



Gaza Ophthalmic Centre

7.2.1

Cerebral Association Fibres

Maged A AbuRamadan
MD, FRCSEd, FICO, PPOS

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Cerebral White Matter

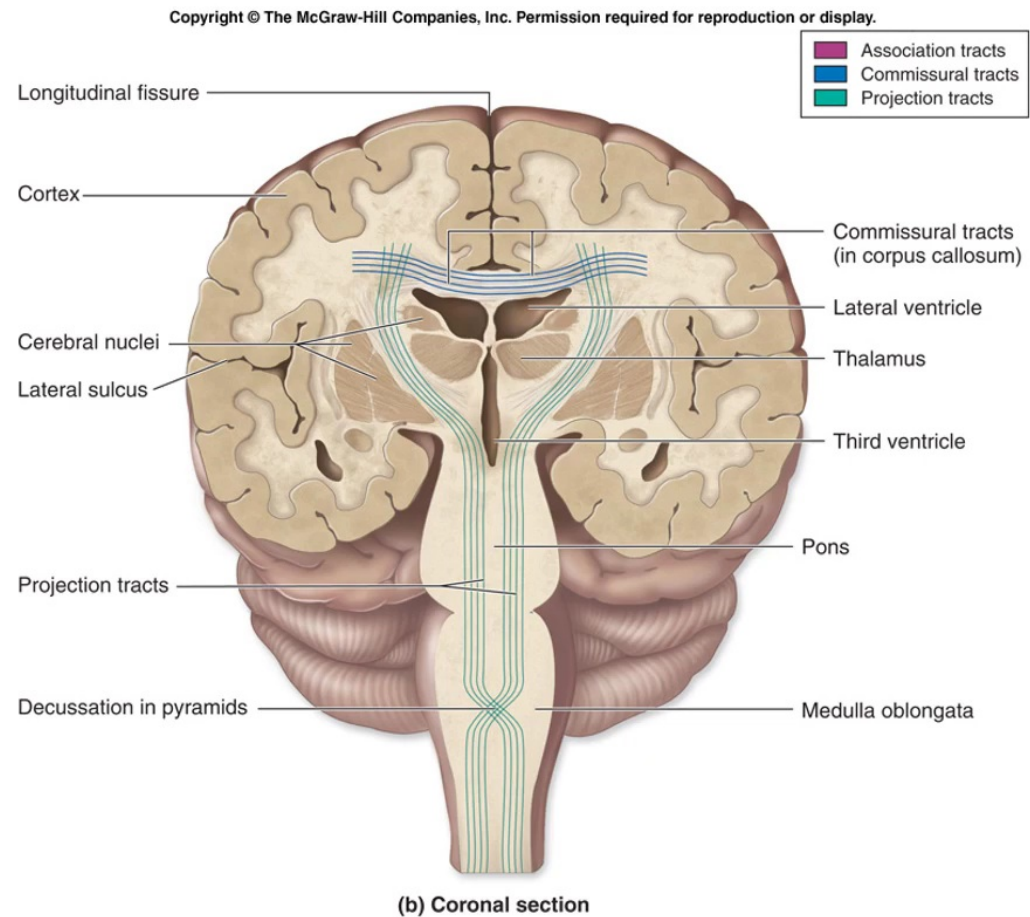
- Different areas of the cerebral cortex communicate:
 1. With each other
 2. With the brainstem and spinal cord
- Fibers are usually
 - Myelinated
 - Bundled into tracts



Cerebral White Matter

- Types of tracts

1. Association fibers
2. Commissures
3. Projection fibers



Cerebral White Matter

1) Association fibers

- Connect different parts of
- the same hemisphere

2) Commissures

- Allows communication between
- Cerebral hemispheres
- Corpus callosum – the largest commissure

3) Projection fibers

- Run vertically
- Descend from the cerebral cortex
- Ascend to the cortex from lower regions



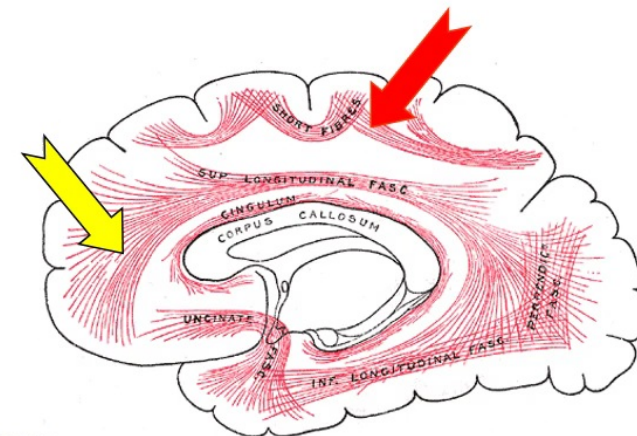
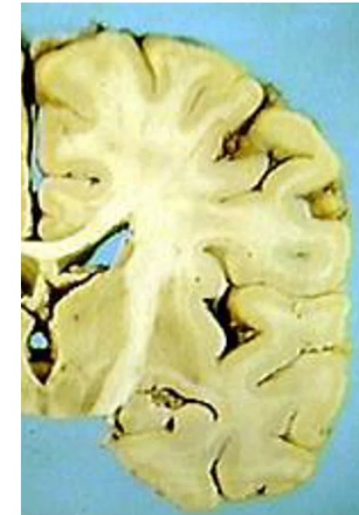
The Association Fibres

Connect

- different
- cortical areas in the
- same Hemisphere

1) Short

- Connect adjacent gyri
- “U” shaped bands
- Arcuate fibres
- Just deep to the cortex



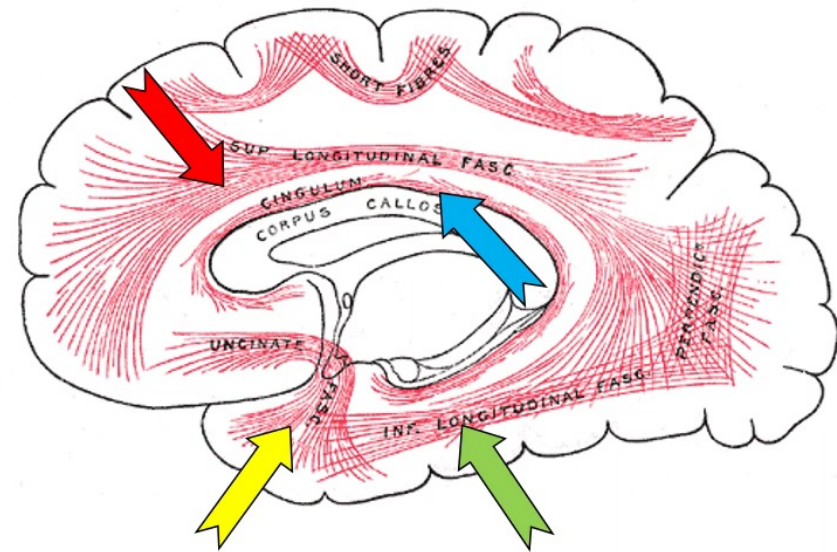
2) Long

- Connect anterior and posterior parts of the same Hemisphere
- 4 large bundles



Long Association Fibres

1. The Superior Longitudinal Bundle
2. The Uncinate Bundle
3. The Inferior Longitudinal Bundle
4. The Cingulum
5. Fronto Occipital Fasciculus



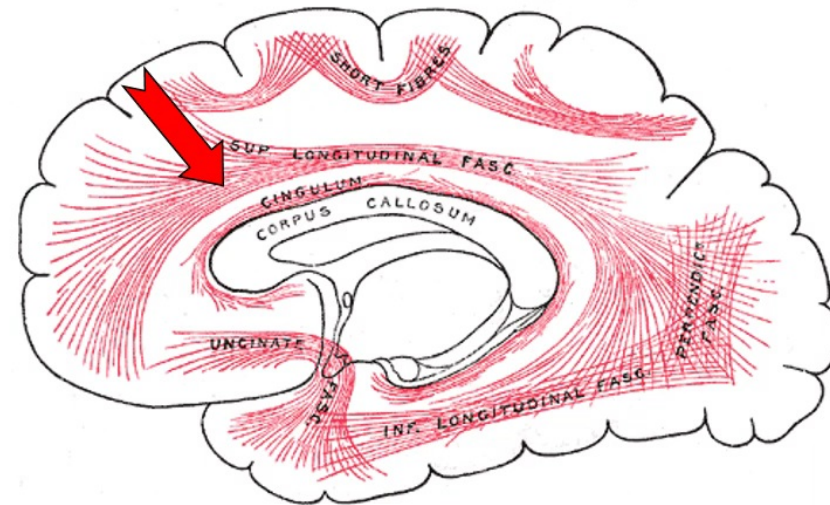
Long Association Fibres

- The Superior Longitudinal Bundle

- Thick
- Passes immediately above Insula
- Connect Frontal, Occipital & Temporal regions

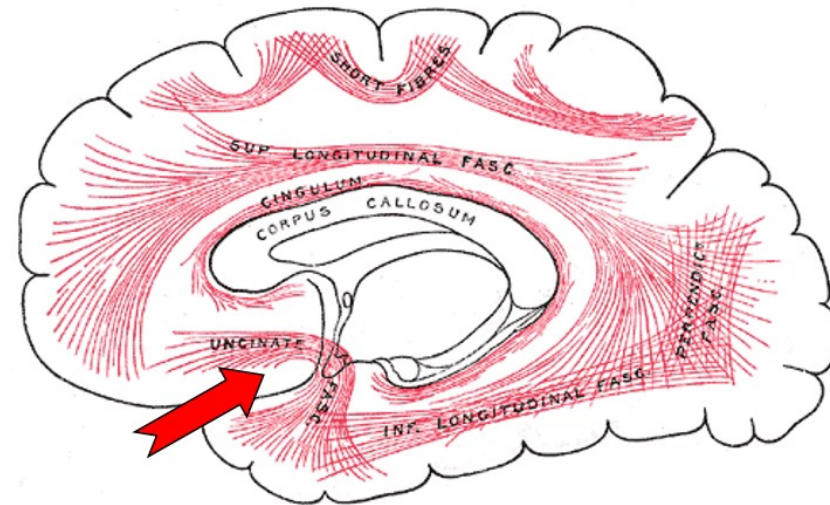
- **Inferior fibres →**

- The Arcuate Fasciculus
 - Connects Wernick's speech area
 - To Broca's speech area
- Damage → receptive aphasia



Long Association Fibres

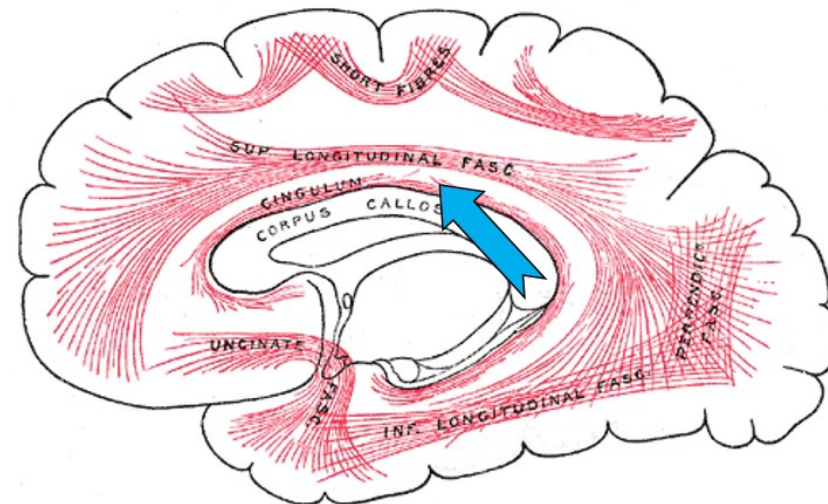
- The Uncinate Bundle
 - Sharp bend over itself
- Connect
 - Orbital Gyri of Frontal Lobe (motor speech area)
 - Anterior part of the Temporal Lobe
- Arch over the stem of the Lateral Sulcus



Long Association Fibres

- The Cingulum

- Girdle C shaped
 - Incomplete circle
- Around Corpus Callosum
 - Very near to the median plane
 - Begins near Rostrum
 - Ends in the parahippocampus
- Gyrus Cinguli
- Hippocampal Gyrus

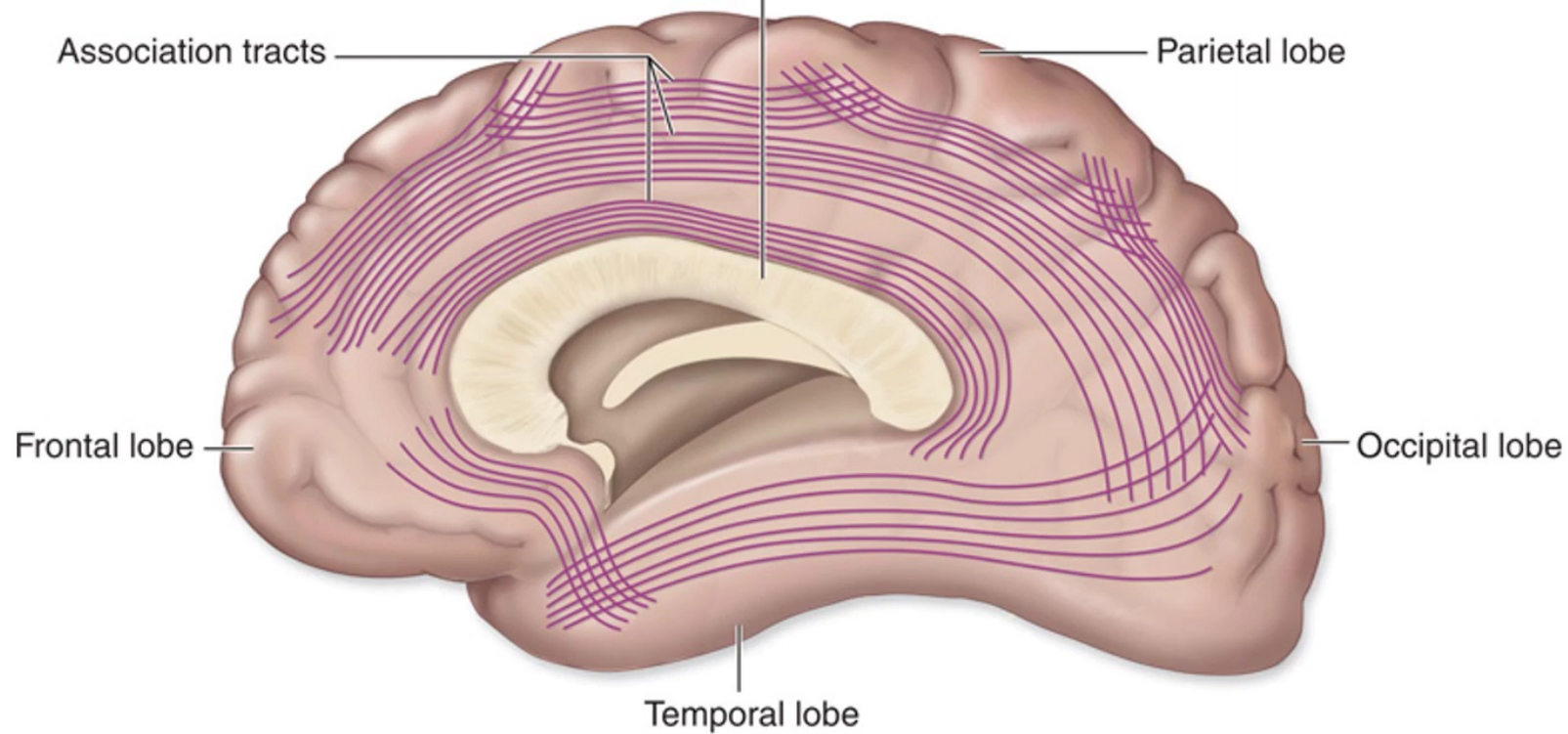


Long Association Fibres

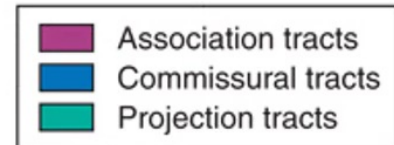
- Fronto Occipital Fasciculus
 - Connects frontal, temporal & occipital poles
 - Deep to the superior longitudinal fasciculus



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Corpus callosum



(a) Sagittal view

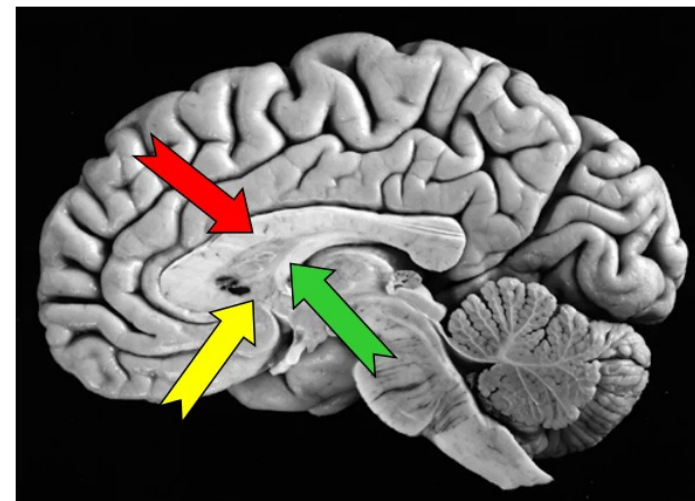
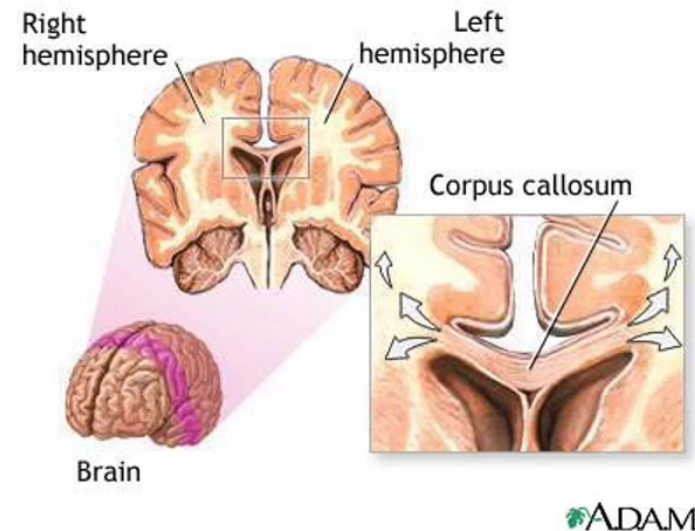


Commissures

Band of white matter

Connecting a

- Part of the CNS on one side with
 - The same part on the opposite side
-
- Arise from the cells of the cerebral cortex
 - Cross middle line
 - Distributed to similar cortical cells



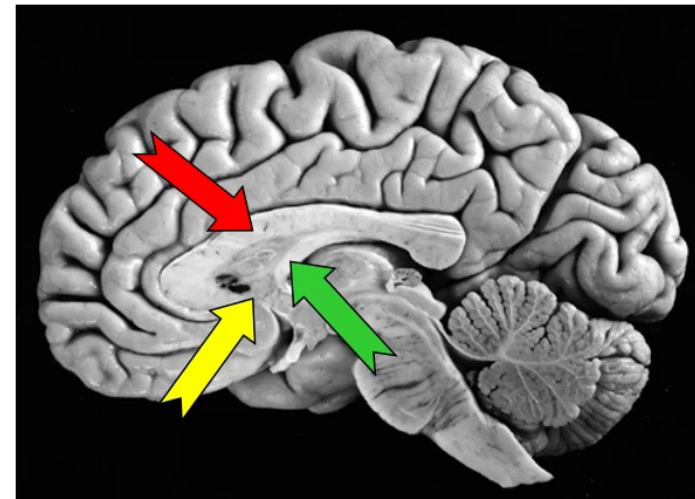
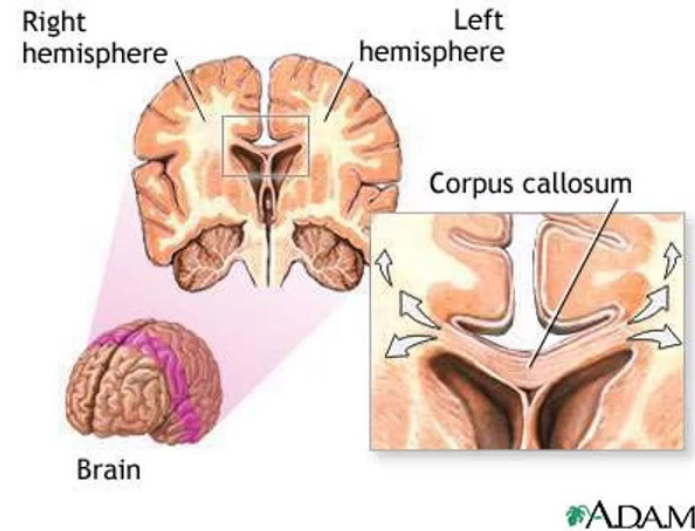
Commissures

- 3 Major Commissures

1. The Corpus Callosum
2. The Anterior Commissure
3. The Hippocampal Commissure

- +

1. The Posterior Commissure
2. The Habenular Commissure

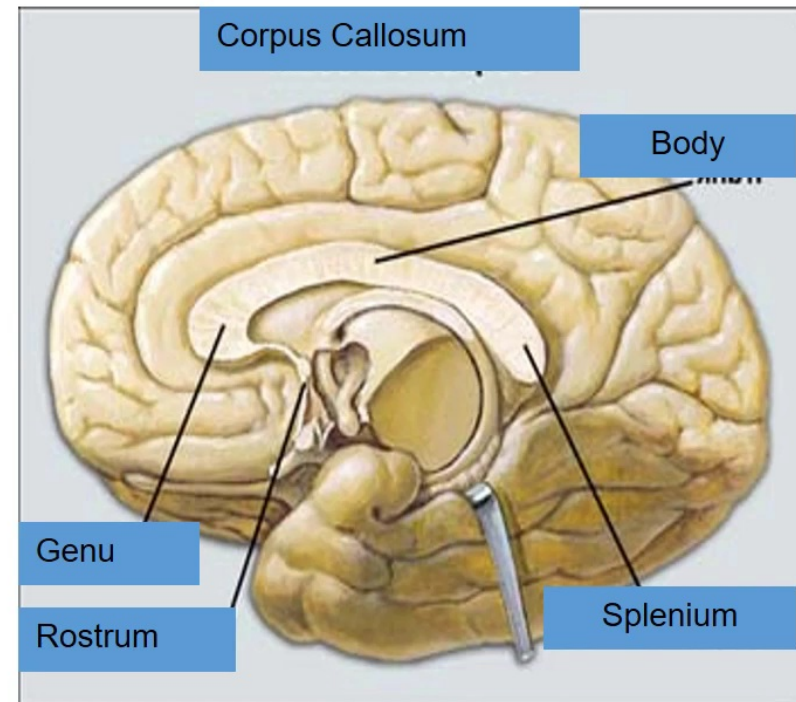


The Corpus Callosum

- The largest & chief commissure

Connects

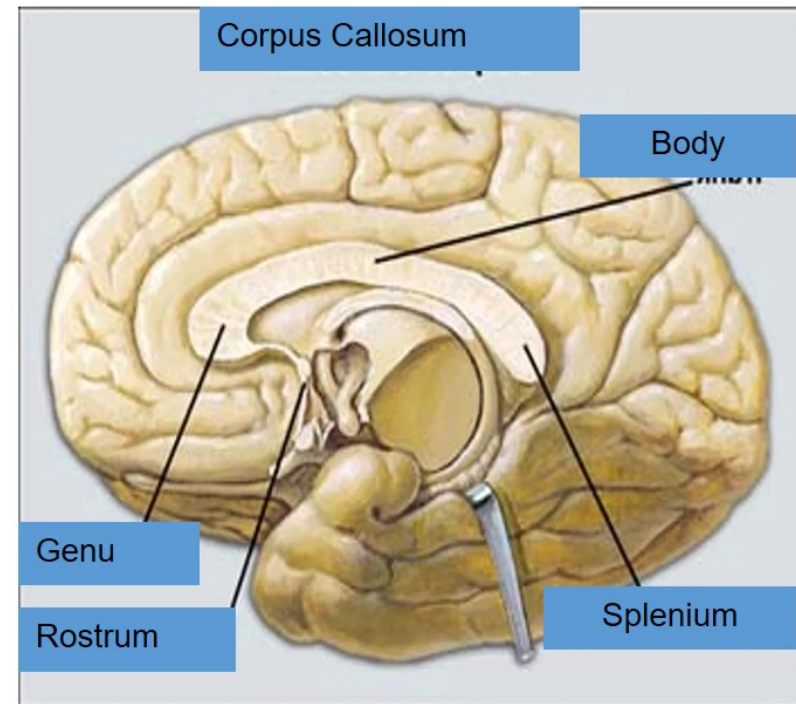
- All areas of
- The 2 hemispheres
- Except
 - The R&L Temporal Poles
 - Cortical areas
 - projecting to distal parts of the limbs



The Corpus Callosum

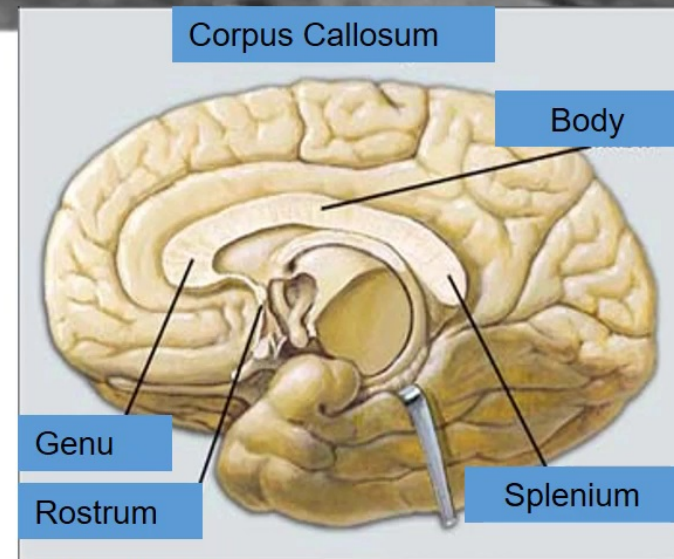
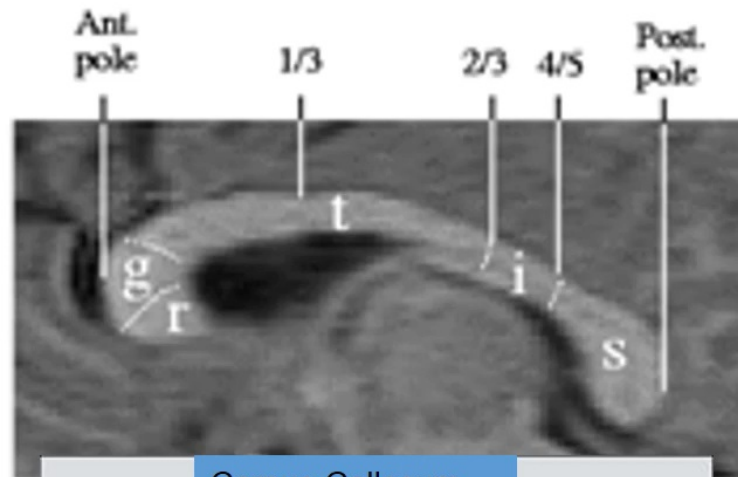
- Relations

- Superiorly
 - Falx Cerebri
 - Anterior Cerebral Artery
- Inferiorly
 - Septum Pellucidum
 - Fornex of Hippocampus



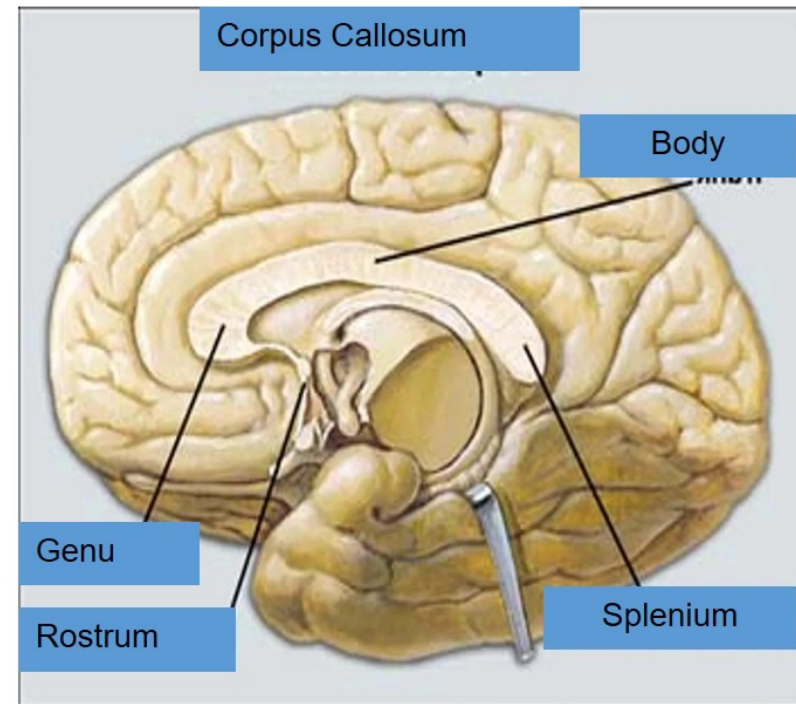
The Corpus Callosum

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



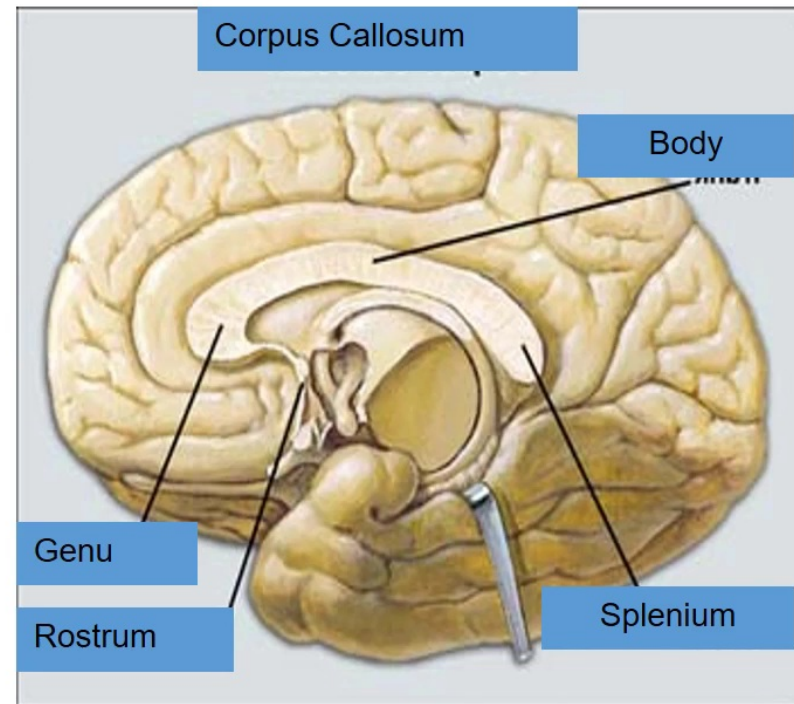
The Corpus Callosum

- Rostrum
 - Connected to the
 - Optic Chiasm by
 - Lamina Terminalis
 - Connects the inferior (orbital) surfaces of the frontal lobes
- Genu
 - Horizontal section
 - Fibres → Forceps Minor
 - Connects the lateral & medial surfaces of the frontal lobes



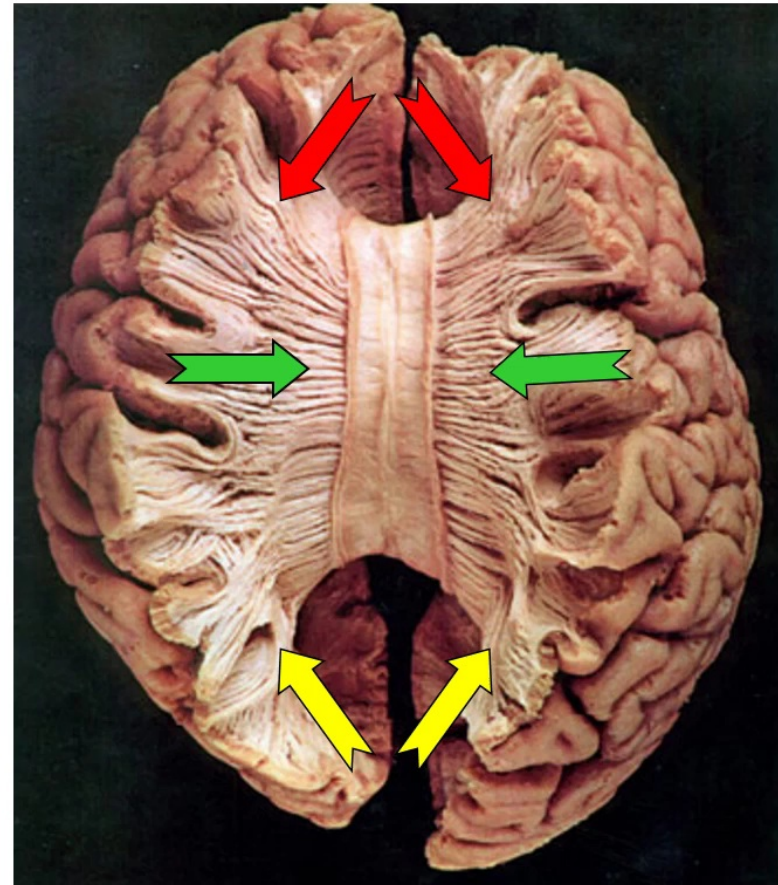
The Corpus Callosum

- Body
 - Anterior fibres connect the cerebral hemispheres
 - Except areas of distal parts of the limbs
 - Posterior fibres share in forming the Tapetum
 - → roof & lateral walls of the posterior horn of the lateral ventricle
- Splenium
 - Anterior fibres → Tapetum
 - Posterior fibres
 - → Forceps Major
 - → bulge (Bulb) in the medial wall of the posterior horn of the lateral ventricle



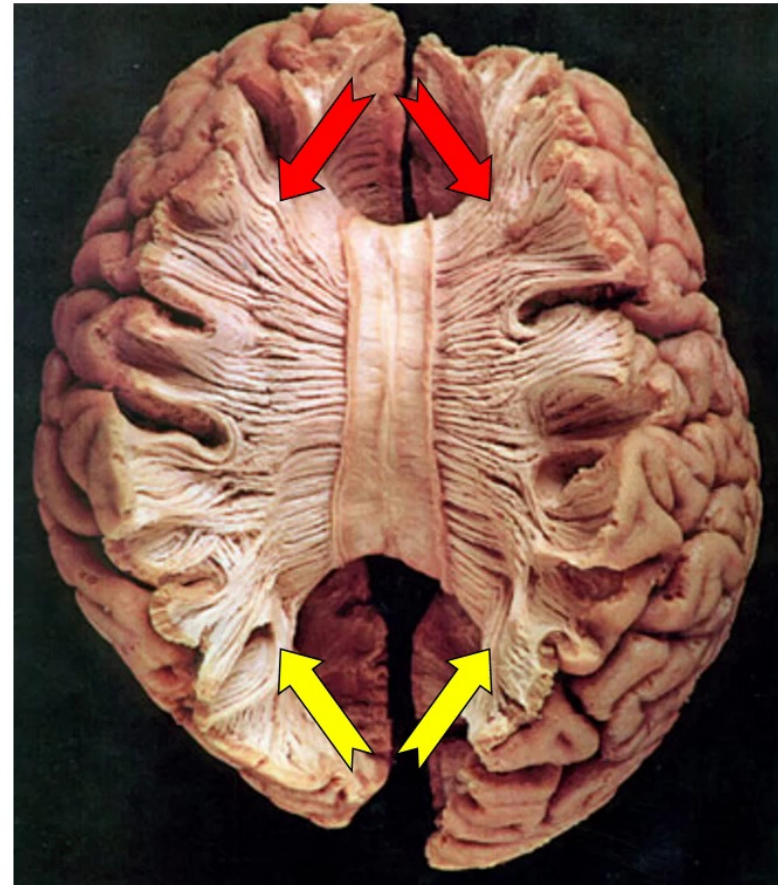
The Corpus Callosum

1. Forceps Anterior (Minor)
2. Forceps Posterior (Major)
3. Middle part of Body fibres
4. Tapetum



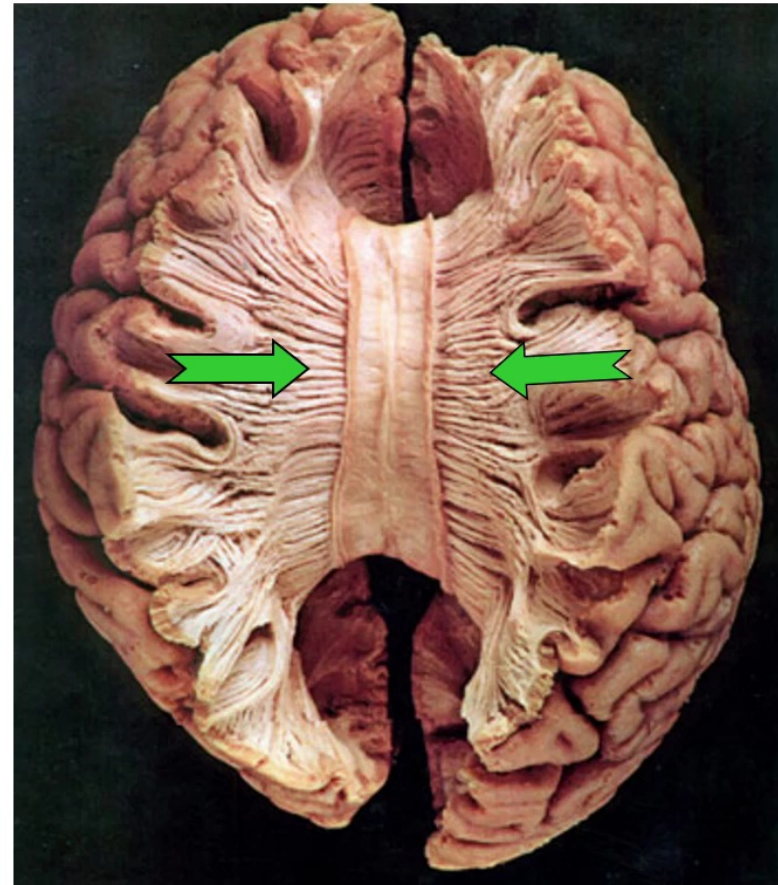
The Corpus Callosum

- Forceps Anterior (Minor)
 - Fibres connecting the prefrontal regions
 - Pass through the Genu & anterior part of the Body
 - Make an Arch as soon as they cross the midline
- Forceps Posterior (Major)
 - Connects the occipital poles
 - Pass through the Splenium & posterior part of the Body
 - Make an Arch as soon as they cross the midline



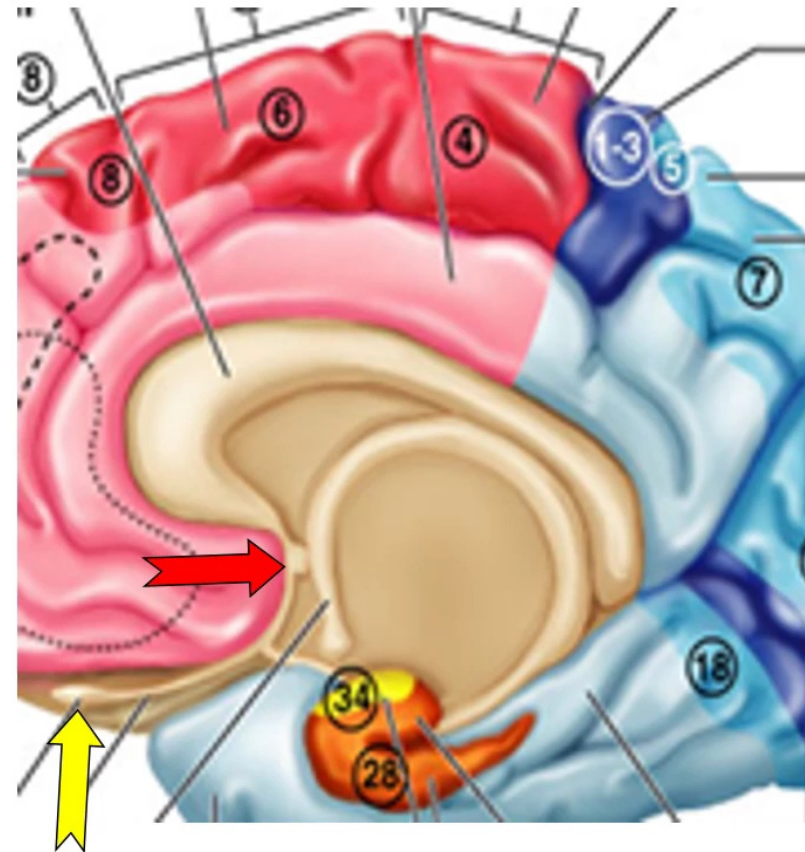
The Corpus Callosum

- Middle part of Body fibres
 - Passes transversely
 - Then passes upward & downward
- Tapetum
 - Occipital part of CC
 - → roof & lateral wall of the posterior horn of the lateral ventricle



The Anterior Commissure

- Bundle of fibres
- Crosses through upper part of Lamina Terminalis
- Mainly connects
 1. The Olfactory Bulbs
 2. The Olfactory Tubercles
 - Of both sides



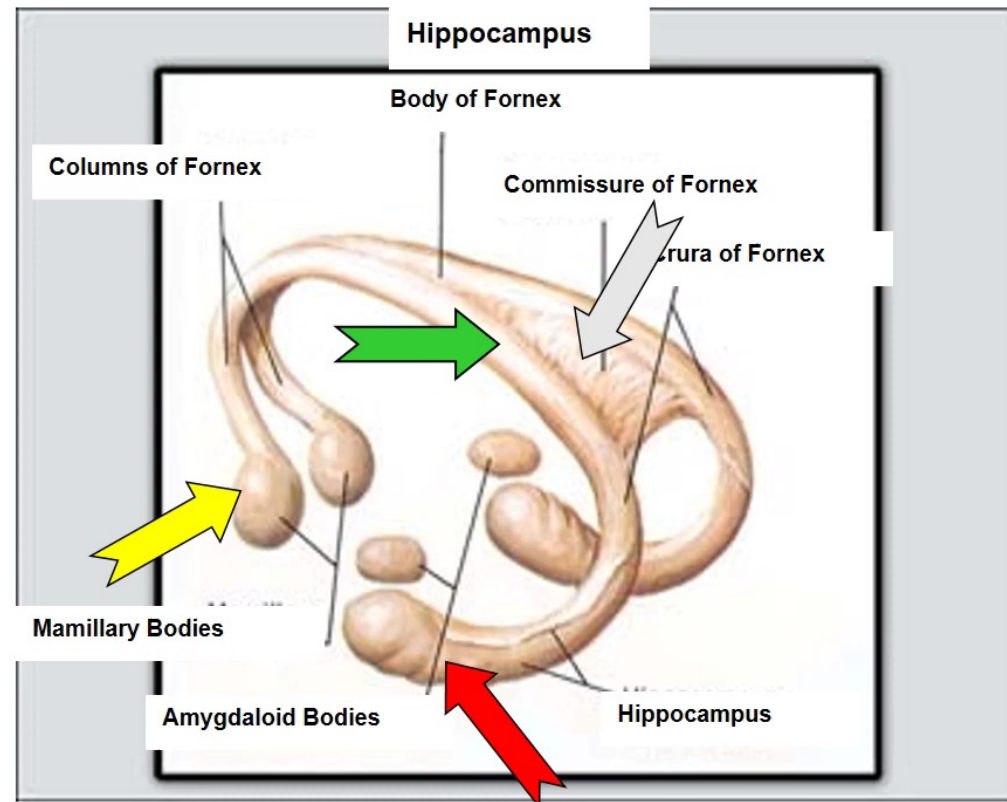
Minor Commissures

- The Hippocampal Commissure
 - A chiasm
 - Partial decussation
 - Fibres between the R & L Fornices
- The Posterior Commissure
 - In the inferior lamina of the Pineal Stalk
 - Connects the
 - 2 Pretectal Nc
 - 2 Superior Colliculi
- The Habenular Commissure
 - In the superior lamina of the Pineal Stalk
 - Connects the Habenular Nc of both sides



The Fornix

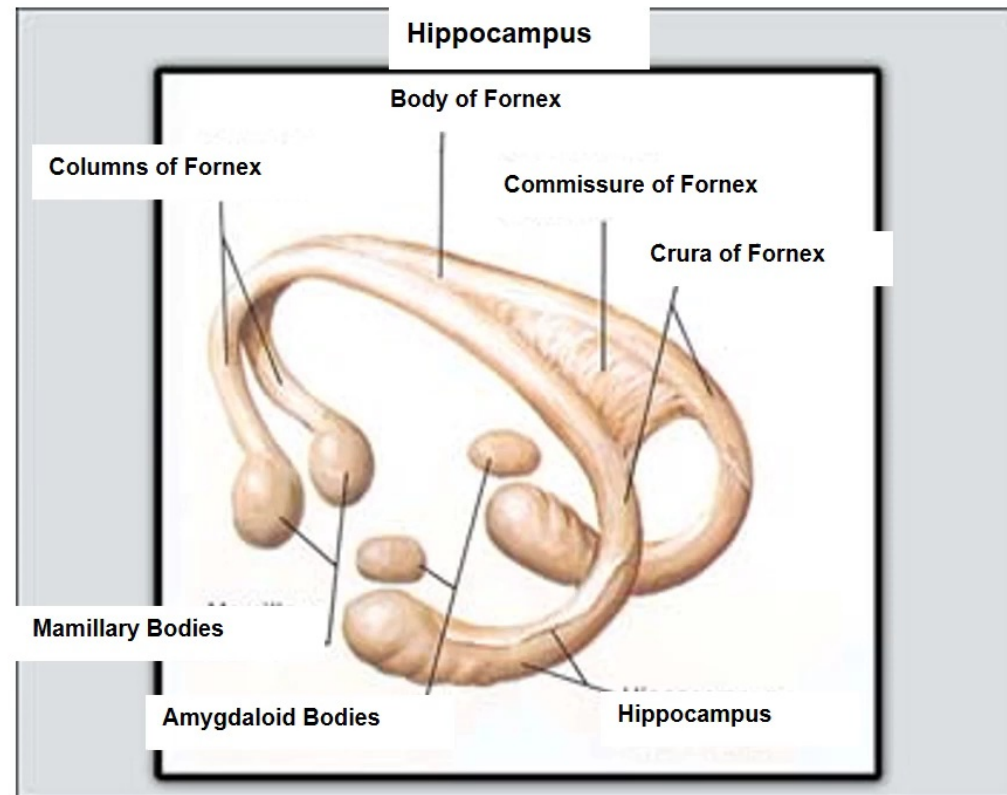
- Arched structure
- Axons of the Hippocampus cells
- Projection fibres
 - Ends at
 - Mammillary Body of Hypothalamus
- Bodies of the 2 Fornices
 - are connected by the
 - Hippocampal Commissure

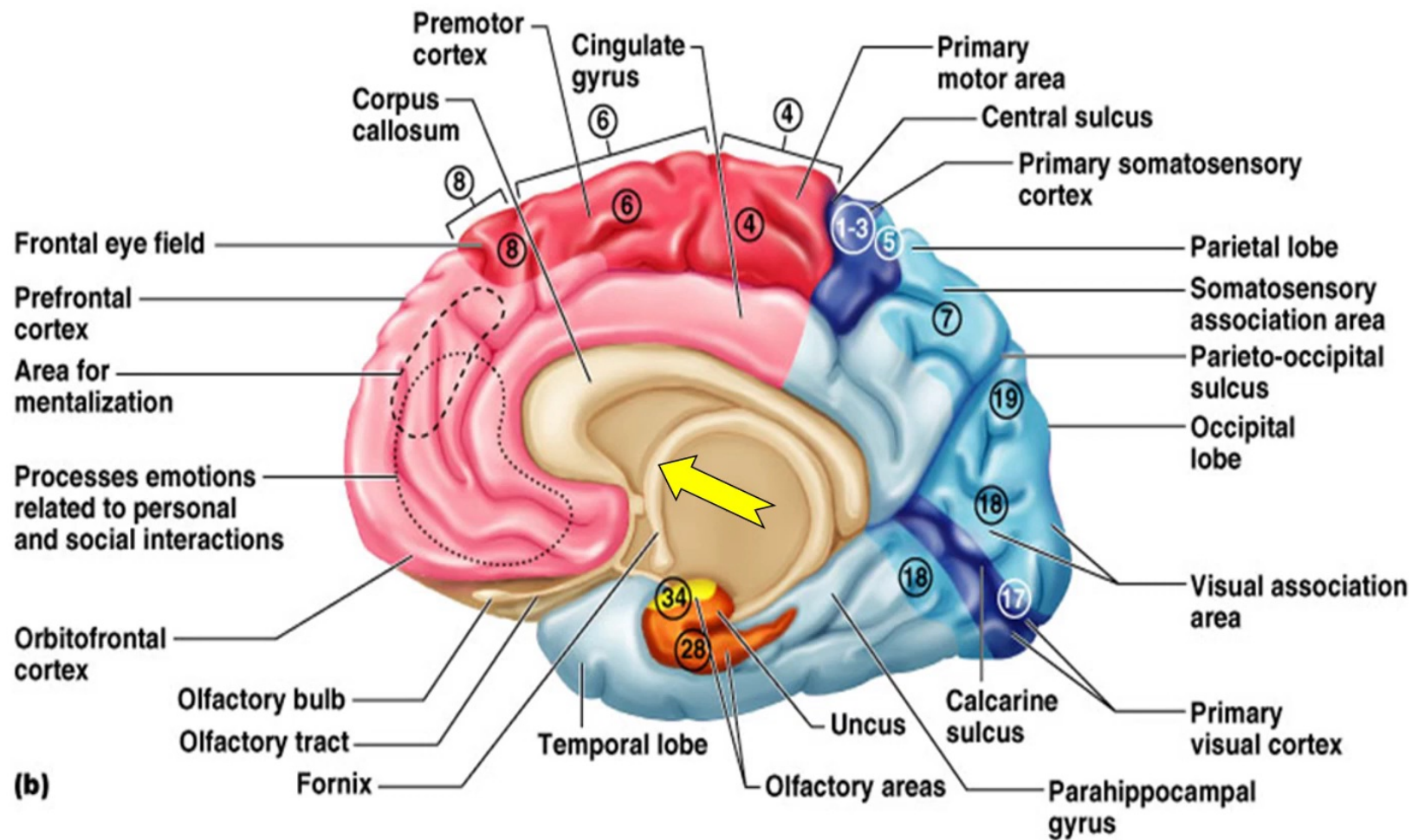


The Fornix

Each fornix has:

- A Column
 - → Mammillary body
- A Body
 - → arch under the corpus callosum
 - Bodies joined by the hippocampal commissure
- A Crus posterior
 - Beneath the splenium





Projection tracts

Connects the cerebral cortex to

- Lower parts of the
 1. Brain and
 2. Spinal cord
- Fibres may be
 1. Ascending to the cortex
 2. Descending from the cortex



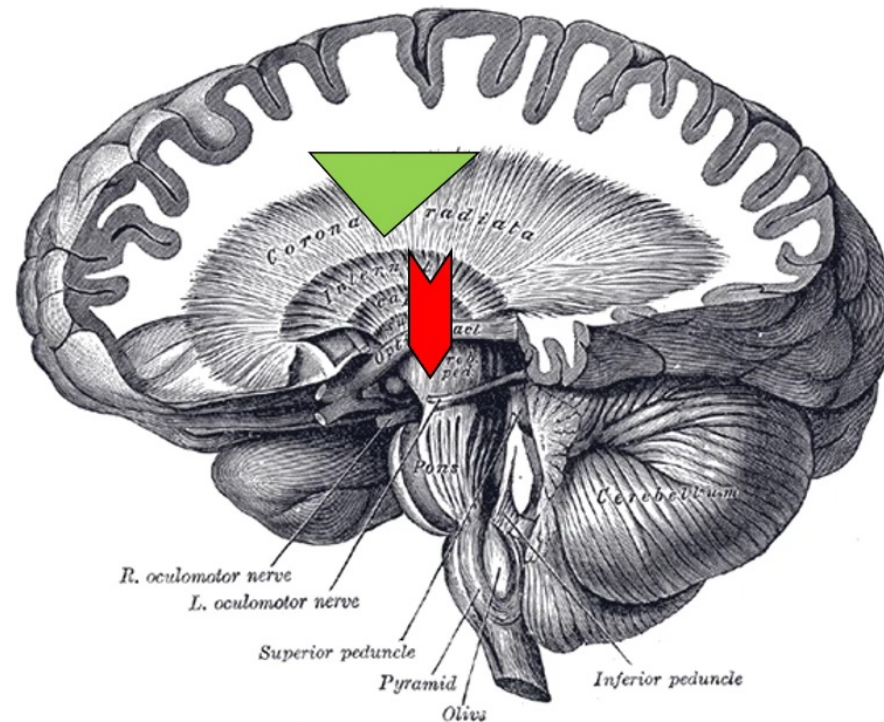
Projection tracts

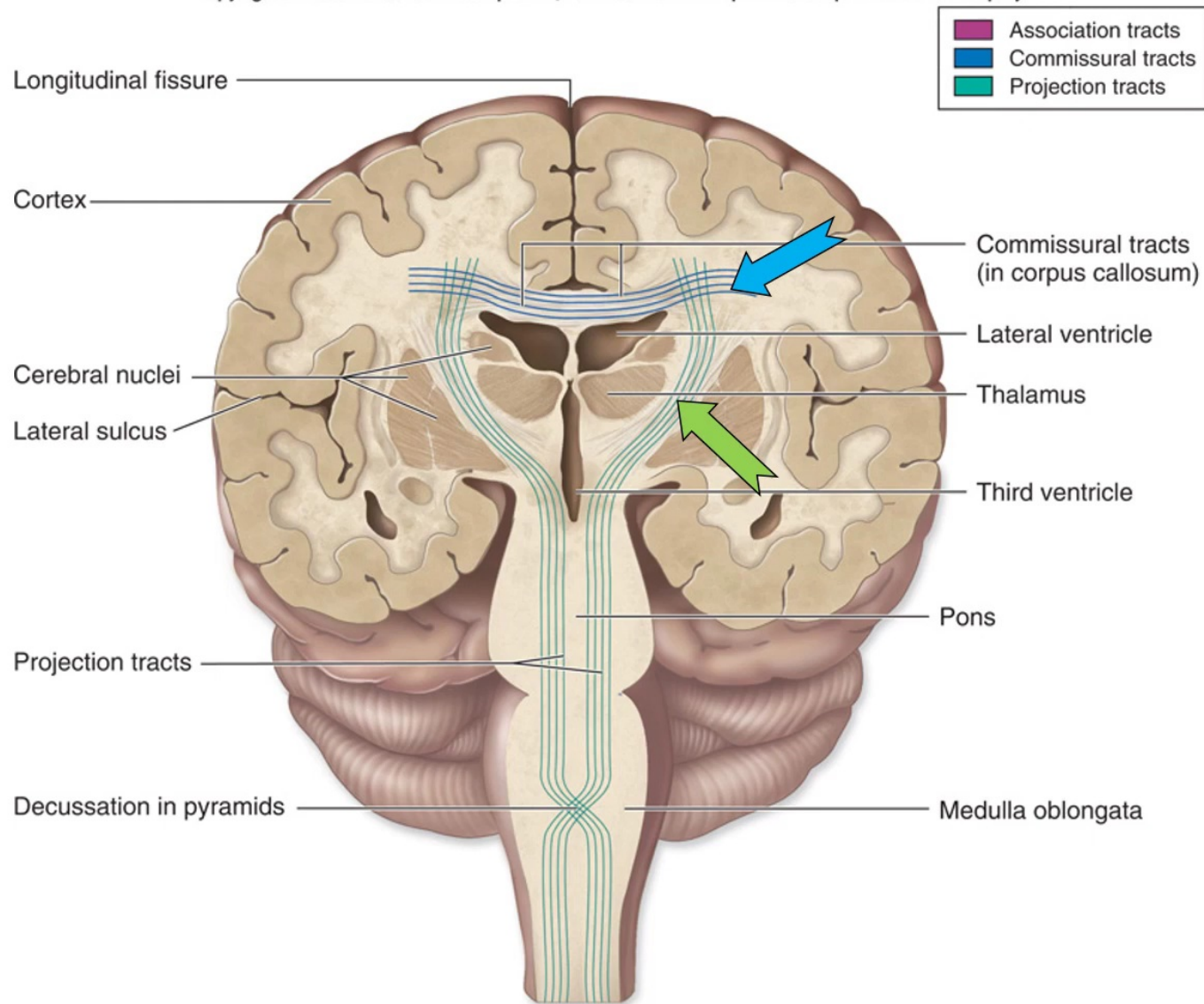
1) Internal capsule

- Projection fibers
- Form a compact bundle
- Passes between the
 1. Thalamus and
 2. Basal nuclei

2) Corona radiata

- Superior to the internal capsule
- Fibers run to and from the cerebral cortex



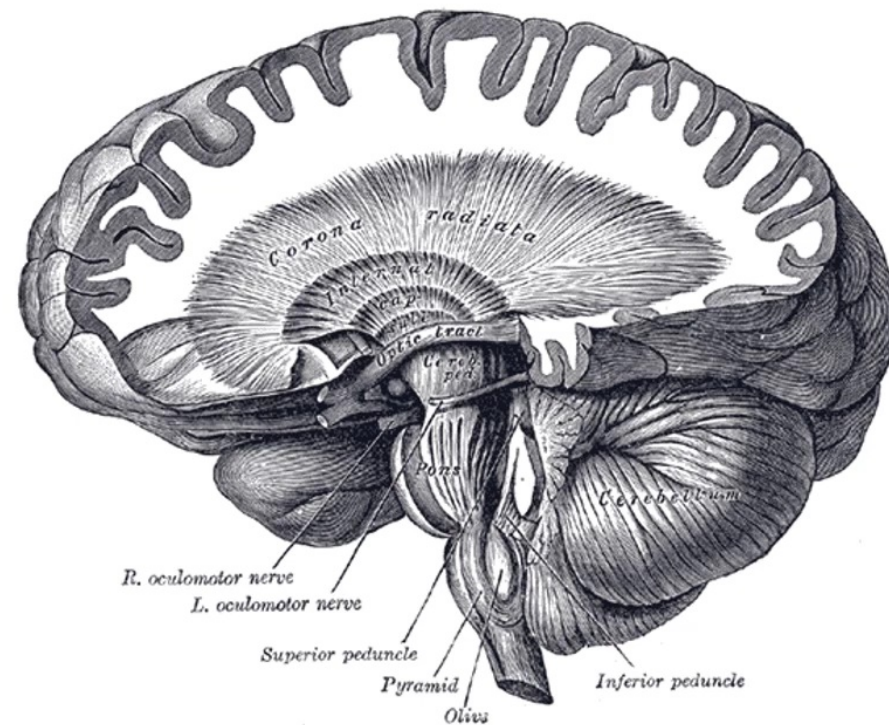


(b) Coronal section



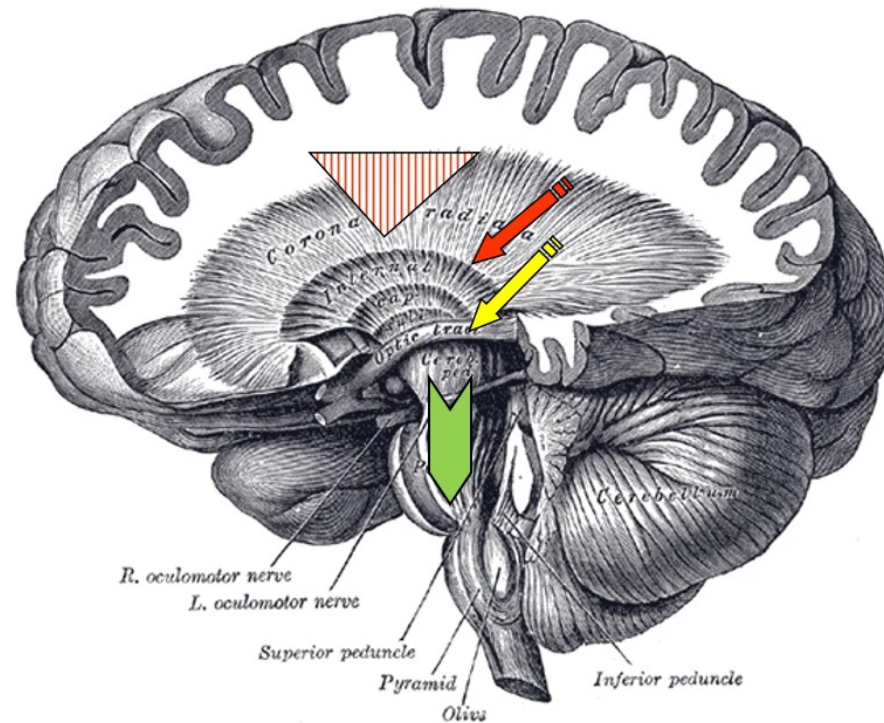
The Internal Capsule

- Broad Band of
 - Projection fibres
 - Connects the
 - Cerebral hemisphere to
 - Lower levels of the
1. Brain &
 2. Spinal Cord



The Internal Capsule

- Extent
 - From level of
 - Basal Nuclei
 - Down to level of
 - Optic Tract
- Internal (Medial) to the
- Lentiform nucleus



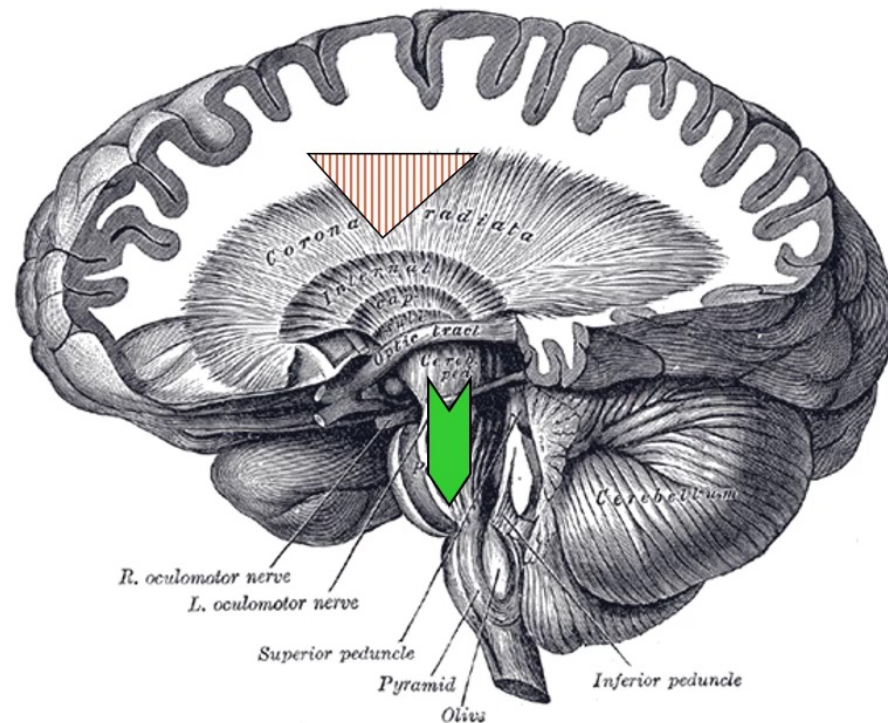
The Internal Capsule

Fan above the

- level of
- BN with the
- Corona radiata

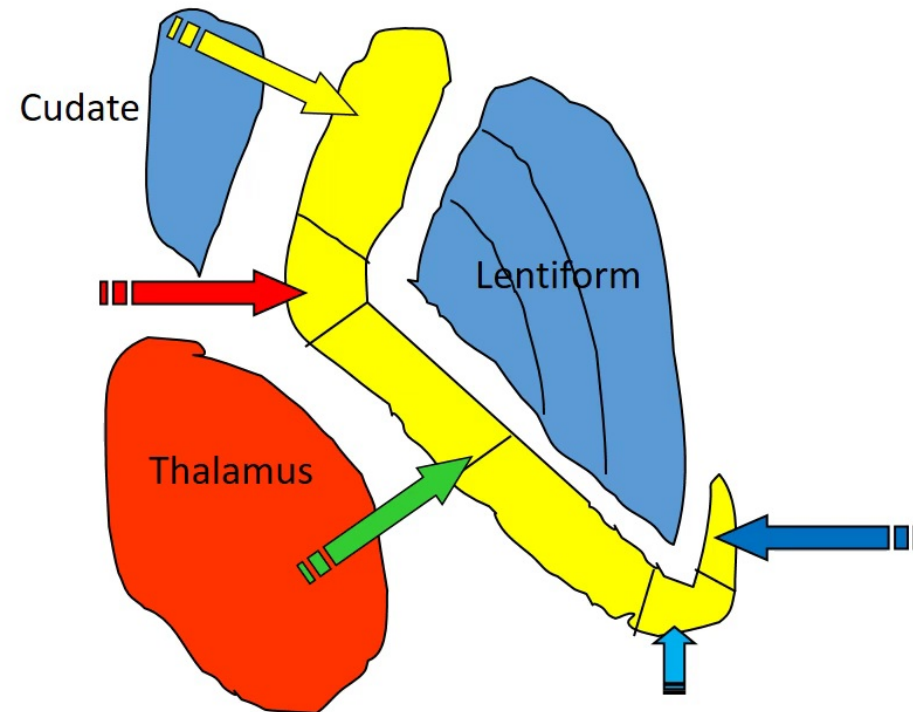
Collects

- below the
- OT with the
- Basis pedunculi of the
- Midbrain

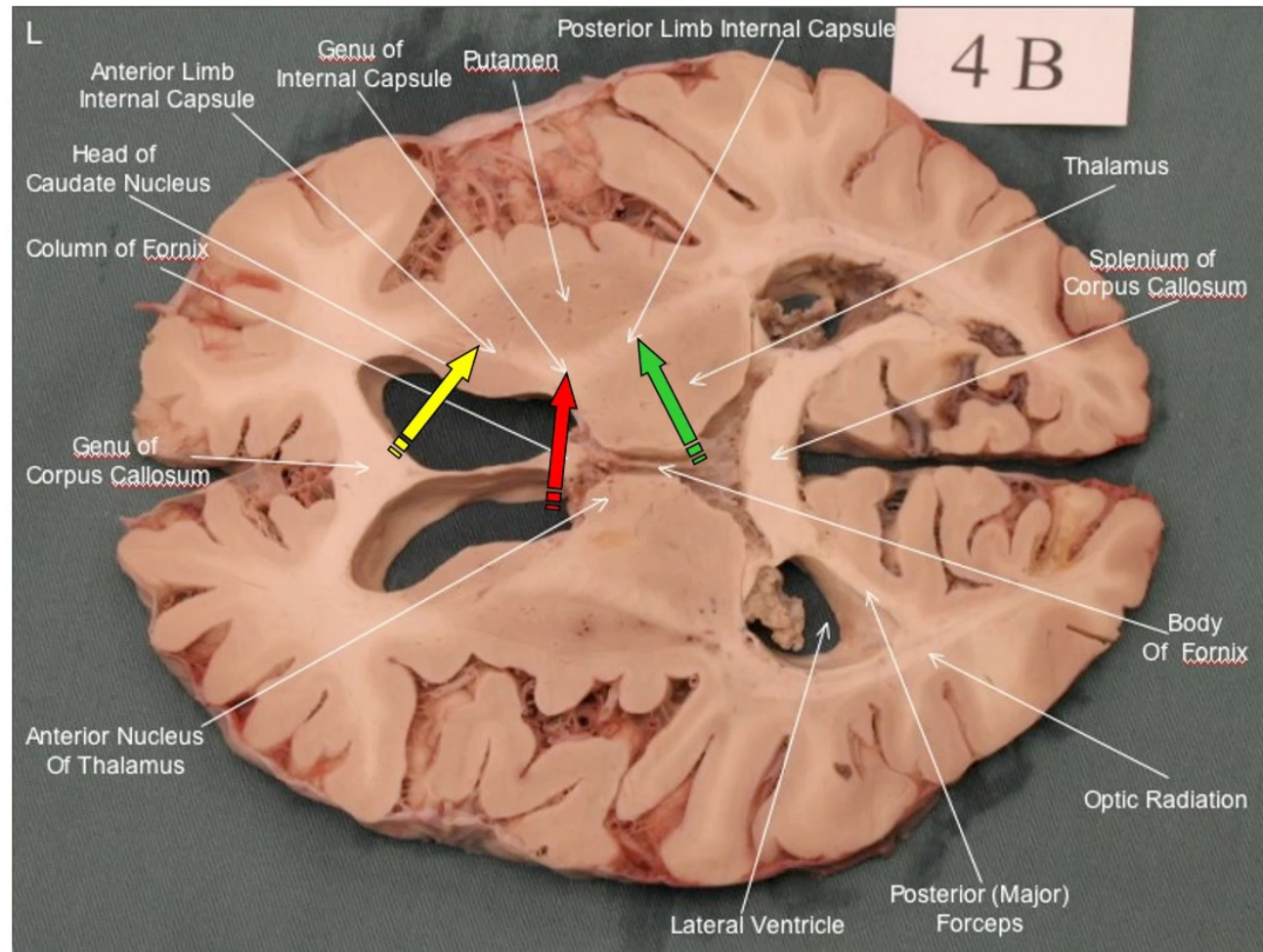


The Internal Capsule

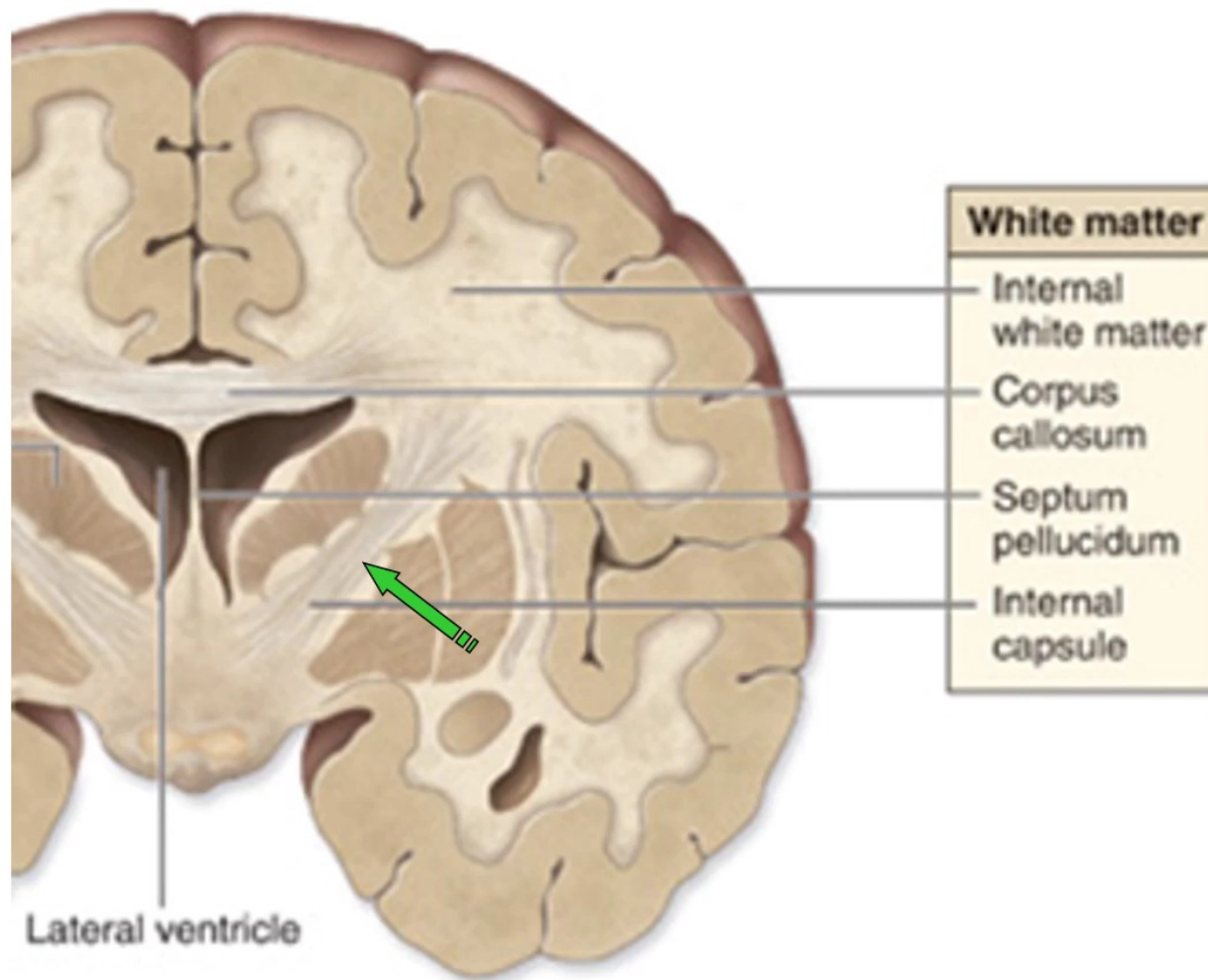
- Has a shape of wide “V”
 - Apex called genu
- Anterior limb
 - <> lentiform nucleus &
 - head of the caudate nucleus
- Posterior limb
 - <> lentiform nucleus &
 - thalamus
- Retrolentiform part
 - behind the
 - lentiform nucleus
- Sublentiform part
 - below the
 - lentiform nucleus



The Internal Capsule



The Internal Capsule



Internal Capsule Fibres

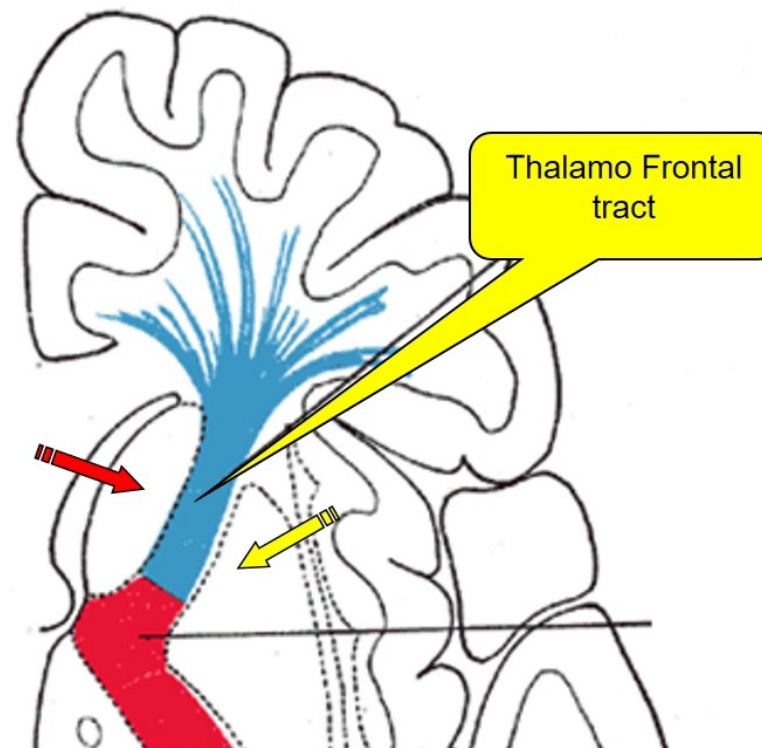
- PORTA CEREBRIE
- All fibres leaving the cerebral cortex
 - Pyramidal
 - Extrapyrarnidal
- All fibres entering the cerebral cortex
 - Thalamocortical



Internal Capsule Fibres

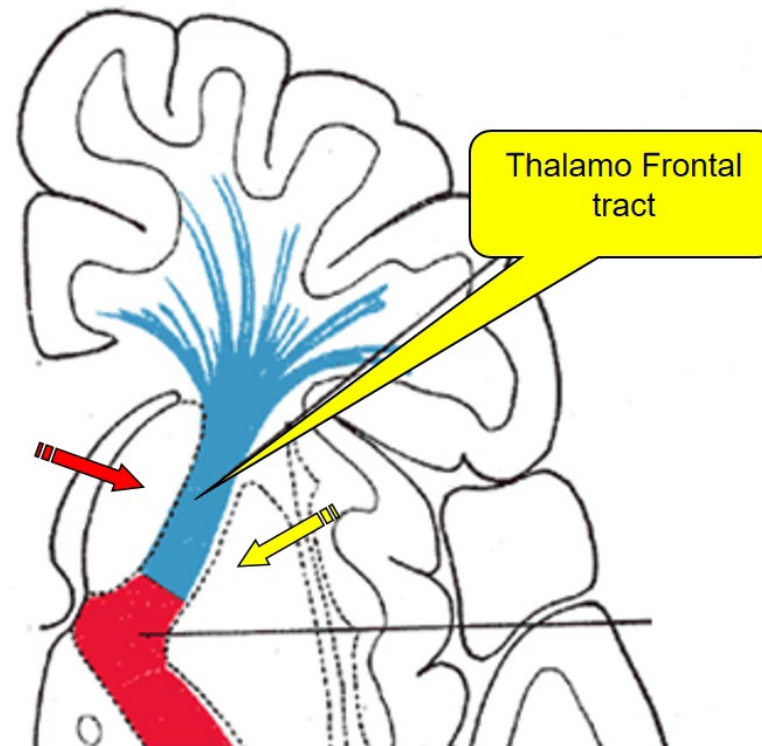
Anterior limb

- Between
 - Head of Caudate Medially
 - Lenticular Nucleus Laterally
- Ascending Fibres
- Descending Fibres



Internal Capsule Fibres

- Ascending Fibres
 - (Anterior Thalamic Radiation)
 - Ant Th Nc → Cingulate G
 - Med Th Nc → Prefrontal Cortex
- Descending Fibres
 - Fronto Pontine Cerebellar f
 - Fronto Nuclear f
 - From area 8
 - III, IV & VI
 - Fronto Tectal f
 - From area 8
 - To Superior Colliculus

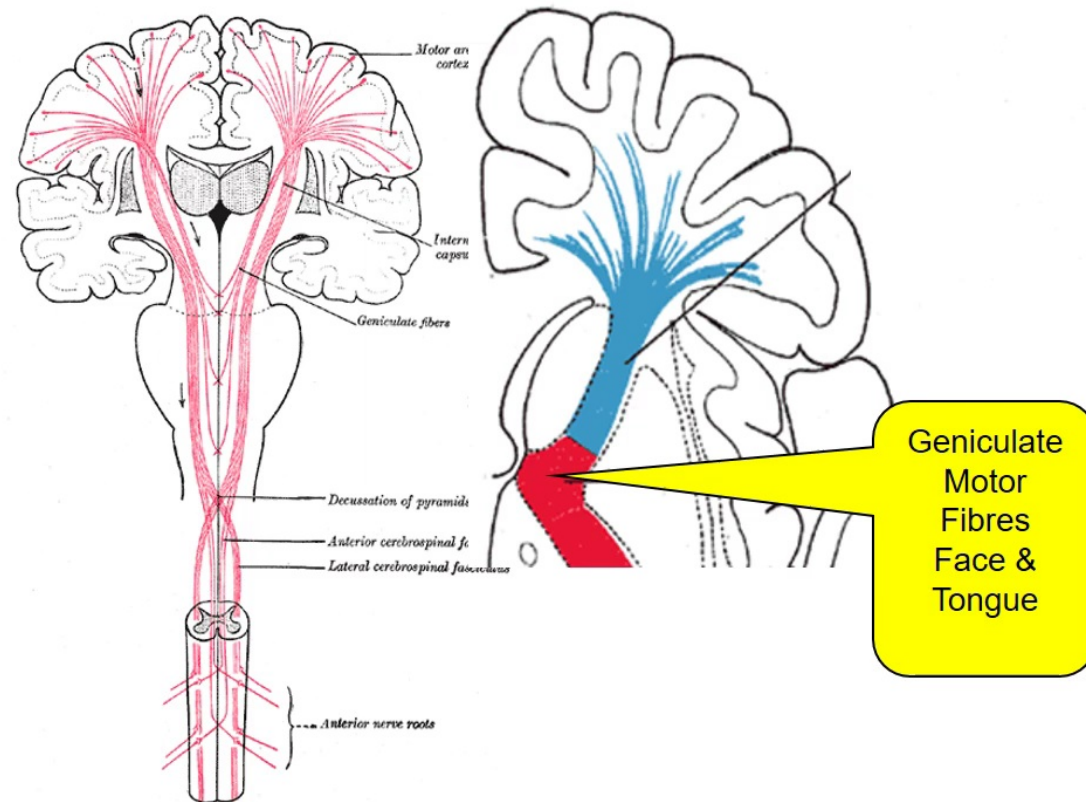


Internal Capsule Fibres

- Genu

At the junction of

- Anterior &
- Posterior limbs
- Motor pyramidal
- Corticobulbar fibres
 - From face area 4
 - To motor Nc of
 - Cranial Nerves



Internal Capsule Fibres

- **Posterior Limb**

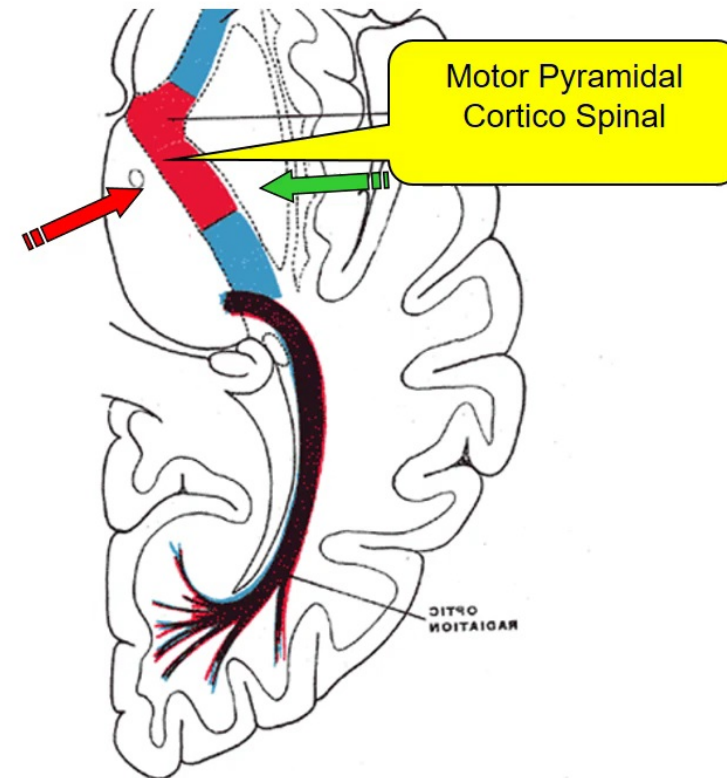
- Thalamus medially
- Lentiform Nc laterally

- 1) **Anterior ½ of posterior limb**

- (Descending Fibres)

- 2) **Posterior ½ of posterior limb**

- (Ascending Fibres)



Internal Capsule Fibres

1) Anterior ½ of posterior limb

- (Descending Fibres)

1) Motor pyramidal

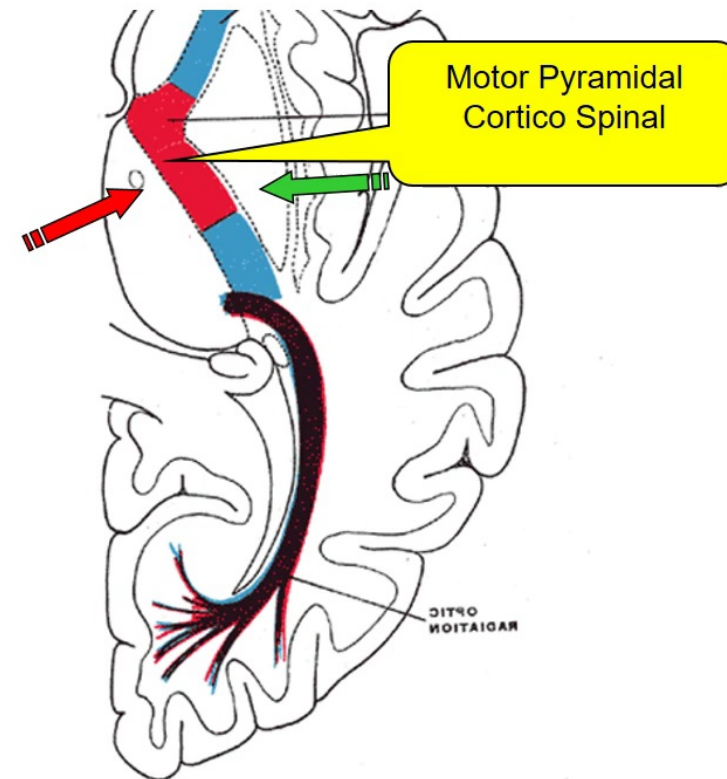
- Corticospinal fibres
 - UL → most anterior
 - LL → most posterior

2) Fronto Pontine fibres

- From area 4 & 6
- To pontine Nc

3) Cortico Rubral

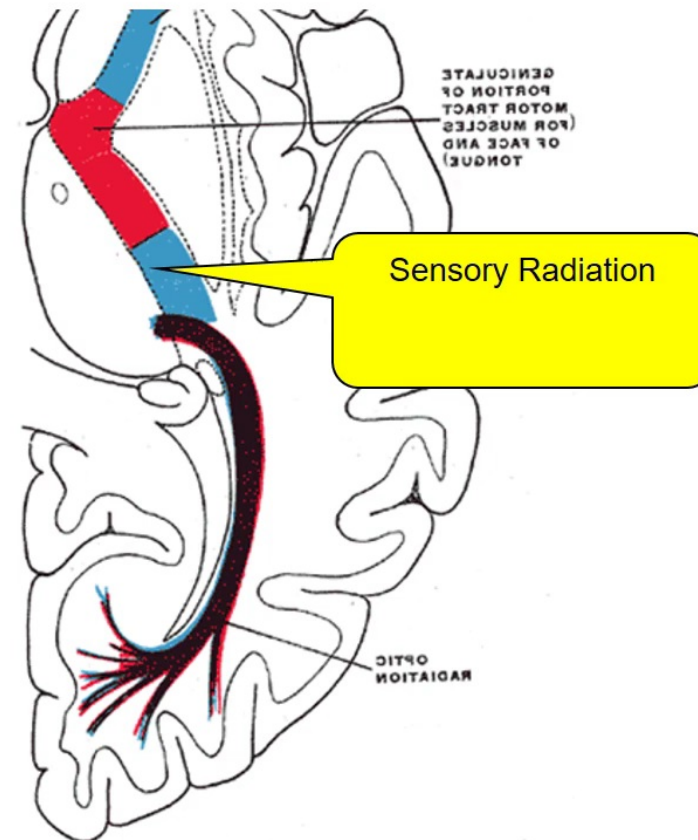
- → Red Nc



Internal Capsule Fibres

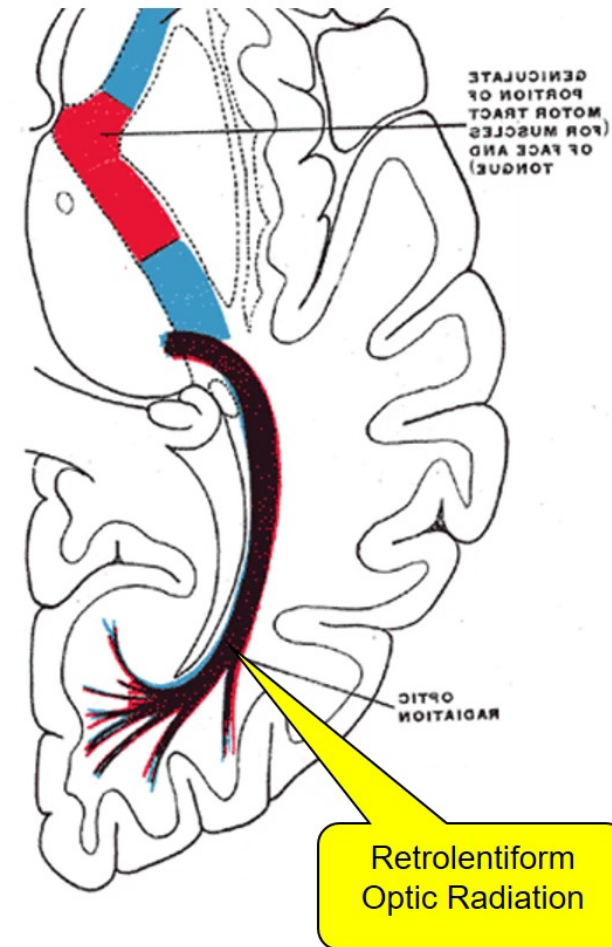
2) Posterior ½ of posterior limb

- (Ascending Fibres)
- Sensory radiation from
 - PLVNT &
 - PMVNT to
 - Main sensory area
- Superior Thalamic Radiation
 - From VPN of Thalamus
 - To S1 in Postcentral Gyrus



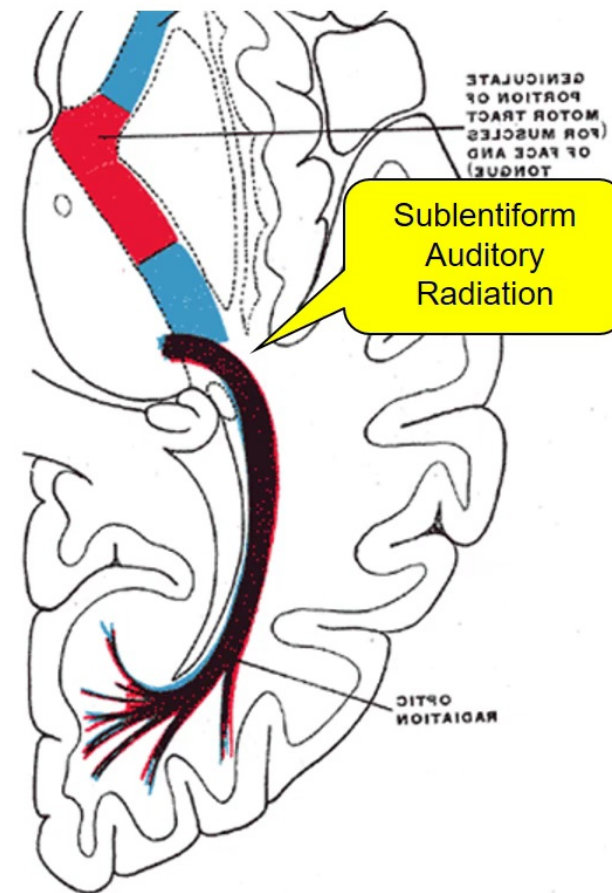
Internal Capsule Fibres

- Retrolentiform part
 - Behind the Lentiform Nc
- Posterior Thalamic Radiation
 - Ascending Fibres
 - Optic radiation
 - from LGB
 - to area 17
 - Pulvinar
 - To Parietal & Occipital Lobes
- Descending Fibres
 - Parieto Pontine
 - Occipito Pontine
 - Occipito Tectal → Sup Colliculus



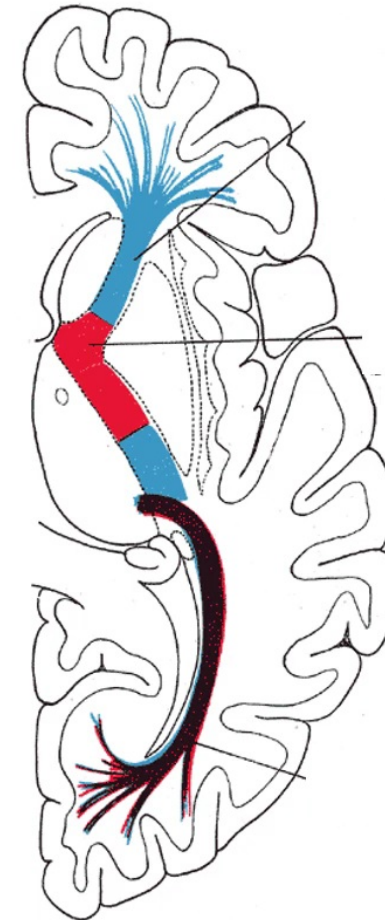
Internal Capsule Fibres

- Sublentiform part
 - Below the Lentiform Nucleus
- Inferior Thalamic Radiation
 - Descending
 - Auditory radiation
 - from MGB
 - to temporal auditory area
- Descending Fibres
 - Temporo Pontine Fibres



Internal Capsule Fibres

- Many extrapyramidal fibres
 - Descend scattered
 - in different parts of
 - Internal capsule
- Due to fibre arrangement
 - Cerebral Hge →
 1. Motor defect > sensory loss
 2. Upper limb paralysis > lower limb

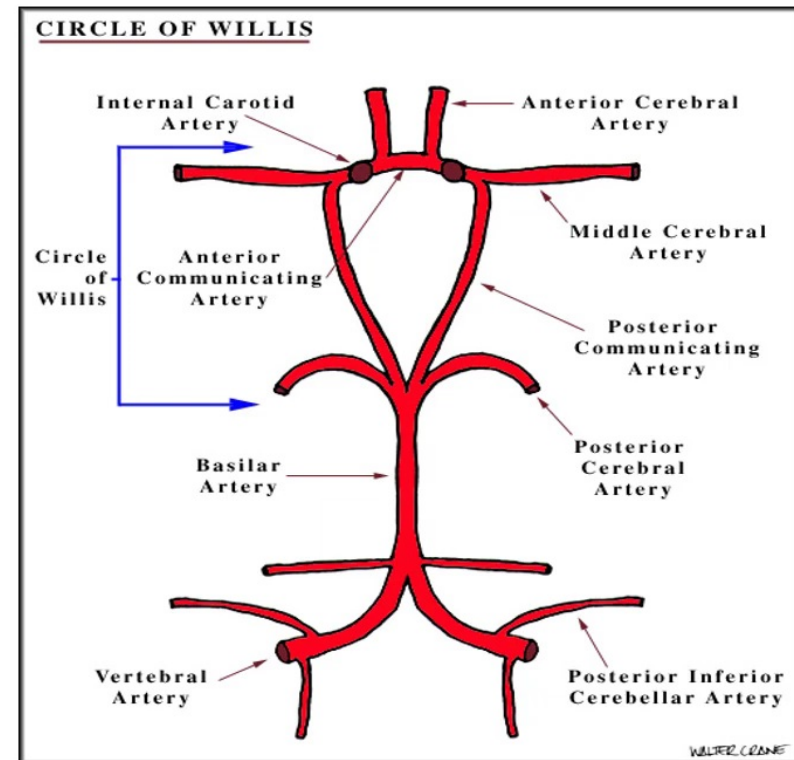


Arterial Blood Supply of the Internal Capsule

The internal capsule is supplied by

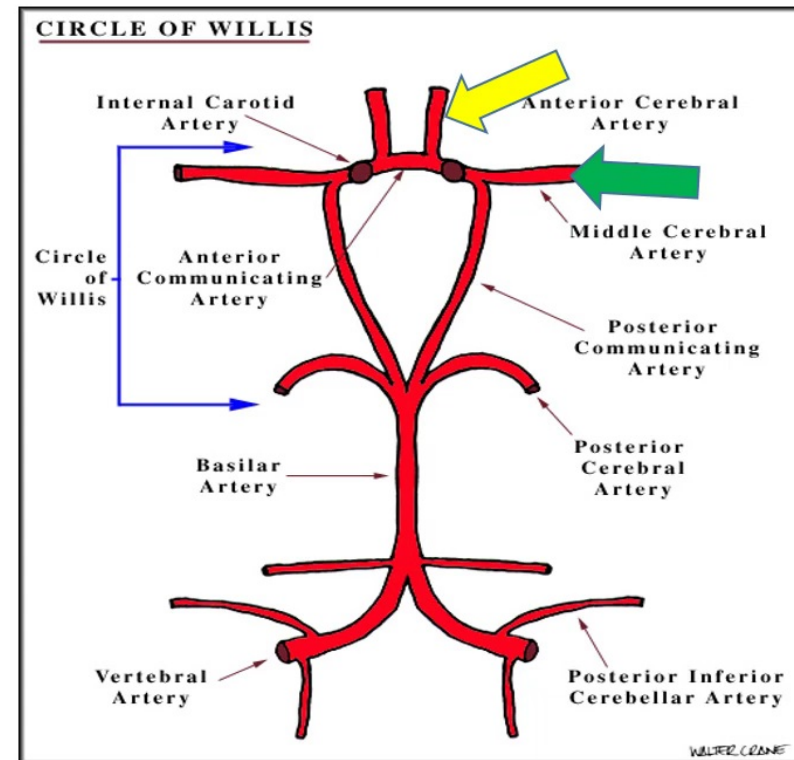
- 4 sets of
- Central branches:

1. The Anterior Cerebral Artery
2. The Middle Cerebral Arteries
3. The Posterior Communicating Artery
4. The Anterior Choroidal Artery (ICA)



Arterial Blood Supply of the Internal Capsule

- The anterior cerebral artery
 - Medial striate branches →
 1. Lower $\frac{1}{2}$ of the Anterior Limb
 2. Genu
- The middle cerebral arteries
 - Lateral striate branches →
 1. Upper $\frac{1}{2}$ of the Anterior Limb
 2. Upper $\frac{1}{2}$ of the Posterior Limb



Arterial Blood Supply of the Internal Capsule

- The Posterior Communicating Artery

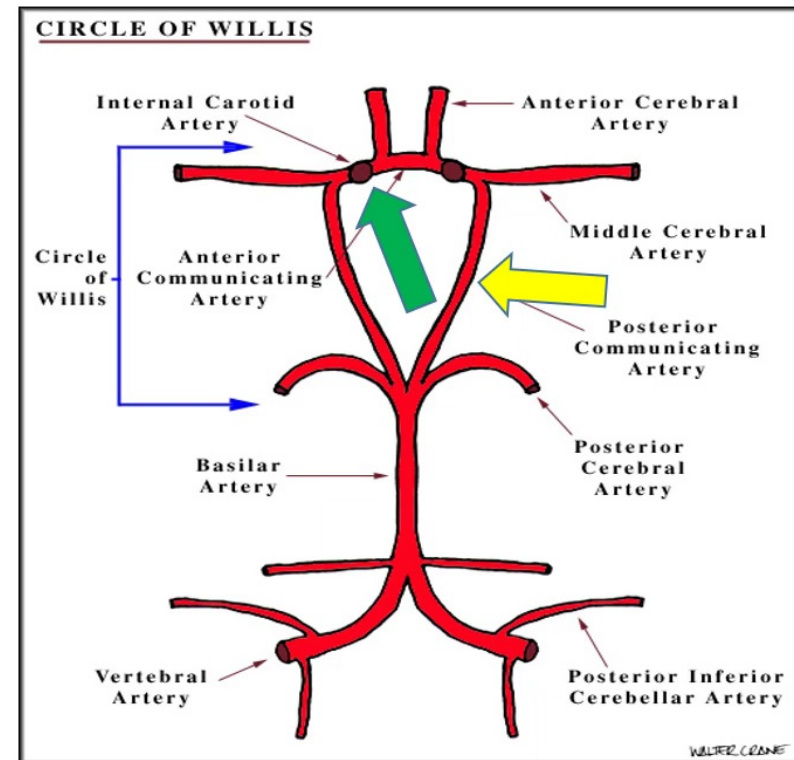
- Anterior 1/3 of the
- Lower 1/2 of the
- Posterior Limb

- The Anterior Choroidal Artery (ICA)

- 1) Posterior 2/3 of the
- Lower 1/2 of the
- Posterior Limb

2) Retro lenticular part (Optic Radiation)

3) Sub lenticular part (Auditory Radiation)



Arterial Blood Supply of the Internal Capsule

- The Middle Cerebral Arteries
 - Lateral striate branches →
 1. Upper ½ of the Anterior Limb
 2. Upper ½ of the Posterior Limb
- The Anterior Cerebral Artery
 - Medial striate branches →
 1. Lower ½ of the Anterior Limb
 2. Genu
- The Posterior Communicating Artery
 1. Anterior 1/3 of the Lower ½ of the Posterior Limb
- The Anterior Choroidal Artery (ICA)
 1. Posterior 2/3 of the Lower ½ of the Posterior Limb
 2. Retrolenticular part (Optic Radiation)
 3. Sublenticular part (Auditory Radiation)

