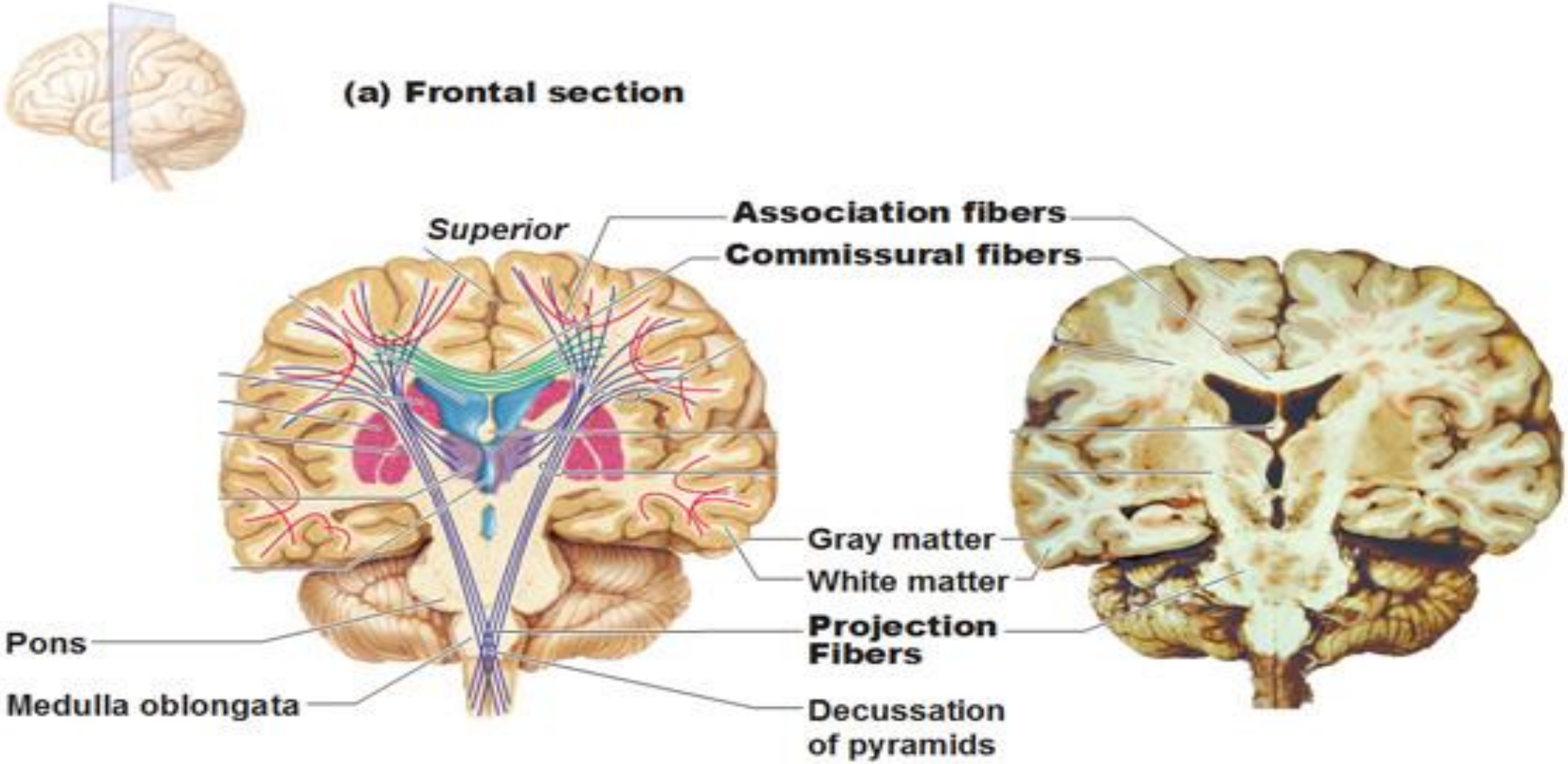
Corpus Callosum

Meysam Mohammadi

Neuroscientist

Cerebral White Matter – 3 types of fibers



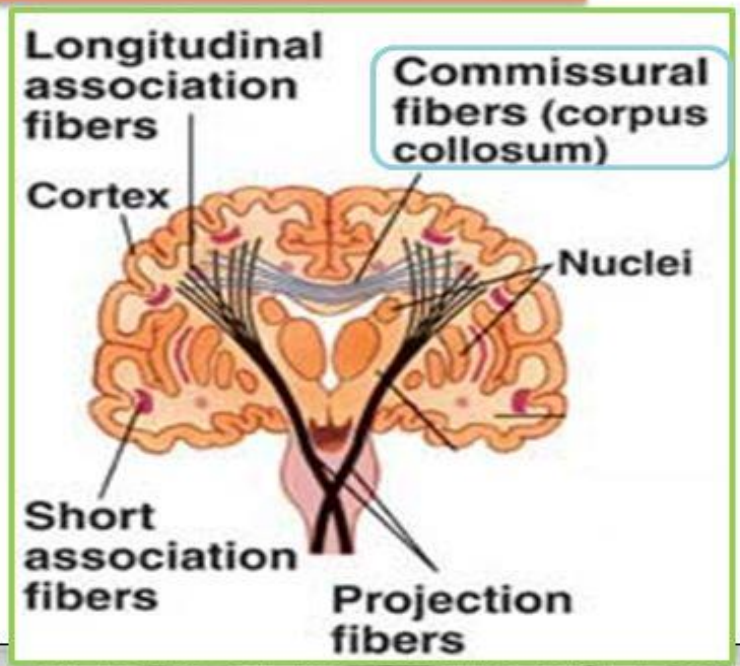
Commissural Fibers

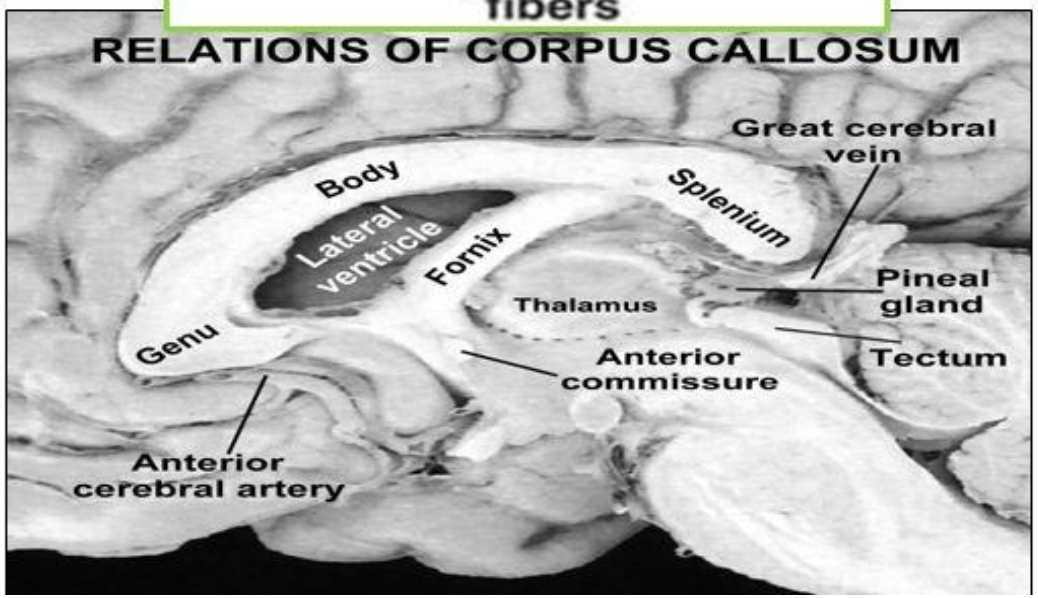
Definition:

They connect the same cortical areas of the two cerebral hemispheres.

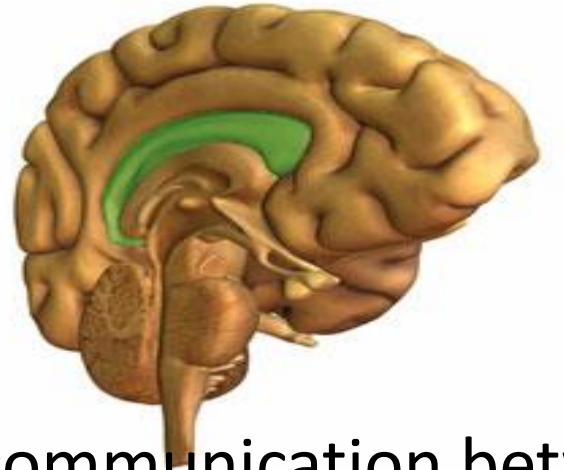
Types: 5

1. Corpus callosum.
2. Anterior commissure.
3. Posterior commissure.
4. Hippocampal commissure.
5. Habenular commissures.



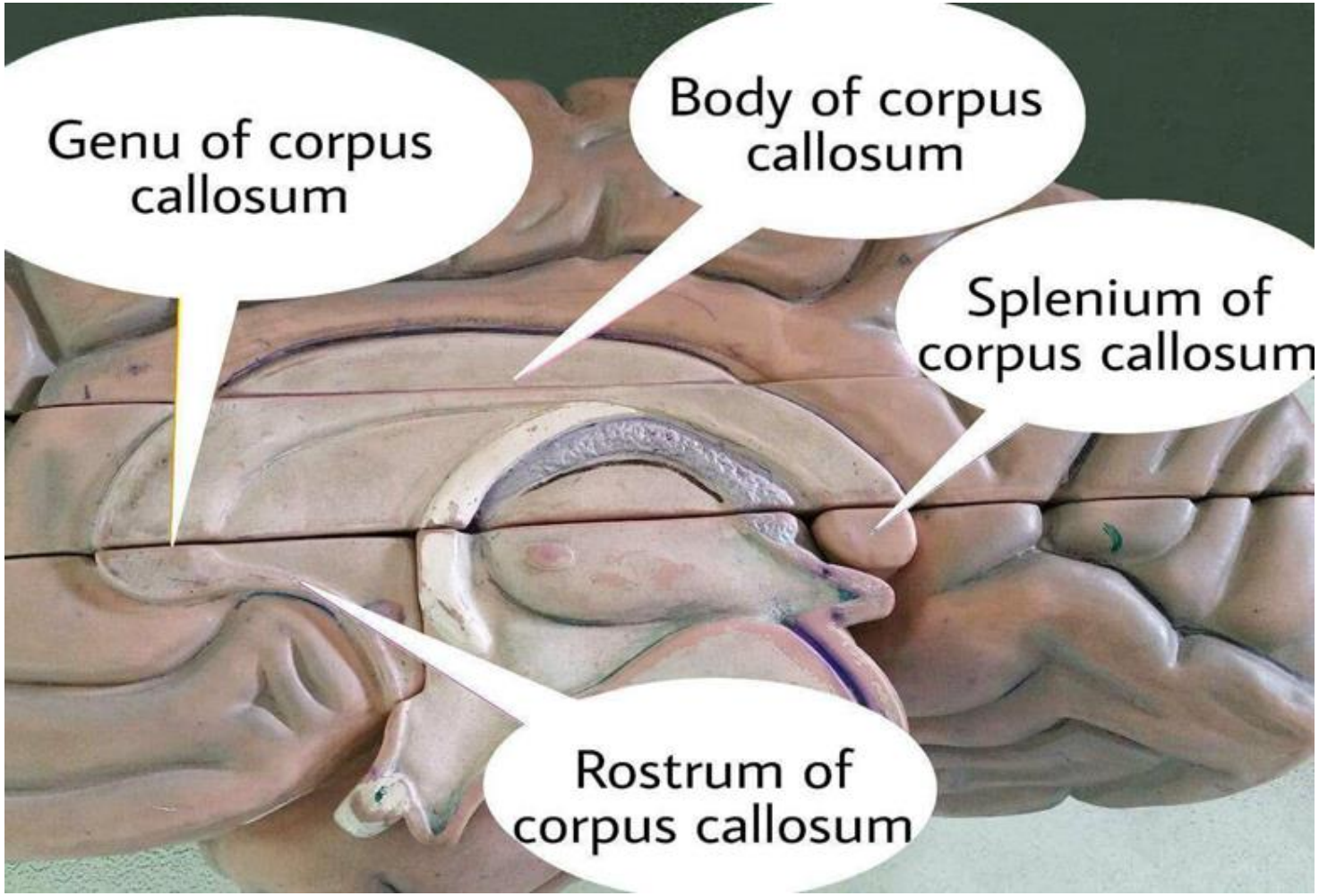


Corpus Callosum



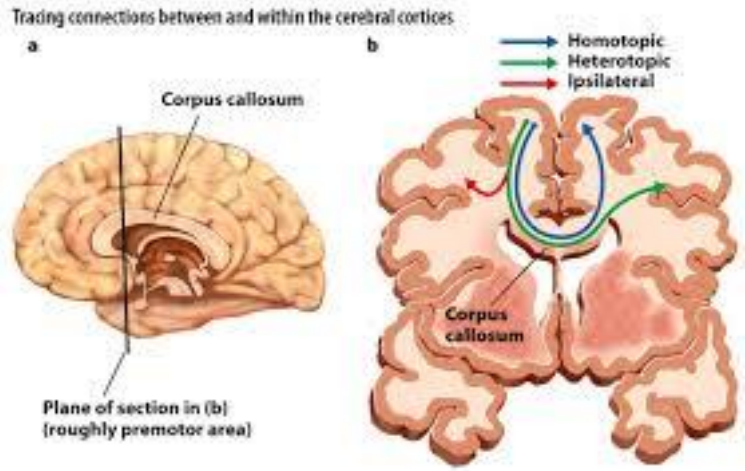
- This thick band of nerve fibers allows the communication between both hemispheres.
- **Dense myelinated fibers**
- responsible for transmitting sensory, motor, and cognitive information between both halves of the brain.
- It is the most extensive connective pathway in the brain, with about **200 million axonal projections** in the middle of two hemispheres.
- It occupies the center of the brain and almost 10 cm in length.

- The word "***Corpus Callosum***" comes from the Latin word corpus meaning "***body***" and callosum, meaning "tough or hard."



Homotopic or Heterotopic

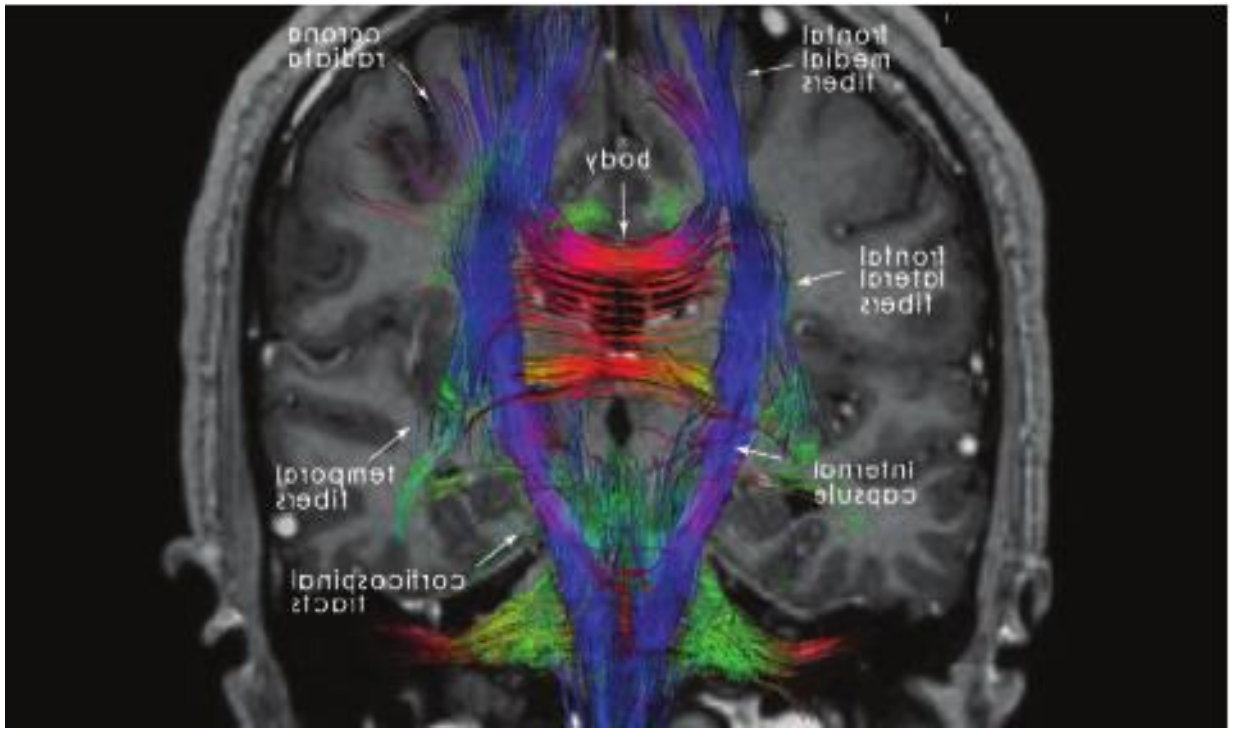
Homotopic connections
connect the similar areas of the left side of the brain with the right side.

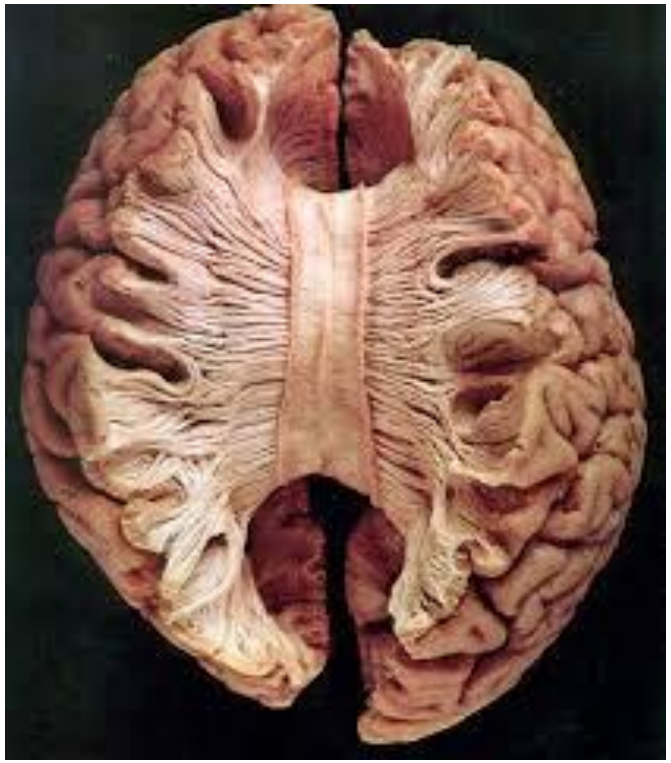


Heterotopic connections
connect the different areas of both sides of the brain hemispheres.

Location

- The Corpus callosum is found under the **cerebrum**, resides within the interhemispheric fissure at the midline of the brain. The interhemispheric fissure is a deep furrow that separates the brain into left and right hemispheres.





Rostrum

The rostrum is continuous with lamina terminals and connects the orbital surfaces of frontal lobes.

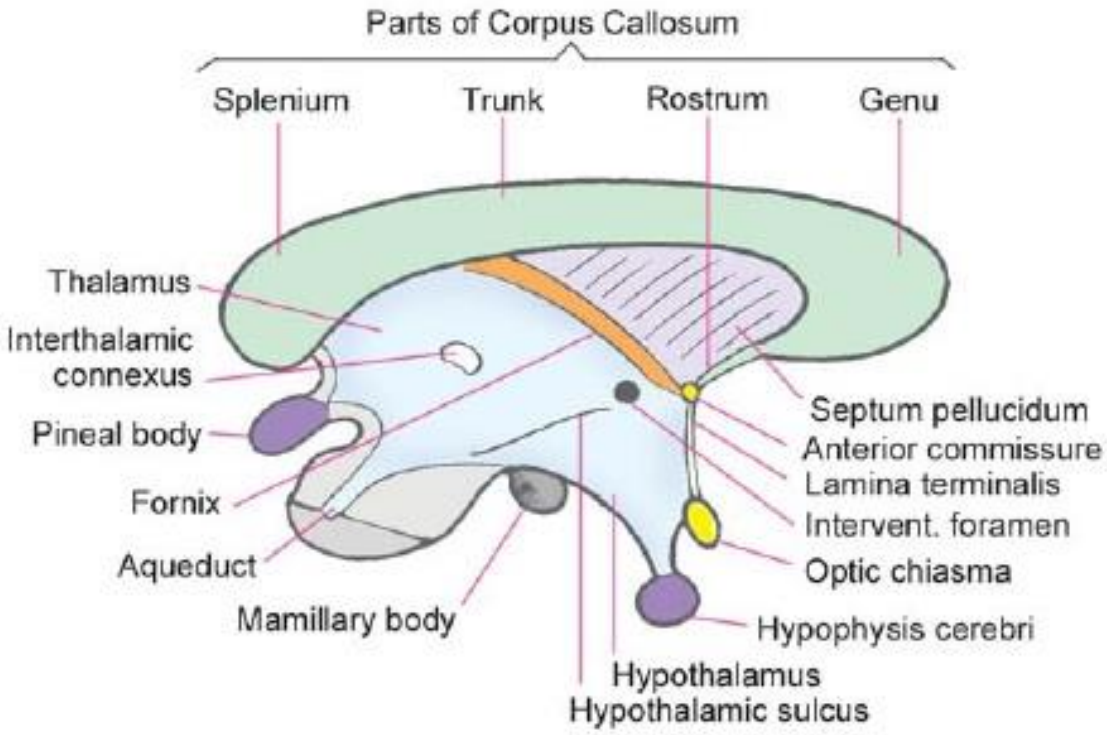


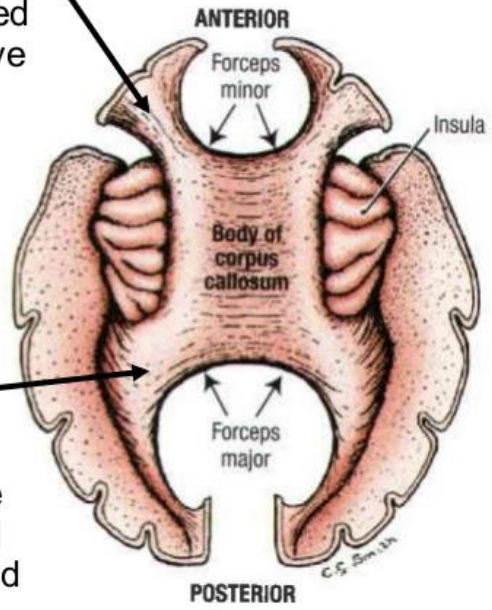
Fig. 8.6. Enlarged view of part of Fig. 8.5 to show some structures to be seen on the medial aspect of the cerebral hemisphere.

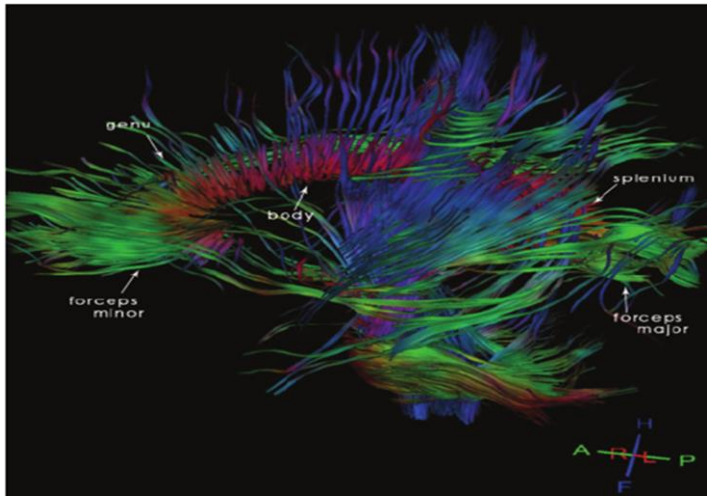
It has a resemblance to a bird's beak; that why it's called rostrum

Genu

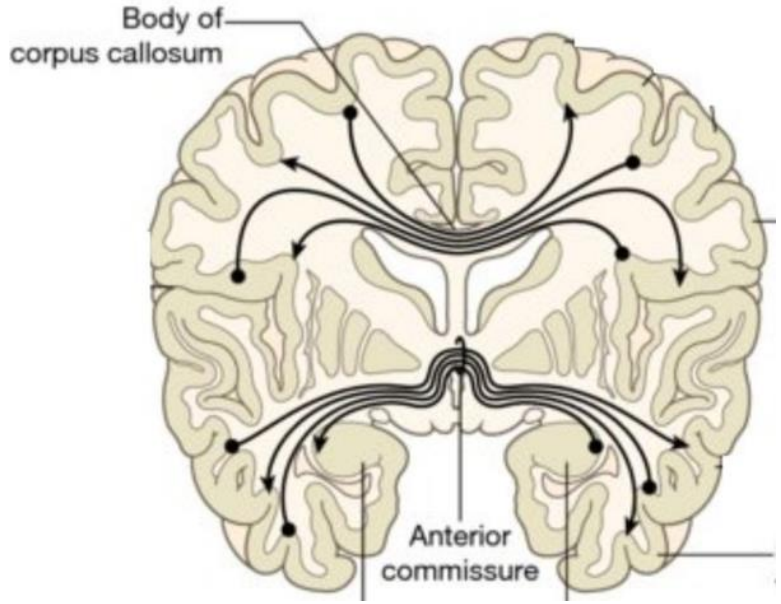
The genu is an outgrowth of the anterior corpus callosum. A tract called “**forceps minor**” extends fibers from the genu and connects the lateral and medial surfaces of frontal lobes

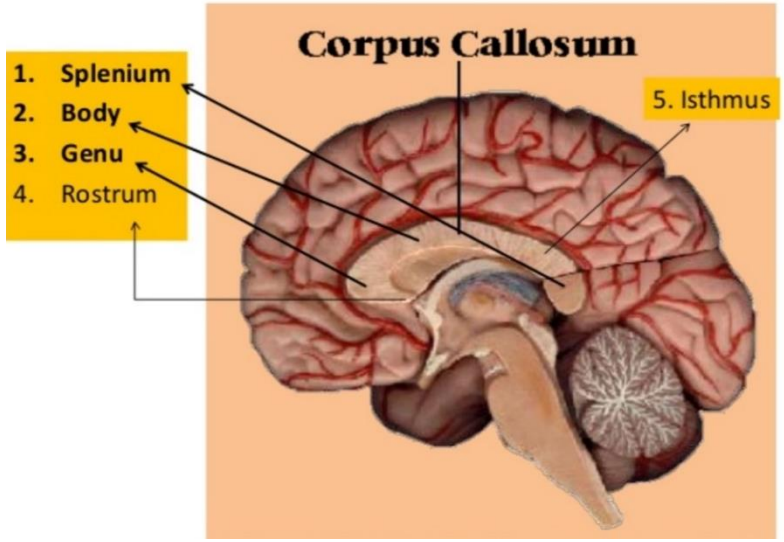
- **Forceps minor** : the fibers directed laterally of the genu curve forward into the frontal lobes
- **Radiation of Corpus Callosum** The fibers of the body extend laterally.
- **Forceps major** : Traced laterally, the fibers in the splenium arch backward into the occipital lobe and form the.





Body

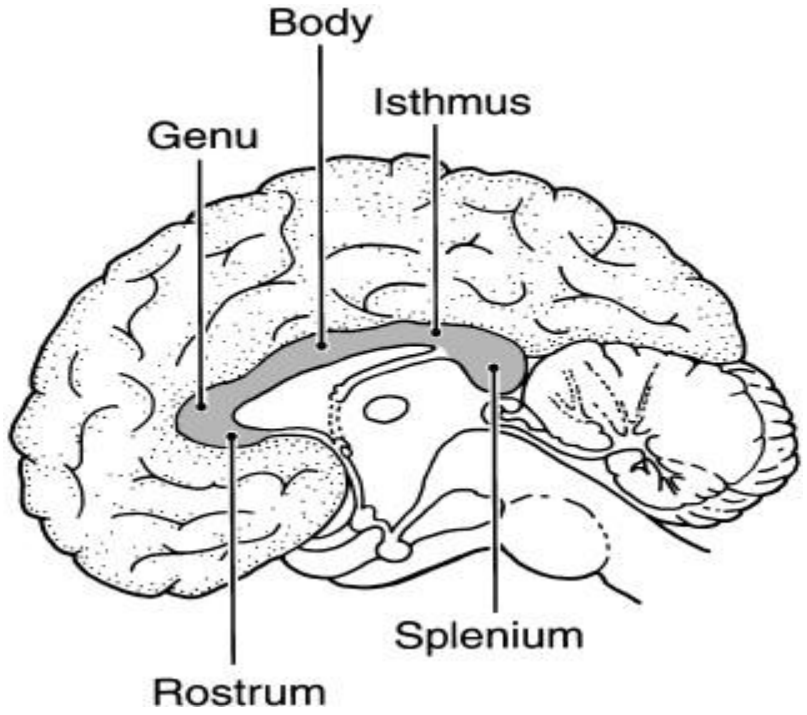




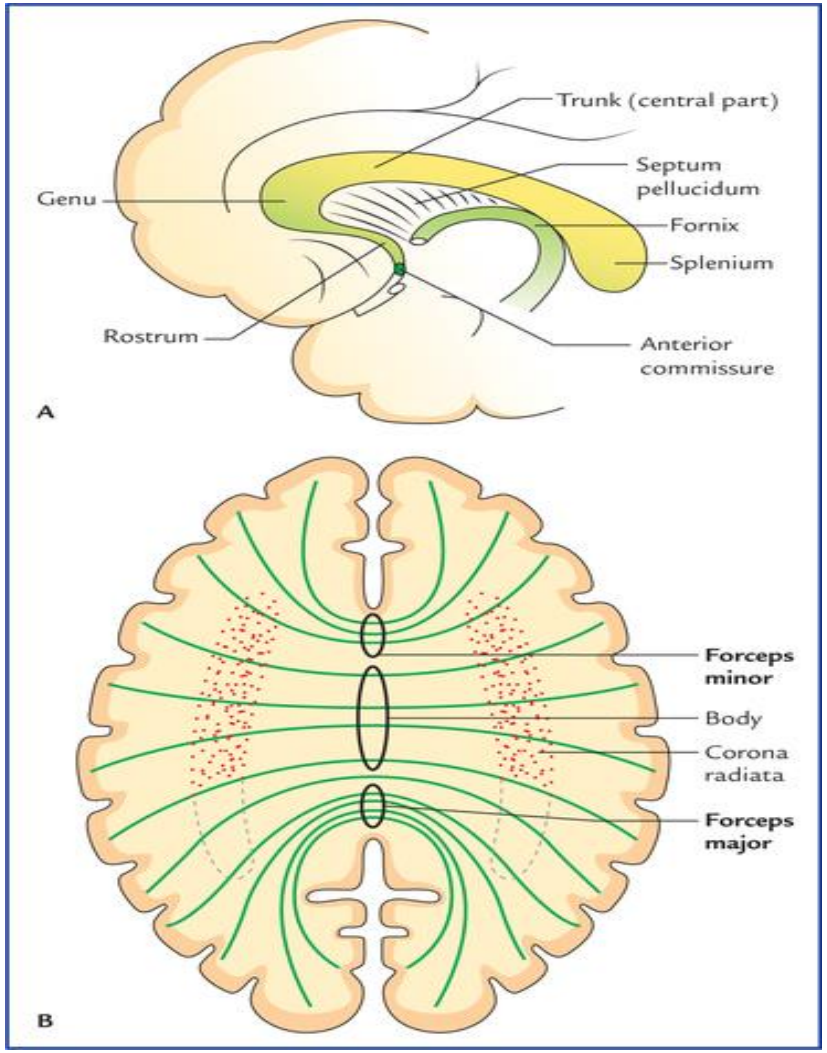
The long central section is called the body, and its fibers extend to the surface of the hemispheres

Isthmus

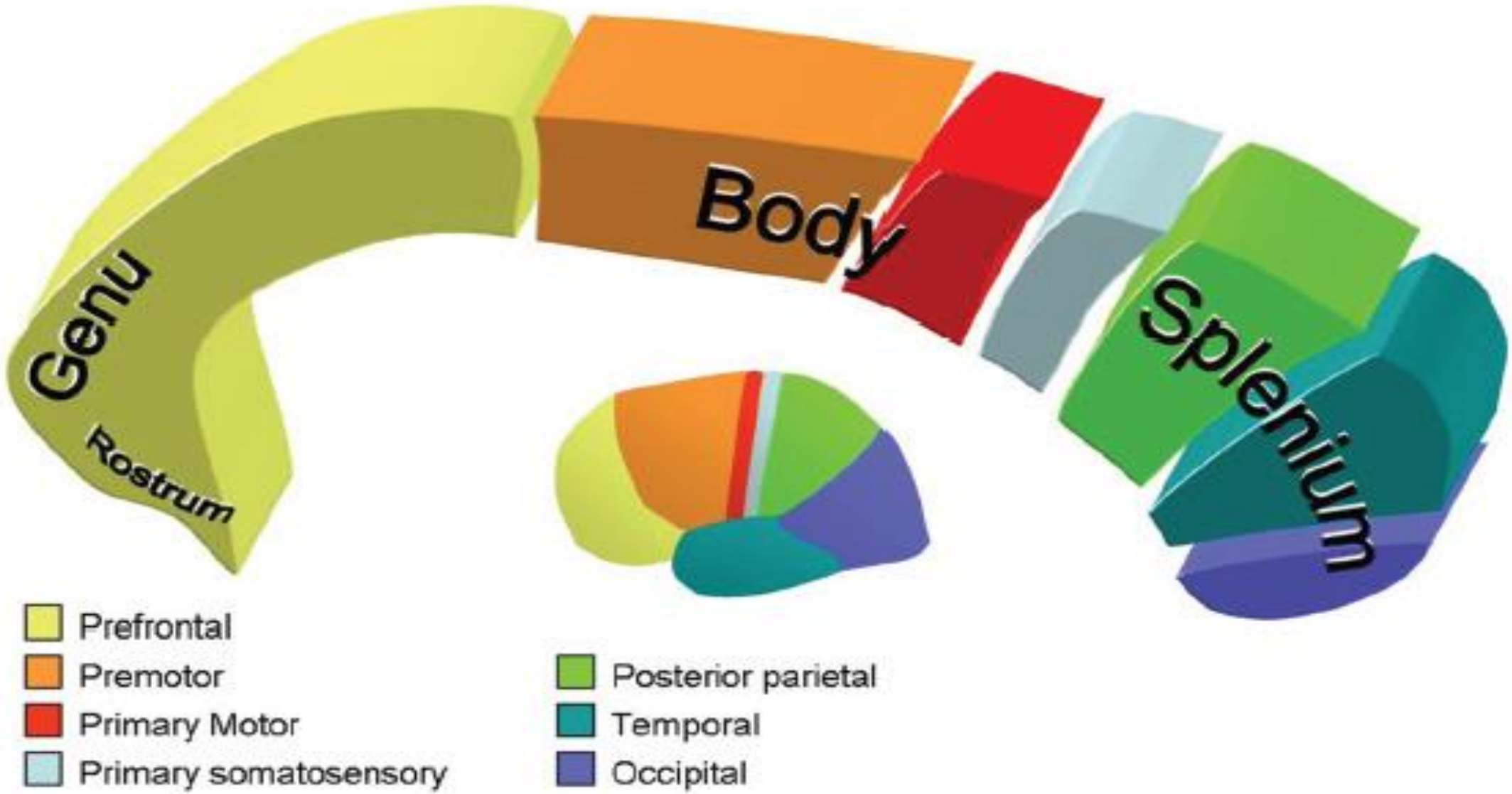
A narrowed part between splenium and body



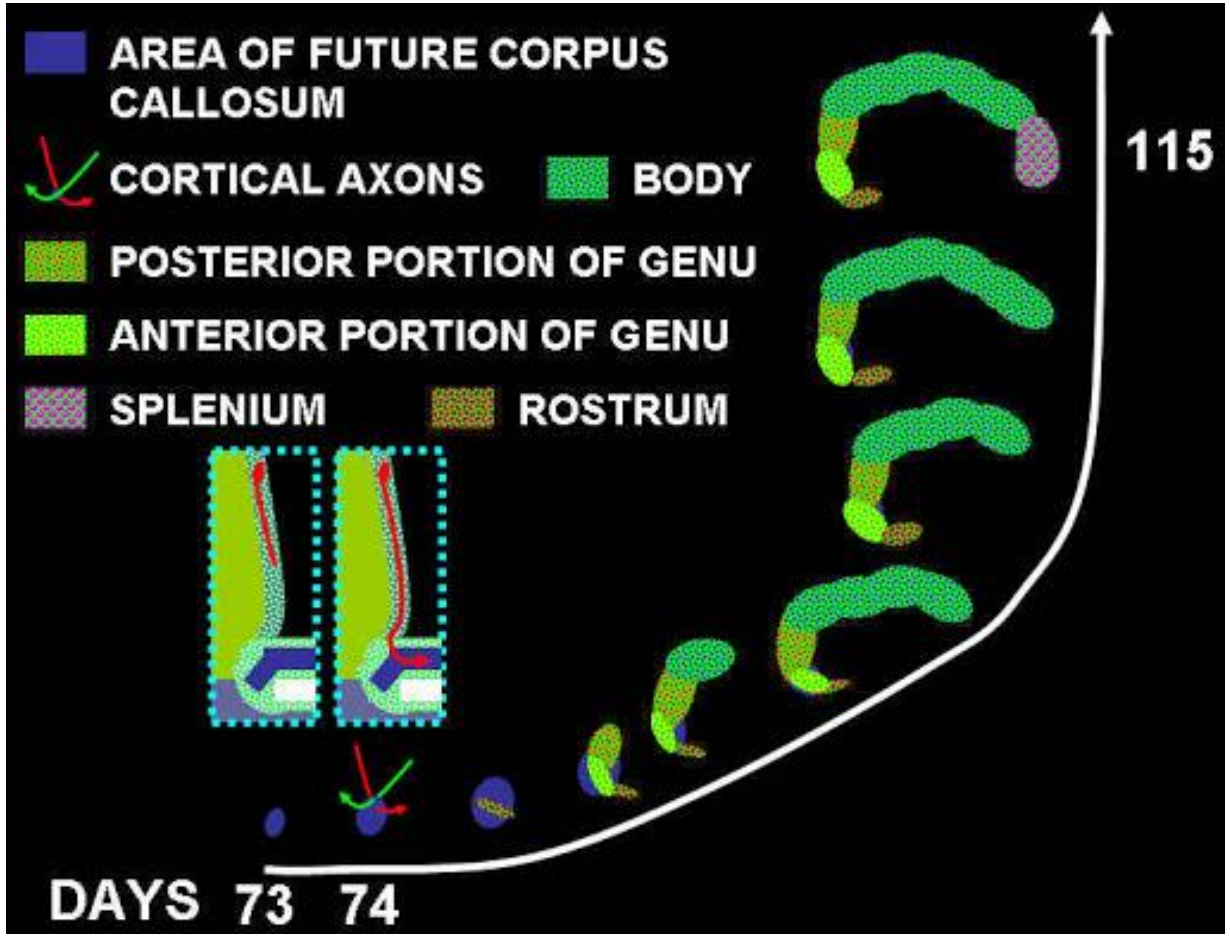
Splenium

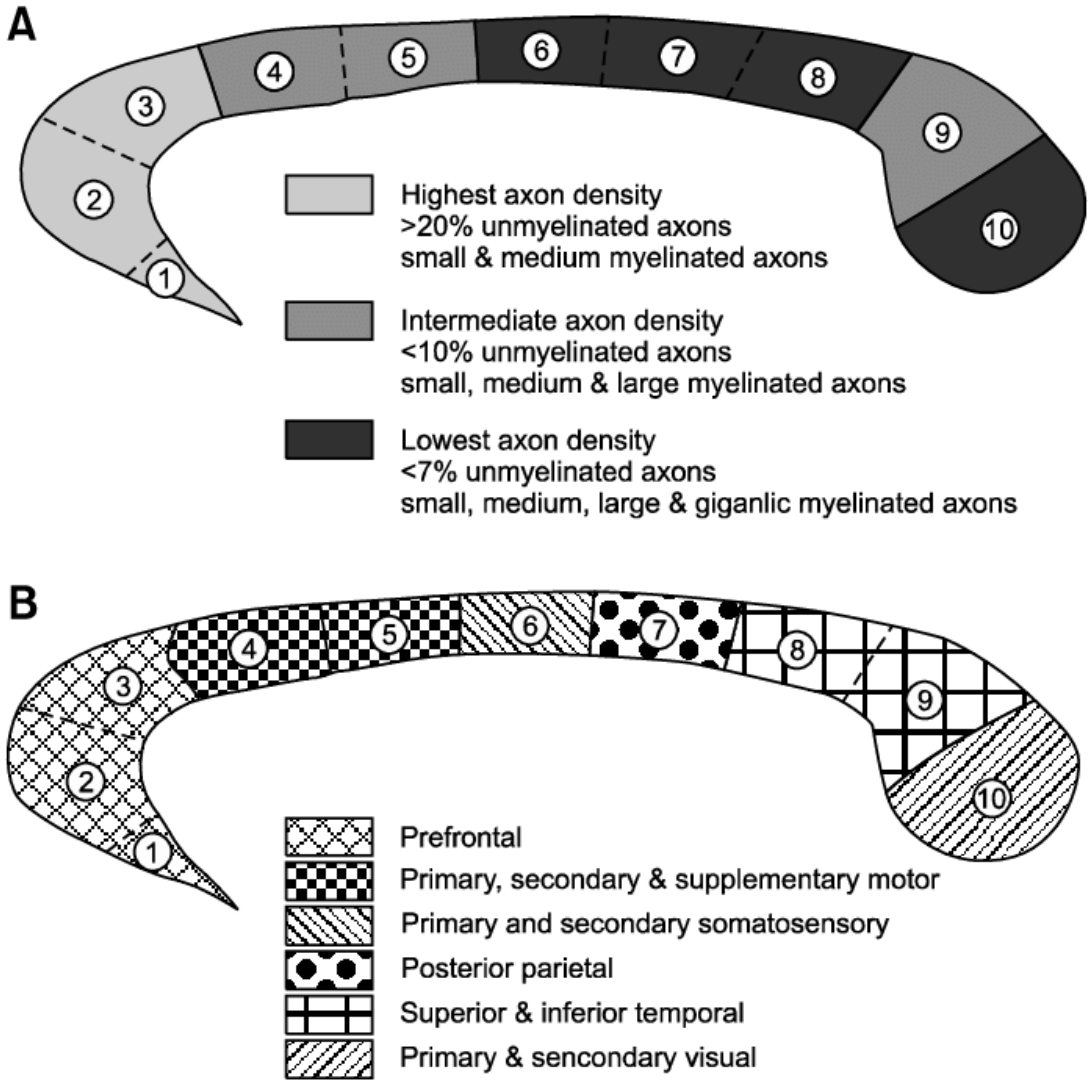

Trunk (central part)
Septum pellucidum
Genu
Fornix
Splenium
Rostrum
Anterior commissure
A
Forceps minor
Body
Corona radiata
Forceps major
B

Approximate location of cortical connections within the corpus callosum



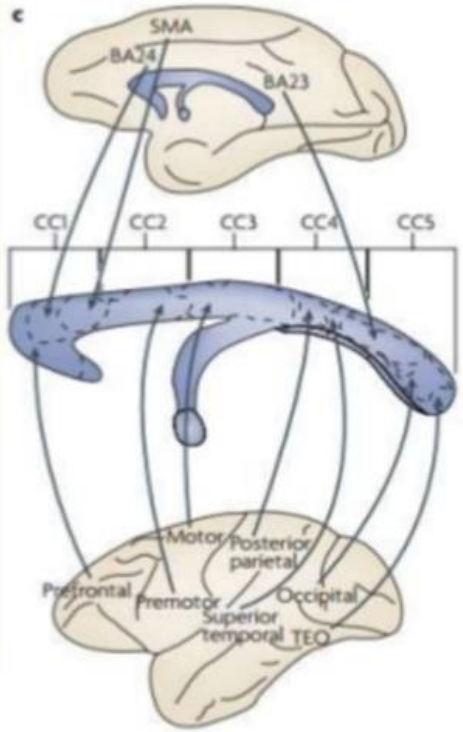
Development and Myelination





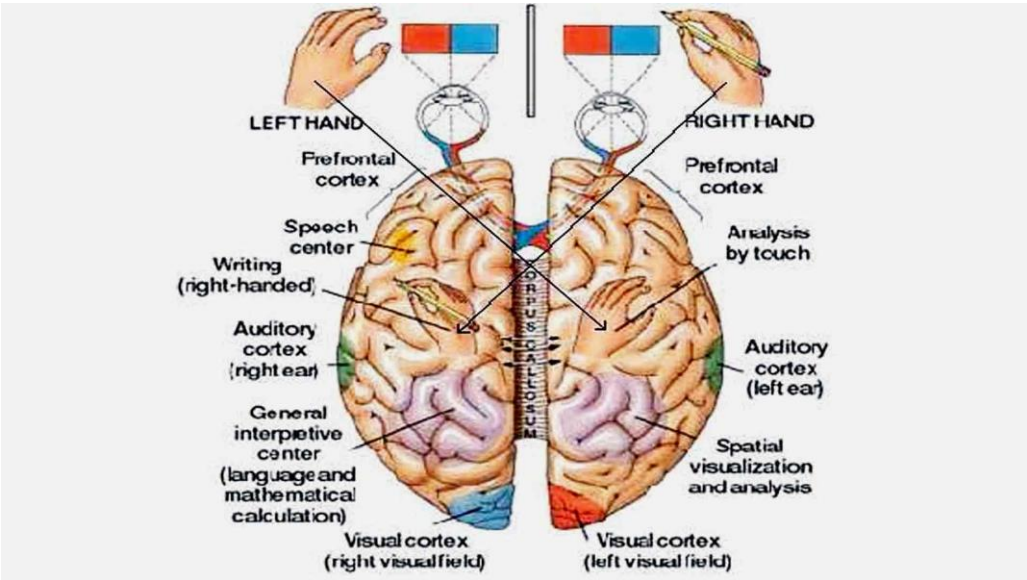
Functions of Corpus Callosum

- The primary **purpose of the corpus callosum** is to integrate the information by joining both cerebral hemispheres to process motor, sensory, and cognitive signals. It connects the similar areas of the brain and transmits the information across the left and right hemispheres.
- For instance, rostrum and genu connect the frontal horns of right and left hemispheres while body and splenium connect the temporal and occipital lobes of both hemispheres. Similarly, by connected similar areas brings harmonization of their functions.



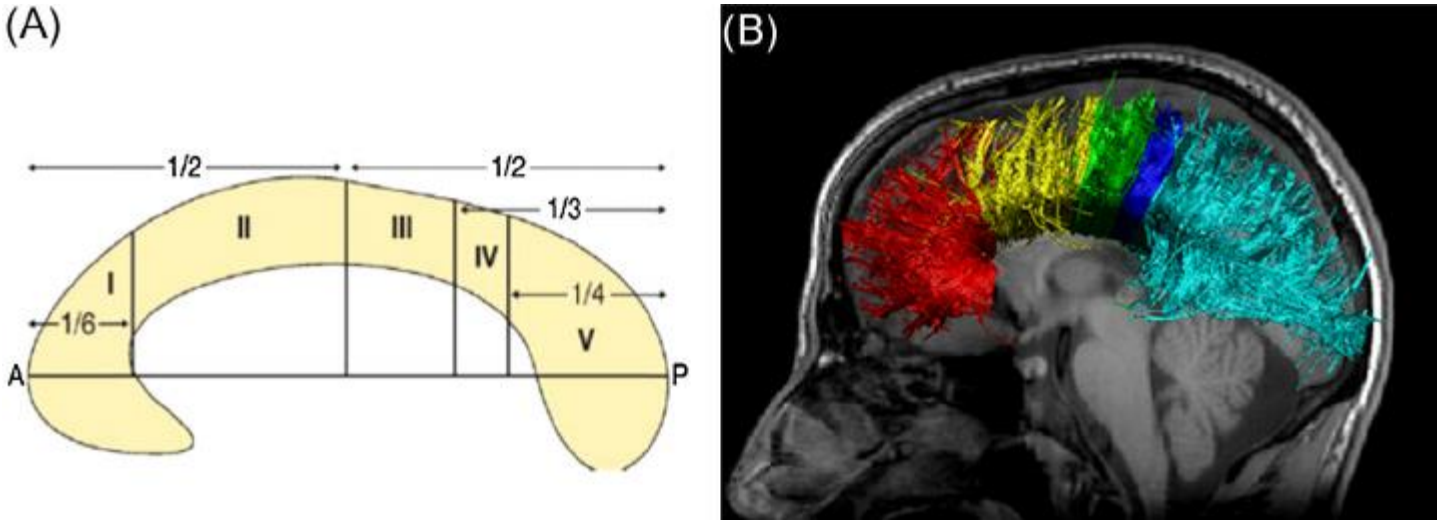
- Corpus callosum plays a crucial role in eye movement and vision by connecting both halves of the hemispheres of the visual field.

- Identifying objects by connecting the visual cortex in brain language centers.



- **Maintaining the balance of attention, arousal and cognition**.

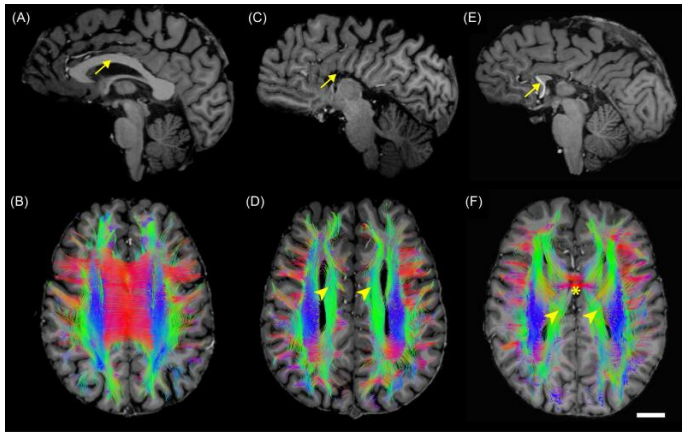
- Increase in callosum thickness helps in those **brain areas development**, which correlates with intelligence, problem-solving activities, and processing speed.



Clinical Significance

- Corpus Callosum is a **significant part of the brain** and integrates and transmits information between the left and right hemispheres.

- Any defect in the corpus callosum leads to distraction in brain communication, which causes severe consequences.



- **Anomic Aphasia**

- **Alexia without Agraphia**

(damage to the splenium of corpus callosum)

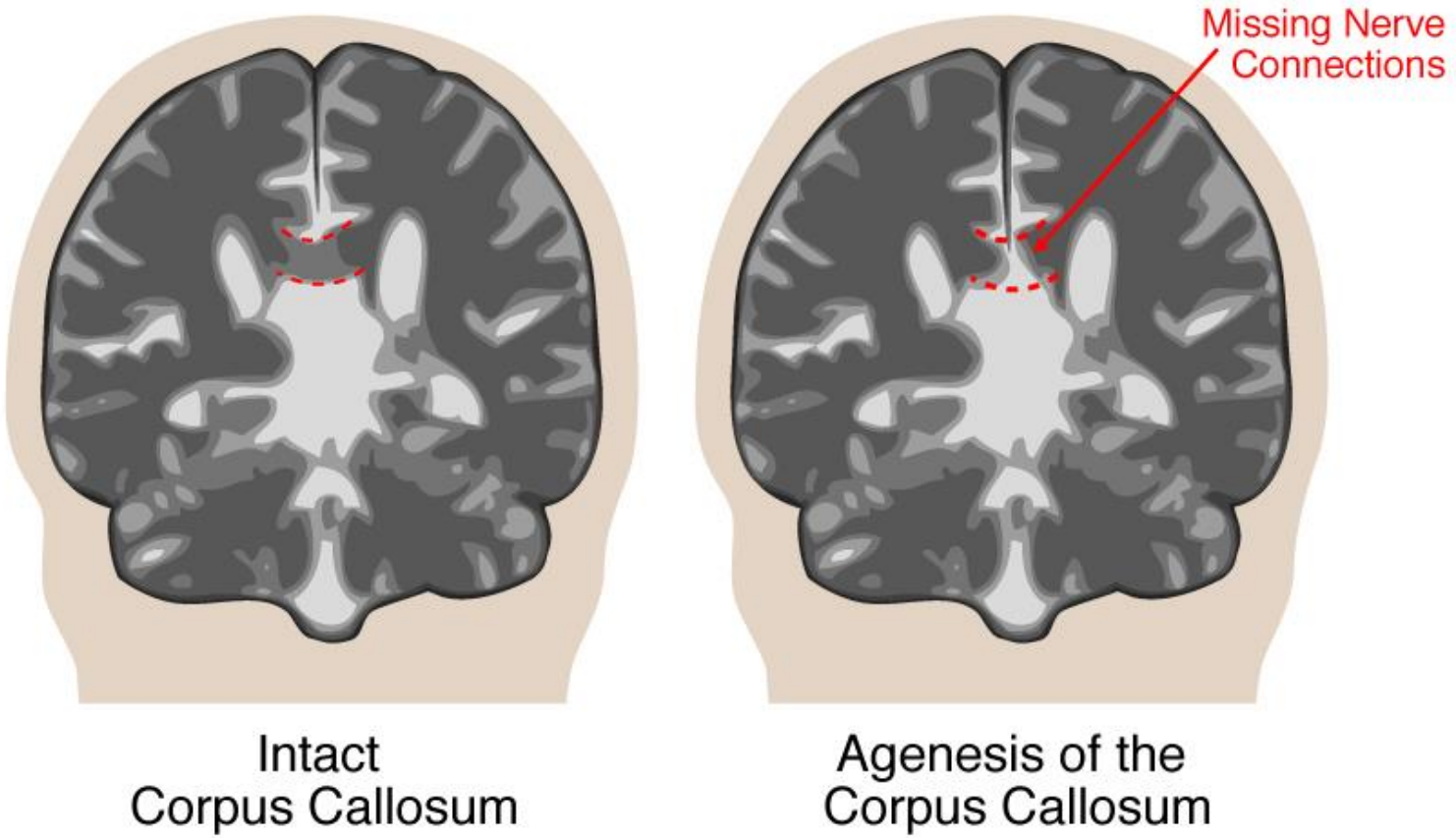
- **Marchiafava–Bignami (A degenerative disease caused by loss of myelin and necrosis of the corpus callosum)**

- **Multiple sclerosis with Dawson's fingers sign**
- **Susac's syndrome (Caused by lesions in the corpus callosum)**

Agenesis of corpus callosum

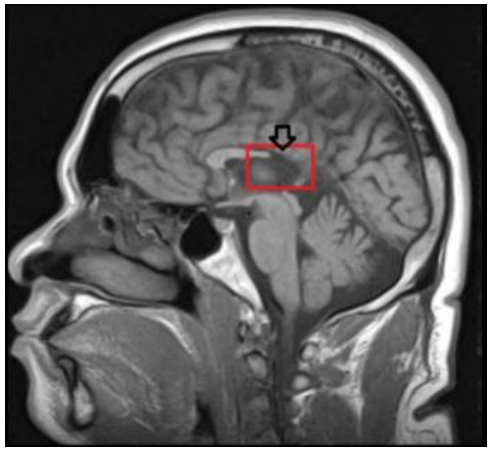
Causes:

(ACC) occurs due to different factors such as genetic inheritance, chromosome mutations, and parental infections.



Agenesis of corpus callosum

- **Symptoms**
- Individuals with ACC experience delay cognitive and communication development, difficulty in understanding social behaviors, chewing difficulty, hearing problem, vision impairment, low muscle tone, lack of movement coordination such as sitting or walking, seizures, spasms, and distorted head or facial features.



- MRI