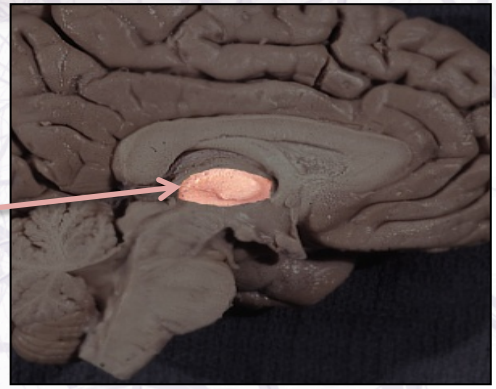
THALAMUS & LIMBIC SYSTEM

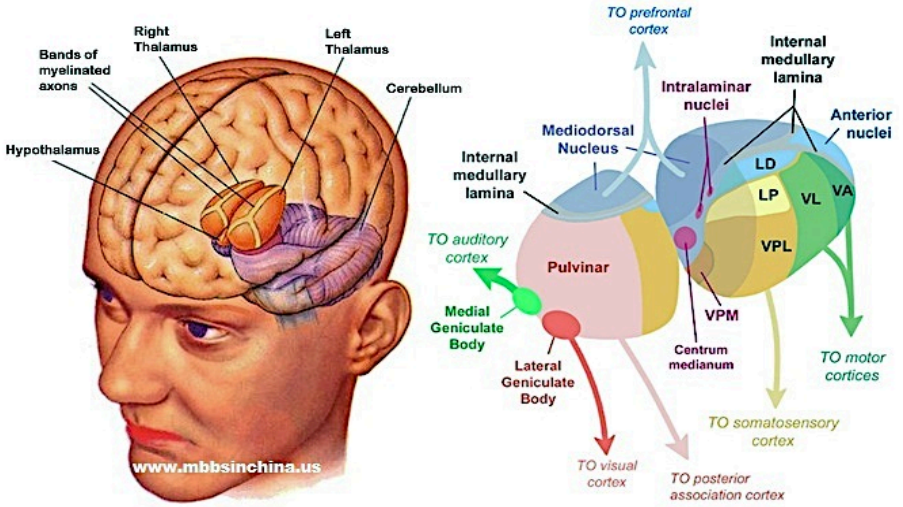
Done by: Hassan Almalak& Maan Alherbish
Revised by: Anjod AlMuhareb & Rahma Alshehri

Anatomy433@gmail.Com
@anatomy433

THALAMUS "the gateway to the cortex"

- It is formed of two oval masses of **gray matter** (the largest nuclear mass of the whole body).
- It is the **largest part** of the **diencephalon**
- Together with the **hypothalamus** they form the lateral wall of the **3rd ventricle**.
- It sends received information from different parts of the brain to the cerebral cortex.
- Axons from every sensory system **(except olfaction)** synapse in the thalamus.
- Some thalamic nuclei receive input from: cerebellar nuclei, basal ganglia and limbic system.



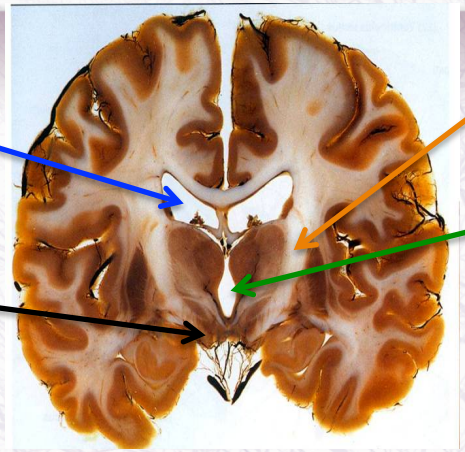


Relations of THALAMUS

Has 4 surfaces and 2 ends:

Superior surface:
Lateral ventricle and fornix.

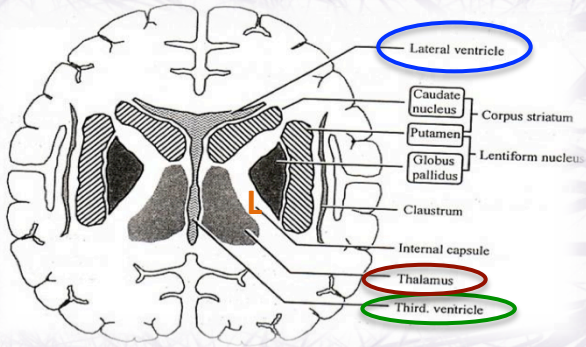
Inferior surface:
Hypothalamus, anteriorly &Subthalamus posteriorly



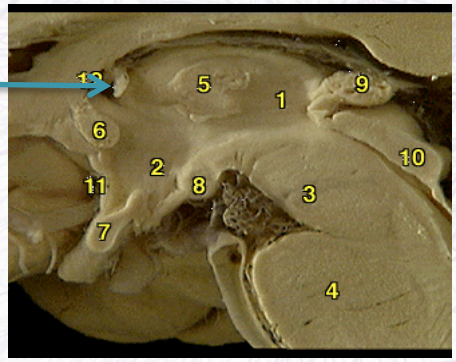
Lateral surface: Posterior limb of the internal capsule

Medial surface*: The 3rd ventricle

*In some people it is connected to the thalamus of the opposite side by the interthalamic connexus, (adhesion) or Massa intermedia.



Anterior end:
Forms a projection, called the **anterior tubercle.**
It lies just **behind the interventricular foramen**.



Posterior end:
Forms a projection called **Pulvinar** which lies **above the superior colliculus and the lateral & medial Geniculate bodies.**

INTERNAL STRUCTURES OF THETHALAMUS

White matter:

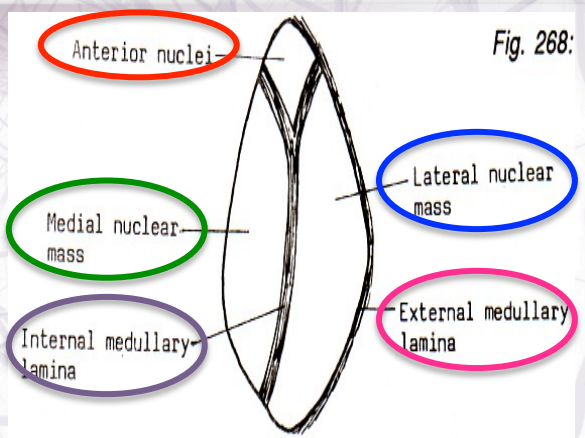
External medullary lamina:

Covers the lateral surface. It consists of **thalamocortical & corticothalamic** fibers.

Internal medullary lamina:

Bundle of Y-shaped myelinated (afferent & efferent) fibers.

It divides the thalamus into: anterior , medial and **lateral** nuclear groups.

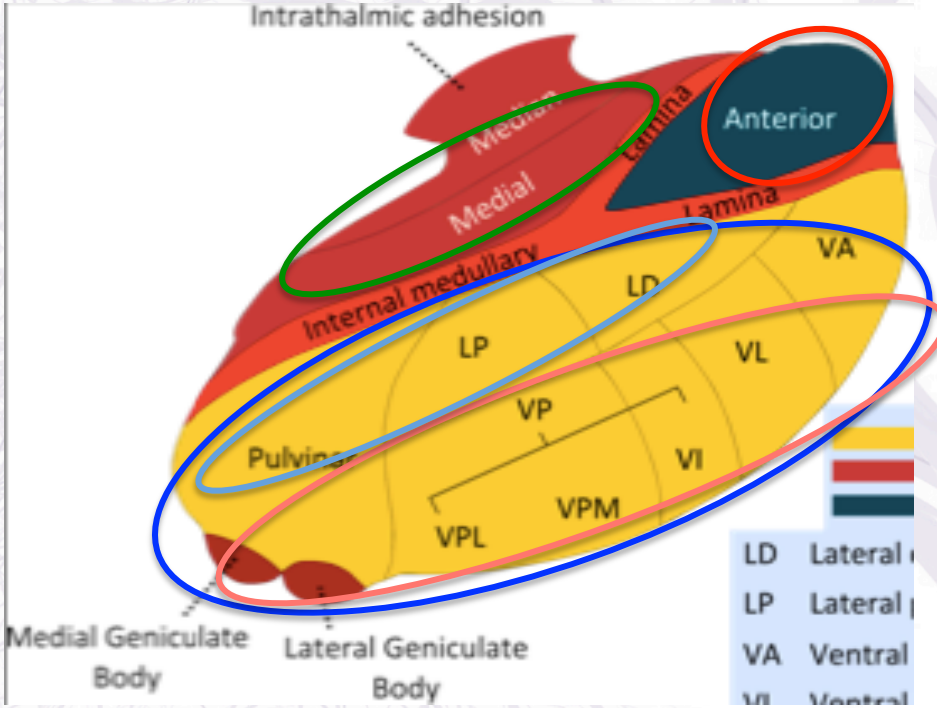


Anterior:
anterior nuclei

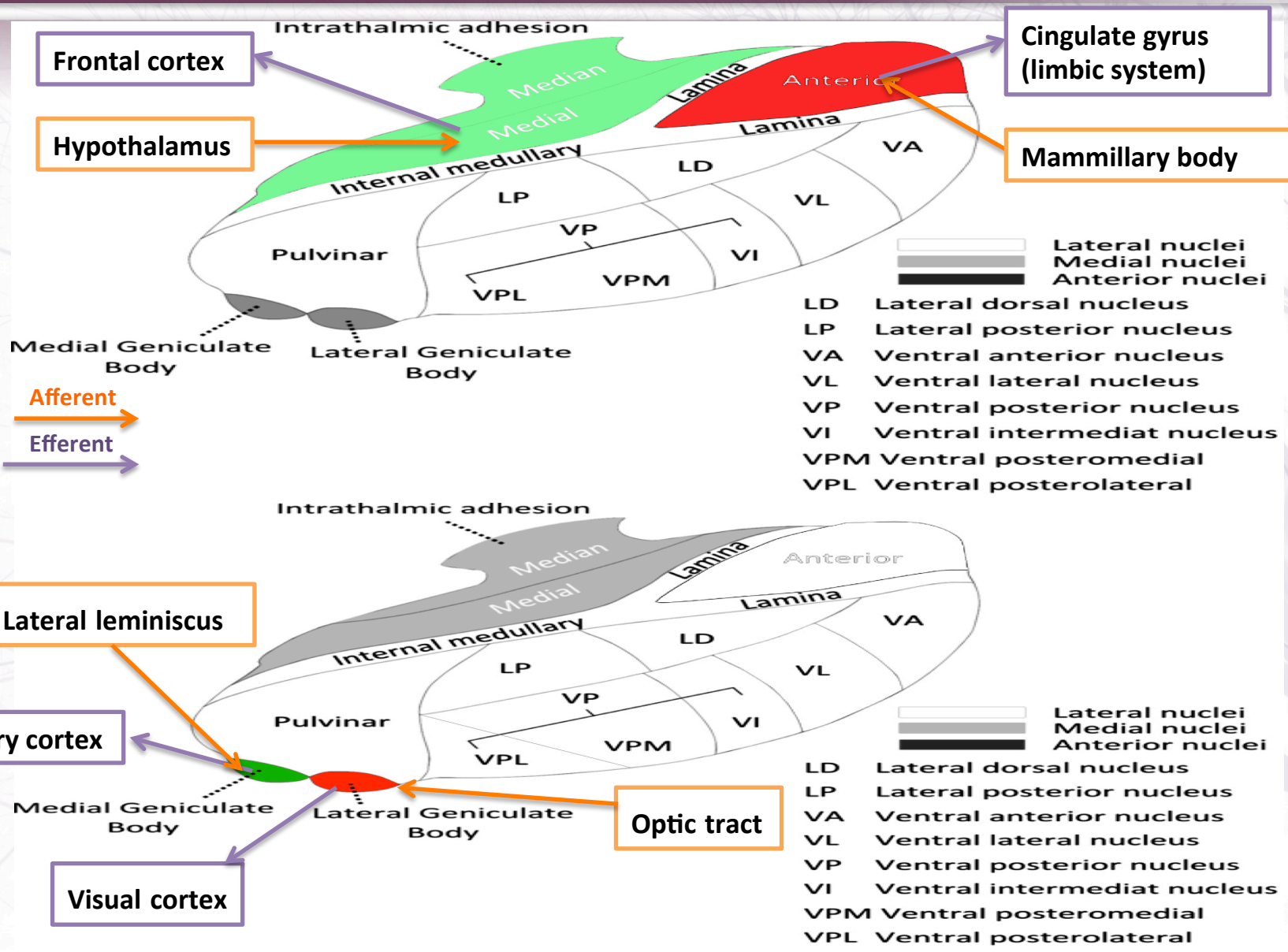
Medial:
medial nucleus

Lateral:

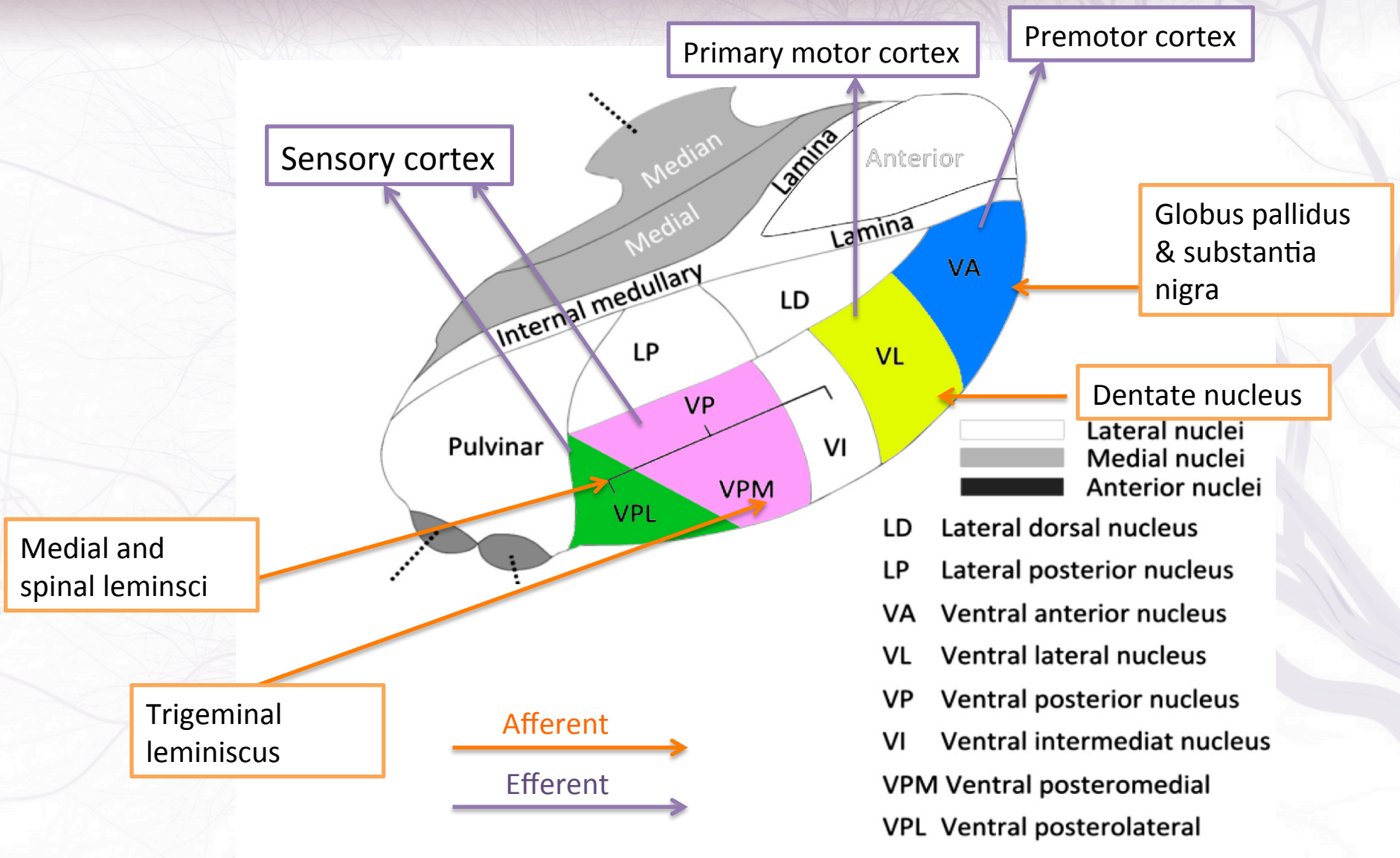
Dorsal tier: 2LP	Ventral tier: 5VML
Lateral dorsal(LD)	Ventral anterior (VA)
Lateral posterior (LP)	Ventral lateral (VL)
Pulvinar	Ventral intermediate (VI)
	Ventral posterior (medial & lateral)(VPM & VPL)
	Medial & lateral geniculate



THALAMUS projection of nuclei

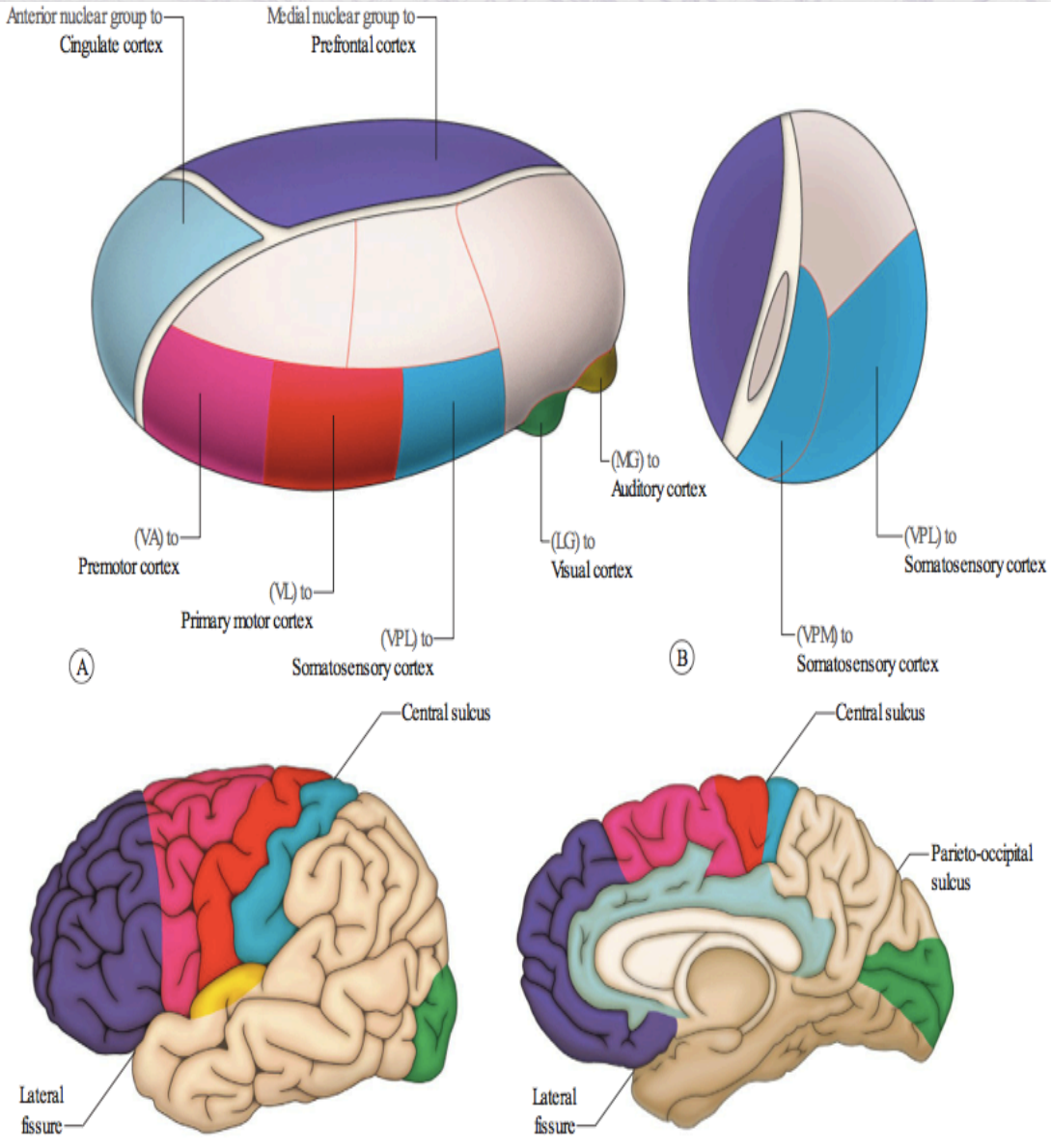


THALAMUS projection of nuclei

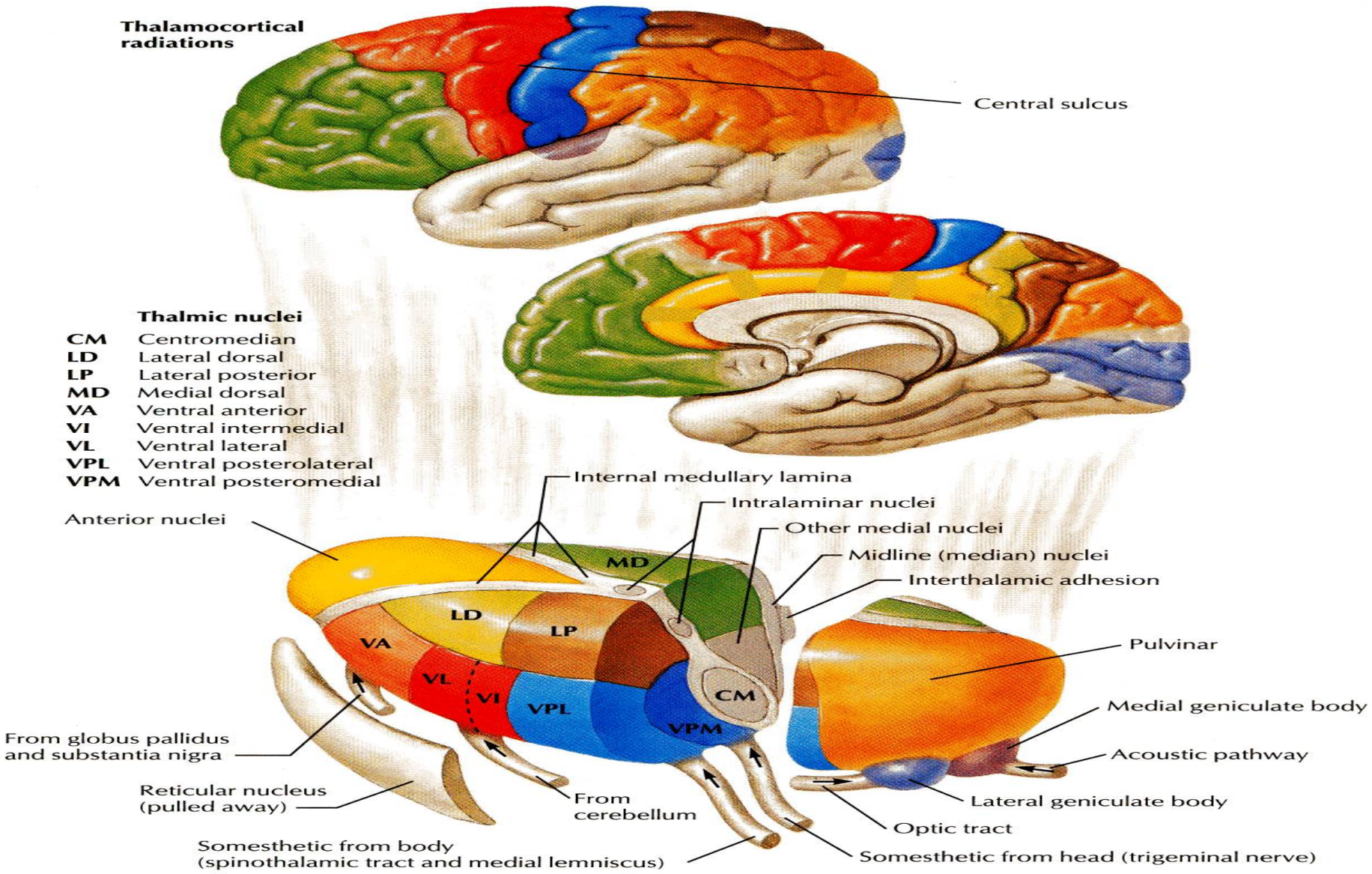


THALAMUS

Nuclei	Afferent	Efferent
Anterior Thalamic	Mammillary body	Cingulate gyrus
Medial	Hypothalamus	Frontal cortex.
Ventral Anterior (VA)	Globus pallidus	Premotor cortex.
Ventral Lateral (VL)	Dentate Nucleus	primary motor cortex.
Ventral Posterior Lateral (VPL)	Medial & spinal leminsci.	(Sensation of body) Sensory cortex. (Sensation of face)
Ventral Posterior Medial (VPM)	Trigeminal Leminiscus	
Medial geniculate body	lateral lemniscus	auditory cortex
Lateral geniculate body	optic tract	visual cortex

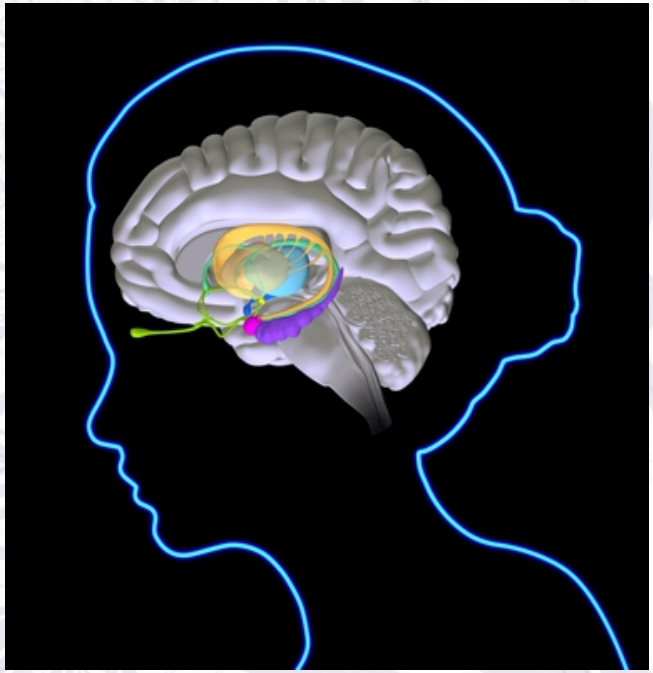


THALAMUS nuclei with associated cortical regions



LIMBIC SYSTEM

- Is composed of more than one structure (cortical & Subcortical) which occupy many regions in the cerebral hemisphere, that are connected to each other.
- All these structures project to Hypothalamus.
- Lies medially between the medial wall of the hemisphere and the **Diencephalon**.



- It has many functions including :
  - ❖ **Emotions**.
  - ❖ Emotional responses.
  - ❖ Behavior & Mood (happy, cry, laugh, sad, afraid, aggression, depression).
  - ❖ Motivation.
  - ❖ **Memory**.
  - ❖ Visceral & Motor responses involved in (sex, **pleasure**, hunger, and reproduction).
  - ❖ **Olfaction**.

LIMBIC SYSTEM

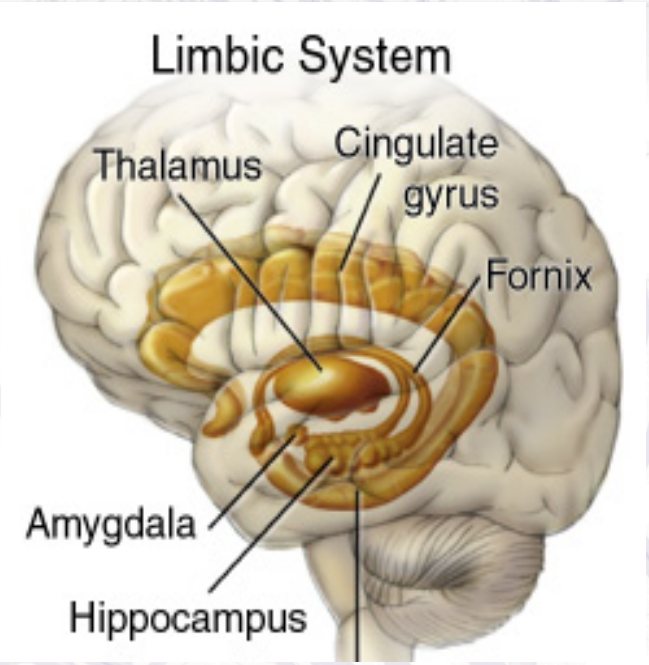
- it is composed of many structures:

1. Limbic cortex or lobe.
2. Amygdala. (Anatomically, considered as a part of basal ganglia)
3. Hippocampus.
4. Septal area.

& Additional cortical areas:

1. ***Limbic lobe (cortex)***
2. ***Hippocampal formation.***
3. ***Septal areas.***
4. ***Prefrontal area.***

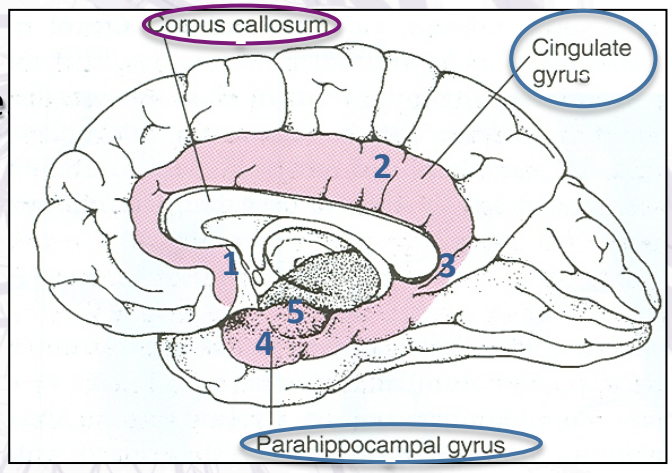
- All connected to ***Thalamus / Hypothalamus / Cerebral cortex.***



❖ *LIMBIC CORTEX (LOBE):*

- C-shaped area of grey matter on the medial aspect of hemisphere
- Surrounds the **corpus callosum.**
- Includes:

1. ***Subcallosal area***
2. ***Cingulate gyrus***
3. ***Isthmus***
4. ***Parahippocampal gyrus***
5. ***Uncus***

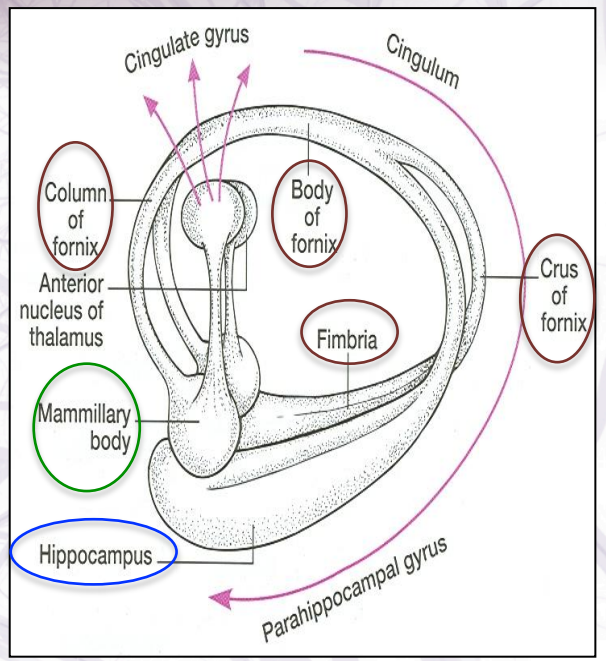


LIMBIC SYSTEM

❖ HIPPOCAMPUS

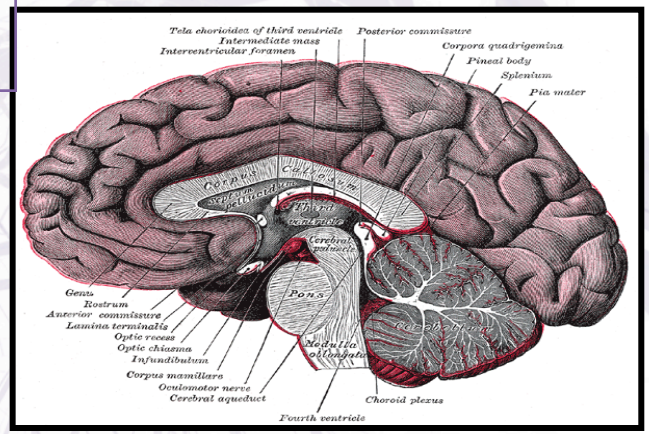
shape	a horseshoe paired structure
site	It is a scrolled (infolding) inferomedial area of the temporal lobe. in each hemisphere
Importance Of Hippocampus	forming and organizing new memories, and correlating them to emotions. It acts as an indexer, sending new memories to a particular region in the cerebral cortex to store it and get it (retrieving) when needed.
FORNIX	It is **C-shaped group of fibers** connecting the **hippocampus** with **mammillary body**.
Parts of FORNIX	Fimbria – Crus – Body – Column
Importance of FORINX	It is principal efferent pathway of Hippocampus ***PAPEZ CIRCUIT***

In short : The hippocampus & its connections are necessary for consolidation of new short-term memories.



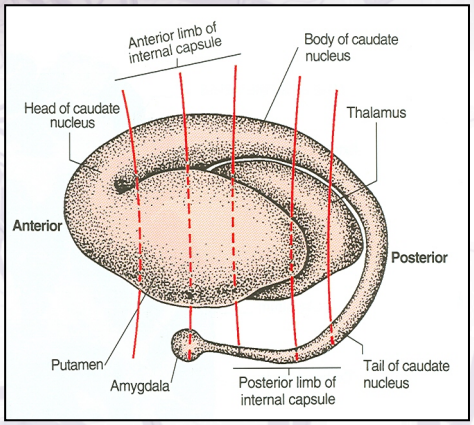
❖ SEPTAL NUCLEUS:

- Lies anterior to **interventricular foramen**.
- Project to **Hypothalamus** and **Habenular nuclei**.
- Responsible in ***Pleasure***.



LIMBIC SYSTEM

❖ AMYGDALA	
shape	***Almond-shaped*** nucleus.
site	Lies in the temporal pole, as a continuation of the tail of caudate nucleus.
function	**Fear – Emotions – Anger – Hormonal secretion**
Lesion	lack of emotional responses & Docility (Easy to be influenced).
Input	**Association areas** of visual, auditory & somatosensory cortices.
Output	**Hypothalamus** & **Autonomic nuclei** in the brain stem,



LIMBIC SYSTEM LESIONS

1-Korsakoff's psychosis: Either ***Retrograde*** **(**loss of new memories at the time of lesion with retained old memories) or ***anterograde*** (inability to gain new memories)

2-Temporal lobe epilepsy:

- The *hippocampus* is a common focus site in epilepsy, and can be damaged through chronic seizures.
- It is sometimes damaged in diseases such as herpes encephalitis.

3-Alzheimer's disease: Damage in hippocampus and other memory-involved areas.

4-Schizophrenia.

MCQs

1- the lateral surface of the thalamus is related to:	**2- the ventral tier of lateral nuclear group contains which one of the following:**
A. Putamen B. Fluccolandular lobe of cerebellum C. Posterior limb of internal capsule D. Lateral ventricle and fornix	A. Medial nucleus B. Lateral posterior nucleus C. Pulvinar D. lateral geniculate nucleus
3- ventral lateral nucleus receives fibers from:	**4- which of the following is a part of the limbic cortex:**
A. Dentate nucleus B. Lateral leminiscus C. globus pallidus D. Hypothalamus	A. Premotor cortex B. Wernicke's area C. Parahippocampal gyrus D. Insula
5- which structure lies in the inferomedial area of the temporal lobe:	**6- Amygdala is the continuation of :**
A. Hippocampus B. Septal nucleus C. Amygdala D. Thalamus	A. putamen B. tail of caudate necleus C. globus pallidus D. subthalamus
7-Which one of the following function of HIPPOCAMPUS	**8-Which one of the following function of septal nuclei**
A. Olfaction B. Memory C. FEAR D. Pleasure	A. Olfaction B. Memory C. FEAR D. Pleasure

Ans: 1-C 2-D 3-A 4-C 5-A 6-B 7-B 8-D