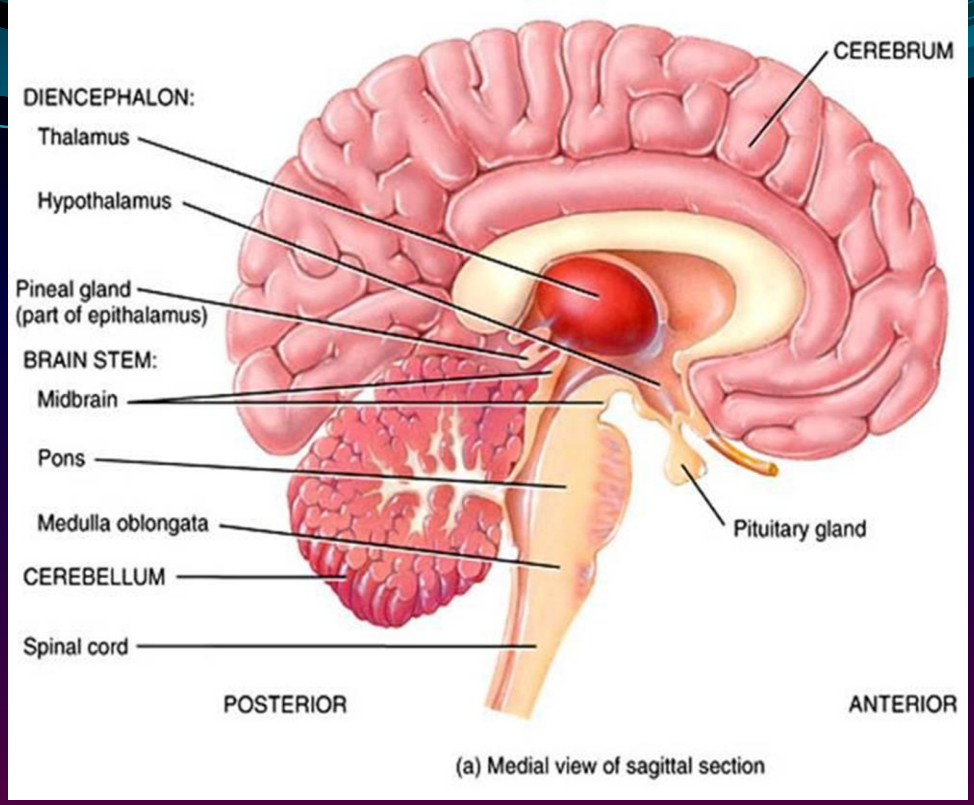
DIENCEPHALON

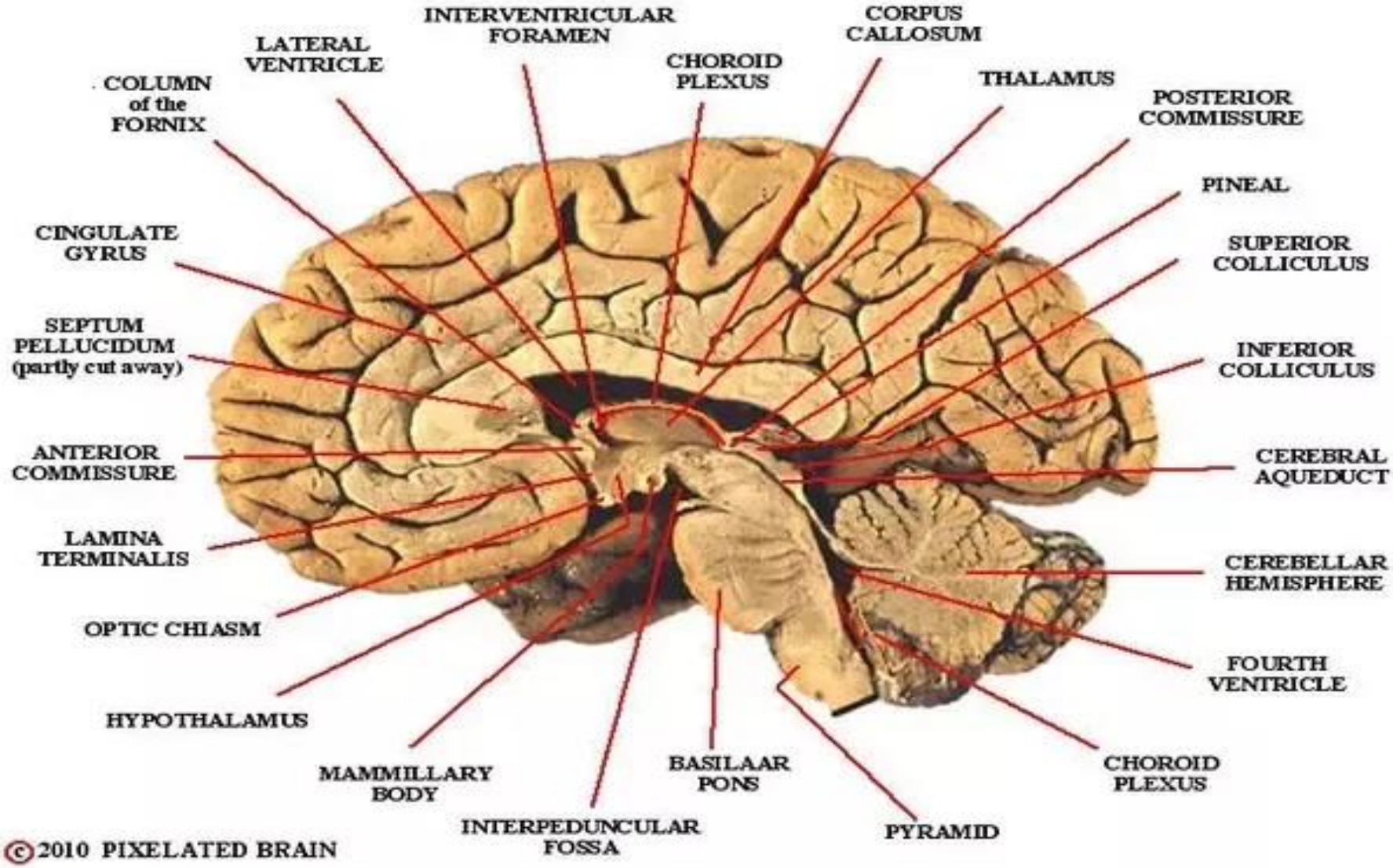


(a) Medial view of sagittal section

By

DR. DALIA MAHMOUD BIRAM

DIENCEPHALON



Diencephalon

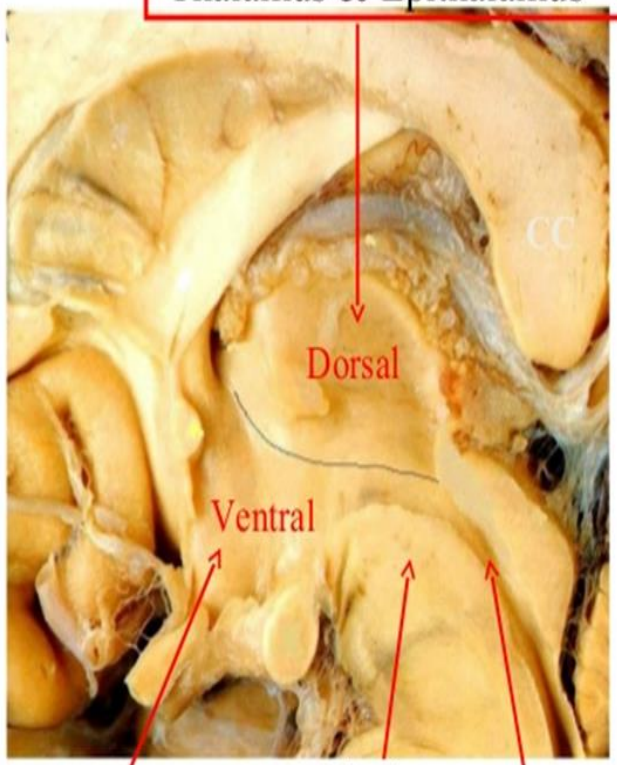
Site:- It is the part of the forebrain which lies above the midbrain, between the lower parts of the 2 cerebral hemispheres.

- It consists of:

1. Thalamus:-the large oval mass of grey matter
2. Subthalamus:- it lies directly above midbrain
3. Hypothalamus: lies infront of subthalamus
4. Metathalamus: formed by lateral & medial geniculate body
5. Epithalamus: Formed of pineal body, 2 habenular nuclei & posterior commissure.

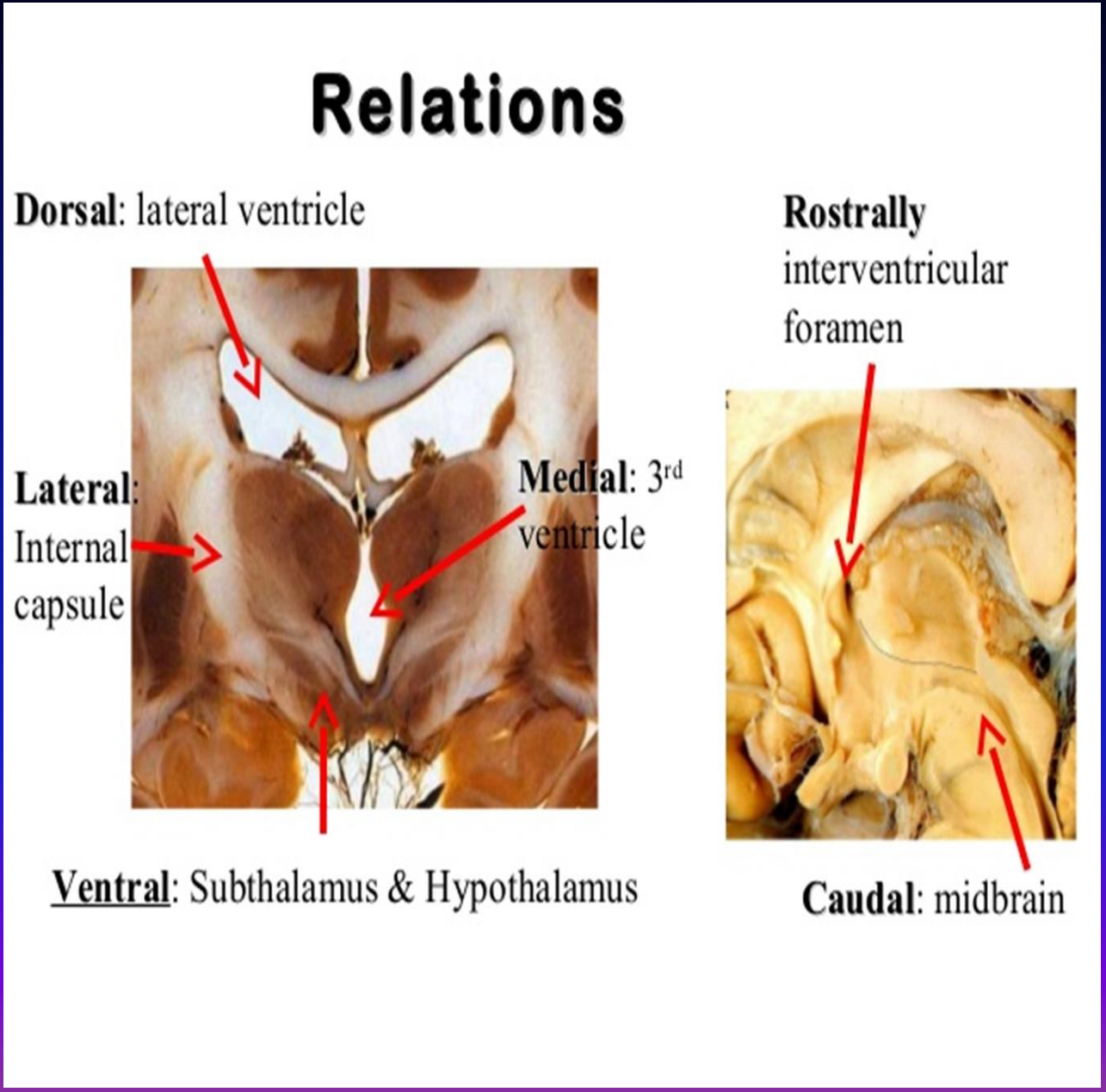
The third ventricle lies between the 2 halves of the diencephalon.

- On the medial surface, the diencephalon is subdivided, by hypothalamic sulcus (indicated by black line) into:
  - Dorsal part:
  - Ventral part:

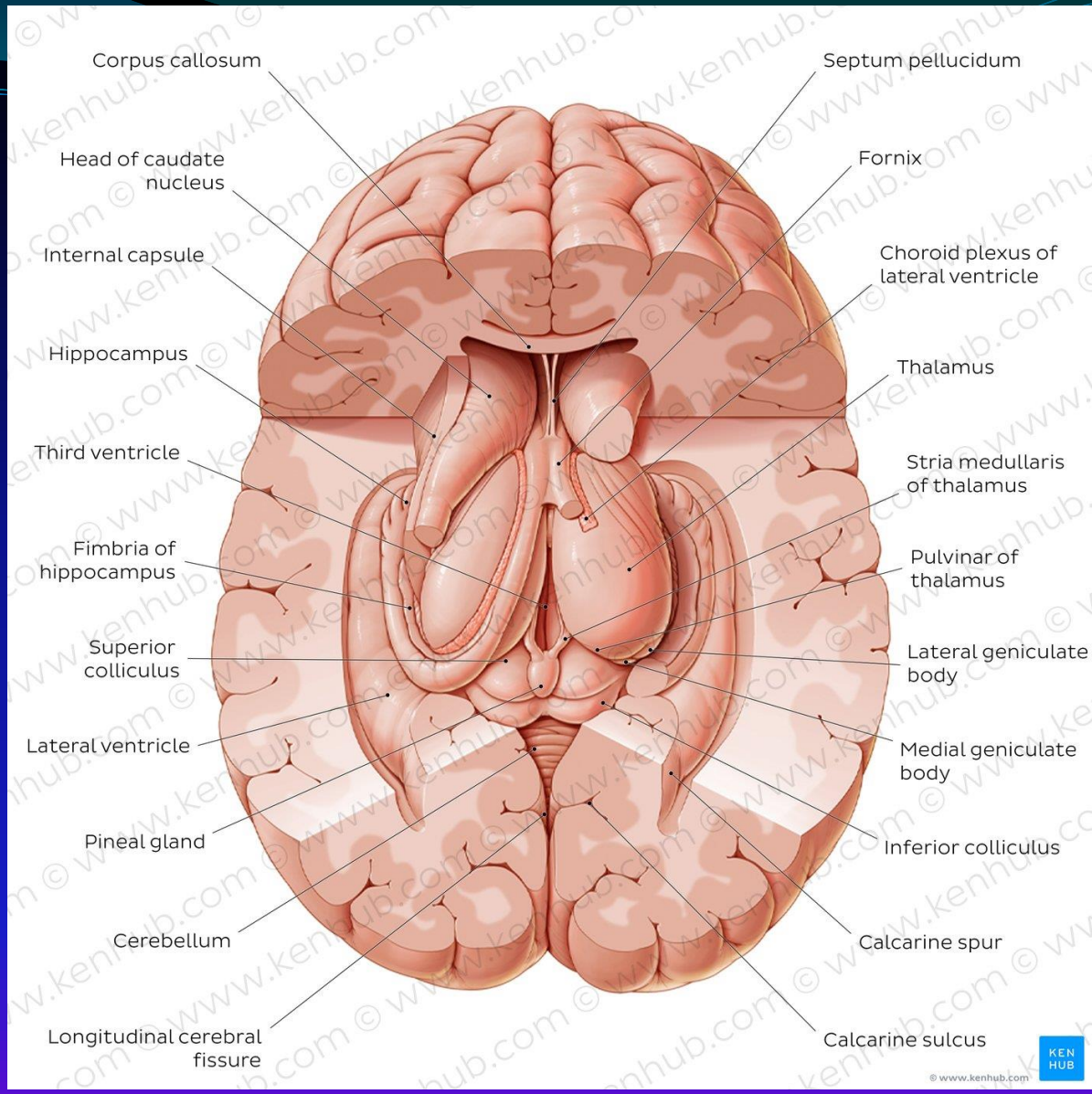


1. Thalamus

- Def.: oval mass of grey matter situated on each side of the 3rd ventricle . 4 cm long and 1.5 cm broad.
- Two ends: Anterior and posterior.
- Four surfaces: Superior, inferior, medial and lateral.



- **Relations :**
- **Anterior end:** It is narrow and lies near the median plane forming the posterior boundary of the interventricular foramen.
- **Posterior end:** (pulvinar). Expanded It is directed dorsally and laterally overhanging the superior colliculus and its brachium.



- **Superior surface:**

Related to the following structures from lateral to medial:

1-Body of caudate nucleus.

2. Stria terminalis.

3. Thalamostriate vein.

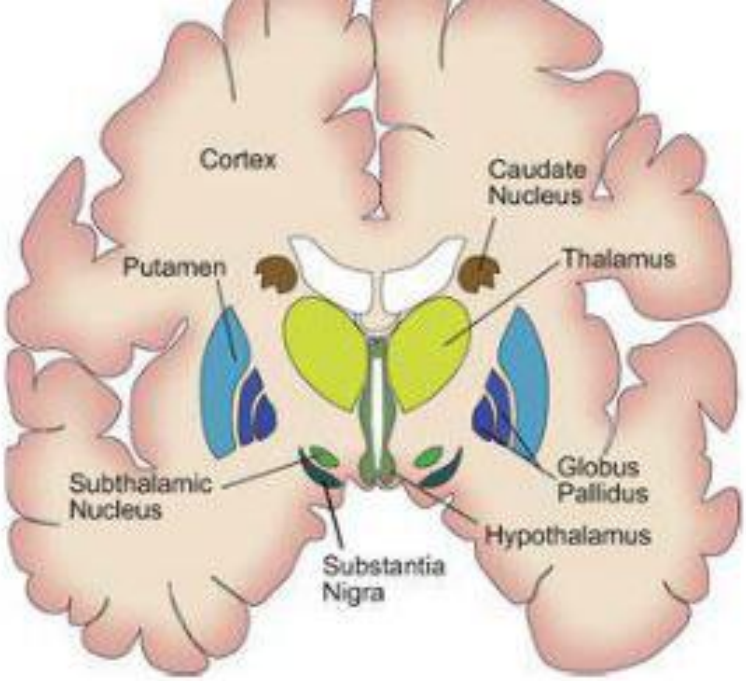
4. Body of lateral ventricle.

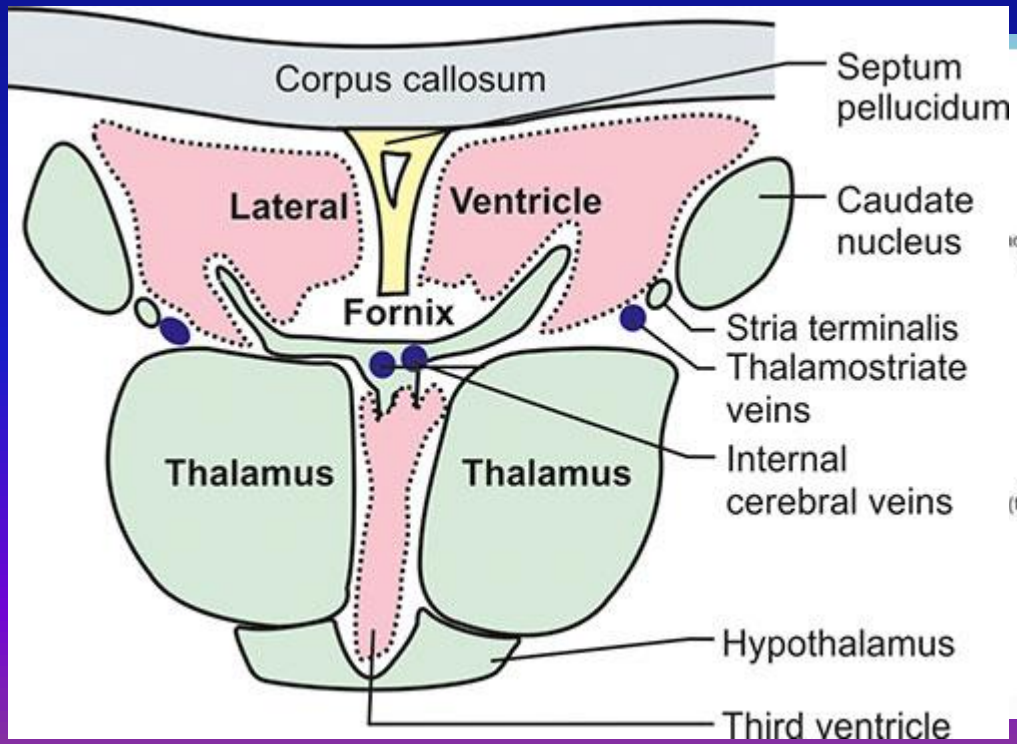
5. Choroid plexus.

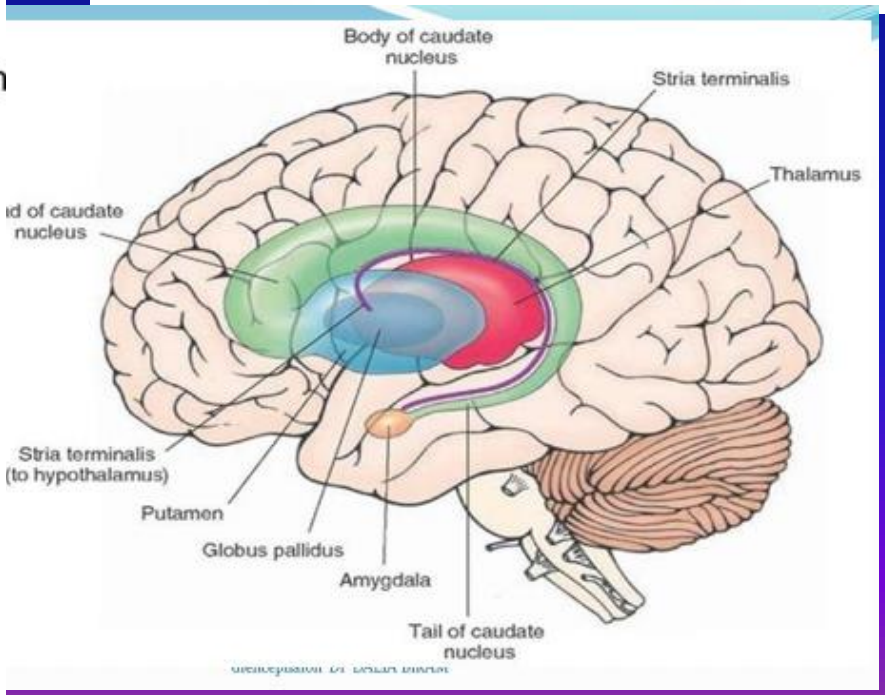
6. body of fornix.

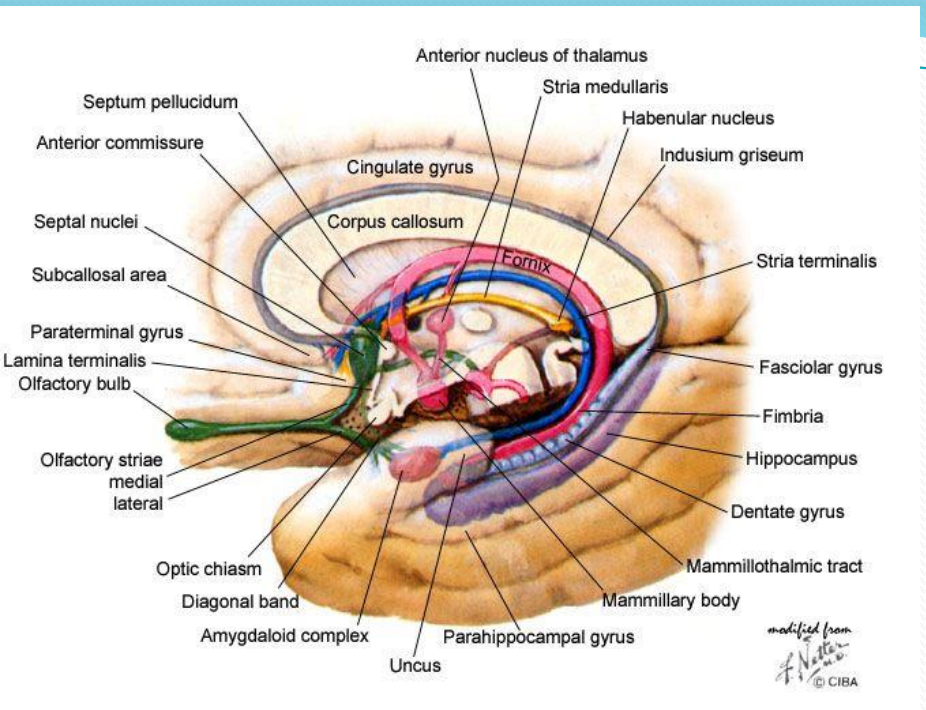
- **Inferior surface:**

Related to the subthalamus, hypothalamus and tegmentum of the midbrain.








Anterior nucleus of thalamus
Stria medullaris
Septum pellucidum
Habenular nucleus
Anterior commissure
Indusium griseum
Cingulate gyrus
Septal nuclei
Corpus callosum
Fornix
Subcallosal area
Stria terminalis
Paraterminal gyrus
Lamina terminalis
Fasciolar gyrus
Olfactory bulb
Fimbria
Olfactory striae
medial
lateral
Hippocampus
Dentate gyrus
Optic chiasm
Mammillothalmic tract
Diagonal band
Mammillary body
Amygdaloid complex
Parahippocampal gyrus
Uncus
modified from
F. Netter, M.D.
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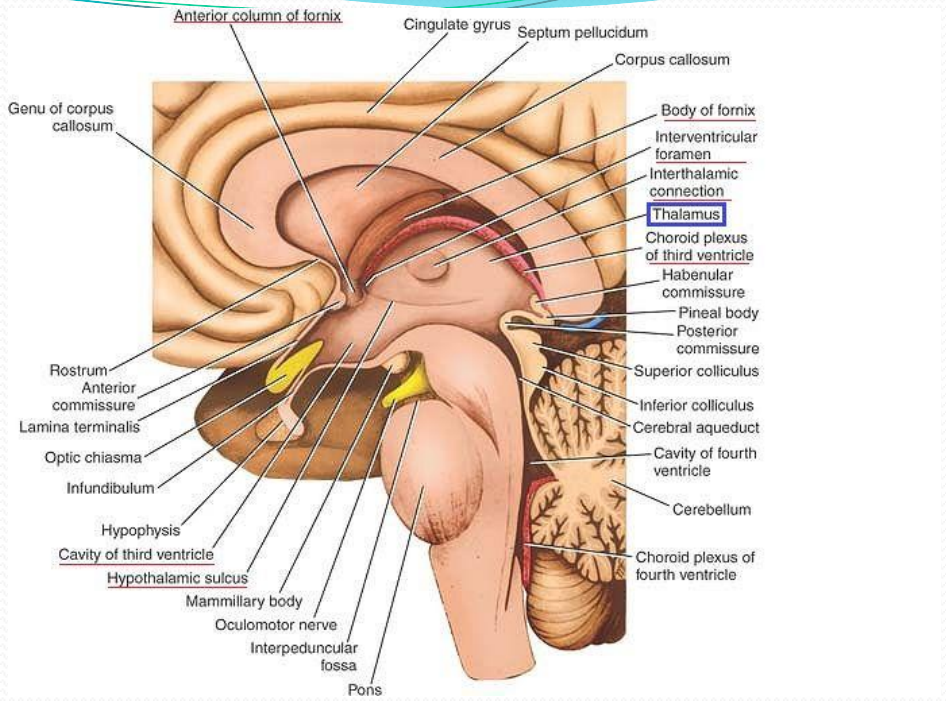
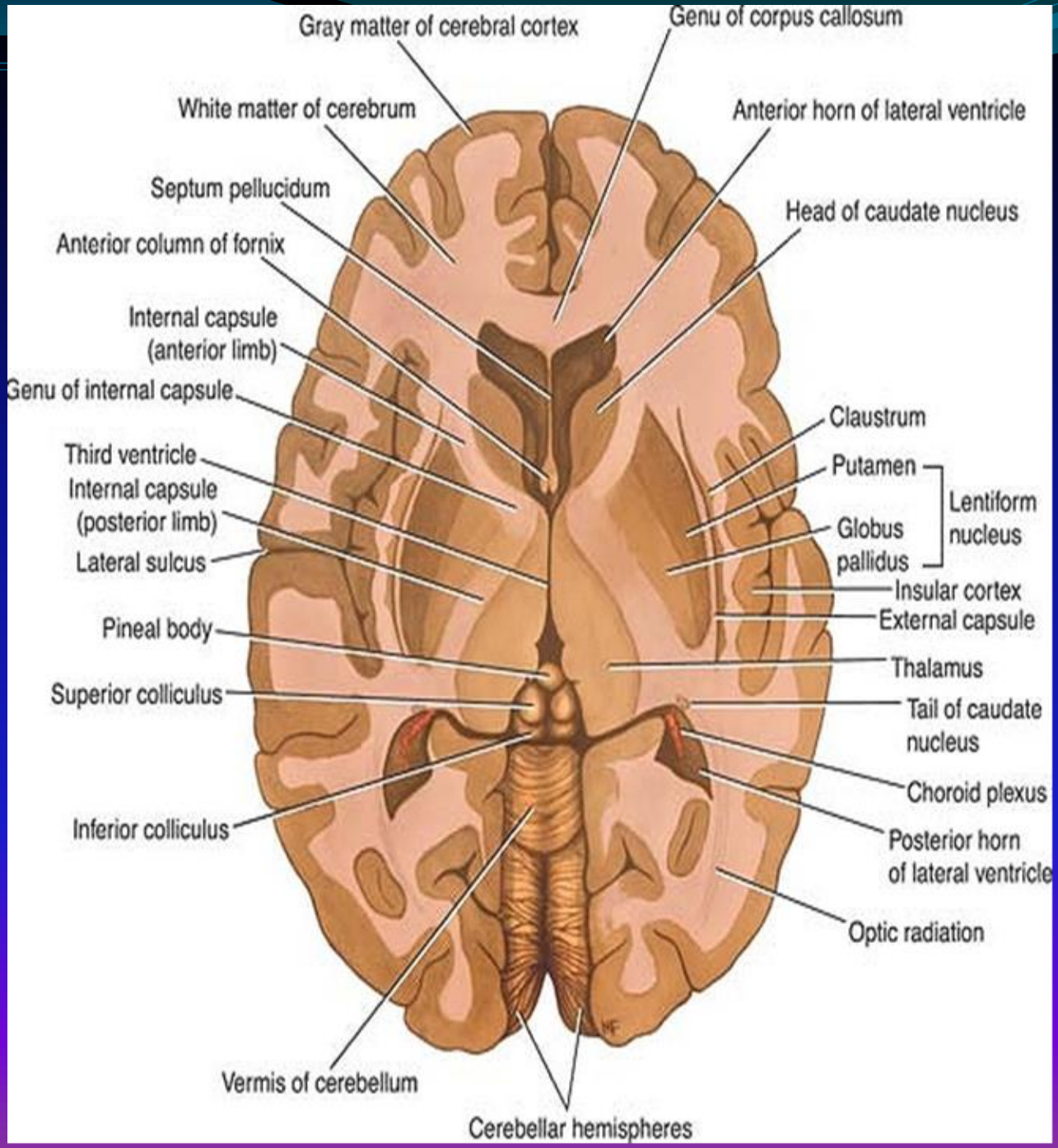

Anterior column of fornix
Cingulate gyrus
Septum pellucidum
Corpus callosum
Genu of corpus callosum
Body of fornix
Interventricular foramen
Interthalamic connection
Thalamus
Choroid plexus of third ventricle
Habenular commissure
Pineal body
Posterior commissure
Superior colliculus
Inferior colliculus
Cerebral aqueduct
Cavity of fourth ventricle
Cerebellum
Choroid plexus of fourth ventricle
Rostrum
Anterior commissure
Lamina terminalis
Optic chiasma
Infundibulum
Hypophysis
Cavity of third ventricle
Hypothalamic sulcus
Mammillary body
Oculomotor nerve
Interpeduncular fossa
Pons

- **Lateral surface:** It is related to the posterior limb of the internal capsule which separates it from the lentiform nucleus.

- **Medial surface:** This surface is related to the cavity of the 3rd ventricle.
- The upper edge of this surface is related to a band of white matter called stria medullaris thalami (or stria habenularis).

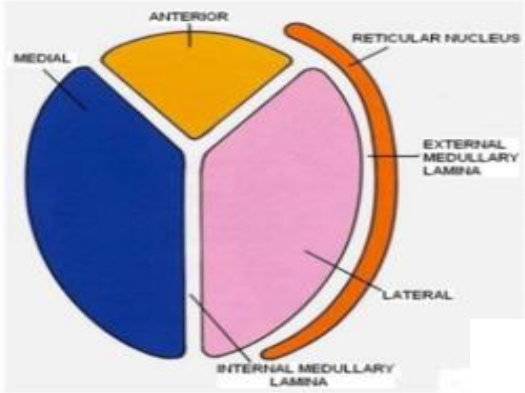
This surface is connected to the corresponding surface of the opposite thalamus by a band of grey matter called inter-thalamic adhesion.



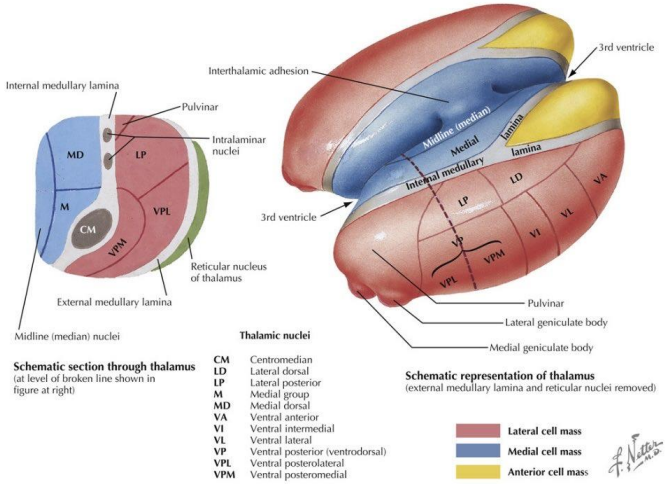
Internal structure of the thalamus :

Internal Organization

- Thalamus is composed of grey matter, interrupted by 2 vertical sheaths of white matter called medullary laminae.
- **External medullary lamina:**
- Located laterally, separates reticular nucleus from the rest of the thalamic mass . It contains thalamocortical & corticothalamic fibers
- **Internal medullary lamina**
- Y shaped complex of nuclei and fibers, separates the thalamus into anterior group between the 2 limbs of Y shaped lamina and two tiers of nuclei medial and lateral group on each side of the stem of Y shaped lamina.



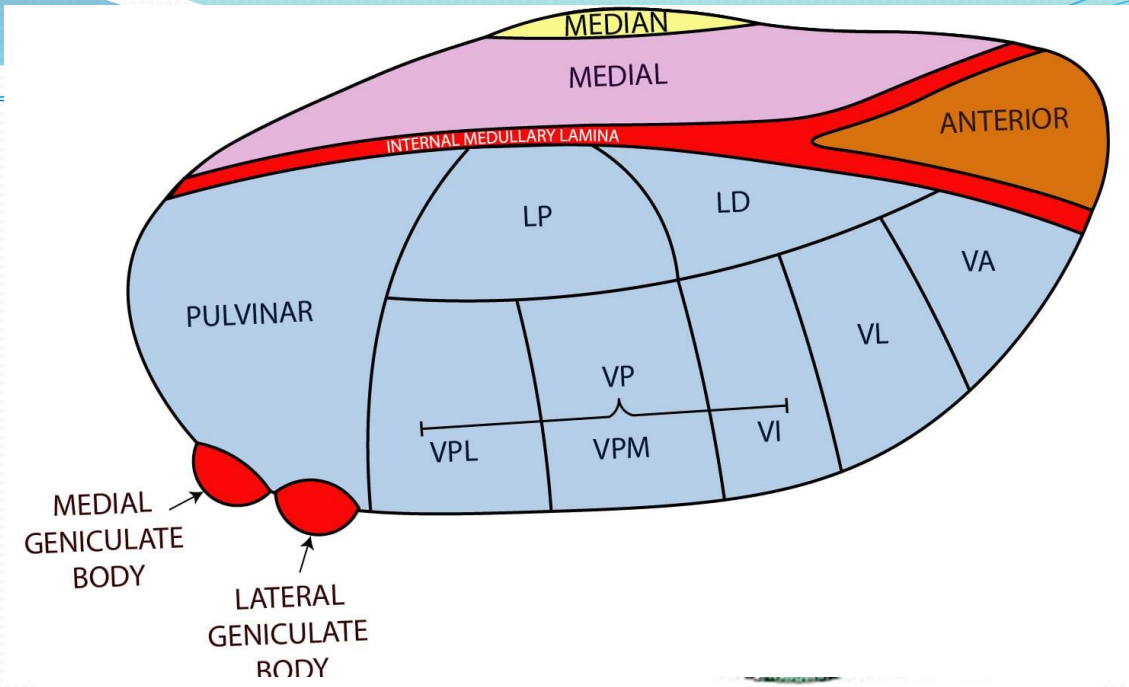
diencephalon Dr DALIA BIRAM

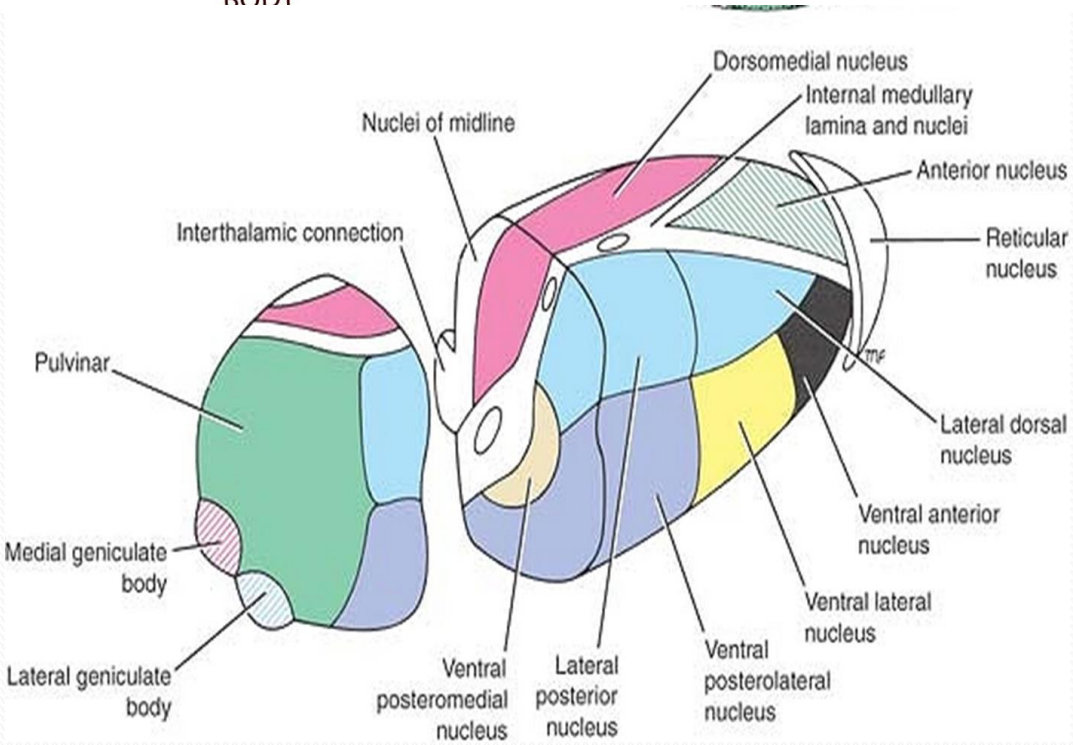


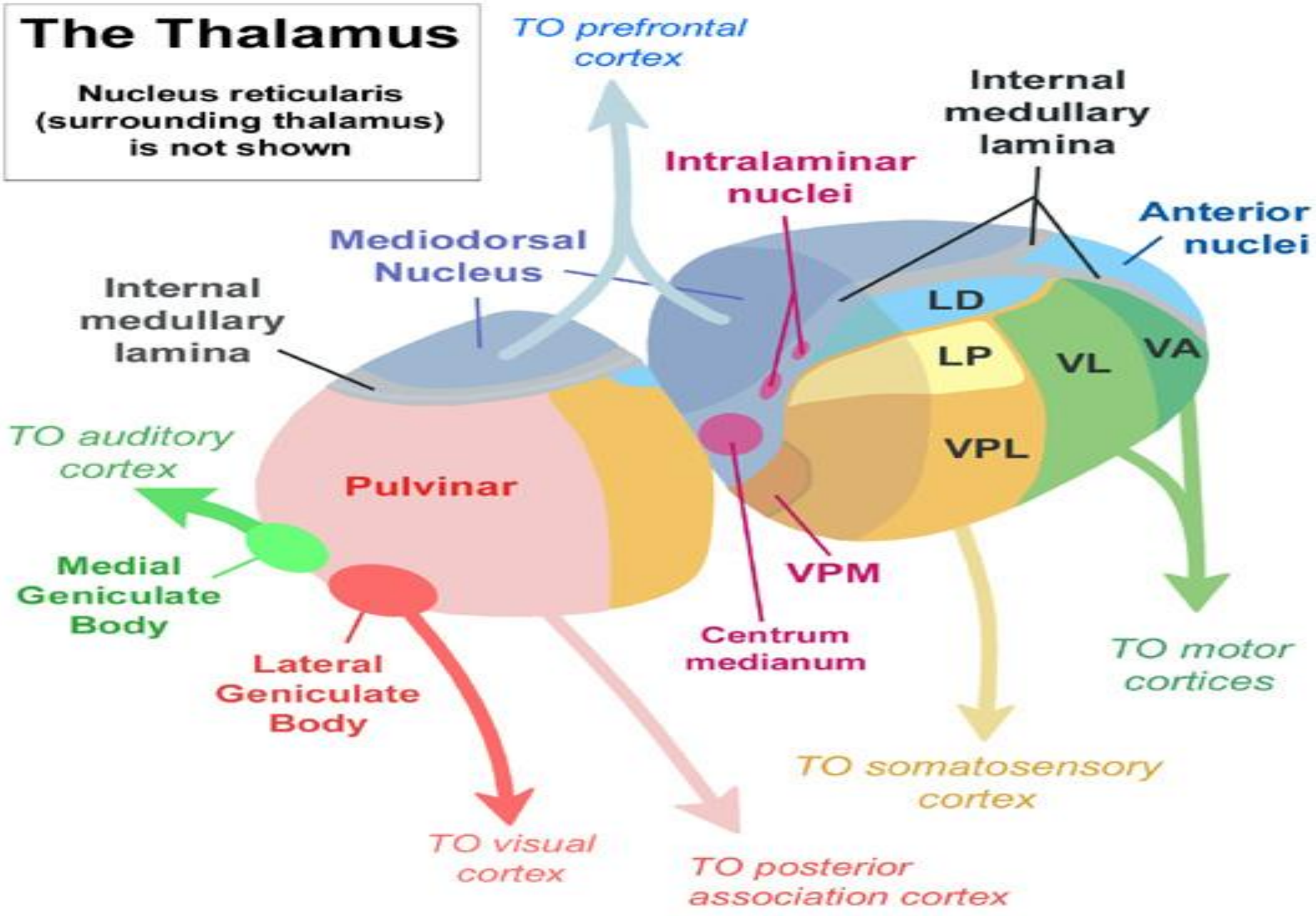
3.19. Thalamic Nuclei

Internal structure of the thalamus

- The anterior part contains anterior nuclear group is in between the bifurcated fibers of the internal medullary lamina
- The medial part of the thalamus consists of; the dorsomedial nucleus (DM) (or mediodorsal nucleus).
- The lateral part of the thalamus divided into 2 parts ventral and dorsal parts.
- ventral group includes;
  - ventral anterior (VA)
  - ventral lateral (VL) and
  - ventral posterior nuclei (VP) that includes ventral posterolateral and ventral posteromedial nuclei.
- Dorsal group includes
  - lateral dorsal nucleus (LD)
  - lateral posterior nucleus (LP)
  - the pulvinar (P).






The Thalamus
Nucleus reticularis (surrounding thalamus) is not shown
TO prefrontal cortex
Internal medullary lamina
Intralaminar nuclei
Anterior nuclei
Mediodorsal Nucleus
Internal medullary lamina
LD
LP
VL
VA
VPL
TO auditory cortex
Pulvinar
Medial Geniculate Body
VPM
Centrum medianum
TO motor cortices
Lateral Geniculate Body
TO somatosensory cortex
TO visual cortex
TO posterior association cortex

- **Functions of the thalamus:**
- The thalamus receives a large number of information from various sources [the spinal cord, reticular formation of the brain stem, cerebellum, basal ganglia and hypothalamus]. These various channels of information are integrated in the thalamus and then projected to the cortical and subcortical centers.

- the activities of major regions of the cerebral cortex are under the influence of the thalamus, and at the same time the thalamic nuclei are under the influence of the cerebral cortex. Thus the projection to the thalamus from the cortex is precisely reciprocal.

Thalamic syndrome

Thalamic syndrome (or **thalamic pain syndrome**) is a condition that can be associated with inadequate blood supply from the posterior cerebral artery.

Rare neurological disorder in which the body becomes hypersensitive to pain as a result of damage to the thalamus, a part of the brain that affects sensation

Primary symptoms are pain and loss of sensation, usually in the face, arms, and/or legs.

Pain or discomfort may be felt[1] after being mildly touched or even in the absence of a stimulus.

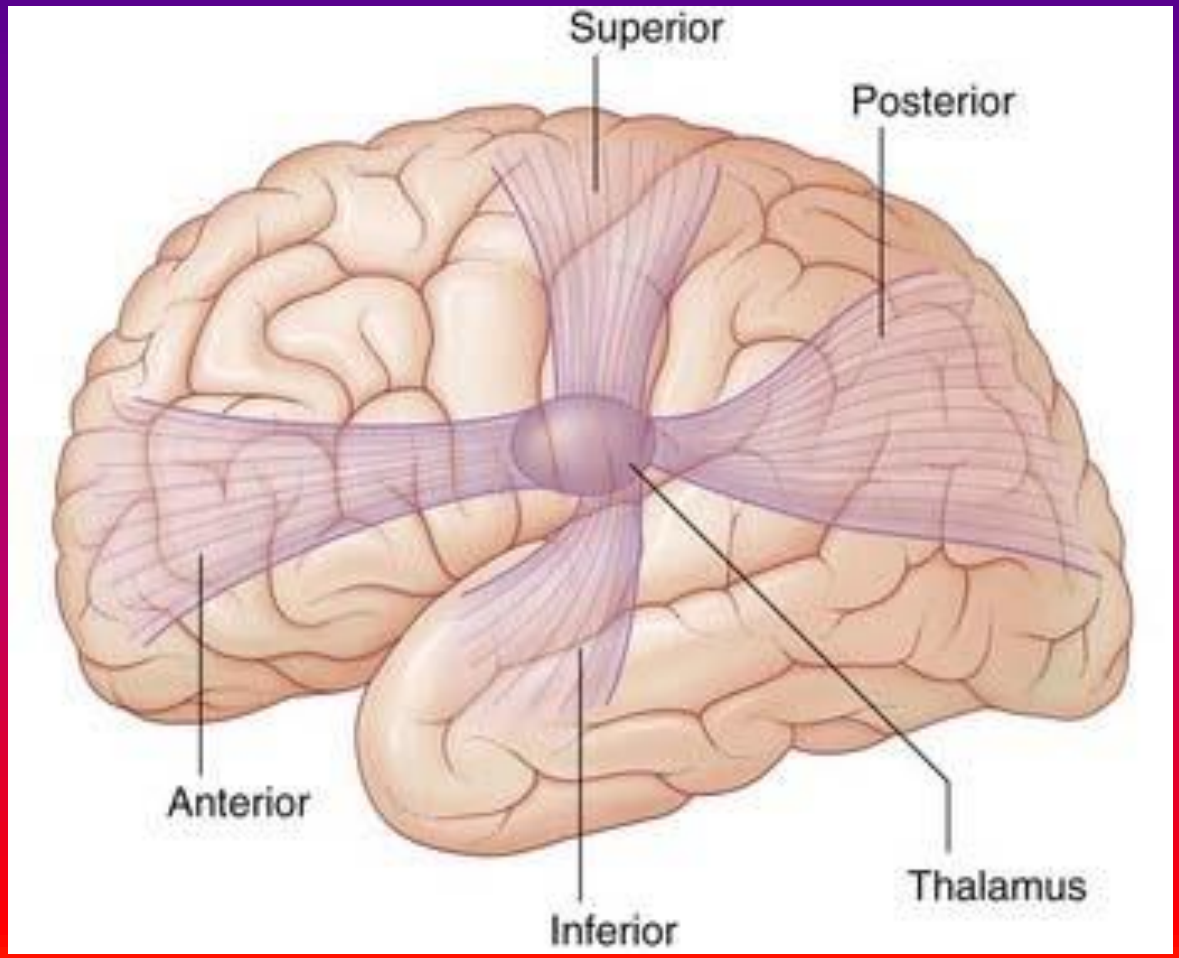
The pain associated with thalamic syndrome may be made worse by exposure to heat or cold and by emotional distress. Sometimes, this may include even such emotions as those brought on by listening to music.

It is also known as "Dejerine-Roussy disease", after Joseph Jules Dejerine and Gustave Roussy

- **Thalamic radiations:**

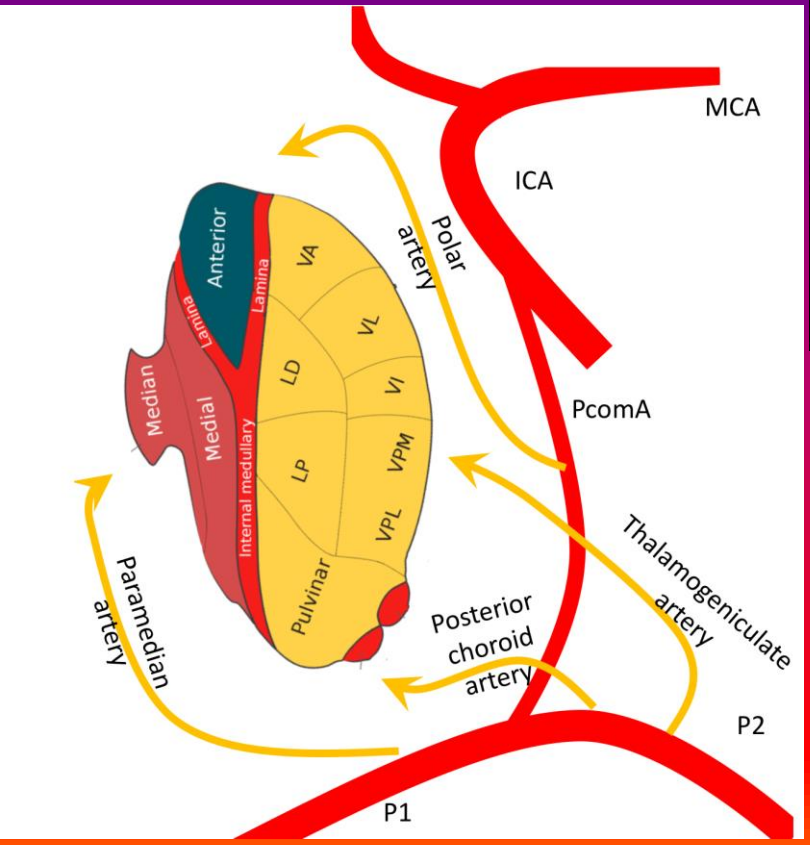
  They represent the different nerve fibers connecting the thalamus to the cerebral cortex.
- **Anterior thalamic** radiation: Connects the frontal lobe with the medial and anterior nuclei.
- **Superior thalamic** radiation: Connects the **ventral** and **lateral** nuclei with the **precentral** and **post central** gyri.
- **Posterior thalamic** radiation: Connects the pulvinar with the occipital lobe. includes the connection between the lateral geniculate body and the occipital lobe (optic radiation).
- **Inferior thalamic** radiation: Connects the pulvinar with the temporal lobe. includes the connection between the medial geniculate body and the temporal lobe (auditory radiation).

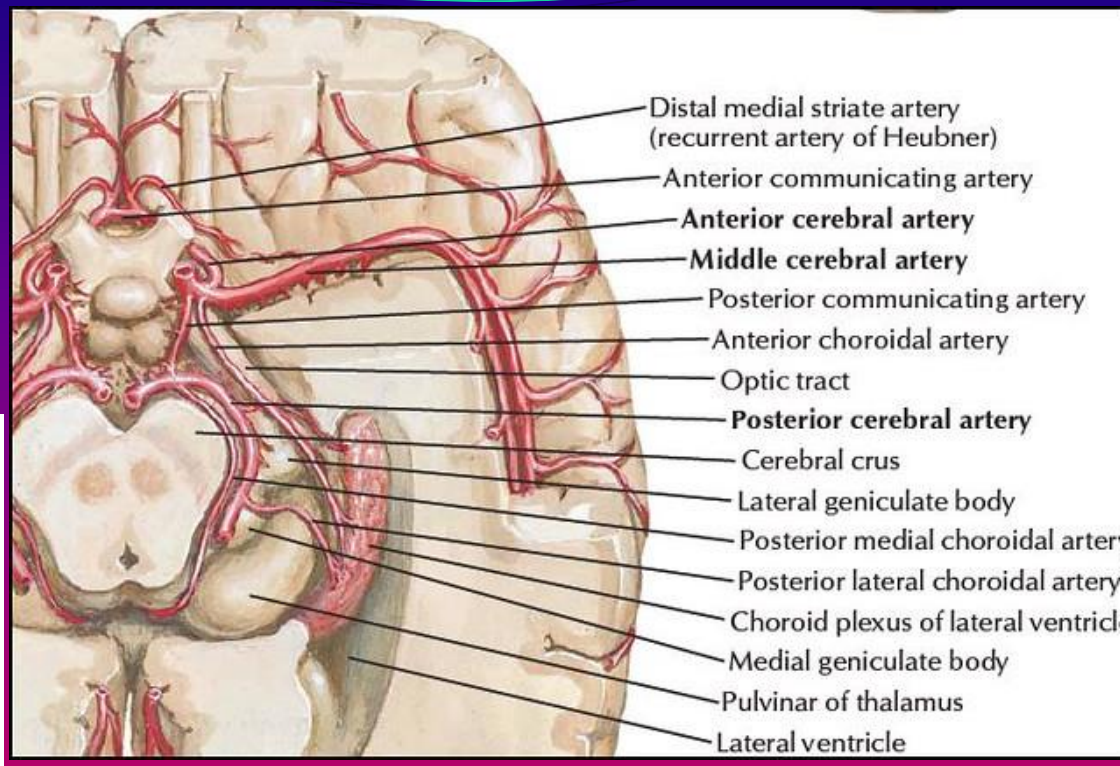
Thalamus



Blood supply of the thalamus:

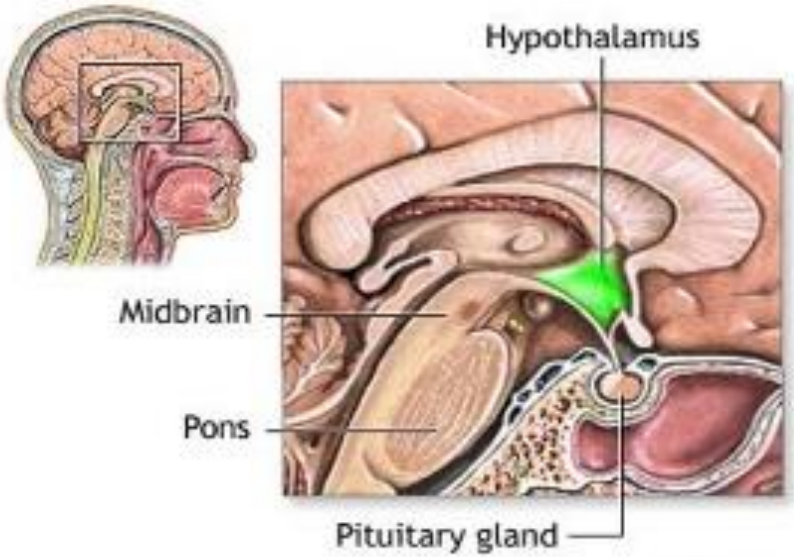
- branches from
- 1-posterior communicating,
- 2-posterior cerebral
- 3-posterior choroidal arteries.



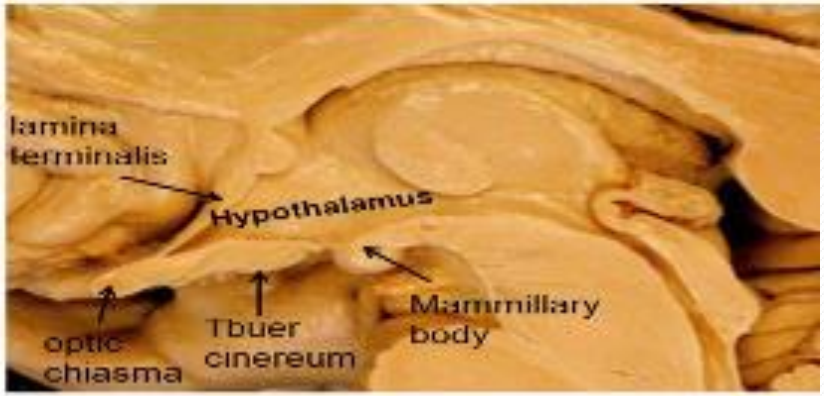


Hypothalamus

- The hypothalamus is the part of the diencephalon forming the floor and the lower part of the lateral wall of the third ventricle. It extends from the region of the optic chiasma to the caudal border of the mammillary bodies.

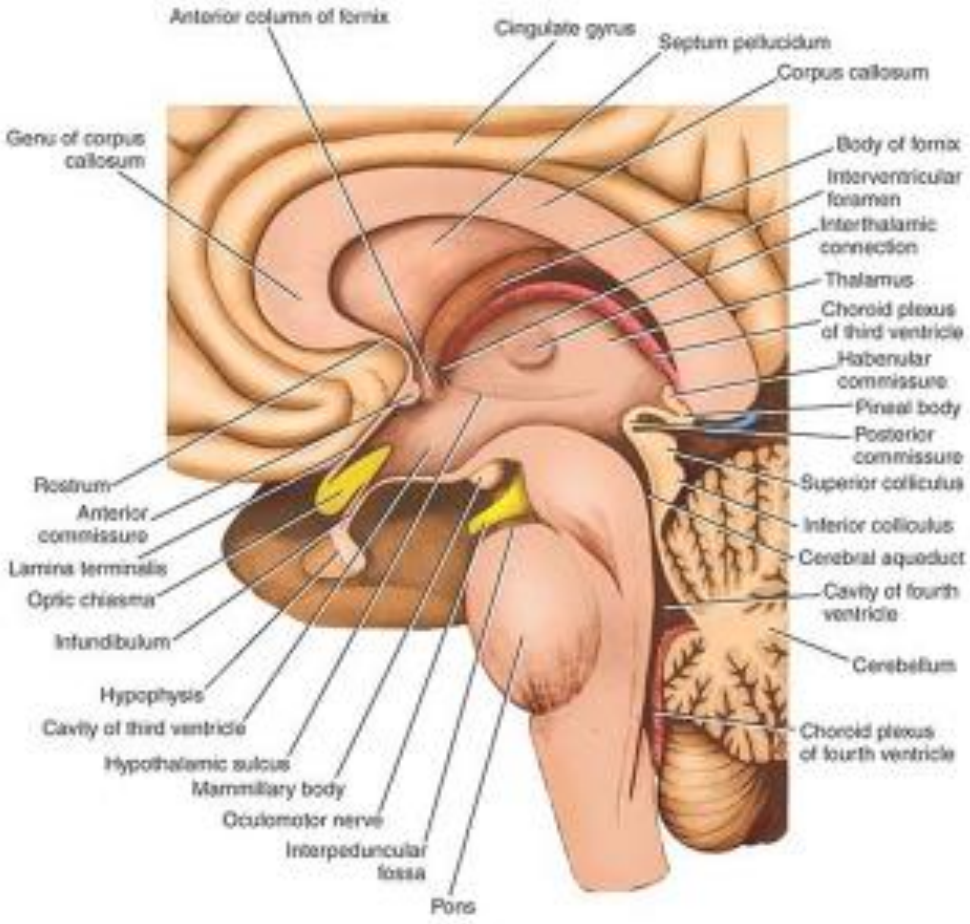


- **Relations**
- Above: the thalamus.
- Below: the hypothalamus merges into the tegmentum of the midbrain.
- Laterally: the internal capsule



Position & Relations

- The hypothalamus extends from the lamina terminalis to a vertical plane caudal to the mammillary bodies, and from the hypothalamic sulcus to include the structures in the ventral side wall and floor of the 3rd ventricle; i.e., it includes the contents of the interpeduncular fossa, and thus the hypothalamus consists of:
- The optic chiasma region.
- The tuber cinereum with its eminence and the stalk of the pituitary gland.
- The mammillary bodies.
- The posterior perforated substance (not usually included in the hypothalamus).



Hypothalamic nuclei

I. Anterior region:

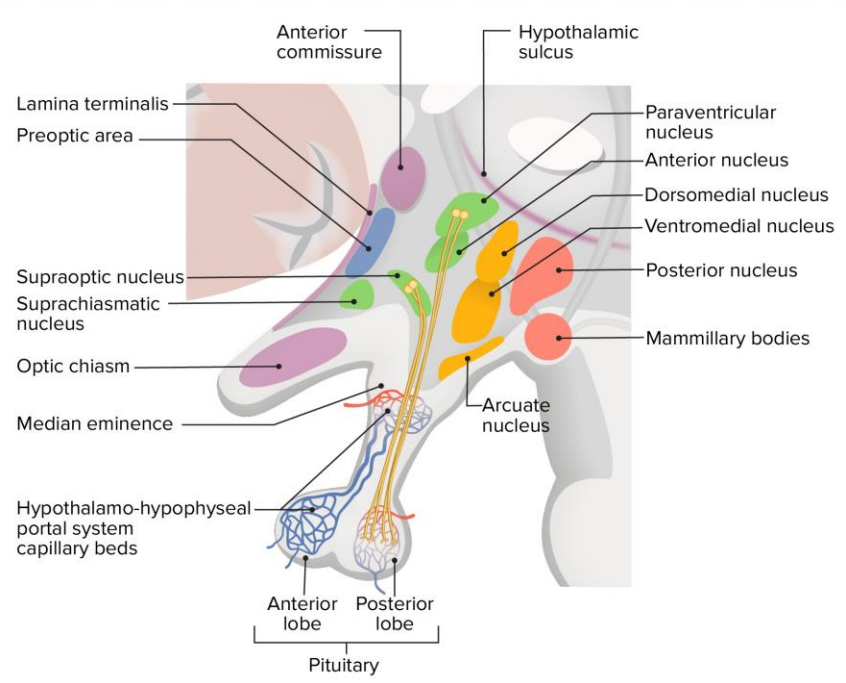
1. **Preoptic nucleus.**
2. **Supraoptic nucleus.**
3. **suprachiasmatic nucleus**
4. **Anterior nucleus.**
5. **Paraventricular nucleus.**

II. Tuberal (or intermediate) region:

1. **Infundibular (or arcuate) nucleus.**
2. **Ventromedial nucleus.**
3. **Dorsomedial nucleus.**

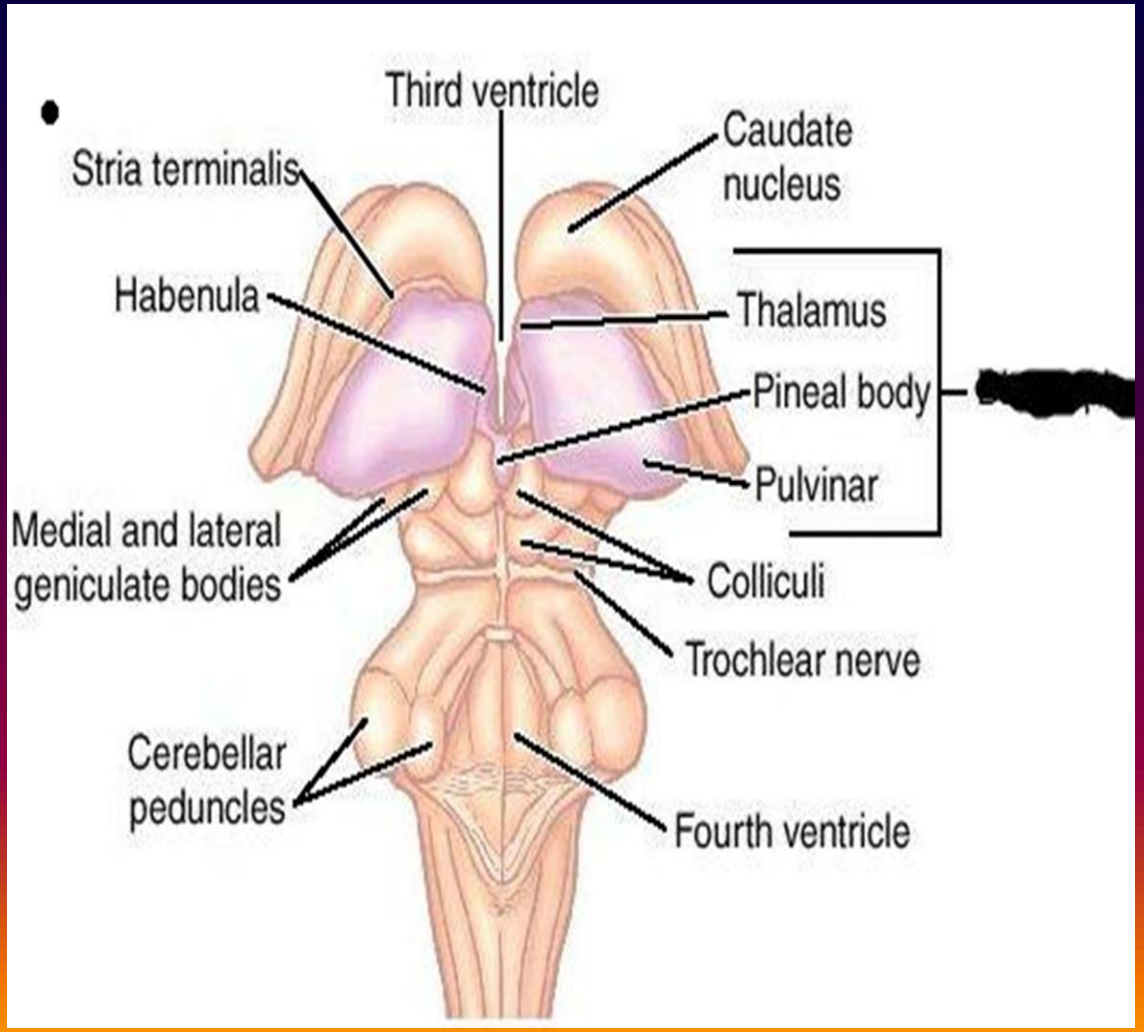
III. Mammillary (or posterior) region:

1. **Posterior nucleus.**
2. **Medial mammillary nucleus.**
3. **Lateral mammillary nucleus.**
4. **Intermediate mammillary nucleus**



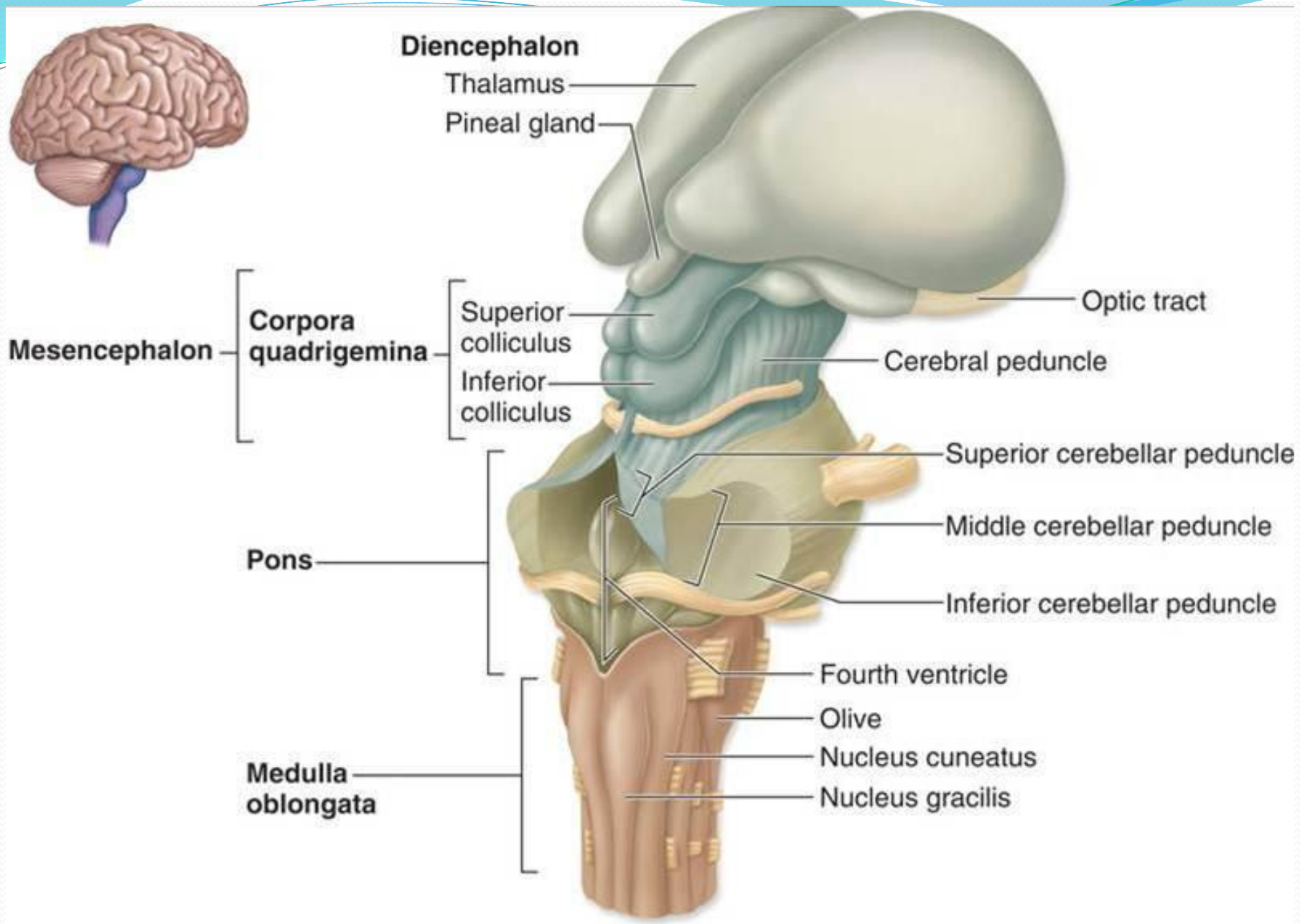
3.Metathalamus

- The metathalamus consists of the medial and lateral geniculate bodies which lie on the inferior surface of the pulvinar of the thalamus.



- **Medial geniculate body:**
- Definition: relay nucleus in the pathway of hearing.
- It is a small ovoid mass of grey matter situated just lateral to the superior colliculus of the midbrain, and is connected with the inferior colliculus by the brachium of the inferior colliculus.

- **Lateral geniculate body:**
- It is a small ovoid mass of grey matter situated lateral to the medial geniculate body.
- It is connected with the optic tract (in front), and the brachium of the superior colliculus (behind).
- It receives most of the fibers of the optic tract carrying visual impulses.
- It sends efferent fibers in the form of optic radiation to the visual area.



(b) Posterolateral view

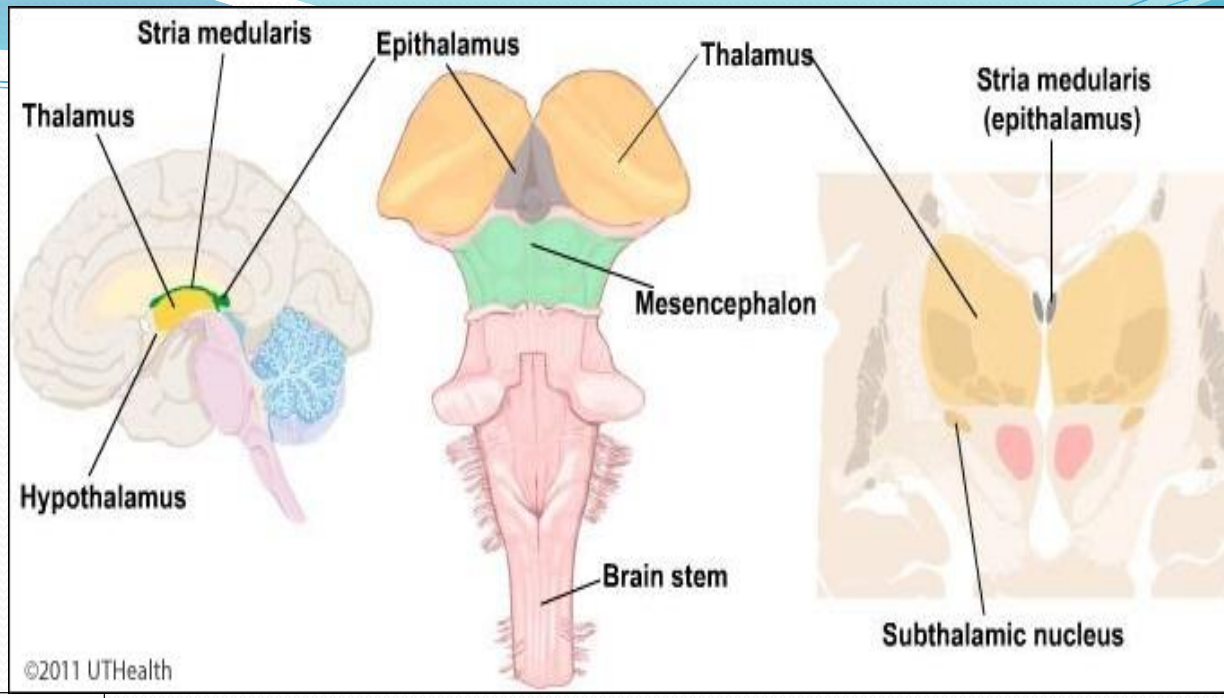
4. Epithalamus

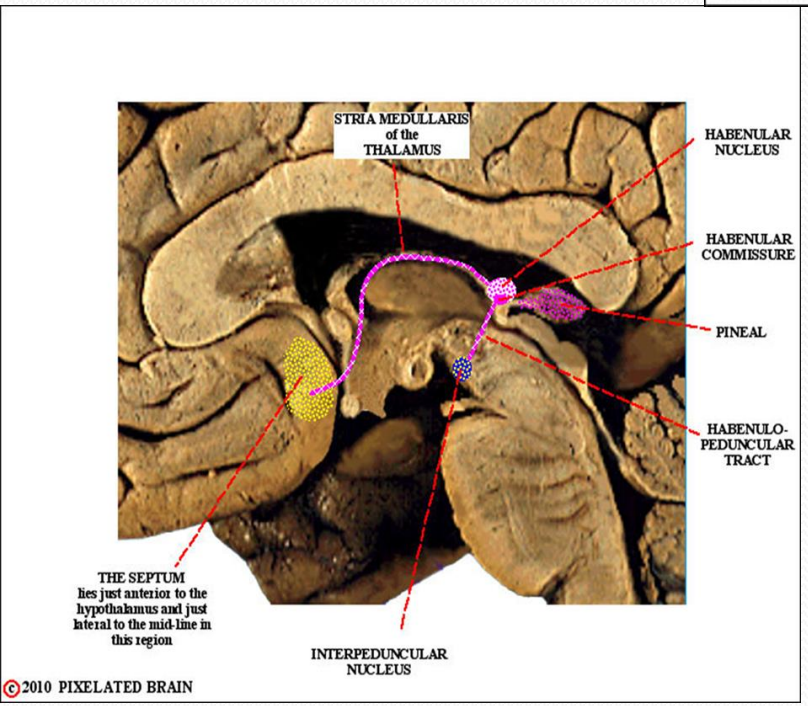
The Epithalamus consists of :

1. Pineal body (gland).
2. Habenular nuclei.
3. Stria medullaris thalami.
4. Habenular commissure.
5. Posterior commissure.

Pineal gland (or pineal body):

- It is also called epiphysis cerebri. It is considered as an endocrine gland.
- It is a small piriform body which lies in the median plane, and overhangs the depression between the two superior colliculi.
- It is overlapped above by the splenium of corpus callosum from which it is separated by the transverse cerebral fissure.
- Its base is directed forwards and is attached to the posterior wall of the 3rd ventricle by a stalk which divides into 2 laminae (superior & inferior). The superior lamina contains the habenular commissure, while the inferior lamina contains the posterior commissure.

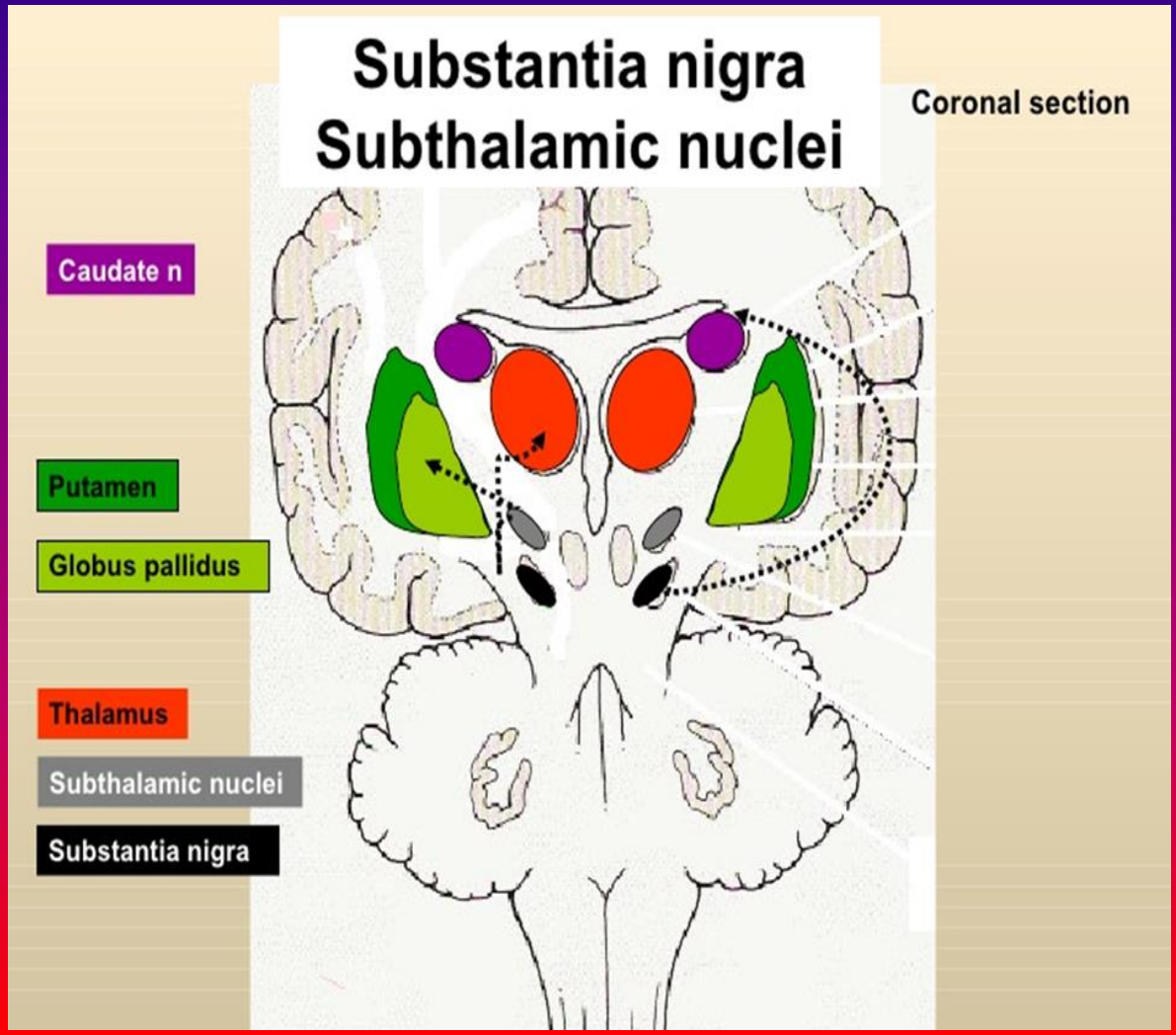

Stria medularis
Epithalamus
Thalamus
Thalamus
Stria medularis
(epithalamus)
Mesencephalon
Hypothalamus
Brain stem
Subthalamic nucleus
©2011 UTHealth


STRIA MEDULLARIS
of the
THALAMUS
HABENULAR
NUCLEUS
HABENULAR
COMMISSURE
PINEAL
HABENULO-
PEDUNCULAR
TRACT
THE SEPTUM
lies just anterior to the
hypothalamus and just
lateral to the mid-line in
this region
INTERPEDUNCULAR
NUCLEUS
©2010 PIXELATED BRAIN

5. Subthalamus

- The subthalamus is situated just above the tegmentum of the midbrain, between it and the ventral nuclei of the thalamus. Medially, it is related to the vertical part of the hypothalamus, and laterally it is related to the junctional zone between the internal capsule and the cerebral peduncle of the midbrain.

- The subthalamus contains mainly the **subthalamic nucleus.** It is a large nucleus which lies above the sustantia nigra and medial to the internal capsule.
- **it is an important extrapyramidal centre, and its damage leads to a condition called hemiballismus (= uncontrollable violent movement on the contralateral side of the body**).



THANK YOU