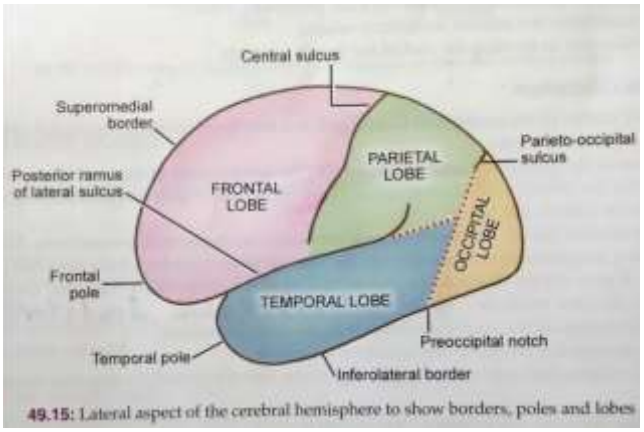
CEREBRUM AND ITS FUNCTIONAL AREAS

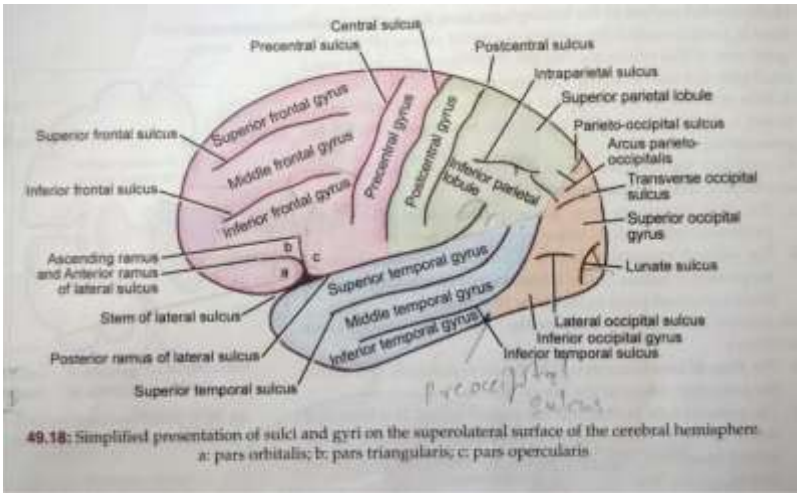
DESCRIBE THE SUPEROLATERAL SURFACE OF CEREBRAL HEMISPHERE UNDER THE FOLLOWING HEADINGS: (A) SUCLI (B) GYRI (C) FUNCTIONAL AREAS (LE)

The superolateral surface lies between superomedial and inferolateral border.
It is convex & related to cranial vault.



49.15: Lateral aspect of the cerebral hemisphere to show borders, poles and lobes

The cerebral hemisphere is folded producing convolutions called gyri,and fissures called sucli.
(a)**Sulci:**
The central sulcus:
Begins at the superomedial border,a little behind the midpoint between frontal and occipital poles. It ends a little above the posterior ramus of lateral sulcus.it is an example for limiting sulcus.
it seperates the motor and sensory areas.
2.**The lateral sulcus**:
Begins on the inferior surface. On reaching the lateral surface ,it divides into three rami.the posterior ramus, anterior ascending ramus &anterior horizontal ramus.It is an example for secondary sulcus.It seperates the parietal and temporal lobes.

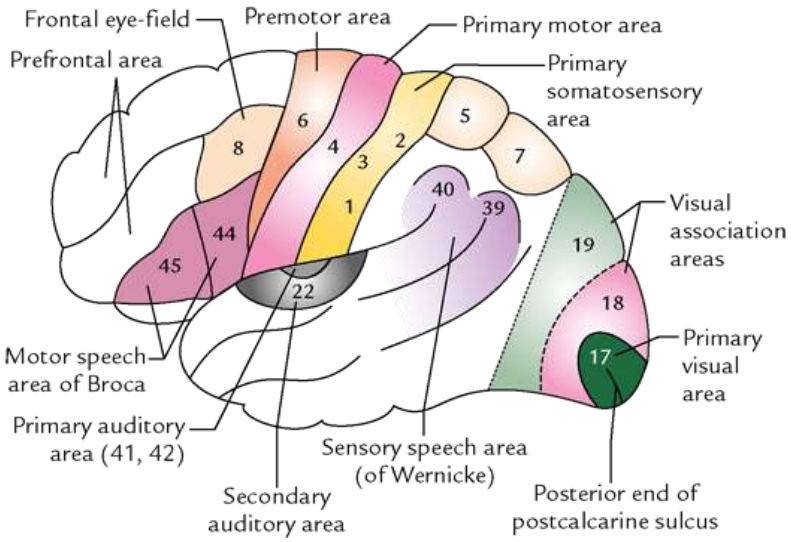


49.18: Simplified presentation of sulci and gyri on the superolateral surface of the cerebral hemisphere. a: pars orbitalis; b: pars triangularis; c: pars opercularis

The sucli & gyri present in the different lobes of superolateral surface.

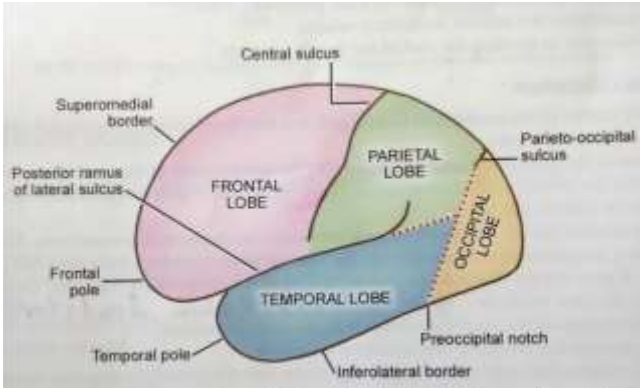
Lobes	Sulci	Gyri
Frontal lobe	precentral	Precentral-lies between precentral & central sulcus
	superior frontal.	superior frontal-lies above the superior frontal sulcus
	superior frontal.	middle frontal-lies between the superior & middle frontal
Parietal lobe	Post central.	Postcentral –lies between central &postcentral sulcus.
	Intraparital	Superior parital lobule-above the intraparietal sulcus.
		Inferior parital lobule-lies below the intraparietal sulcus.
Temporal lobe	Superior temporal	Superior temporal –lies above the superior temporal sulcus.
		Middle temporal-lies between suerior and inferior temporal sulcus.
	Inferior temporal	Inferior temporal-lies below the inferior temporal gyrus.
occipital lobe	Transverse occipital	Arcus parito-occipitalis.
	Lateral occipital	Superior occipital-lies above the lateral occipital sulcus.
	lunate	Inferior occipital-lies below the lateral occipital sulcus.lunate sulcus seperates these gyri from the occipital pole.
		The area around the parieto occipital sulcus is the arcus parieto occipitalis. It is seperated from the superior occipital gyrus by transverse occipital sulcus.

Functional areas present on the superolateral surface



lobe	Area	Area number	Location
Frontal	Motor area	4	Precentral gyrus & paracentral lobule
	Premotor area	6	Posterior parts of superior ,middle & inferior frontal gyri.
	Frontal eye field	6,8	Posterior part of middle frontal gyrus
	Motor speech area	44,45	Pars triangularis,pars opercularis
	Prefrontal area		The remaining large, anterior part of frontal lobe.
Parietal lobe	Sensory area	3 1 2	Postcentral gyrus & paracentral lobule
	Parietal area		Between sensory & visual area.
Occipital lobe	Visuosensory area/striate area	17	**In &**around the postcalcarine sulcus
	Visuopsychic area parastriate and peristriate area	18,19	Surround the striate area
Temporal lobe	Auditosensory area	41,42	Posterior part of superior temporal gyrus & anterior transverse temporal gyrus
	Audiopsychic area	22	Rest of the superior temporal gyrus

CENTRAL SULCUS (SE)



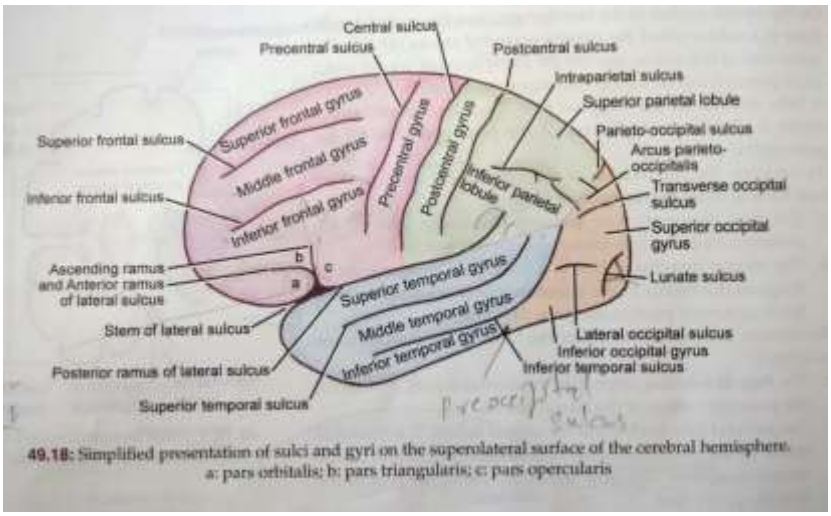
49.15: Lateral aspect of the cerebral hemisphere to show borders, poles and lobes

The central sulcus begins at the superomedial border of the cerebral hemisphere a little behind the midpoint between the frontal & occipital pole.
It runs obliquely downwards and forwards on the superolateral surface and ends above the posterior ramus of the lateral sulcus.
Its upper end extends for a short distance on to the medial surface in the paracentral lobule.
It is an example for limiting sulcus,because it seperates the motor and sensory area.
In front of this sulcus precentral gyrus(moror area) is present.
Behind this sulcus is the post central gyrus(sensory area).

Importance:
This sulcus serves as a key to localize the other sulci &gyri for the pathologist while performing autopsy.

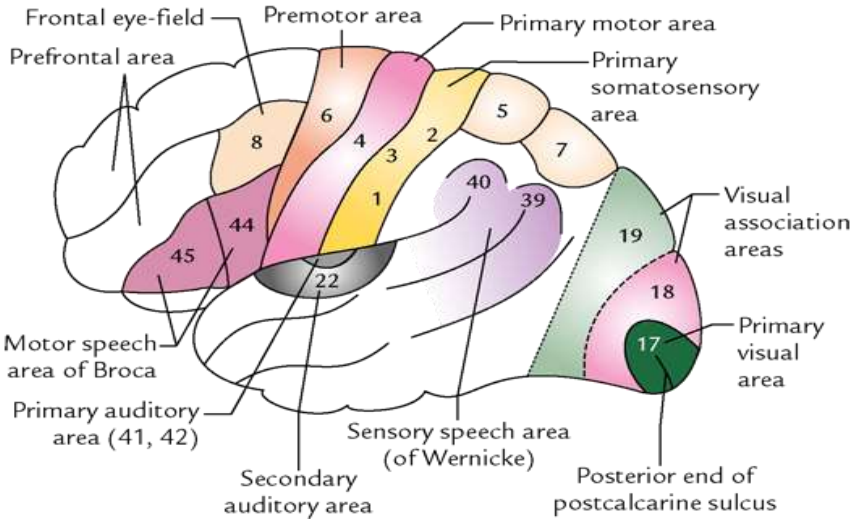
PRECENTRAL GYRUS (SE)

Precentral gyrus lies between the central sulcus and precentral sulcus.



49.18: Simplified presentation of sulci and gyri on the superolateral surface of the cerebral hemisphere. a: pars orbitalis; b: pars triangularis; c: pars opercularis

The primary motor area is located in the precentral gyrus.
It contains large number of pyramidal cells of Betz.
About 40% pyramidal fibres arise from this area.
It controls voluntary motor activities of the opposite half of the body .
Only movements are represented in this area and not the muscles.
The human body is represented in an upside down manner in this area(motor homunculus).
In the motor homunculus there is disproportionate registration of individual parts.



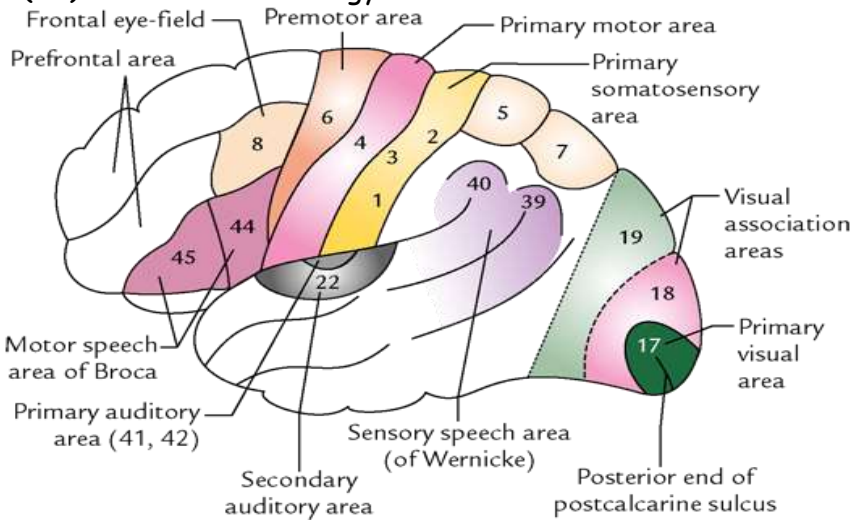
Applied aspects:

Ablation of the primary motor cortex which is present in this gyrus results initially flaccid paresis of contralateral movements with decreased deep tendon reflexes and positive Babinski sign.

This is followed by moderate recovery of function,except the retention of positive Babinski sign and decreased ability to perform skilful movements.

MOTOR SPEEECH AREA.

The motor speech area of Broca is located in the pars triangularis (area44) and pars opercularis (45) of inferior frontal gyrus of frontal lobe .



It is present on the left side in 98% of right handed persons.
Among left hand persons, 70% it is present in left hemisphere and in 30% in the right hemisphere.
Broca's area is responsible for the production of expressive speech/vocalization.
It brings about the formation of words by its connections with the adjacent primary motor area,and stimulates the muscles of the larynx,mouth,tongue,soft palate,and the respiratory muscles.

Applied aspects:

Injury to Broca"s area causes difficulty in speaking. The individual may know what words they wish to speak but are unable to do so.

SENSORY SPEECH AREA IN THE CEREBRUM (SA)

Sensory speech area of Wernicke is located in the left dominent hemisphere.
It occupies the posterior part of the superior temporal gyrus of temporal lobe and angular and supramarginal gyri of the inferior parietal lobule.
Corresponds to area numbers 22,39 & 40.
The Wernicke"s area is concerned with interpretation of language through visual and auditory input.
It is also an essential zone for constant availbility of learned word patterns.
The Wernickes area is connected to the motor speech area or Brocas area by a bundle of nerve fibres called arcuate fasiculus.

CENTRAL SULCUS (SA)

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It runs obliquely downwards and forwards on superolateral surface and ends above the posterior ramus of the lateral sulcus.
It is an example for limiting sulcus,because it lies seperates the motor and sensory area.
In front of this sulcus precentral gyrus is present.
Behind this sulcus is the post central gyrus.

Imporance:

This sulcus serves as a key to localize the other sulci & gyri for the pathologist while performing autopsy.

CALCARINE SULCUS (SA)

Calcarine sulcus is present on the medial surface of the cerebral hemisphere.
It begins as a deep fissure, a little below the posterior end of the corpus callosum (splenium)& follows an arched course with the convexity upwards to the occipital pole,and extend slightly on to the superolateral surface.

Posterior end of the calcarine sulcus sometimes meets the lunate sulcus like figure (--.

The triangular area of cortex intervening between the parieto-occipital and calcarine sulcus is known as cuneus.

The area below the calcarine sulcus forms the lingual gyrus.

Both cuneus and lingual gyrus adjoining the calcarine sulcus act as primary receptive area (striate area) for vision and receive projections from the lateral geniculate body.

BROCAS MOTOR SPEECH AREA (SA)

The motor speech area of Broca is located in the pars triangularis(area44) and pars opercularis(45) of inferior frontal gyrus of frontal lobe .

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Applied aspects:

Injury to Broca"s area causes difficulty in speaking. The individual may know what words they wish to speak but are unable to do so.

WHITE MATTER OF CEREBRUM

DESCRIBE CORPUS CALLOSUM. ADD A NOTE TO ITS ROLE IN CEREBRAL ASYMMETRY (LE)

Corpus callosum is the largest commissural fibers of white matter connecting right and left cerebral hemisphere. It is responsible for interhemispheric transfer of information which is essential for bilateral responses and in learning process.

PARTS:

Rostrum:

It is directed downwards and backwards from genu and is continuous with lamina terminalis. It connects orbital surfaces of two hemispheres.

Genu:

It is anterior end which bend around the anterior horn of lateral ventricle, lies 4cm behind the frontal pole. Fibers extending from genu anteriorly towards frontal lobe form the forceps minor.

Trunk or body:

Middle part present posterior to the genu. It provides attachment to septum pellucidum and fornix in the median plane and forms roof of body of lateral ventricle. Fibers extend laterally towards the cortex intersecting the fibers of corona radiata. Posterior fibers without intersecting corona radiata runs laterally and downwards in relation to posterior horn and inferior horn of lateral ventricle form tapetum.

Splenium:

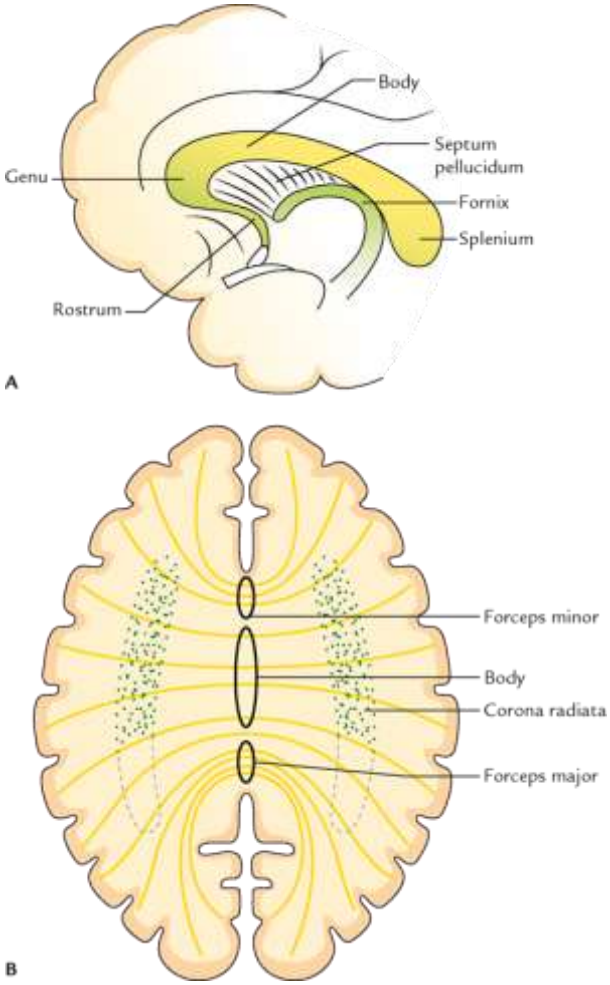
It is the posterior end of the corpus callosum. Fibers extending from splenium to occipital lobe form the forceps major.

Cerebral asymmetry:

The cerebral hemispheres are not same/symmetrical on both sides inspite of apparent congruity in size, shape and features. Memory developed by learning processes from sensory input and motor output is usually confined to one hemisphere and through the fibers of corpus callosum it is utilized by both hemispheres for motor expression. The term dominant hemisphere refers to the side concerned with the perception and production of language, speech. According to this left hemisphere is dominant in more than 90% of people. The left hemisphere controls the right side of the body.

The left dominant hemisphere is concerned with handedness, perception of language, speech, writing and calculation (solving arithmetical problems by addition, subtraction or multiplication and carries out other computer like operations)

The right non-dominant hemisphere functions in all kinds of geometrical and spatial arrangements in three dimensional perspective and is concerned with musical sense, artistry and synthesis of coherent thoughts.



CORPUS CALLOSUM (SE)

Corpus callosum is the largest commissural fibers of white matter connecting right and left cerebral hemisphere. It is responsible for interhemispheric transfer of information which is essential for bilateral responses and in learning process.
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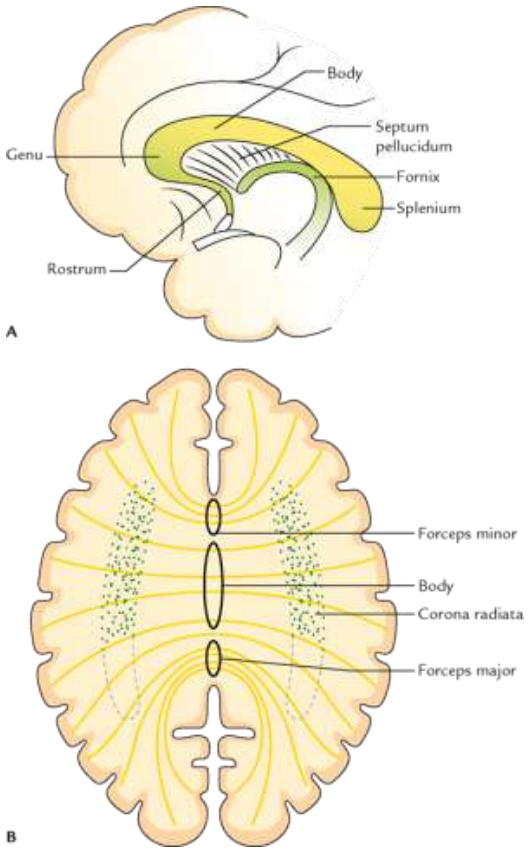
Splenium:

It is the posterior end of the corpus callosum. Fibers extending from splenium to occipital lobe to form the forceps major.

Applied aspects:

Split-brain syndrome:

If corpus callosum is congenitally absent or sectioned each hemisphere becomes isolated and patient responds as if they have two separate brains. There is no change in personality or intelligence in that person. Only special tests of tactile and visual systems will reveal any abnormality.



INTERNAL CAPSULE (SE)

Internal capsule is the projection fibers which is continuous above with corona radiata and below with crus cerebri of midbrain. It is present between thalamus and caudate nucleus medially and lentiform nucleus laterally. The fibers of internal capsule interconnect cerebral cortex with brainstem and spinal cord.

Parts and relations:

Parts	Relations	Fibers passing through	
		Descending fibers	Ascending fibers
Anterior limb	Medial: head of caudate nucleus Lateral: lentiform nucleus	Frontopontine fibers	Anterior thalamic radiation
Posterior limb	Medial: thalamus Lateral: lentiform nucleus	Frontopontine fibers, corticospinal fibers, corticorubral fibers	Superior thalamic radiation
Genu	Concavity of bend directed laterally	Frontopontine fibers, corticonuclear fibers	
Retrolentiform part	Lies behind lentiform nucleus	Parietopontine, occipitopontine fibers	Optic radiation, posterior thalamic radiation
Sublentiform part	Lies below lentiform nucleus	Temporopontine fibers	Auditory radiation

Arterial supply:

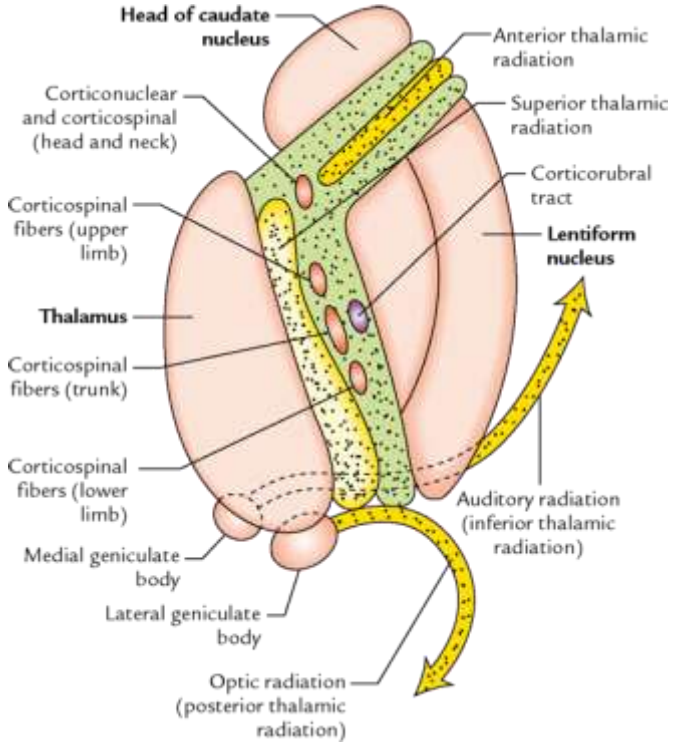
Parts	Arteries supplying
Anterior limb	Striate and recurrent (artery of Heubner) branches of anterior cerebral artery, striate branch of middle cerebral artery (Charcot's artery of cerebral haemorrhage)
Posterior limb	striate branch of middle cerebral artery, anterior choroid artery, postero-lateral branch of posterior cerebral artery
Genu	recurrent branches of anterior cerebral artery, striate branch of middle cerebral artery, few direct branches of internal carotid artery
Retrolentiform part	postero-lateral branch of posterior cerebral artery
Sublentiform part	Anterior choroid artery, posterior cerebral artery

Applied aspects:

Damage to internal capsule due to rupture of Charcot's artery of cerebral haemorrhage leads to loss of sensations and paralysis of opposite half of the body (contralateral hemiplegia)

Rupture in recurrent artery of Huebner leads to paralysis of face and upper limb on opposite side.

Lesions of posterior one-third of posterior limb, sublentiform and retrolentiform parts leads to visual and auditory defects



NAME WHITE FIBERS OF CEREBRUM (SA)

Association fibers:

Connects different cortical areas of same hemisphere. Examples- Short association fibers, long association fibers

Projection fibers:

Connect cerebral cortex to brainstem and spinal cord. Example- corona radiata, internal capsule

Commissural fibers:

Connects corresponding parts of two hemispheres. Examples- corpus callosum, anterior commissure, posterior commissure, habenular commissure

MENTION COMMISSURAL FIBERS OF CEREBRAL HEMISPHERE (SA)

Corpus callosum, anterior commissure, posterior commissure, habenular commissure, hippocampal commissure and hypothalamic commissure

PARTS OF CORPUS CALLOSUM (SA)

Rostrum connects two orbital areas
Genu- connects two frontal lobes
Body-connects two parietal lobes
Splenium- connects two occipital lobes.

PARTS OF INTERNAL CAPSULE (SA)

Anterior limb- corticopontine fibers
Genu- corticopontine fibers
Posterior limb- corticopontine fibers
Sublentiform part- temporopontine fibers
Retrolentiform part-parieto pontine, occipito pontine fibers

BASAL GANGLIA

Components of Corpus Striatum (SA)

Corpus striatum contains two components

Caudate Nucleus
Lentiform Nucleus

Caudate Nucleus –

It is a 'C' shaped mass of grey matter.
Parts: Head, Body and Tail
This nucleus is closely related with lateral ventricle and lies lateral to thalamus.

Lentiform nucleus-

It is large lens shaped (Biconvex) nucleus. This nucleus lies lateral to internal capsule

Components:
Putamen (Outer part)
Globus Pallidus(Inner Part)
Caudate nucleus and putamen together form Neo-Striatum
Globus pallidus forms Paleostriatum.

CAUDATE NUCLEUS (SE)

Caudate nucleus is a large 'C' shaped mass of grey matter.
Forms a component of corpus striatum.

Situation:

Lies lateral to thalamus within the white matter of cerebral hemisphere.

Parts: Head, Body and Tail.

Relations:

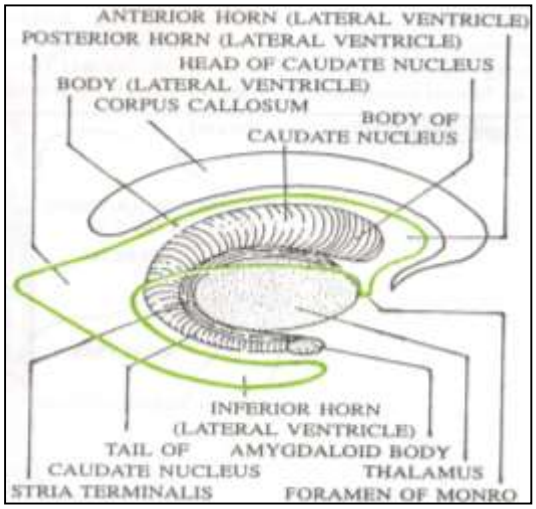
Head – Large and rounded.
Forms lateral wall of anterior horn of lateral ventricle
Continuous inferiorly with putamen.

Body –Long & narrow.

Close to the floor of body of lateral ventricle.

Tail – Long & slender. Lies close to roof of inferior horn of lateral ventricle.

Terminates anteriorly with amygdaloid body.



Connections:

Afferent Connections:

Receives input from

Cerebral cortex

Thalamus

Substantia nigra

Efferent Connections:

Sends efferent fibers to Globus pallidus and Substantia Nigra.

Applied Anatomy:

Lesion of caudate nucleus can present with features of **Chorea**.

Chorea is characterized by Quick, jerky, irregular, purposeless, nonrepetitive involuntary movements.

THALAMUS

DESCRIBE THALAMUS AND ITS CONNECTIONS (LE)

Thalamus is a large ovoid mass of grey matter situated in the lateral wall of 3rd ventricle & lies dorsal to hypothalamic sulcus.

EXTERNAL FEATURES :

Thalamus presents 2 ends, 4 surfaces

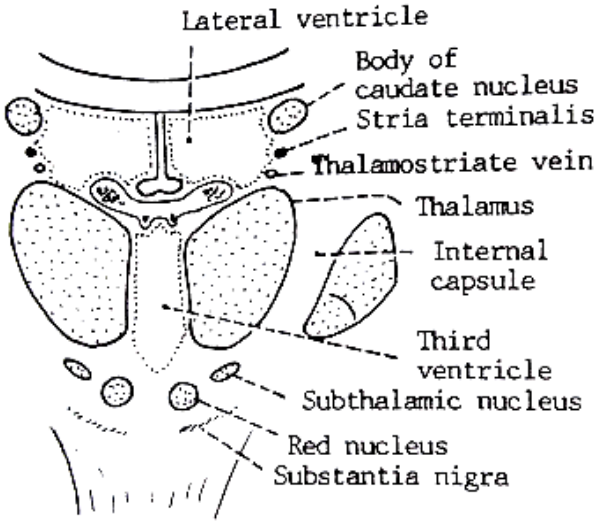
Ends :

Anterior end :

Narrow – known as **tubercle** of thalamus

Posterior end :

Wide – known as **pulvinar**



Surfaces :

Superior surface:

Lateral part – forms floor of central part of lateral ventricle

Medial part – covered by tela choroidea of 3rd ventricle

Inferior surface :

related to hypothalamus, subthalamus

Medial surface :

forms lateral wall of 3rd ventricle

medial surface of both thalami are interconnected by **interthalamic adhesion**

Lateral surface :

related to posterior limb of internal capsule

INTERNAL FEATURES :

Thalamus consists mainly of grey matter & only a small amount of white matter

White matter :

The lateral surface of thalamus is covered by a thin layer of white matter – **External medullary lamina**

vertical Y shaped sheet of white matter within the thalamus - **Internal medullary lamina**

Grey matter :

Is divided by "Y" shaped internal medullary lamina into 3 parts

Anterior – lies between the limbs of "Y"

Medial } lie on either side of stem of "Y"
Lateral }

Grey matter consists of number of nuclei known as thalamic nuclei.

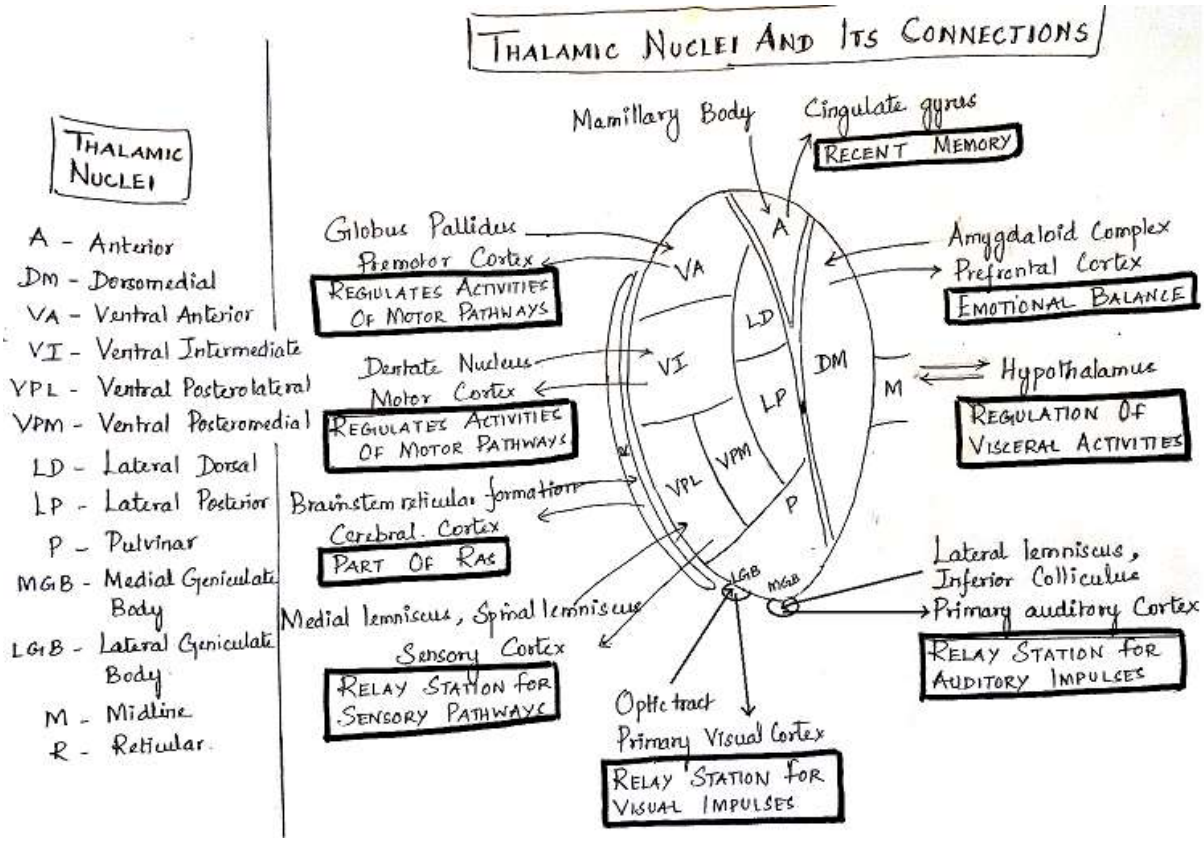
Thalamic nuclei :

- **Anterior nucleus**
- **Medial / Dorsomedial nucleus**
- Nuclei in lateral part is divided into ventral & dorsal part.

Ventral part is subdivided craniocaudally into **Ventral Anterior, Ventral Intermediate, Ventral Posterior** (further divided into ventral posterolateral, ventral posteromedial)

Dorsal part is subdivided into **Lateral Dorsal, Lateral Posterior, Pulvinar**

Intralaminar nuclei
Midline nuclei
Reticular nuclei
Medial geniculate body
Lateral geniculate body



Connections of thalamic nuclei:

NUCLEI	AFFERENTS	EFFERENTS	FUNCTION
Anterior	Mamillary body	Cingulate gyrus	Recent memory
Medial	Amygdaloid complex	Prefrontal cortex	Emotional balance
Ventral anterior	Globus pallidus	Premotor cortex	Regulates activities of motor pathways
Ventral intermediate	Dentate nucleus	Motor cortex	Regulates activities of motor pathways
Ventral posterolateral	Spinal lemniscus, Medial lemniscus	Sensory cortex	Relay station for sensory pathways
Medial geniculate body	Lateral lemniscus, Inferior olliculus	Primary auditory cortex	Relay station for auditory impulses
Lateral geniculate body	Optic tract	Primary visual cortex	Relay station for visual impulses
Reticular	Brainstem reticular formation	Cerebral cortex	Forms part of RAS
Midline	Hypothalamus	Hypothalamus	Regulates visceral activities

LATERAL GENICULATE BODY (SE)

It is a small oval elevation situated anterolateral to the medial geniculate body, beneath the pulvinar ofthalamus

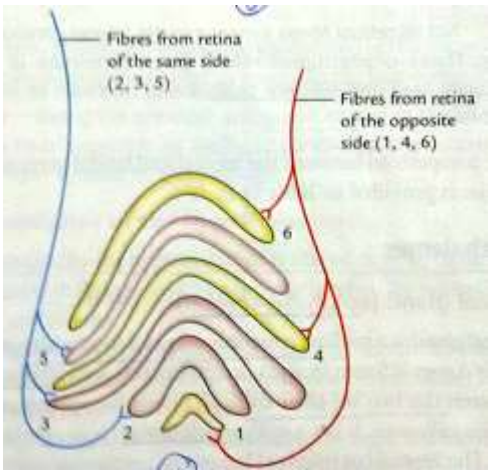
-connected to superior colliculus by the superior brachium

Structure:

-Grey matter is 6 layered separated by nerve fibres (numbered 1 to 6 from ventral to dorsal surface)

-Layers 1,4,6 – receive fibres from retina of opposite side

-Layers 2,3,5 – receive fibres from retina of same side



Connections :

Afferents – optic tract (lateral root) consisting of temporal fibres of same side & nasal fibres of opposite side

Efferents - gives rise to **optic radiation**, reaches visual cortex through retrolentiform part of internal capsule

Function:

Last relay station in visual pathway

Applied anatomy:

Lesion of lateral geniculate body – **contralateral homonymous hemianopia**