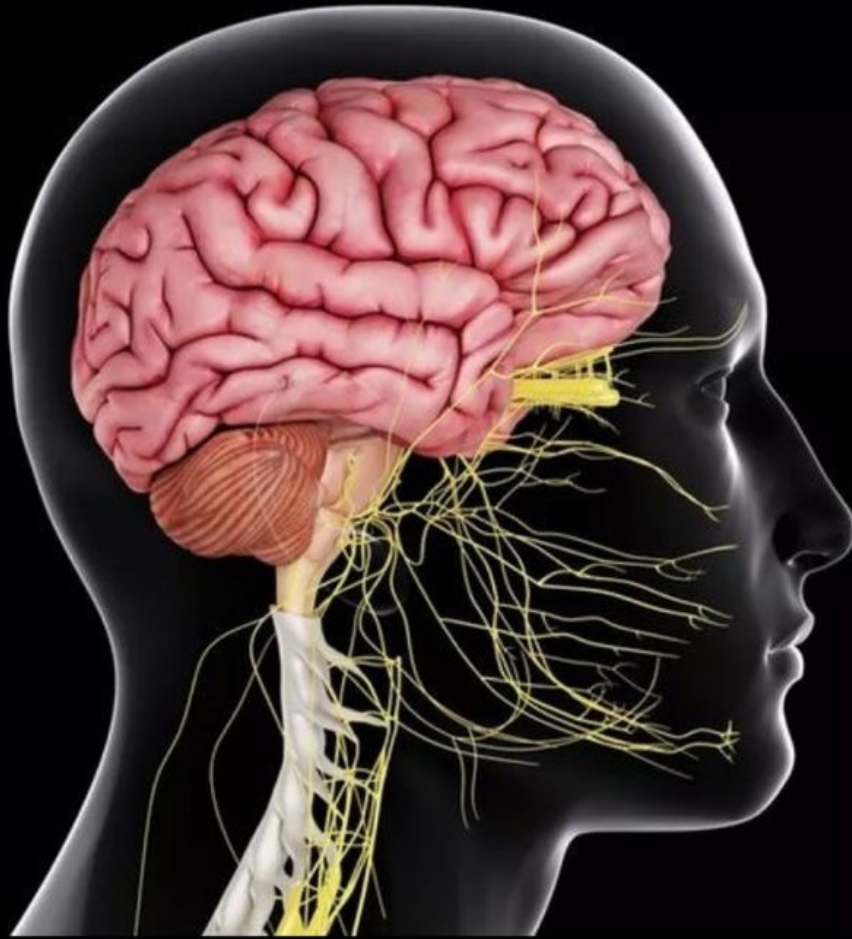




# CENTRAL NERVOUS SYSTEM



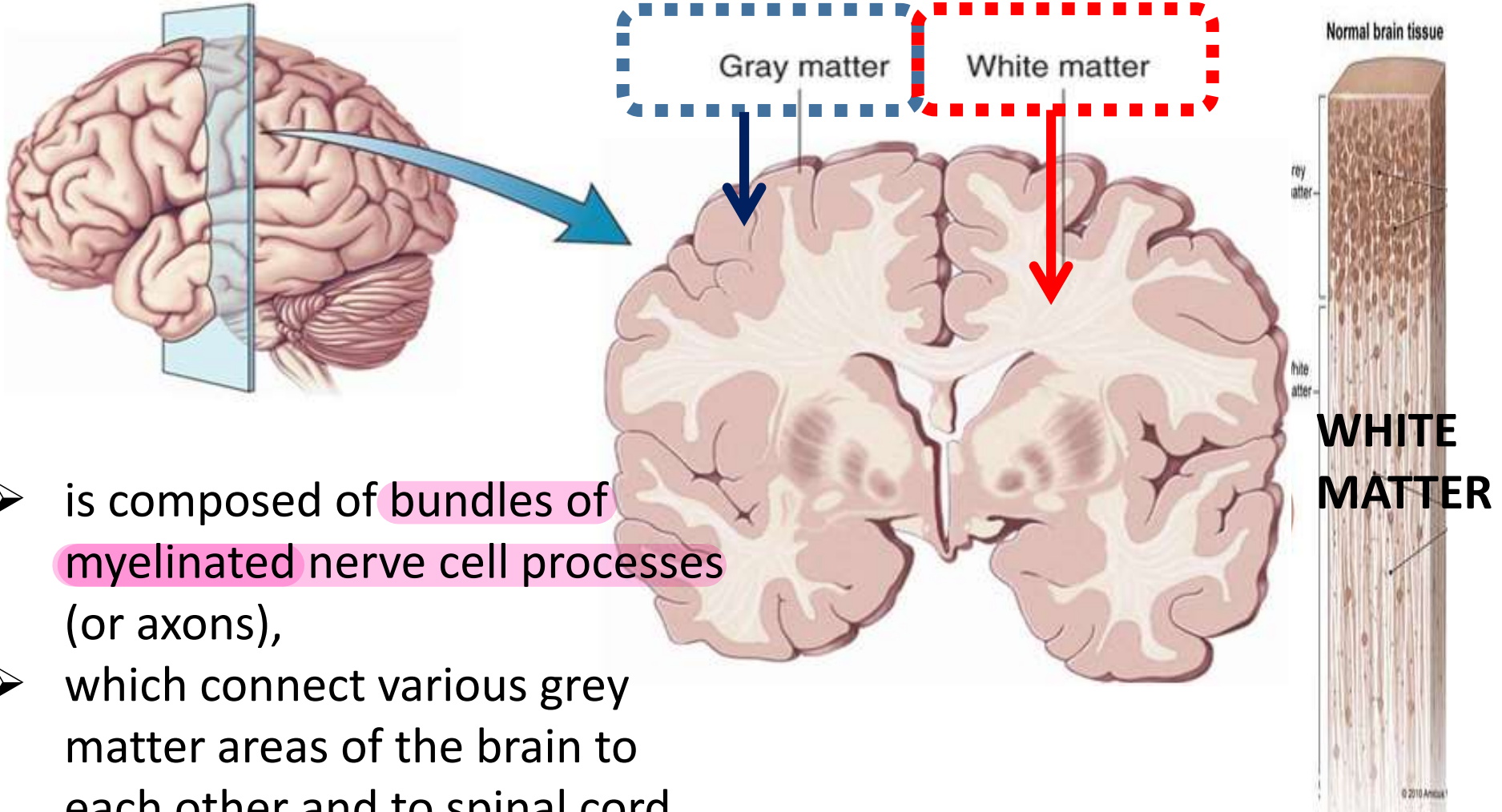
SUBJECT : Anatomy

LEC NO. : 10

DONE BY : Batool ALzubaidi & Hashem Ata

وَقُلْ رَبِّ زِدْنِي عِلْمًا

# WHITE MATTER OF CEREBRAL HEMISPHERES

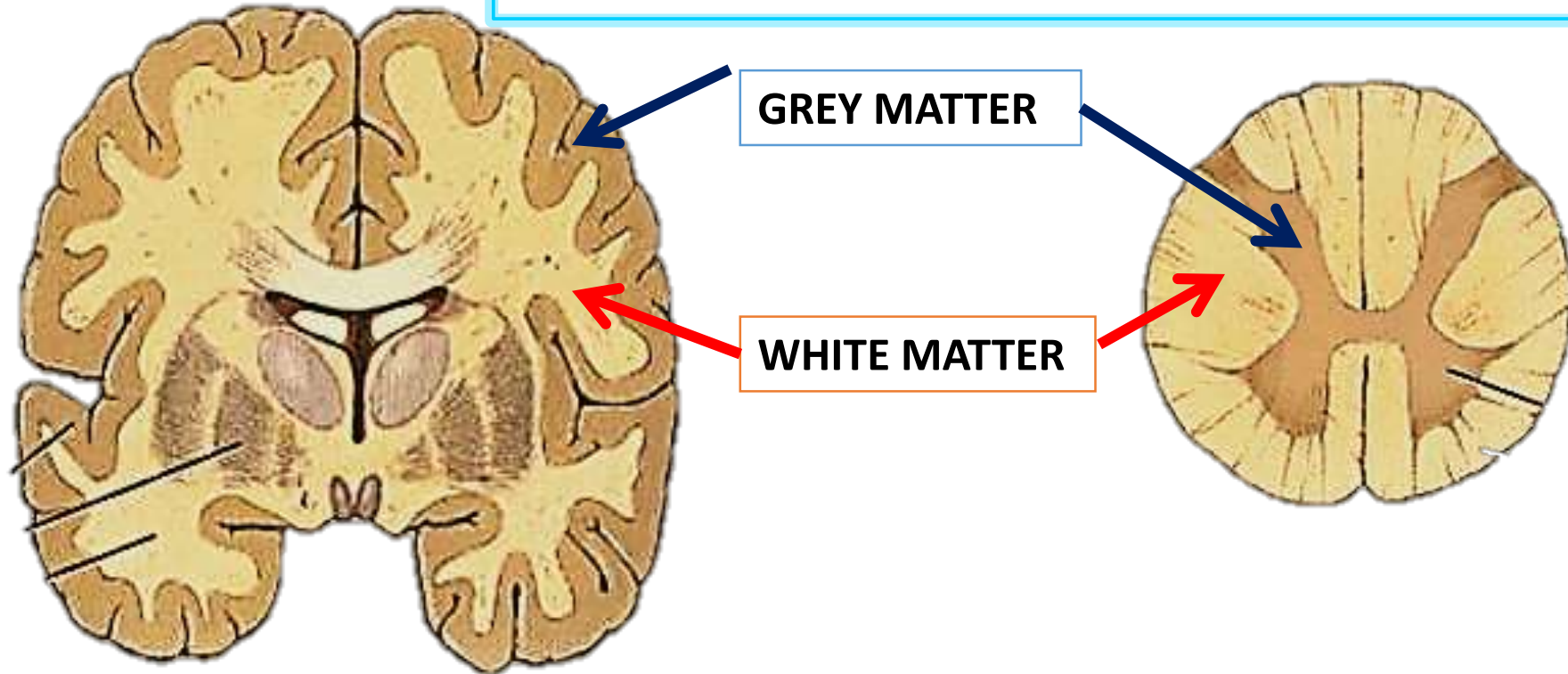


- is composed of bundles of myelinated nerve cell processes (or axons),
- which connect various grey matter areas of the brain to each other and to spinal cord.

حكينا قبل انه الدماغ  
من برة في cortex و  
ال core من الداخل  
بحتوي على white  
matter و فيه تتين  
hemispheres  
متوصلين ببعض عن  
طريق commissure  
fibers منهم واحد  
كبير الي هو ال  
corpus callosum،  
جوة ال white matter  
فيه nuclei/islets of  
gray matter وحدة  
بالنص الي هي ال  
thalamus و وحدة  
lateral ال basal  
ganglia/nuclei  
الاسم الاصح ال  
nuclei

# DIFFERENCE BETWEEN WHITE MATTER OF CEREBRAL HEMISPHERES & SPINAL CORD

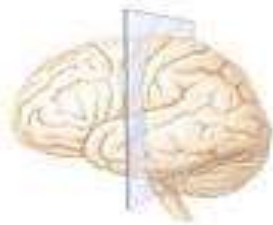
بال cerebral hemisphere ال core بمون white matter و ال gray matter بتكون بالقشرة ال cortex اما بال spinal cord ال H shaped core هو ال gray matter و الي حواليه من برة ال white matter



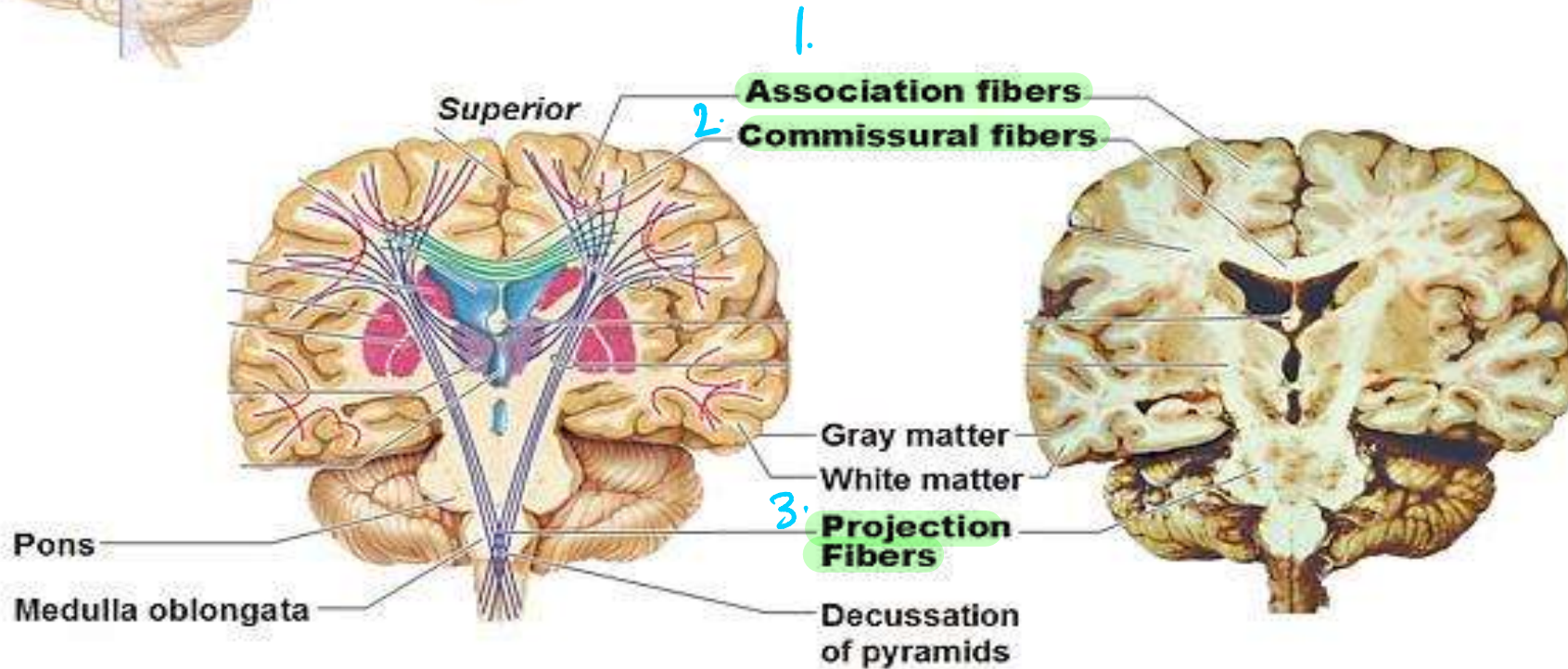
# TYPES OF WHITE MATTER

Cerebral White Matter – 3 types of fibers

بناءً على الاناتومي تاعهم



(a) Frontal section



# TYPES OF WHITE MATTER OF CEREBRAL HEMISPHERES :

Ascending and descending tracts ←

## □ projection fibers

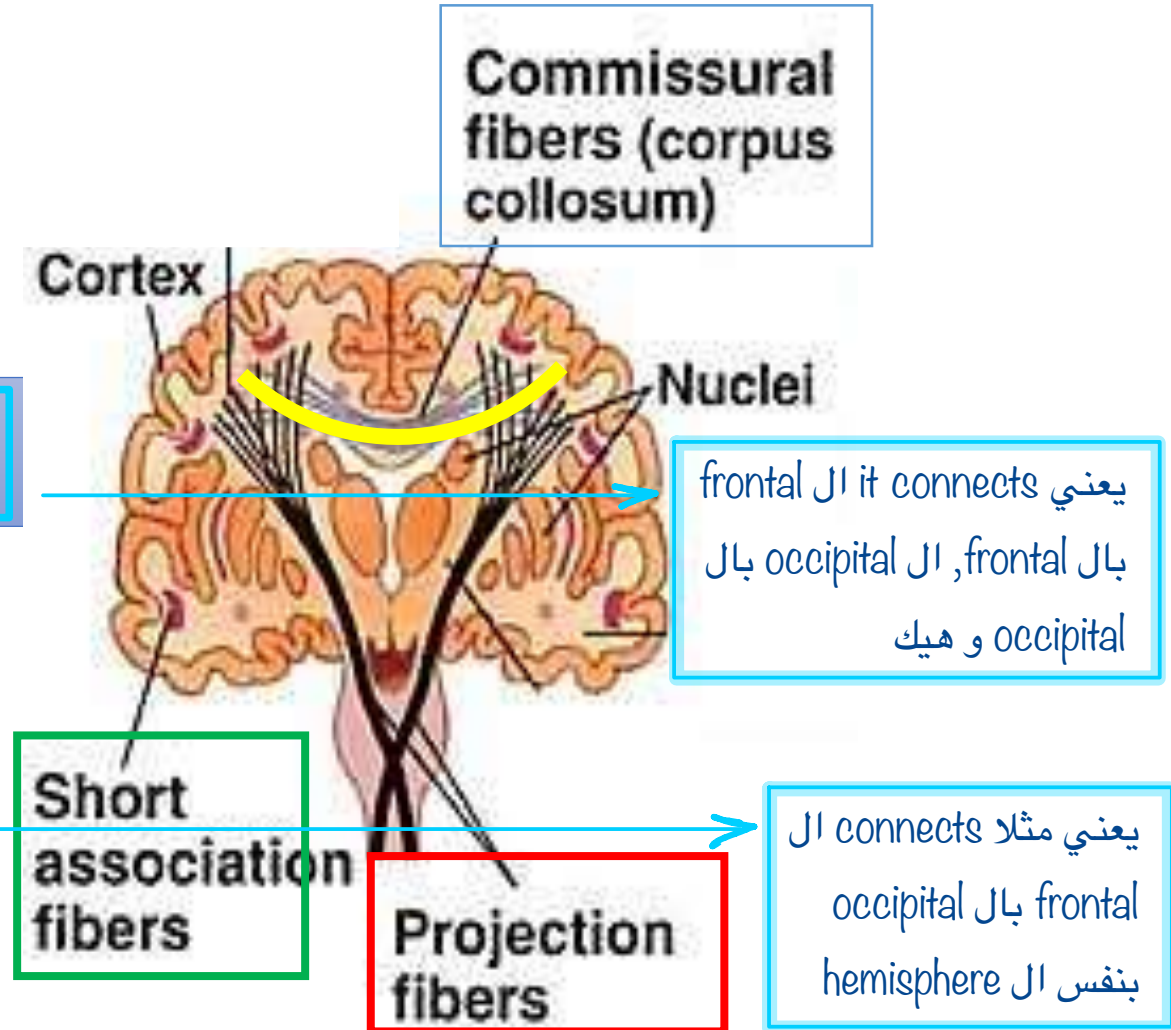
connect the cerebral cortex with lower centers

## □ Commissural fibers

connect the same area in the Two cerebral hemispheres

## □ Association fiber

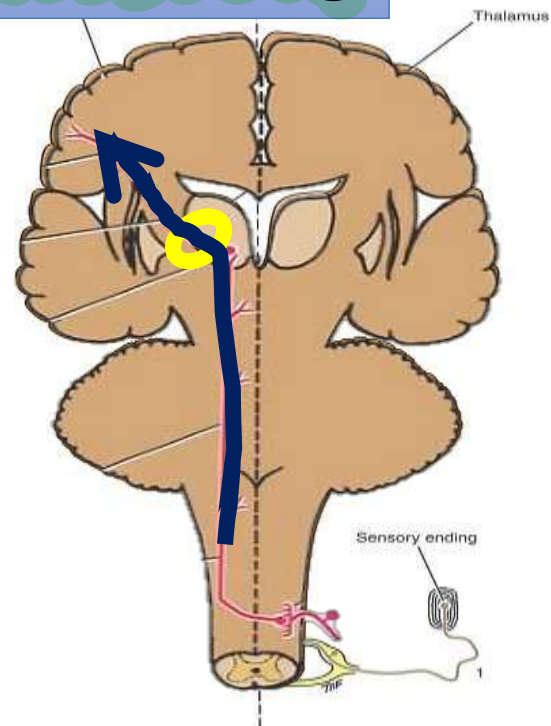
Connect different parts of the Same cerebral hemispheres



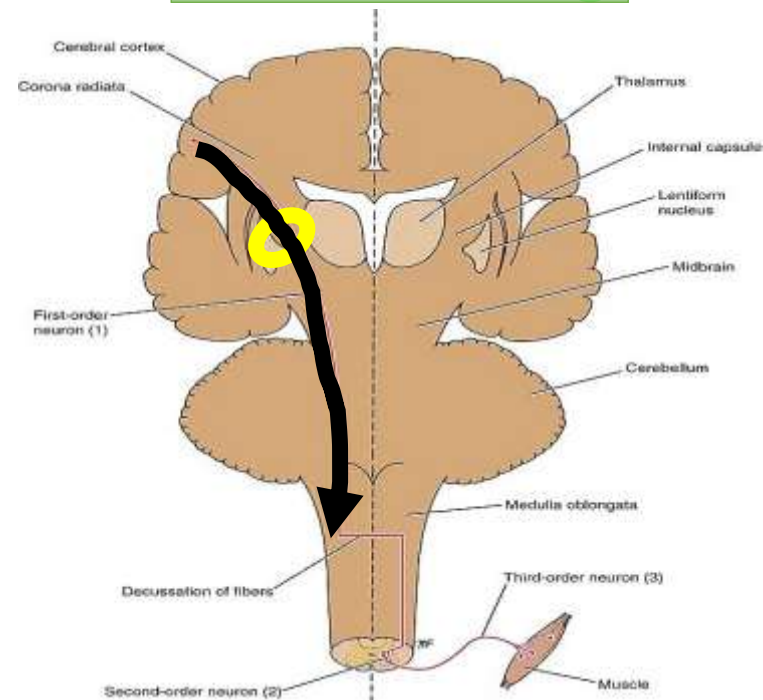
# I- projection fibers

Include fibers that connect the cerebral cortex  
With  
lower centers (diencephalon, brain stem, spinal cord).

Ascending



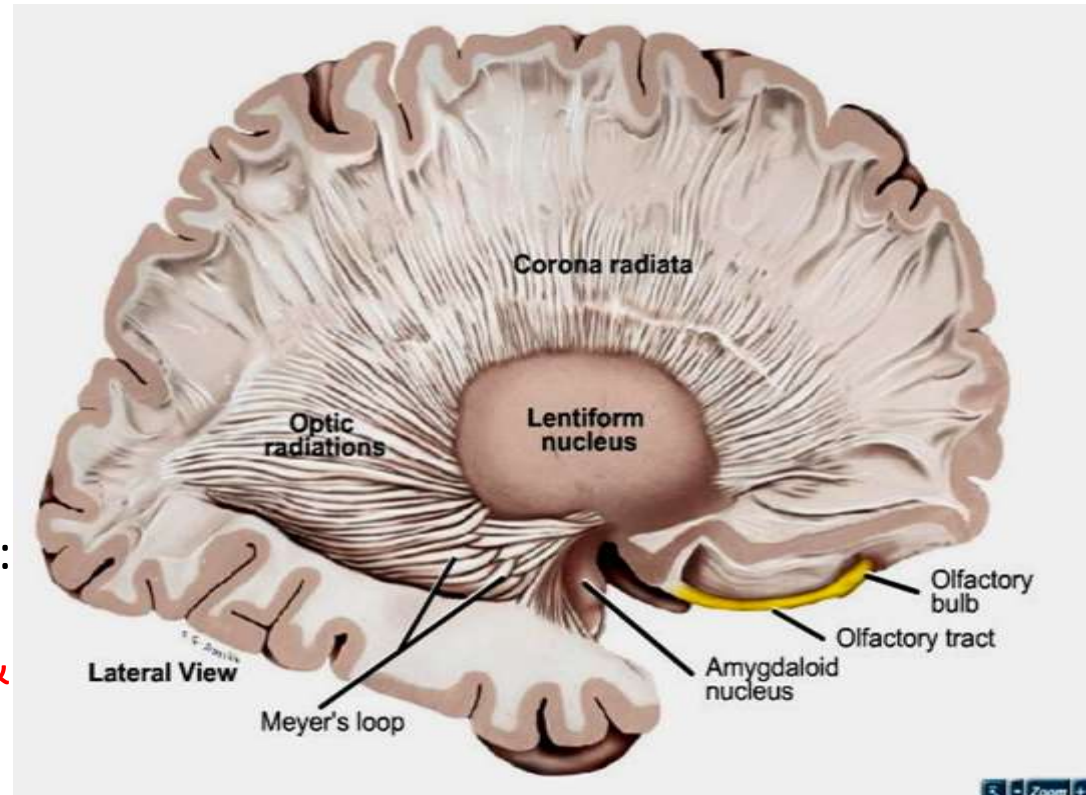
Descending

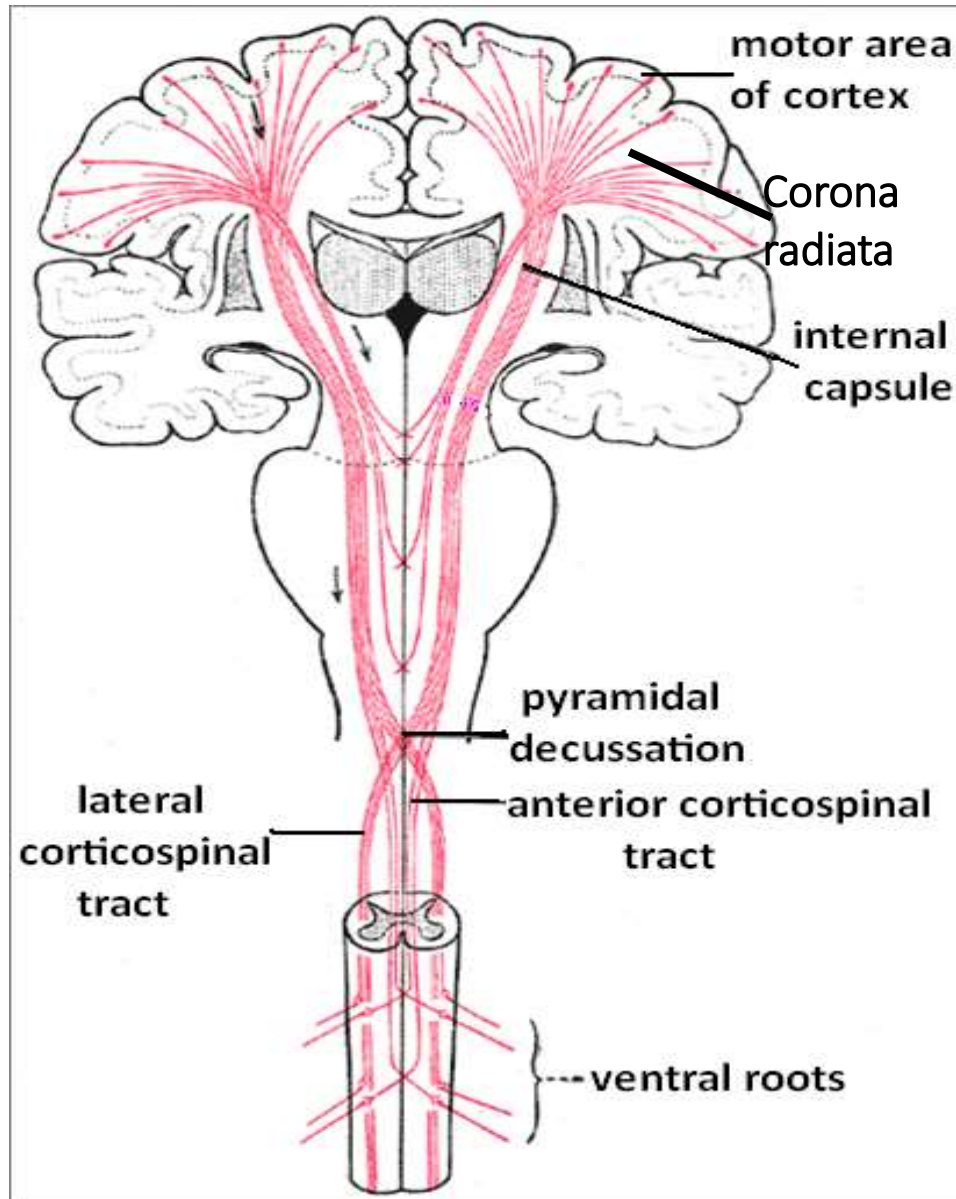


# Projection Fibers

- Fibers running vertically through the hemispheres
- Consist of:
  - **Cortical afferent** :fibers conveying impulses to the cerebral cortex: (mainly thalamo-cortical fibers)
  - **Cortical efferent** :fibers carrying impulses away from the cortex to the lower centers: (corticostriate, corticobulbar, corticopontine, corticospinal, & descending autonomic fibers)

دايما ال afferent بتعدي على السكرتيرة الي هي ال thalamus شايفين ال lentiform nucleus وراها راح تكون ال thalamus و بينهم ال internal capsule الي بطلع منها ال corona radiata و بتروح لكل ال surface of the cortex





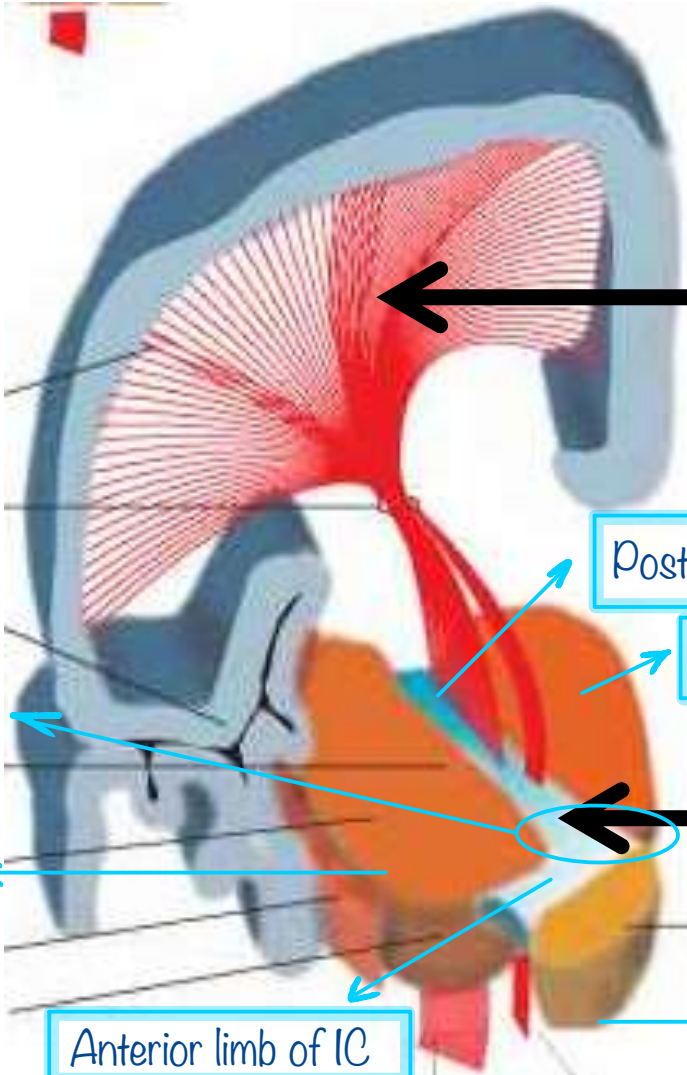
- Deeper to the cortex, these fibers are arranged radially as the **corona radiata**
- Then the fibers converge to form **internal capsule**, that passes between the thalamus and the basal ganglia
- Then Continue in the **(brain stem)** ↙
  - Crus of the midbrain
  - Basilar part of pons
  - Pyramid of medulla oblongata
- Continue in the spinal cord as the **corticospinal tracts** ↙

دایما بال anterior part

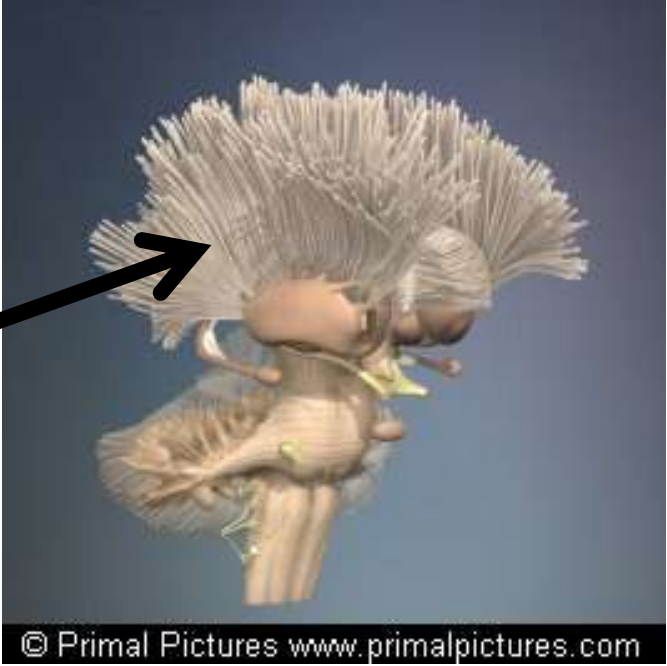
بتکمل بال spinal cord عند ال anterior horn



# projection fibers



*corona radiata*



Angle » genu

Posterior limb of IC

Lentiform nuclei

Thalamus

Anterior limb of IC

Internal capsule

Caudate nucleus

# Internal capsule

A broad band of **projection fibers** running between three masses of grey matter:

**Thalamus & caudate nucleus**  
**lentiform nucleus**

(medially)  
(laterally).

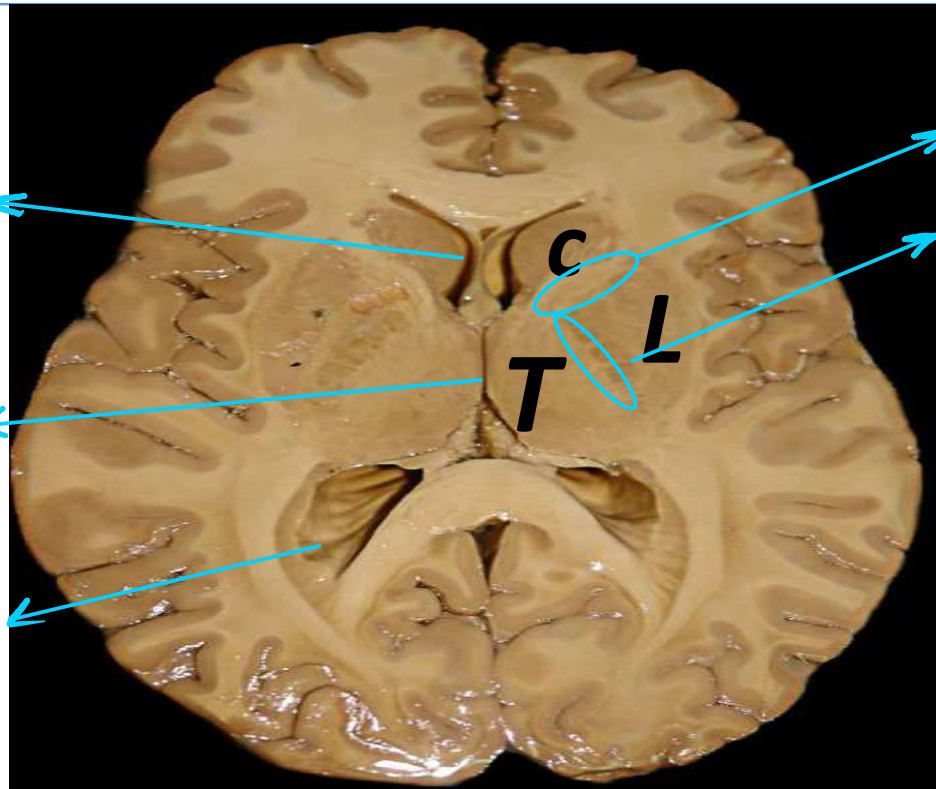
All of them together » basal ganglia

شكل العدسة

Anterior horn of lateral ventricle

Third ventricle

Posterior horn of lateral ventricle



Anterior limb

Posterior limb

**caudate**

Anterior limb between caudate and lentiform

**lentiform**

Posterior limb between thalamus and lentiform

**Thalamus**

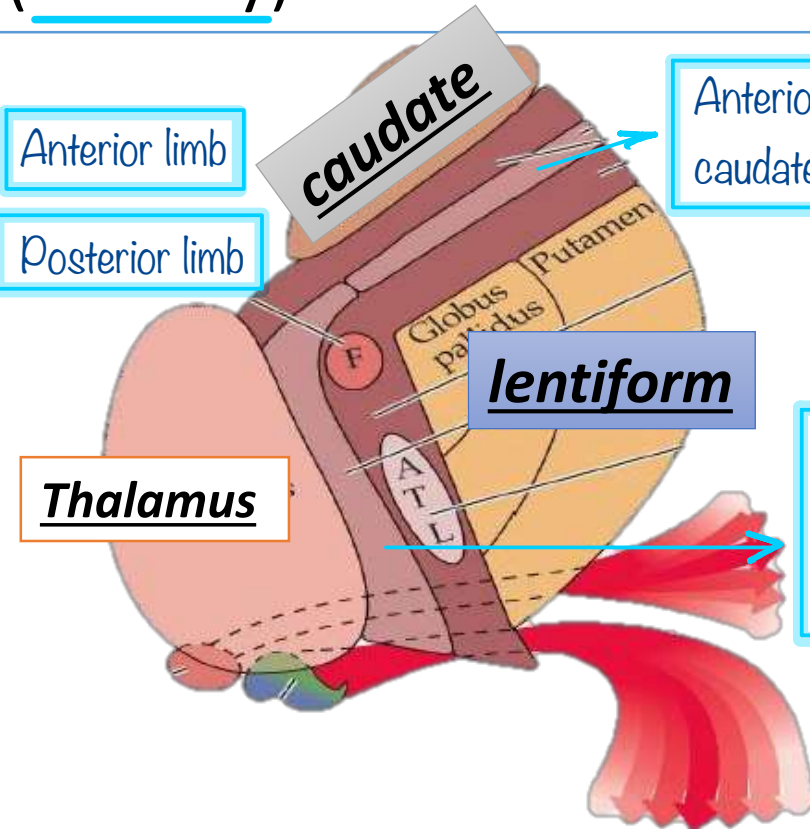
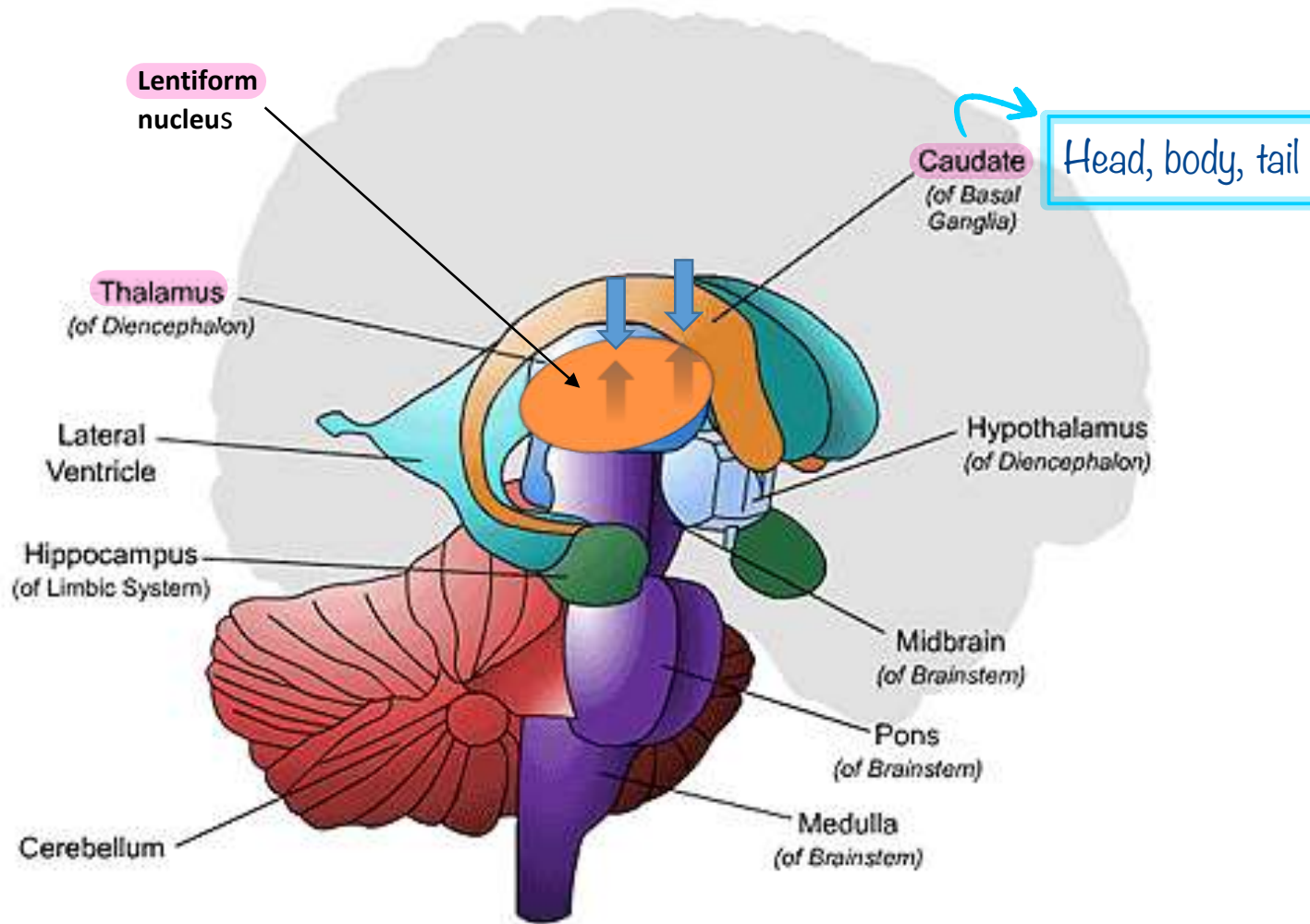
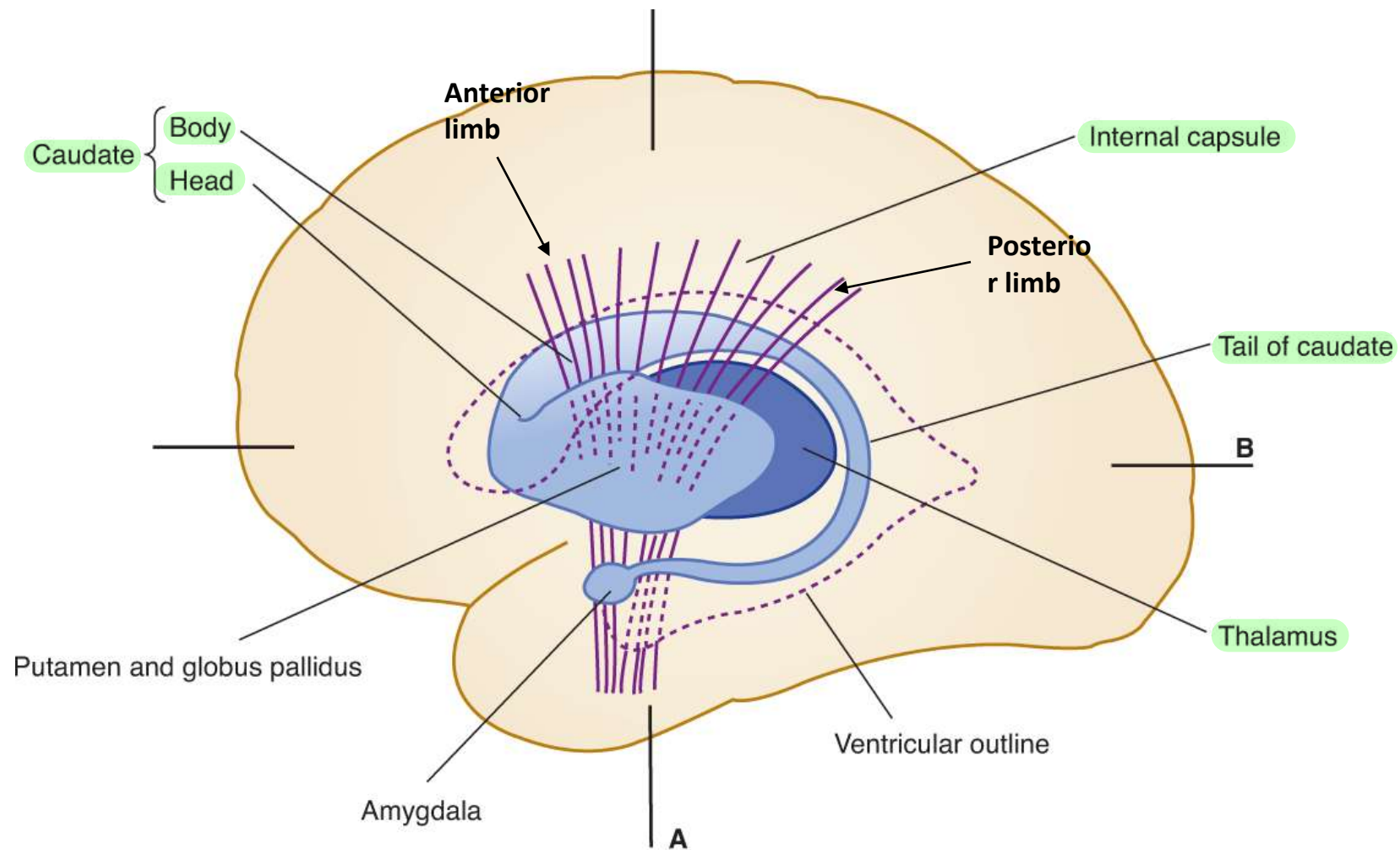


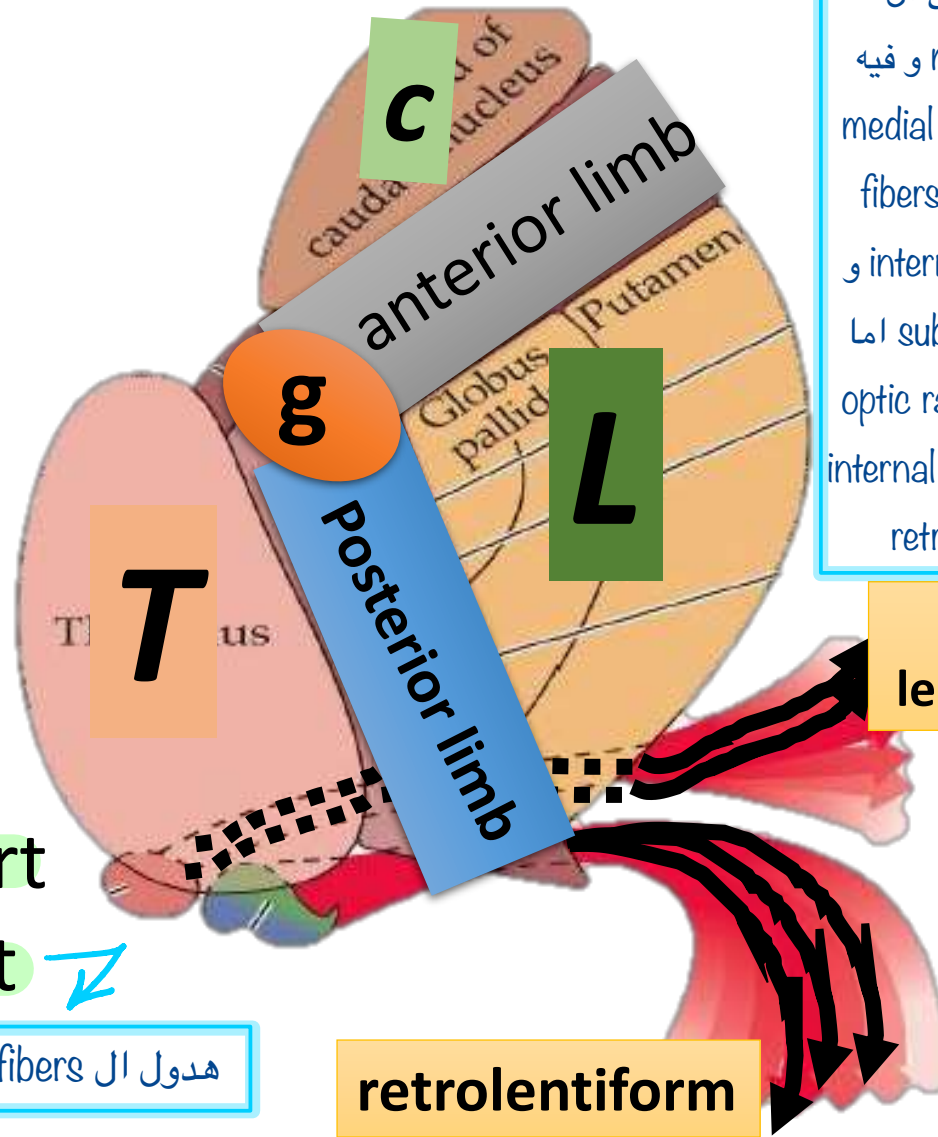
Figure AB-33: Build A Brain, Step 8





# Internal capsule

- ❑ It is **V-shaped**.
- ❑ **It consists of:**
  - I. **anterior limb**  
between caudate and lentiform
  - II. **genu**
  - III. **posterior limb**  
between thalamus and lentiform
  - IV. **retrolentiform part**
  - V. **sublentiform part**



اتذكروا حكيما انه الجزء الخلفي من ال thalamus اسمه ال metathalamus وفيه medial ال medial and lateral geniculate fibers ال auditory pathway جزء من ال internal capsule تاعته بتمشي تحت ال sublentiform part اما ال lateral هي جزء من ال optic radiation و ال fibers تاعته بتمشي خلف ال internal capsule و متوصلة بال retrolentiform

هدول ال fibers بمشوا خلف ال capsule و حيكونوا جزء من ال optic radiation

هدول ال fibers بمشوا تحت ال capsule و حيكونوا جزء من ال auditory radiation

Sub lentiform

retrolentiform

هدول fibers جاين من ال frontal lobe بعدوا على ال crus cerebri of midbrain و بروحوا لل pones

من ال anterior  
nuclei of the  
ال thalamus

يبتستقبل من ال  
mammillary  
body رايحة لل  
prefrontal lobe

**Anterior limb**

- 1. **Frontopontine fibers:**
- 2. **Anterior Thalamic Radiation**

**Genu** Responsible of cranial nerves » head and neck movement  
Contains **corticocaudate fibers**

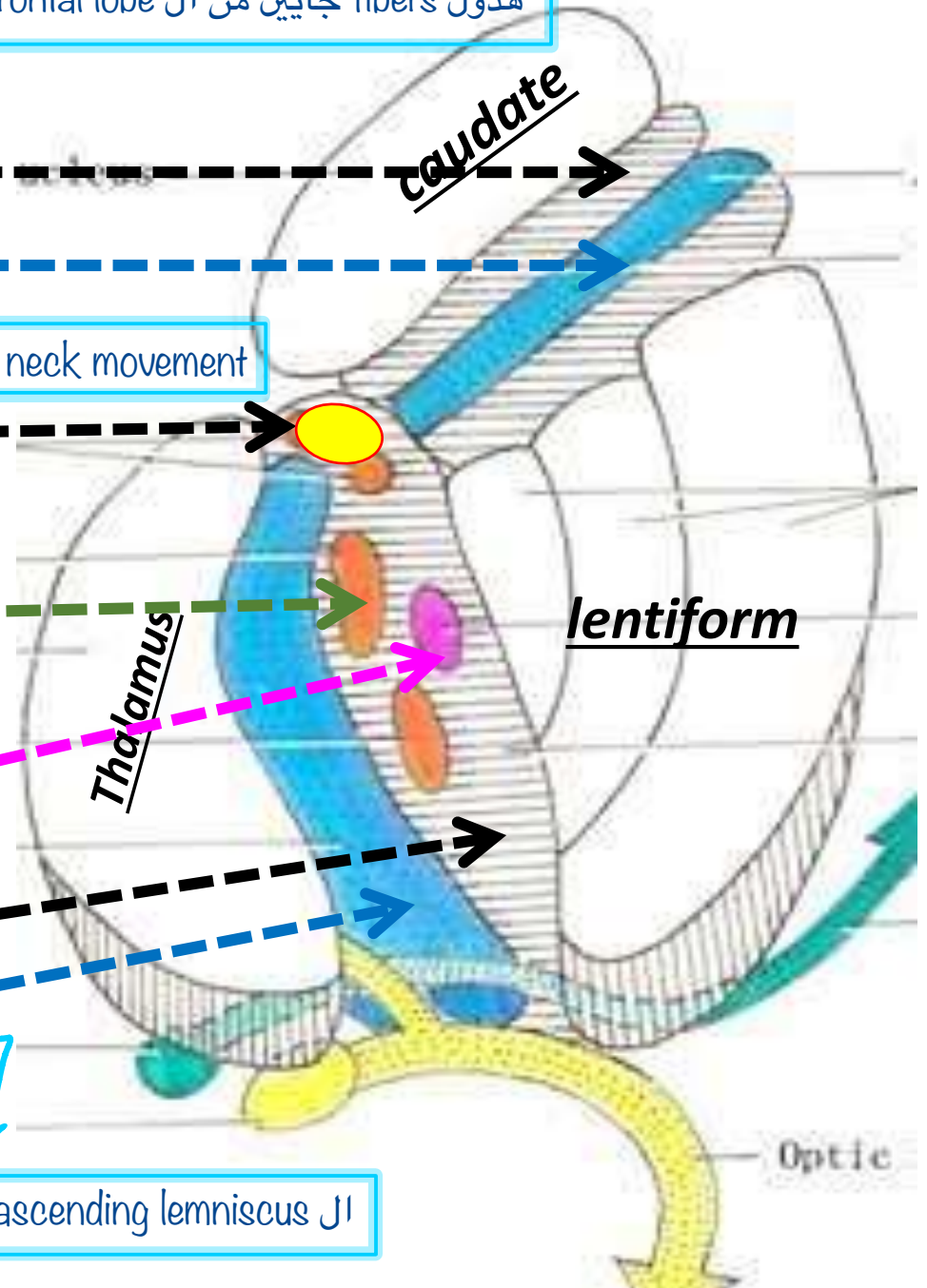
**Posterior limb** Pyramidal tract

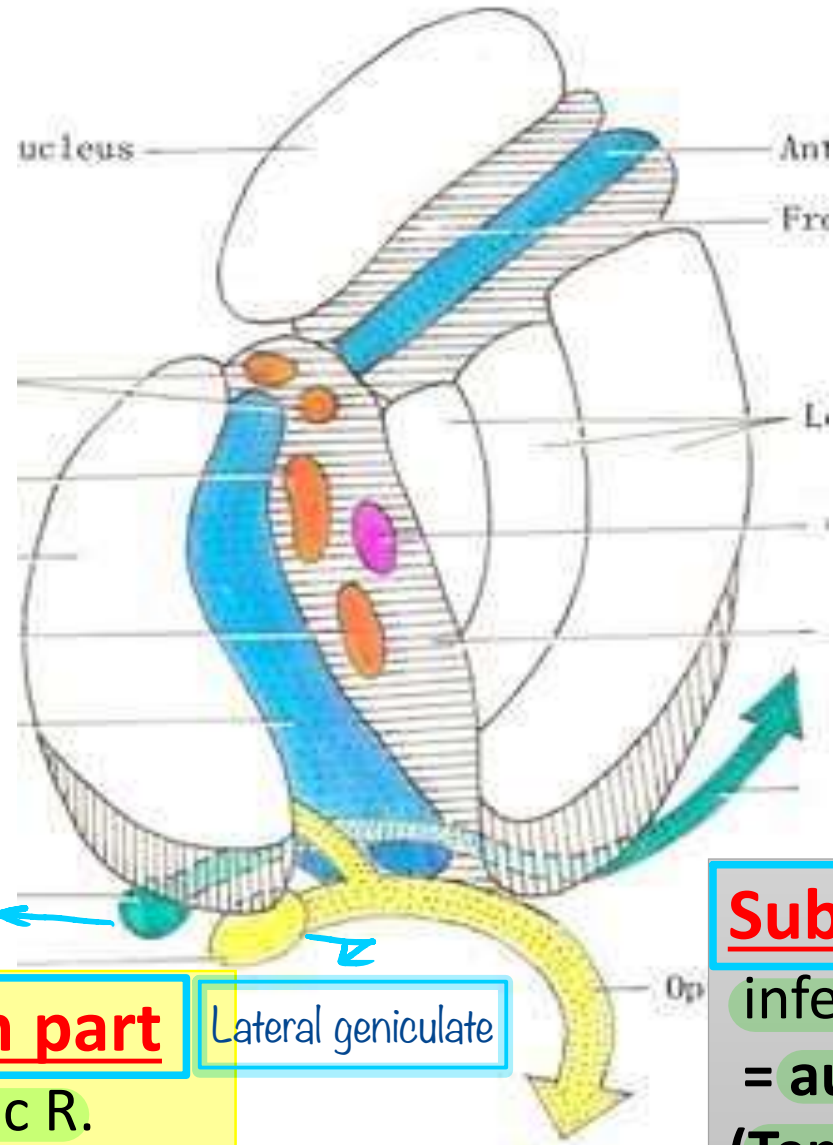
- 1. **Corticospinal fibers**  
(fibers for upper limb lie anterior while fibers for lower limb lie posterior)

- 1. **Corticorubral fibers**
- 2. **Frontopontine fibers**
- 3. **Superior thalamic radiation**  
(sensory radiation) from VPLN & VPMN of thalamus to sensory cortex (SI & SII).

ال ascending lemniscus من ال spinal and trigeminal lemniscus

من ال cortex  
لل red nucleus





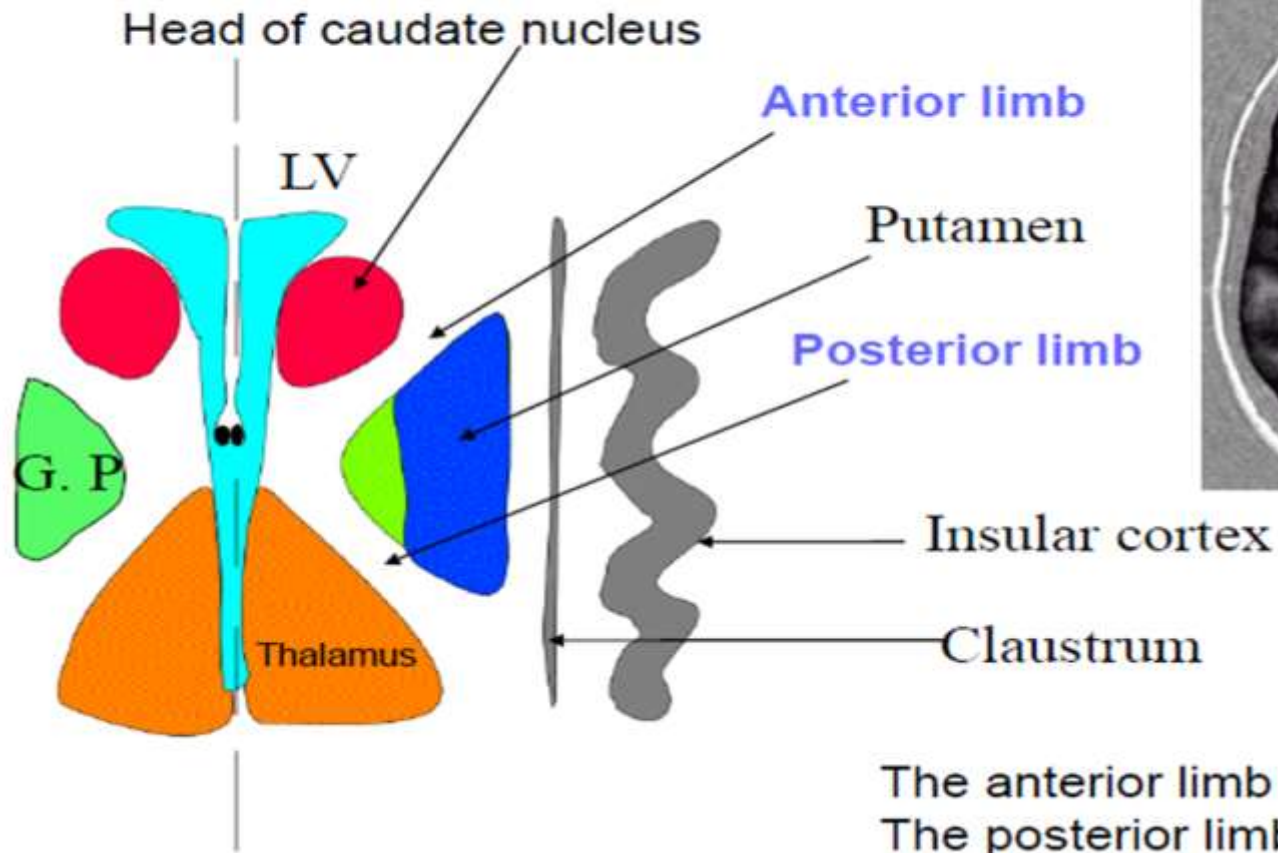
Medial geniculate

**Retrolentiform part**  
 Posterior thalamic R.  
 = (optic radiation)  
 (occipito-pontine fibers)

Lateral geniculate

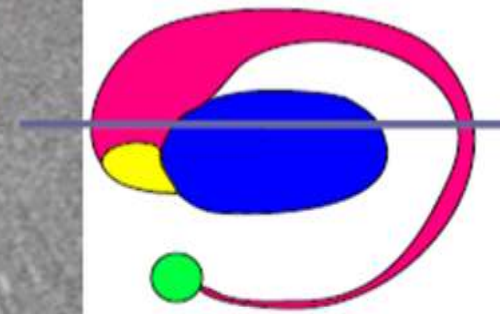
**Sublentiform parts**  
 inferior thalamic R.  
 = auditory radiation  
 (Temporo-pontine fibers)

Horizontal section through the internal capsule  
(white matter and a very important site of strokes)





Posterior limb of internal capsule. Motor and somatosensory fibres for contralateral side of body  
Next slide shows this



Head of cauda nucleus

Globus pallidus

Thalamus

•Globus Pallidus

•Putamen

•Caudate nucleus

•Subthalamic nucleus

•Substantia nigra

•Lentiform nucleus = putamen and globus pallidus

•Neostriatum = putamen and caudate nucleus

lentiform nucleus

حكى ما بده تفاصيل الي عليه هايلايت هو الي قرأه

## Blood supply of internal capsule by perforating branches of

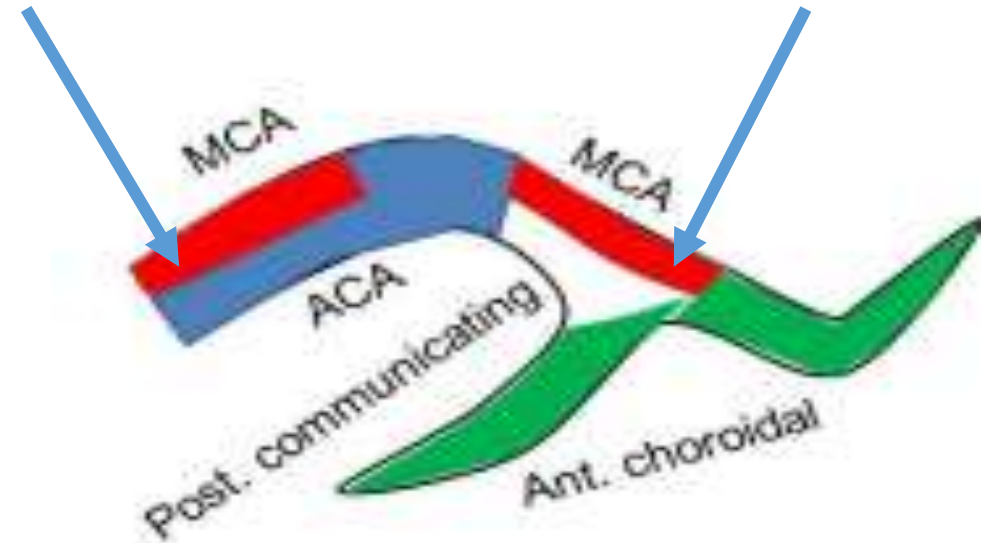
middle cerebral artery,  
anterior cerebral artery,  
posterior communicating artery,  
anterior choroidal artery.

*N.B Blood supply of internal capsule: Upper 1/2 of ant. limb and upper 1/2 of post. limb are supplied by branches of middle cerebral artery.*

- *Lower 1/2 of ant. limb+ the genu by branches of anterior cerebral artery.*
- *Lower 1/2 of post. limb by branches of posterior communicating artery and anterior choroidal artery.*

Anterior limb

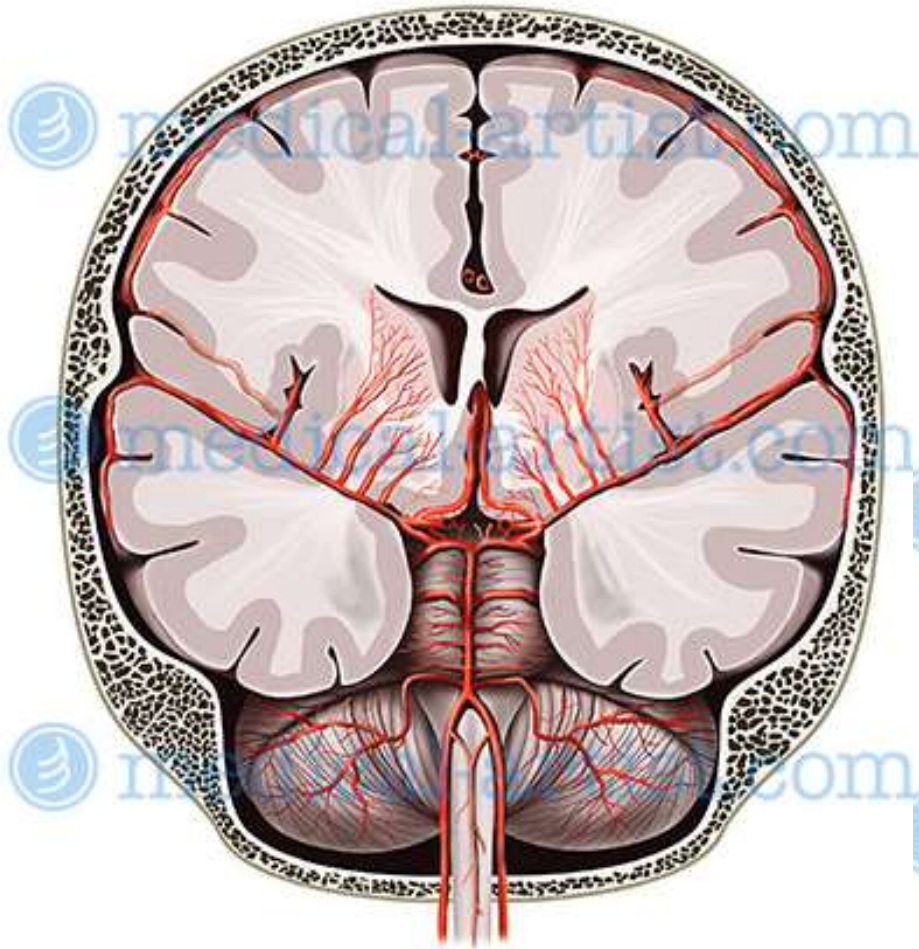
Posterior limb



○ *Retrolentiform and sublenticular parts by branches of anterior choroidal artery.*

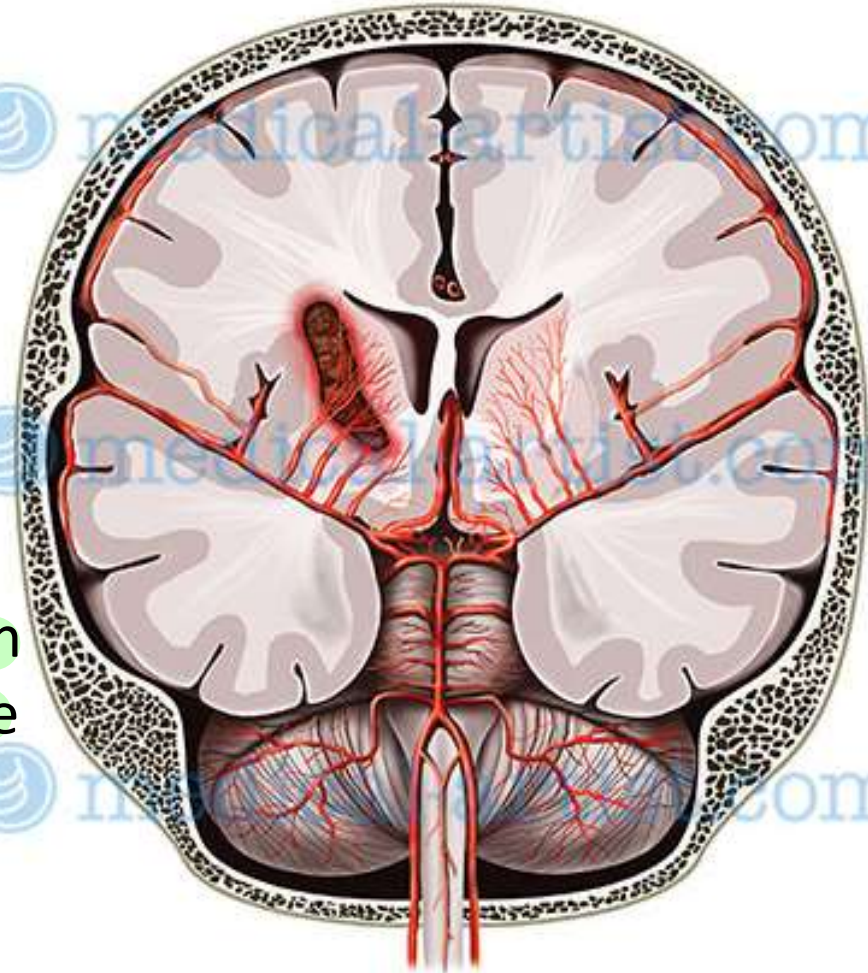


يعني ال auditory and optic radiations are supplied by anterior choroidal artery



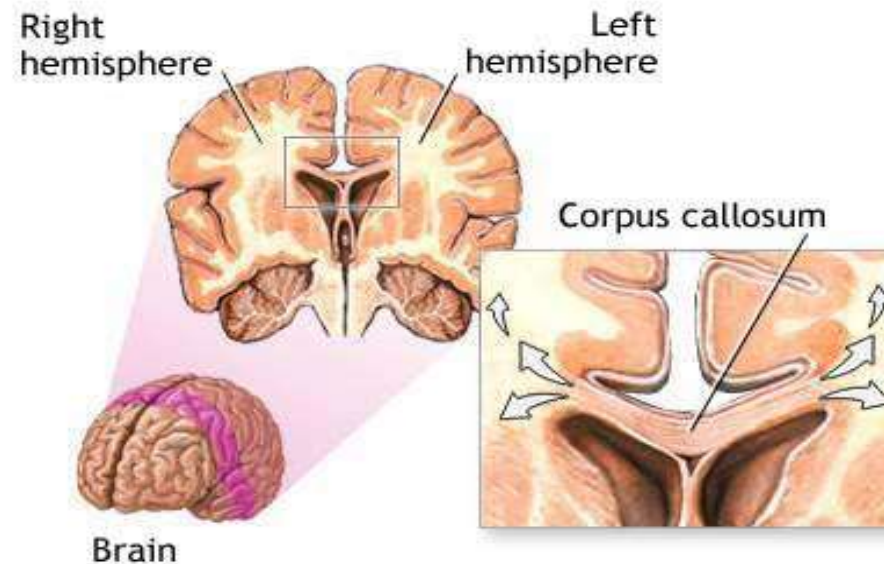
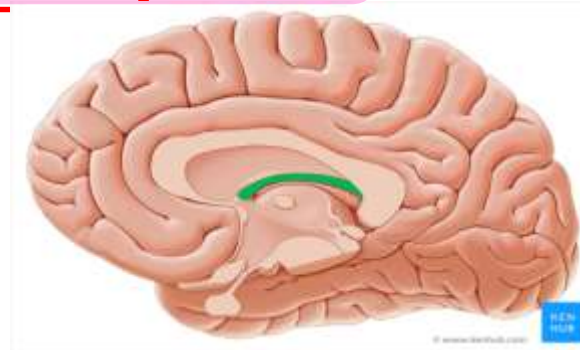
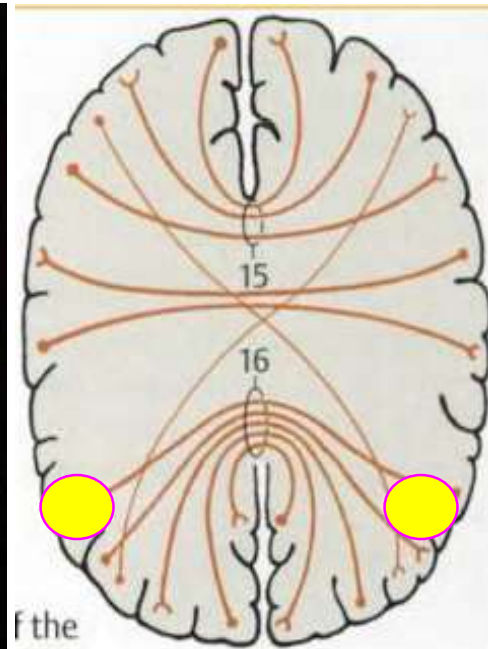
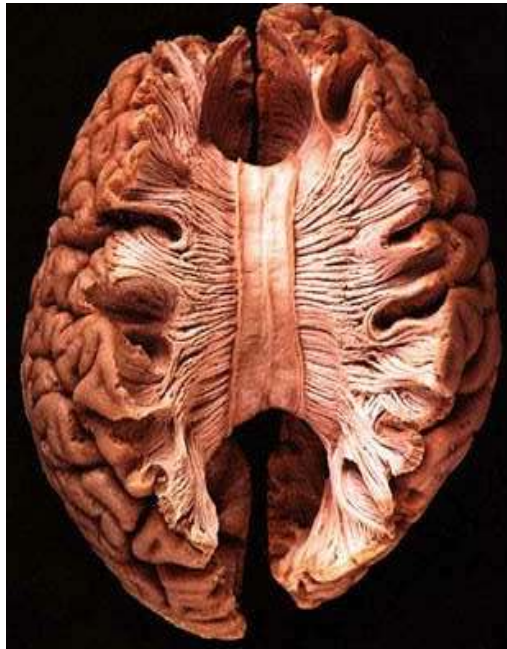
The internal capsule is frequently involved in cerebrovascular accidents.

Because so many fibers are grouped in a small area, even a small hemorrhage can cause wide spread effects on the contralateral side of the body



# II- Commissural fibers

Include fibers that connect corresponding (Same) area  
In the Two Rt. & Lt cerebral hemispheres  
This fibers cross the midline.



# II- Commissural fibers

## 1- Corpus callosum

## 2- Anterior Commissure

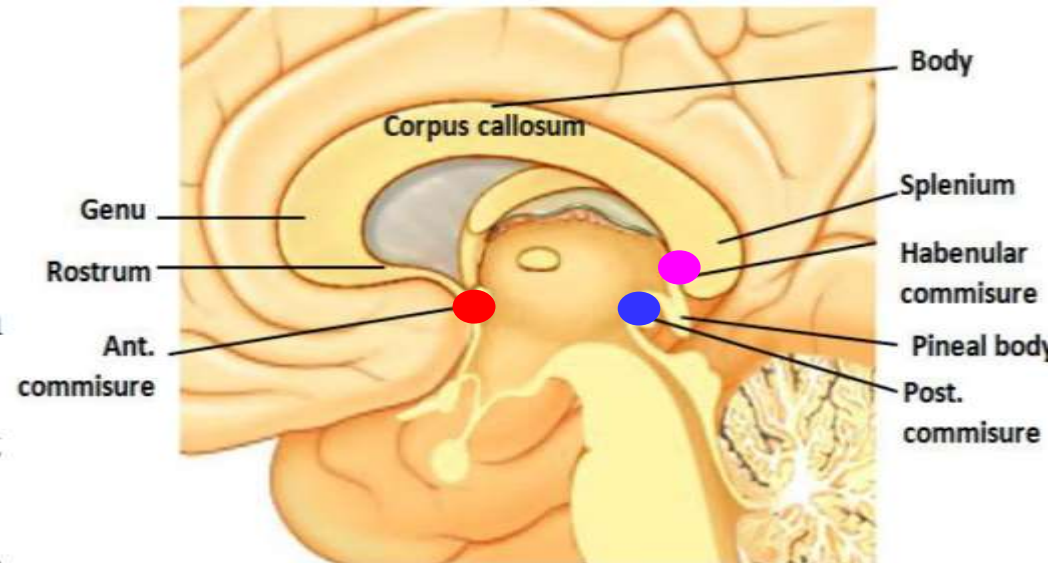
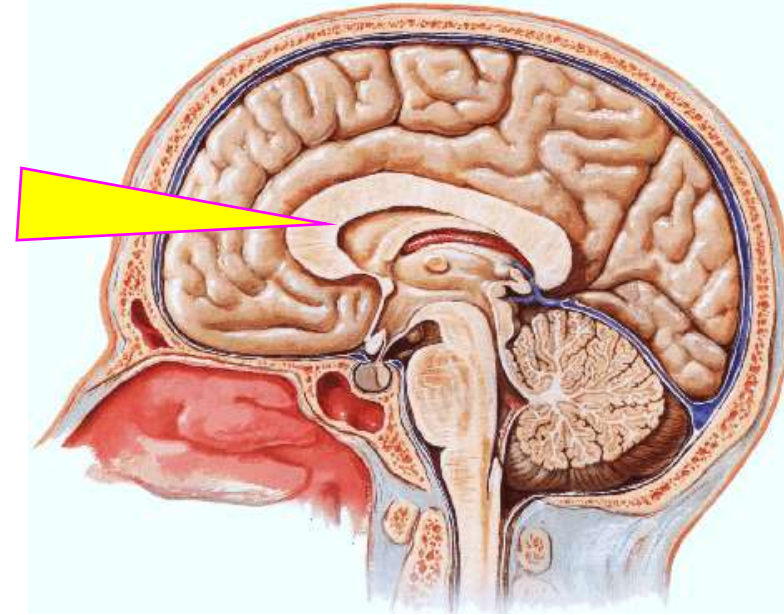
embedded in the lamina terminalis

## 3- Posterior commissure

embedded in the lower lamina of the pineal stalk

## 4- Habenular commissure

embedded in the upper lamina of the pineal stalk.



# II- Commissural fibers

## 1- Corpus callosum

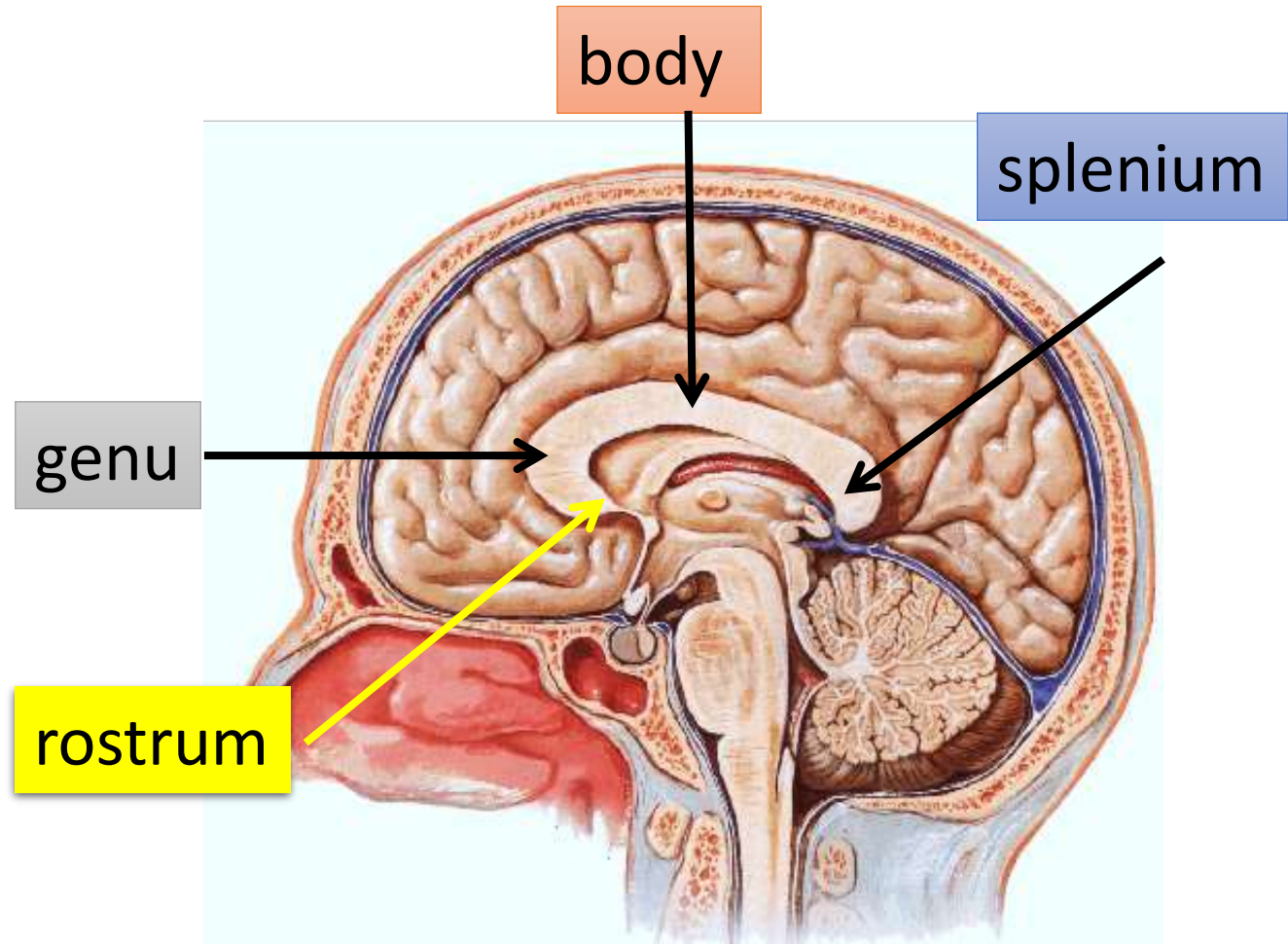
Parts: منقار

1. Rostrum

2. Genu ركبّة

3. Body

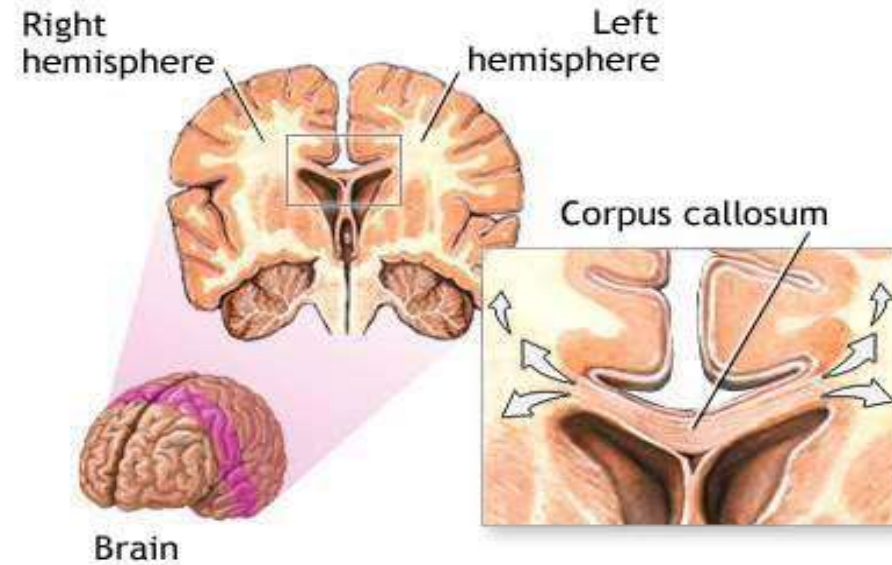
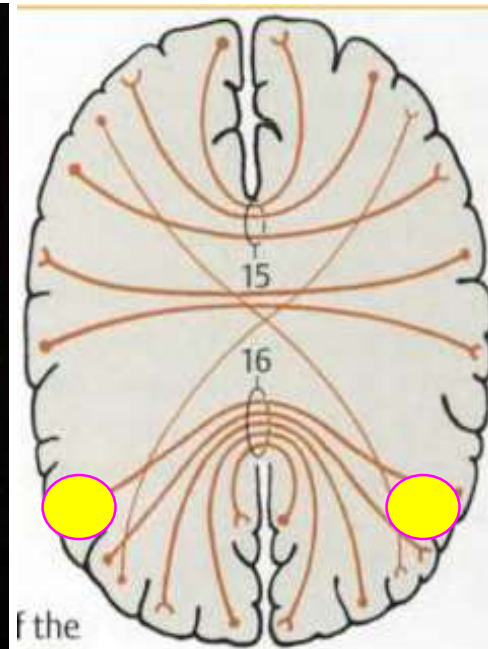
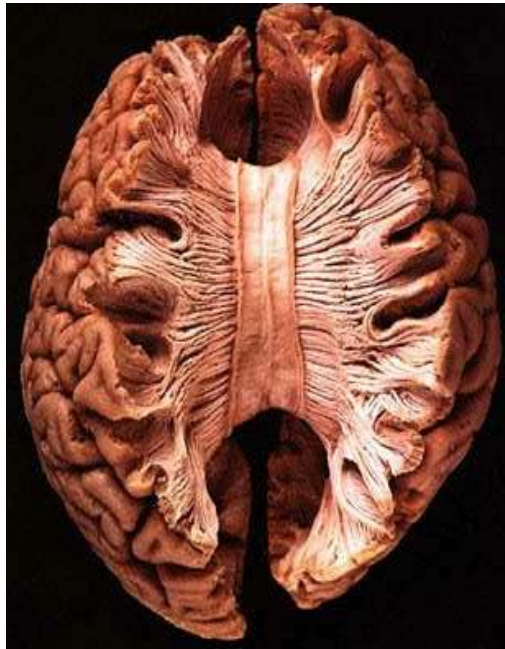
4. Splenium ذيل

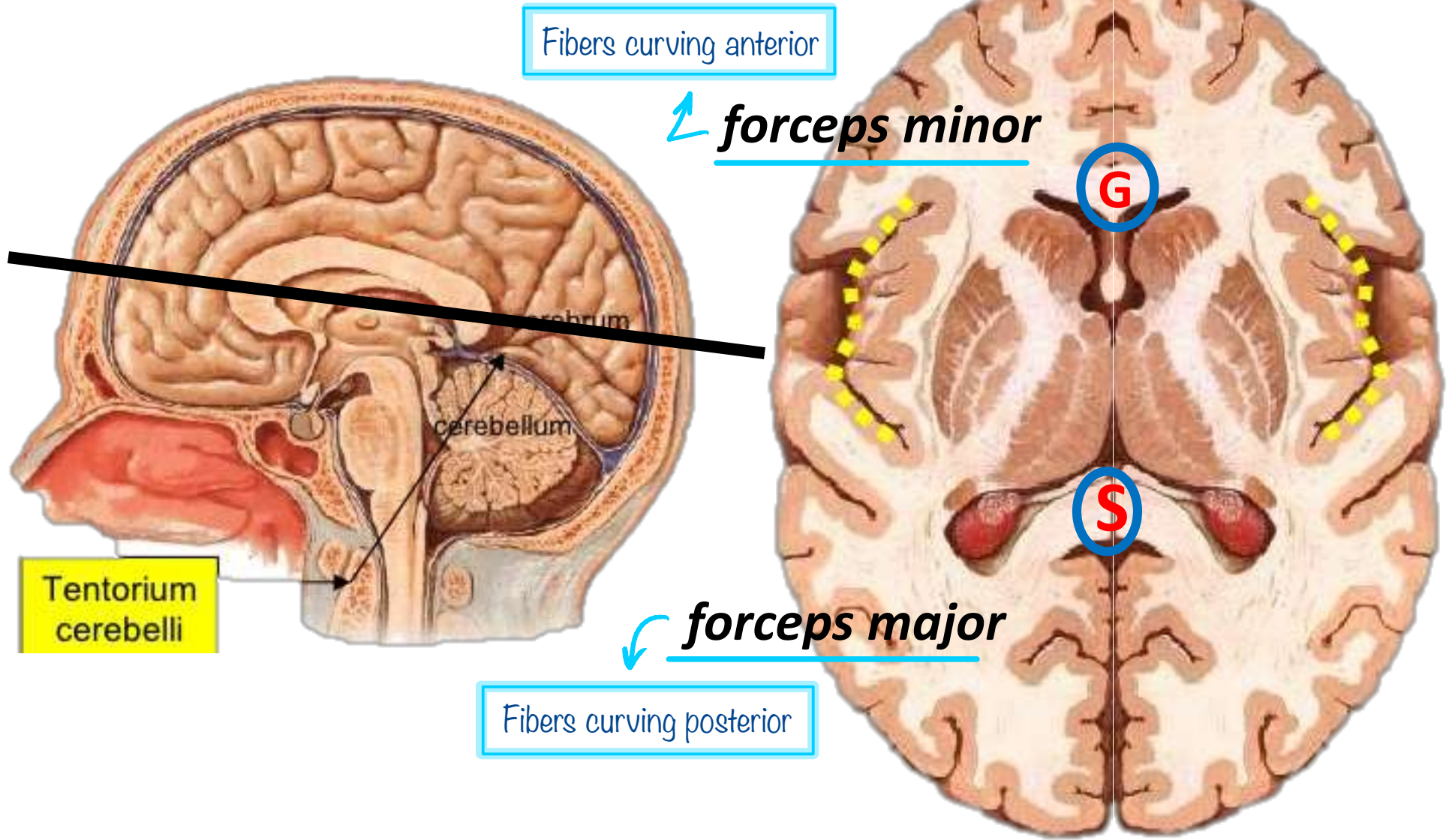


# II- Commissural fibers

## 1- Corpus callosum

fibers that connect corresponding area  
in Rt. & Lt hemispheres  
across the midline





Fibers curving anterior

**forceps minor**

G

Tentorium cerebelli

Fibers curving posterior

**forceps major**

S



## 1-Rostrum:

Connects the orbital surfaces of the two frontal lobes.

## 2. Genu:

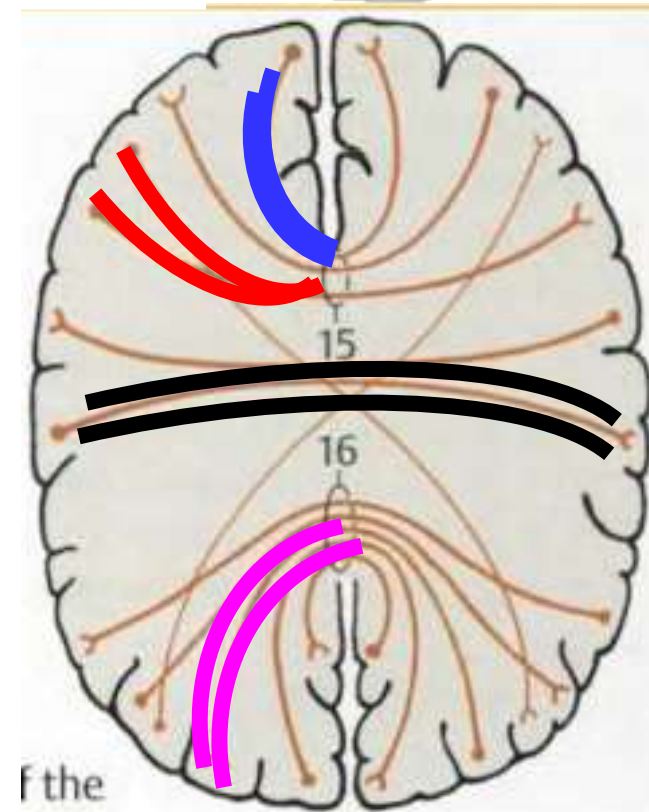
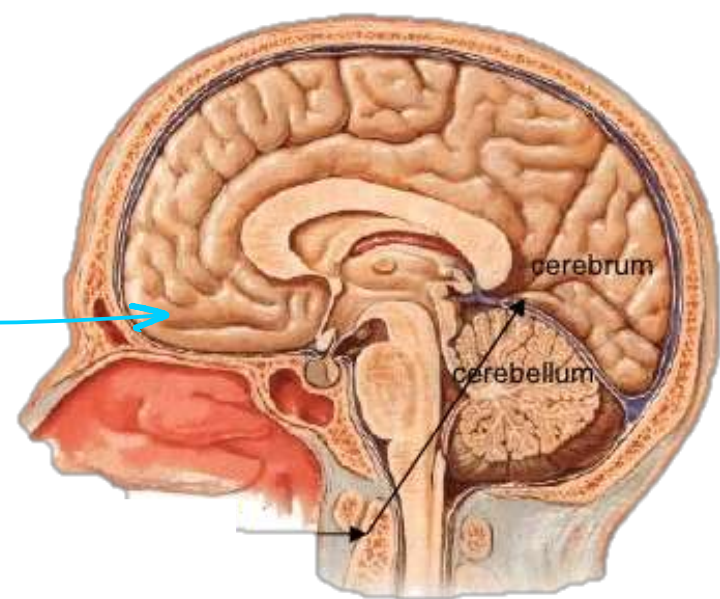
Its fibers form the *forceps minor*.  
Connect the medial & lateral surfaces of the two frontal lobes.

## 3. Body (Trunk):

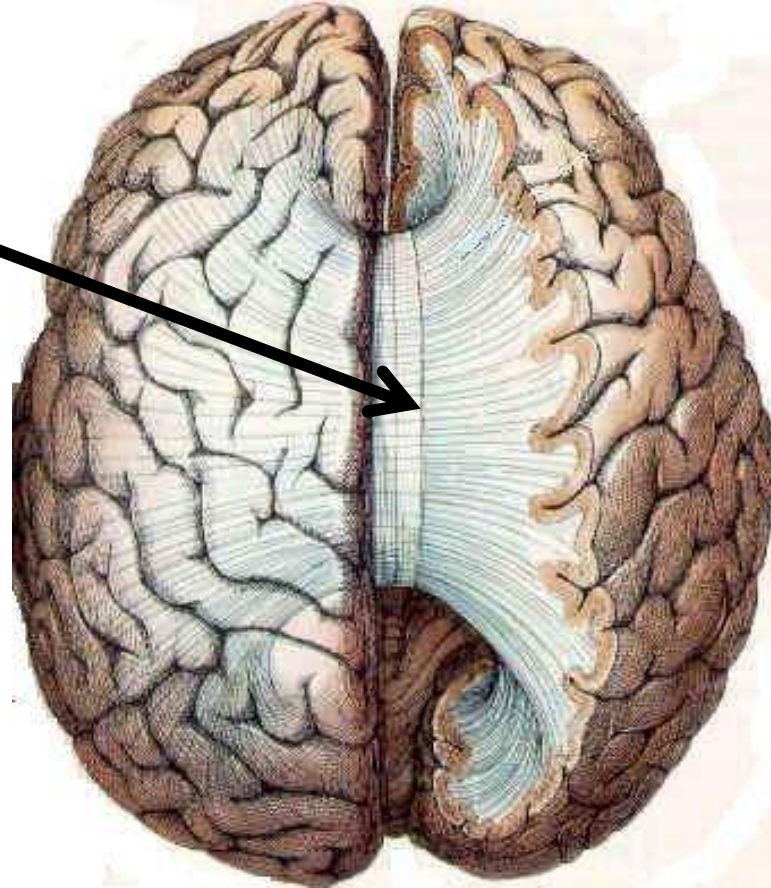
wide areas of cortex (parietal, temporal and occipital lobes).

## 4-Splenium:

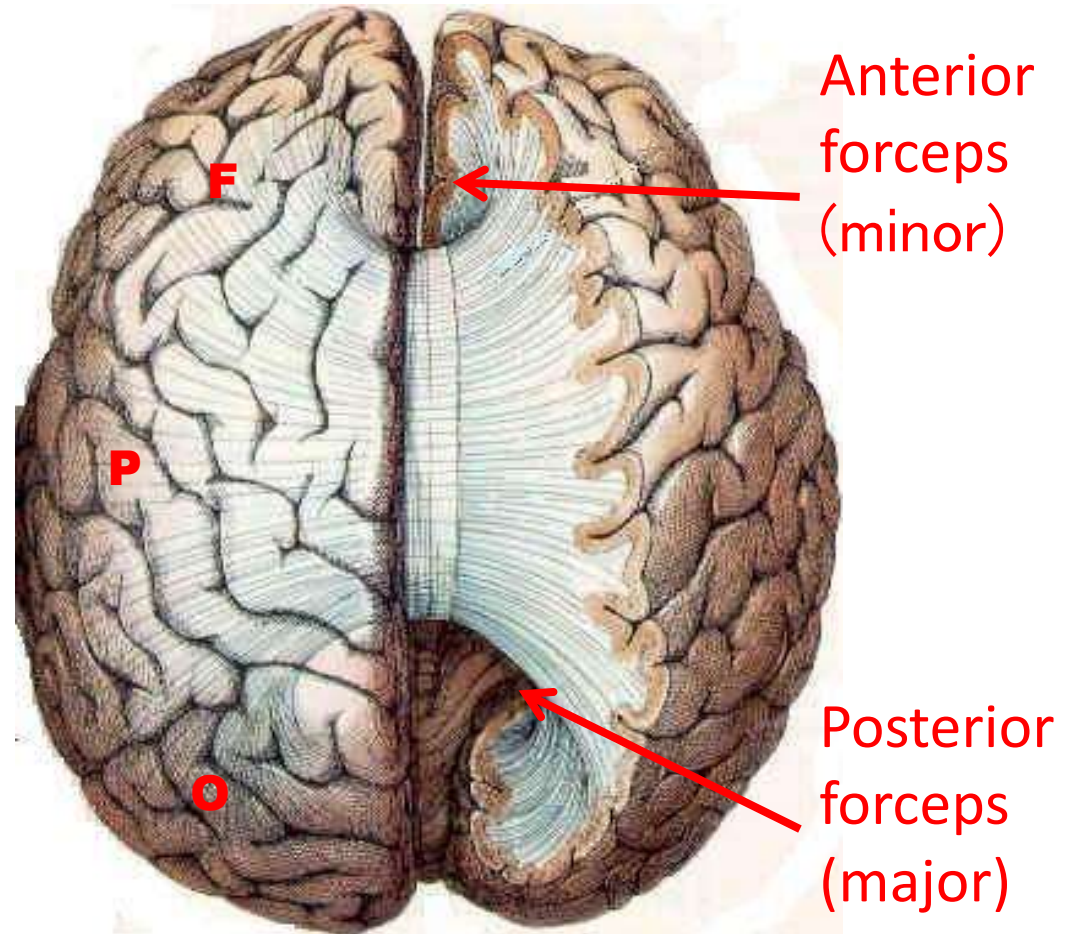
Its fibers curve back into occipital lobes forming *forceps major*



- The fibers in the **corpus callosum** connect the corresponding regions of the two hemispheres with each other



- Fibers linking the two **frontal poles** with each other, curve forward & form u-shaped anterior forceps (**forceps minor**)
- Fibers linking the two **occipital poles** with each other, curve backward & form u-shaped posterior forceps (**forceps major**)

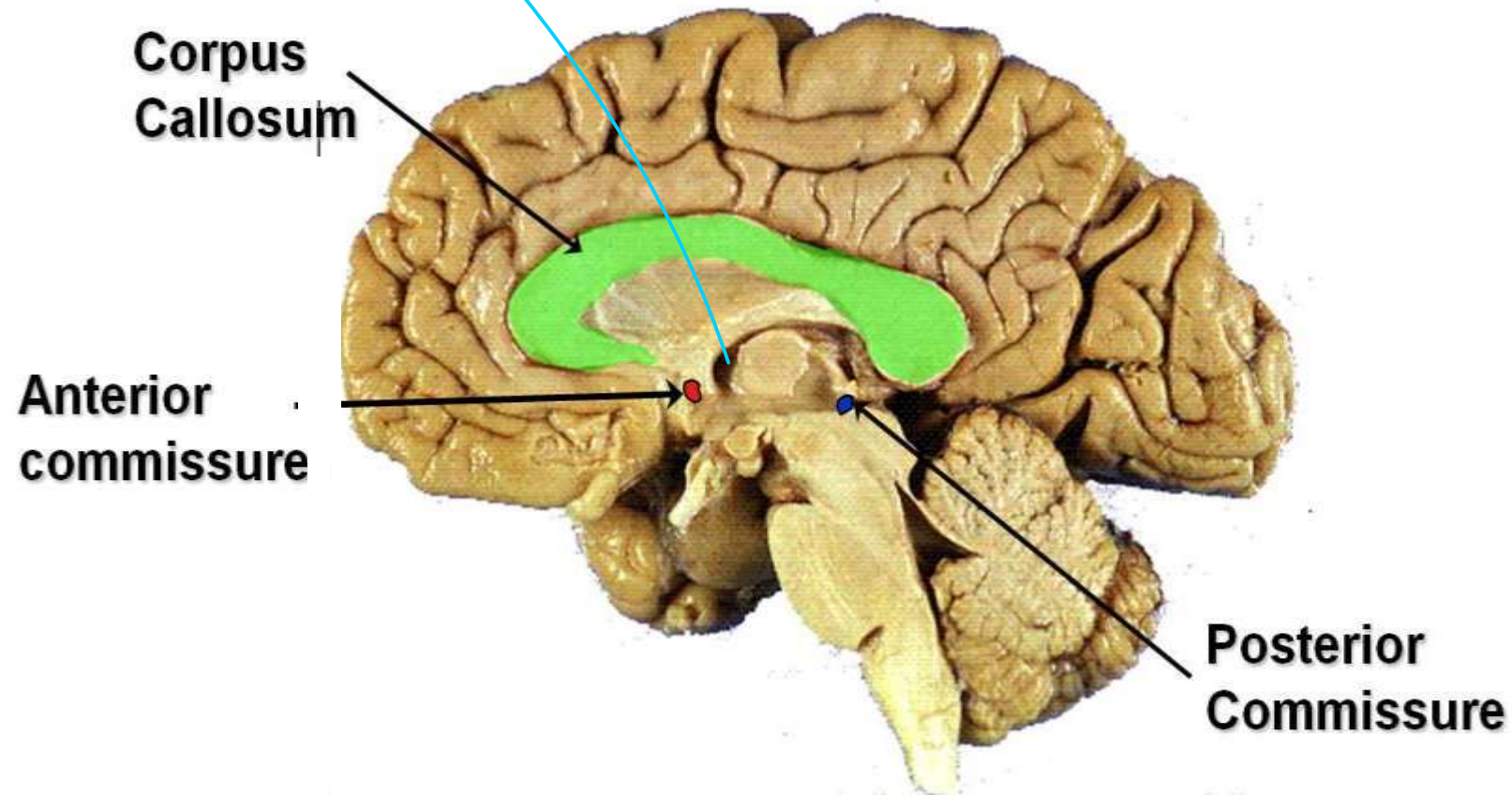


# Blood supply of corpus callosum

- All corpus callosum is supplied by anterior cerebral artery except splenium supplied by posterior cerebral artery.

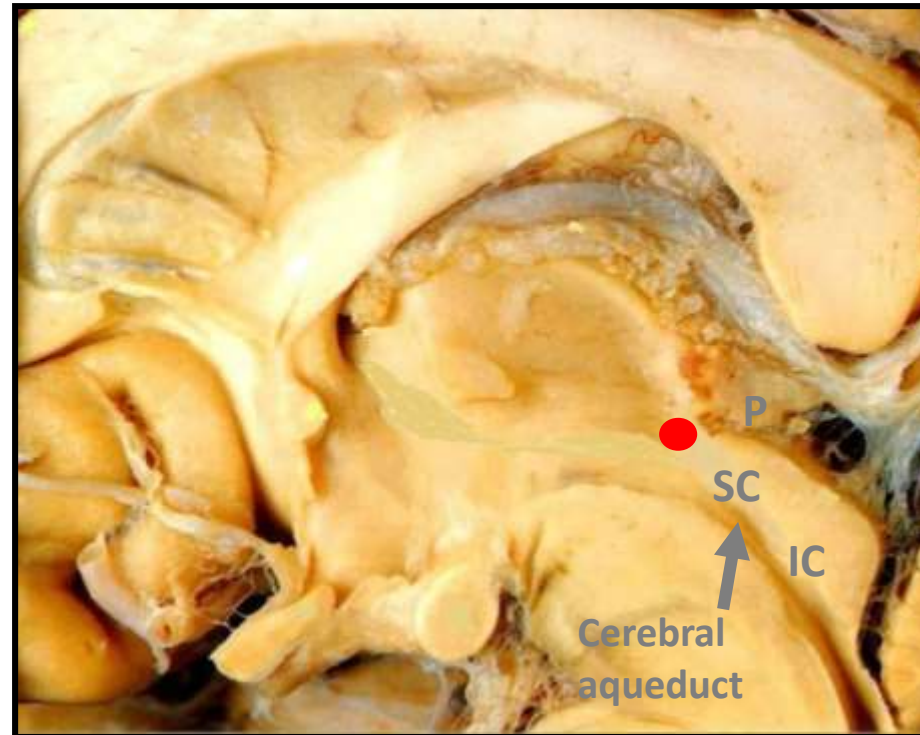
# Anterior Commissure

- Bundle of fibers runs transversely in front of the anterior columns of fornix



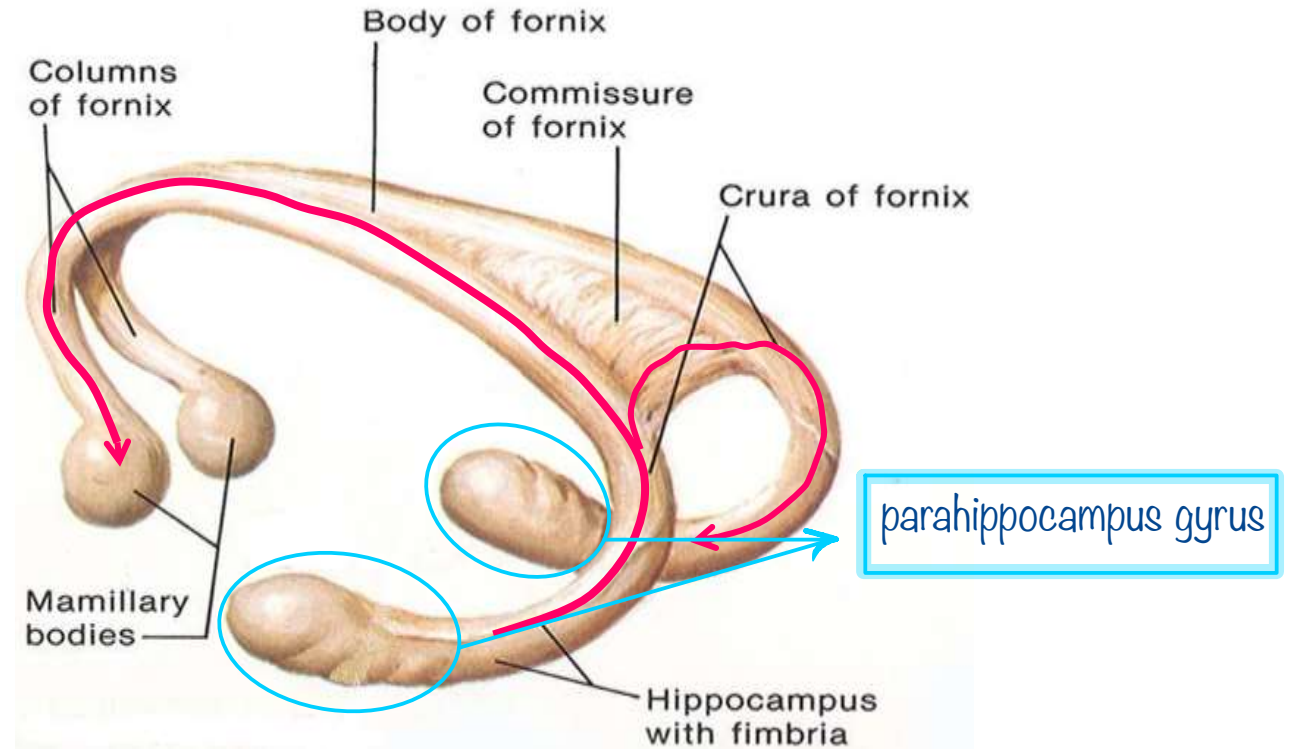
# Posterior Commissure

- Connects the left and right midbrain. Plays important role in the bilateral pupillary reflex



# Hippocampal Commissure

- Bundle of fibers runs transversely between the crura of the fornix
- Connect the two hippocampi with each other



في بال inferior surface of the cortex اشبي اسمه parahippocampus gyrus بمسك ب fibers اسمها ال hippocampus و بكملاوا فوق ب اشبي اسمه ال fornix على اليمين و الشمال بقربوا من بعض بس ما بلمسوا بعض عشان هيك في commissure fibers بتربطهم مع بعض، وبضل ال fornix مكمل لقدام و ببعد عن بعضه و بعمل اشبي اسمه columns of fornix و اخر اشبي بكملاوا بال mamillary bodies

# III- Association fiber

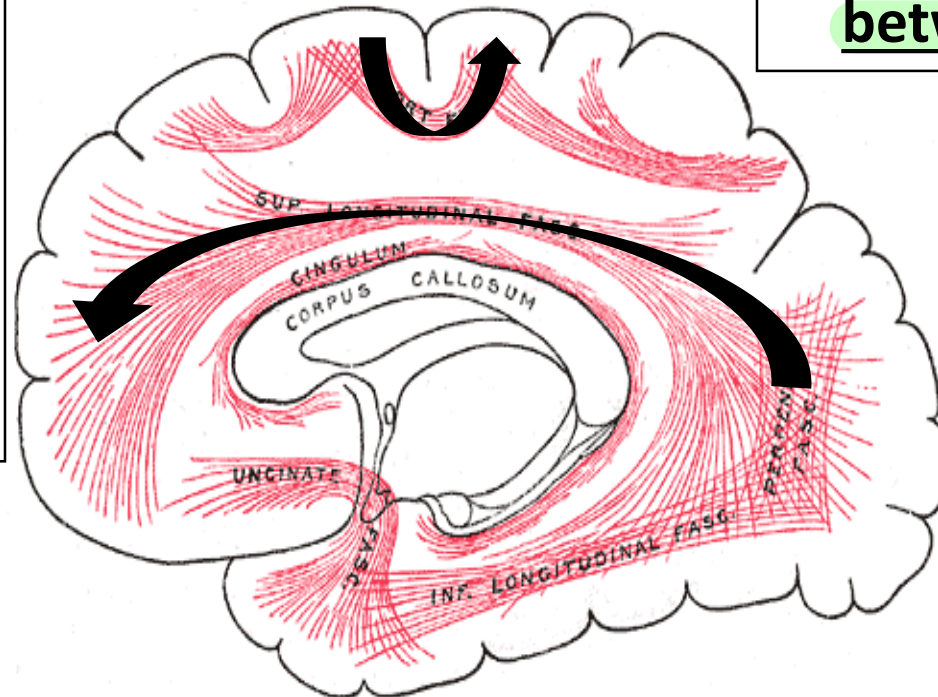
fibers unite different parts of  
the same cerebral hemisphere

## (1) short fibers

U-fibers connect  
adjacent gyri  
in same lobe,  
lie immediately  
beneath the gray  
substance of the  
cortex

## (2) long fibers

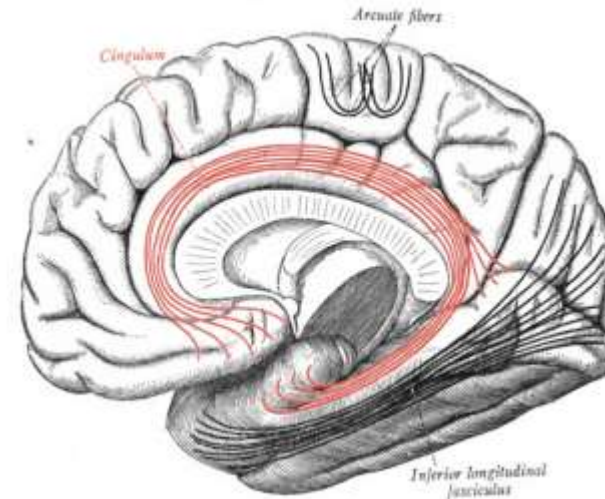
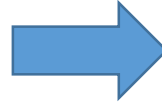
connect  
between lobes



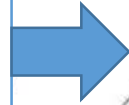


# LONG ASSOCIATION FIBERS

**1-Cingulum**



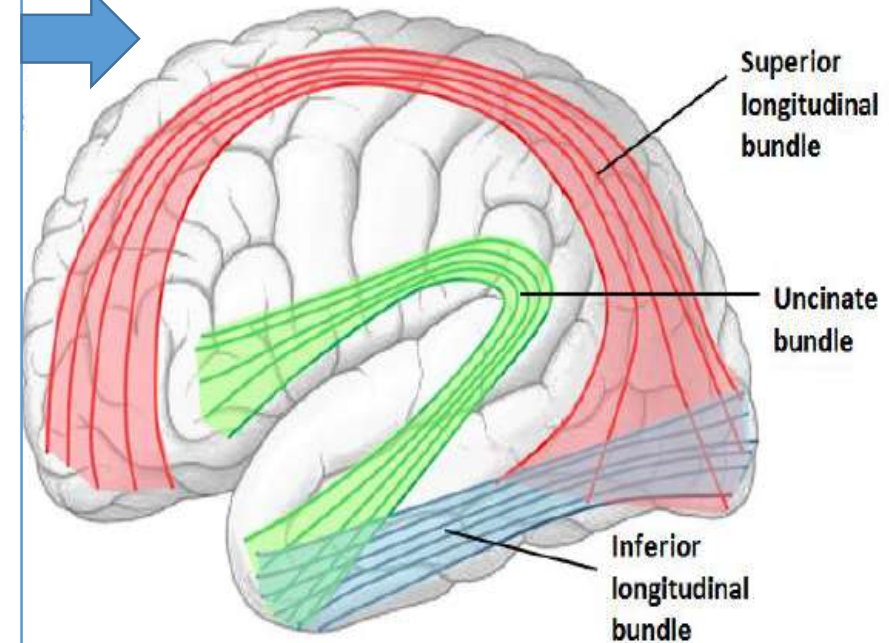
**2- Superior longitudinal bundle**



**3- Inferior longitudinal bundle**

**4- Fronto - occipital bundle**

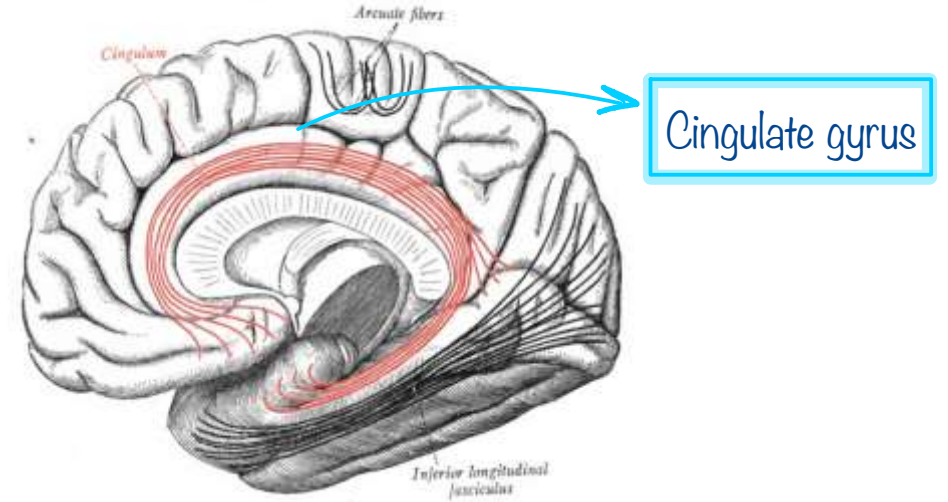
**5- Uncinate bundle**



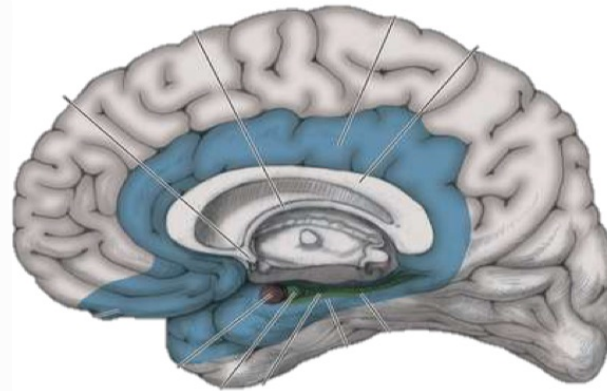
# LONG ASSOCIATION FIBERS

## 1-Cingulum

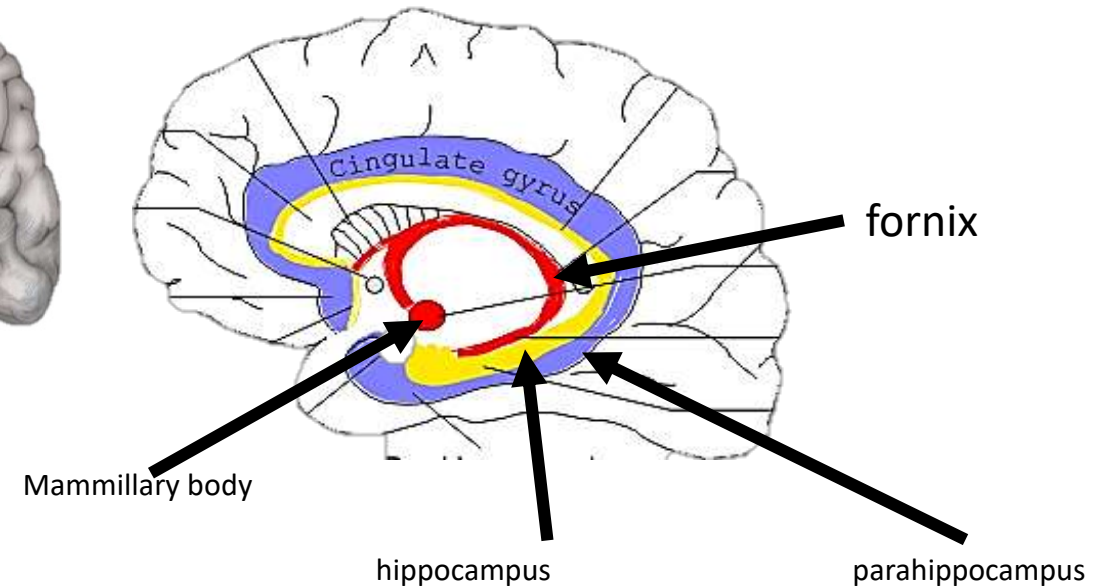
- runs deep to cingulate gyrus
- connected to the limbic lobe



ال cingulate gyrus متوصل بال  
parahippocampus الي متوصل بال  
hippocampus الي متوصل بال fornix الي  
متوصل بال mammillary bodies المتوصلة بال  
anterior nuclei of thalamus عن طريق  
thalamus (mammillo-thalamic radiation) و  
يعملوا anterior thalamic radiation الي  
cingulate gyrus لل



The Limbic System



# Now we can understand the limbic lobe and Papez circuit

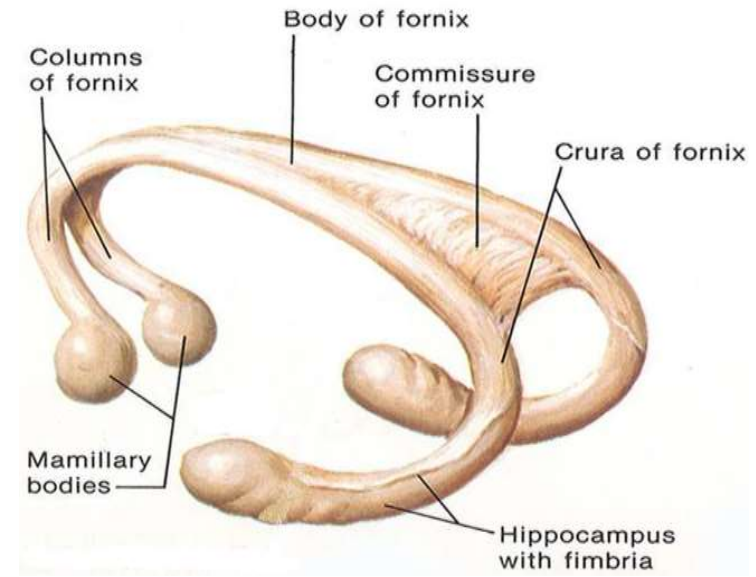
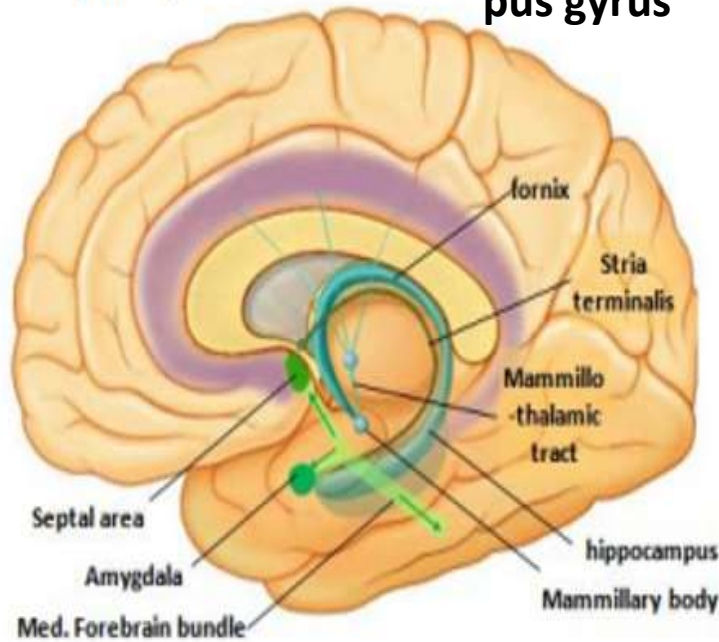
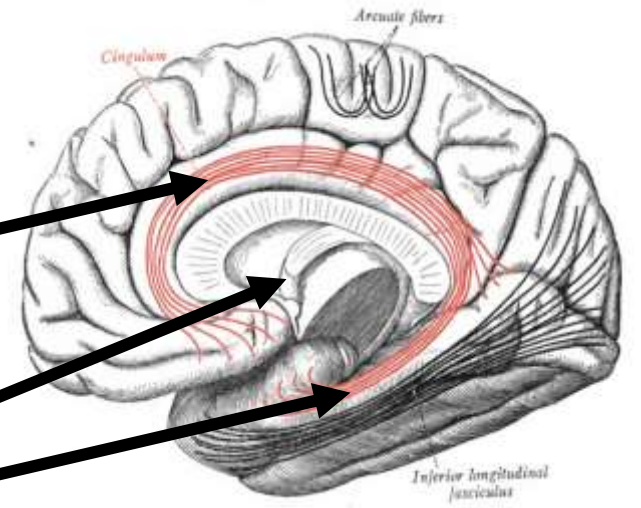
مسئولة عن الذاكرة

- 1-The cingulate gyrus receives input from 3 association areas (sensory, visual & auditory). It is connected with the parahippocampal gyrus & uncus via the cingulum.
- 2-The parahippocampal gyrus is connected with the hippocampus.
- 3-The hippocampus is connected to the mammillary bodies of hypothalamus via the fornix.
4. The mammillary body is connected to the anterior nucleus of thalamus via the mamillo-thalamic tract
- 5- The anterior nucleus of thalamus is connected to the anterior part of the cingulate gyrus via the anterior thalamic radiation thus closing the circuit.

Cingulate gyrus

fornix

Parahippocampus gyrus



# LONG ASSOCIATION FIBERS

## ❑ Superior longitudinal bundle

connects frontal lobe to occipital lobe & temporal lobe

## ❑ Inferior longitudinal bundle

connects the occipital lobe to the temporal lobe.

## ❑ Fronto-occipital bundle

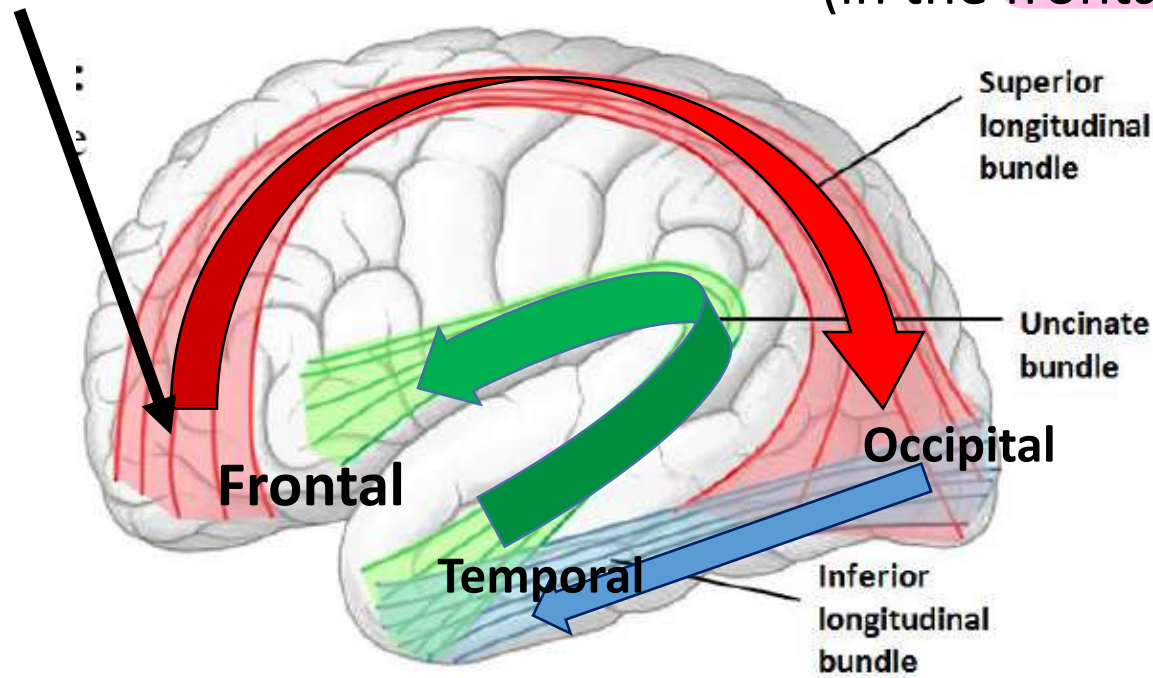
situated deeper to superior longitudinal bundle

## ❑ Uncinate bundle

مسؤول عن الفهم

connects Wernicke's area (in the temporal lobe) to Broca's area (in the frontal lobe)

مسؤول عن الكلام



# Clinical Notes

Damage to corpus callosum leads to **split-brain syndrome**.

The two half of the brain behave relatively autonomously

Damage to splenium of corpus callosum leads to **posterior disconnection syndrome of alexia** (cannot understand written material) **without agraphia** (can speak and write without difficulty)

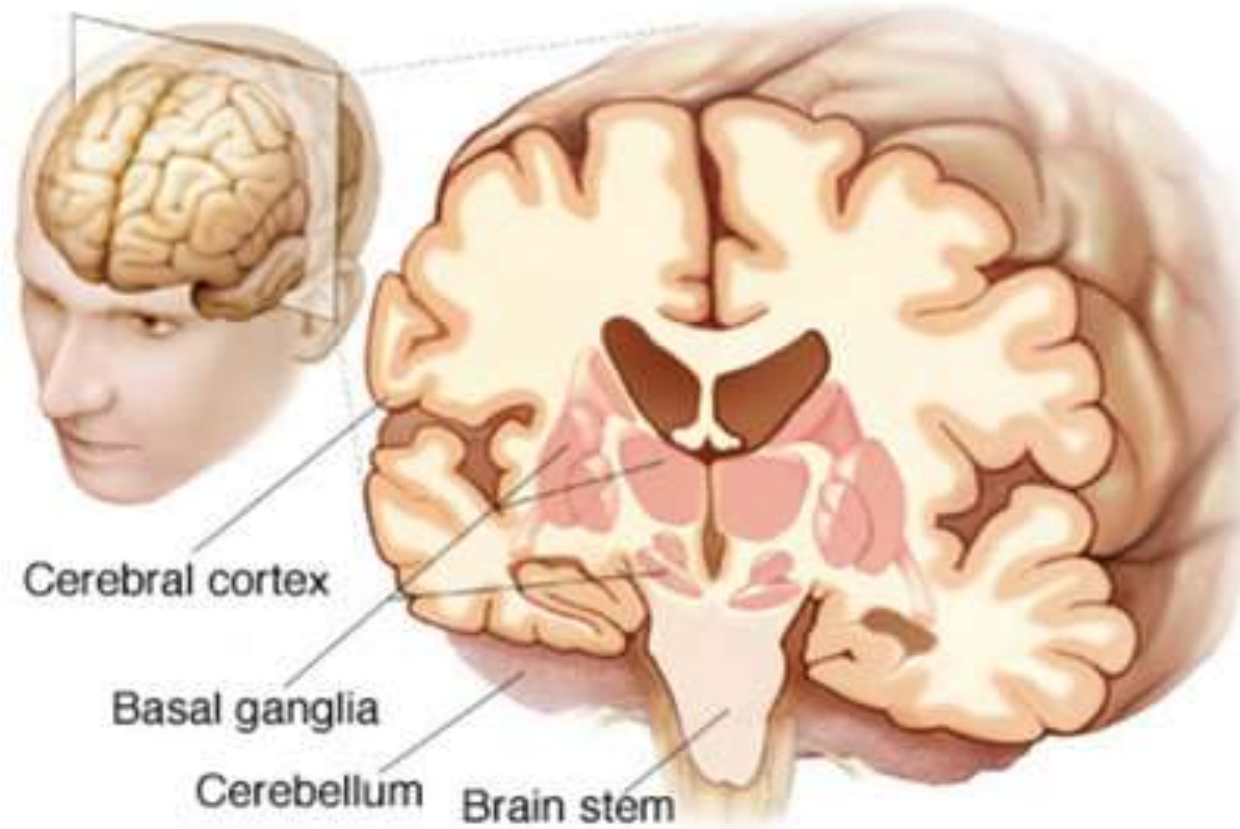
**BASAL NUCLEI**  
**(BASAL GANGLIA)**

الاسم  
العام

الاسم  
المستعمل

# BASAL NUCLEI (BASAL GANGLIA)

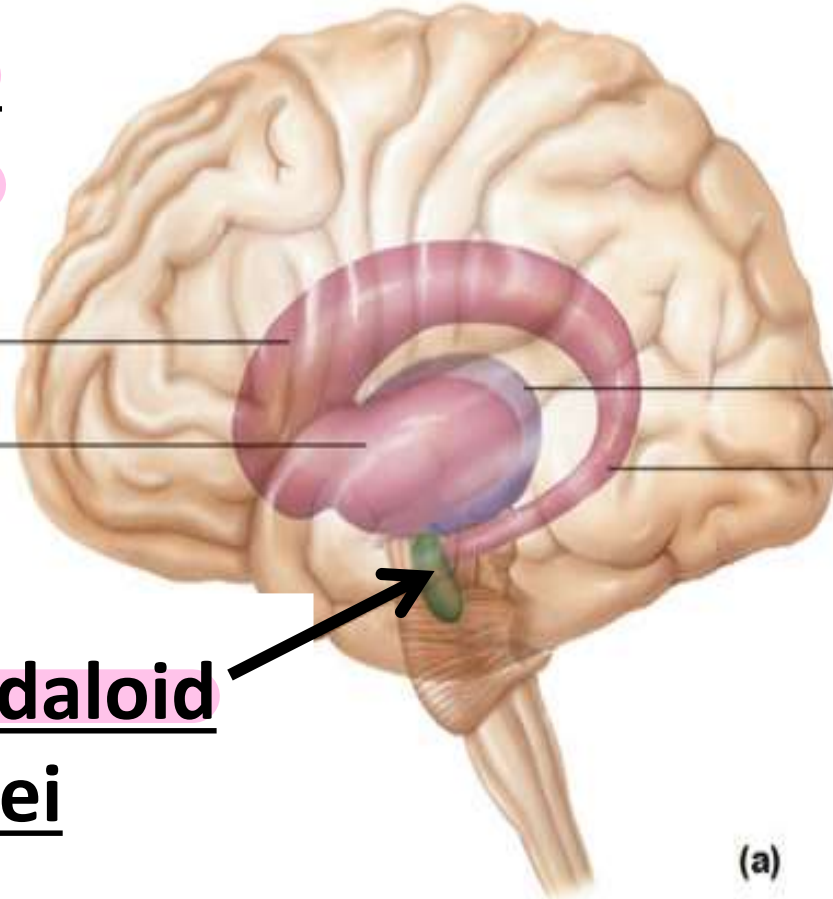
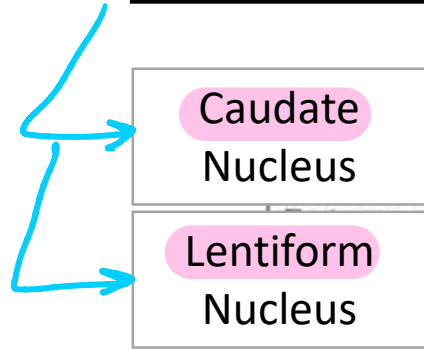
They are masses of grey matter lying within each cerebral hemisphere near its base.



# BASAL NUCLEI

They include :

## I- Corpus striatum



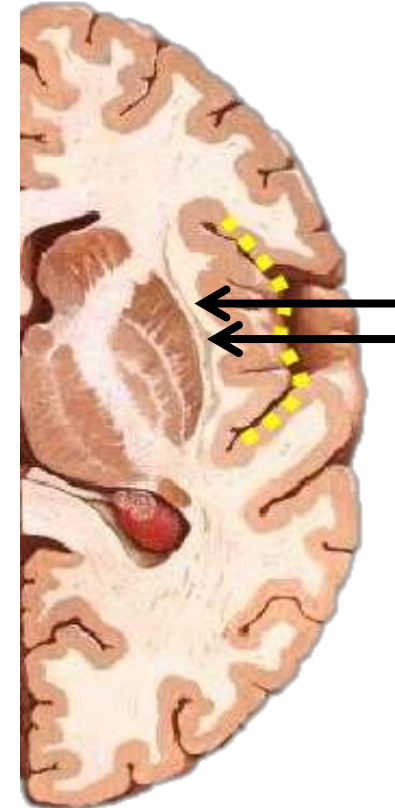
## II - Amygdaloid Nuclei

مسئولة عن الخوف

مخيفه من حده

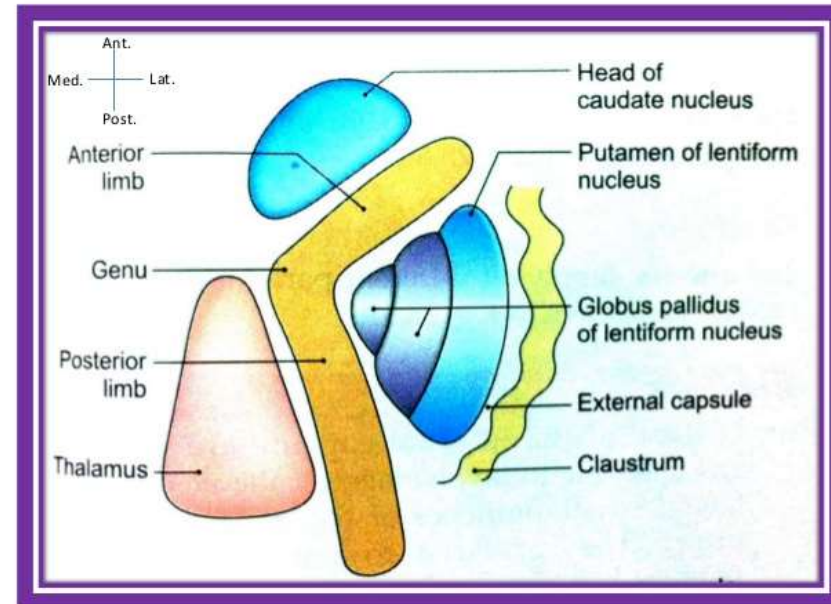
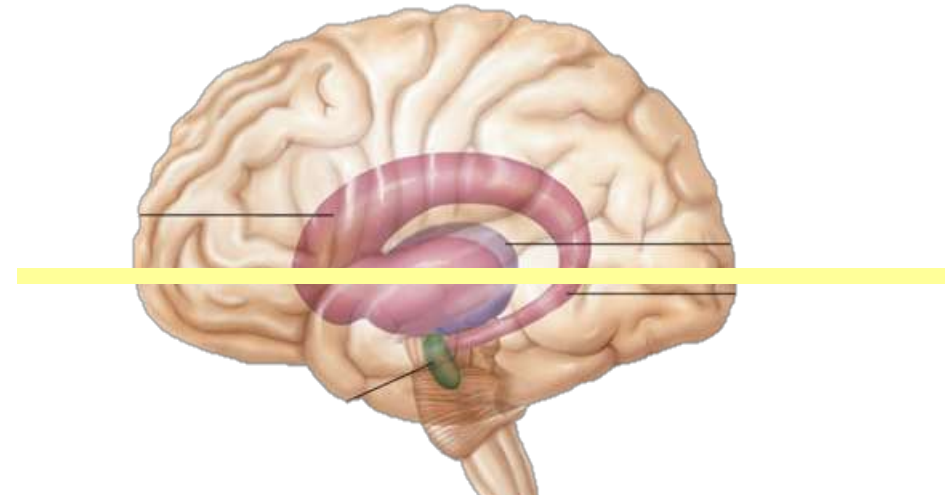
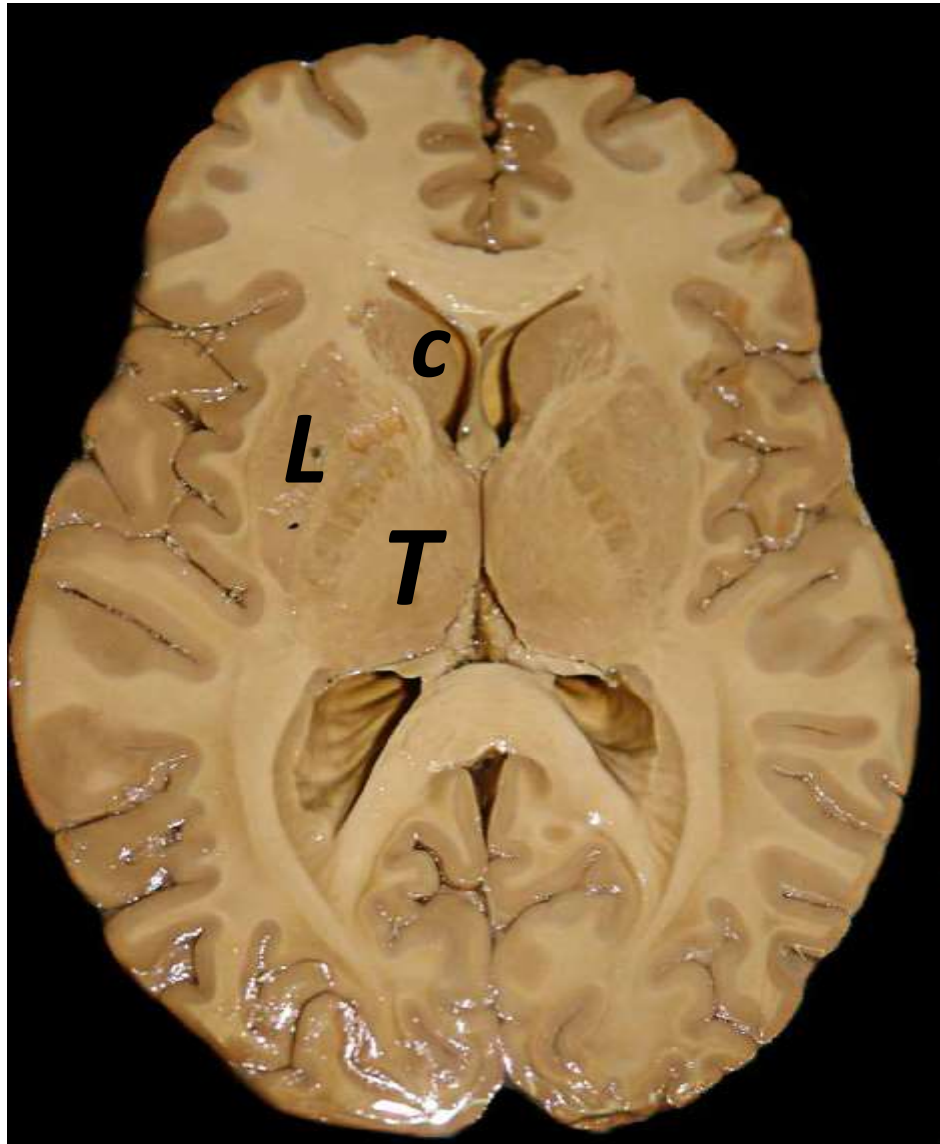
## III - Claustrum

(grey matter that lies lateral to Lentiform N)





# BASAL NUCLEI



# BASAL NUCLEI

## Lentiform Nucleus

It is divided into:

- ❑ Putamen (laterally)
- ❑ Globus Pallidus (medially):  
appears white due to rich myelin content.

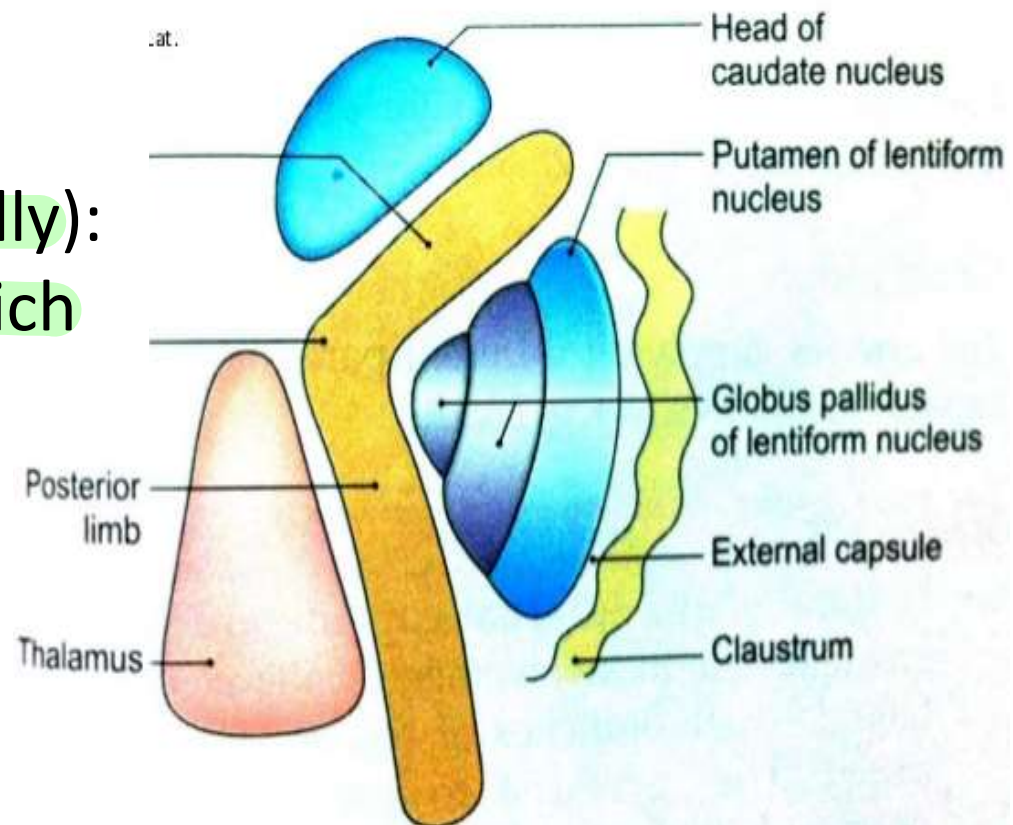
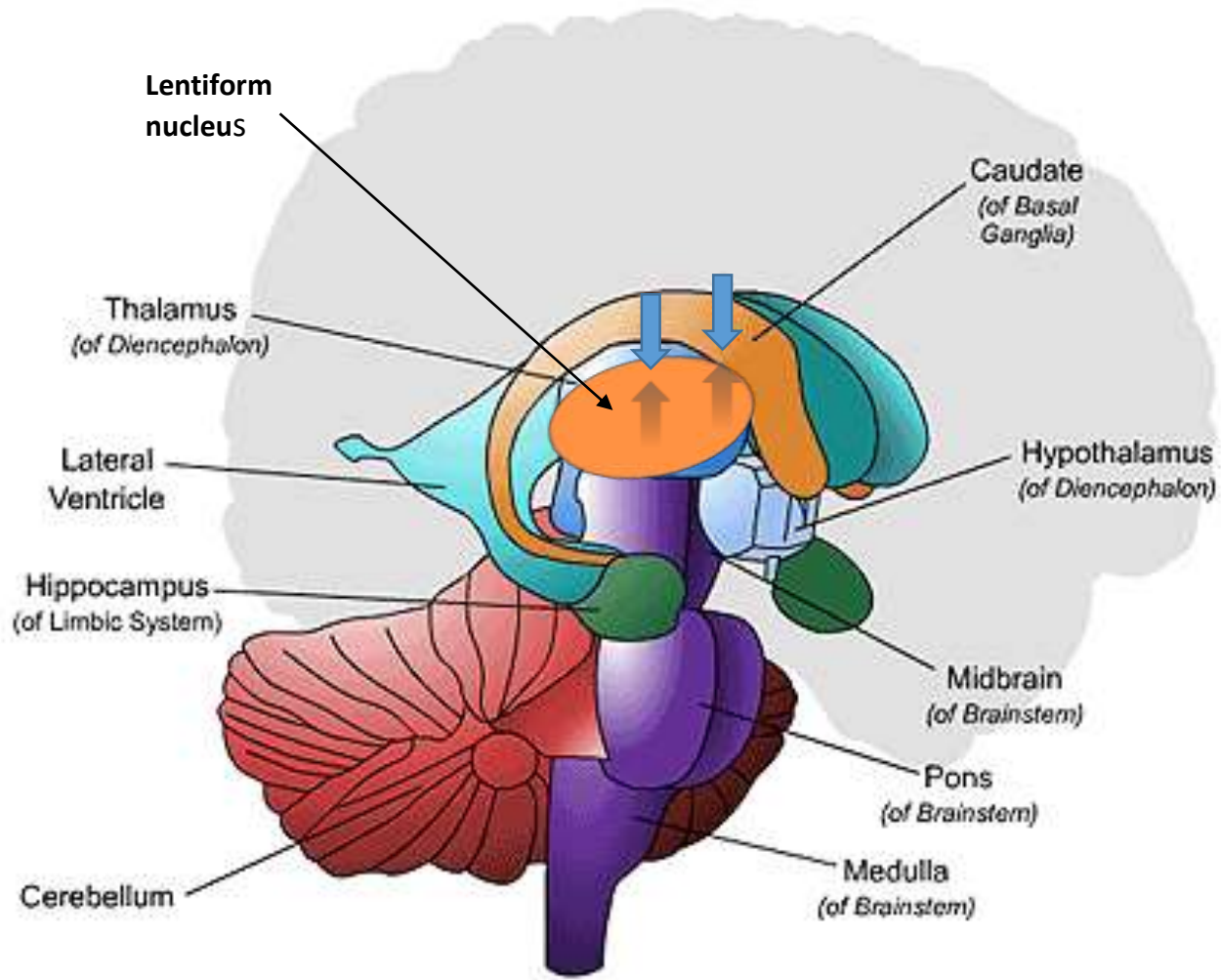
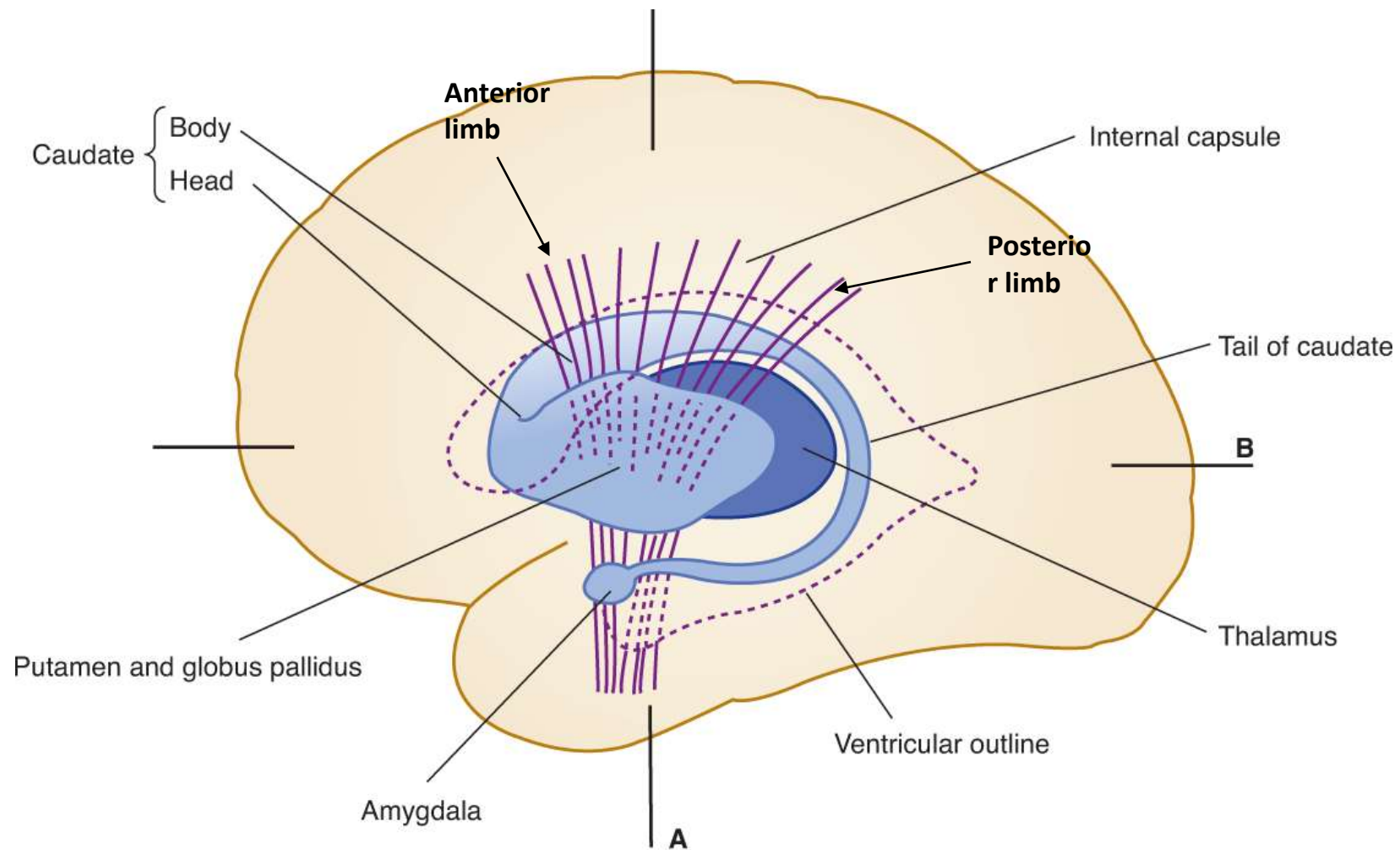
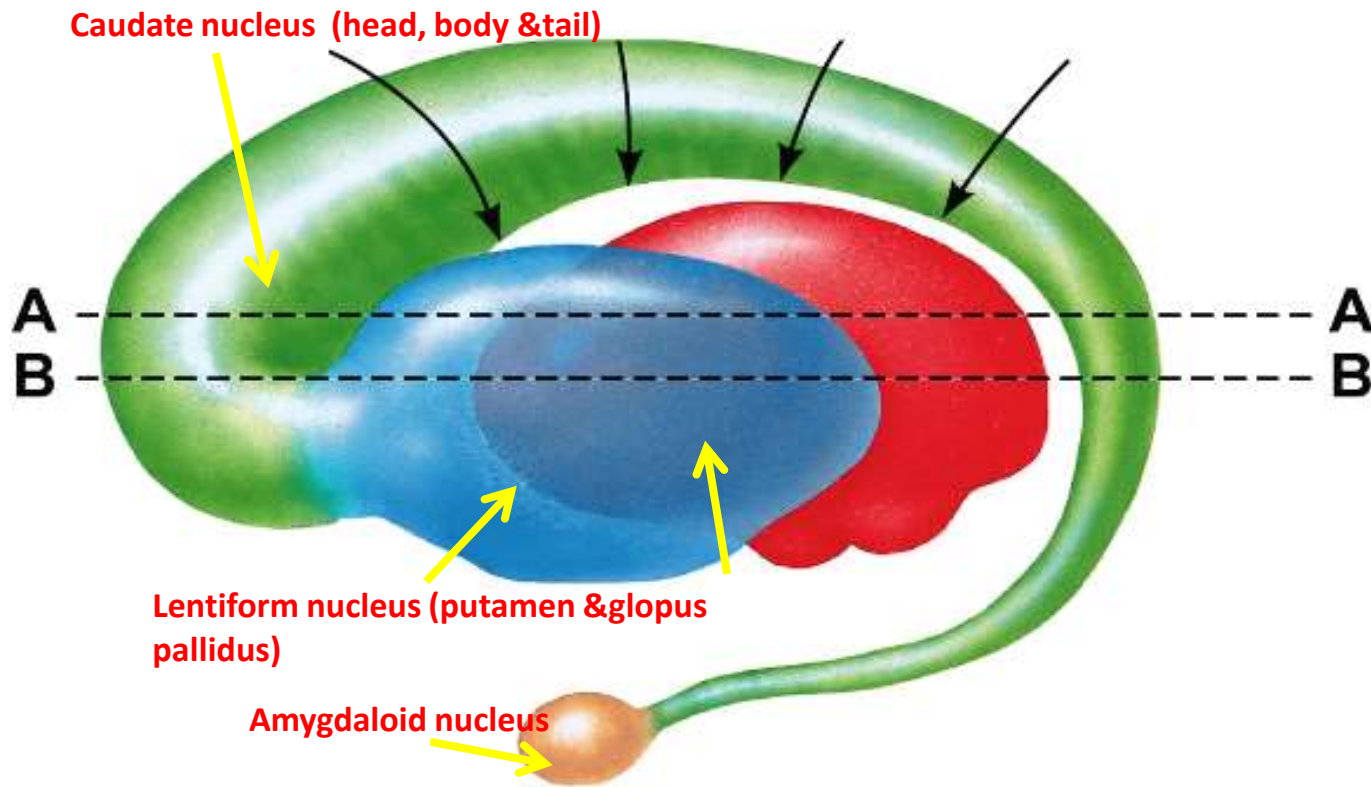


Figure AB-33: Build A Brain, Step 8



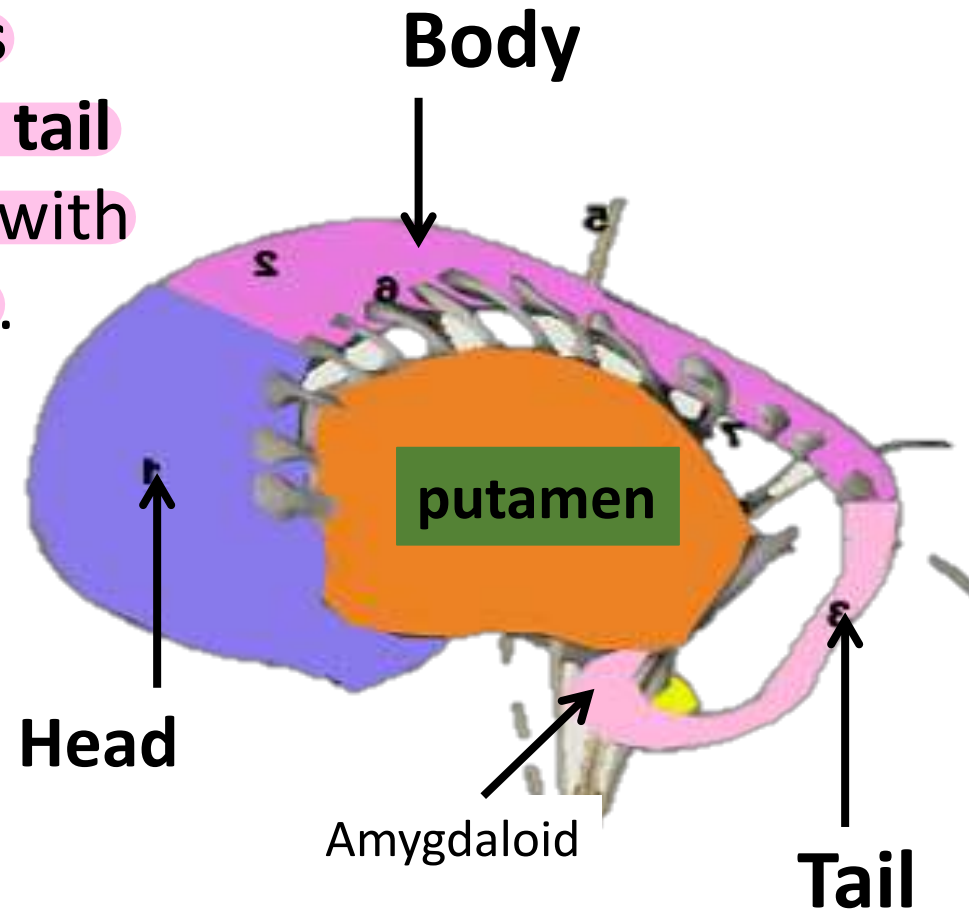


# *Basal nuclei*



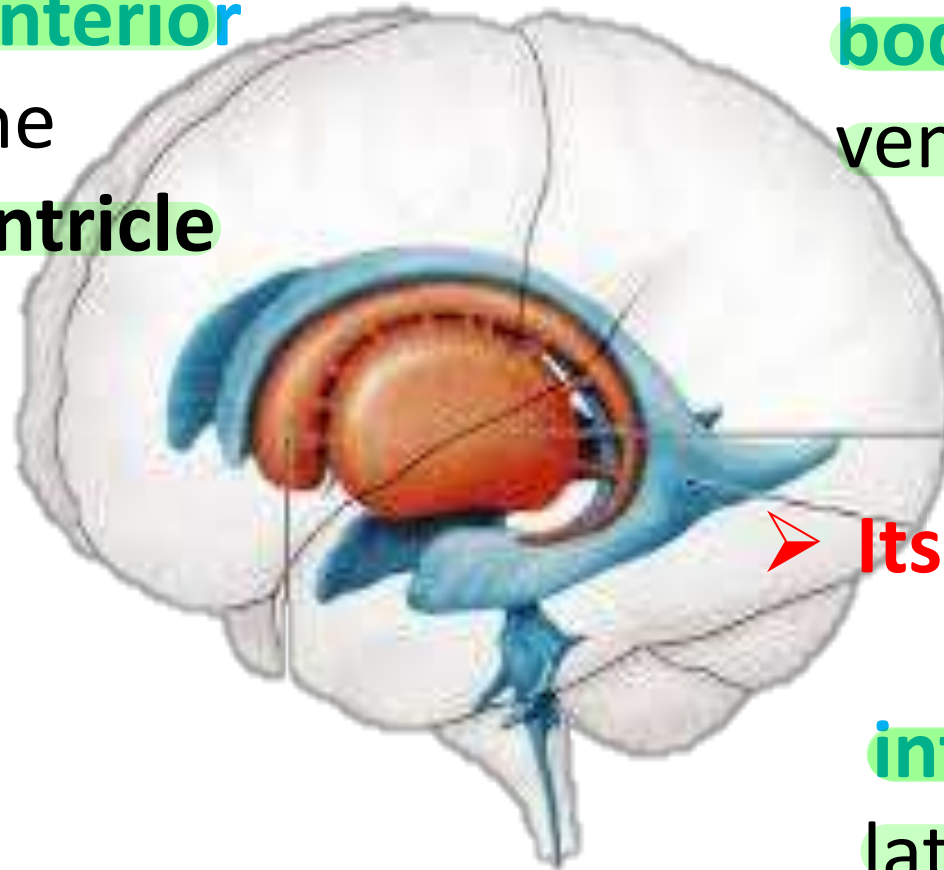
# Caudate Nucleus

- It is a **C-shaped Nucleus**
- It has a **head, body and tail**
- The **head is continuous with putamen of lentiform N.**
- The **tip of the tail is continuous with the amygdaloid nuclei.**



# Caudate Nucleus

➤ **The head** bulges into the **anterior horn** of the **lateral ventricle**



➤ **Its body** lies in the **floor of the body** of lateral ventricle.

➤ **Its tail** lies in the **roof of the inferior horn** of lateral ventricle.

## FUNCTIONAL DIVISIONS

### 1. Striatum

- a. caudate nucleus
- b. putamen

### 2. Pallidum

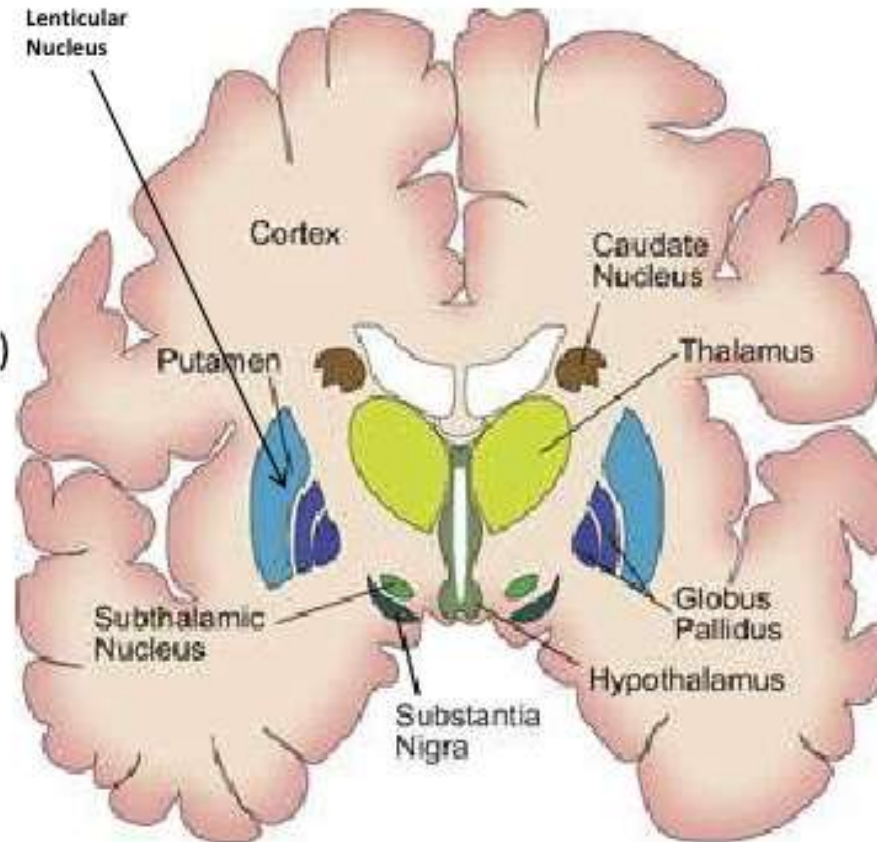
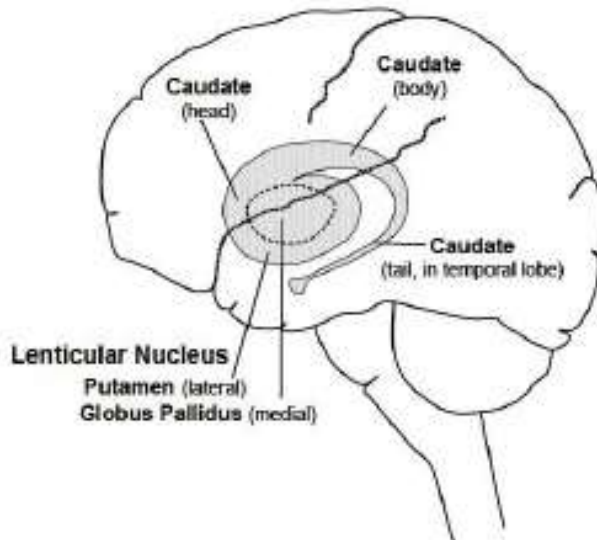
- a. Globus Pallidus Interna (Gpi)
- b. Globus Pallidus Externa (Gpe)

### 3. Thalamus

### 4. Subthalamic Nucleus

### 5. Substantia Nigra

ventro-anterior nuclei JI





**Thank you**