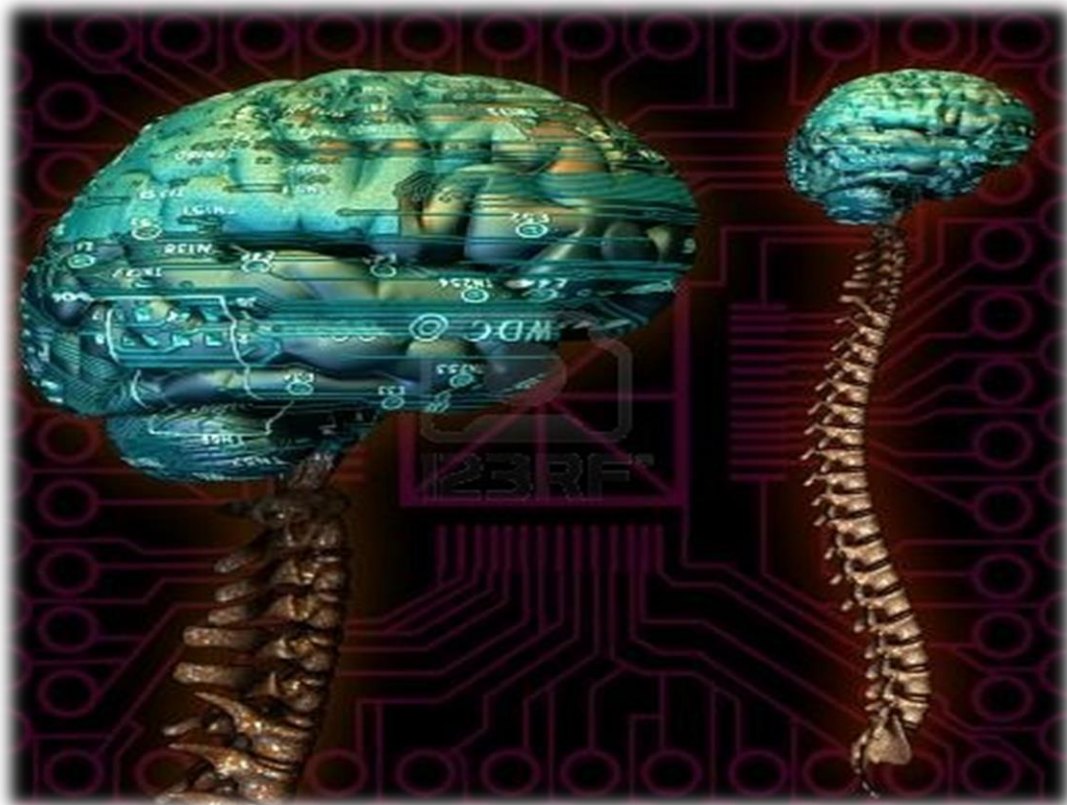




CNS Block

LECTURE (17)



[If there is any mistake please feel free to contact us:](#)

Anatomyteam32@gmail.com

Done by:Raghad Al misfer

Reviewed by:AlWaleed Alotaibi

Both - Black

Male Notes - BLUE

Female Notes - GREEN

Explanation and additional notes - ORANGE

Very Important note - Red



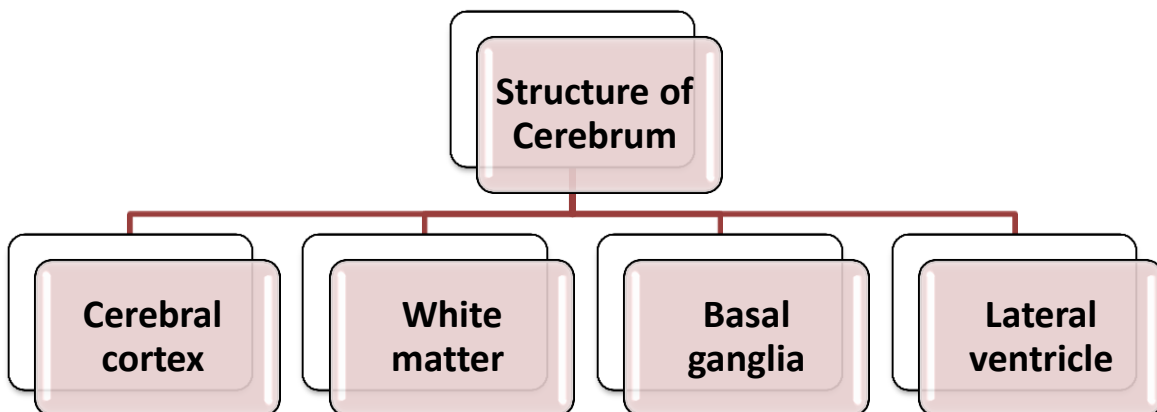
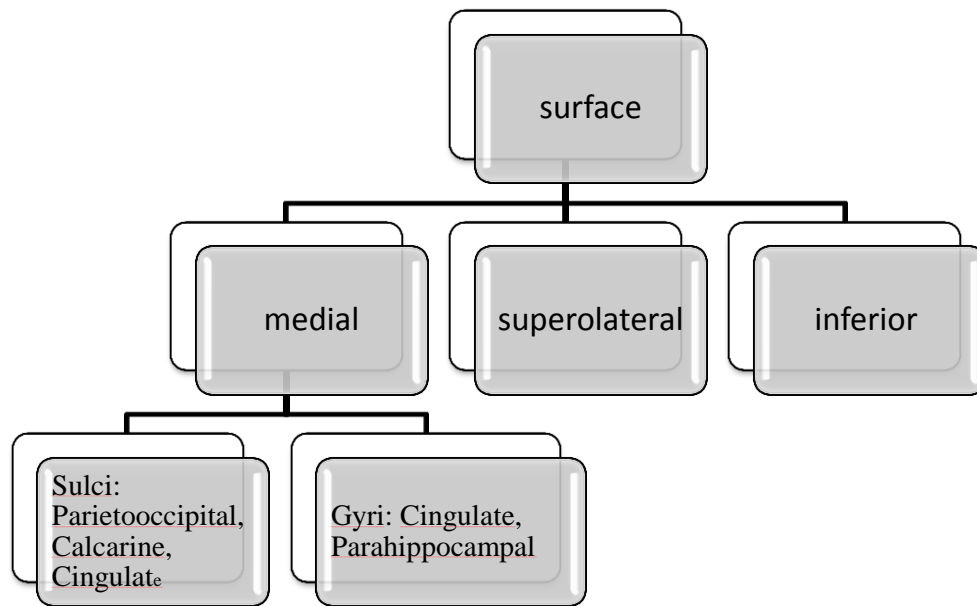
Objectives:

At the end of the lecture, the student should be able to:

- List the parts of the cerebral hemisphere (cortex, medulla, basal nuclei, lateral ventricle).
- Describe the subdivision of a cerebral hemisphere into lobes.
- List the important sulci and gyri of each lobe.
- Describe different types of fibers in cerebral medulla (association, projection and commissural) and give example of each type.

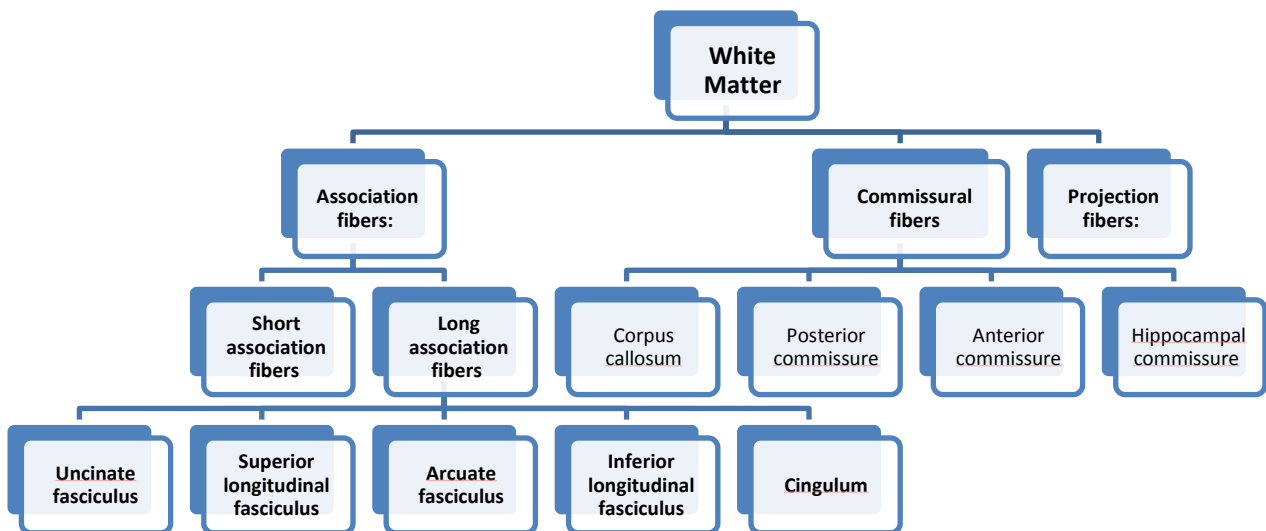
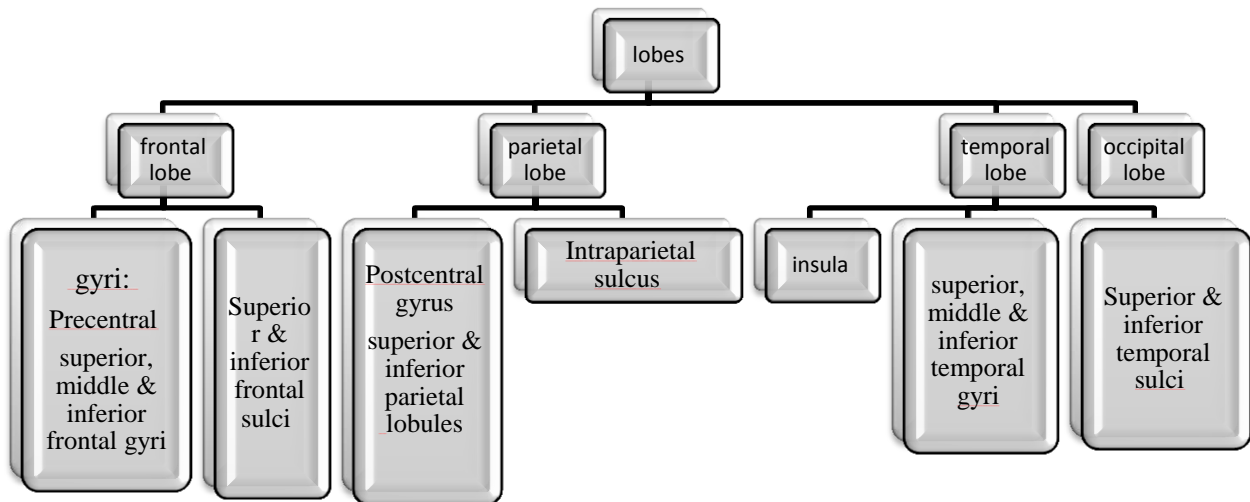


MIND MAP





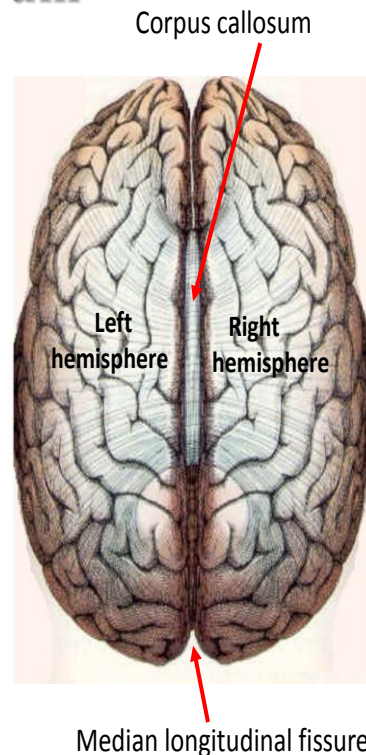
MIND MAP





Cerebrum

- Largest part of the forebrain.
- Divided into two halves, the **cerebral hemispheres**, which are separated by a deep **median longitudinal fissure** which lodges the falx cerebri.
- In the depth of the fissure, the hemispheres are connected by a bundle of fibers called the **corpus callosum**.

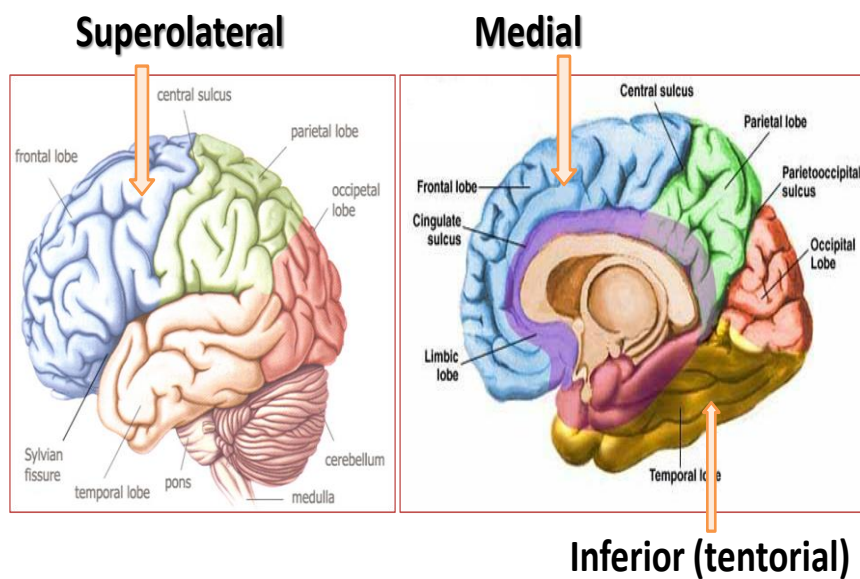


Note :

median longitudinal fissure---->>you can describe it as deep sulcus



Surfaces



Note :

Tentorium cerebelli : it is a dura matter layer setting horizontally between cerebrum and cerebellum .

Where you cut corpus callosum ----> medial surface

Outer surface ----->superolateral surface

Above the cerebellum -----> Inferior (tentorial)

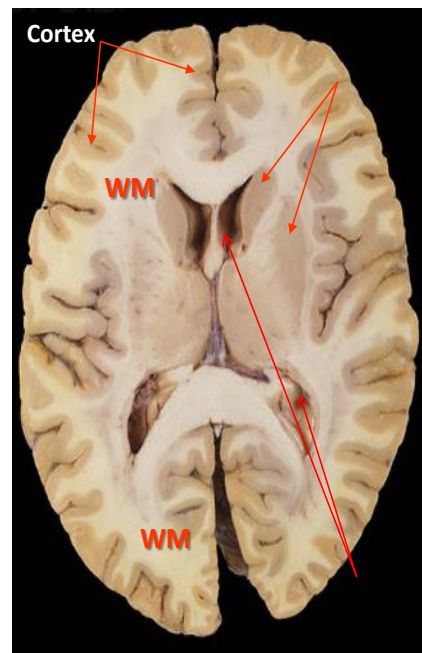




Structure of Cerebrum

Includes:

- ❑ **Cerebral cortex:** Superficial layer of grey matter
- ❑ **White matter (WM):** Deeper to the cortex, containing axons to and from the cells of the cortex
- ❑ **Basal ganglia:** Number of nuclear masses buried within the white matter
- ❑ **Lateral ventricle:** The cavity of hemisphere



Note :

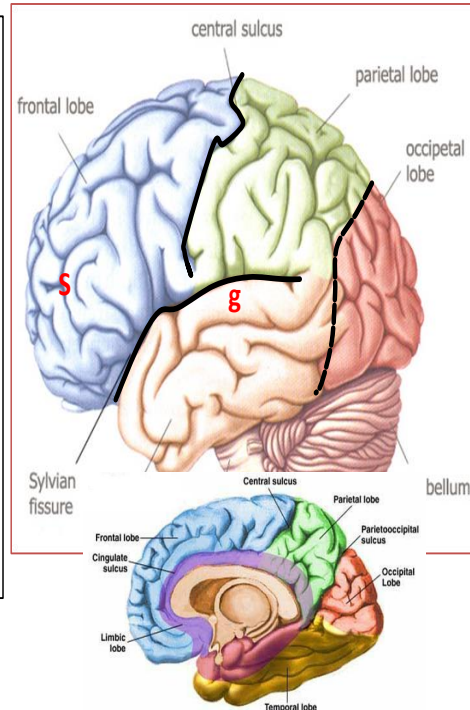
(caudate, putamen, globus pallidus) collectively known as the **basal ganglia**



Lobes of Cerebrum

The superficial layer of grey matter is highly convoluted to form a complex pattern of ridges (**gyri**) and grooves (**sulci**). This arrangement maximizes the surface area of the cerebral cortex (about 70% is hidden within the depths of sulci).

- Three sulci, consistent in position, named **central**, **lateral (sylvian)** & **parieto-occipital**, divide each hemisphere into **FOUR** lobes: **Frontal**, **Parietal**, **Temporal** & **Occipital** (named after overlying bones) by
- Functionally each hemisphere contains a '**limbic lobe**' on the medial surface.



NOTE :

- Many of sulci and gyri do not arrange in fix position (vary from person to person, from one hemisphere to other hemisphere)
- But Some of sulci and gyri have fix position :
- central, lateral (sylvian) & parieto-occipital
- parieto-occipital sulci prominent in medial surface
- limbic lobe : beside these lobes around central
- diencephalon structure

limbic lobe is responsible for:

Establishing **emotional** states ○

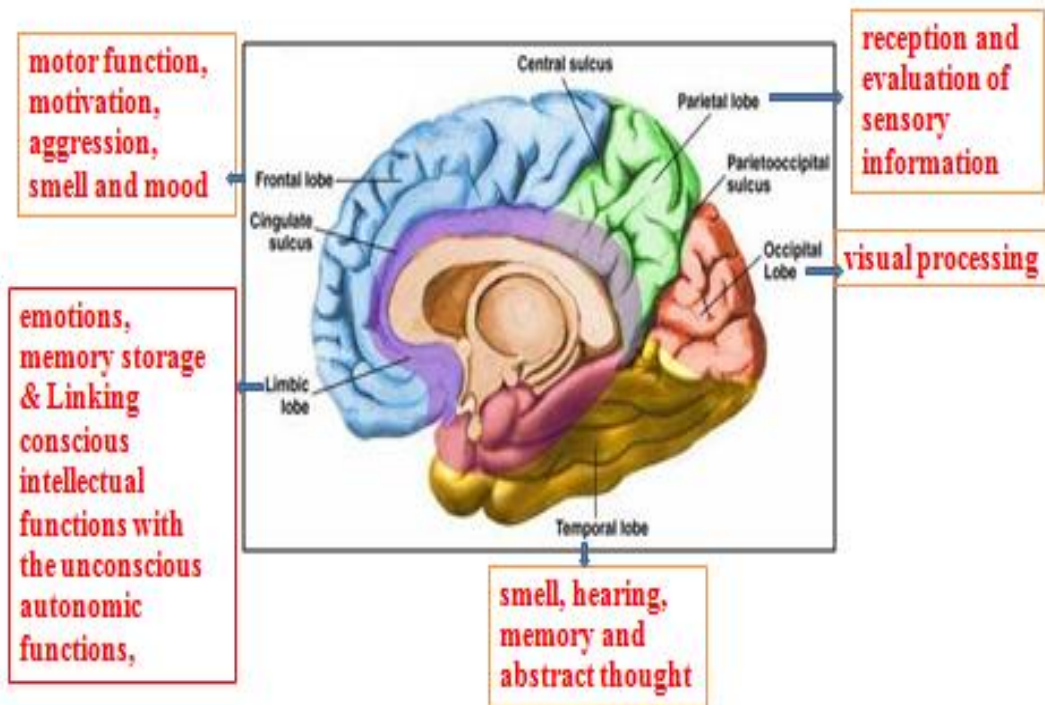
Linking conscious **intellectual** functions with ○
the unconscious **autonomic** functions

Facilitating **memory** storage. ○





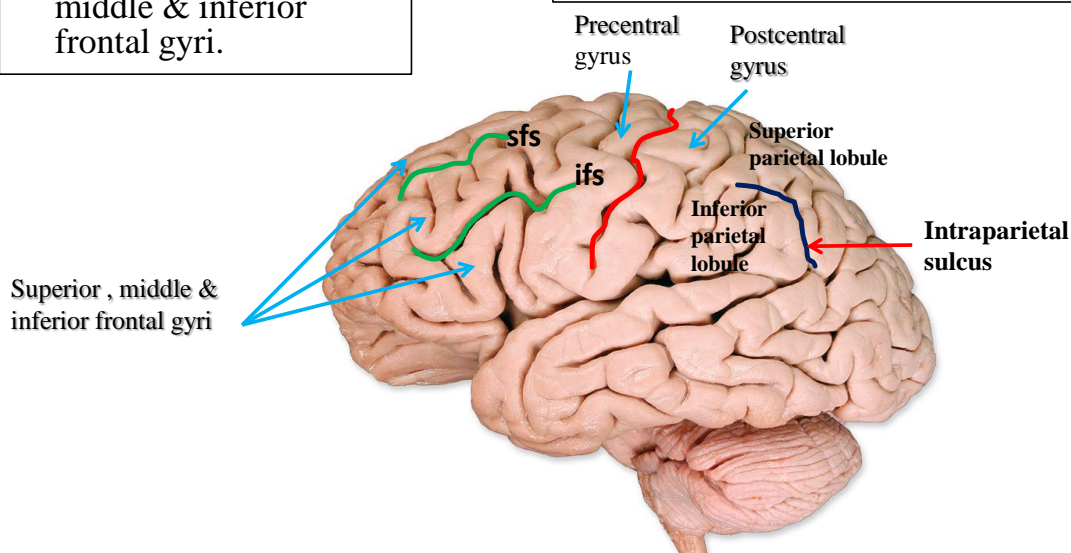
Function of Each Lobe





- ❑ **Frontal lobe:**
 - **Precentral gyrus.**
 - **Superior & inferior frontal sulci** divide the lobe into superior, middle & inferior frontal gyri.

- ❑ **Parietal lobe:**
 - **Postcentral gyrus.**
 - **Intraparietal sulcus** dividing the lobe into superior & inferior parietal lobules.



Note :

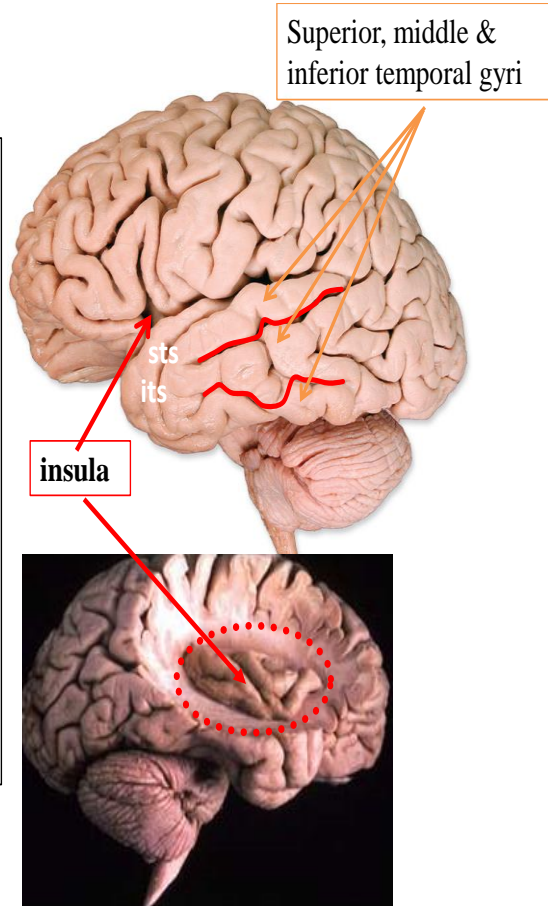
frontal lobe :Sfs and ifs running antero – posteriorly

parietal lobe : intra-parietal sulcus :deep line in the centre



□ Temporal lobe:

- **Superior & inferior temporal sulci** giving rise to superior, middle & inferior temporal gyri.
- **Insula:** the gyri in the depth of lateral fissure, covered by parts of frontal, parietal & temporal lobes called the opercula (removed in lower picture.).



Note :

Superior & inferior temporal sulci -----> parallel lines across temporal lobe

what different lobes form the lateral sulcus?-----> upper lip formed by frontal , lower lip formed by parietal inferior lip formed by superior temporal gyrus .

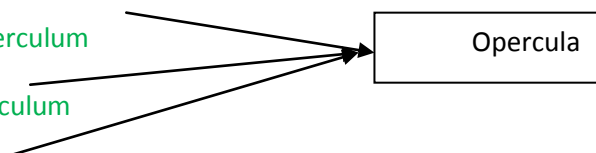
if you hold the brain , and pole apart of temporal from frontal and parietal , you will find groupe of grey matter called insula

operculum :it means a certain structure that hide another structure .

so , part of frontal lobe is operculum

part of temporal is operculum

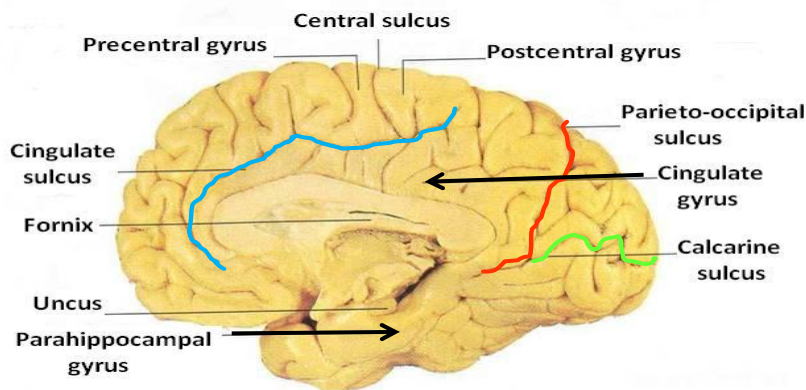
part of parietal is operculum





Medial Surface

- Sulci: Parietooccipital, Calcarine, Cingulate
- Gyri: Cingulate, Parahippocampal



Note:

Cingulate sulcus : across frontal lobe enter into parietal lobe

Cingulate gyrus: below cingulate sulcus , Cingulate gyrus part of limbic system

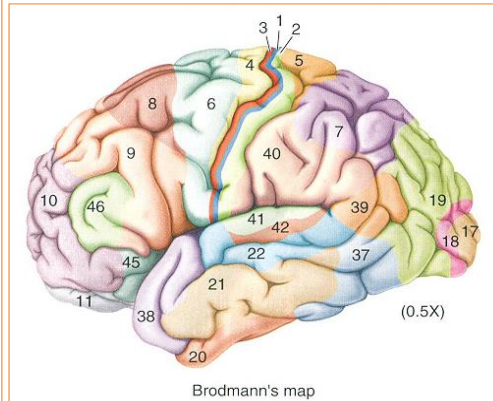
Calcarine sulcus : from the root of parieto-occipital sulcus to tip of occipital lobe

Parahippocampal gyrus: located in temporal lobe and it is part of limbic system



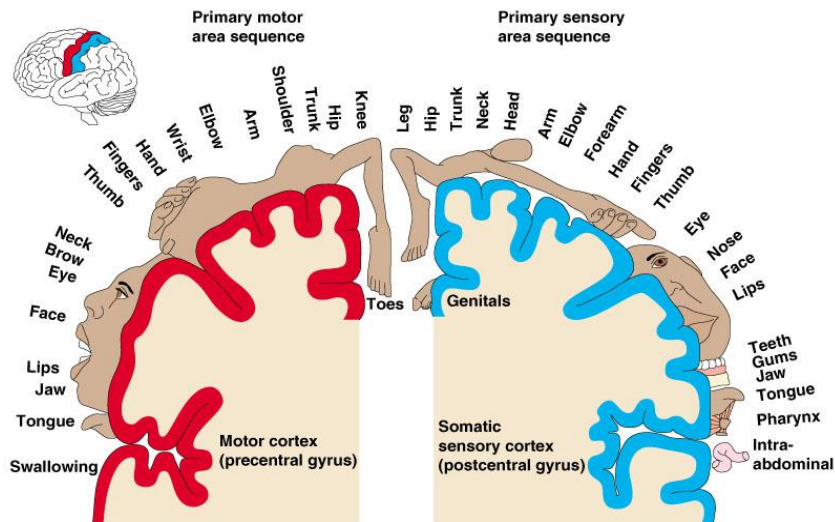
Brodmann's Map

- Brodmann produced a **numbered, cytological map** of cerebral cortex based upon **its regional histological characteristics**
- Subdivisions with **similar cellular and laminar structure** are called **'areas'**
- Brodmann's numbering of these cortical locations has become one of the **standard ways** to identify **brain areas**.





Lobe	Function area	
Frontal	<p>Primary motor cortex: Located in precentralgyrus (Brodmann area 4).</p> <p>Premotor cortex: Located in the region immediately anterior to the precentralgyrus (Brodmann's area 6).</p> <p>Prefrontal cortex: Extensive region of the frontal lobe anterior to premotor area.</p> <p>Broca's (motor speech) area: Located in the inferior frontal gyrus of the dominant hemisphere, usually left (Brodmann's area 44 & 45).</p> <p>Frontal eye field: Located in the middle frontal gyrus immediately in front of motor cortex (Brodmann's area 8).</p>	
Parietal	<p>Primary somatosensory cortex: located in postcentralgyrus (Brodmann's area 1, 2, 3).</p> <p>Parietal association cortex: located posterior to primary somatosensory cortex.</p>	
Temporal	<p>Primary auditory cortex: located in the superior surface of the superior temporal gyrus (Brodmann's area 41, 42)</p> <p>Auditory association cortex: located immediately around the primary auditory cortex (also includes Wernick's area)</p> <p>Parahippocampalgyrus: located in the inferomedial part of temporal lobe. Deep to this gyrus lies the hippocampus and the amygdala, which are parts of limbic</p>	
Occipital	<p>Primary visual cortex: located on the medial surface of the hemisphere, in the gyri surrounding the calcarine sulcus (Brodmann's area 17).</p> <p>Visual association cortex: located around the primary visual cortex</p>	



Note :

Most sensitive area of the body has large area of cortex

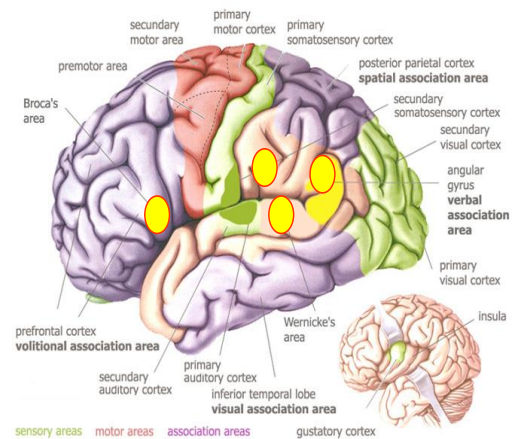
organ do motor activity have large area of brain

The body represent up to down



Language Area

- Organized around the lateral fissure.
- **Broca's area:** concerned with expressive aspects of language.
- **Wernick's area:** responsible for comprehension of the spoken words.
- Nearby regions of temporal lobe and parietal lobe (**angular gyrus & supramarginal gyrus** of the inferior parietal lobule) are important in naming, reading, writing, and calculation.



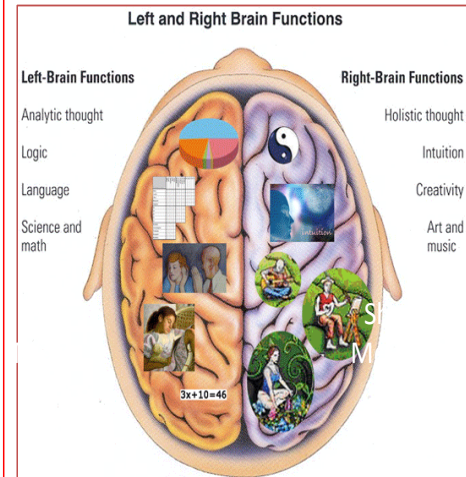
Note :

Wernick's area -----> has two function in the auditory and speech



Hemispheric Dominance

- The localization of **speech centers & mathematical ability** is the criterion for defining the dominant cerebral hemisphere.
- In 96% of normal **right-handed** individuals and 70% of normal **left-handed** individuals, the left hemisphere contains the language centers. These are **left hemisphere dominant**.
- Cerebral dominance becomes established during the **first few years after birth**.



Hemispheres communicate via the corpus callosum

Note :

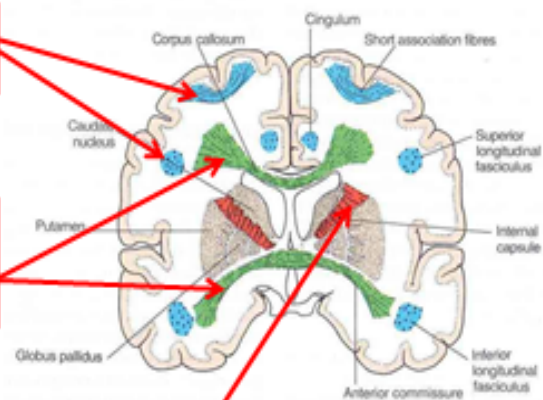
Broca's area mainly in the left hemisphere for both right handed people and left handed people



Depending on their origin & termination, these nerve fibers are classified into three types:

Association fibers: Unite different parts of the same hemisphere

Commissural fibers: Connect the corresponding regions of the two hemispheres



Projection fibers: Consisting of

- Afferent fibers conveying impulses to the cerebral cortex.
- Efferent fibers conveying impulses away from the cortex.



Association Fibers

Long association fibers connect more distant parts and include:

Short association fibers connect adjacent gyri,

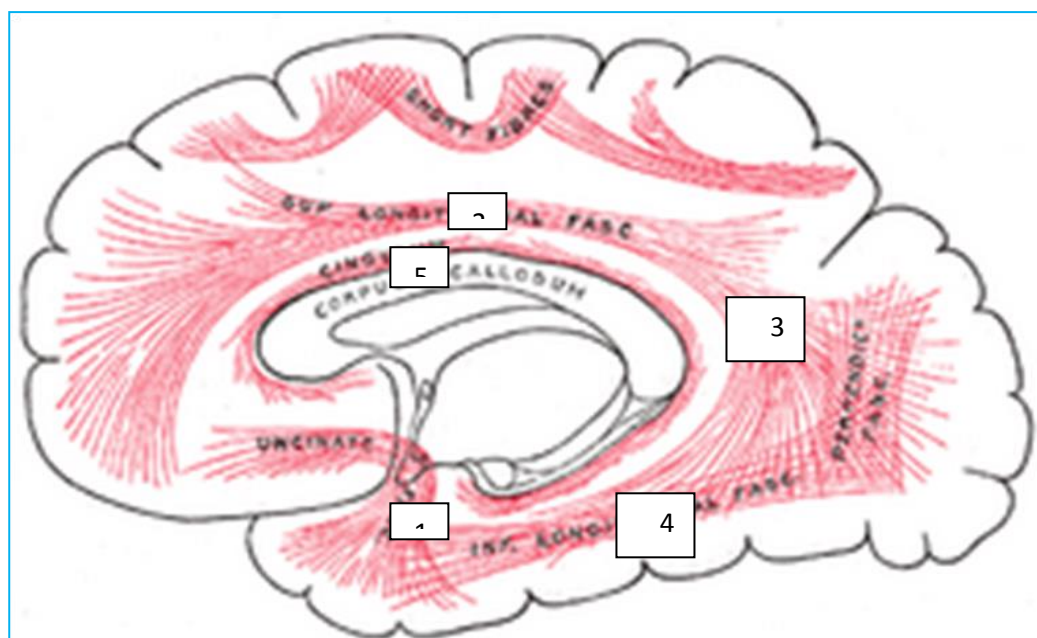
1. Uncinate fasciculus:
connects frontal to temporal lobe

2. Superior longitudinal fasciculus:
connects the frontal, occipital, parietal, and temporal lobe
the fiber which curve to enter the temporal lobe is arcuate fasciculus

3. Arcuate fasciculus:
connect gyri in frontal to temporal lobes

4. Inferior longitudinal fasciculus:
connects occipital to temporal pole

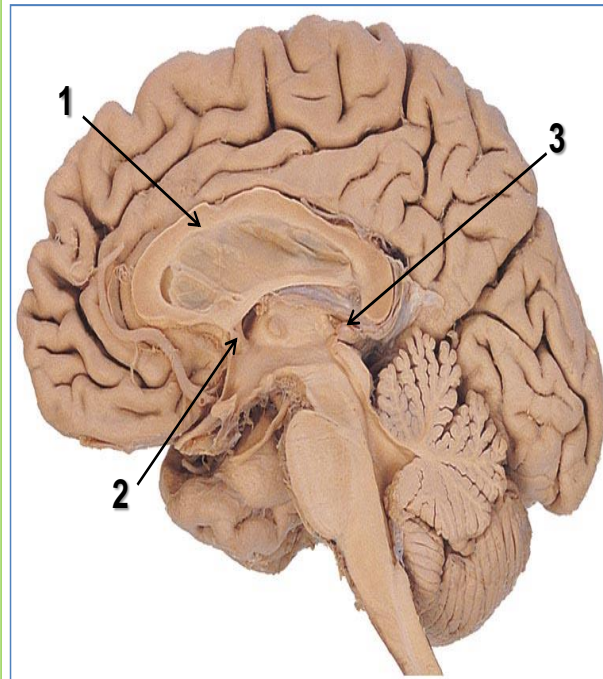
5. Cingulum:
connects frontal & parietal lobes to the parahippocampal gyrus and adjacent temporal gyri





Commissural Fibers

- Connect the corresponding regions of the two hemispheres.
- Include:
 1. Corpus callosum.
 2. Anterior commissure.
 3. Posterior commissure.
 4. Hippocampal commissure (commissure of fornix).



NOTE:

Anterior commissure-----> small fiber , below anterior part of corpus callosum

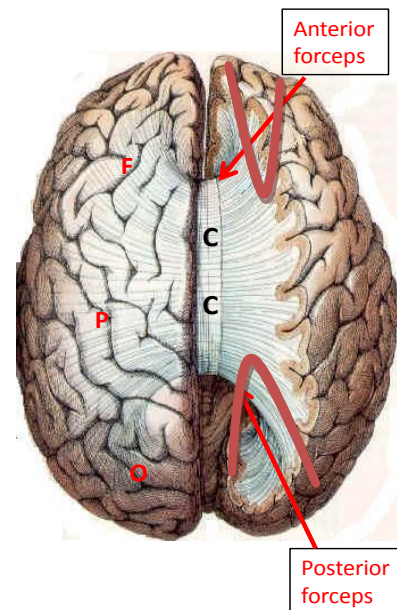
Posterior commissure-----> just above superior colliculus

Hippocampal commissure (commissure of fornix).-----> deeper within parahippocampalgyrus (when you open parahippocampalgyrus you will find tow swelling (hippocampi) , connect whith each other by Hippocampal commissure



Corpus Callosum

- Connects the corresponding regions of the two hemispheres except the temporal lobes, that are connected by anterior commissure
- It is shorter craniocaudally than is the hemisphere
- The callosal fibers linking the frontal poles curve forward forming anterior forceps (**forceps minor**)
- The callosal fibers linking the occipital poles curve backward forming posterior forceps (**forceps major**)



Note :

Antero-posterior length of corpus callosum shorter than Antero-posterior length of hemisphere because of that :

The fiber that connect the anterior pole of frontal lobes , will pass backward reach anterior part of corpus callosum then go to opposite side and reach anterior pole of corpus callosum

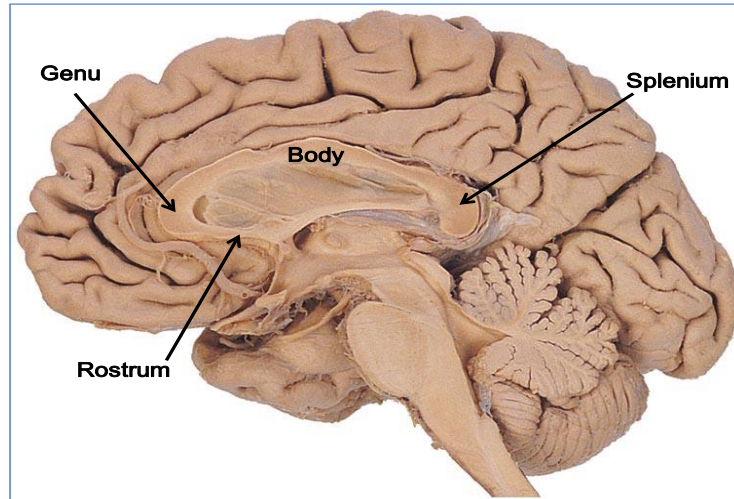
The anterior end of corpus callosum ---- form forceps

The fiber that connect the two occipital lobe run forward reach corpus callosum then to opposite hemisphere go backward to reach corresponding area in occipital lobe

The posterior end of corpus callosum ---- form forceps



Parts of Corpus Callosum



Note :

Genu --- --> anterior curve

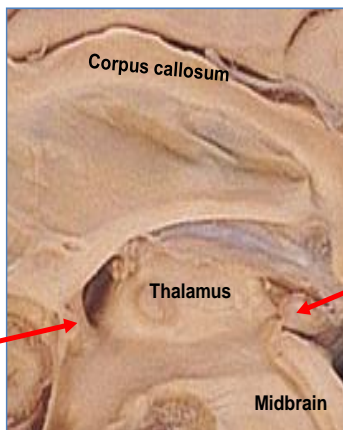
Lower part , connect to anterior commissure ---->
rostrum

Extend anteriorly -----> body

Splenium----> posterior round structure

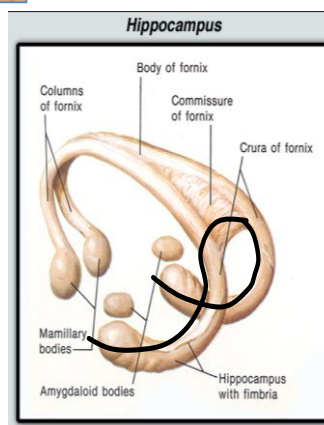


❑ **Anterior commissure:** connects the inferior and middle temporal gyri & the olfactory regions of the two hemispheres



❑ **Posterior Commissure:** connects the left and right midbrain. Important in the bilateral pupillary reflex

❑ **Hippocampal Commissure:** connects the two hippocampi with each other



Note :

To have bilateral pupillary reflex (reflex in tow eye) , you have to have intact **Posterior Commissure** because the impulse pass through it .

Right hippocampus project to right mamillary body of hypothalamus

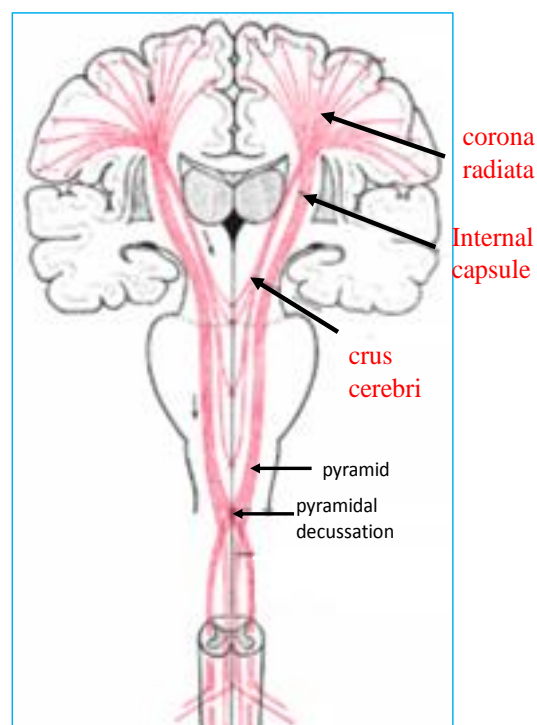
Left hippocampus project to left mamillary body of hypothalamus

Hippocampal Commissure: not go to mamillary body



Projection Fibers

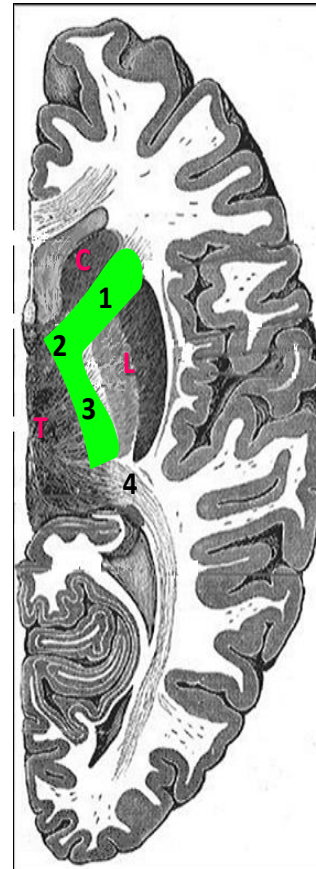
- Consist of **Afferent & Efferent** of the cerebral cortex.
- Deeper to the cortex, these fibers are arranged radially as the **corona radiata**.
- Then the fibers converge downward, form **internal capsule**, between thalamus and basal ganglia.
- Continue in the **crus cerebri** of the midbrain, basilar part of pons, & pyramid of medulla oblongata.





Internal Capsule

- Bundle of projection fibers, passes through the interval between the thalamus and the basal ganglia
- Has 5 parts:
 1. Anterior limb: contain Thalamocortical & Frontopontine fibers
 2. Genu: contain corticobulbar fibers
 3. Posterior limb: contain Corticospinal, Corticobulbar & Thalamocortical fibers
 4. Retrolenticular part: contain Geniculocalcarine fibers
 5. Sublenticular part (not shown): contain geniculo-temporal fibers



Note :

Anterior limb located between caudate nucleus (part of basal ganglia) and lenticular nucleus (part of basal ganglia)

Genu – going to motor nuclei of cranial nerve

Posterior limb located between the thalamus and lenticular nucleus

Retro: means behind ----->Retrolenticular part : located behind lenticular nucleus come from (optic nerve)

Sublenticular part (not shown): auditory nerve



Summary of Crossman book

- The precentral gyrus is the primary motor region of the cerebral cortex and is located within the frontal lobe, immediately in front of the central sulcus. Anterior to this lie the premotor and supplementary motor cortices and, in the left hemisphere, Broca's (motor speech) area. The prefrontal cortex is concerned with complex cognitive functions.
- The postcentral gyrus is the primary somatosensory region of the cerebral cortex and lies within the parietal lobe, immediately posterior to the central sulcus. It receives afferents from the ventral posterior nucleus of the thalamus, which is the site of termination of the spinothalamic tracts, trigeminothalamic tract and the medial lemniscus. Behind this region lies the sensory association cortex, which is responsible for the interpretation of general sensory information.
- The temporal lobe lies beneath the lateral fissure. On the superior surface of the superior temporal gyrus, the transverse temporal (Heschl's convolutions) mark the location of the primary auditory cortex, which receives input from the medial geniculate nucleus of the thalamus. Adjacent lies the auditory association cortex, which is responsible for the interpretation of auditory information and which, in the left hemisphere, constitute Wernicke's area.
- The occipital lobe makes up the posterior part of the hemisphere. On the medial surface, the calcarine sulcus indicates the location of the primary visual cortex, which receives afferents from the lateral geniculate nucleus of the thalamus. The rest of the occipital lobe is the visual association cortex, which is responsible for the interpretation of visual information.



Quiz ;

1- Which part of internal capsule contain Corticospinal and Corticobulbar fibers ?

- A- Posterior limb.
- B- Genu .
- C- Sublenticular part.
- D- Retrolenticular part.

2- Which one of the following commissure Important in the bilateral pupillary reflex:

- A-Corpus callosum.
- B-Anterior commissure.
- C-Hippocampal commissure
- D-Posterior commissure

3- one of the following part is important in naming, reading, writing, and calculation:

- A- Broca's area
- B- Wernick's area



C- supramarginal gyrus

D- Brodmann's area 17

4- Primary somatosensory cortex located in :

A-Brodmann's area 17

B- Brodmann's area 1, 2, 3

C- Brodmann's area 4

D- Brodmann's area 8

5-Which one of the following not in frontal lobe:

A- Brodmann's area 8

B- Brodmann's area 4

C- Brodmann's area 44

D- Brodmann's area 41



6- Brodmann produced a numbered, cytological map of cerebral cortex based upon:

- A- Suci and gyri
- B- anatomical characteristics
- C- regional histological characteristics
- D- non of them

7- one of the following is function of temporal lope?

- A- memory
- B- visual processing
- C- mood
- D- motivation

8- Caudate, Putamen and Globus pallidus are nuclear masses known as:

- A- basal ganglia
- B- Insula
- C- cerebral nuclei
- D- non of them



9- Aggression is one of the function of :

- A- temporal lobe
- B- occipital lobe
- C- frontal lobe
- D- parietal lobe

10- Smell is one of the function of :

- A- temporal and frontal lobes
- B- occipital lobe only
- C- parietal lobe only
- D- parietal and frontal lobes

11- Which lobe not participate to cover Insula:

- A- frontal lobes
- B- parietal lobes
- C- temporal lobe
- D- Occipital lobe



12- Primary auditory cortex located in :

- A- Brodmann's area 17
- B- Brodmann's area 1, 2, 3
- C- Brodmann's area 45, 46
- D- Brodmann's area 41, 42

13- Which one of the following is true about Association Fibers are :

- A- Connect the corresponding regions of the two hemispheres.
- B- arranged radially as the corona radiata
- C- has short association fibers only.
- D- Unite different parts of the same hemisphere



Questions	Answers
1	A
2	D
3	C
4	B
5	D
6	C
7	A
8	A
9	C
10	A
11	D
12	D
13	D

GOOD LUCK

Anatomy Team Leaders:

FahadAlShayhan&Eman AL-Bedica.