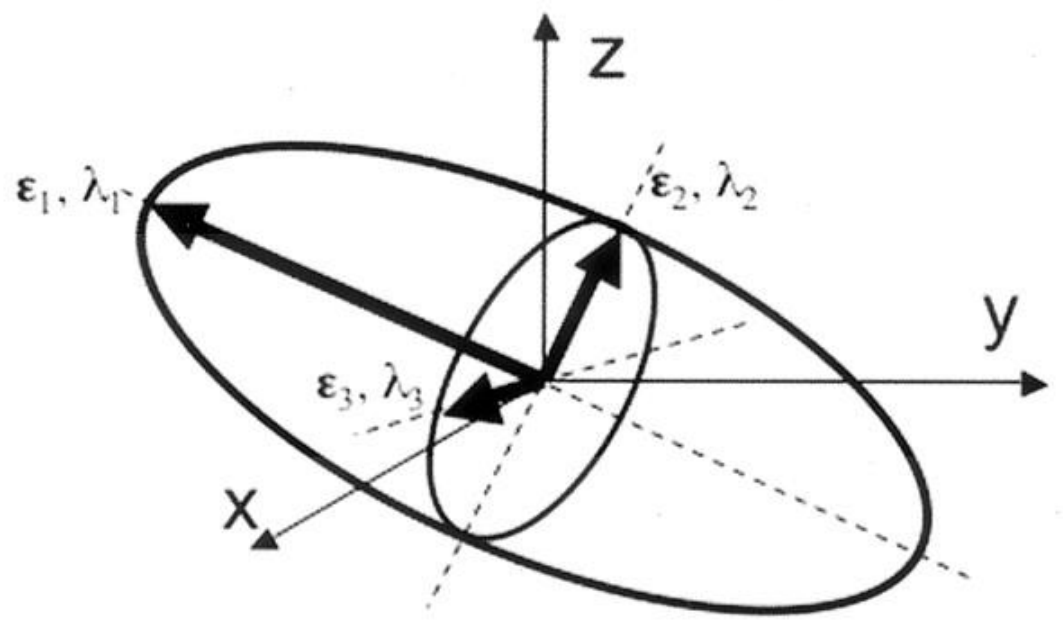
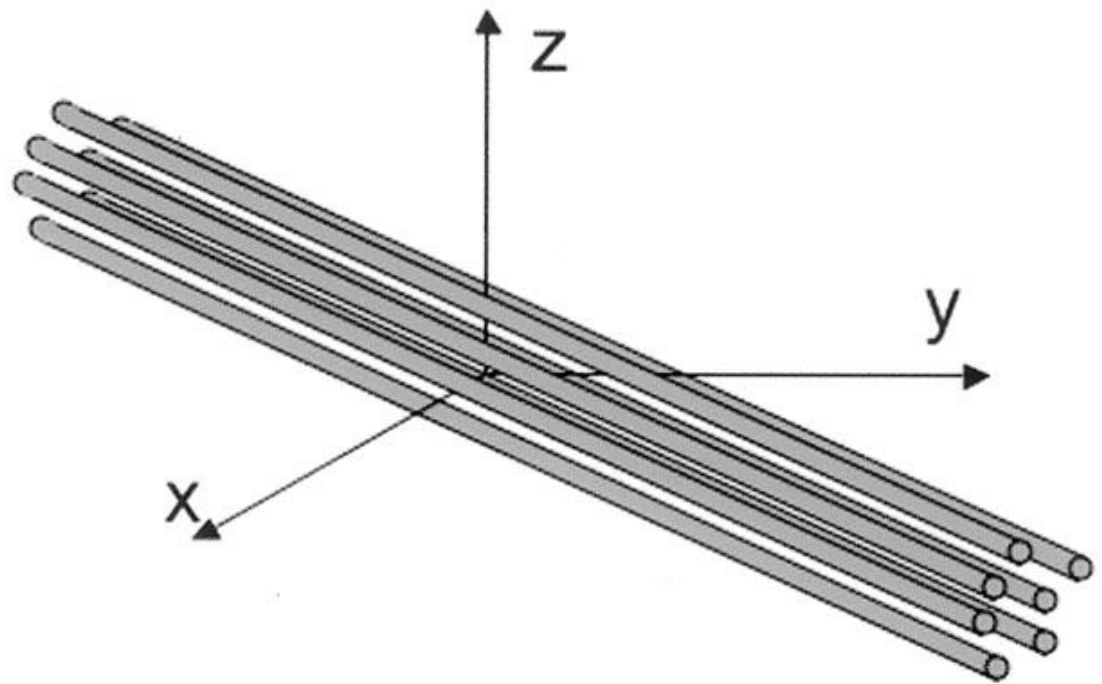


A dramatic landscape view from a narrow canyon opening. The foreground is dominated by dark, textured rock walls on either side, framing a view of a vast, rugged mountain range in the distance. The sky is a deep, clear blue. The overall scene conveys a sense of grandeur and natural beauty.

In the name of God

Dr Aidin Taghiloo, radiologist
Arad general hospital



$$\mathbf{D} = \begin{pmatrix} D_{xx} & D_{xy} & D_{xz} \\ D_{yx} & D_{yy} & D_{yz} \\ D_{zx} & D_{zy} & D_{zz} \end{pmatrix} = \mathbf{E}^T$$

Tensor derived from
directional diffusivities
(ADC's)

$$\begin{pmatrix} \lambda_1 & 0 & 0 \\ 0 & \lambda_2 & 0 \\ 0 & 0 & \lambda_3 \end{pmatrix} \mathbf{E}$$

Eigenvalues

Matrix of 3
eigenvectors

FA < 0.2
Angle > 45°



WM Fiber Classification

Association fibers

Projection fibers

Commissural fibers



Association fibers interconnect cortical areas in each hemisphere.

Fibers of this type include:

1-cingulum,

2,3-superior and inferior occipitofrontal fasciculi,

4-uncinate fasciculus,

5-superior longitudinal (arcuate) fasciculus, and

6-inferior longitudinal (occipitotemporal) fasciculus



***Projection fibers* interconnect cortical areas with deep nuclei, brain stem, cerebellum, and spinal cord.**

1-corticospinal,

2-corticobulbar, and

3-corticopontine tracts,

4-geniculocalcarine tracts (optic radiations).



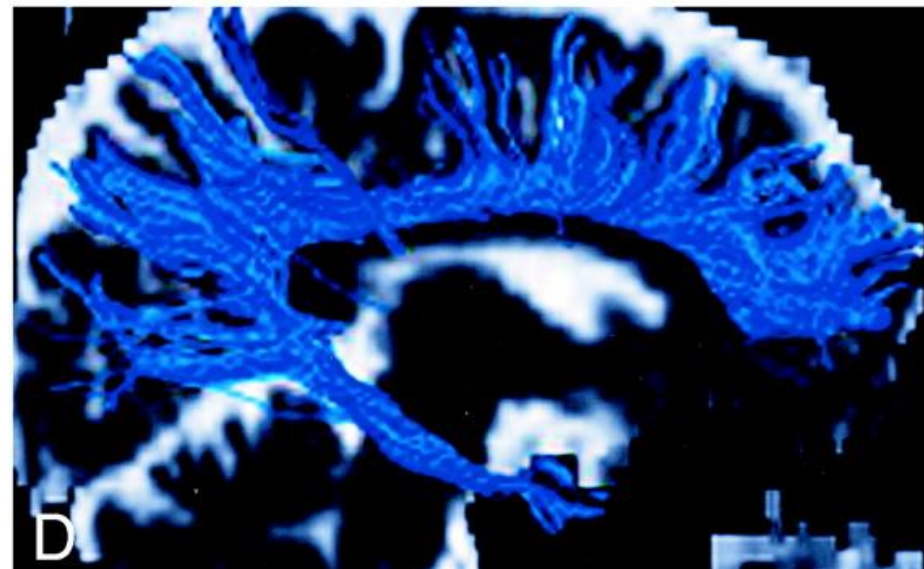
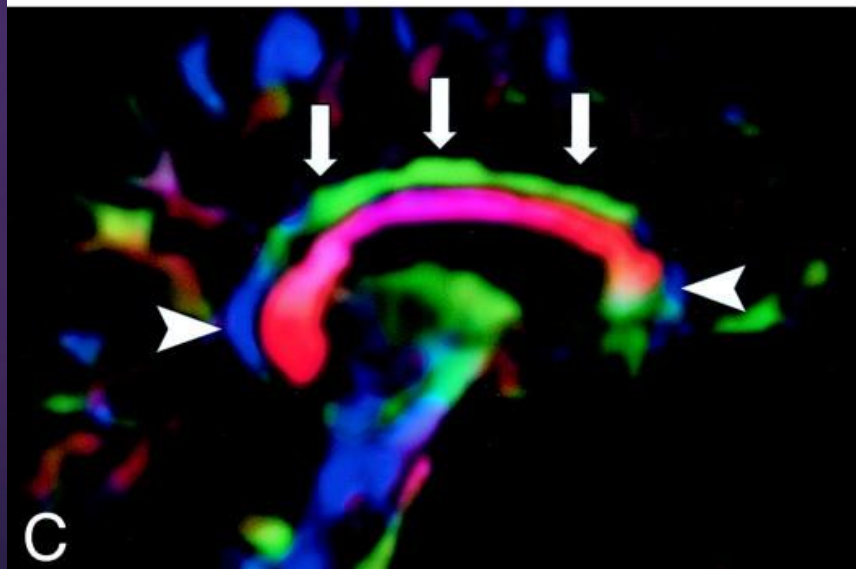
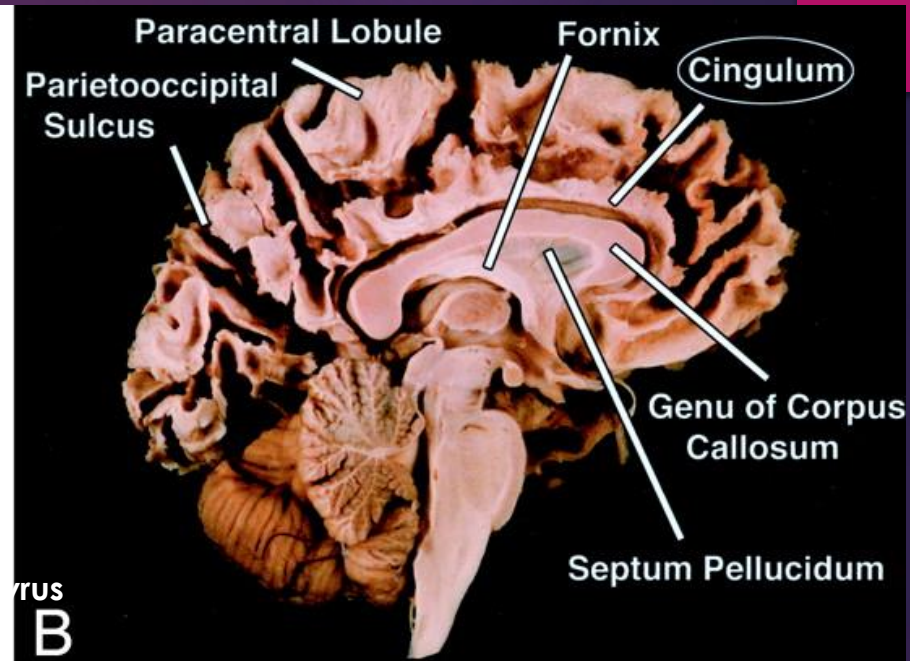
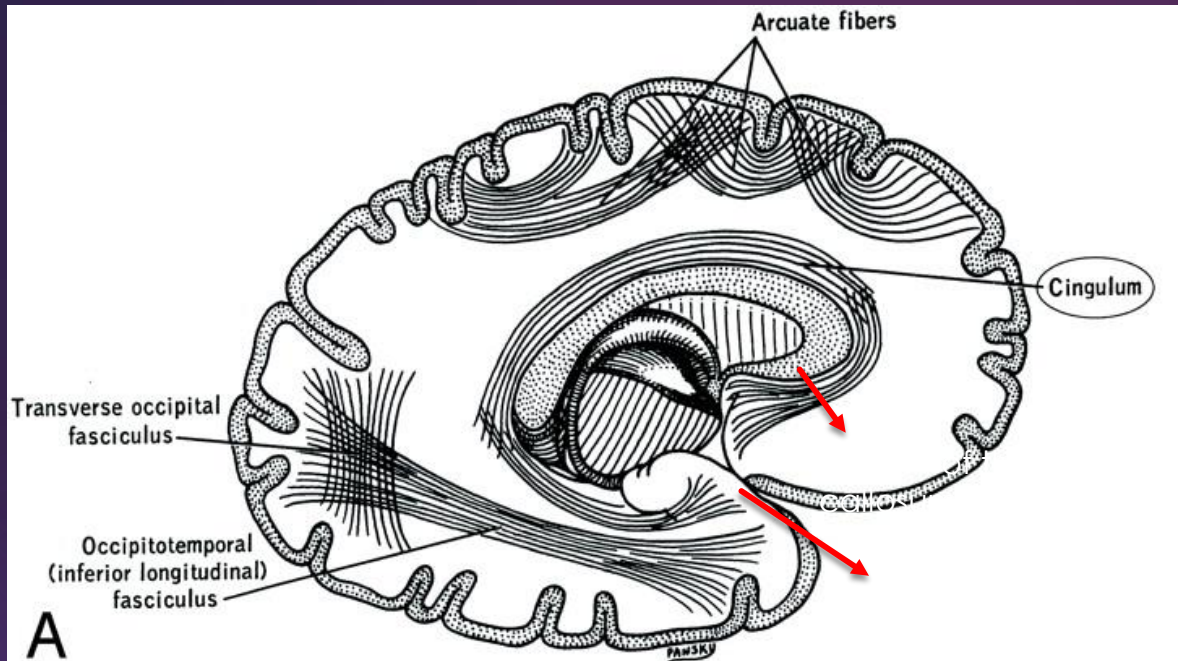
***Commissural fibers* interconnect similar cortical areas between opposite hemispheres.**

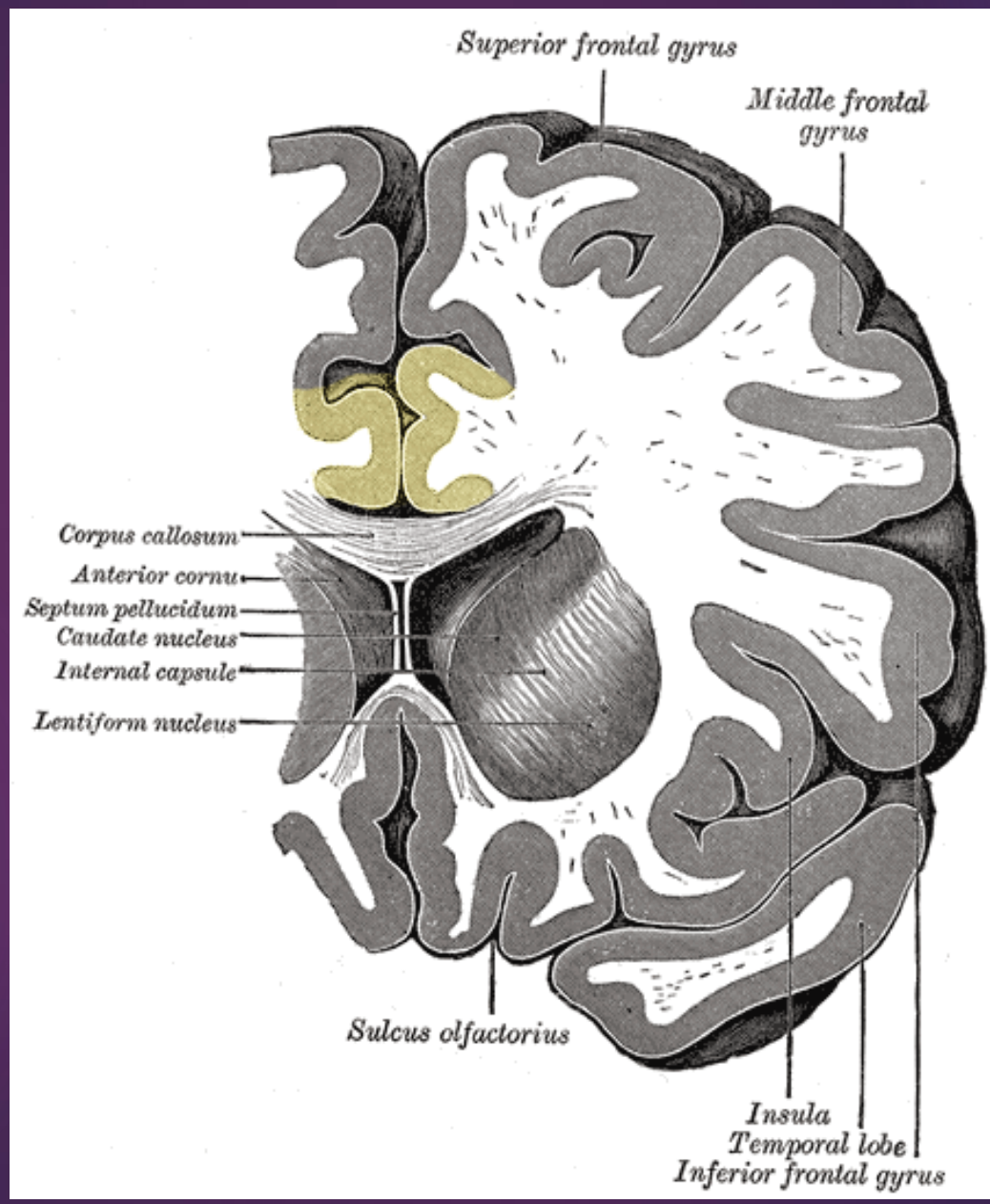
Fibers of this type include

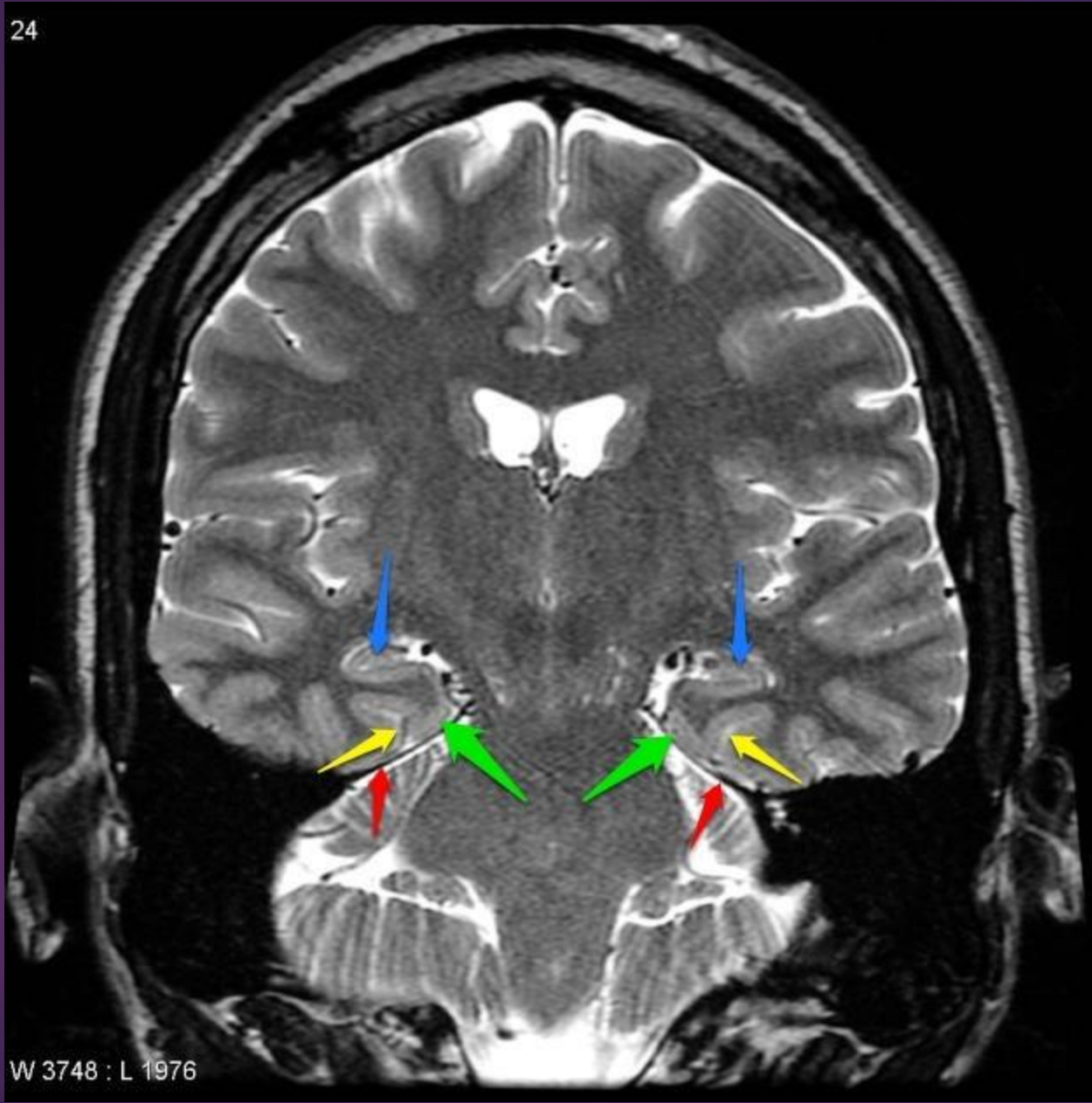
**1-corpora callosa and
2-anterior commissure.**

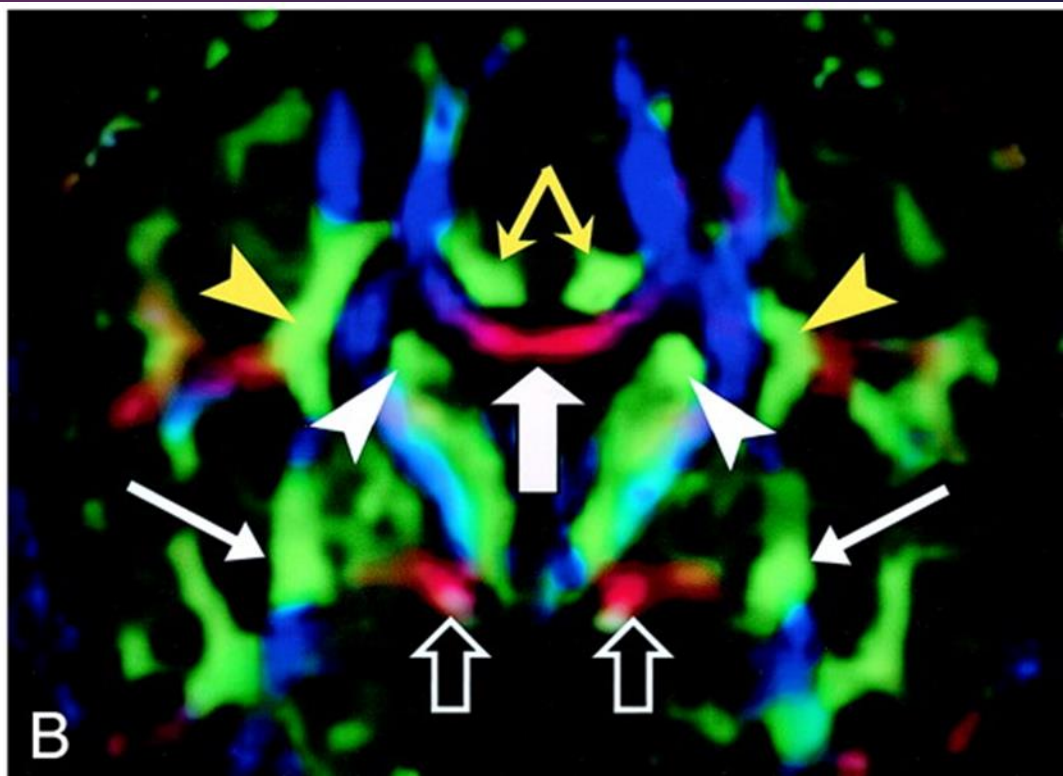
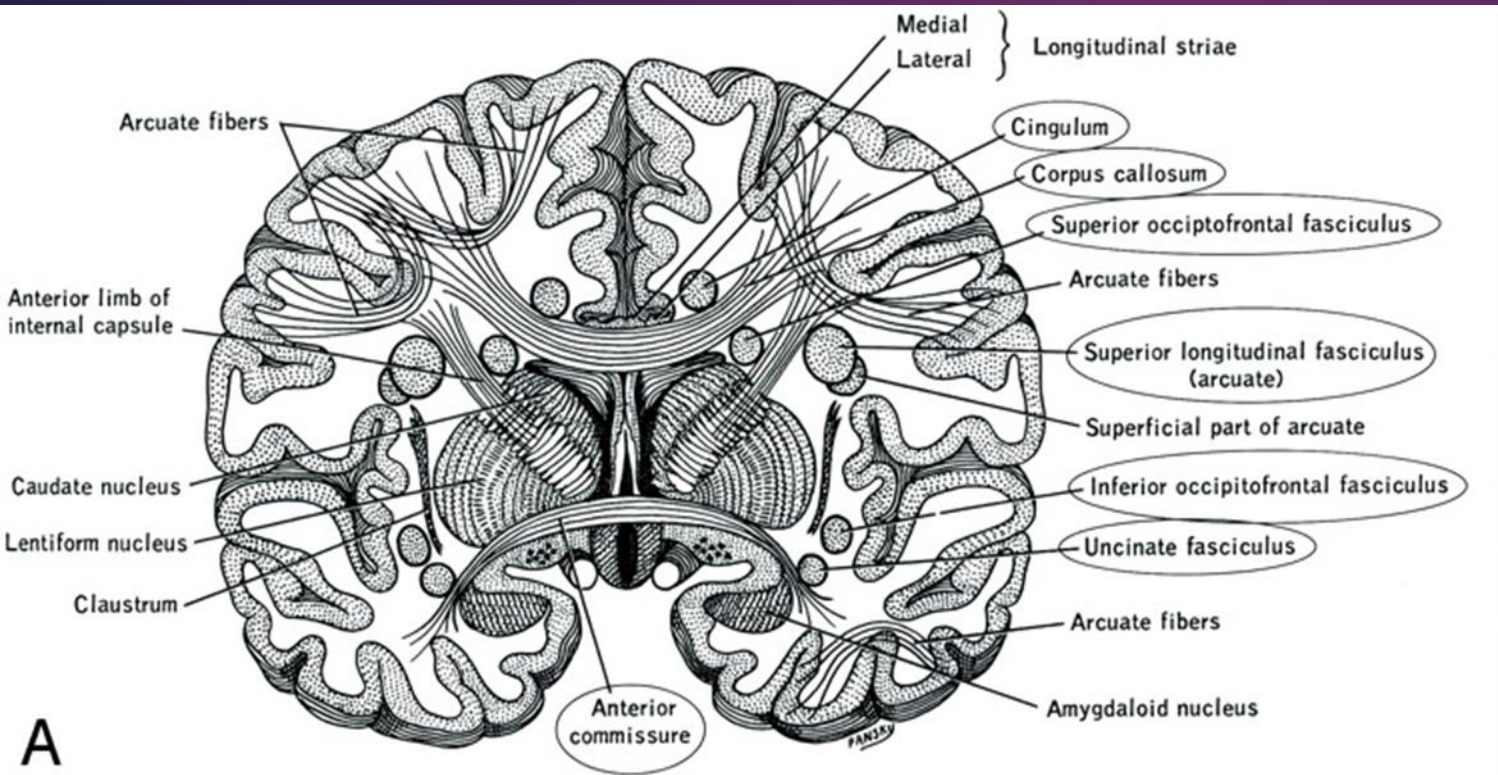
Cingulum


It interconnects portions of the frontal, parietal, and temporal lobes











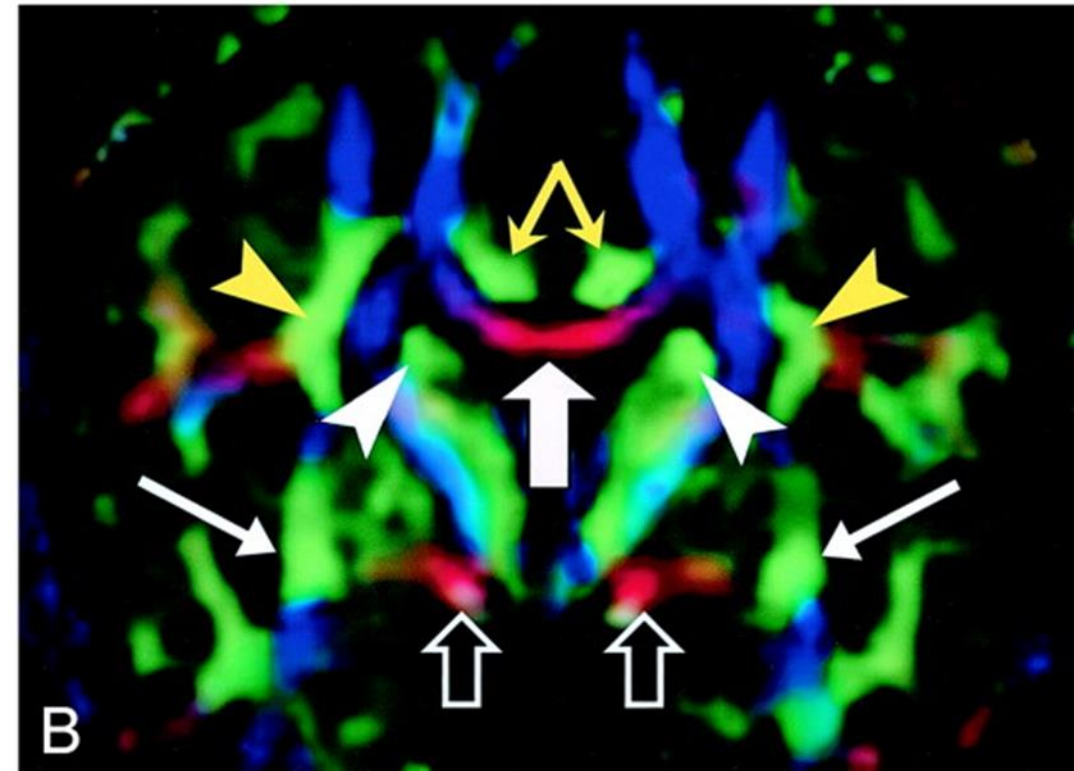
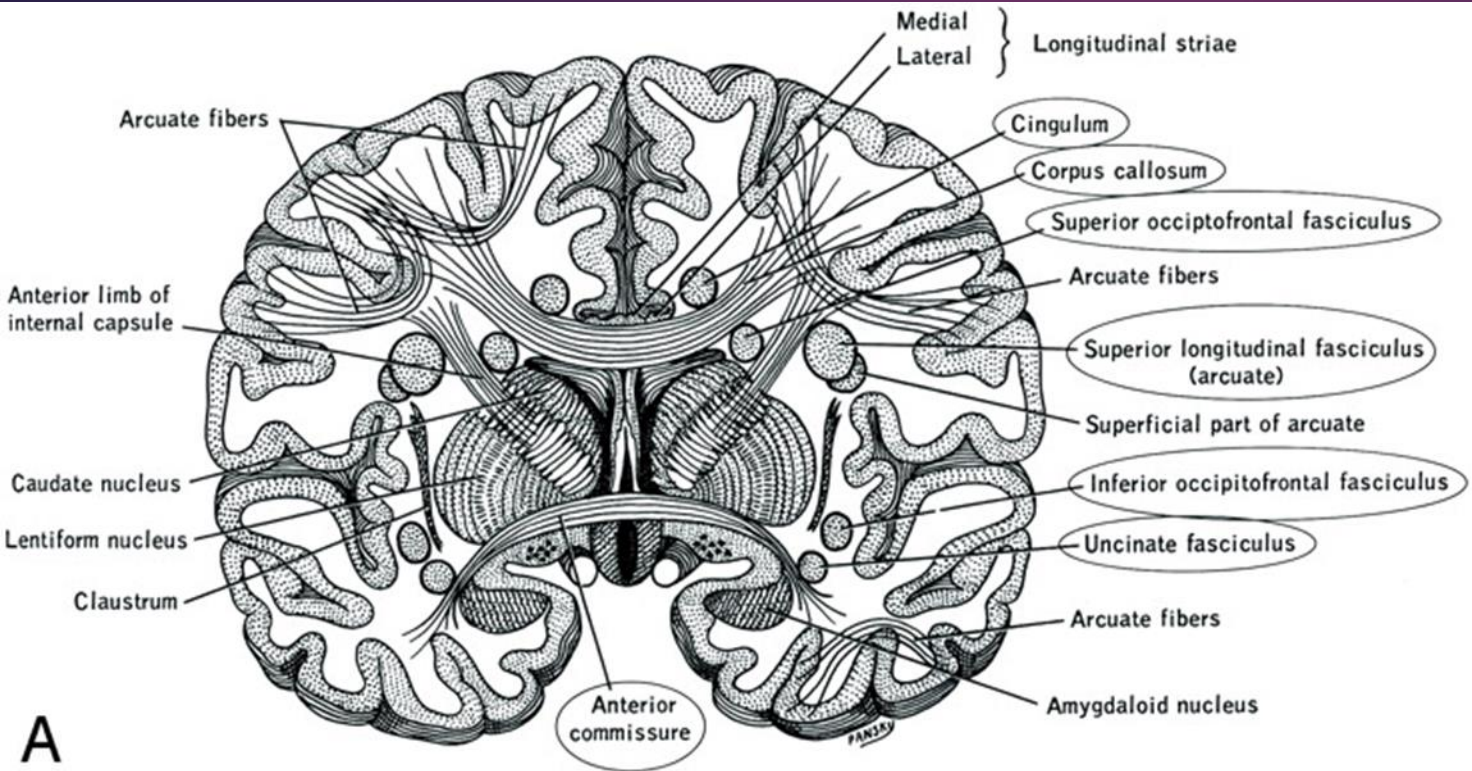
It is an integral part of the **limbic system**, which is involved with **emotion formation** and processing, **learning**, and **memory**.

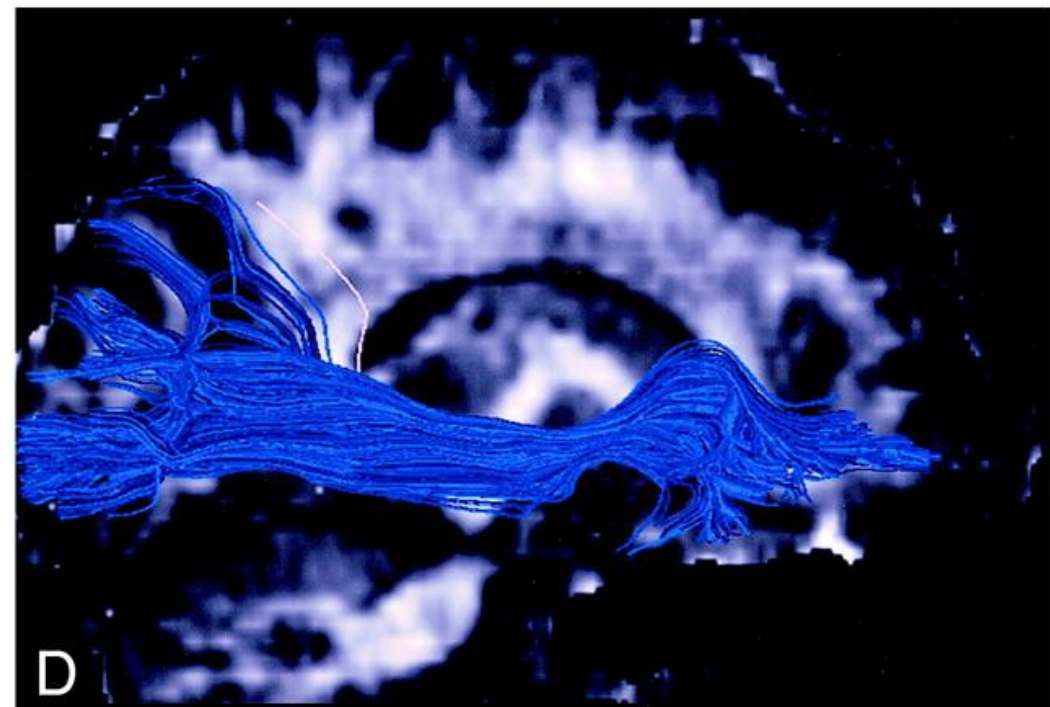
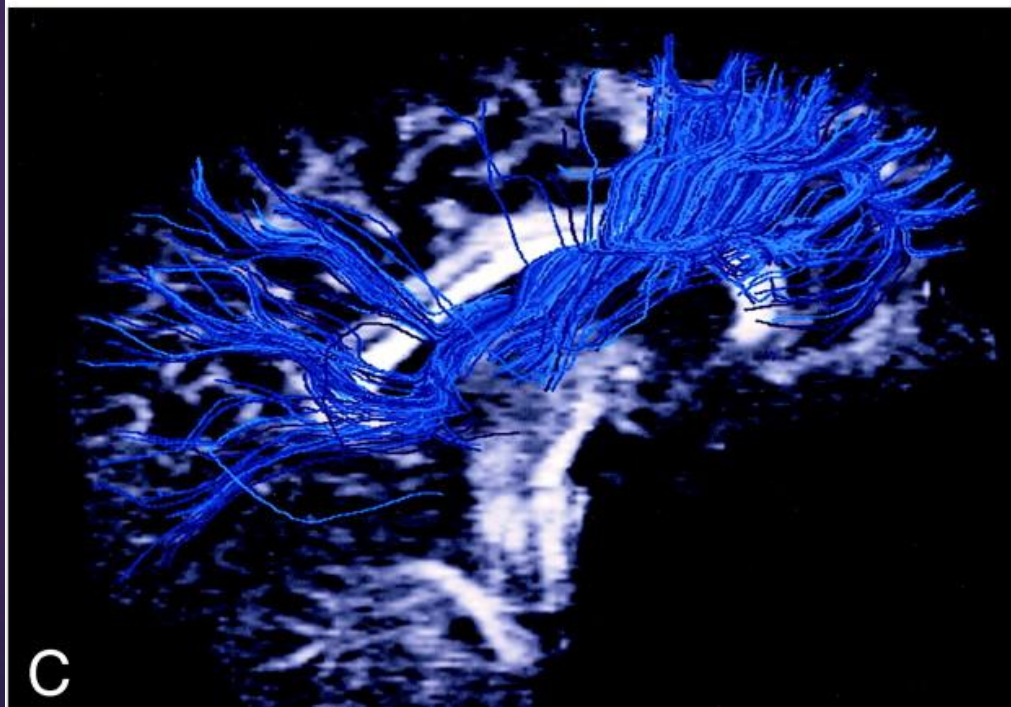
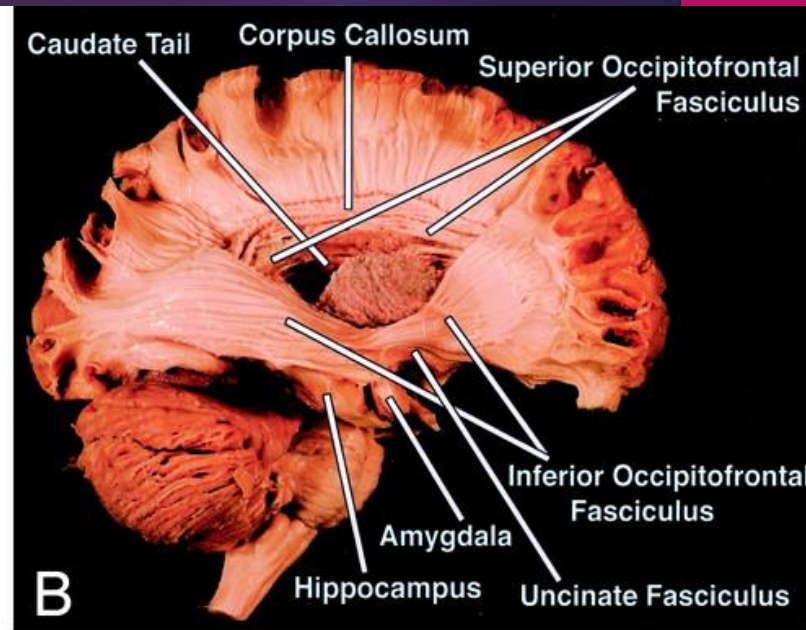
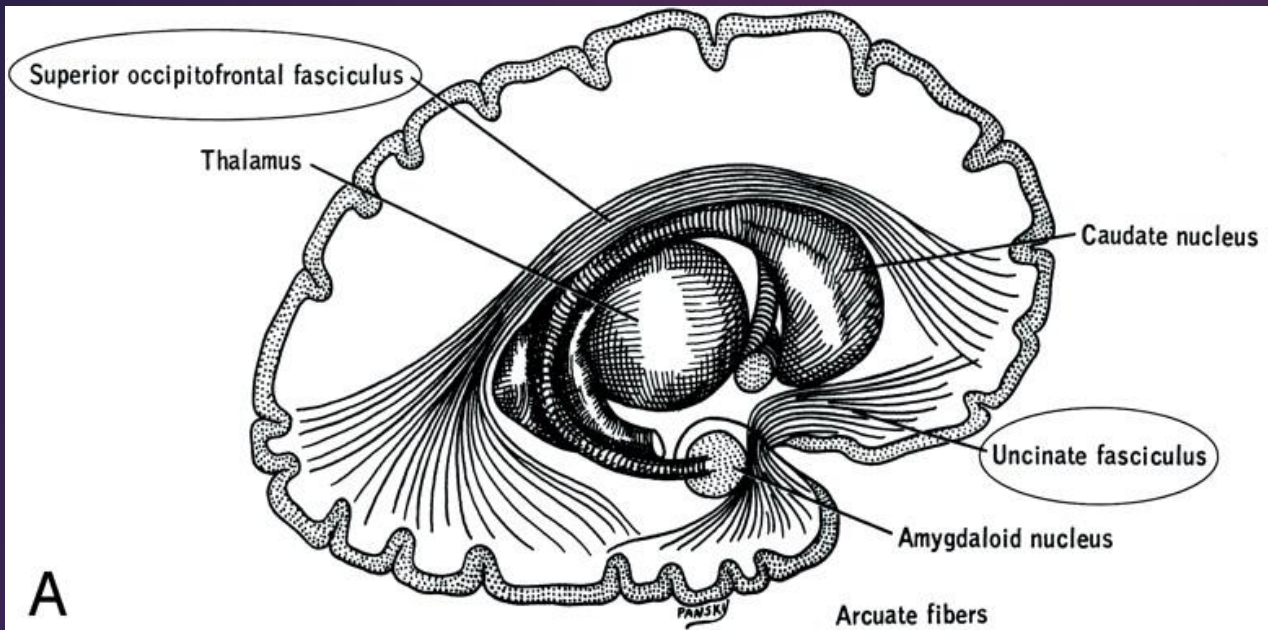
The combination of these three functions makes the cingulate gyrus highly influential in linking behavioral outcomes to motivation (e.g. a certain action induced a positive emotional response, which results in learning).


This role makes the cingulate cortex highly important in disorders such as depression and schizophrenia. It also plays a role in executive function and respiratory control.

Superior Occipitofrontal Fasciculus

Whereas the cingulum wraps around the superior aspect of the corpus callosum, the superior occipitofrontal fasciculus lies beneath it. It connects occipital and frontal lobes, extending posteriorly along the dorsal border of the caudate nucleus



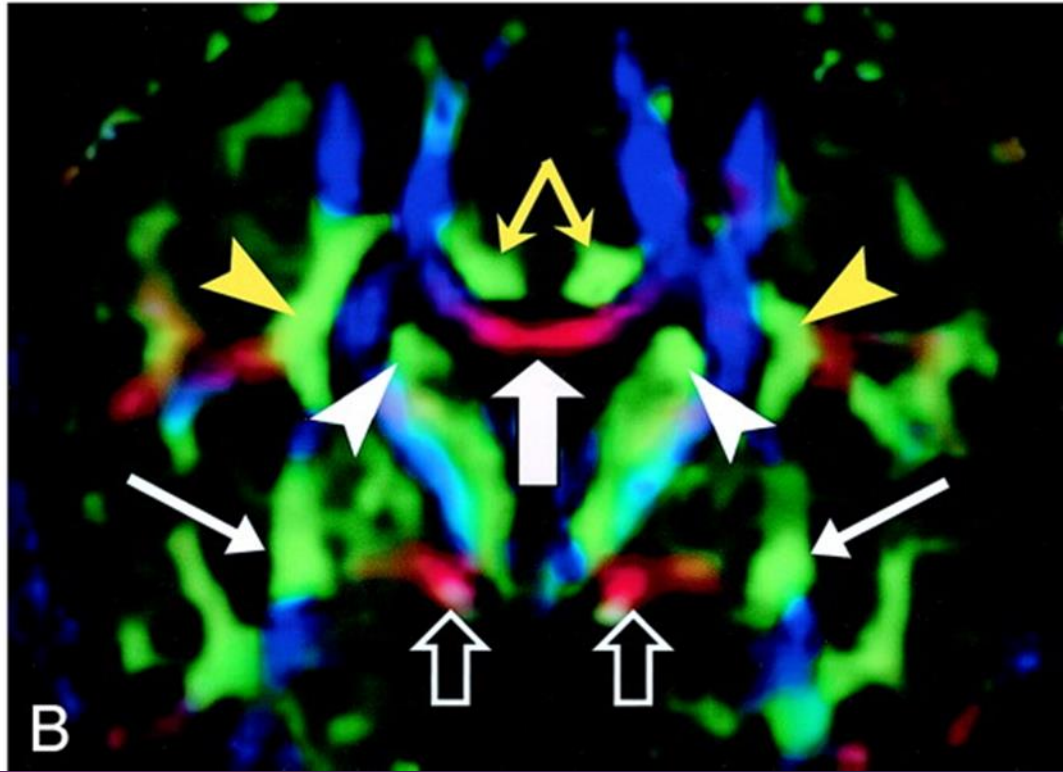
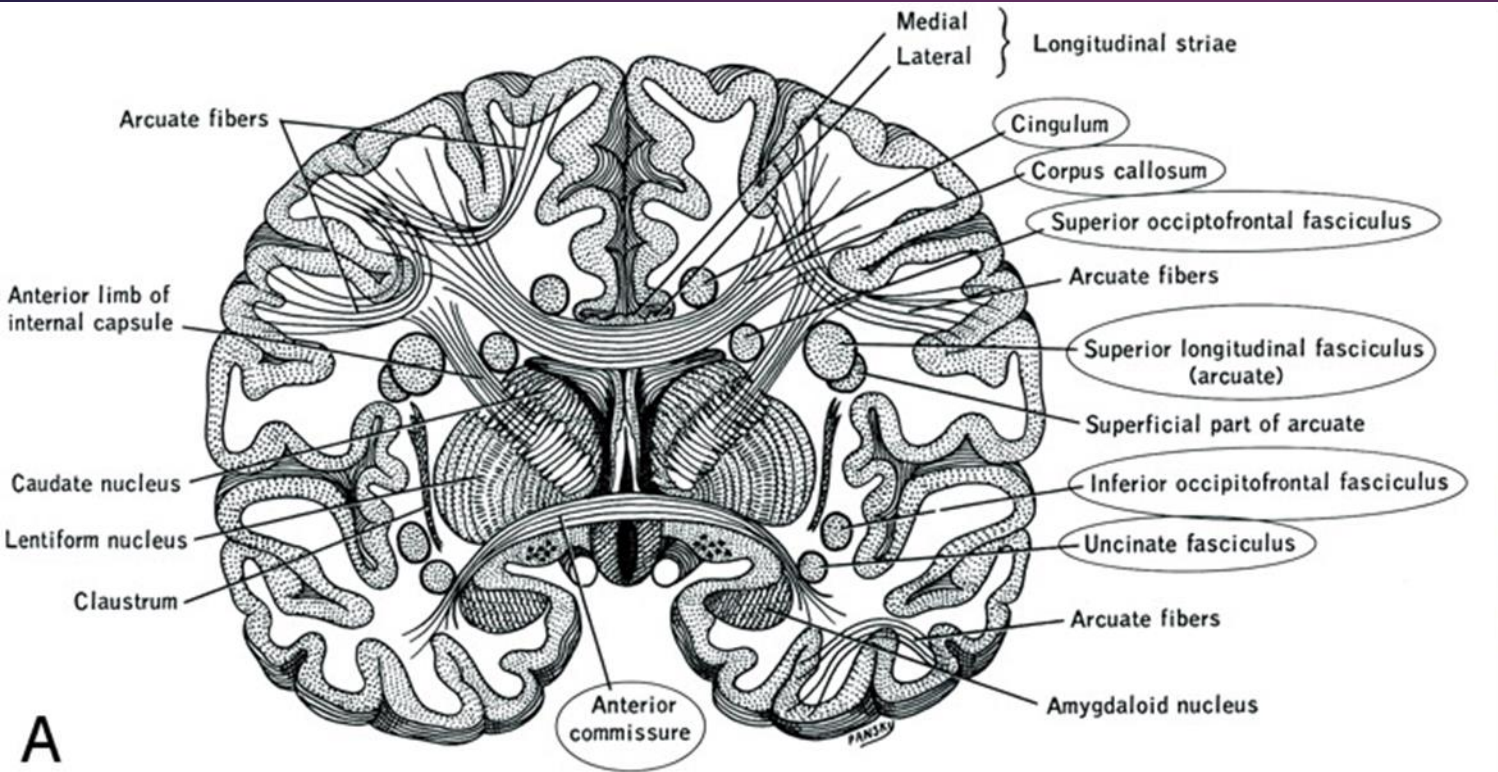


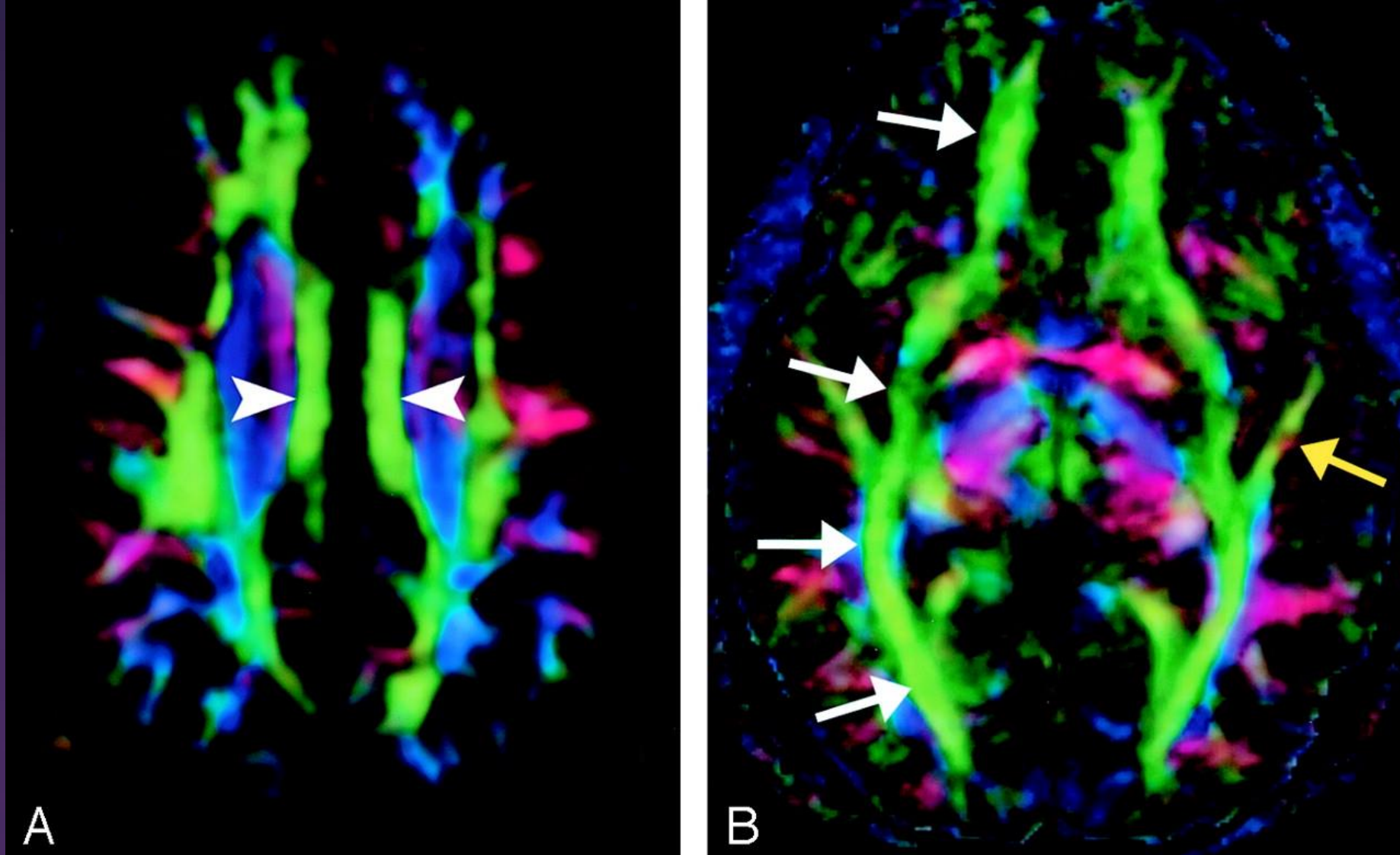


Some sources distinguish between a "Inferior occipitofrontal fasciculus" and "superior occipitofrontal fasciculus," however the latter is no longer believed to exist (in the human brain)


Inferior Occipitofrontal Fasciculus

It extends along the inferolateral edge of the claustrum, below the insula






Inferior occipitofrontal fasciculus (white arrows) and inferior longitudinal fasciculus (yellow arrow), axial directional map. The inferior occipitofrontal fasciculus lies in a roughly axial plane and is easily identified in green; it connects frontal and occipital lobes at the level of the **midbrain**.



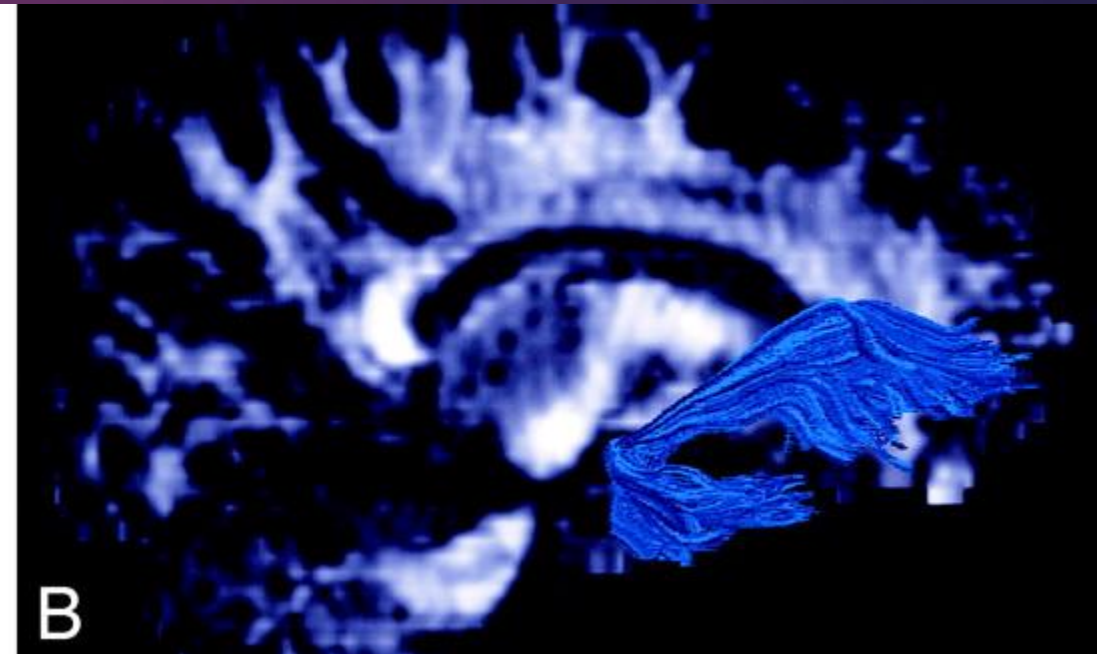
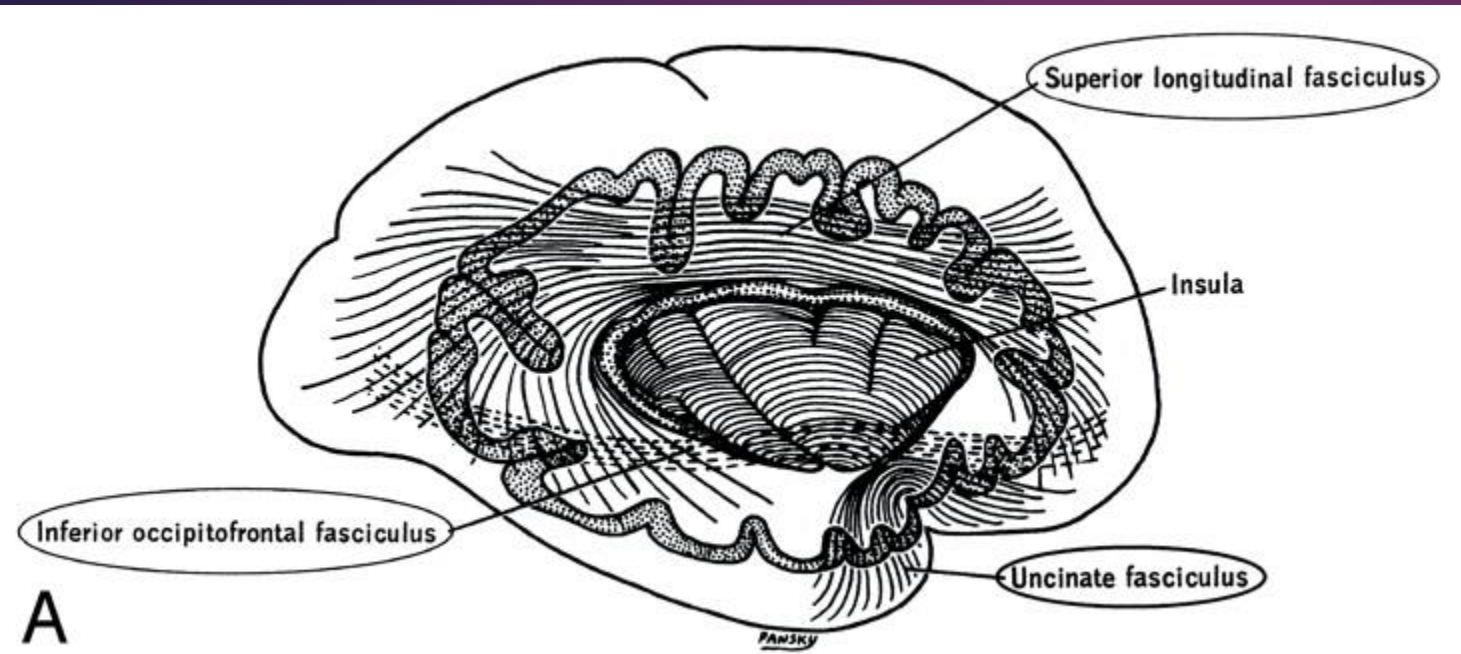
Posteriorly, the inferior occipitofrontal fasciculus joins the **inferior longitudinal fasciculus**, the descending portion of the **superior longitudinal fasciculus**, and portions of the **geniculocalcarine** tract to form most of the *sagittal stratum*, a large and complex bundle that connects the occipital lobe to the rest of the brain

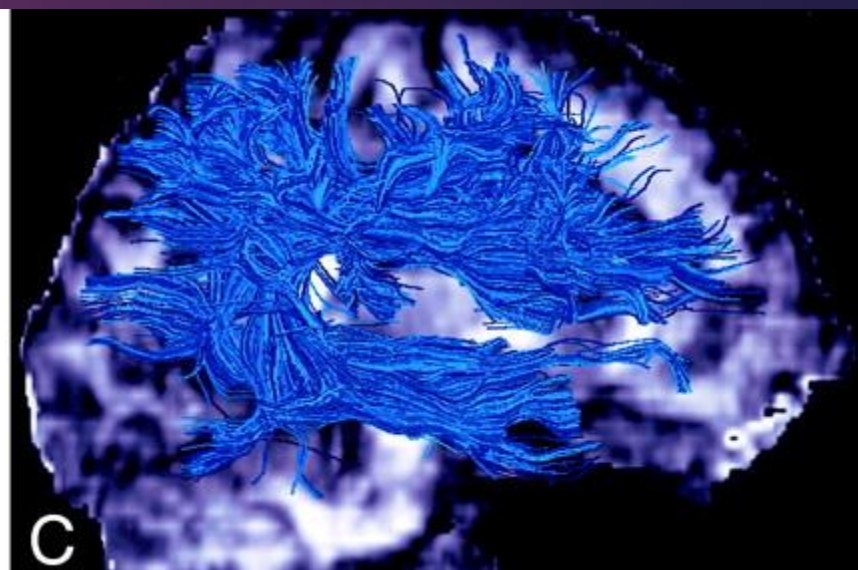
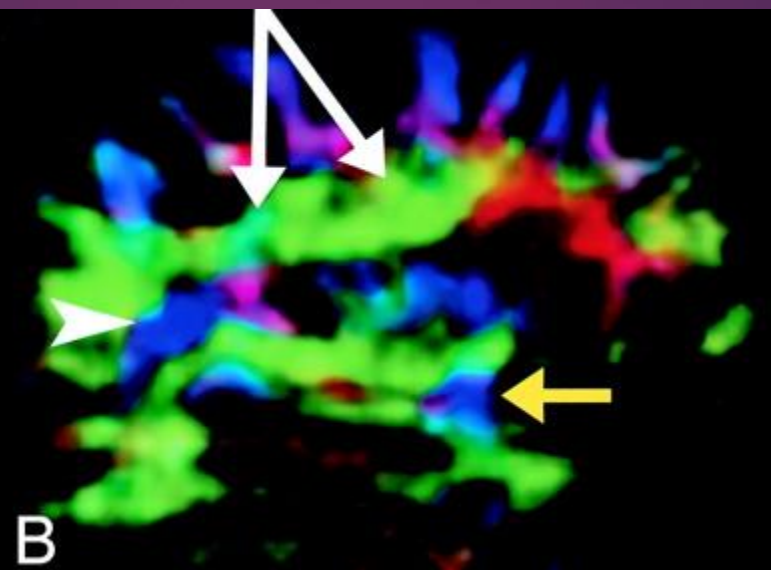
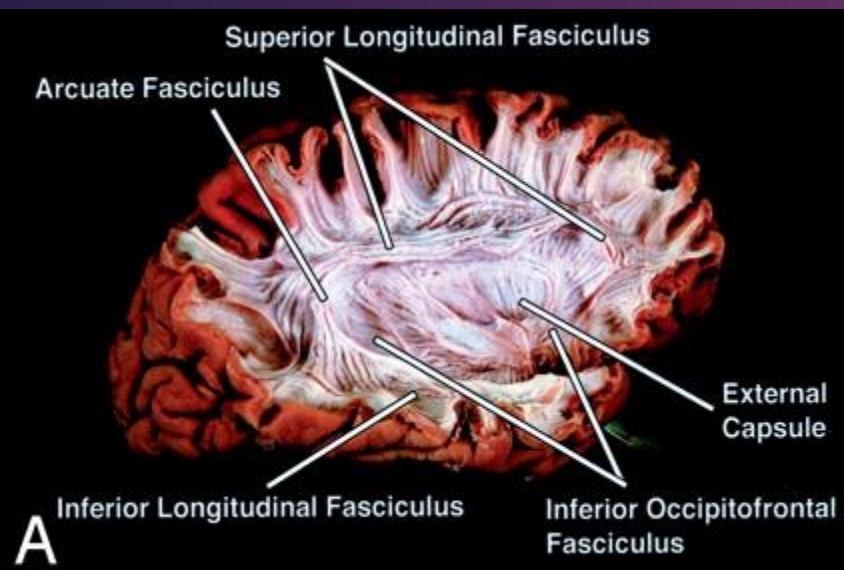


The middle portion of the inferior occipitofrontal fasciculus is bundled together with the middle portion of the uncinate fasciculus

Uncinate fasciculus Hook

The uncinate fasciculus hooks around the lateral fissure to connect the orbital and inferior frontal gyri of the frontal lobe to the anterior temporal lobe.





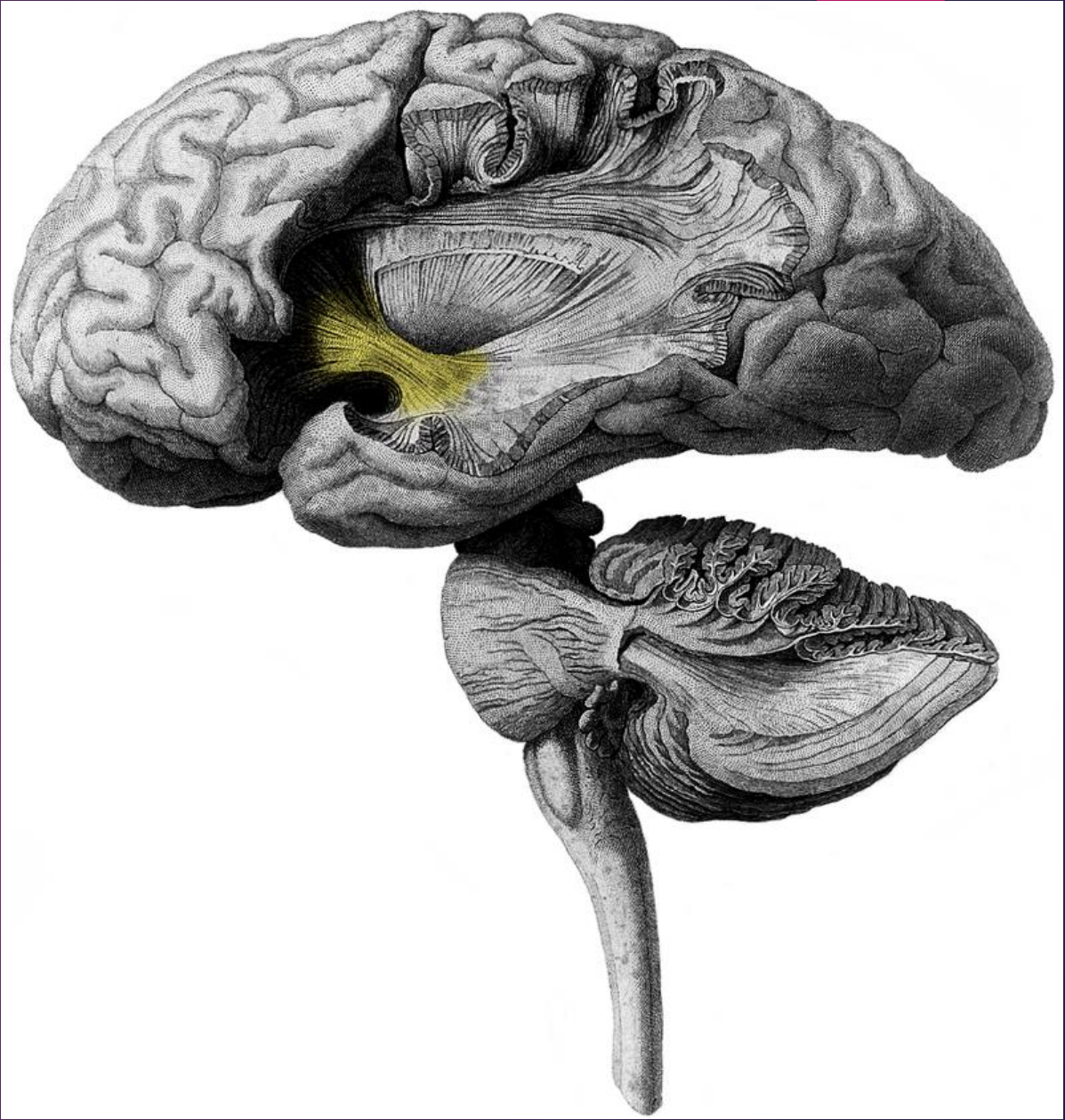
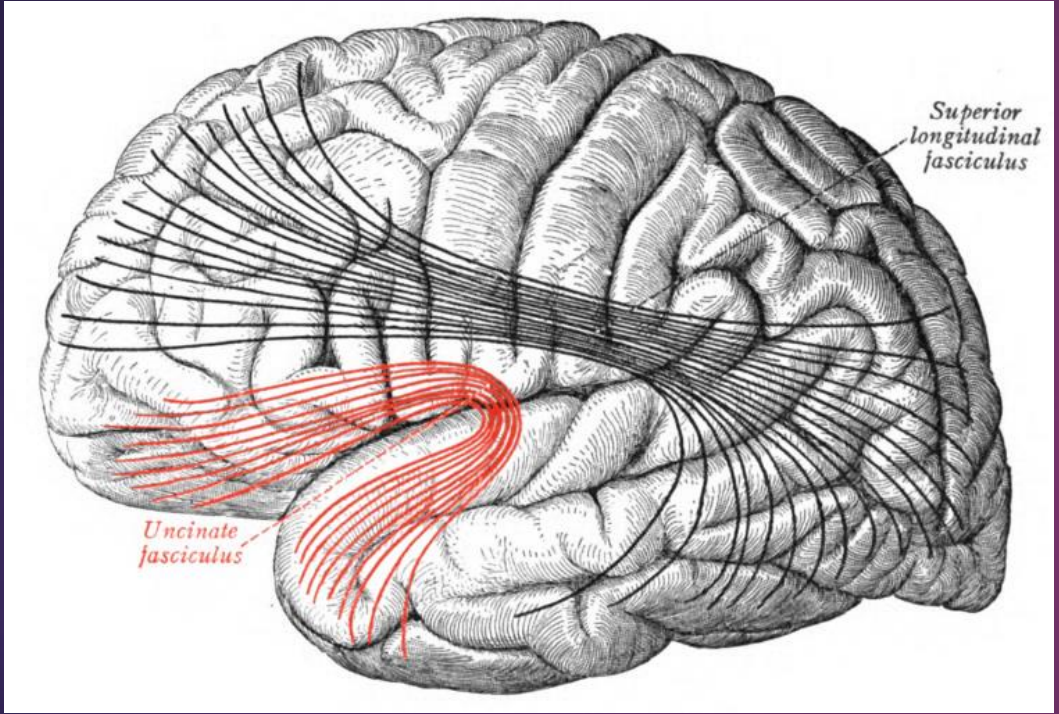
connects parts of the limbic system such as the hippocampus and amygdala in the temporal lobe with frontal ones such as the orbitofrontal cortex.

Its function is unknown though it is affected in several psychiatric conditions
Diffusion tensor imaging, shows a greater fractional anisotropy on the left side than on the right

left hemispheric specialization for language

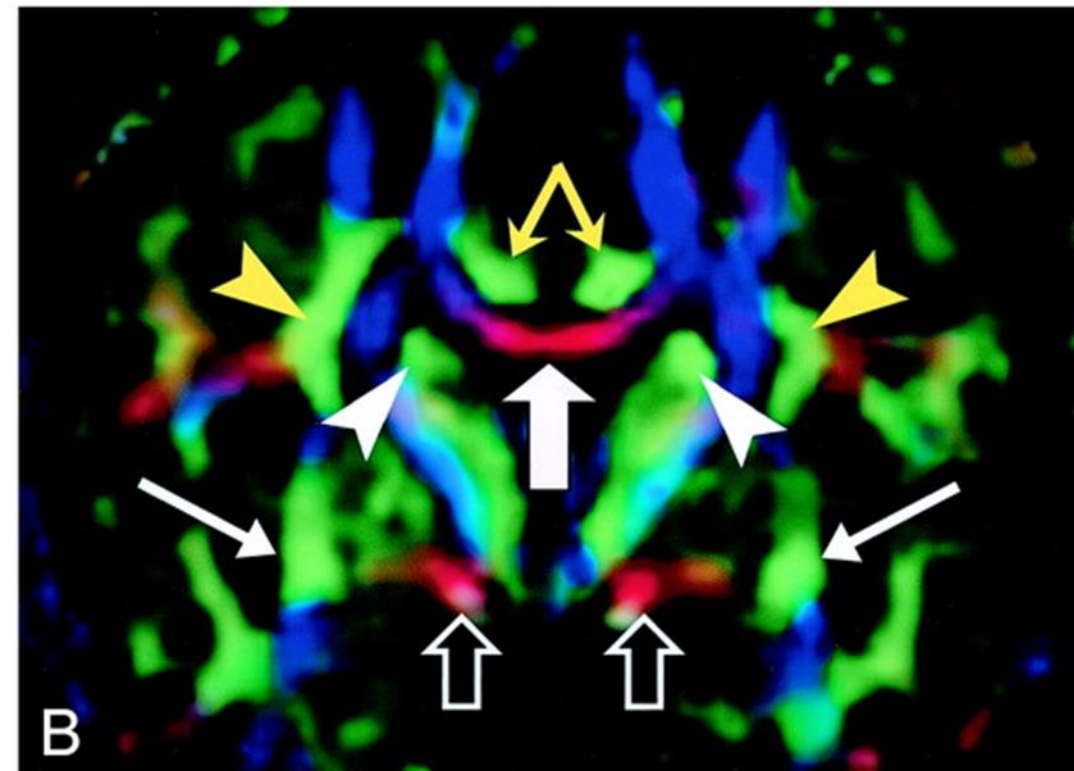
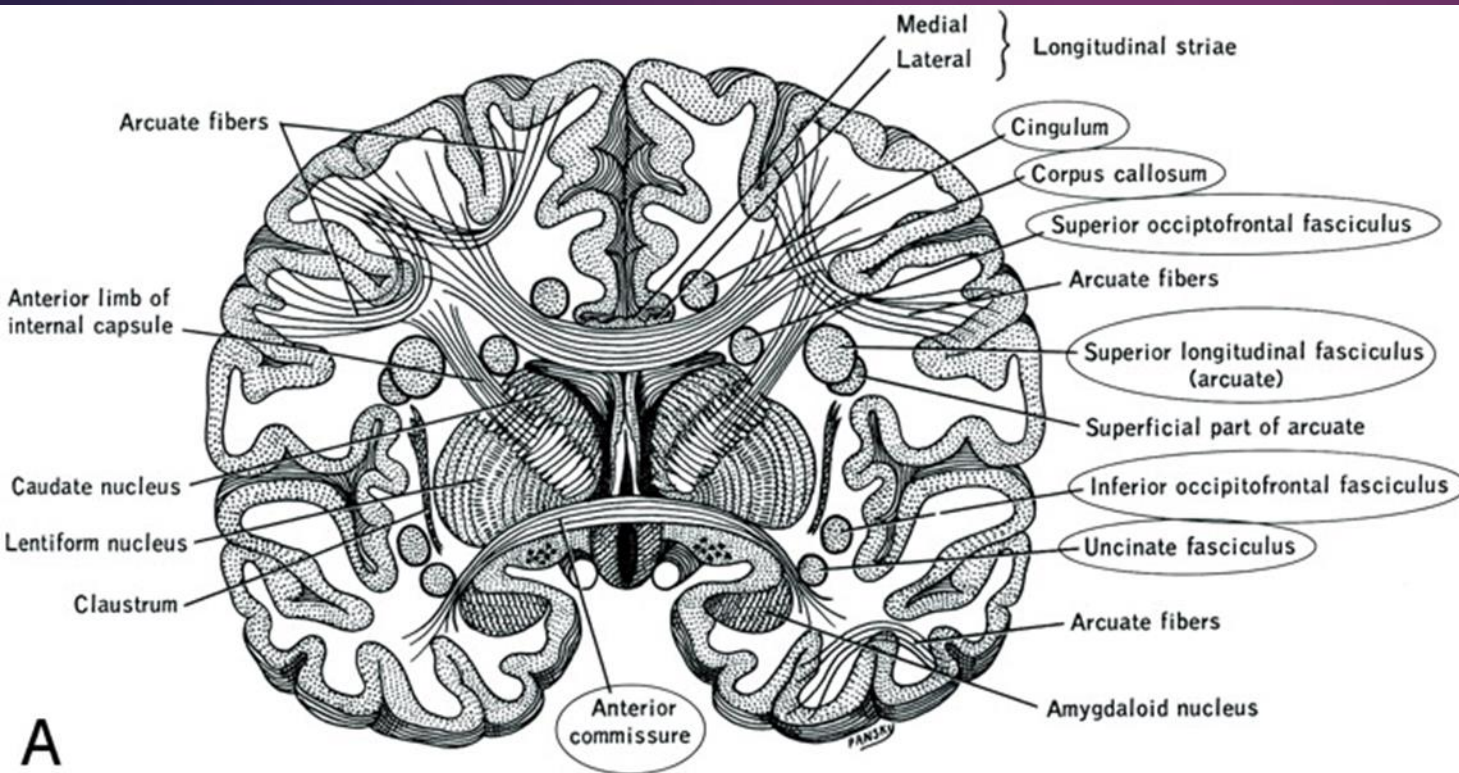
The capacity for autonoetic self-awareness that is **re-experiencing previous events** as part of one's past as a continuous entity across time has been linked to the **right** uncinate fasciculus

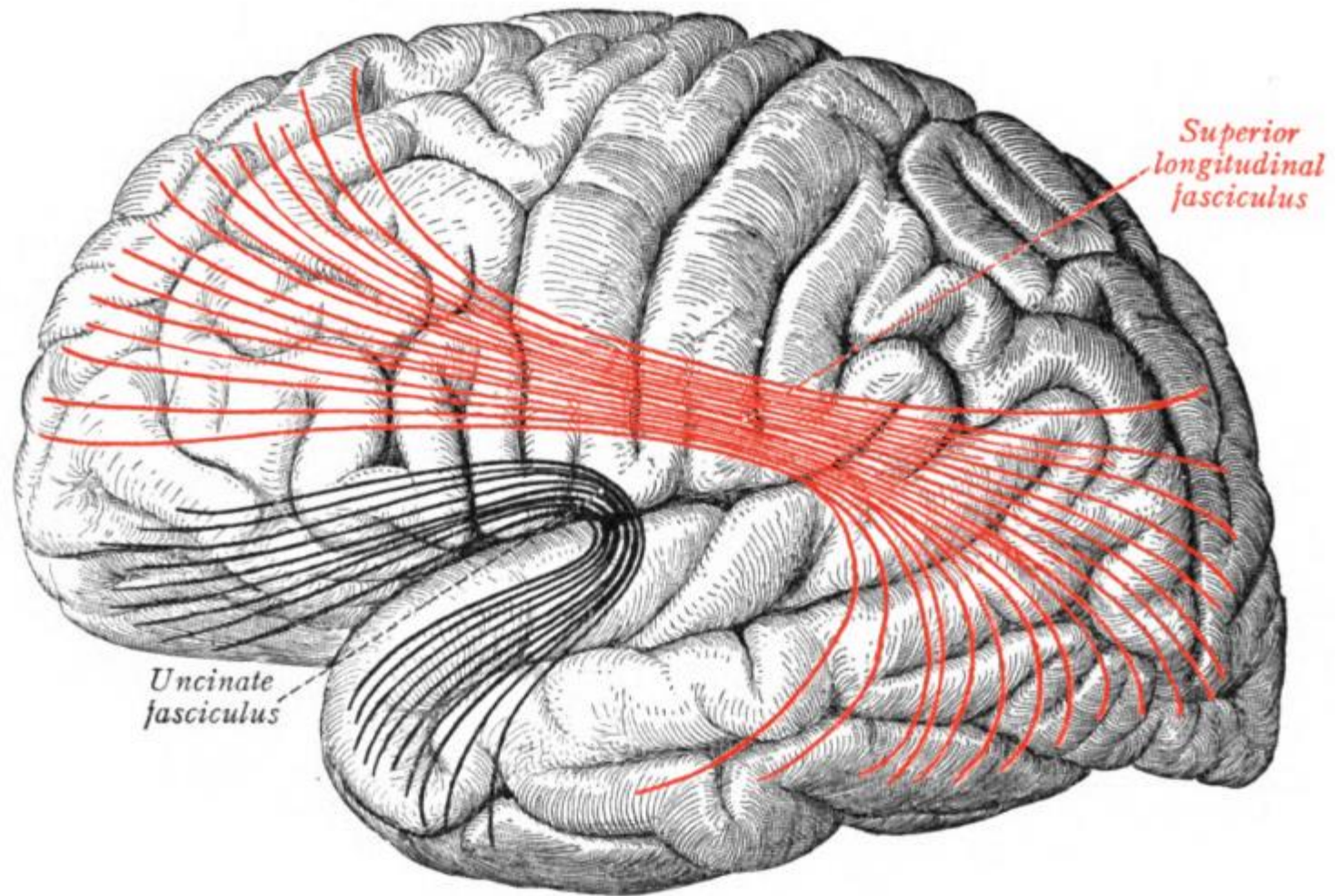
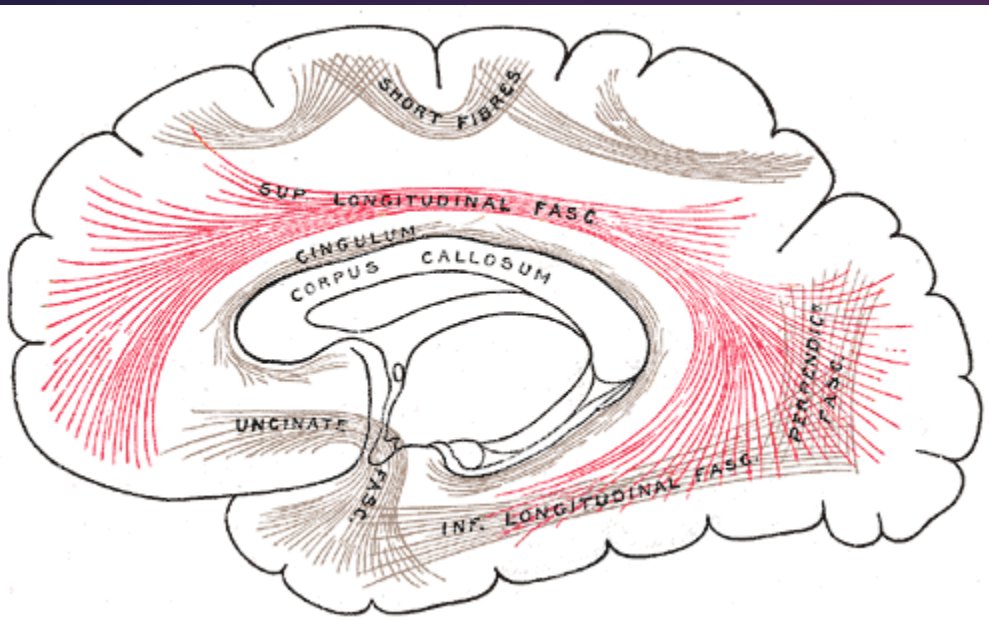
as has proficiency in **auditory-verbal memory** and **declarative memory** to the integrity of the left uncinate fasciculus



Superior Longitudinal (arcuate) Fasciculus

sweeps along the superior margin of the **insula** in a great arc, gathering and shedding fibers along the way to connect frontal lobe cortex to parietal, temporal, and occipital lobe cortices. The superior longitudinal fasciculus is the **largest association bundle**





role of the arcuate fasciculus in language use is best represented by **conduction aphasia**

An acquired language disorder, it is characterized by **intact** auditory comprehension, **fluent** speech production, but **poor speech repetition**.

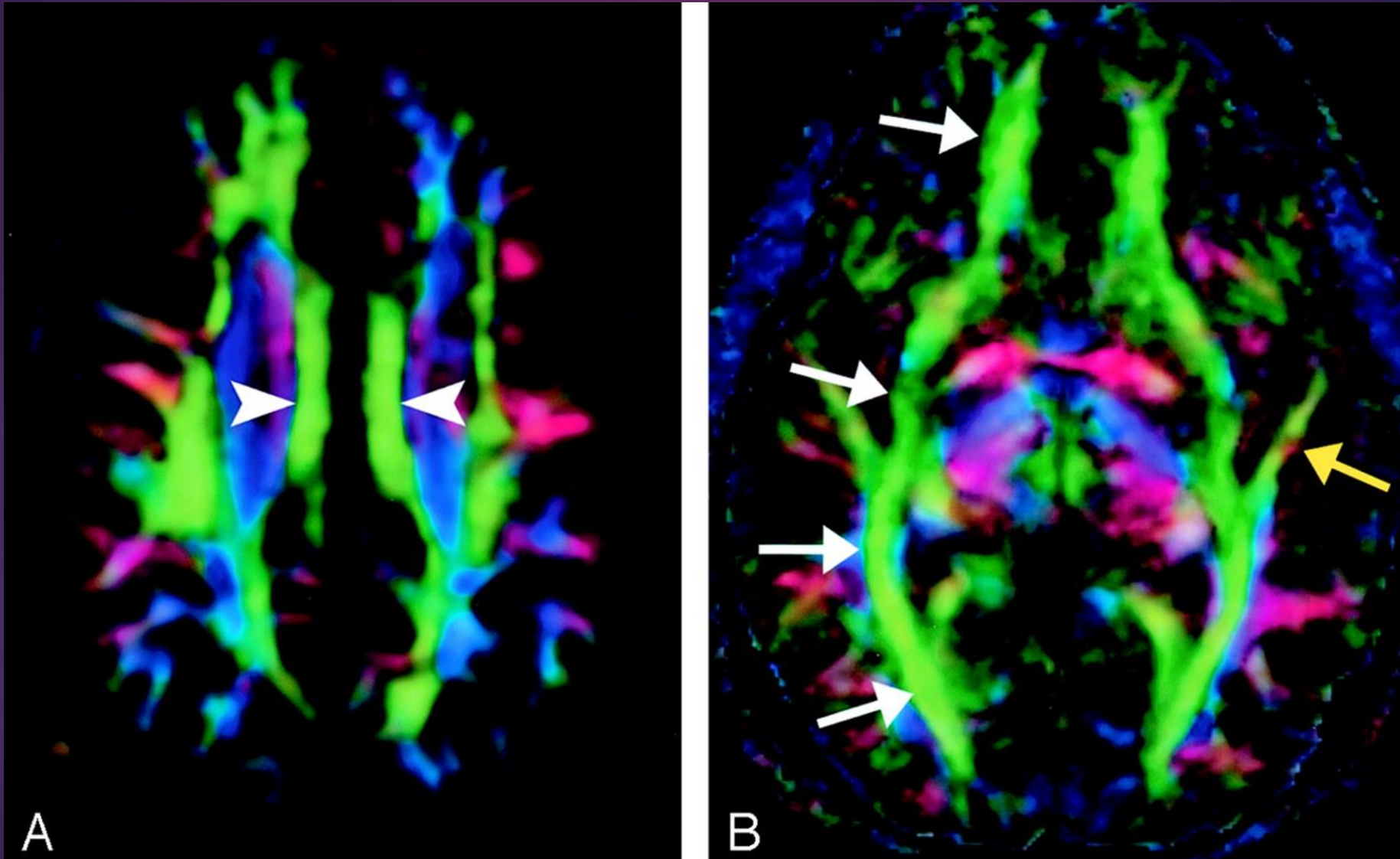
In nine out of ten people with **tone deafness**, the superior arcuate fasciculus in the **right** hemisphere could not be detected, suggesting a disconnection between the posterior superior temporal gyrus and the posterior inferior frontal gyrus.

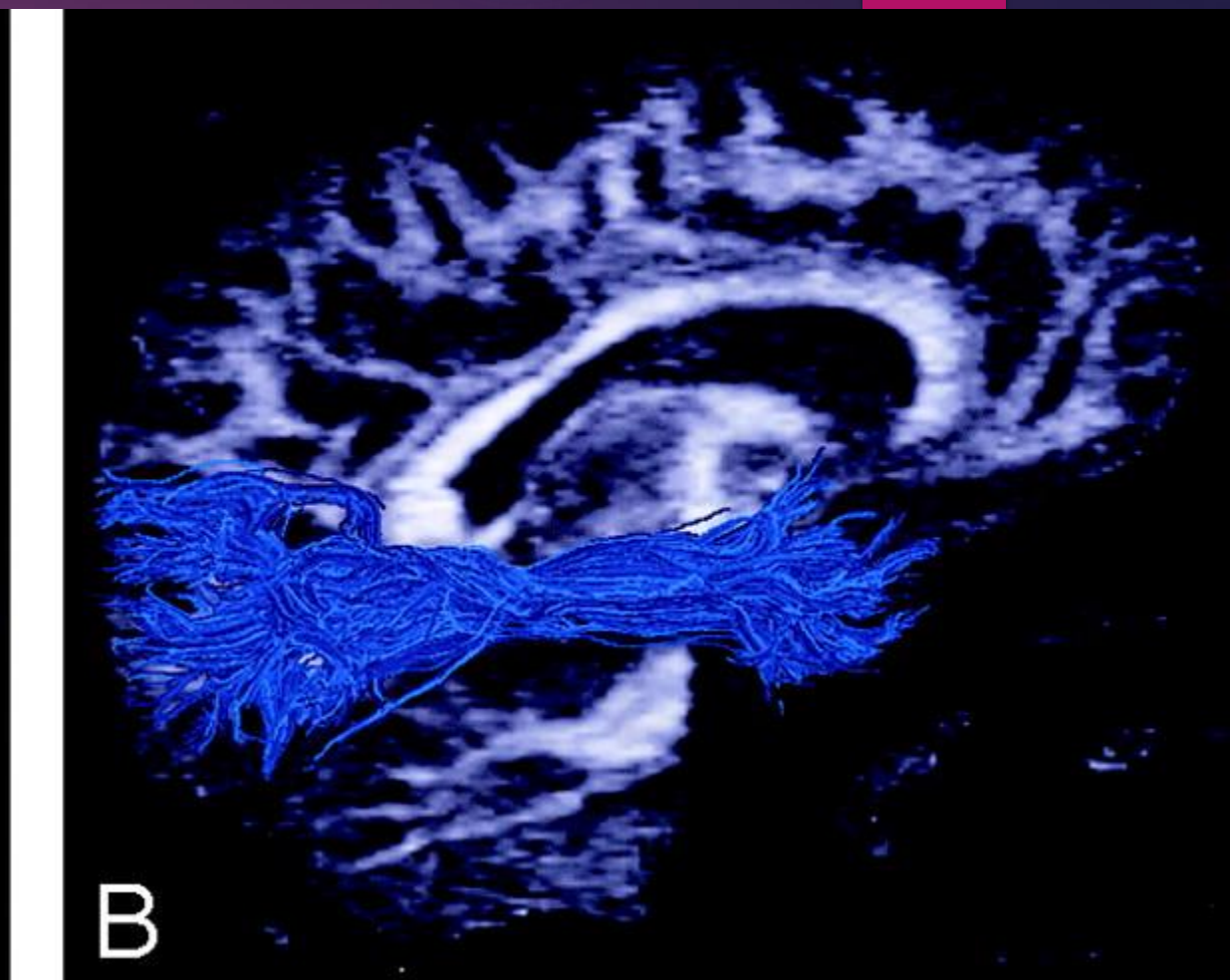
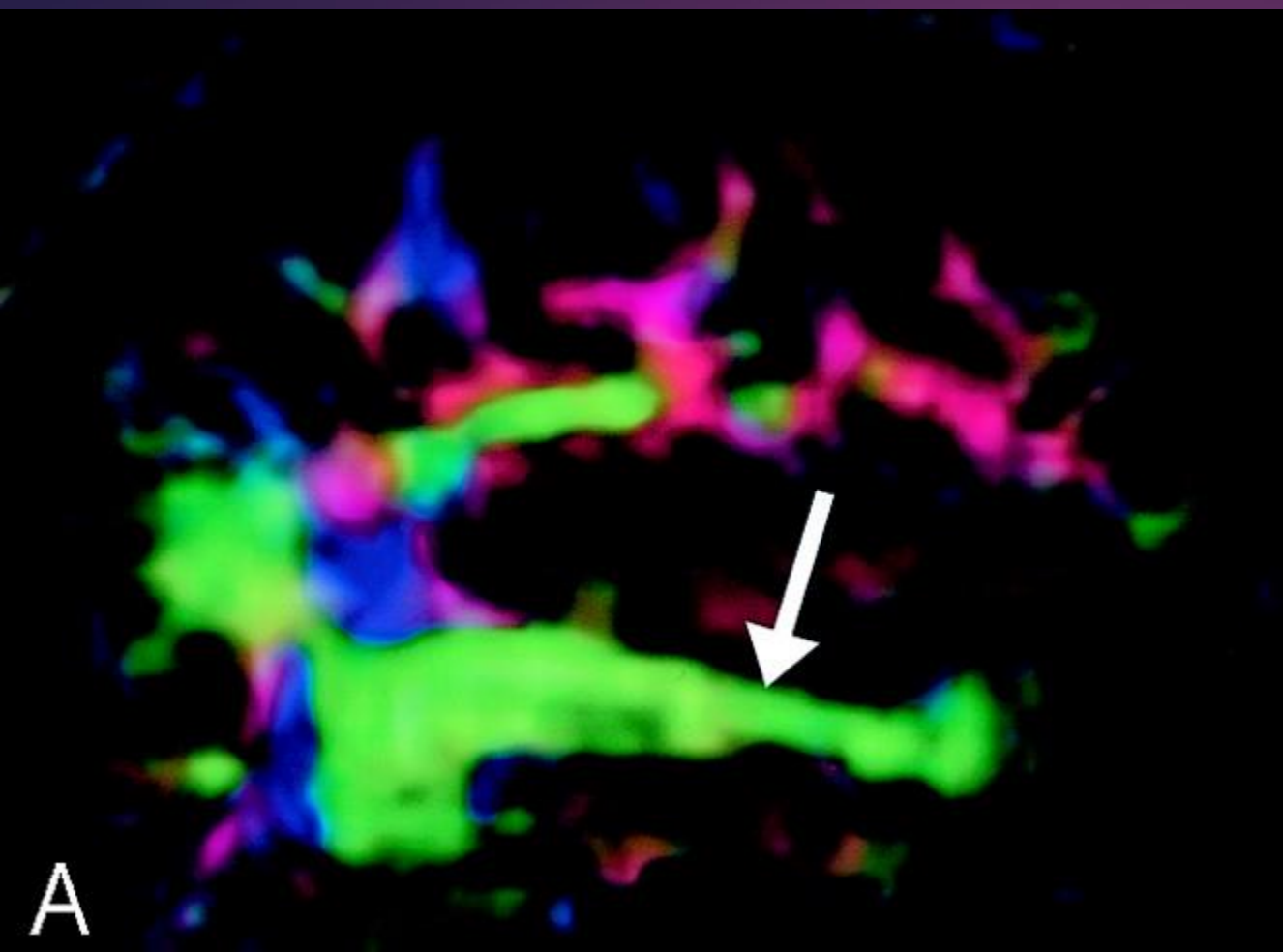
4% of the population suffers from this disorder



Inferior Longitudinal (occipitotemporal) Fasciculus

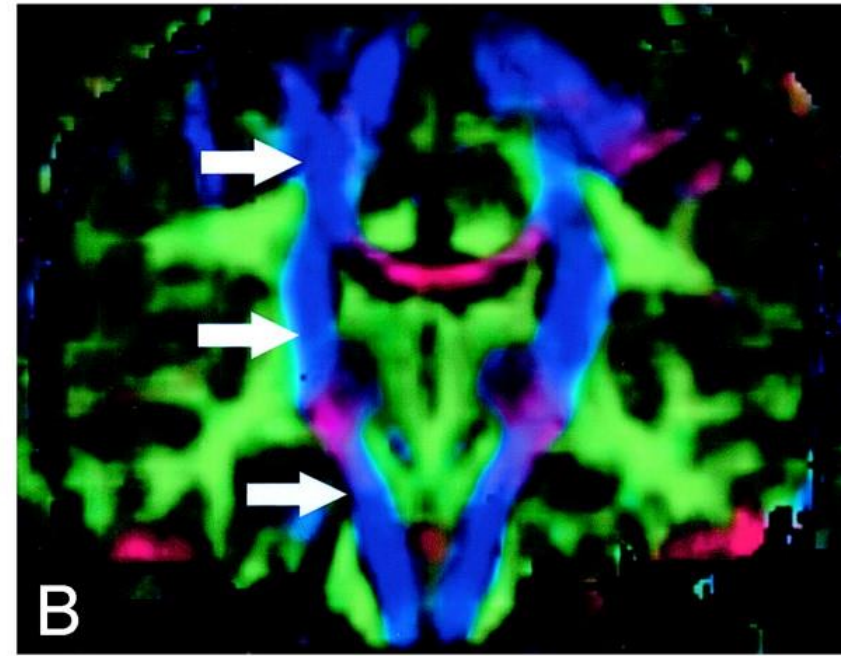
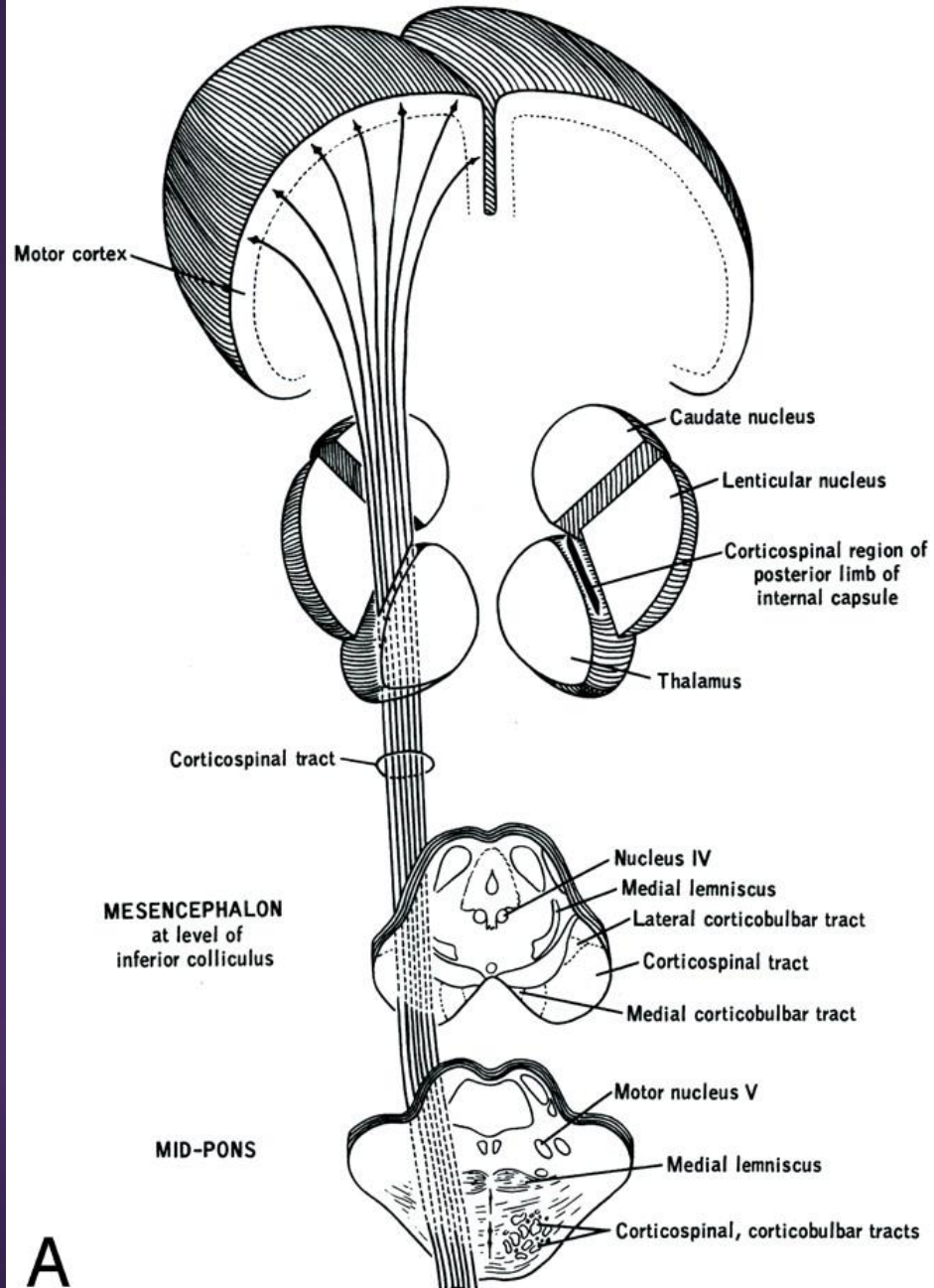
The inferior longitudinal fasciculus connects temporal and occipital lobe cortices






Projection Fibers

Corticospinal, Corticopontine, and Corticobulbar Tracts



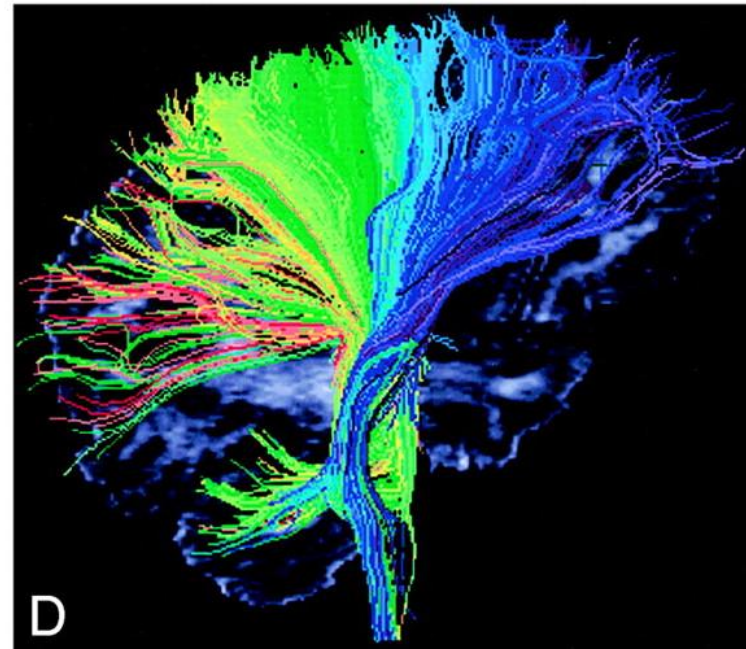
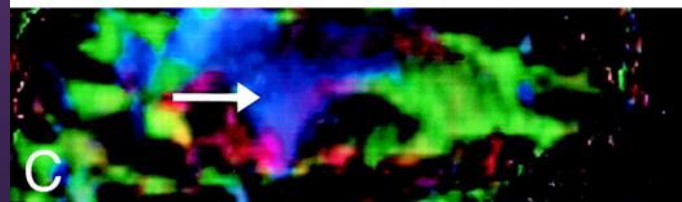
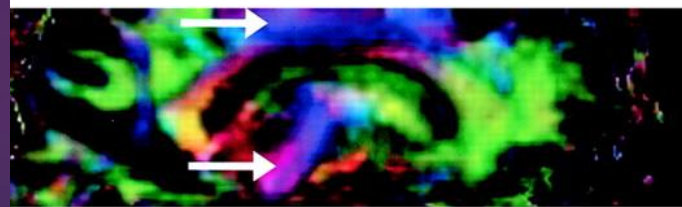
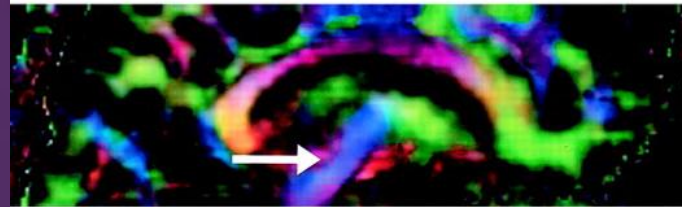
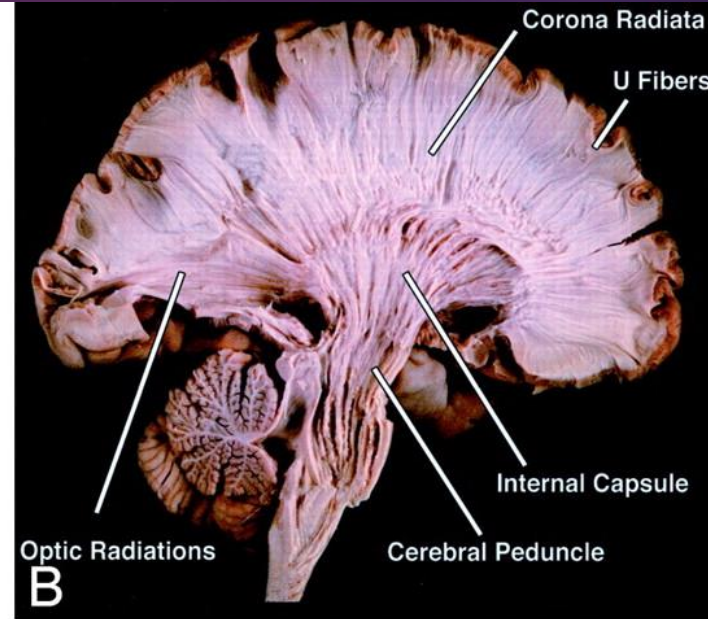
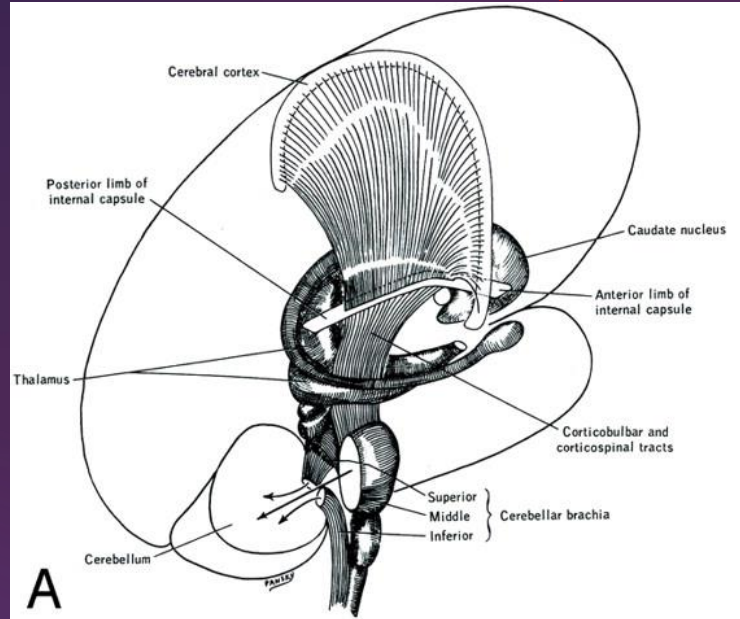


Corticospinal fibers converge into the corona radiata and continue through the **posterior limb** of the internal capsule to the cerebral peduncle.

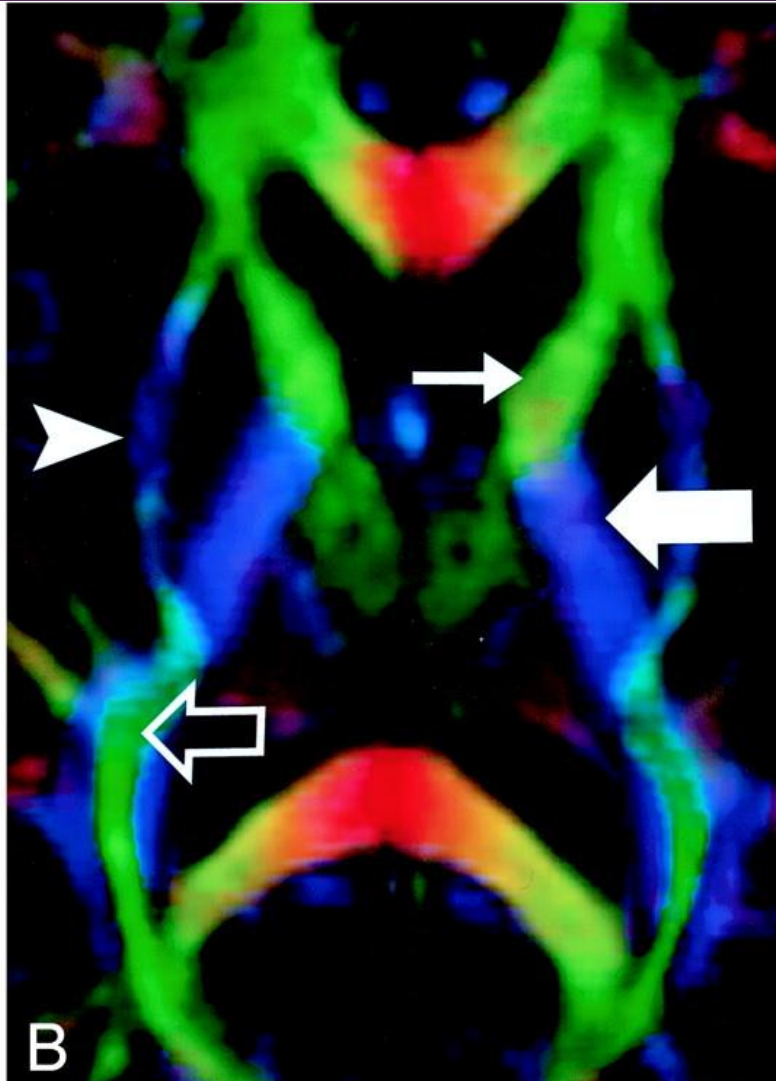
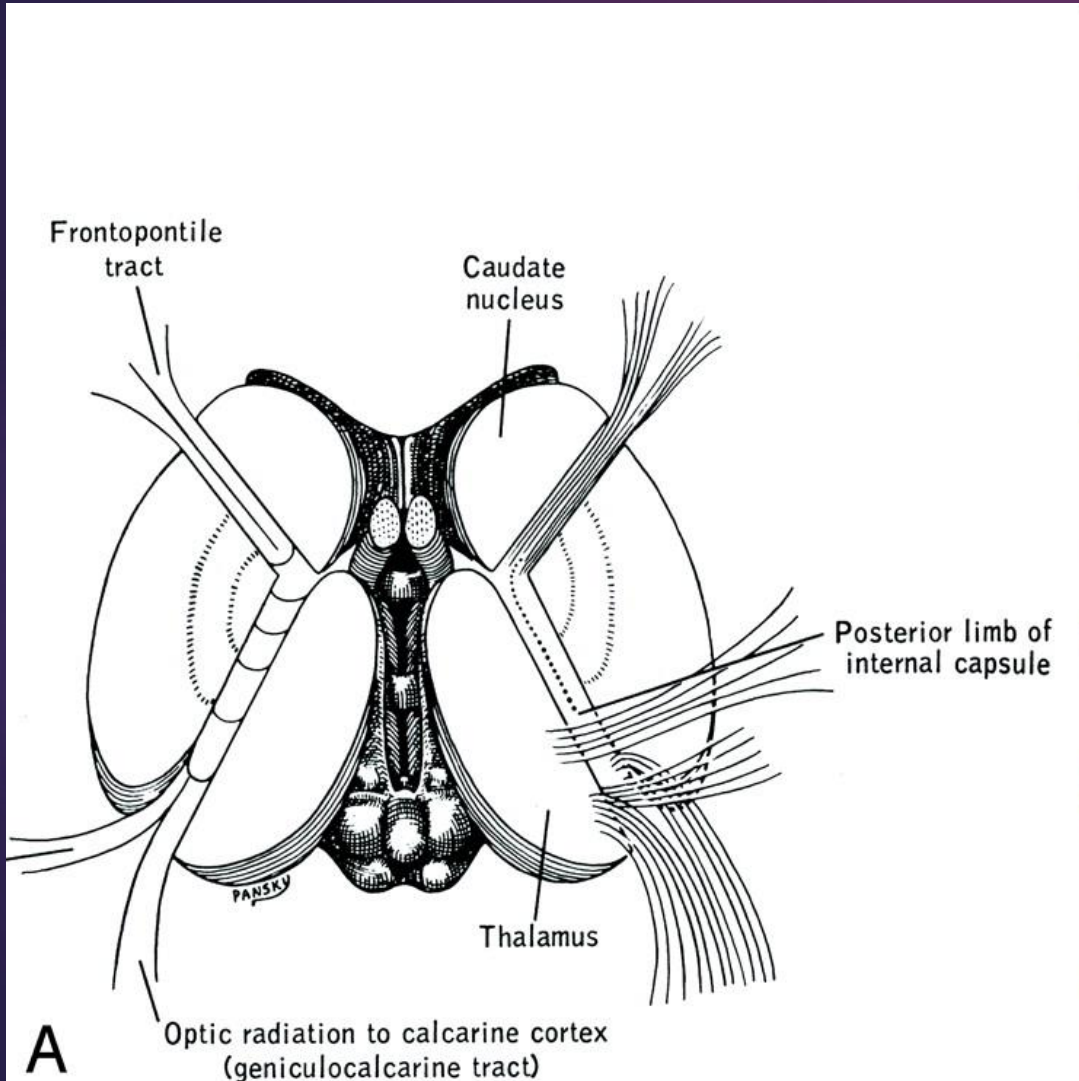
Corticobulbar fibers converge into the corona radiata and continue through the **genu** of the internal capsule

Corticobulbar fibers predominantly terminate at **the cranial motor nuclei**.

Fibers **to and from** virtually all cortical areas fan out superolaterally from the **internal capsule** to form the corona radiata.



Internal Capsule



The **anterior limb** lies between the head of the **caudate** and the rostral aspect of the lentiform nucleus, while the **posterior limb** lies between the **thalamus** and the posterior aspect of the lentiform nucleus.

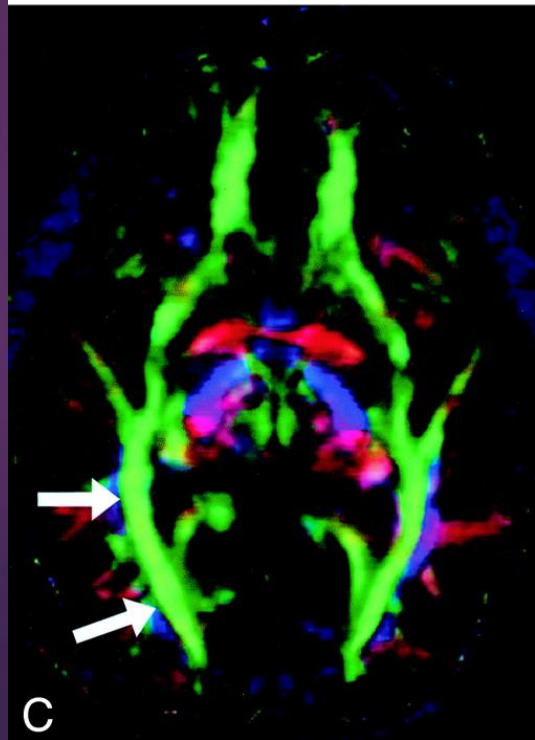
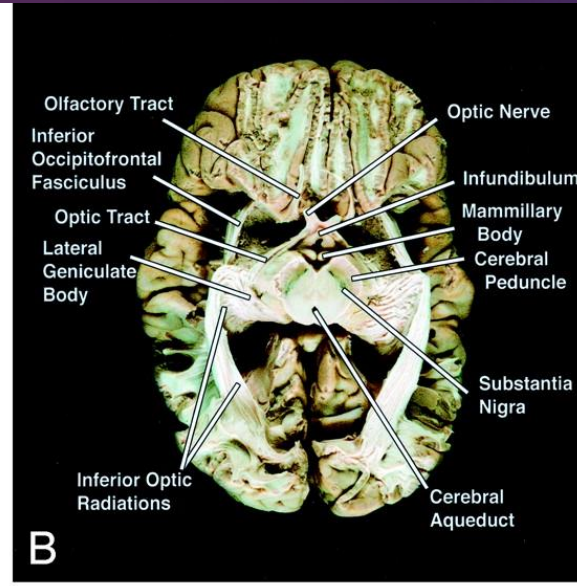
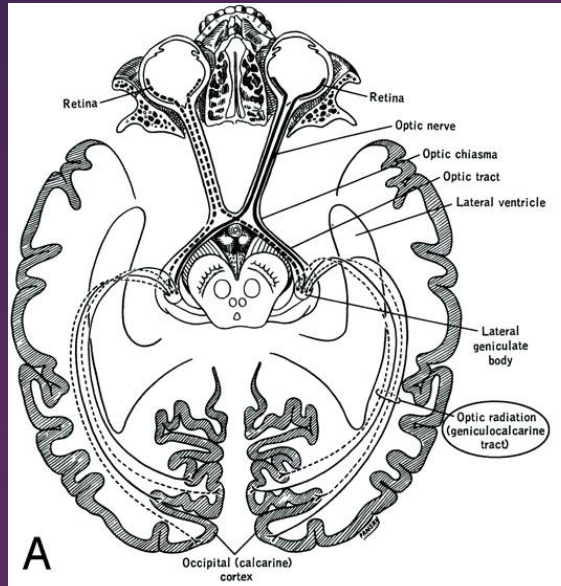


The **anterior limb** passes projection fibers to and from the thalamus (**thalamocortical projections**)

posterior limb, which passes the superior-inferiorly oriented fibers of the **corticospinal, corticobulbar, and corticopontine** tracts.

This gives the anterior and posterior limbs distinctly different colors on directional DTI maps.

Geniculocalcarine Tract (optic radiation)

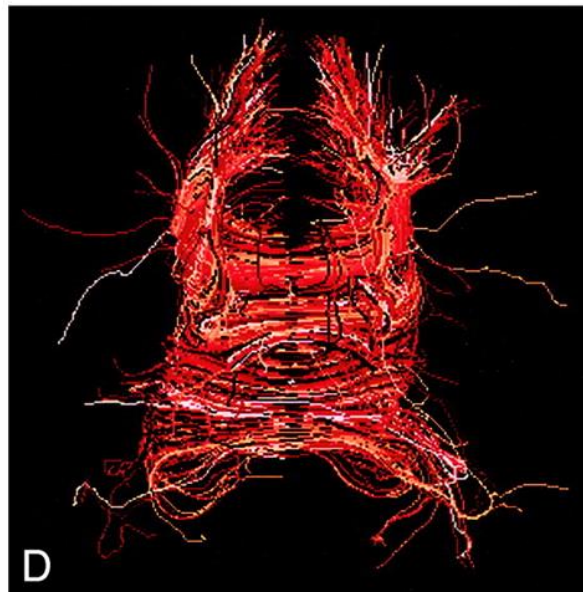
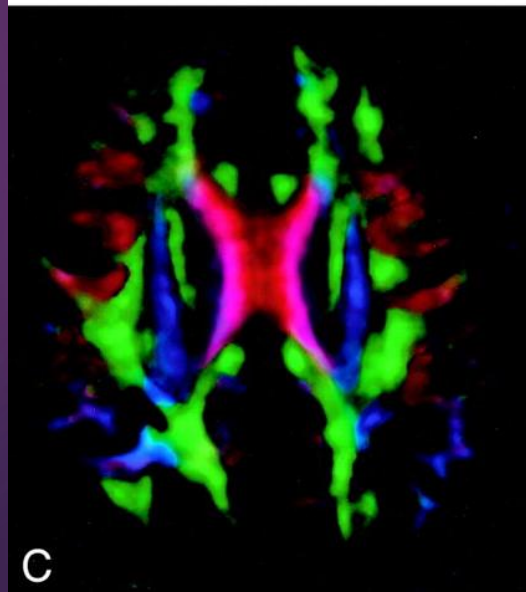
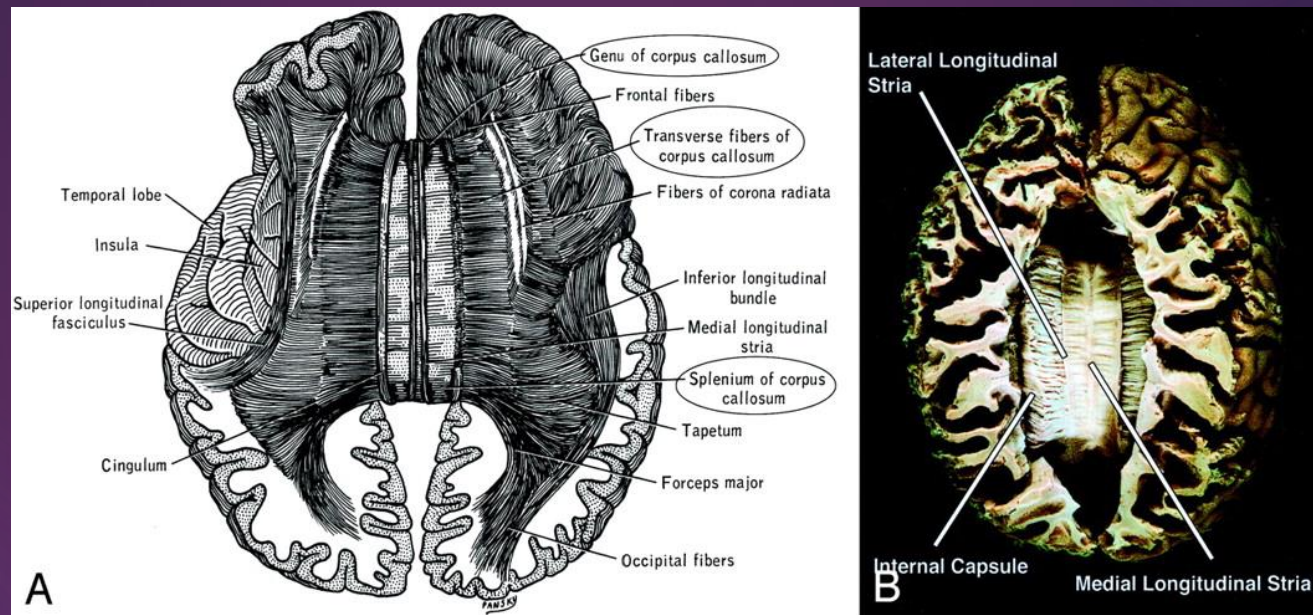


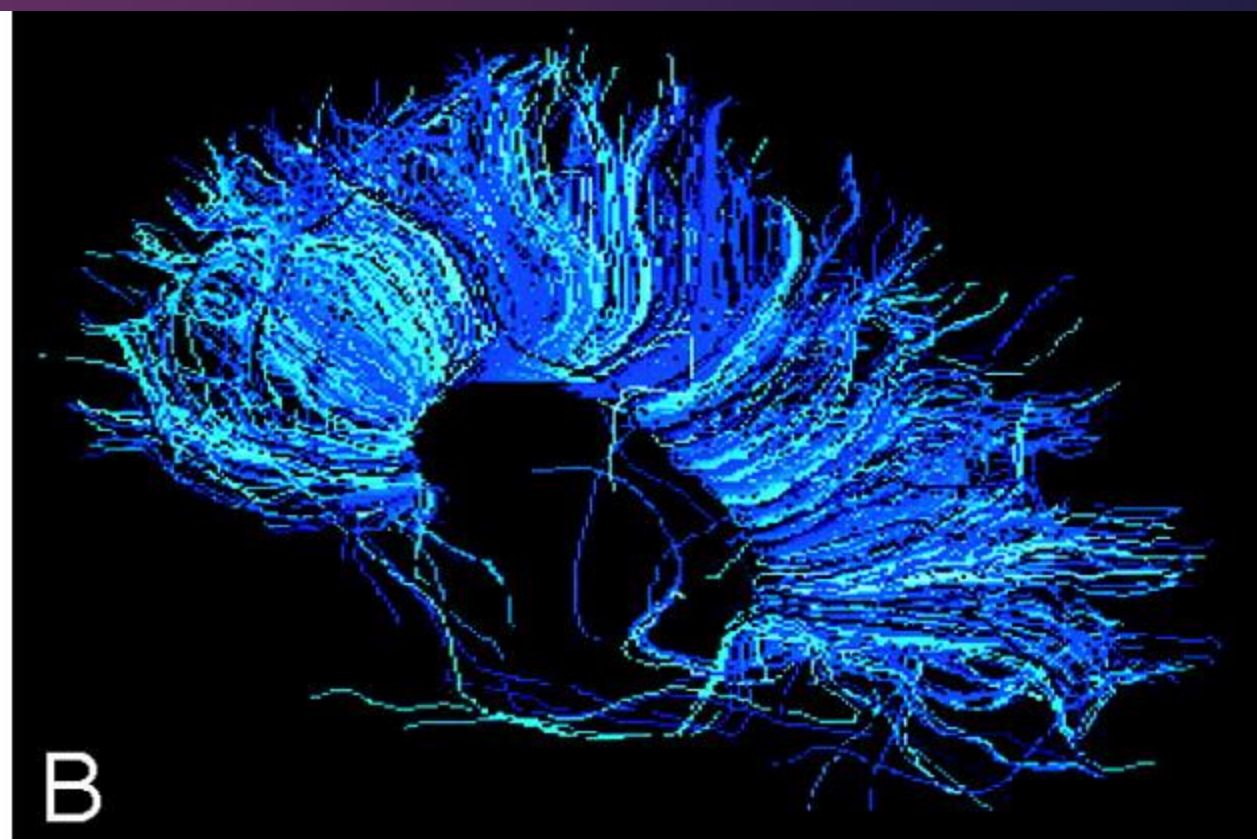
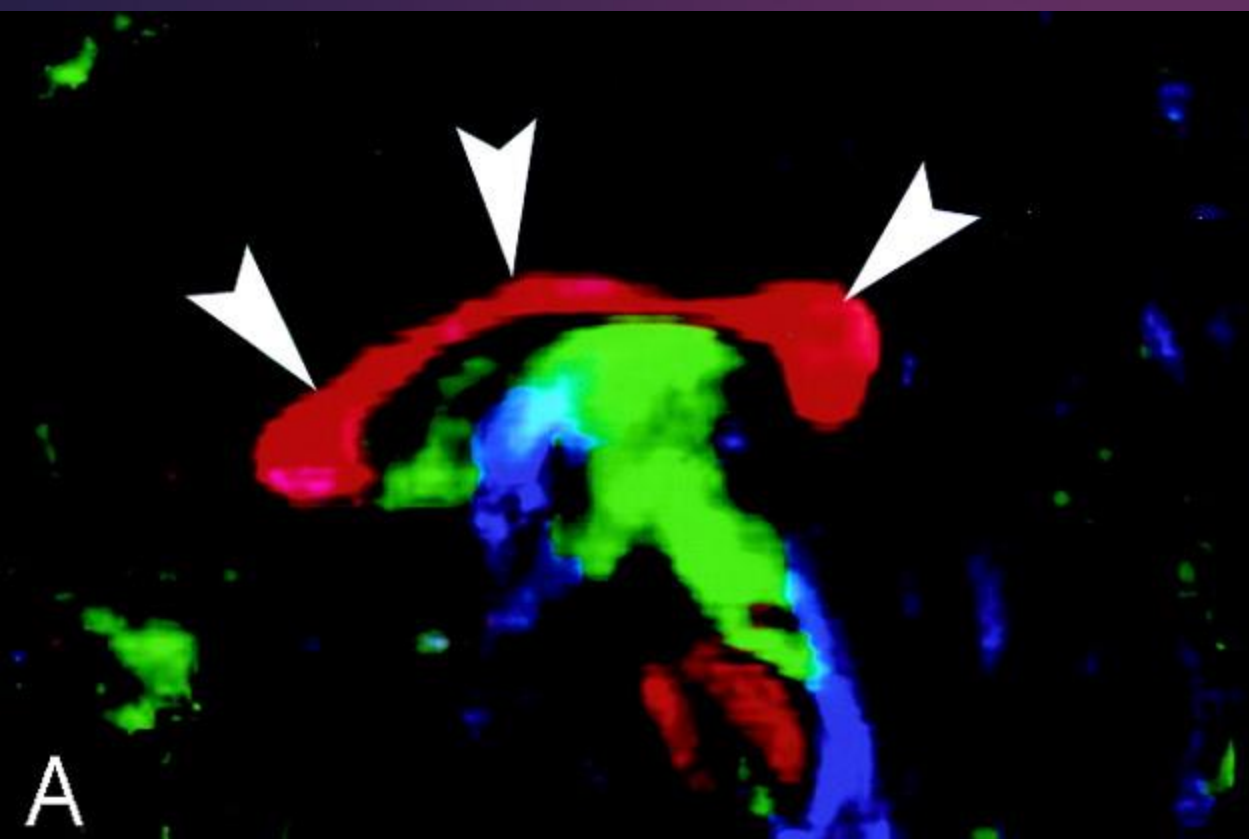
The optic radiation connects the lateral geniculate nucleus to occipital (primary visual) cortex.

Commissural Fibers

Corpus Callosum

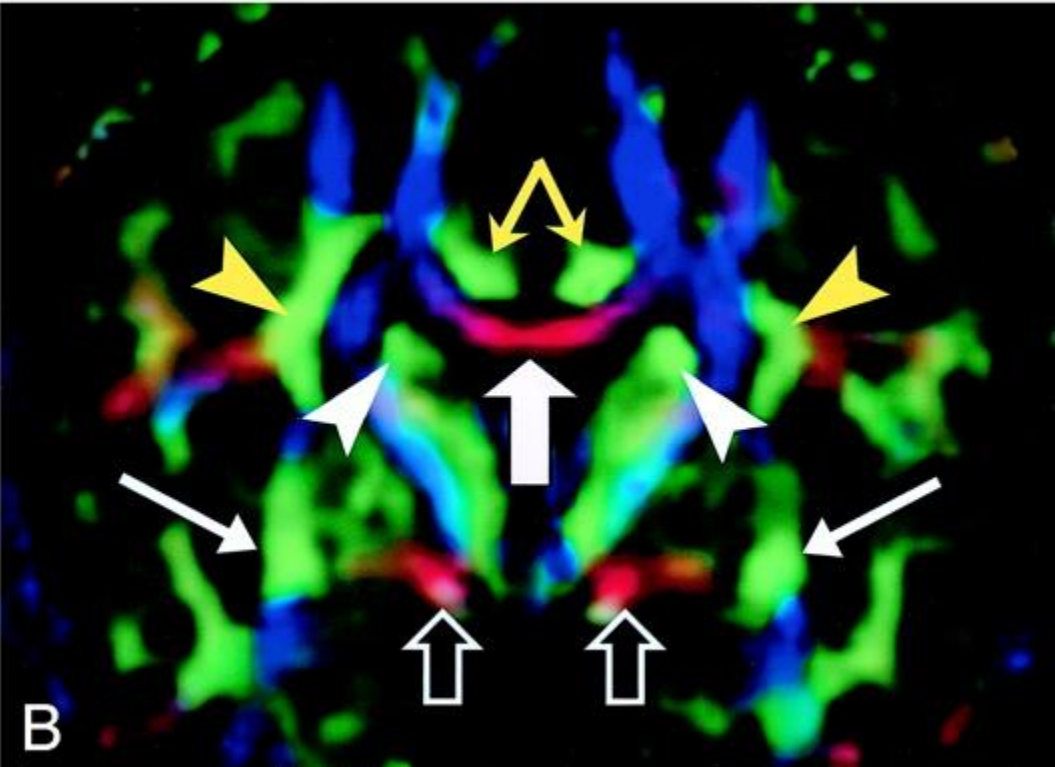
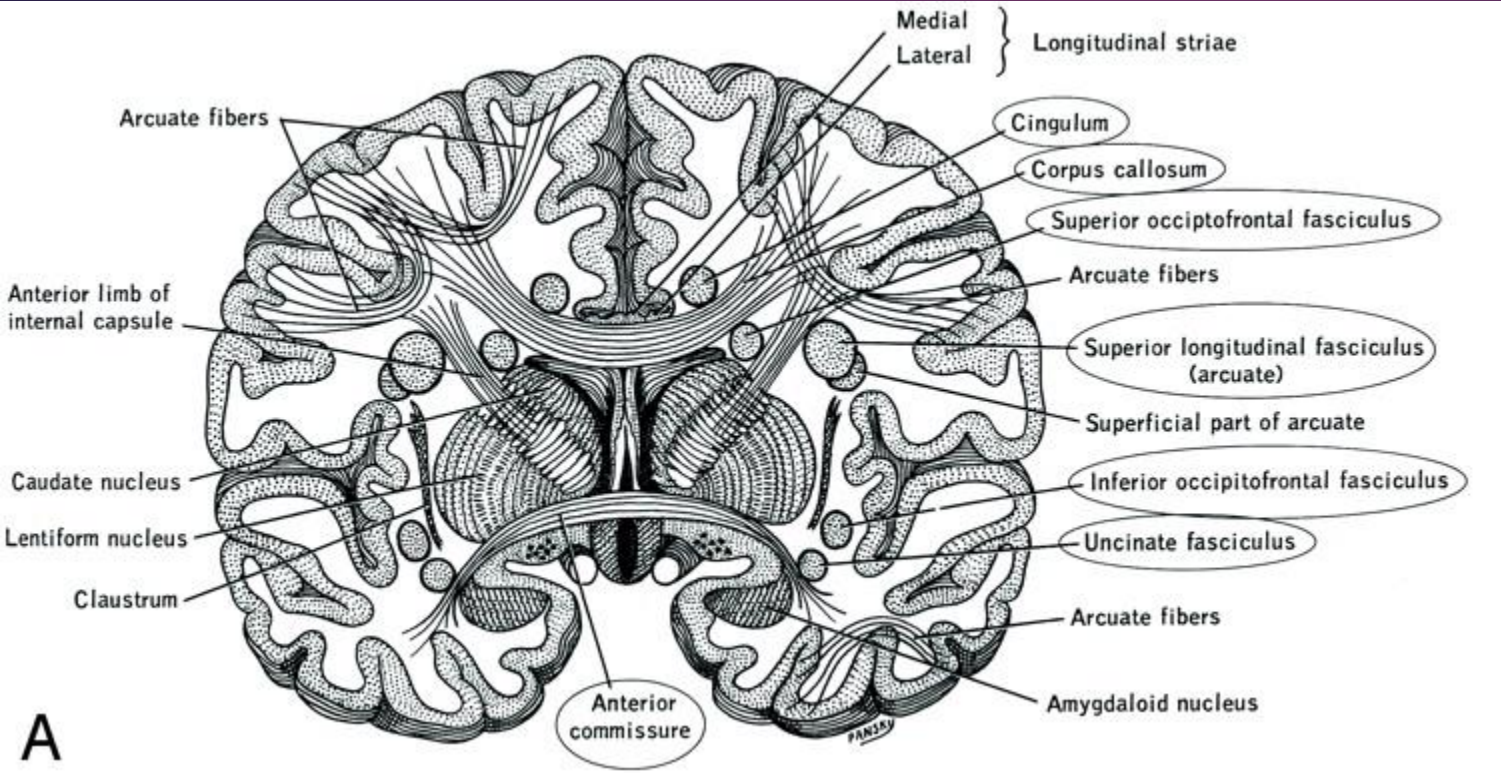
connecting corresponding areas of cortex between the hemispheres





Anterior Commissure

The anterior commissure crosses through the lamina terminalis. Its anterior fibers connect the **olfactory bulbs and nuclei**; its posterior fibers connect middle and inferior temporal gyri.



The anterior commissure plays a key role in **pain sensation**, more specifically sharp, acute pain.

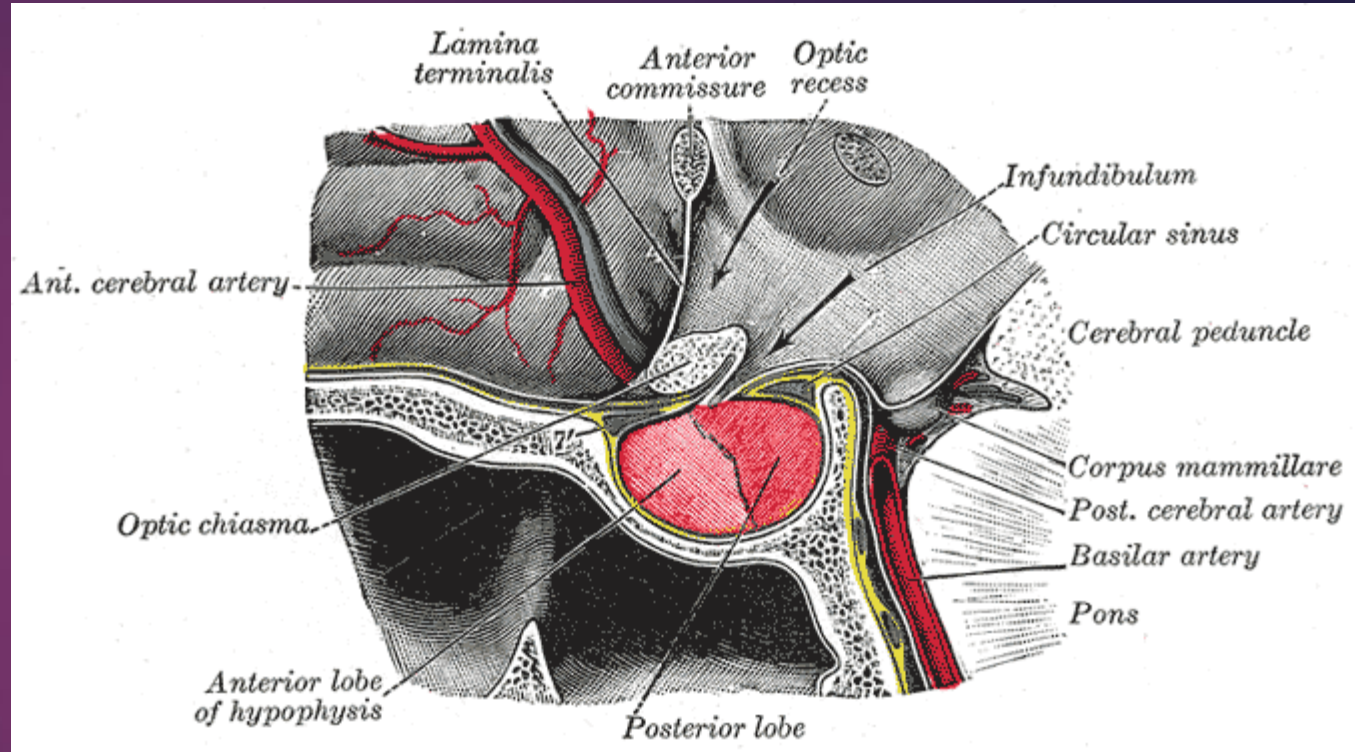
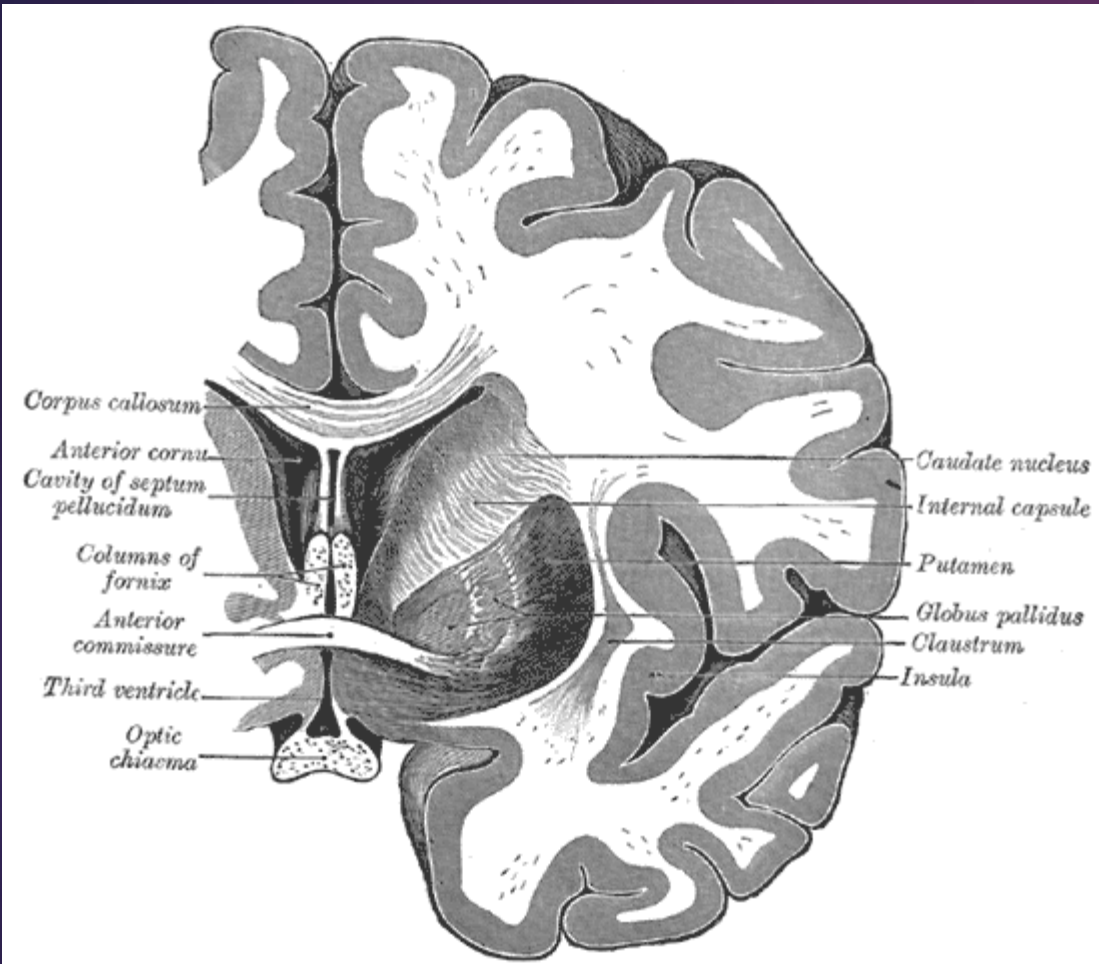
It also contains decussating fibers from the **olfactory tracts**, vital for the sense of **smell and chemoreception**.

The anterior commissure works with the posterior commissure to link the two cerebral hemispheres of the brain and also interconnects the **amygdalae and temporal lobes**, contributing to the role of **memory, emotion, speech and hearing**.

It also is involved in olfaction, **instinct**, and **sexual behavior**.

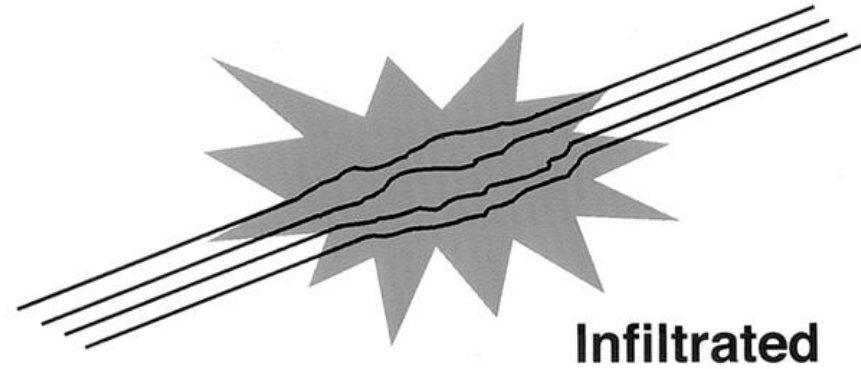
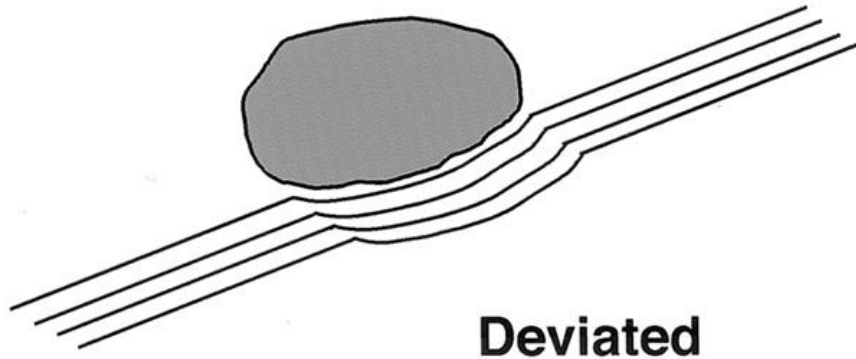
Researchers have implicated it in functions ranging from **colour perception** to **attention**.

homosexual males having the largest anterior commissure, followed by heterosexual **women**, and then **heterosexual** men, who had the smallest anterior commissures



DTI Patterns in WM Tracts Altered by Tumor

pattern



pattern

