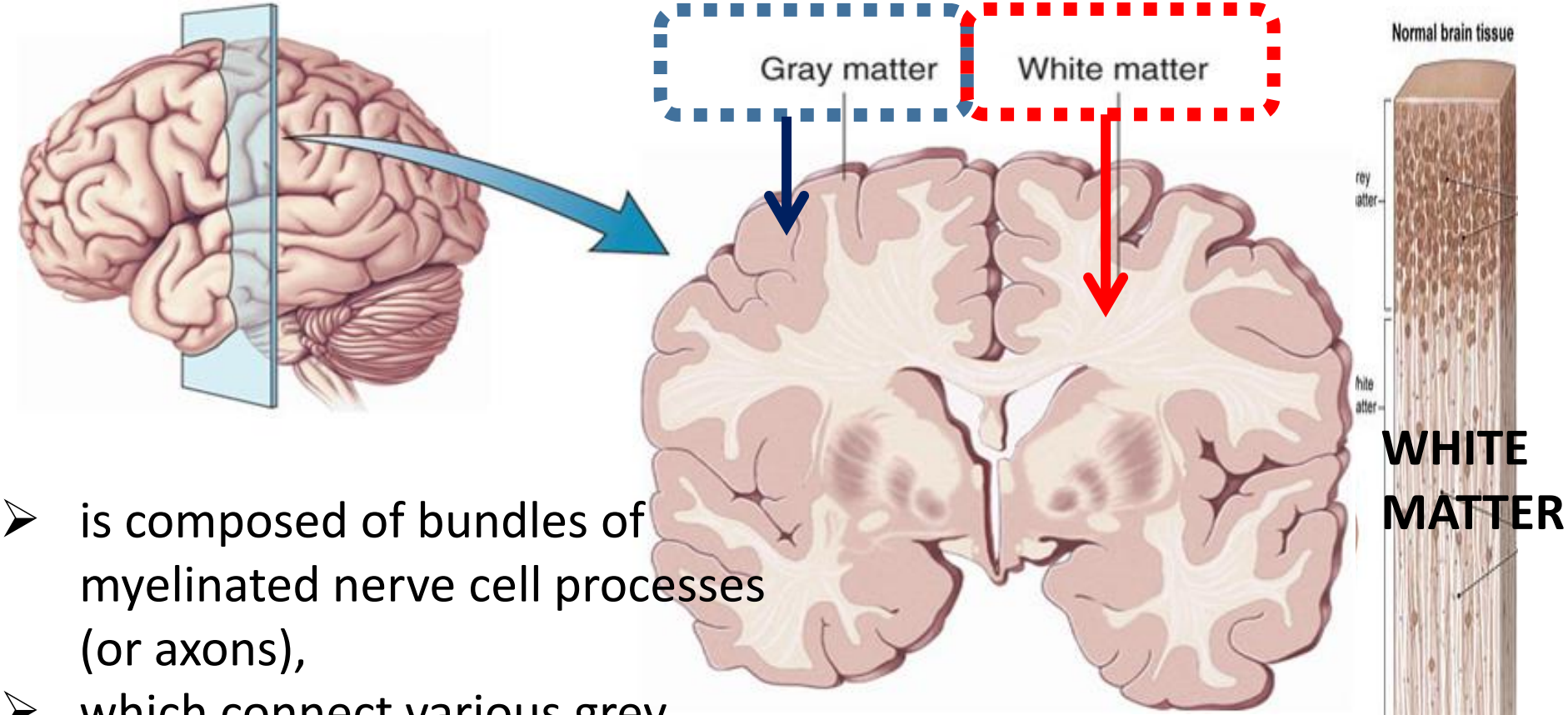
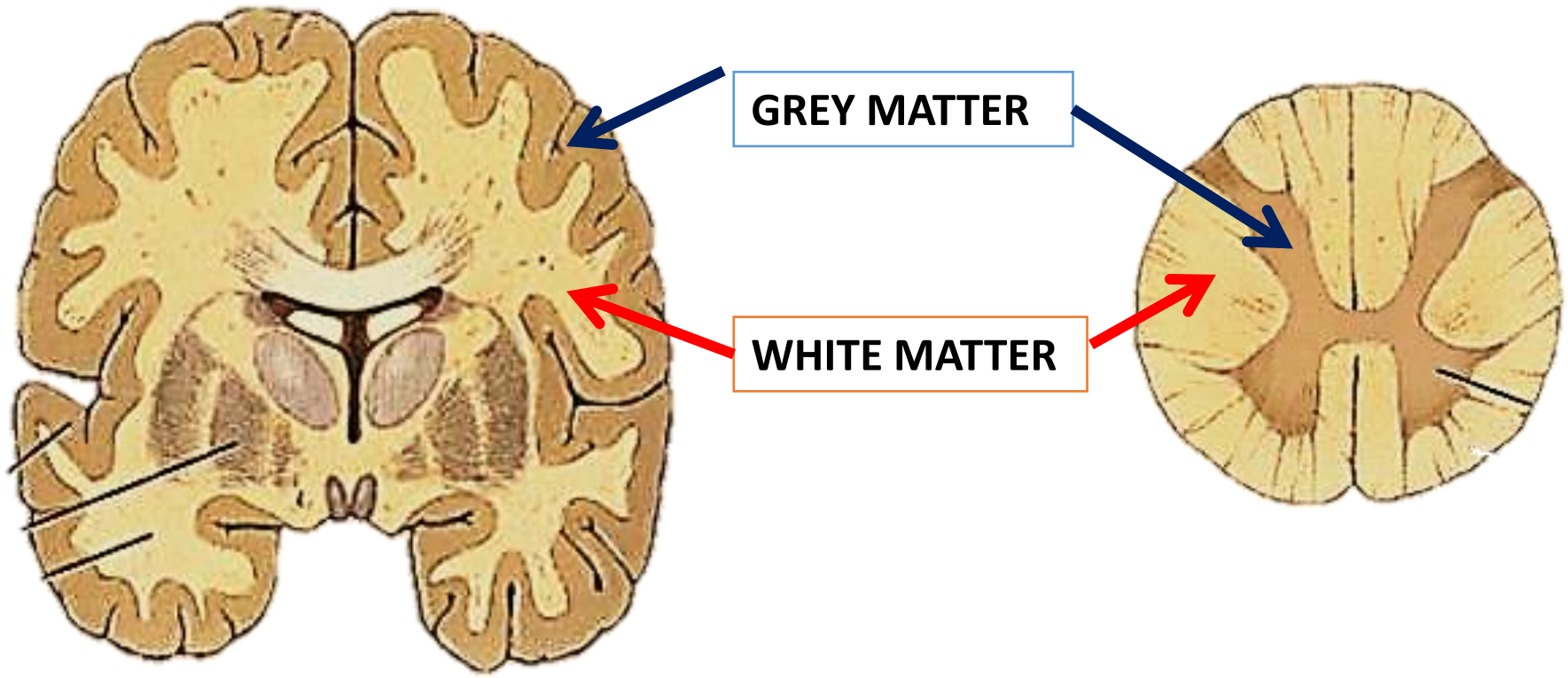
WHITE MATTER OF CEREBRAL HEMISPHERES



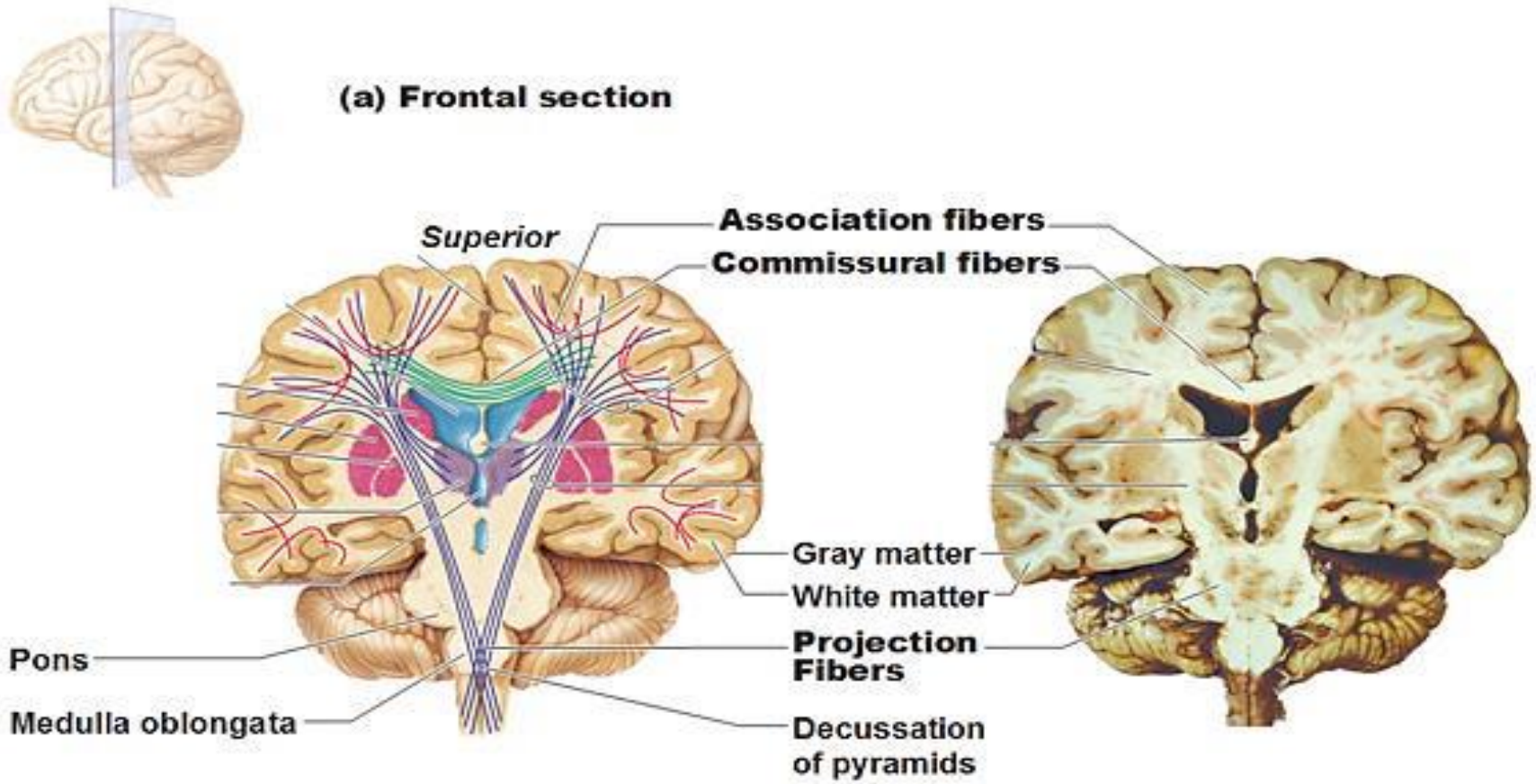
- is composed of bundles of myelinated nerve cell processes (or axons),
- which connect various grey matter areas of the brain to each other and to spinal cord.

DIFFERNCE BETWEEN WHITE MATTER OF CEREBRAL HEMISPHERES & SPINAL CORD



TYPES OF WHITE MATTER

Cerebral White Matter – 3 types of fibers



TYPES OF WHITE MATTER OF CEREBRAL HEMISPHERES :

❑ projection fibers

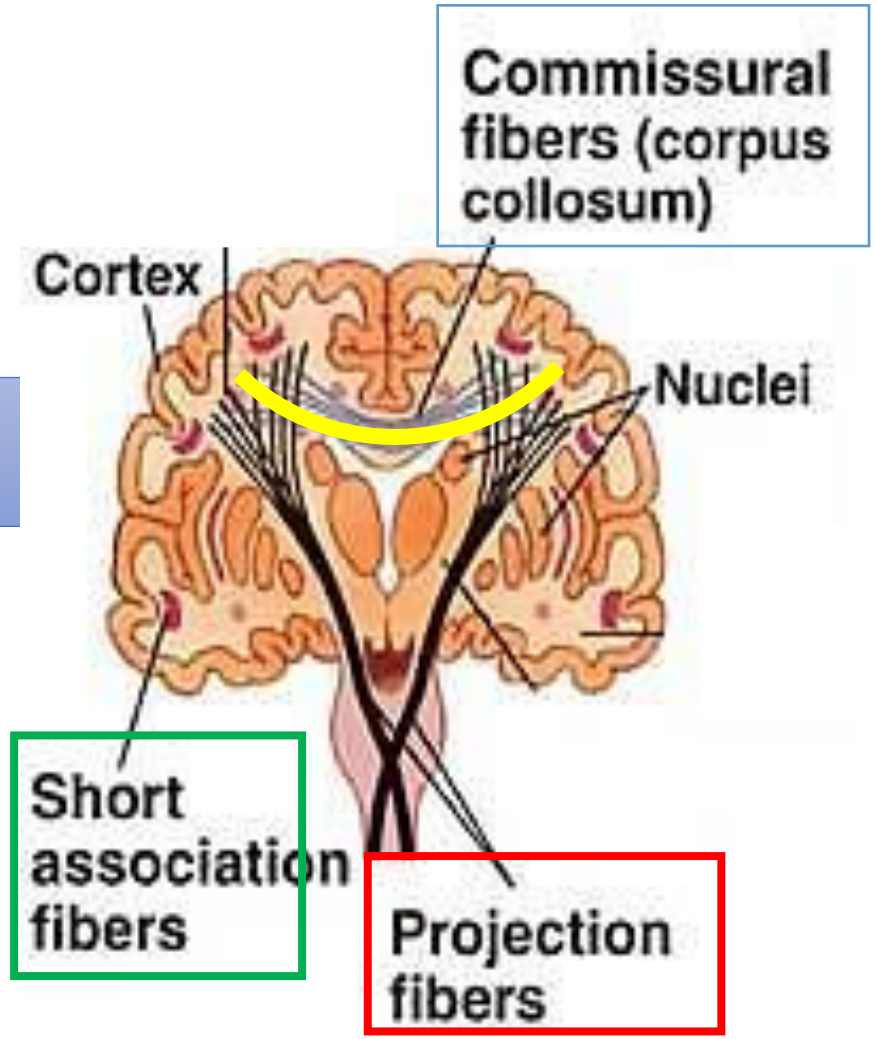
connect the cerebral cortex with lower centers

❑ Commissural fibers

connect **the same area** in **the Two cerebral hemispheres**

❑ Association fiber

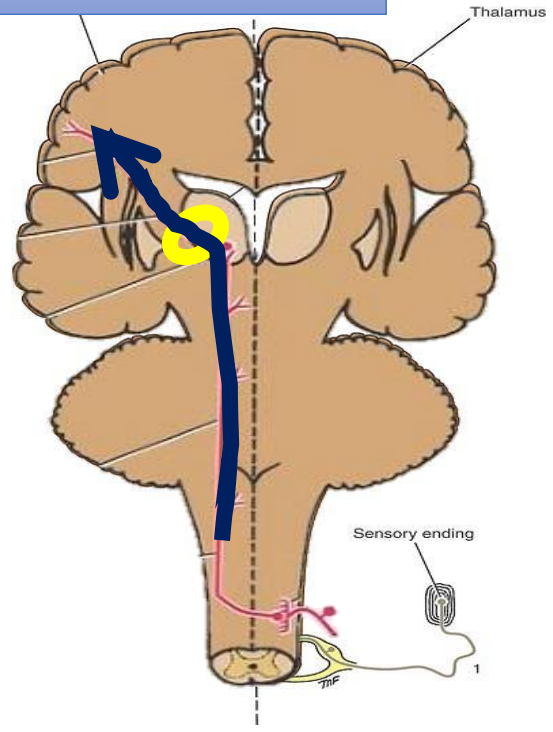
Connect different parts of the **Same cerebral hemispheres**



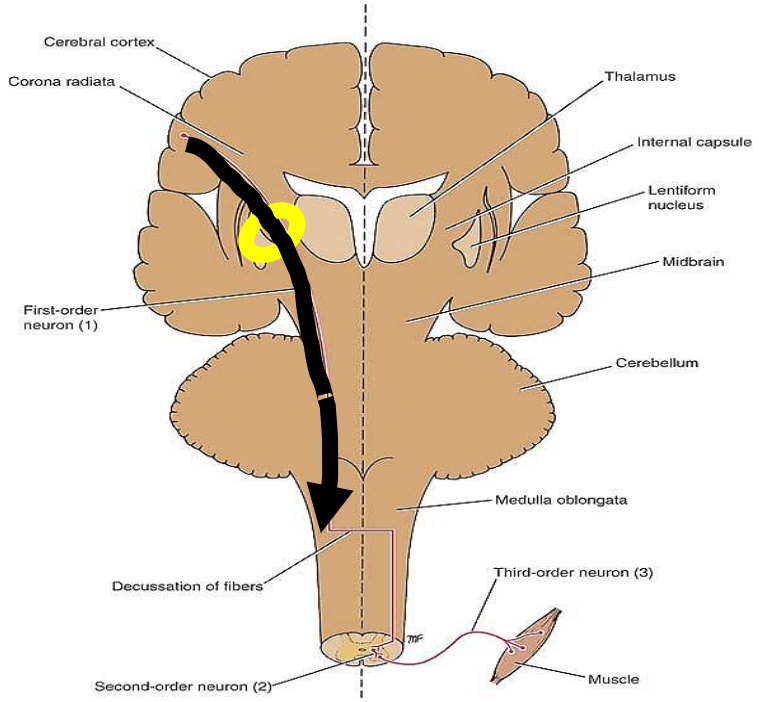
I- projection fibers

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

Ascending

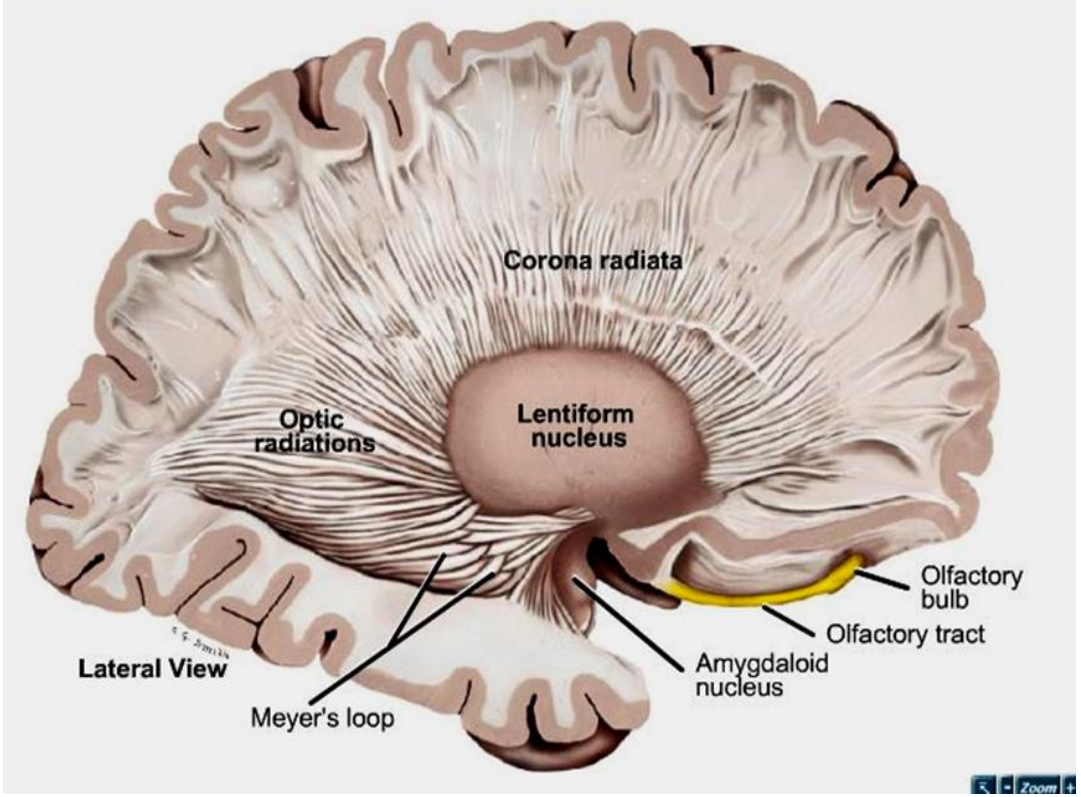


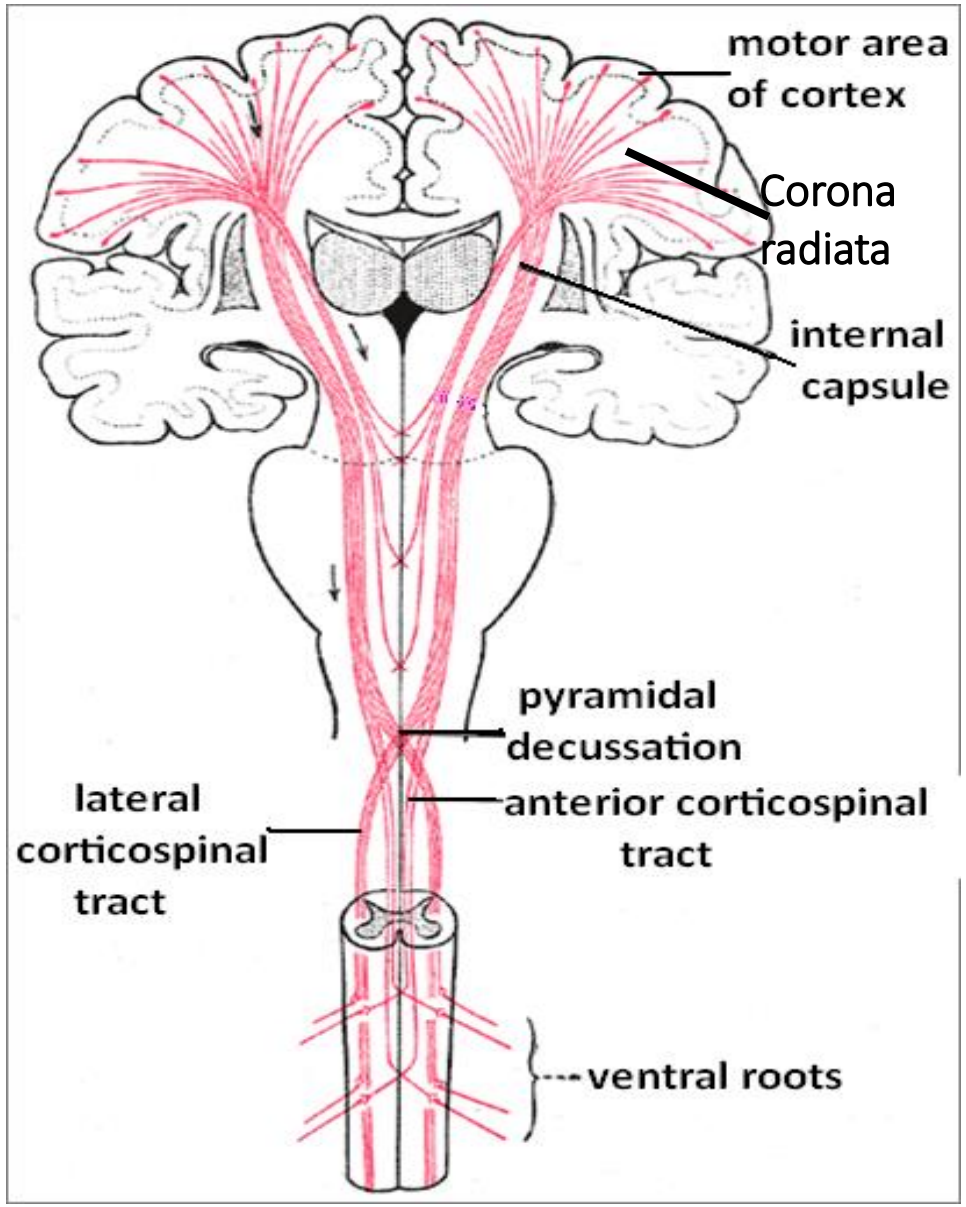
Descending



Projection Fibers

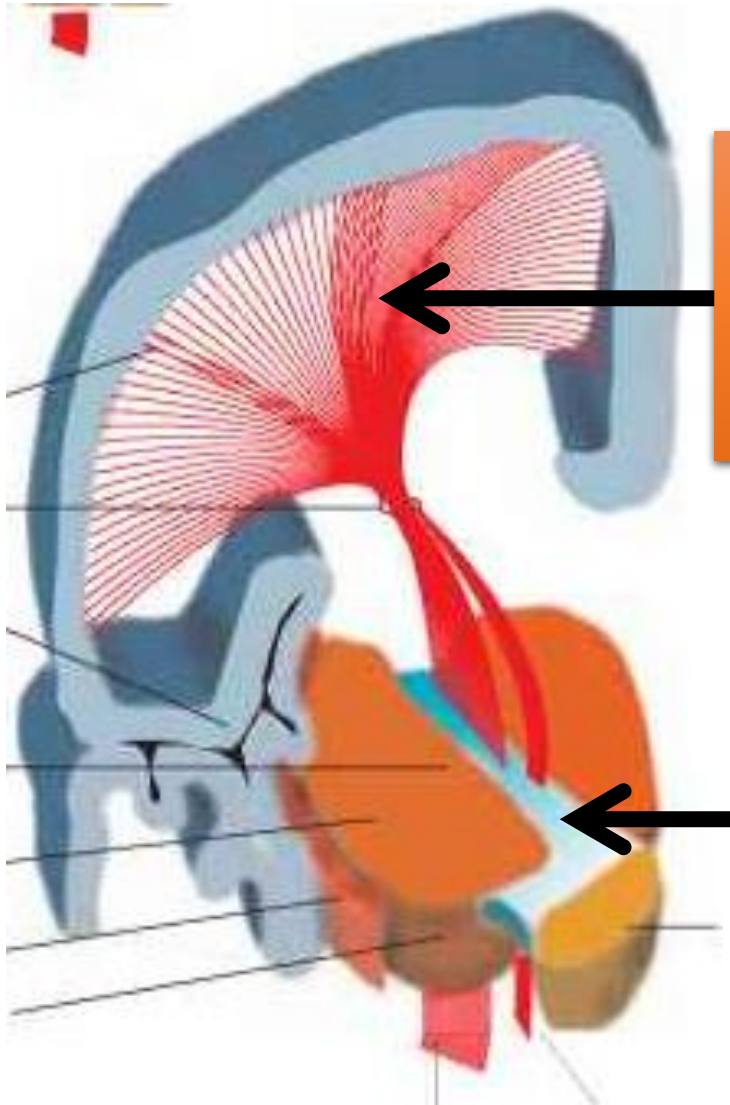
- Fibers running vertically through the hemispheres
- Consist of:
  - **Cortical afferent :**fibers conveying impulses to the cerebral cortex: (mainly thalamo-cortical fibers)
  - **Cortical efferent :**fibers carrying impulses away from the cortex to the lower centers: (corticostriate, corticobulbar,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



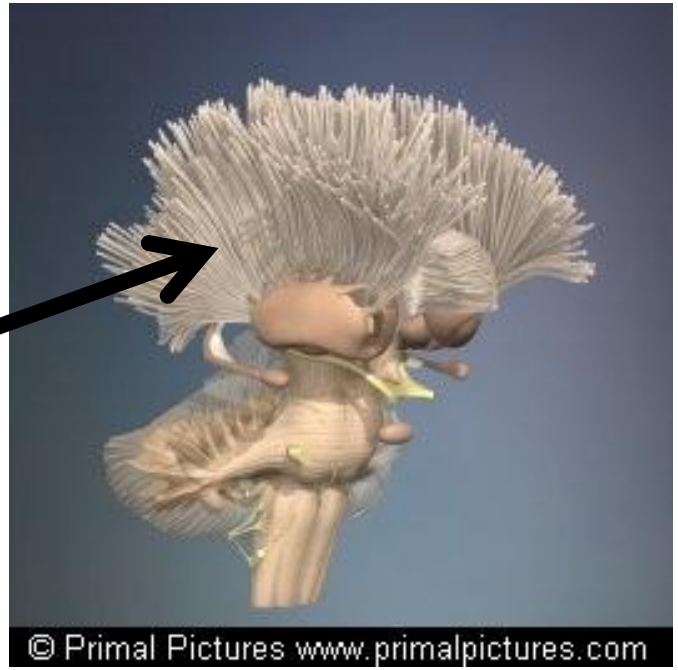


- Deeper to the cortex, these fibers are arranged radially as the **corona radiata**
- Then the fibers converge to form **internal capsule**, that passes between the thalamus and the basal ganglia
- Then Continue in the **(brain stem)**
  - Crus of the midbrain
  - Basilar part of pons
  - Pyramid of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

projection fibers



corona radiata



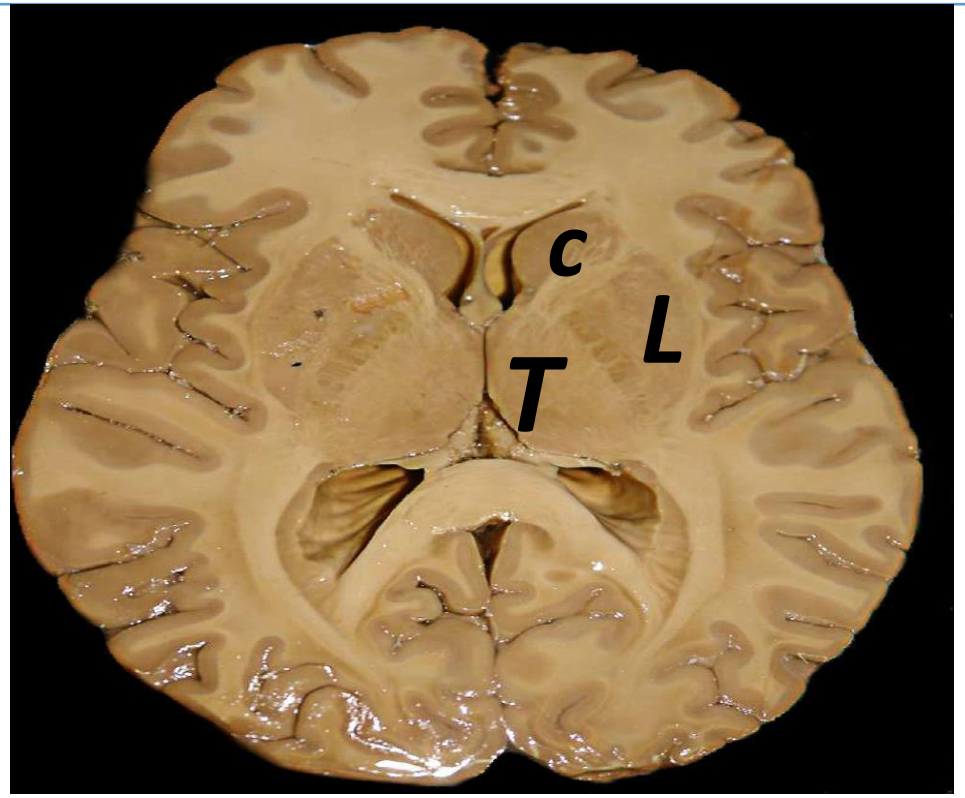
Internal capsule

Internal capsule

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

Thalamus & ***caudate nucleus*** (medially)

lentiform nucleus (laterally).



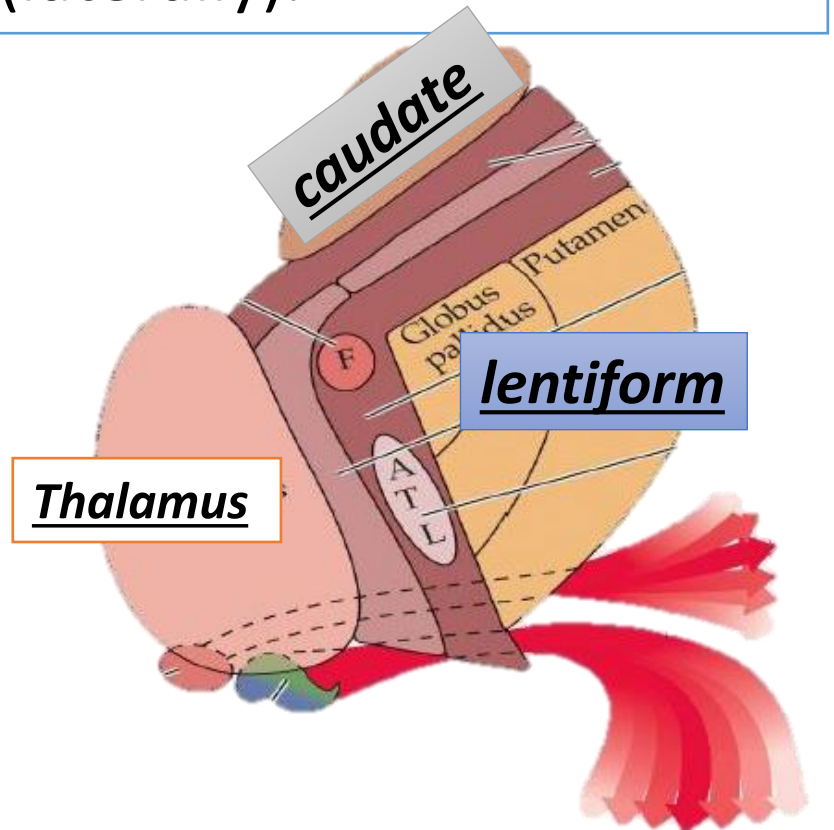
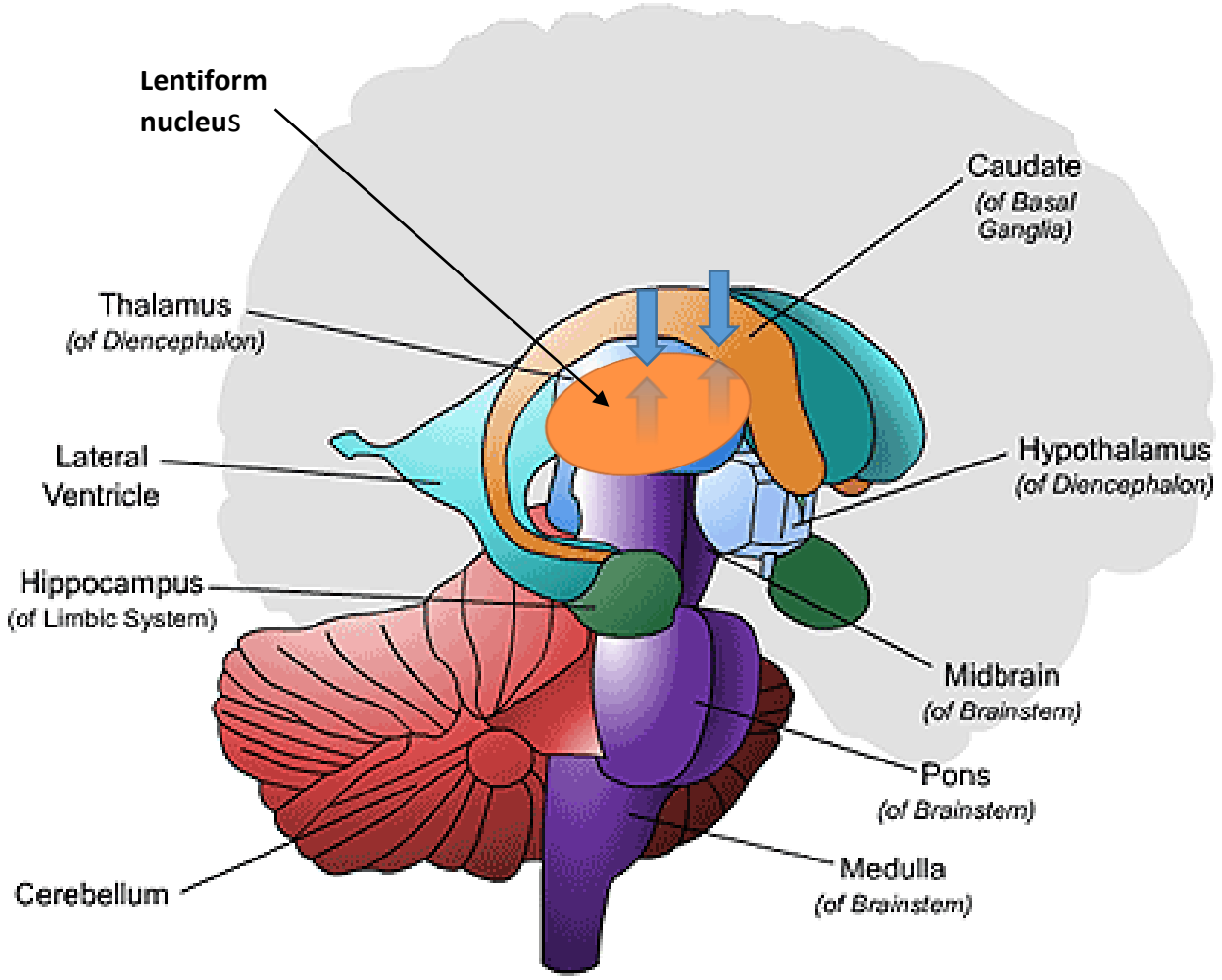
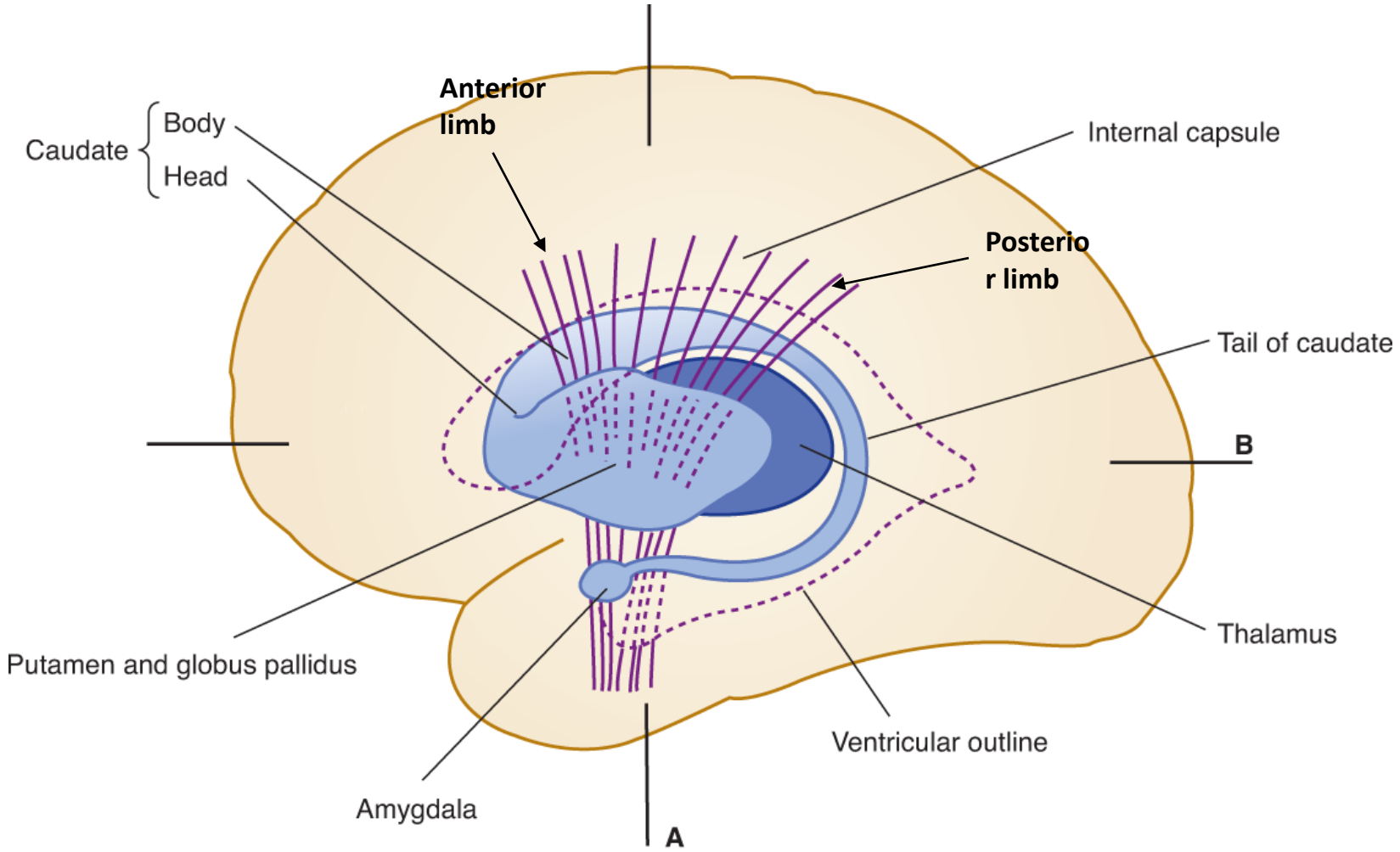


Figure AB-33: Build A Brain, Step 8





Internal capsule

- ❑ It is **V-shaped.**
- ❑ **<u>It consists of:</u>**

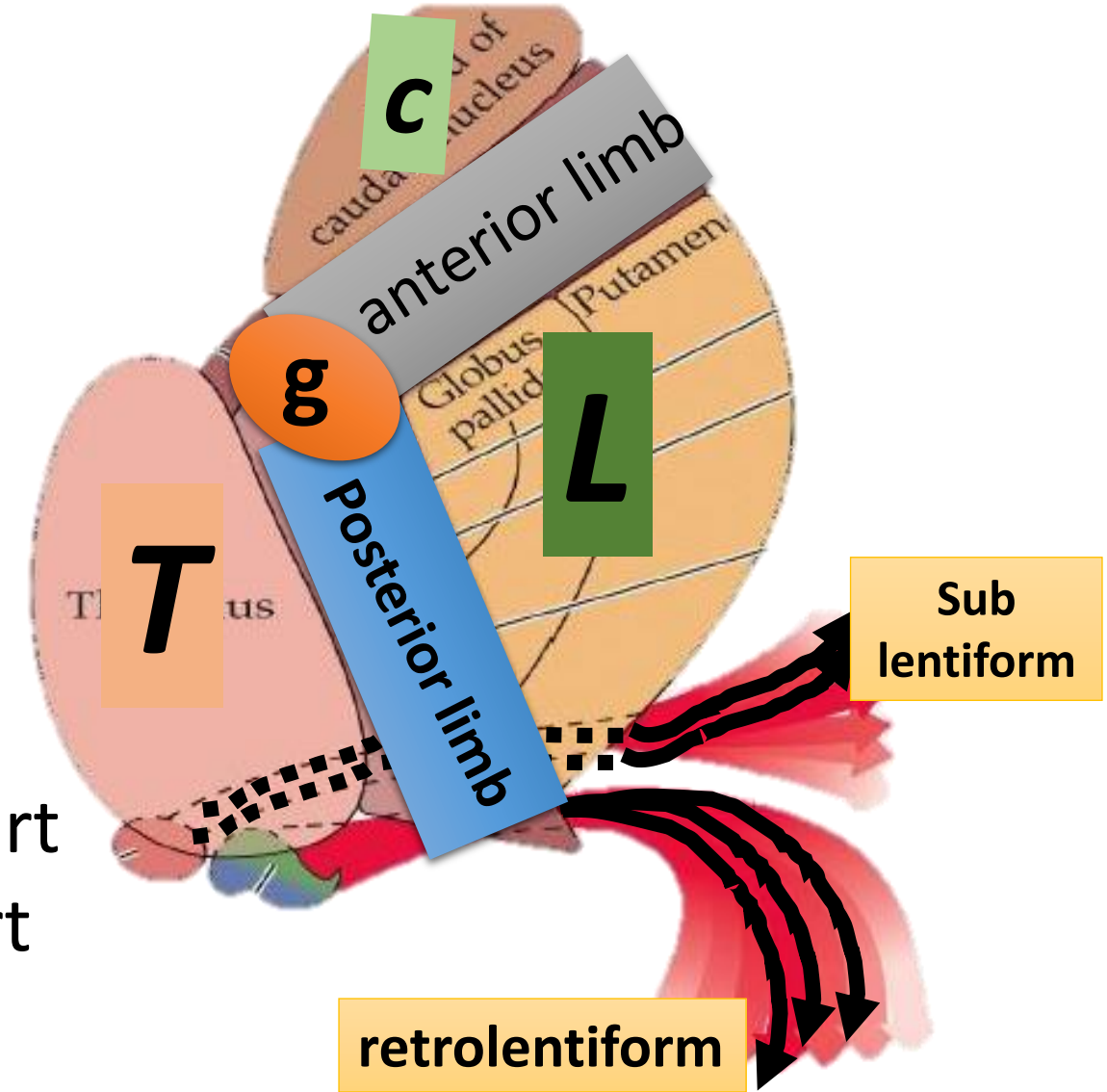
I. anterior limb
between caudate and lentiform

II. genu

III. posterior limb
between thalmus and lentiform

IV. retrolentiform part

V. sublentiform part



Anterior limb

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

Genu

Contains ***corticonuclear fibers***

Posterior limb

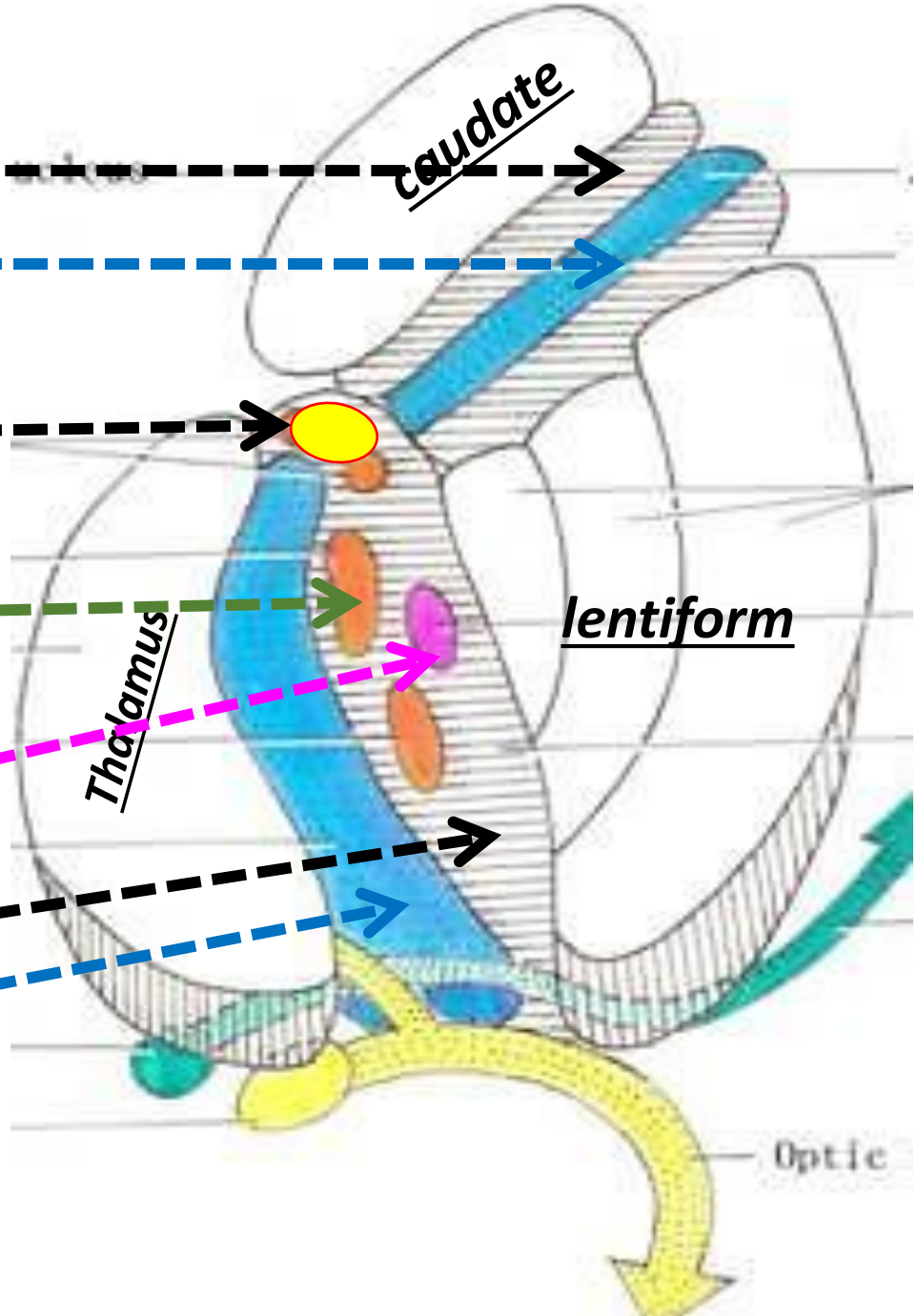
1. ***Corticospinal fibers***

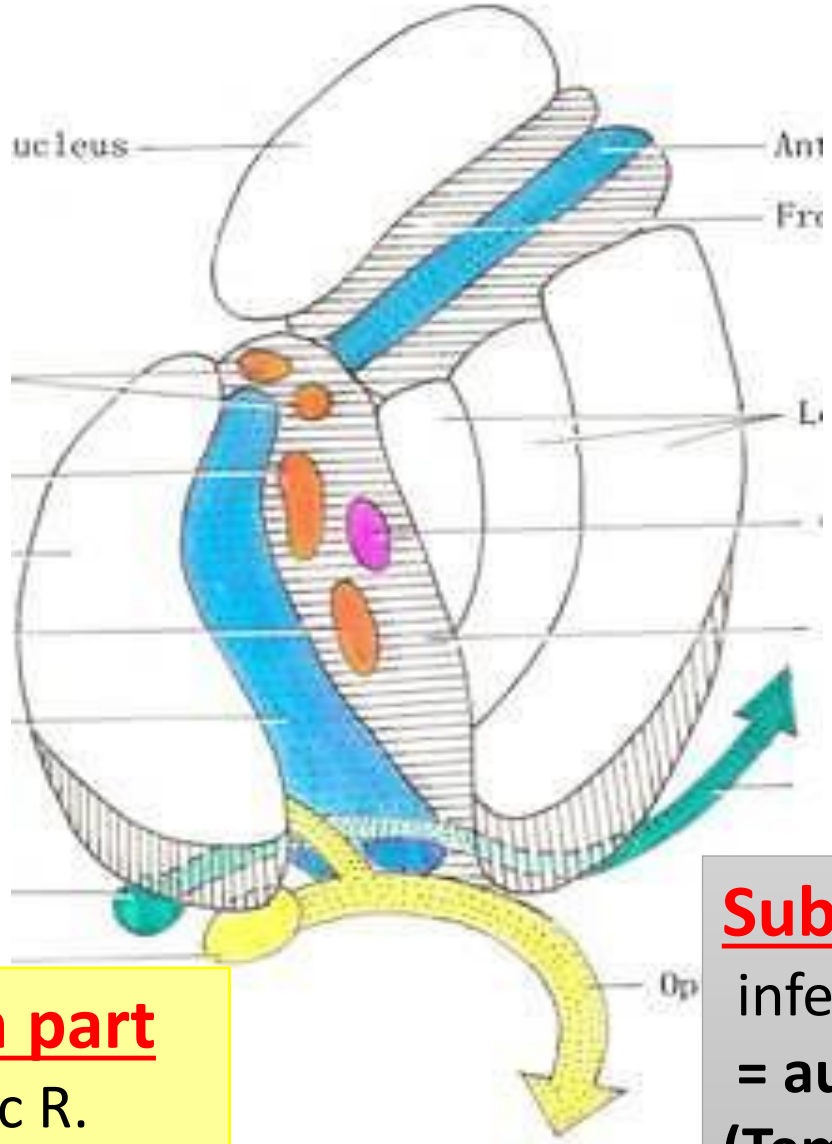
(fibers for upper limb lie anterior while fibers for lower limb lie posterior)

1. ***Corticorubral fibers***

2. ***Frontopontine fibers***
3. ***Superior thalamic radiation***

(sensory radiation) from VPLN & VPMN of thalamus to sensory cortex (SI & SII).





Retrolentiform part

Posterior thalamic R.

= **(optic radiation)**

(**occipito-**pontine fibers)

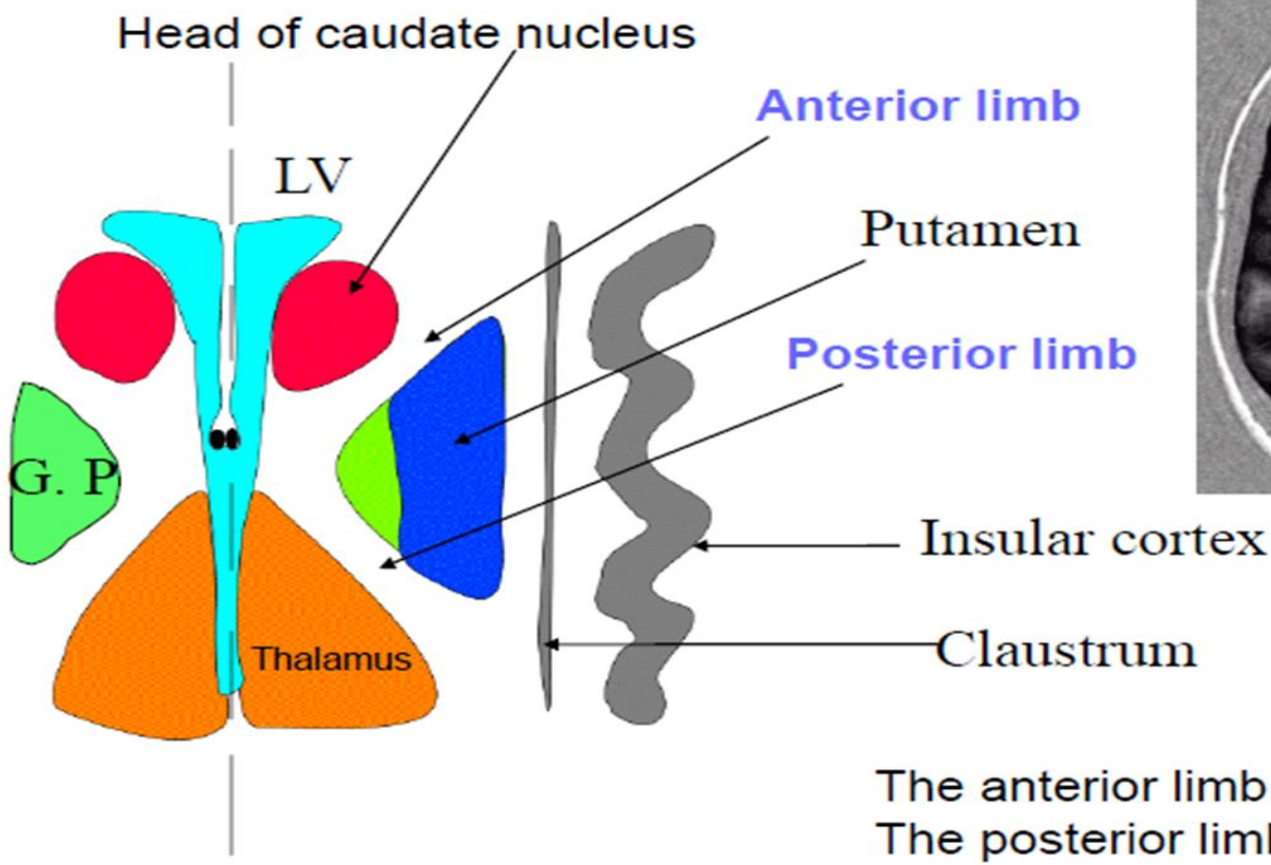
Sublentiform parts

inferior thalamic R.

= auditory radiation

(Temporo-pontine fibers)

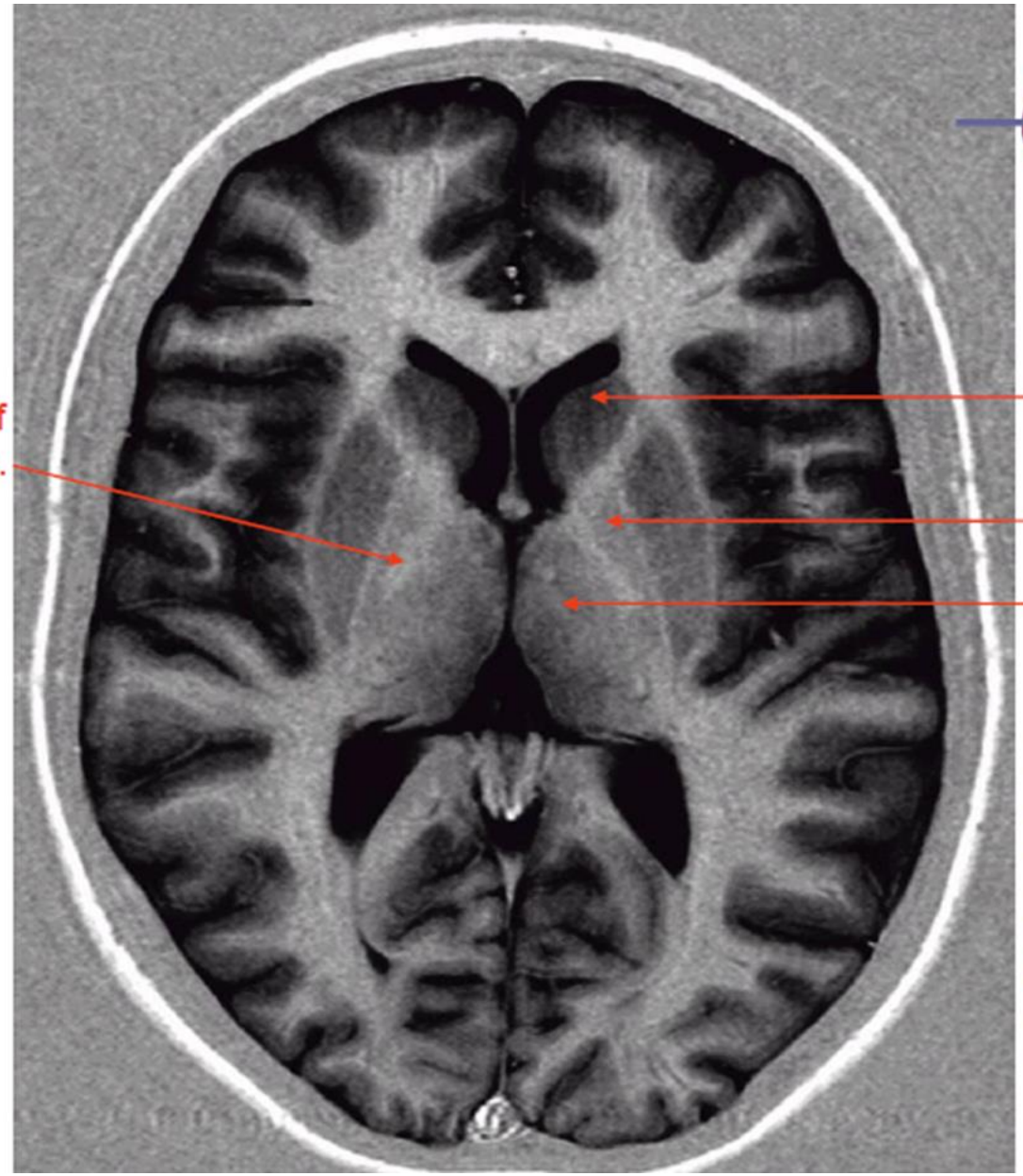
Horizontal section through the internal capsule (white matter and a very important site of strokes)

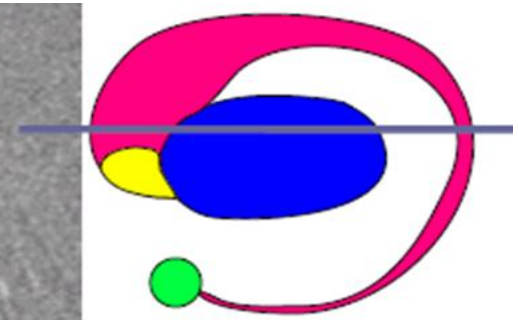


The anterior limb is between…
The posterior limb is between….

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

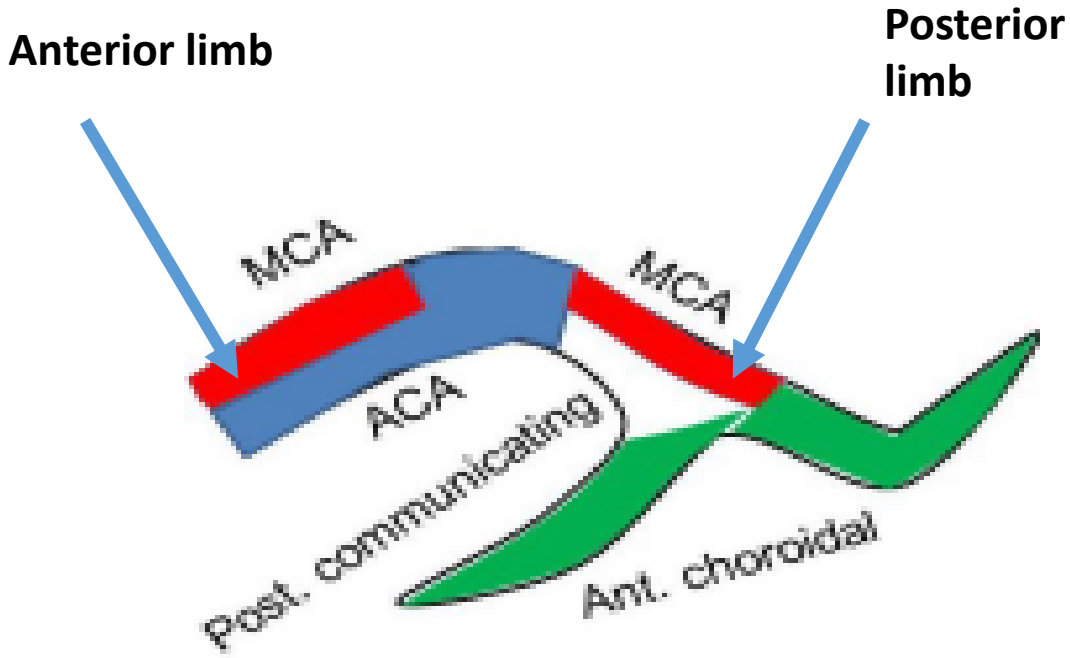
Blood supply of internal capsule by perforating branches of

middle cerebral artery,

anterior cerebral artery,

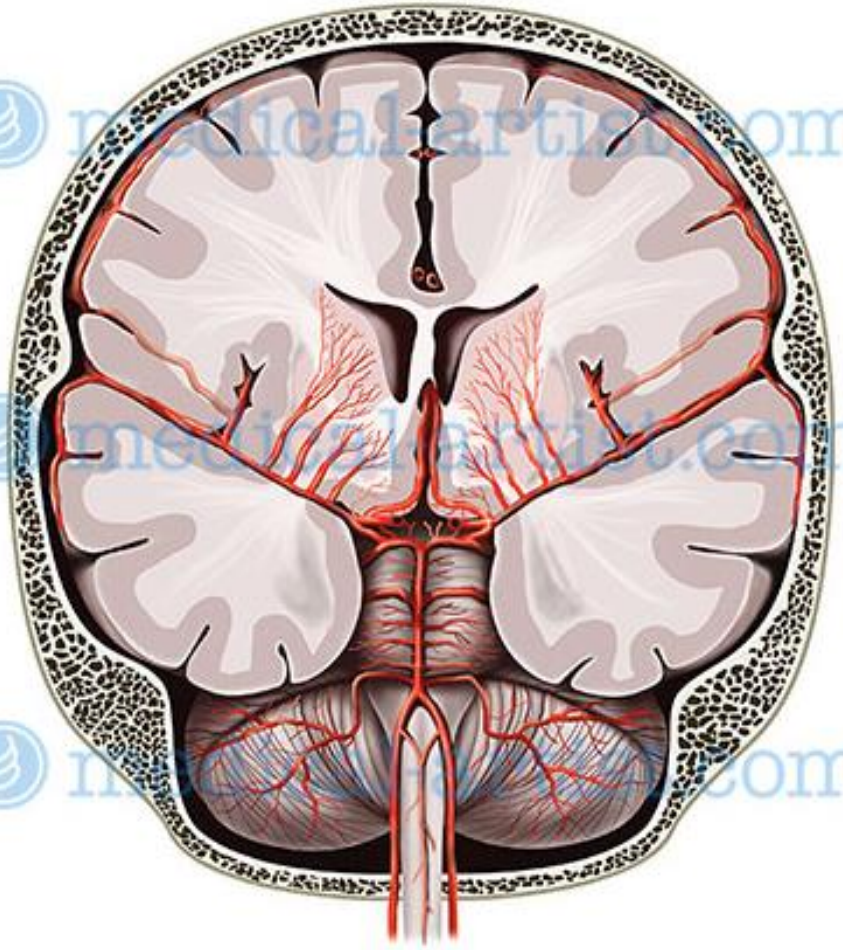
posterior communicating artery ,

anterior choroidal artery.

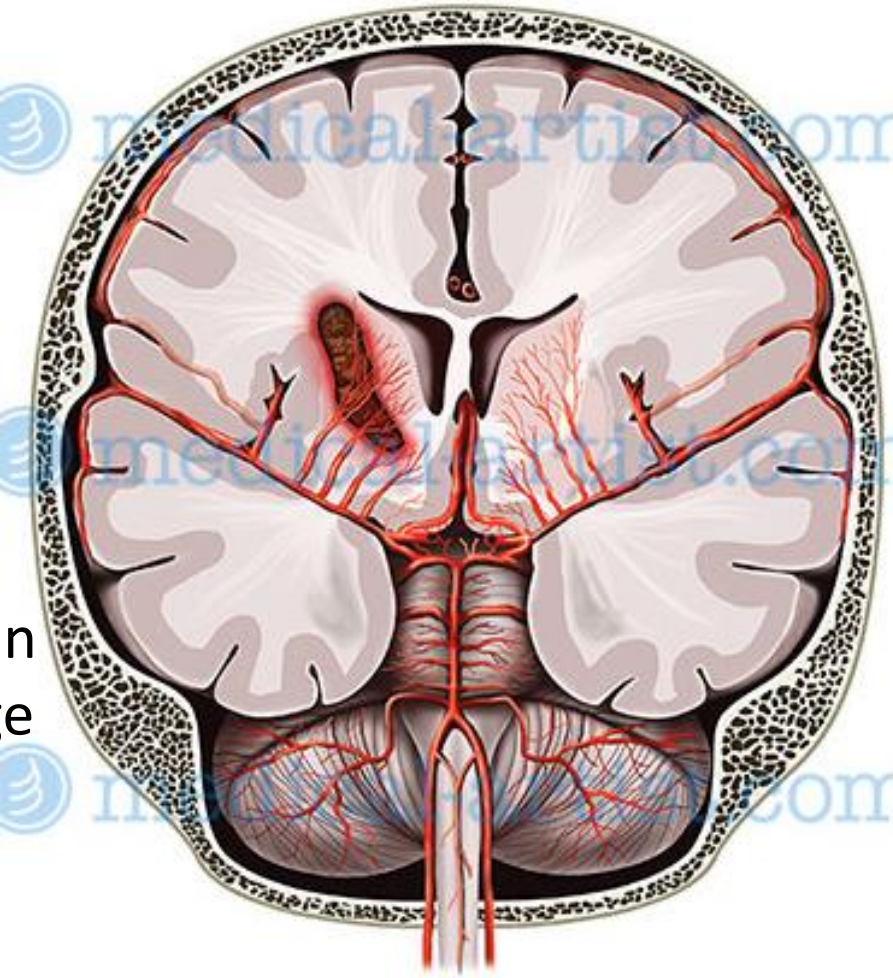


N.B Blood supply of internal capsule: Upper 1/2 of ant. limb and upper 1/2 of post. limb are supplied by branches of middle cerebral artery.

- *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.*
- *Retrolentiform and sublentiform parts by branches of anterior choroidal artery.*



The internal capsule is frequently involved in cerebrovascular accidents.



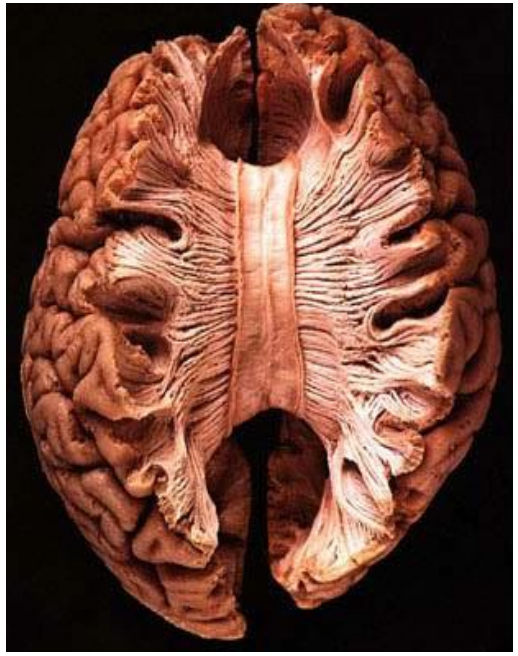
Because so many fibers are grouped in a small area, even a small hemorrhage can cause wide spread effects on the contralateral side of the body

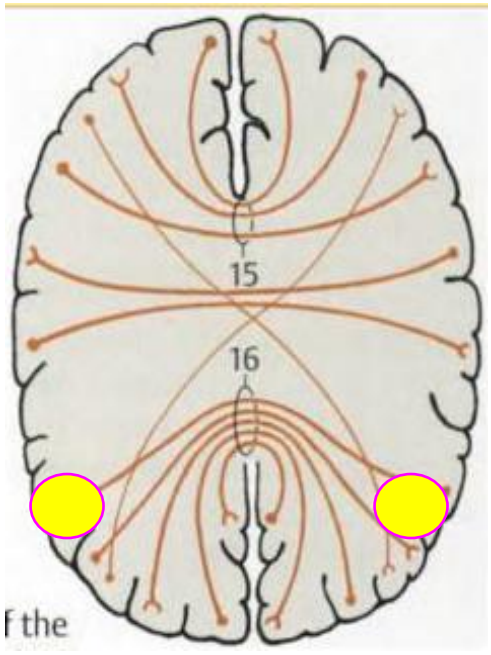
II- Commissural fibers

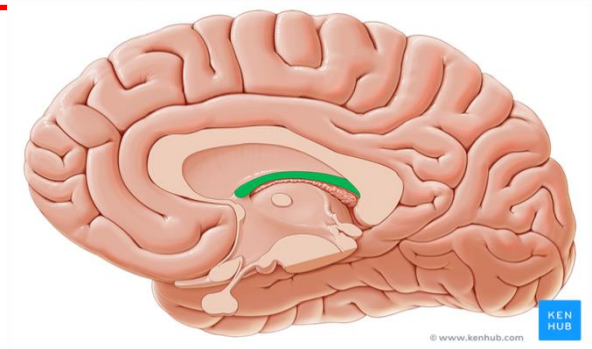
Include fibers that connect **corresponding (Same) area**

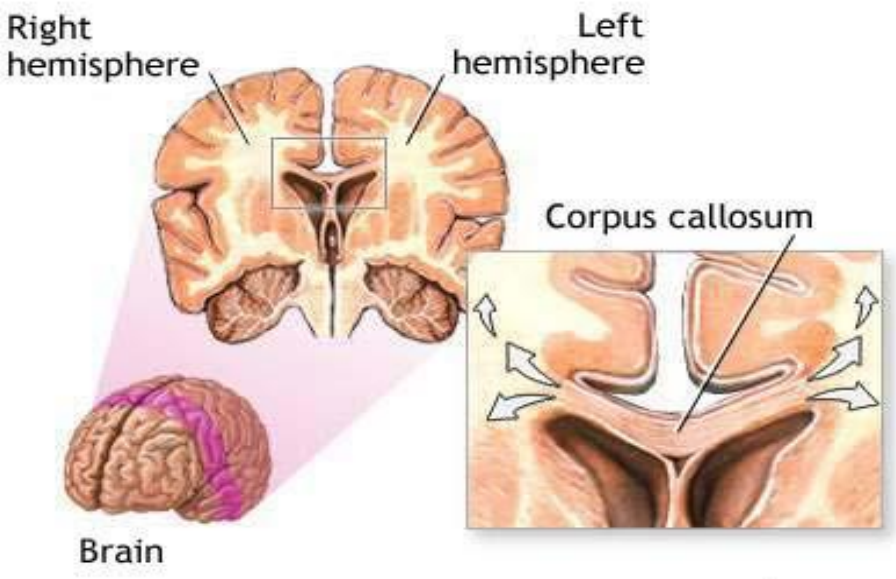
In the **Two Rt. & Lt cerebral hemispheres**

This fibers cross the midline.









II- Commissural fibers

1- Corpus callosum

2- Anterior Commissure

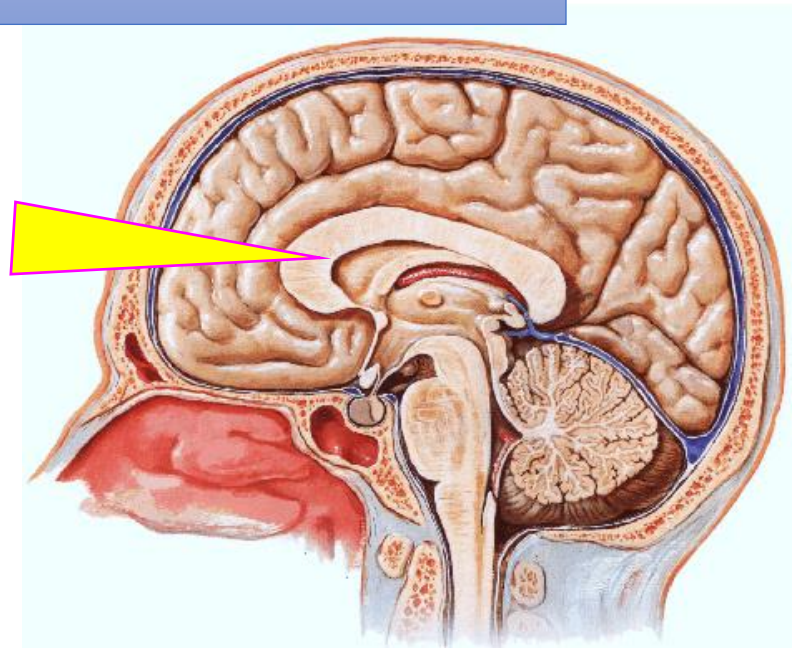
embedded in the lamina terminalis

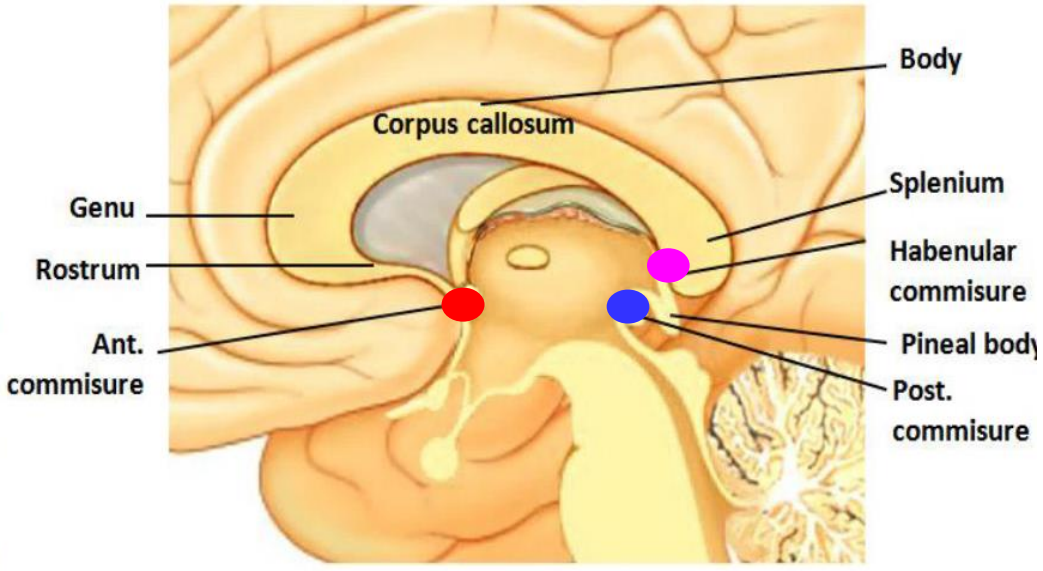
3- Posterior commissure

embedded in the lower lamina of the pineal stalk

4- Habenular commissure

embedded in the upper lamina of the pineal stalk.



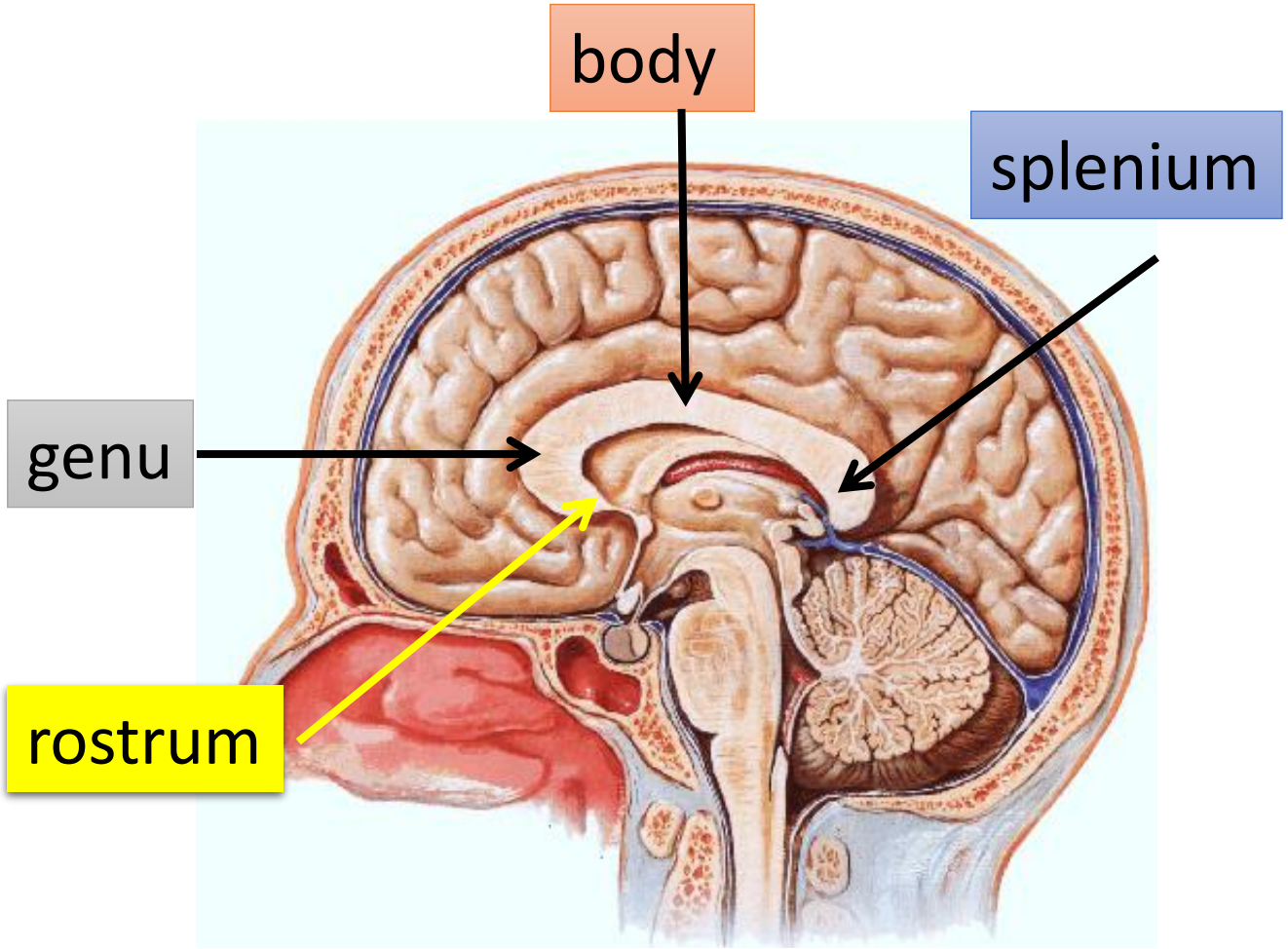


II- Commissural fibers

1- Corpus callosum

Parts:

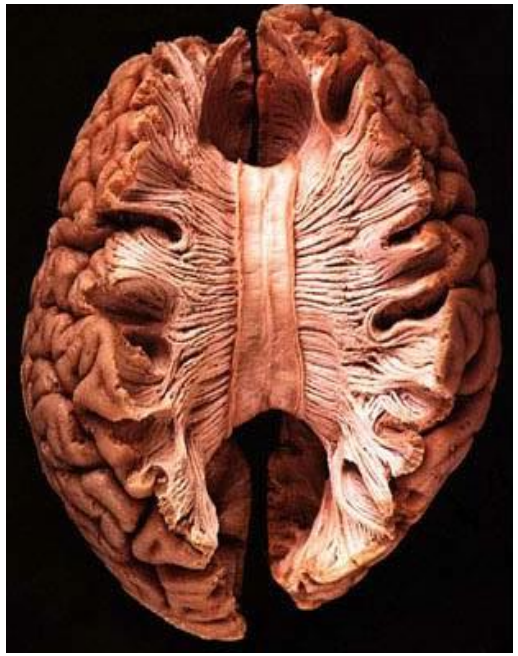
1. Rostrum
2. Genu
3. Body
4. Splenium

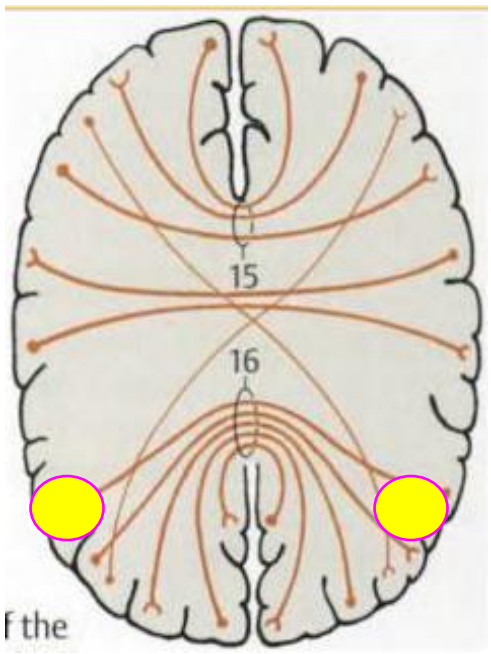


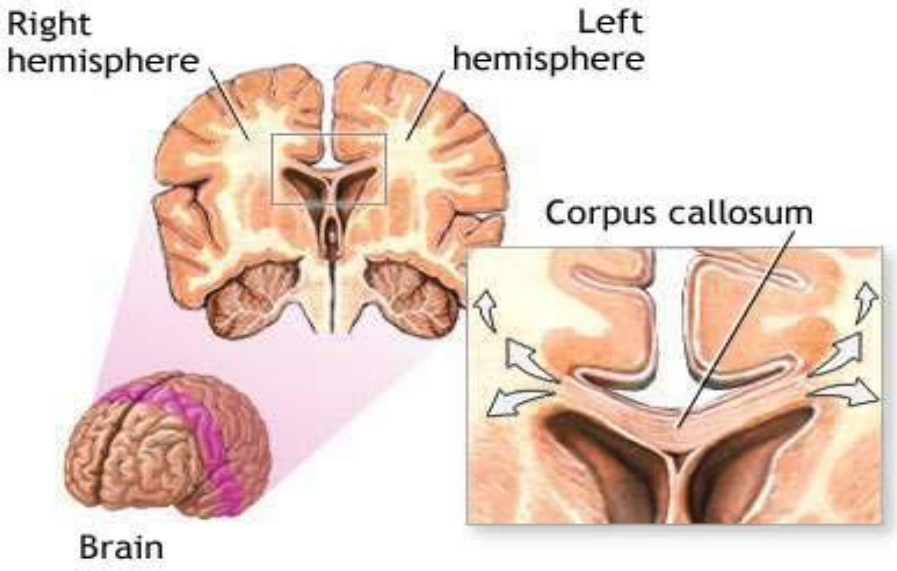
II- Commissural fibers

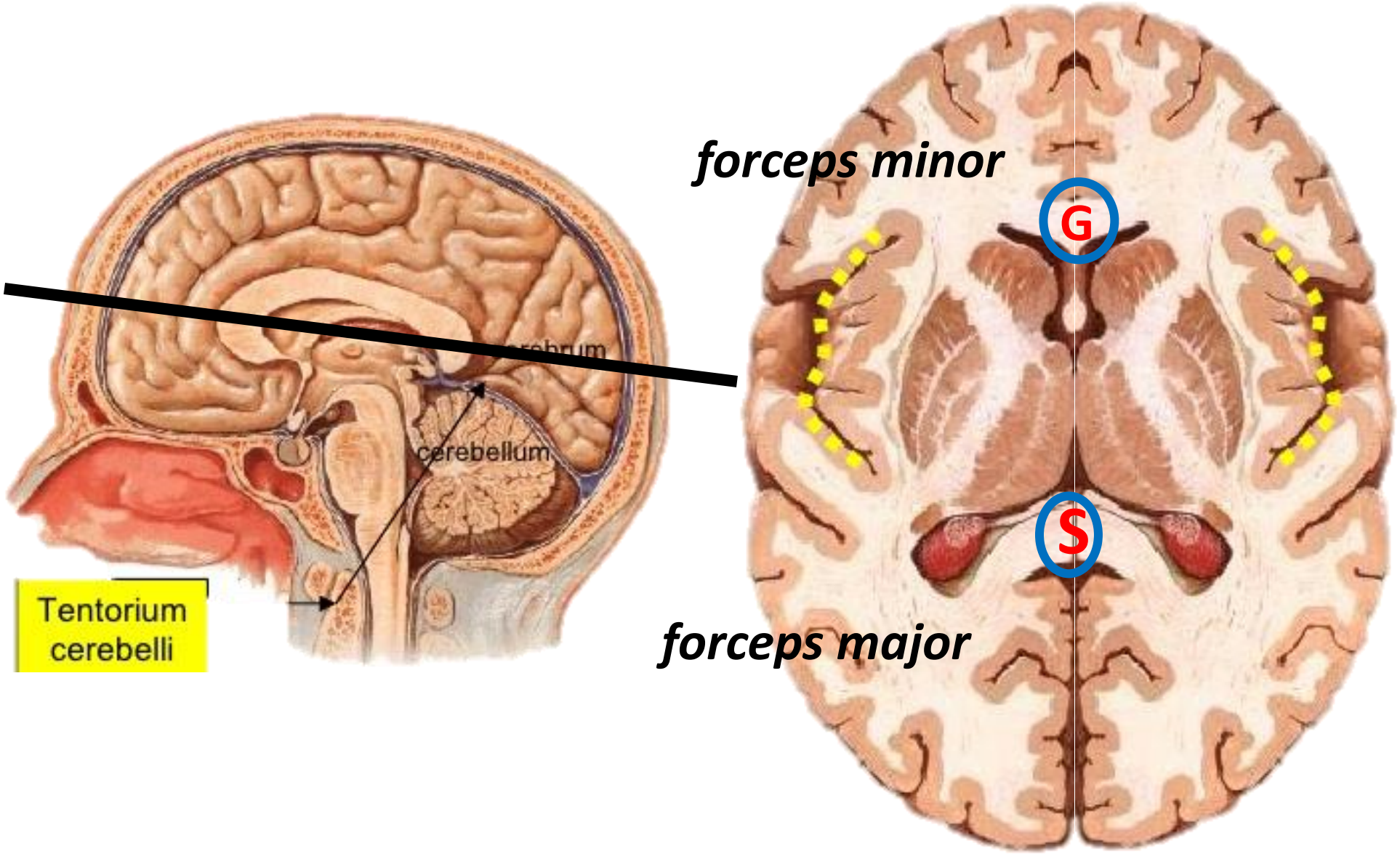
1- Corpus callosum

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








cerebellum
Tentorium cerebelli
forceps minor
G
S
forceps major

1-Rostrum:

Connects the orbital surfaces of the two **frontal lobes**.

2. Genu:

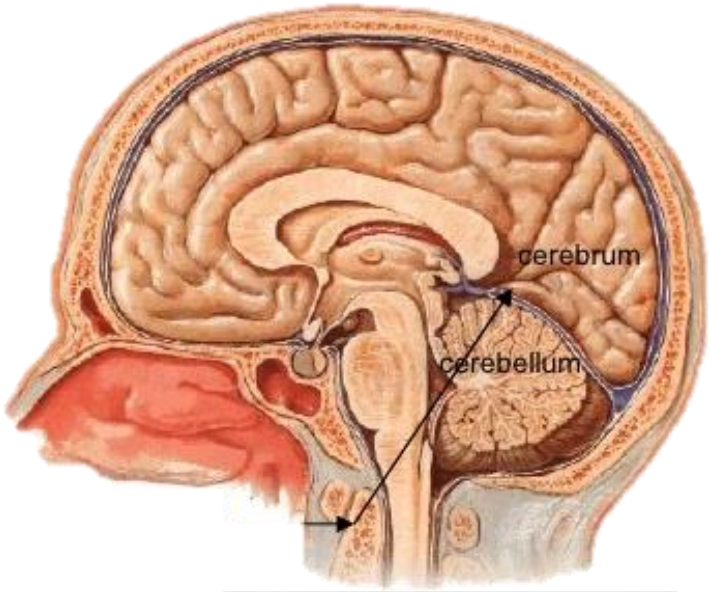
Its fibers form the ***forceps minor***. Connect the medial & lateral surfaces of the two **frontal lobes**.

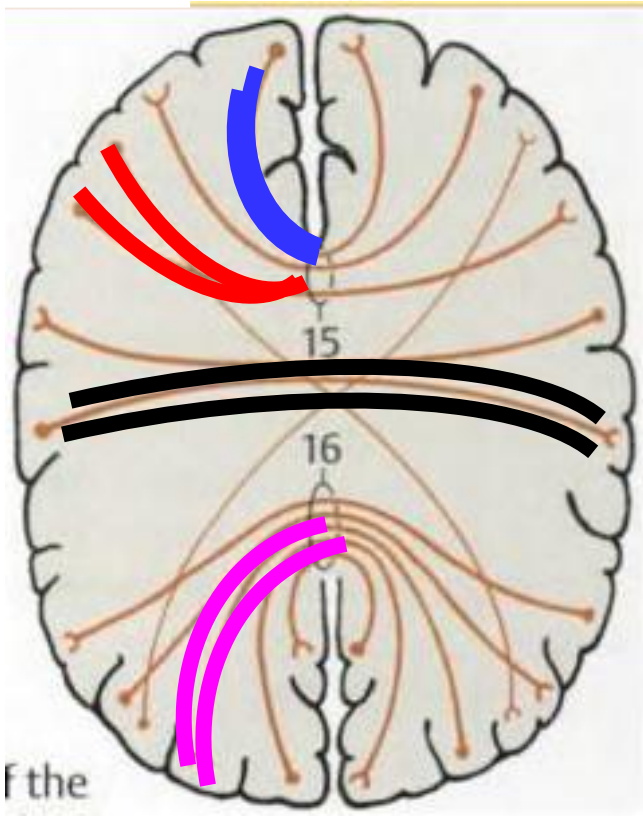
3. Body (Trunk):

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

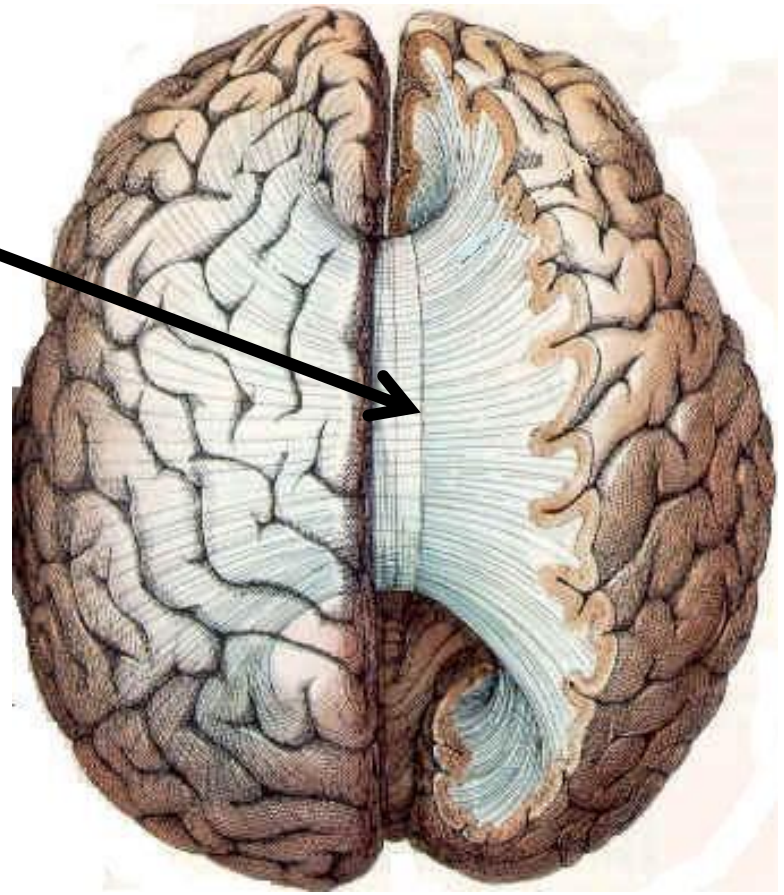
4-Splenium:

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



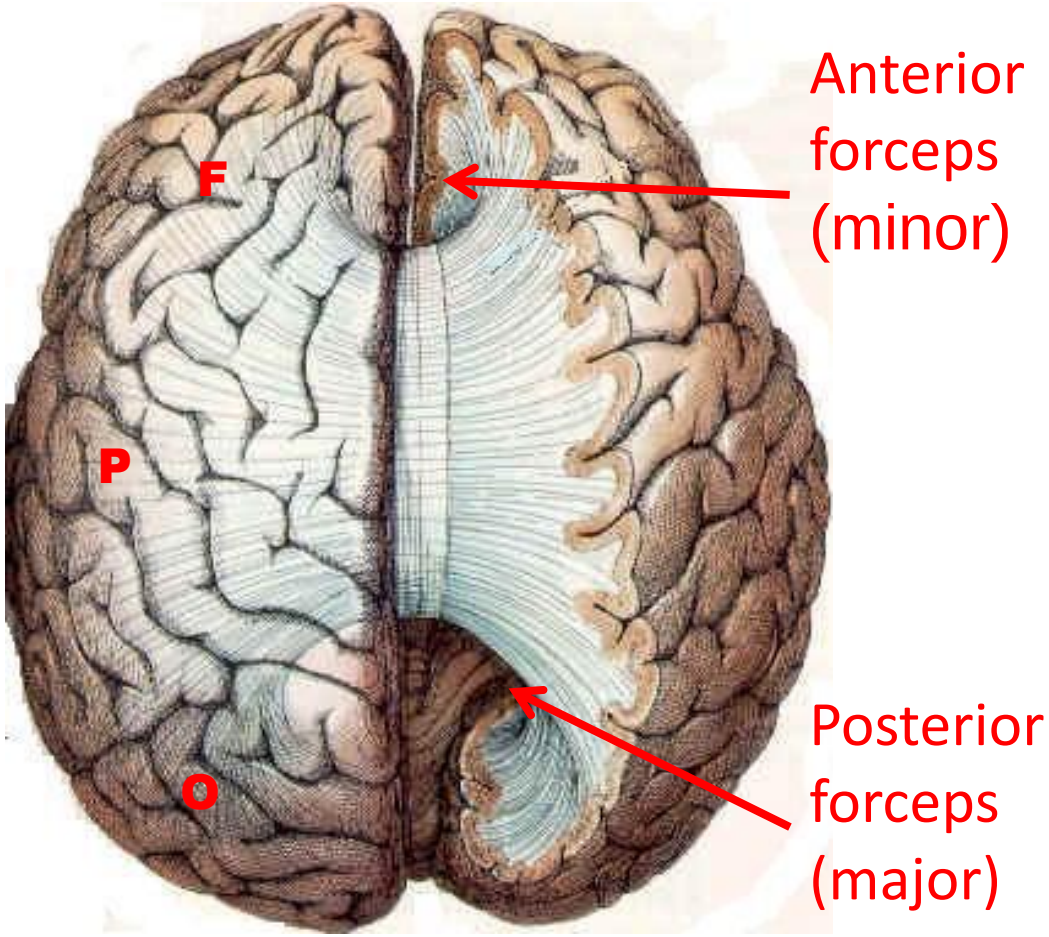


- The fibers in the corpus callosum connect the corresponding regions of the two hemispheres with each other



- 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)

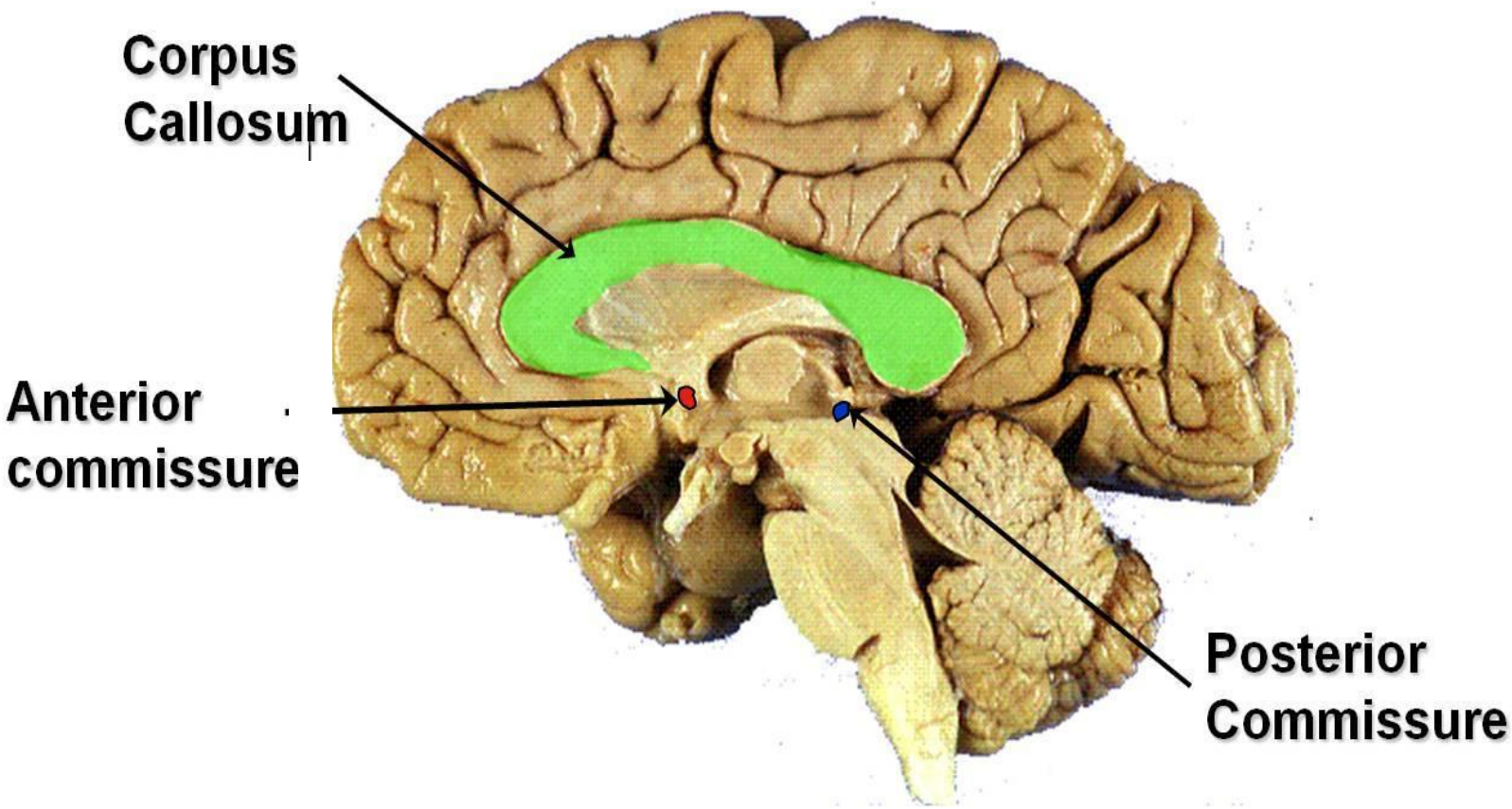


Blood supply of corpus callosum

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

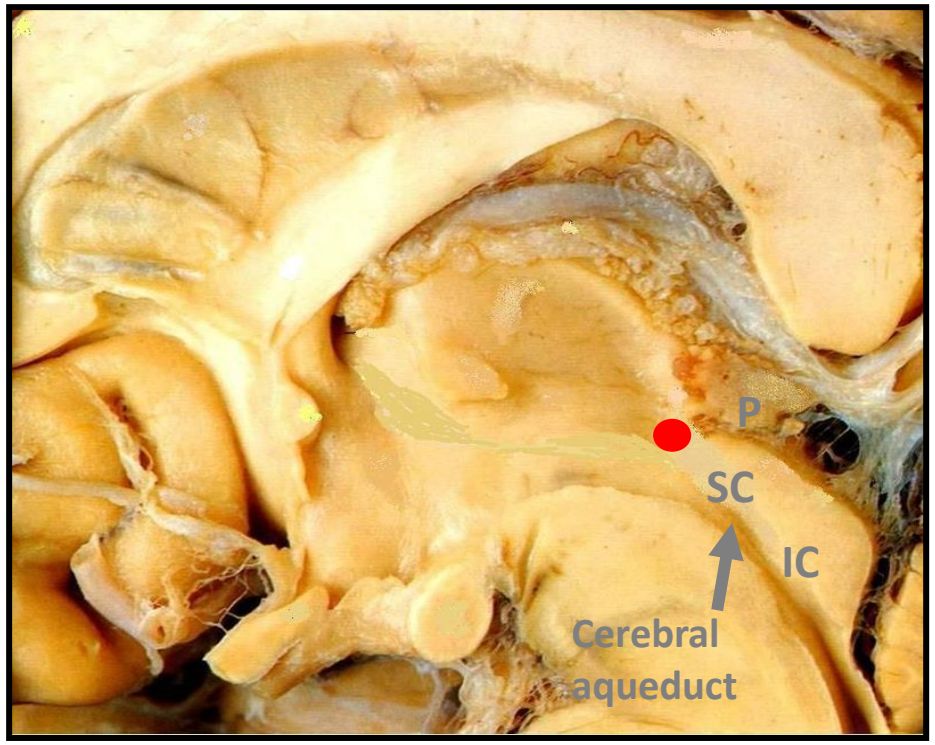
Anterior Commissure

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



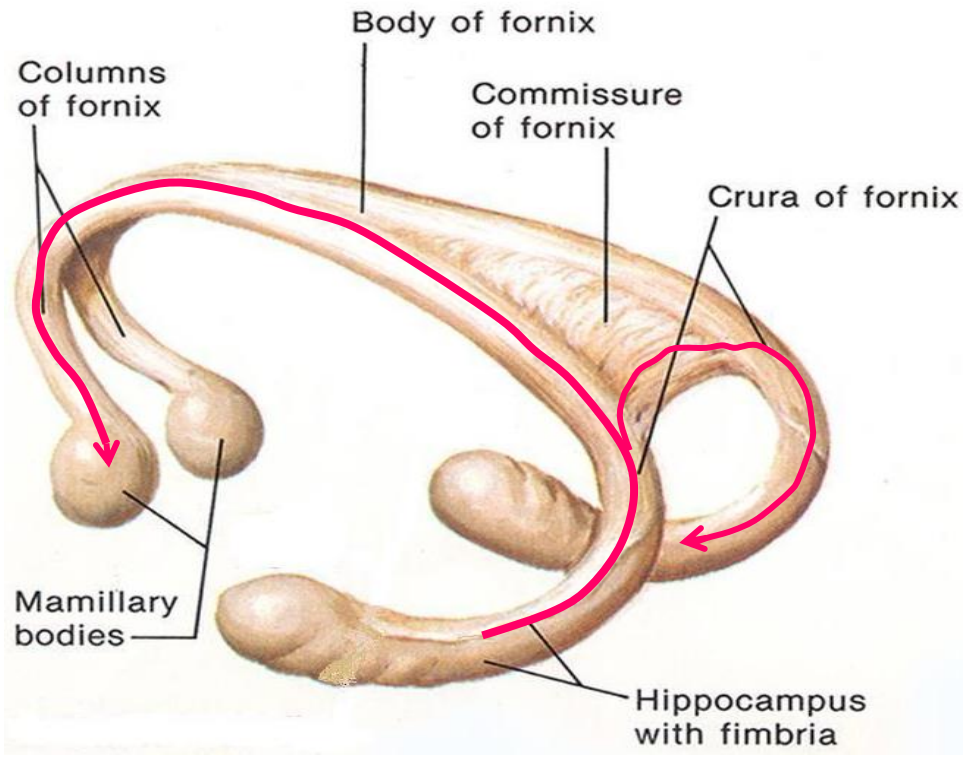
Posterior Commissure

- 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



III- Association fiber

fibers unite **different parts** of

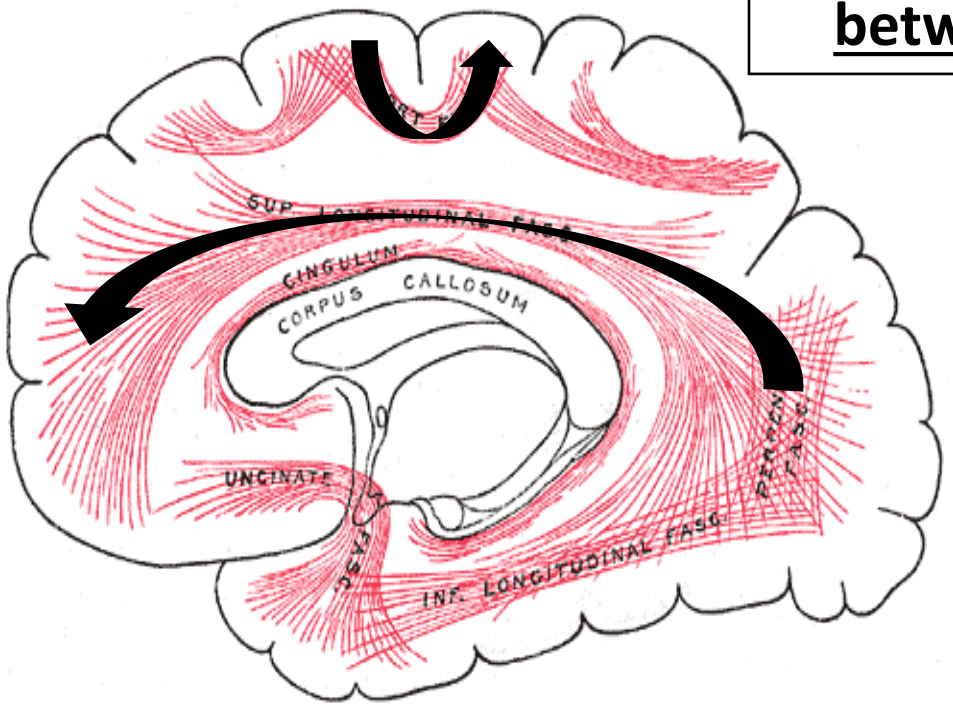
the **same cerebral hemisphere**

(1) short fibers

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

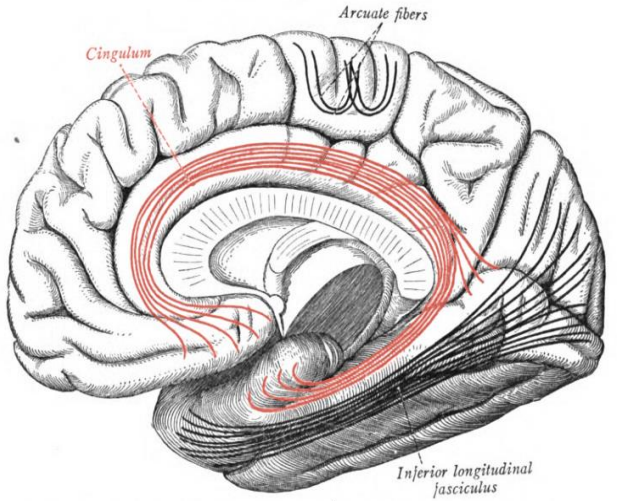
(2) long fibers

connect **between lobes**



LONG ASSOCIATION FIBERS

1-Cingulum

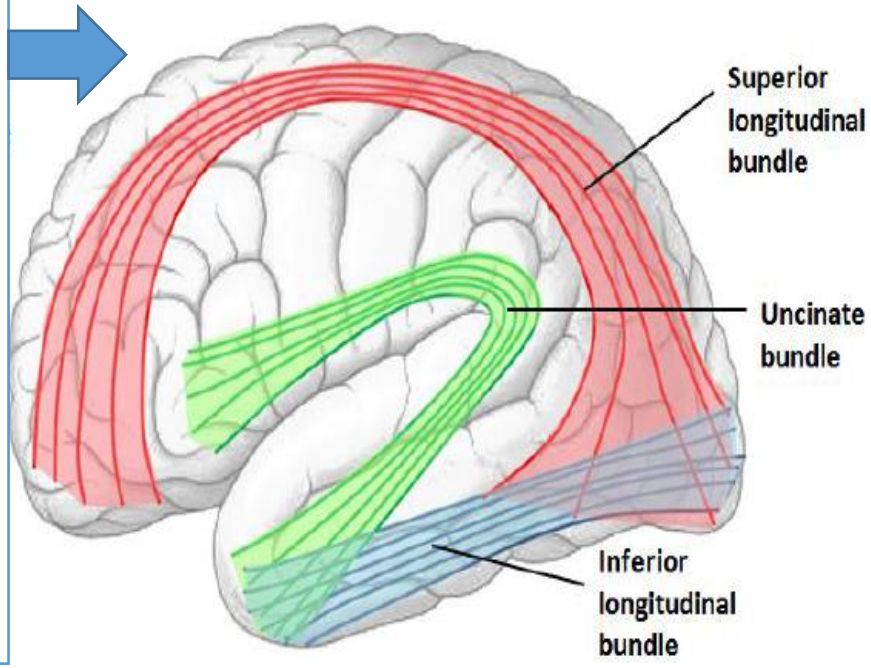


2- Superior longitudinal bundle

3- Inferior longitudinal bundle

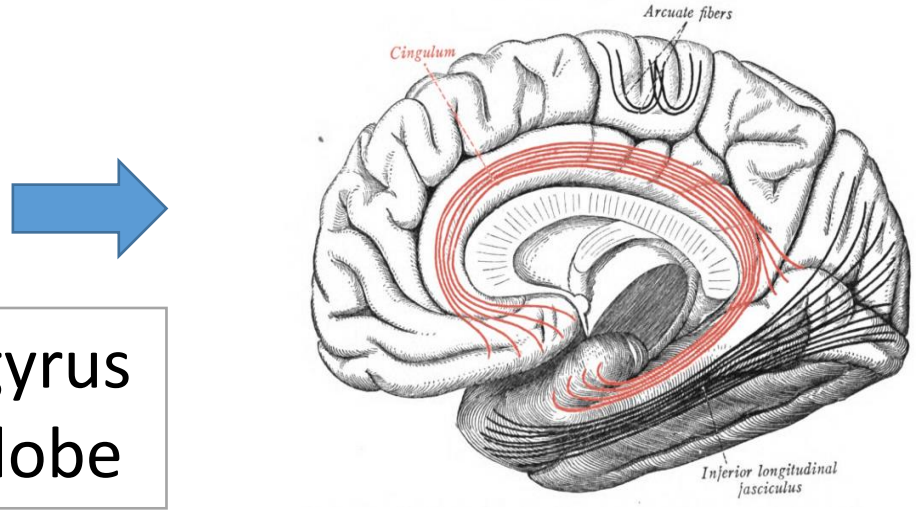
4- Fronto - occipital bundle

5- Uncinate bundle

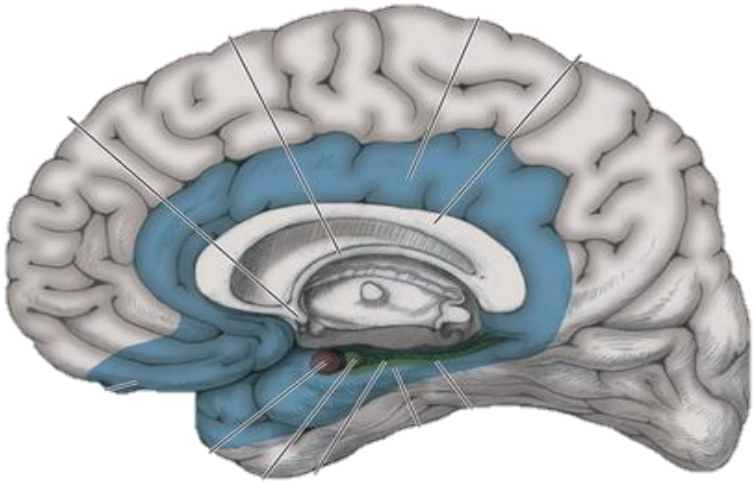


LONG ASSOCIATION FIBERS

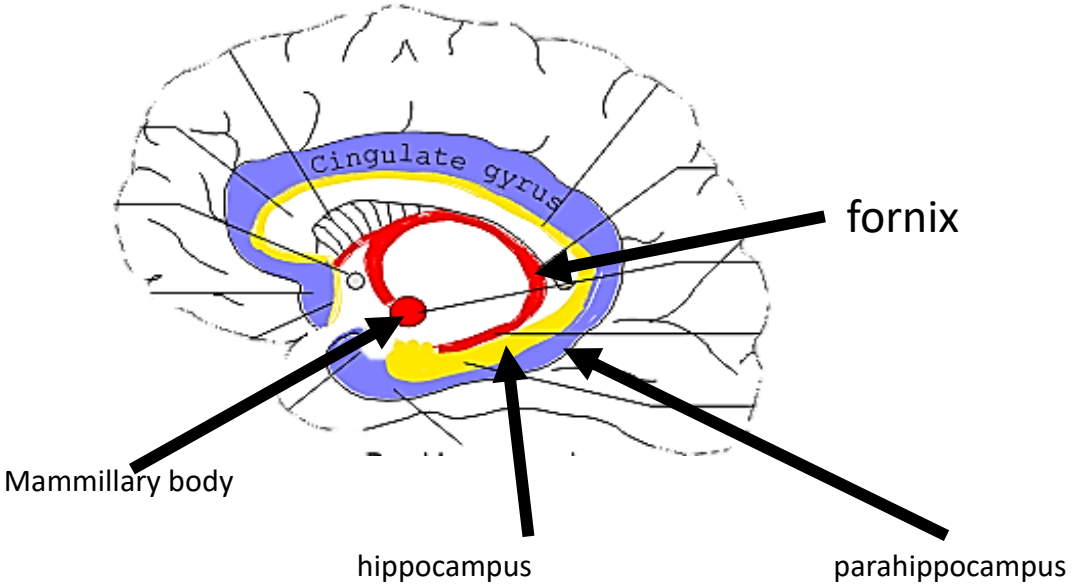
1-Cingulum



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

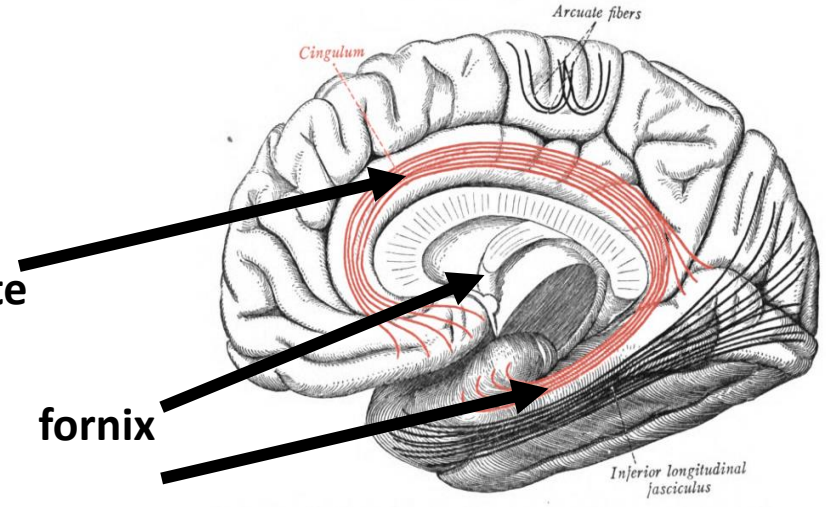


The Limbic System



Now we can under stand the limbic lobe and Papez circuit

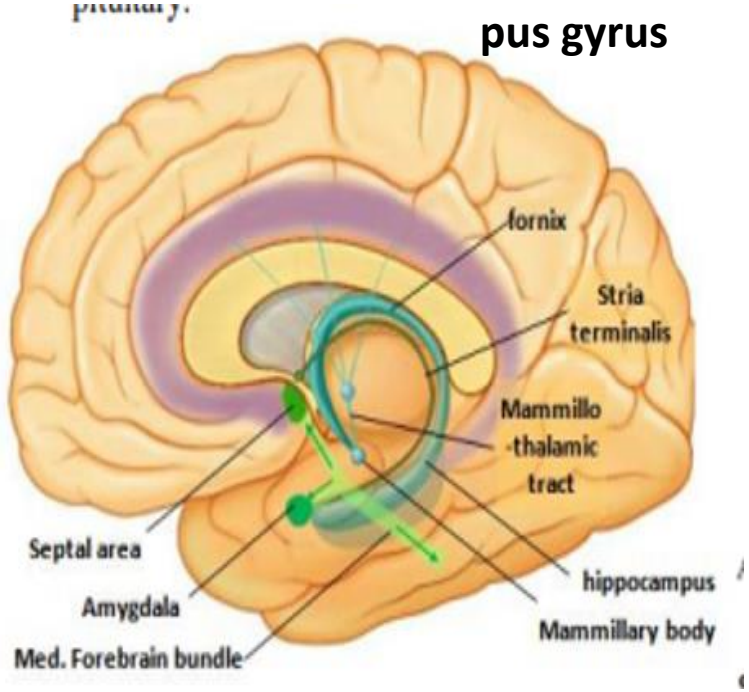
1-The cingulate gyrus receives input from 3 association areas (sensory, visual & auditory). It is connected with the parahippocampal gyrus & uncus via the cingulum.
2-The parahippocampal gyrus is connected with the hippocampus.
3-The hippocampus is connected to the mammillary bodies of hypothalamus via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

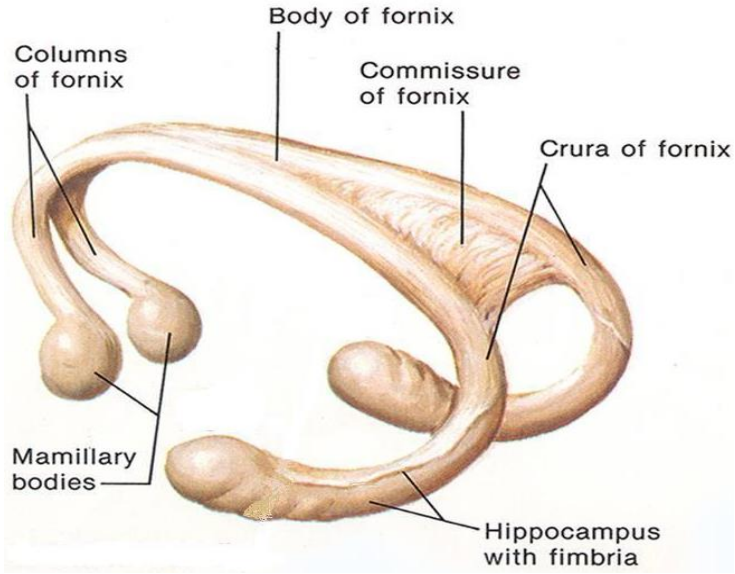


Cingulate gyrus

fornix

Parahippocampus gyrus





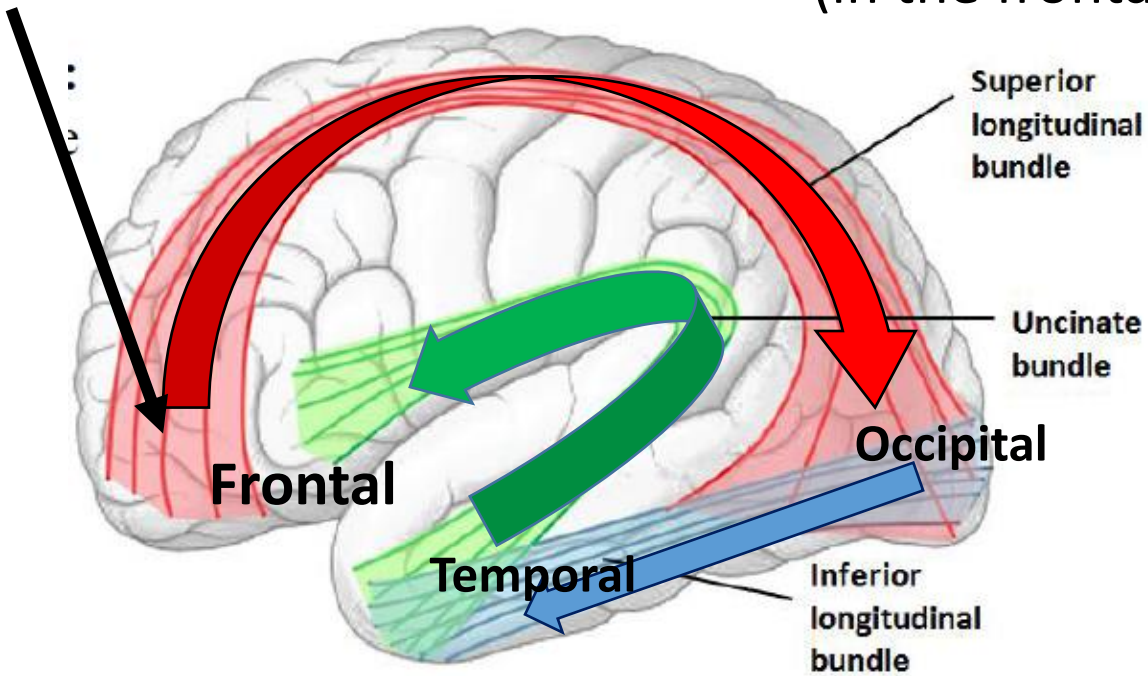
LONG ASSOCIATION FIBERS

- **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**
  connects Wernicke‟s area (in the temporal lobe) to Broca‟s area (in the frontal lobe)



Clinical Notes

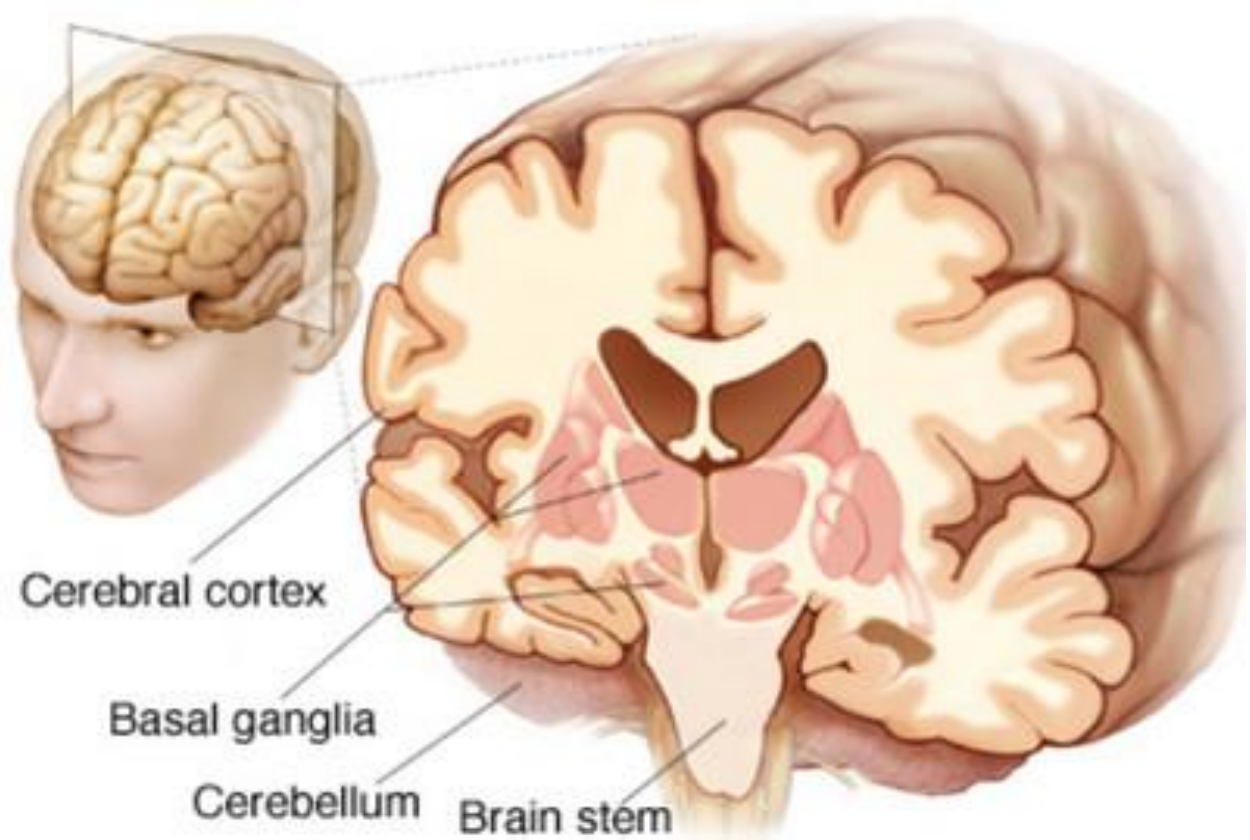
Damage to corpus callosum leads to **split-brain syndrome**. The two half of the brain behave relatively autonomously

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)

BASAL NUCLEI
(BASAL GANGLIA)

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



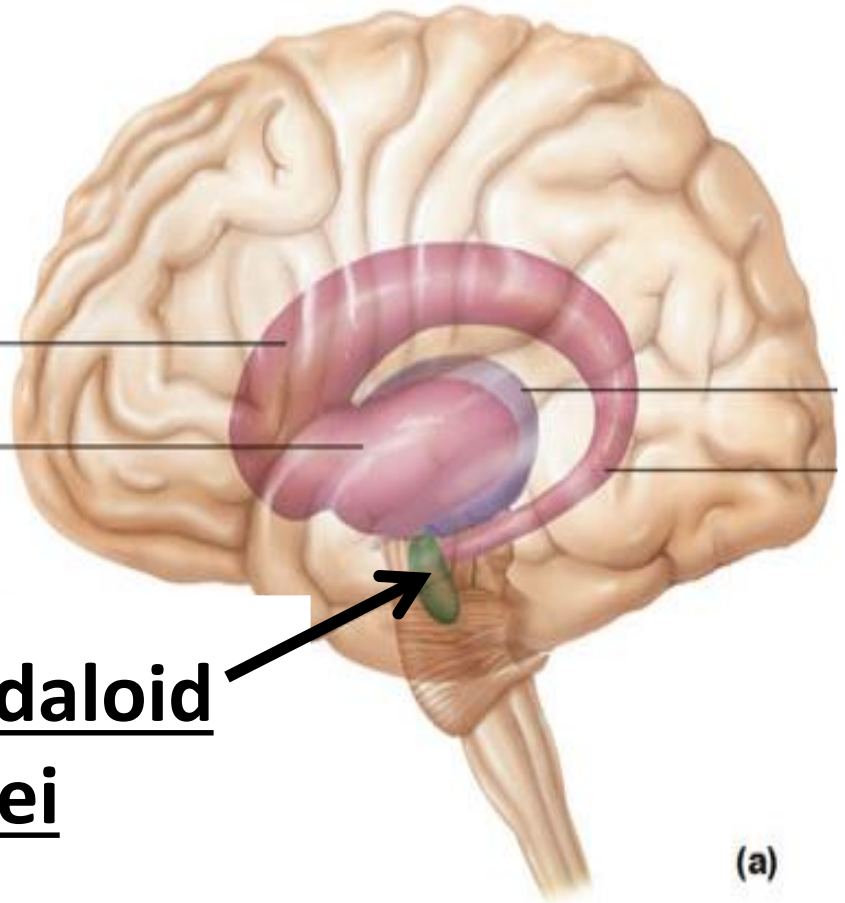
BASAL NUCLEI

They include :

I- Corpus striatum

Caudate Nucleus

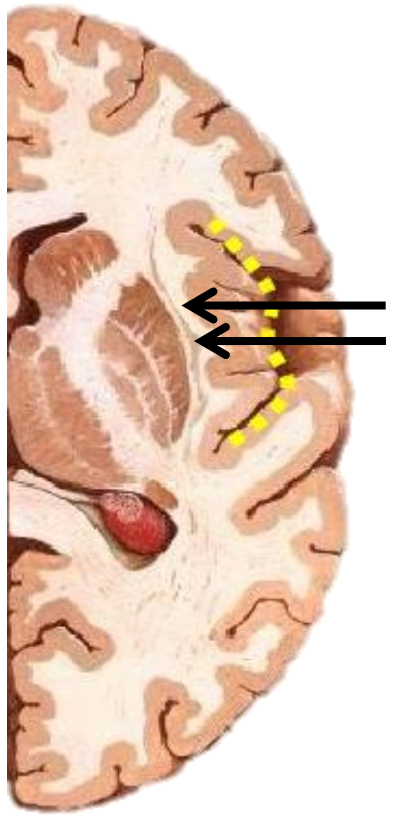
Lentiform Nucleus



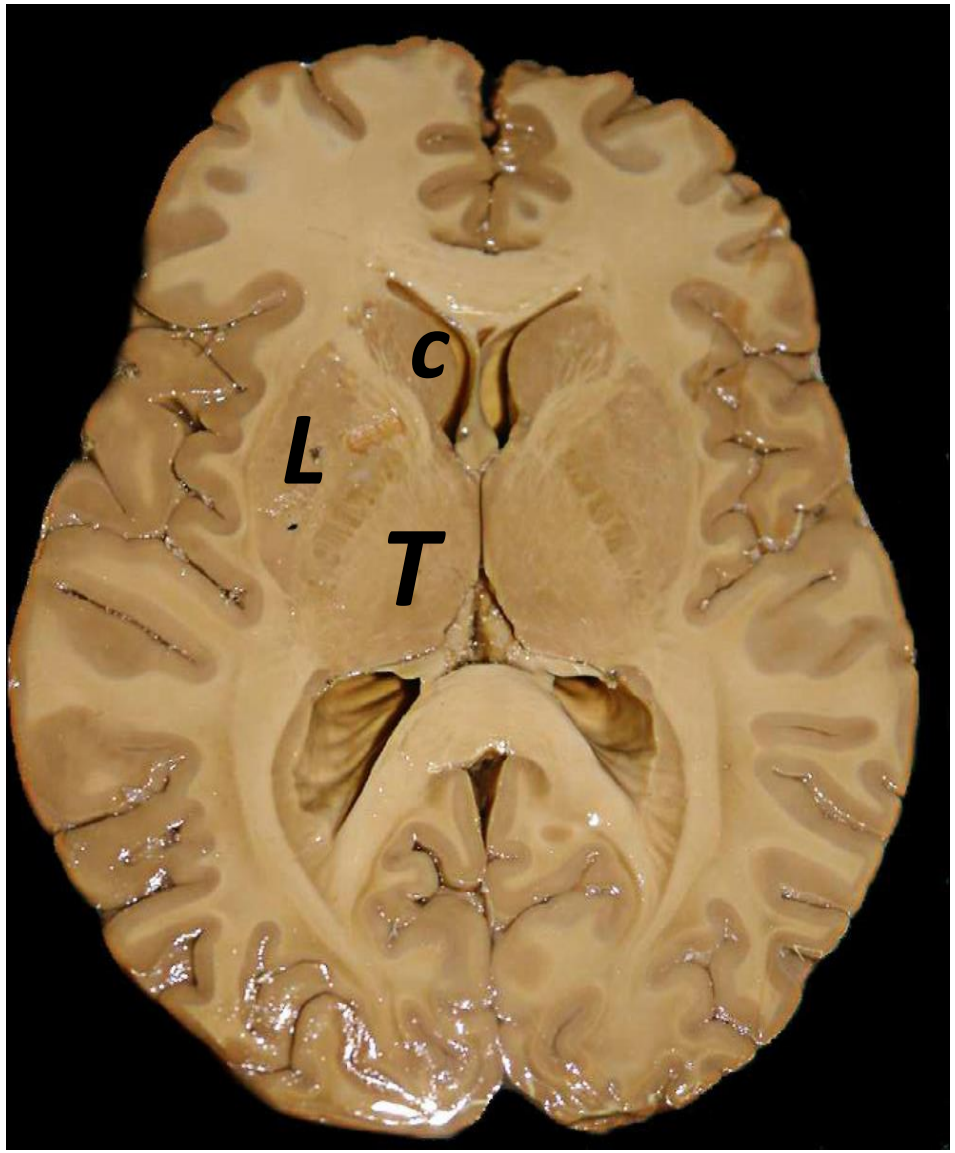
II - Amygdaloid Nuclei

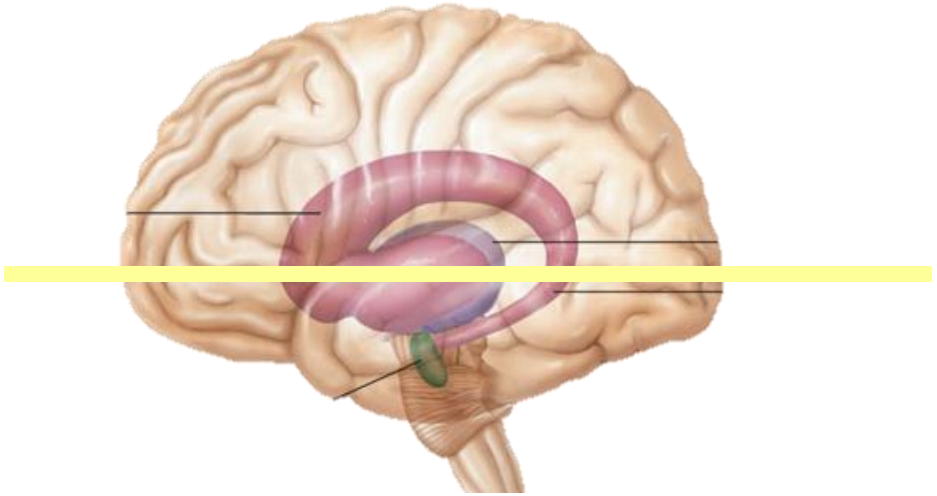
III - Claustrum

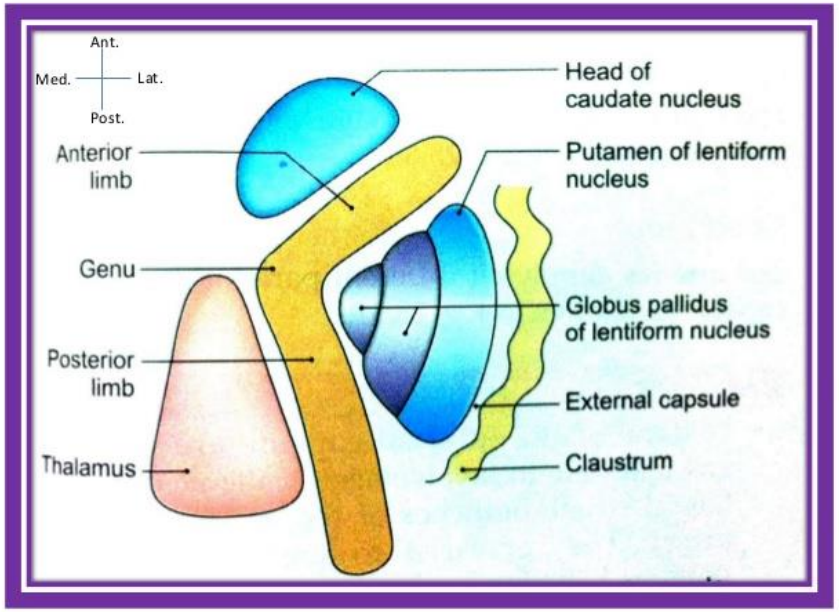
(grey matter that lies lateral to Lentiform N



BASAL NUCLEI







BASAL NUCLEI

Lentiform Nucleus

It is divided into:

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

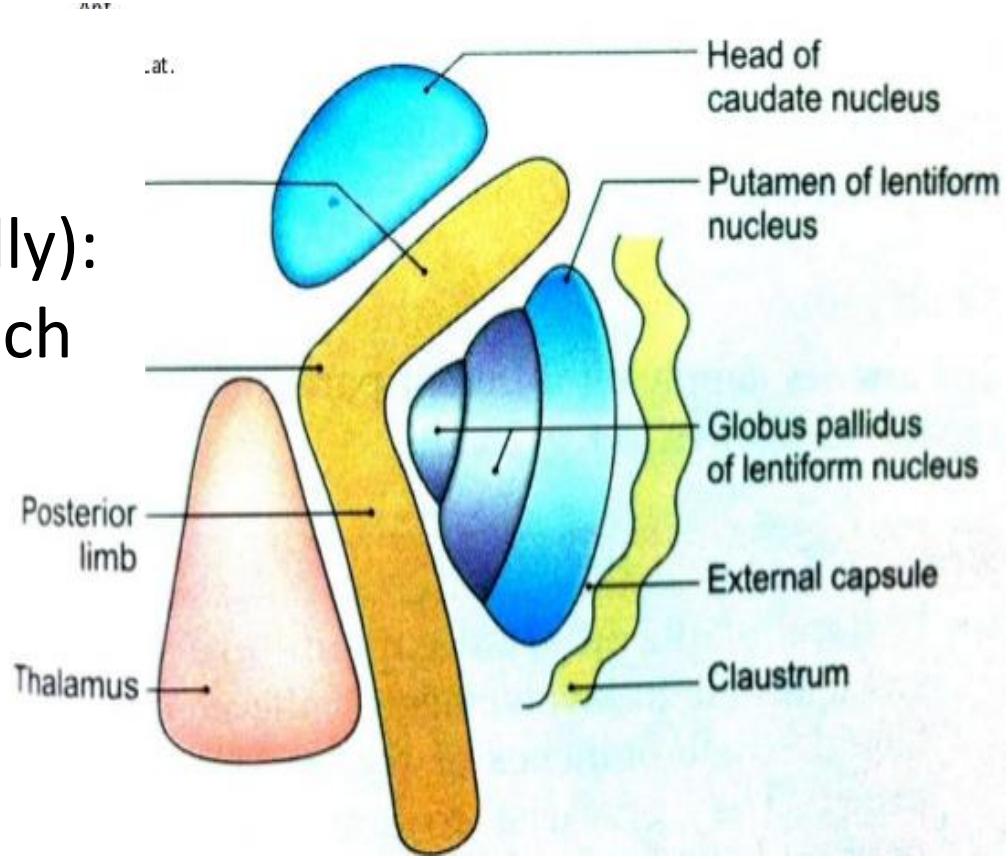
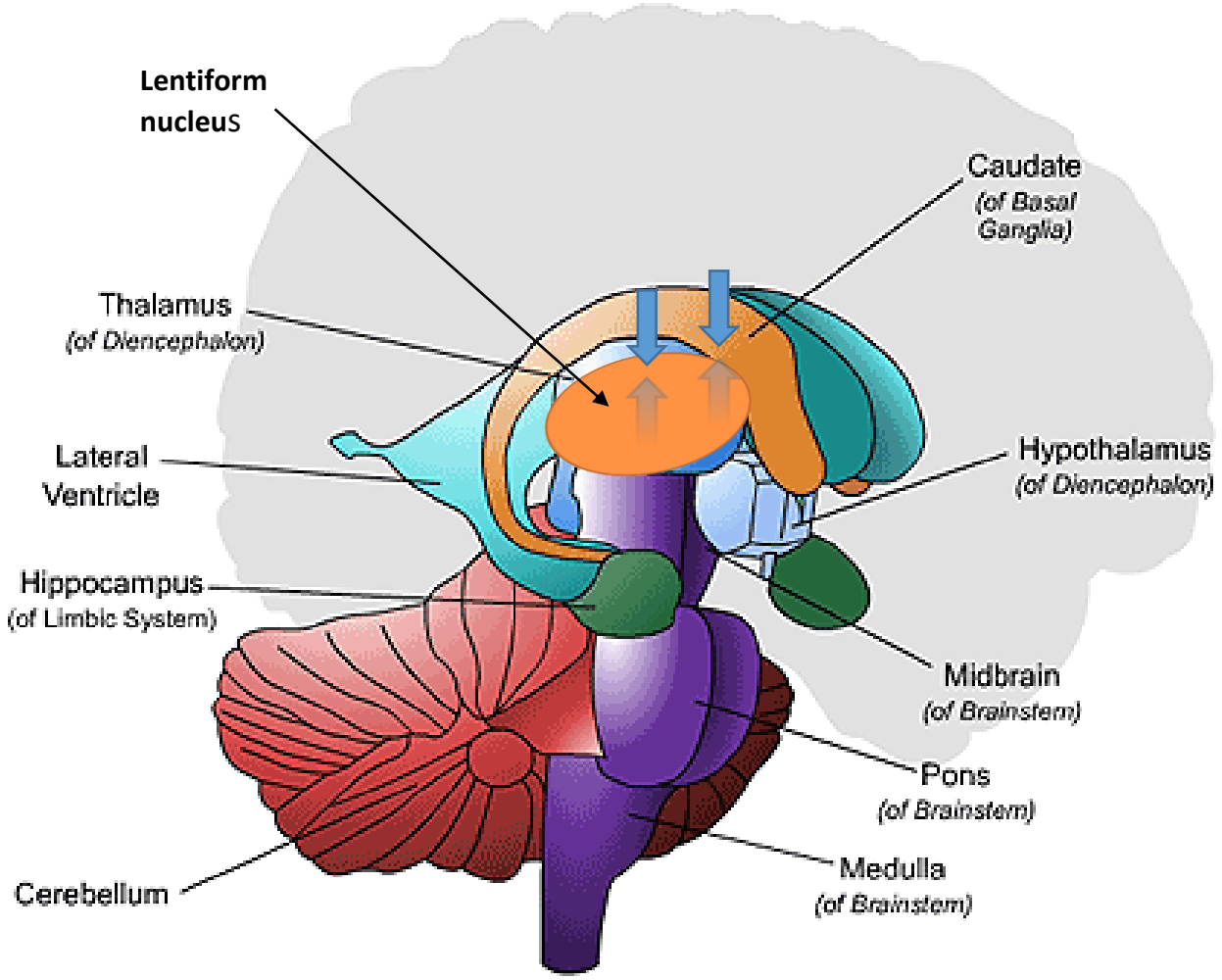
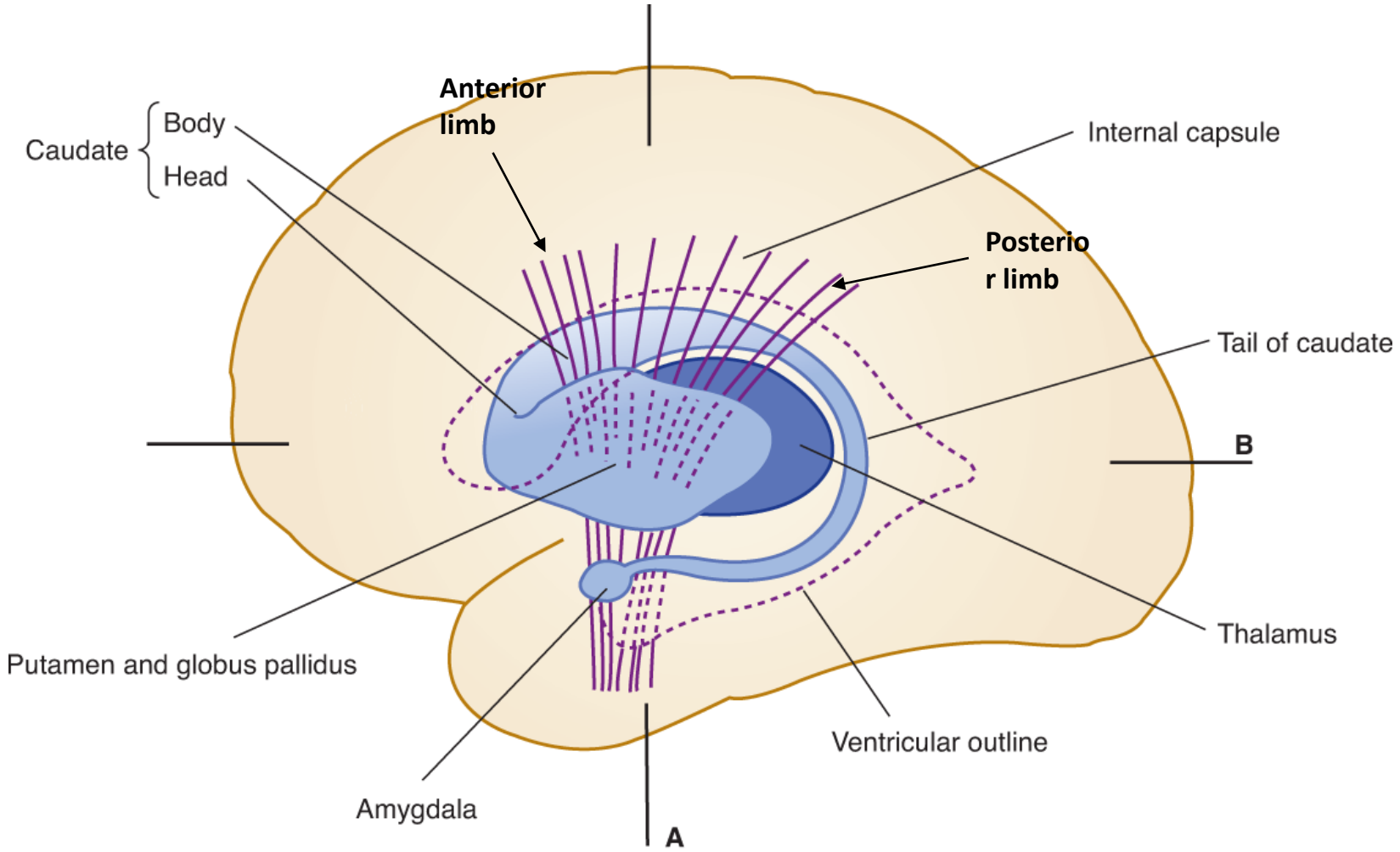
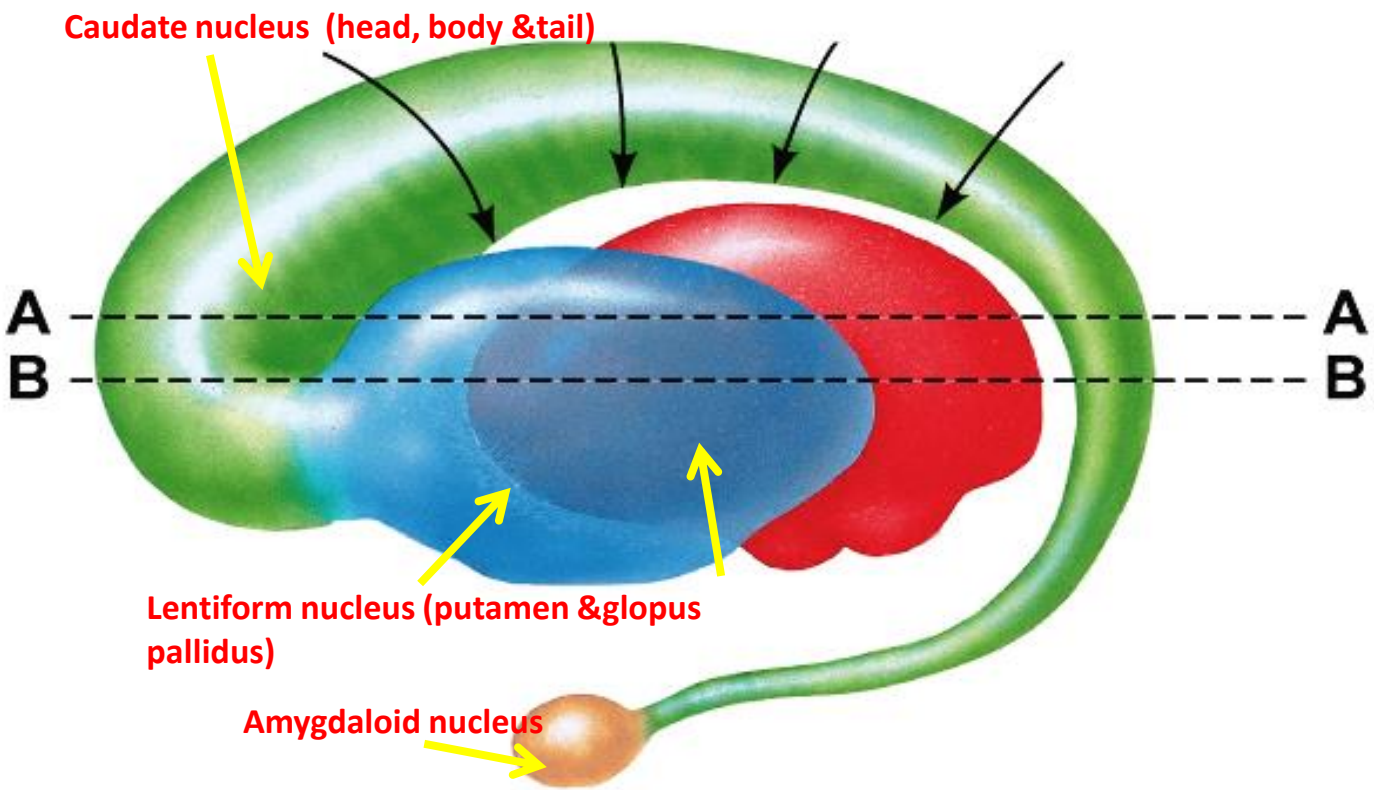


Figure AB-33: Build A Brain, Step 8



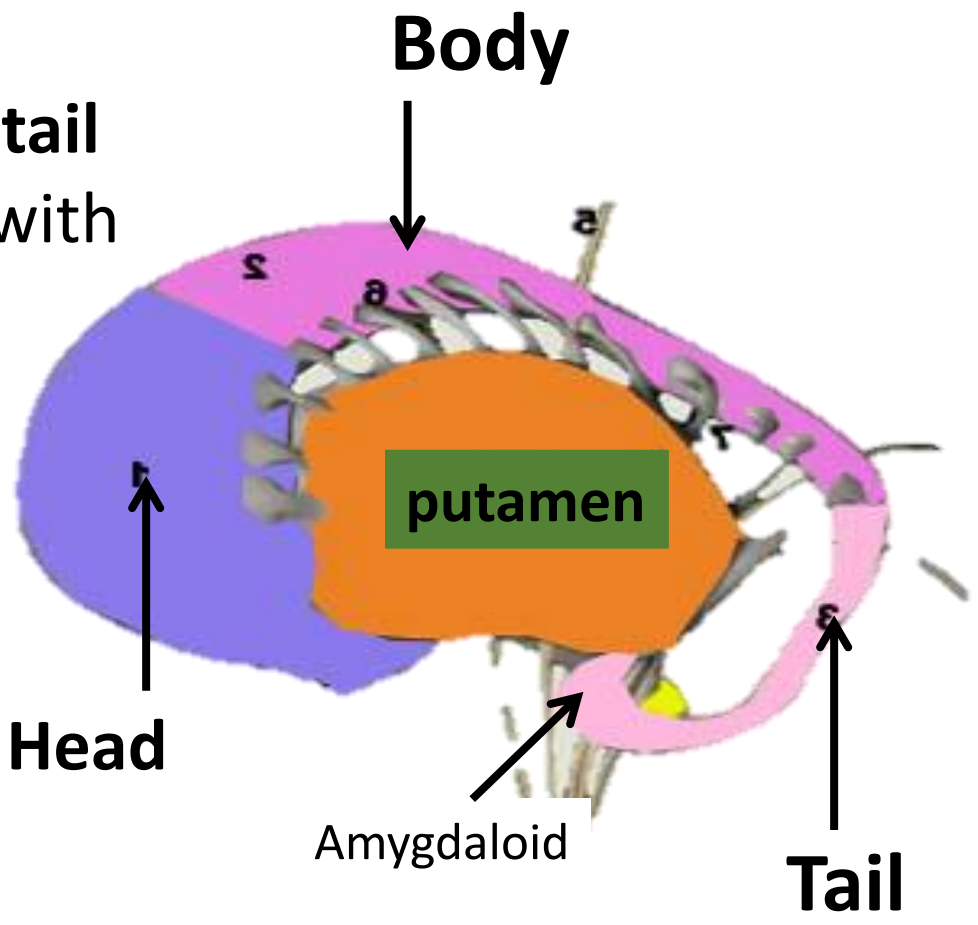


Basal nucleii



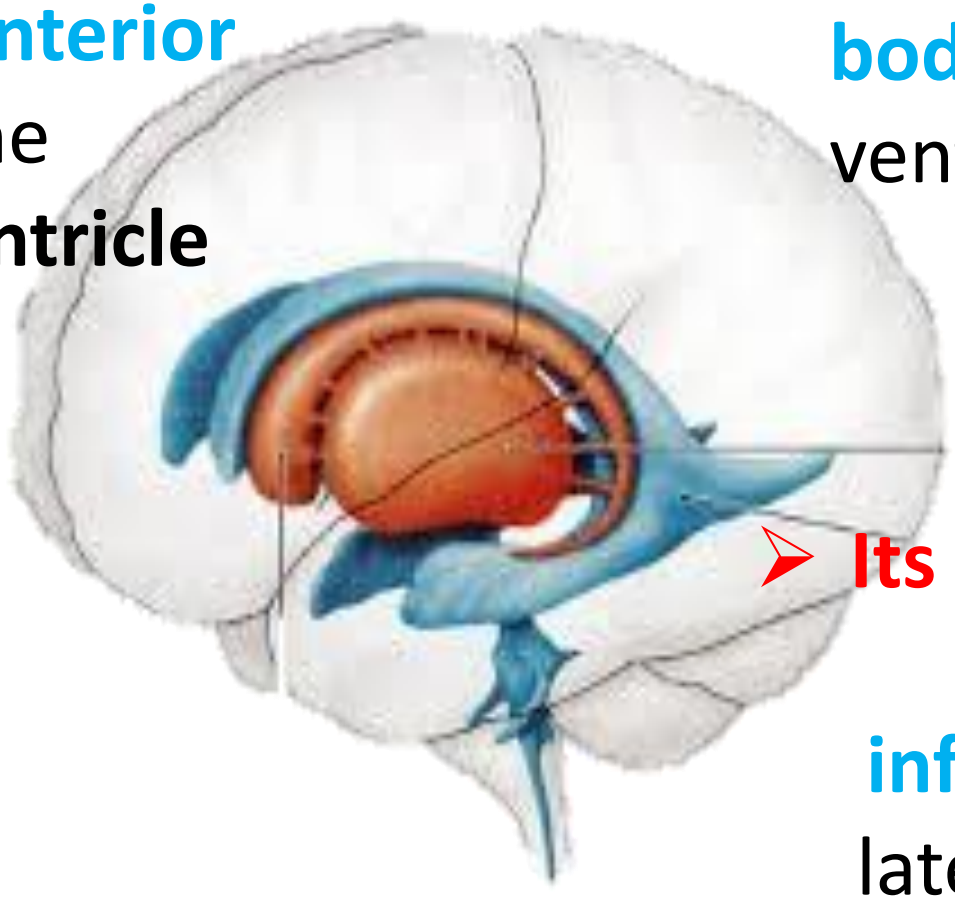
Caudate Nucleus

- 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

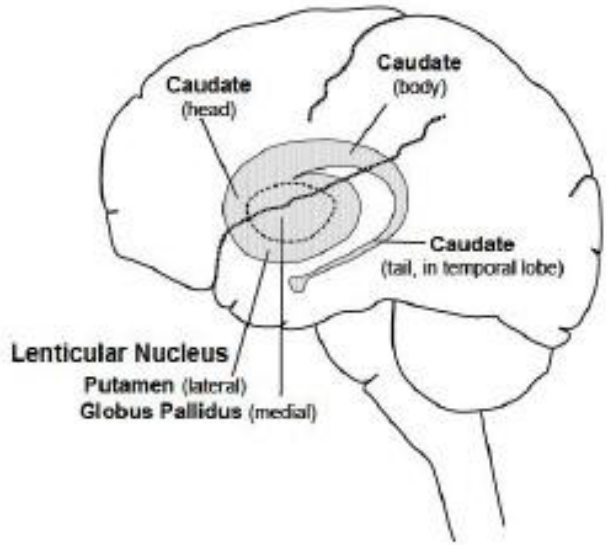
- **The head** bulges into the **anterior horn** of the **lateral ventricle**

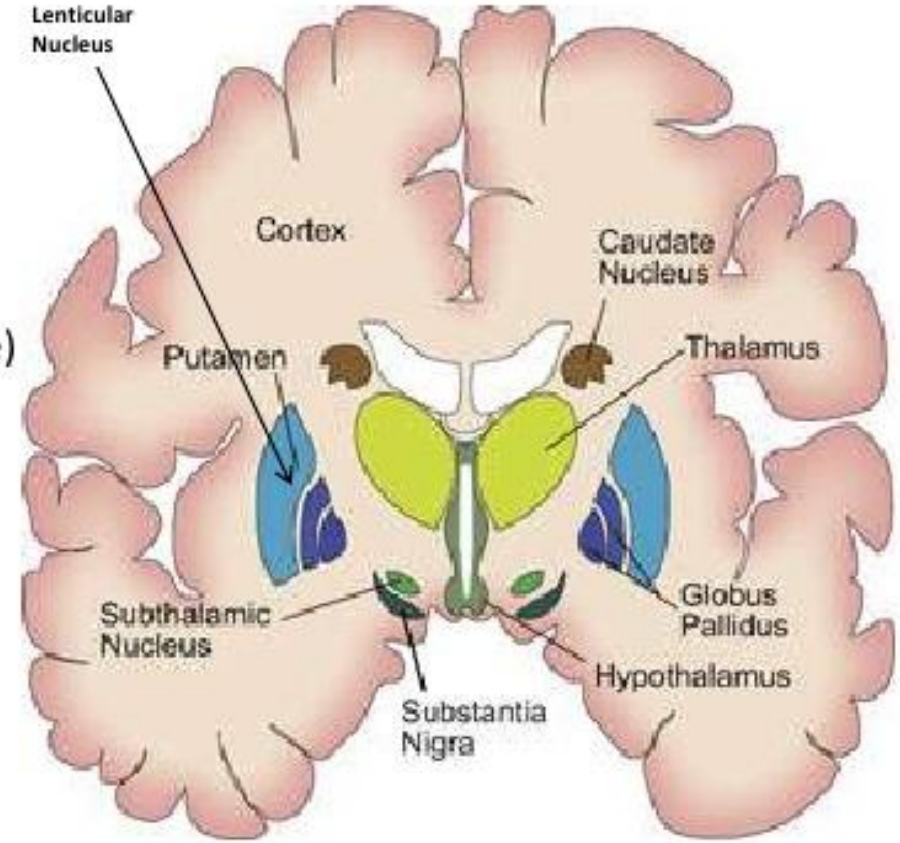


- **Its body** lies in the **floor of the body** of lateral ventricle.
- **Its tail** lies in the roof of the **inferior horn** of lateral ventricle.

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**





Thank you