Anatomy of white matter

Commissural fibers

Definition

They connect the **same cortical areas** of the **two different cerebral hemispheres**

Types

A. Corpus Callosum:

➲ **Parts:**

Rostrum
- Continuous with the lamina terminalis.
Genu
- The Anterior end - Fibers form the forceps minor - Connects the 2 frontal lobes
Body (trunk)
- The central part - Fibers form the radiation of corpus - The posterior fibers form tapetum, which connects the 2 temporal lobes.
Splenium
- The posterior end - form the forceps major - connects 2 occipital lobes

➲ **Function:**

- Transfer of information (memory and language) between the 2 hemispheres

➲ **Lesion: Callosal Apraxia.**

- The memory and language processes will not be accessible to the nondominant hemisphere causing left side disorders

B. Anterior Commissure: connects the 2 temporal lobes

C. Posterior Commissure: It connects: (**POS**)

- The pretectal nucleus & the Edinger Westphal nuclei for the bilateral light reflex.
- The 2-oculomotor nuclei for the upward gaze.
- The 2 superior colliculi.

D. Hippocampal Commissure: connects the 2 fornices & the 2 hippocampi

E. Habenular Commissure: connects the habenular nuclei of the 2 sides

Association fibers

Definition

Connect **different cortical areas** in the **same cerebral hemisphere**

Types

A. Short Association Fibers:

- They connect adjacent cortical areas. (**Arcuate fibers**)

B. Long Association Fibers:

- **They connect distant cortical areas:**

1) **Superior longitudinal fasciculus** (**arcuate fasciculus**): connects the 4 lobes.
2) **Inferior longitudinal fasciculus:** connects the occipital lobe with the temporal lobe.
3) **Uncinate fasciculus:** forms an arch around the stem of the lateral sulcus and connects the frontal lobe with the temporal lobe.
4) **Cingulum:** lies in the cingulate gyrus. It is the fiber bundle of the limbic lobe. It connects the cingulate gyrus with the para-hippocampal gyrus and ends in the uncus.

Projection fibers

Definition

They connect the cerebral cortex with the subcortical areas & form a compact bundle = **internal capsule**

Types

A. **Ascending projection fibers:** mainly thalamocortical fibers.

B. **Descending projection fibers:** such as corticospinal & corticobulbar fibers

Anatomy of limbic system

Nuclei	Fiber bundles connecting the nuclei
1) **Limbic lobe:** formed of the - Cingulate gyrus - Para-hippocampal gyrus - Uncus.	1) **Cingulum:** fiber bundle of the limbic lobe.
2) **Hippocampus:** - continuous externally with para-hippocampal gyrus. 3) **Hypothalamus:** - mammillary bodies	2) **Fornix:** Arises from the hippocampus & terminates in the mamillary body. **Formed of 4 parts:** - **Fimbria:** nerve fibers on the medial border of the hippocampus. - **Crus of the fornix** is the continuation of fimbria. - **Body of the fornix:** fused two crura of the fornix. - **Anterior column of the fornix:** each one terminates in the mamillary body
4) **Anterior thalamic nuclei**	3) **Mammillothalamic tract:** connects the anterior thalamic nucleus with mamillary body
5) **Medial thalamic nuclei** 6) **The prefrontal cortex** "personality center"	4) **Anterior thalamic radiation:** connects the medial thalamic nucleus with personality center
7) **Amygdaloid nucleus** "amygdala" 8) **Septal area "medial olfactory area":** below the rostrum.	5) **Stria terminalis:** it begins in the amygdaloid nucleus and ends in the septal area.
9) **Habenular nucleus**	6) **Stria medullaris thalami:** begins in the septal area and in the habenular nucleus.

Functions	1) **Recent memory:** the **hippocampus** has a role in remembering recent events. 2) **Emotional behavior:** it plays a role in feeling, feeding, aggression, anger, fear, sadness, pleasure and emotions associated with sexual behavior. 3) **Olfaction:** the **uncus** is a primary olfactory area.

What is the function of the limbic system?

It controls a variety of functions

Emotions	Memory	Olfaction
Behavior & Mood (happy, cry, laugh, sad, afraid, aggression, depression) Visceral & Motor responses involved in sex, pleasure, hunger, and reproduction	**Part** • Amygdala • Cingulate gyrus • Hippocampus • Mamillary body • Prefrontal cortex	**Function** aggression & fear autonomic functions recent memory long memory personality

Lesions	1) **Leads to psychiatry disorders** - e.g. Schizophrenia, depression and senile dementia 2) **Lesions in Hippocampus:** - loss of recent memory, in Alzheimer's disease there is extensive degeneration of hippocampus 3) **Lesions in Amygdaloid nucleus:** - loss of aggressive behavior, fear & anger