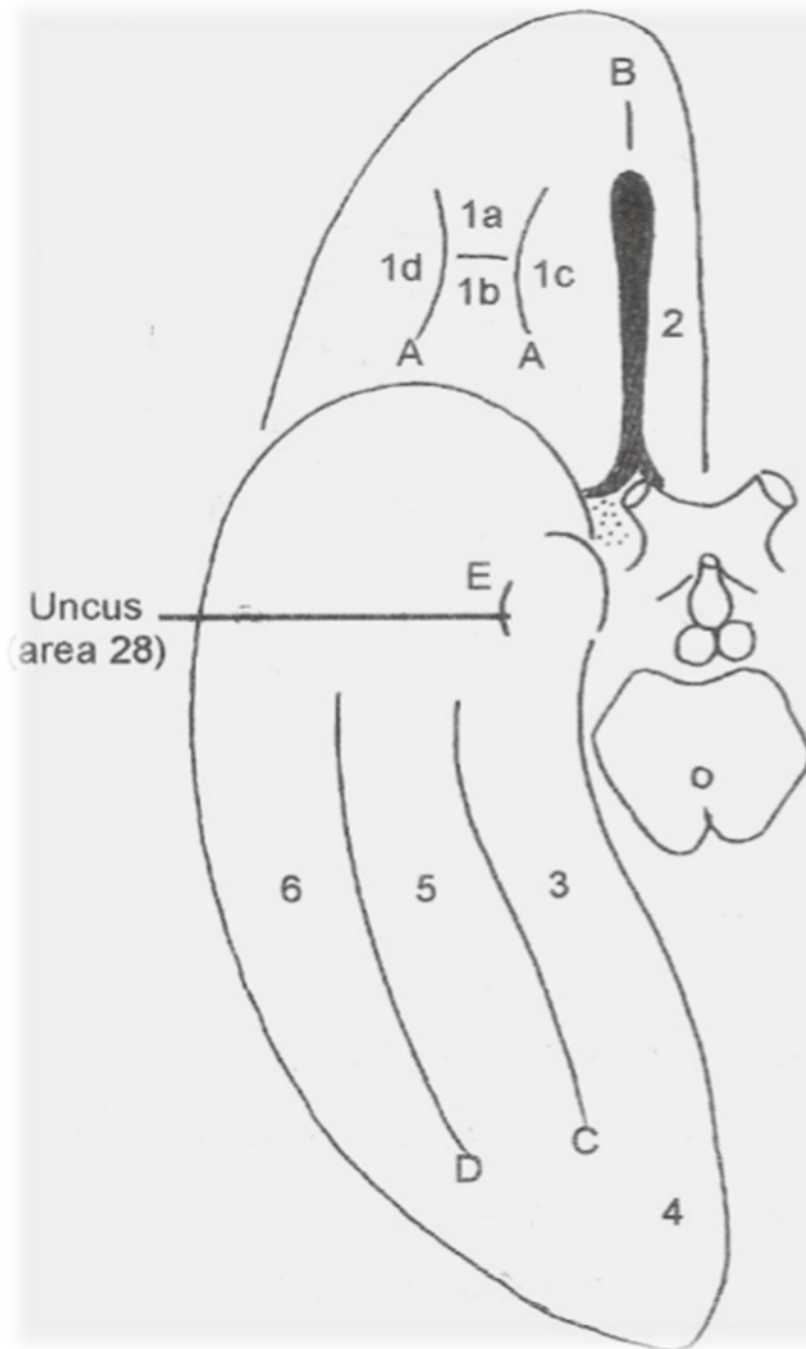
Other Gyri of the Cerebral Hemisphere

- **The cingulate gyrus:** is present between the callosal and cingulate sulci.
- **The medial frontal gyrus:** is present above the cingulate sulcus.
- **The paracentral gyrus (lobule):** is contains:
 - **Anterior paracentral lobule:** lies in the upper medial surface of precentral gyrus.
 - **Posterior paracentral lobule:** lies in the upper medial surface of postcentral gyrus.
- **Paraterminal and subcallosal gyri:** located anterior to the lamina terminalis and inferior to the rostrum of the corpus callosum.
- **Cuneus:** situated behind the parieto-occipital sulcus and above the calcarine sulcus in the medial surface of occipital lobe.
- **Lingual gyrus:** lies inferior to the calcarine sulcus in the medial surface of occipital lobe.
- **Precuneus:** located in the medial surface of the parietal lobe.

- **Gyrus rectus** : located in the inferior surface of frontal lobe medial to the olfactory sulcus.
- **Orbital gyrus**: located in the inferior surface of frontal lobe lateral to the olfactory sulcus.
- **Uncus**: is present in the inferior surface of temporal lobe.
- **Parahippocampal gyrus**: is present in the inferior surface of temporal lobe, **medial to collateral sulcus and lateral to hippocampal sulcus.**
- **Medial occipito-temporal gyrus**: is present **between the collateral and occipito-temporal sulci.**
- **Lateral occipito-temporal gyrus (Fusiform gyrus)**: is present **lateral to occipito-temporal sulcus.**

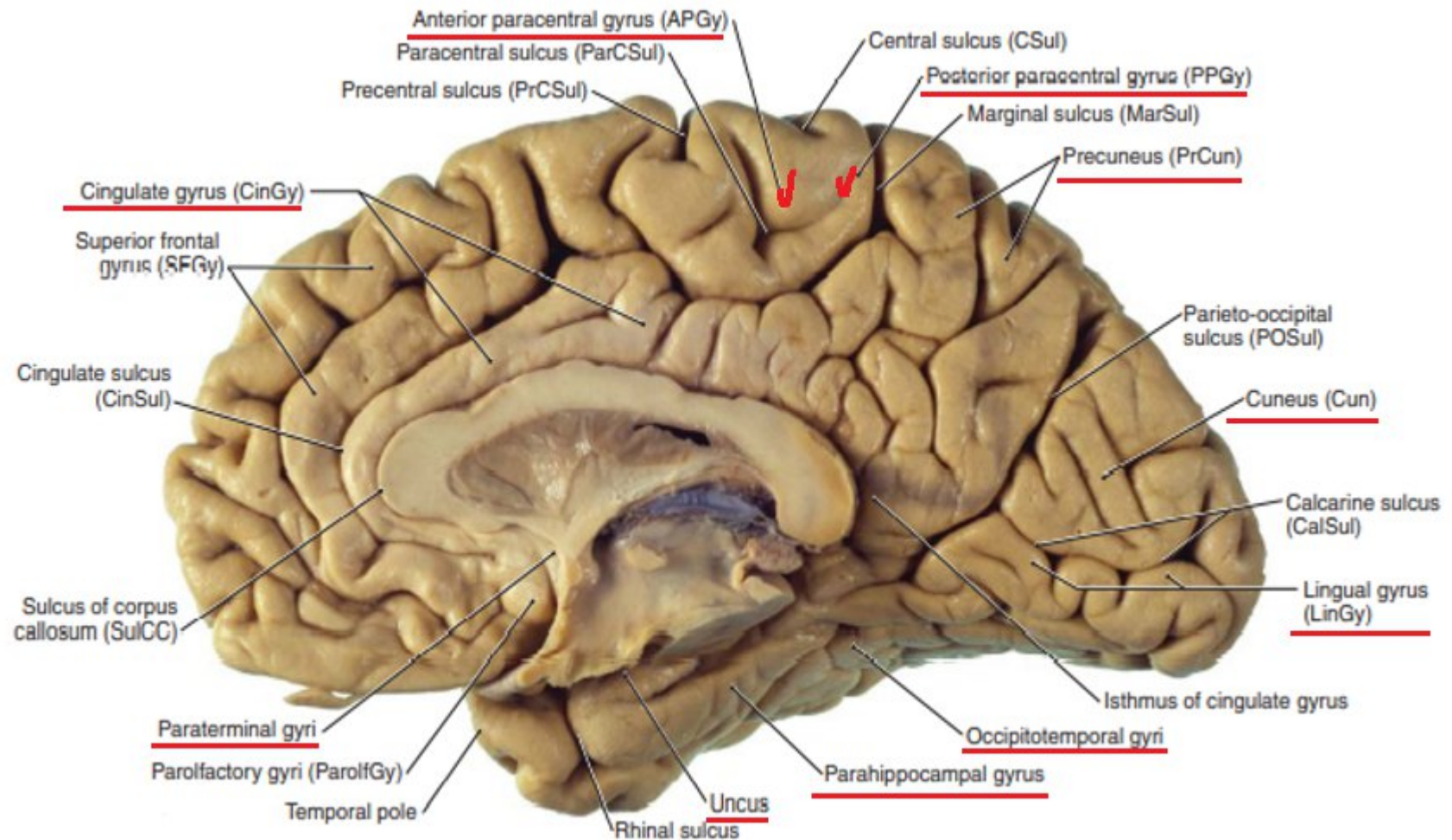
Other Gyri of the Cerebral Hemisphere





- A. : Orbital sulcus.
- B. : Olfactory sulcus.
- C. : Collateral sulcus.
- D. : Occipitotemporal sulcus.
- E. : Rhinal sulcus.
- 1. : Orbital gyri.
 - 1a Anterior.
 - 1b Posterior.
 - 1c Medial.
 - 1d Lateral.
- 2. : Gyrus rectus.
- 3. : Parahippocampal gyrus.
- 4. : Lingual gyrus.
- 5. : Medial occipitotemporal gyrus.
- 6. : Lateral occipitotemporal gyrus.

Other Gyri of the Cerebral Hemisphere



5. The Insular Lobe

The insula is a part of the cerebral cortex which is hidden in the bottom of lateral sulcus.

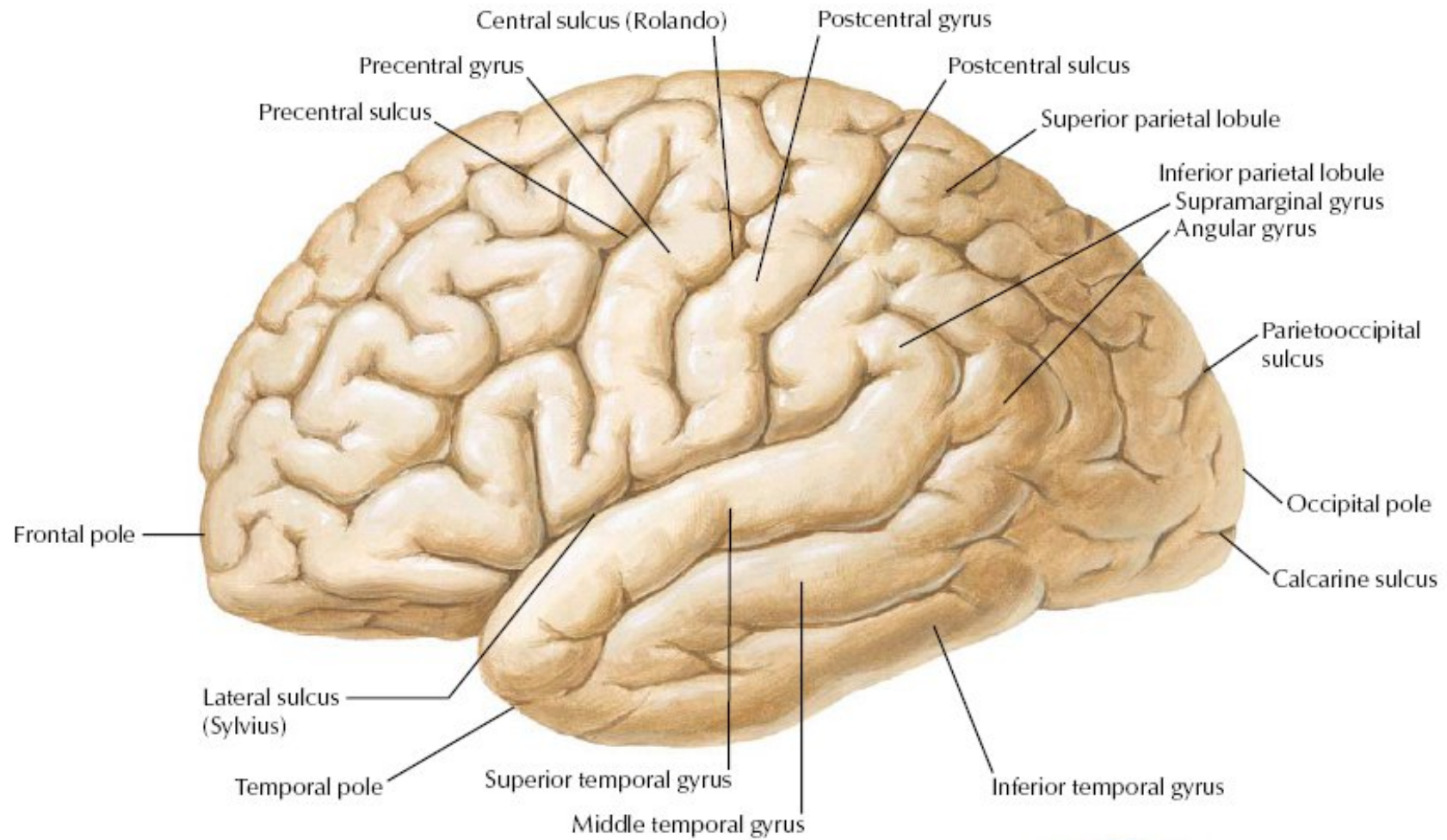
Its margins are surrounded by the circular sulcus of the insula.

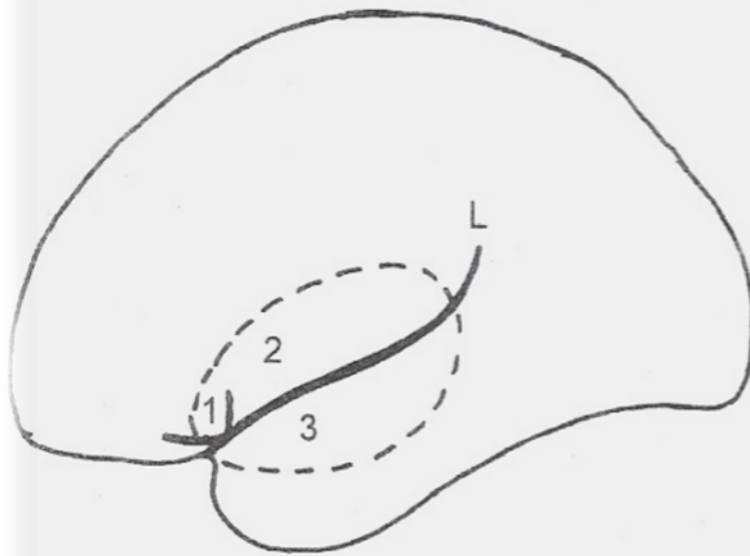
The insula contains two long gyri (behind) and 3-4 short gyri (in front).



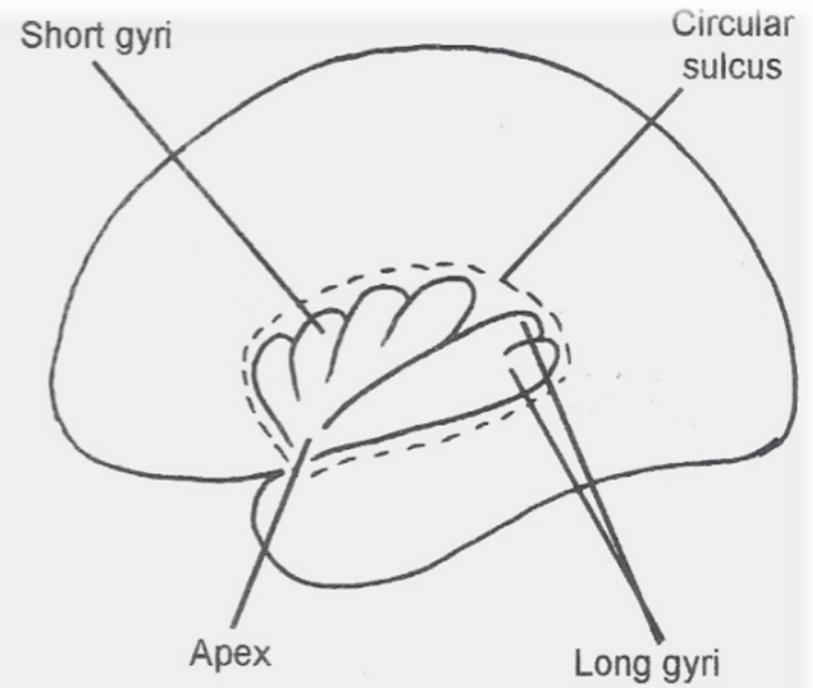
The parts of the cerebral hemisphere which cover it are called **opercula of the insula** (orbital operculum, frontal operculum, frontoparietal operculum and temporal operculum).

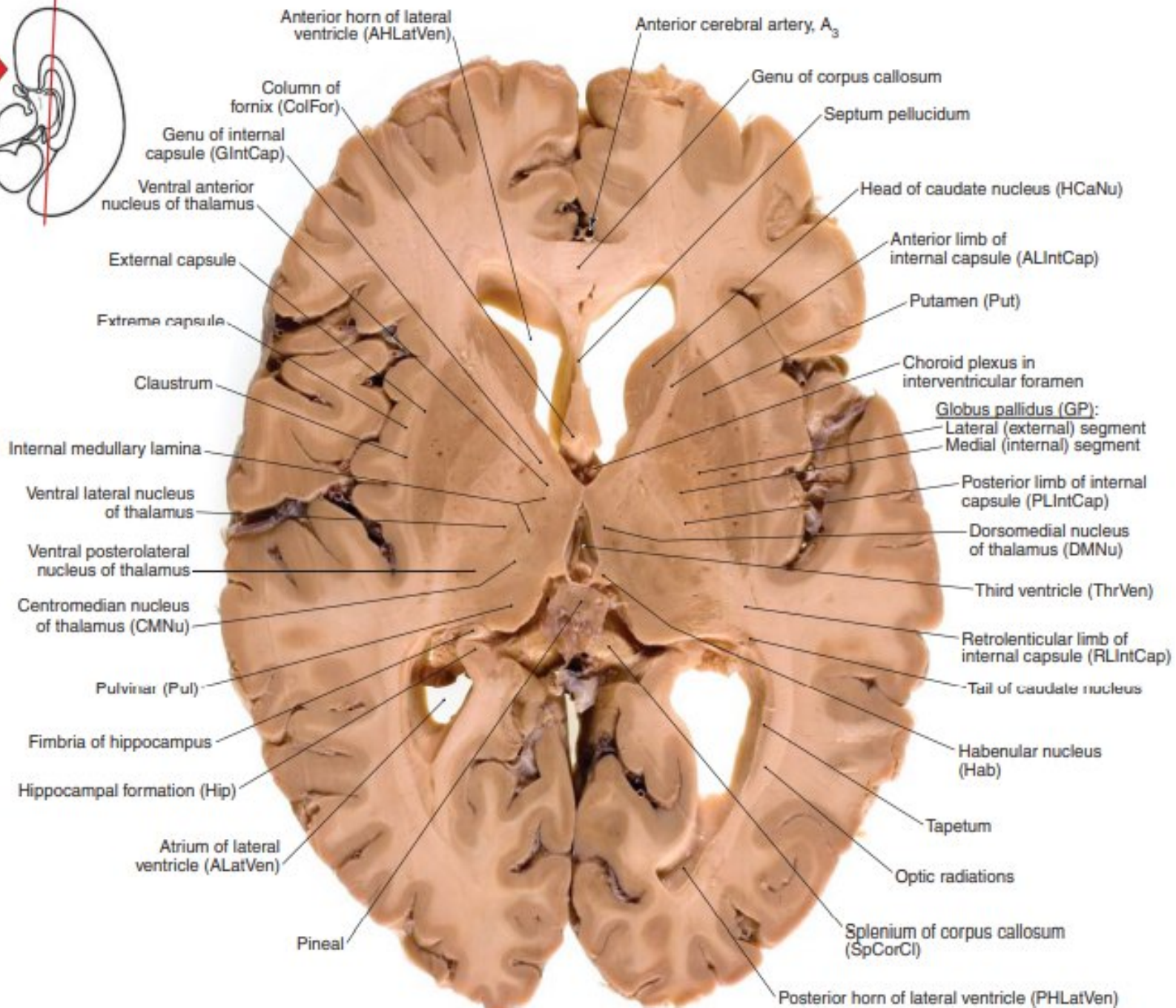
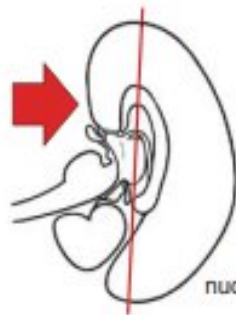
Function of the insula cortical taste center and some visceral activities (e.g. salivation).



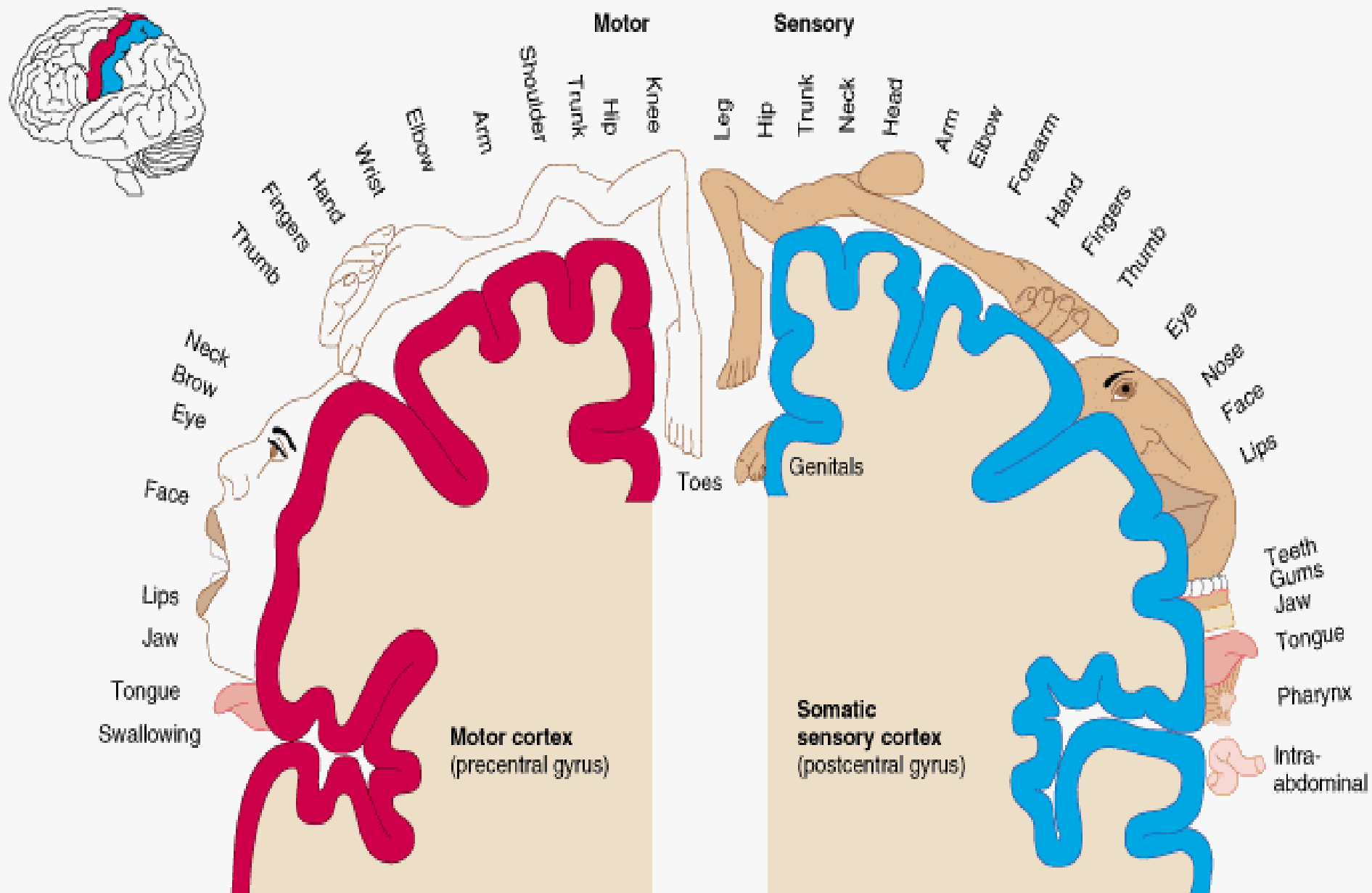


- 1 : Frontal operculum.
- 2 : Frontoparietal operculum.
- 3 : Temporal operculum.
- L : Lateral sulcus.

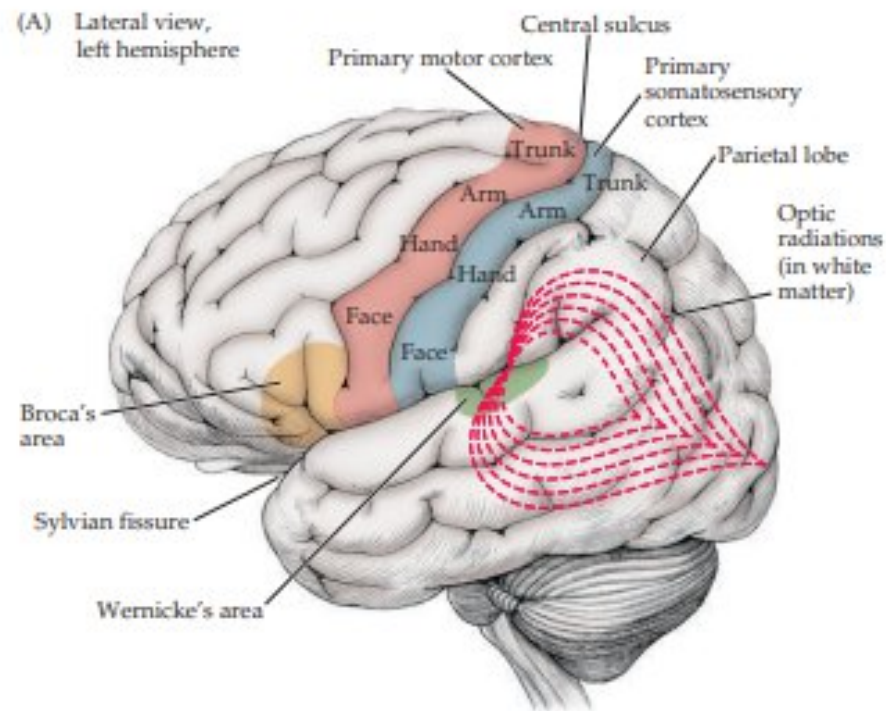




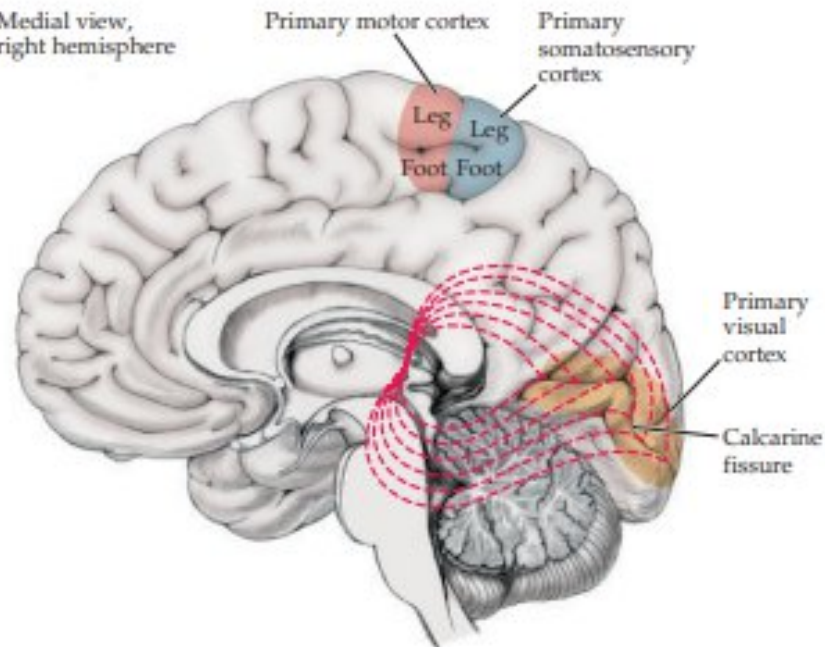
Cortical Somatotopy



(A) Lateral view,
left hemisphere



(B) Medial view,
right hemisphere

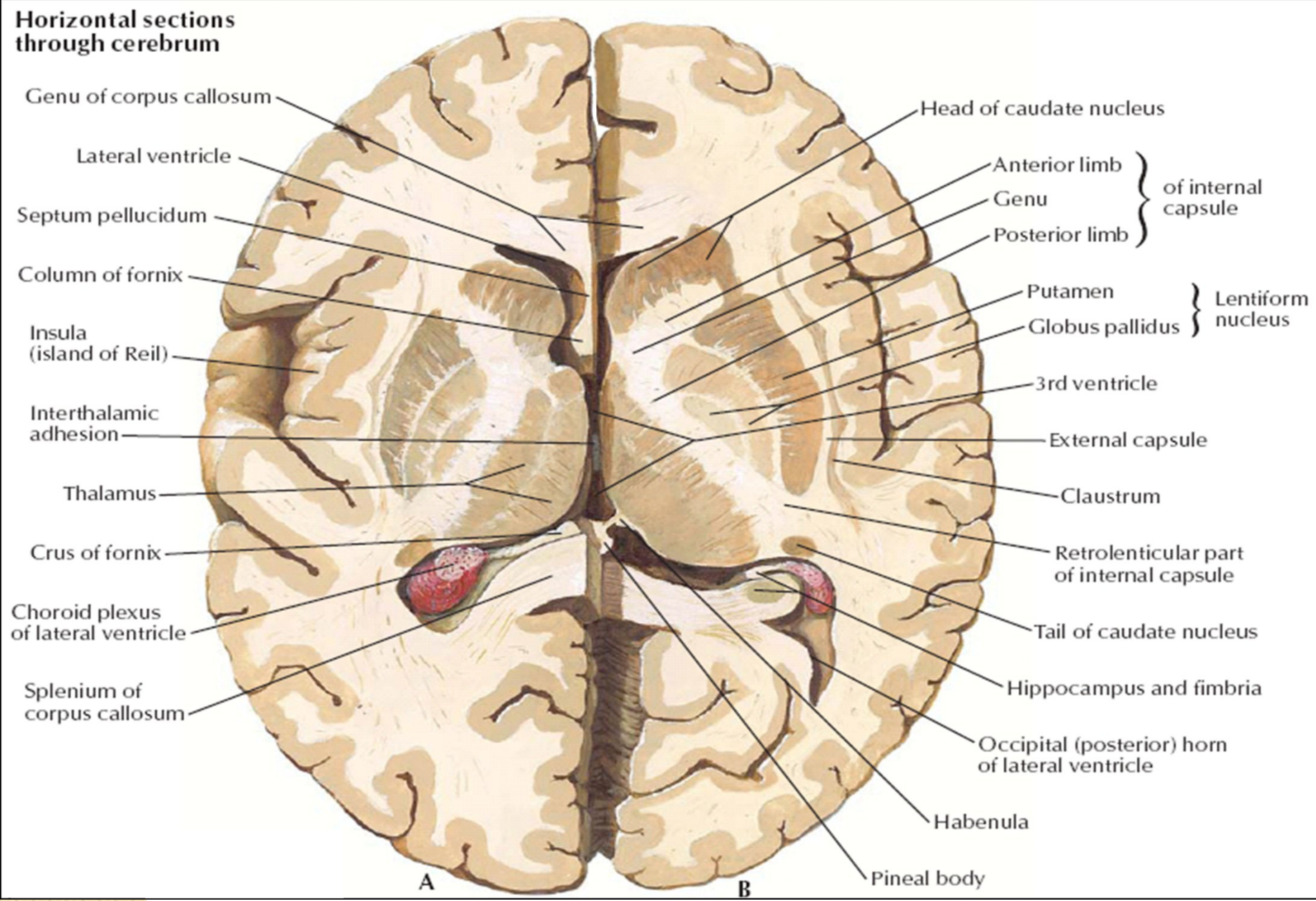


Internal Structure of the Cerebrum

The cerebral hemispheres consists of :

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

Internal Structures of the Cerebral Hemispheres



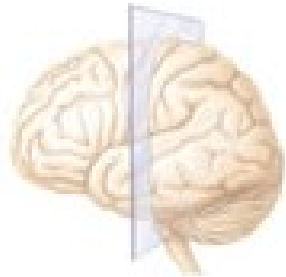
The White Mater of the Cerebrum

Consists of myelinated nerve fibers .

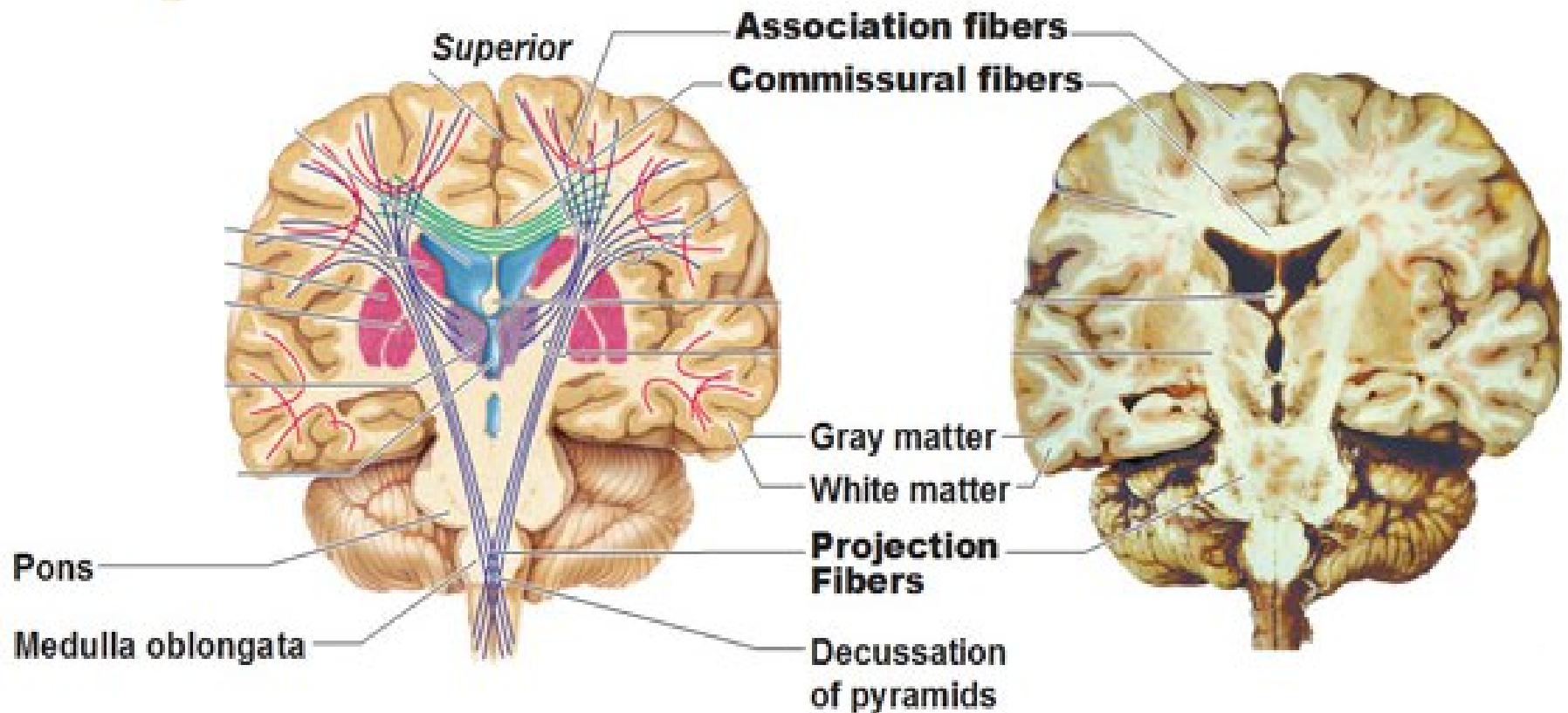
There are three types of fibers in the white mater:

- **Projection fibers:**They connect the cerebral cortex with the lower subcortical centers and spinal cord.
- **Association fibers:**They connects different areas of the same cerebral hemisphere .
- **Commissural fibers:**They connect similar areas of both hemispheres.

Cerebral White Matter – 3 types of fibers



(a) Frontal section



The Projection Fibers

Definition: they are afferent and efferent fibers (tracts) of the cerebral cortex which connect the cerebral cortex with the lower part of the brain and spinal cord (e.g. pyramidal tract).

Types of the Projection Fibers:

- **Ascending (afferent or sensory)** to the cerebral cortex from the thalamus and spinal cord.
- **Descending (efferent or motor)** from the cerebral cortex to lower centers and spinal cord.

The Association Fibers

Definition: they are fibers which connect the different cortical areas in the same hemisphere.

Types of Association Fibers:

- **Short association fibers:** they connect adjacent gyri with one another (in the lobe).
- **Long association fibers:** connect the different lobes of the hemisphere together.

Thank You

