

Neurosurgery

MARROW
— Super Speciality

Instructions

- The notes must be used in conjunction with the Marrow SS Surgery videos and should not be considered standalone material.

Please note:

- The information in this book has been printed based on the transcript of the Marrow SS Surgery videos.
- The information contained in this book is for educational purposes only. The content provided is not intended to substitute for professional medical advice, diagnosis or treatment.
- This book cannot be sold separately. It has been made available to only select eligible users who have an active subscription to Marrow SS Surgery videos.
- The text, images, slides, and other materials used in this book have been contributed by the faculty, who are subject-matter experts. We have merely reproduced them as video transcripts in this book.
- The notes have been consciously designed in a way that is concise and revisable. To ensure this, we have intentionally added only the most relevant modules and images that are needed for you.
- Reasonable care has been taken to ensure the accuracy of the information provided in this book. Neither the faculty nor Marrow takes any responsibility for any liability or damages resulting from applying the information provided in this book.
- This set contains notes of all main videos published in the app until August 2025. You can find notes for any additional videos published after this date within the app under the videos section.

All Rights Reserved

No part of this publication shall be reproduced, copied, transmitted, adapted, modified or stored in any form or by any means, electronic, photocopying, recording or otherwise.

© Marrow

// ME821-PPL

Contents

Neuroanatomy and Localization

1. Gross Anatomy of Brain	1
2. Anatomy of Cranial Nerves	16
3. Functional Neuroanatomy I	36
4. Functional Neuroanatomy II	44
5. Spinal Localisation	59
6. Neuroradiology Basics	68
7. Neuro Ophthalmology	80

Neuro-Oncology

8. Overview of Brain Tumors and WHO Classification	88
9. Gliomas	97
10. Posterior Fossa Tumors	106
11. Meningiomas, Intraventricular & Pineal Gland Tumors	118
12. Pituitary Tumors	125
13. Vestibular Schwannomas	136
14. Specific Tumors : Part I	145
15. Specific Tumors : Part II	154

Developmental Anomalies

16. Cranial Development	159
17. Neural Tube Defects of Cranium & Spine	167

Neurovascular Conditions

18. Vascular Anatomy of Brain & Spine	177
19. SAH & Aneurysms	193
20. AVM, AVF & Moyamoya Disease	201

Neurotrauma

- | | |
|--|-----|
| 21. Neurotrauma - Intracranial Pressure Management | 209 |
| 22. Spinal Injury | 215 |
| 23. Atlanto Axial Dislocation | 221 |

Neurocritical Care

- | | |
|--|-----|
| 24. Management of Neurosurgical Emergencies | 232 |
| 25. Surgical Decompression and Fusion of The Spine | 237 |

Functional Neurosurgery

- | | |
|-----------------------------|-----|
| 26. Functional Neurosurgery | 246 |
| 27. Trigeminal Neuralgia | 251 |

Specific Neurosurgical Conditions

- | | |
|--|-----|
| 28. CSF and Hydrocephalus | 257 |
| 29. Neurocutaneous Syndromes | 267 |
| 30. Infections in Neurosurgery | 273 |
| 31. Seizure & Neurosurgery | 285 |
| 32. Sodium Homeostasis | 296 |
| 33. Degenerative Spine Disease | 303 |
| 34. Miscellaneous Spine Problems | 312 |
| 35. Peripheral Nerve Surgery | 316 |
| 36. Brain Death | 323 |
| 37. Scoliosis and Spinal Tumor Surgery | 329 |

Sessions in Neurosurgery

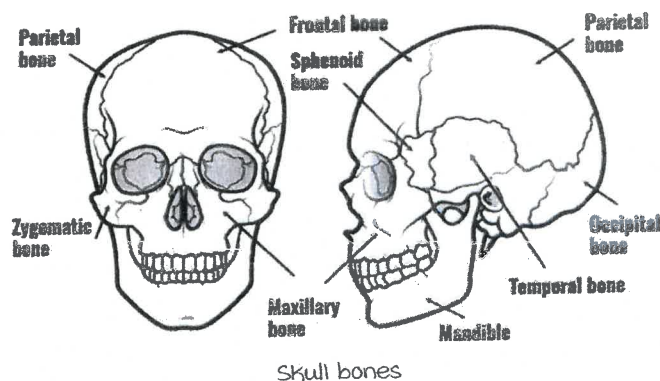
- | | |
|--------------------------------------|-----|
| 38. Neurology For Neurosurgeons | 333 |
| 39. Important Trials in Neurosurgery | 342 |
| 40. Neuropharmacology | 346 |
| 41. CP Angle Lesions Practicals | 351 |
| 42. Pituitary and Sellar Lesions I | 359 |
| 43. Pituitary and Sellar Lesions II | 367 |

GROSS ANATOMY OF BRAIN

----- Active space -----

Skull bones

00:00:11



major skull bones :

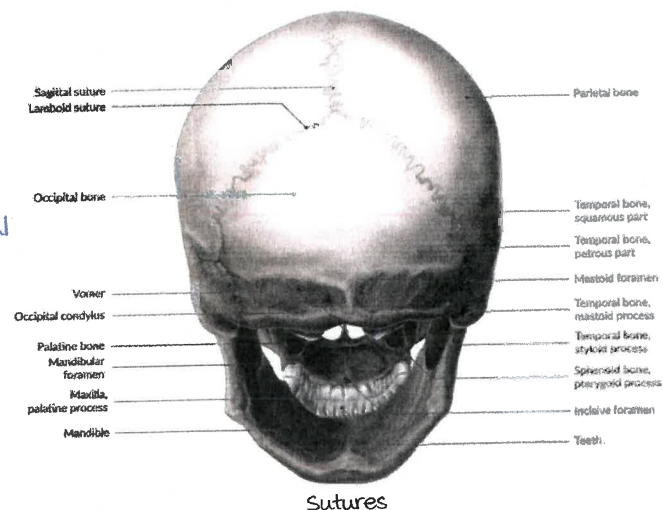
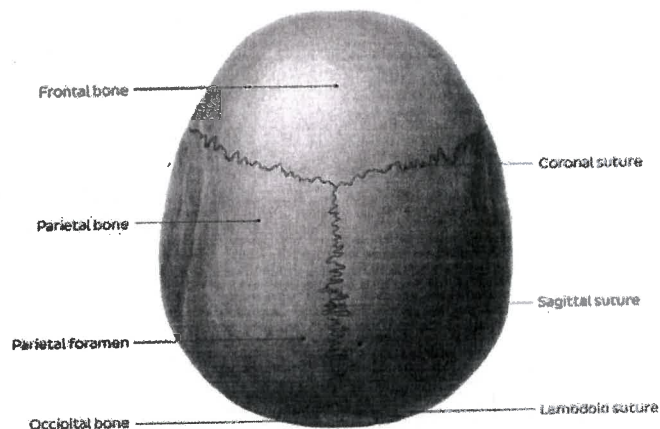
- Frontal.
- Parietal.
- Temporal.
- Sphenoid bone → covers more of base of skull.
- Occipital.

Fusion of sutures :

- Pathological : **Craniosynostosis**.
- Surgically significant : Defines landmark and window for surgery.
- No intraoperative exploration followed.

Sutures :

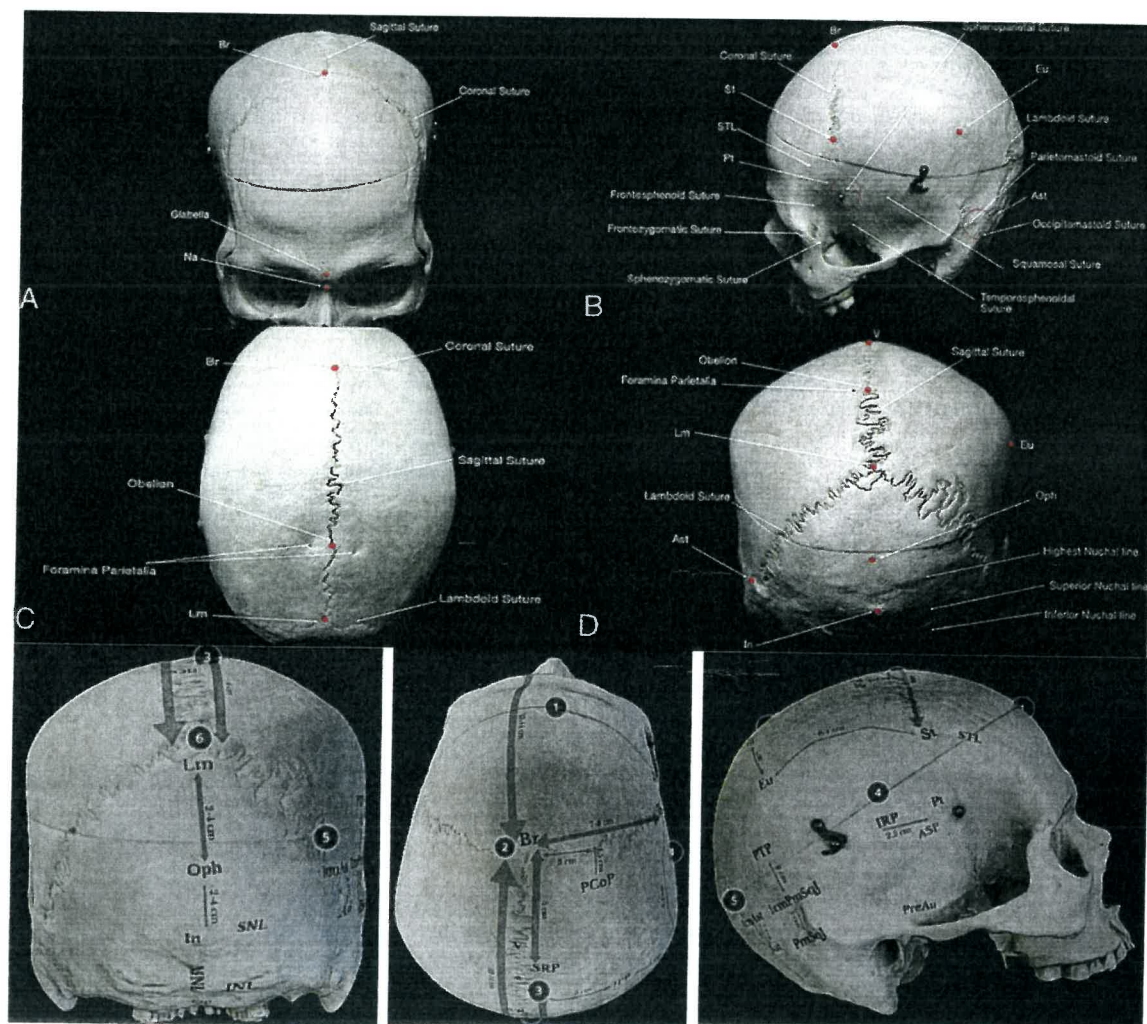
- Coronal : where frontal bone joins the parietal bone.
- Sagittal : where two parietal bones fuse.
- Lambdoid : where parietal bones joins the occipital bone.



----- Active space -----

Craniometric points :

Define locations of various structures of brain.



Craniometric points

- Inion :
 - Lowest part.
 - Above subocciput.
 - Significance : measurements done from nasion & inion (Points of description).
- Opisthion : Posterior bulge on skull.
- Lambda : Union of lambdoid & sagittal sutures.
- Bregma : Union of coronal & sagittal sutures.
- Vertex : Top most point
- Nasion : Union of nose & skull.
- Glabella : Above nasion.

examples :

- Central sulcus : 5 cm behind coronal suture.
 - Significance : Location of motor strip (If damaged → motor dysfunction/paralysis).
 - Safe point of entry : Coronal suture.

Pterion :

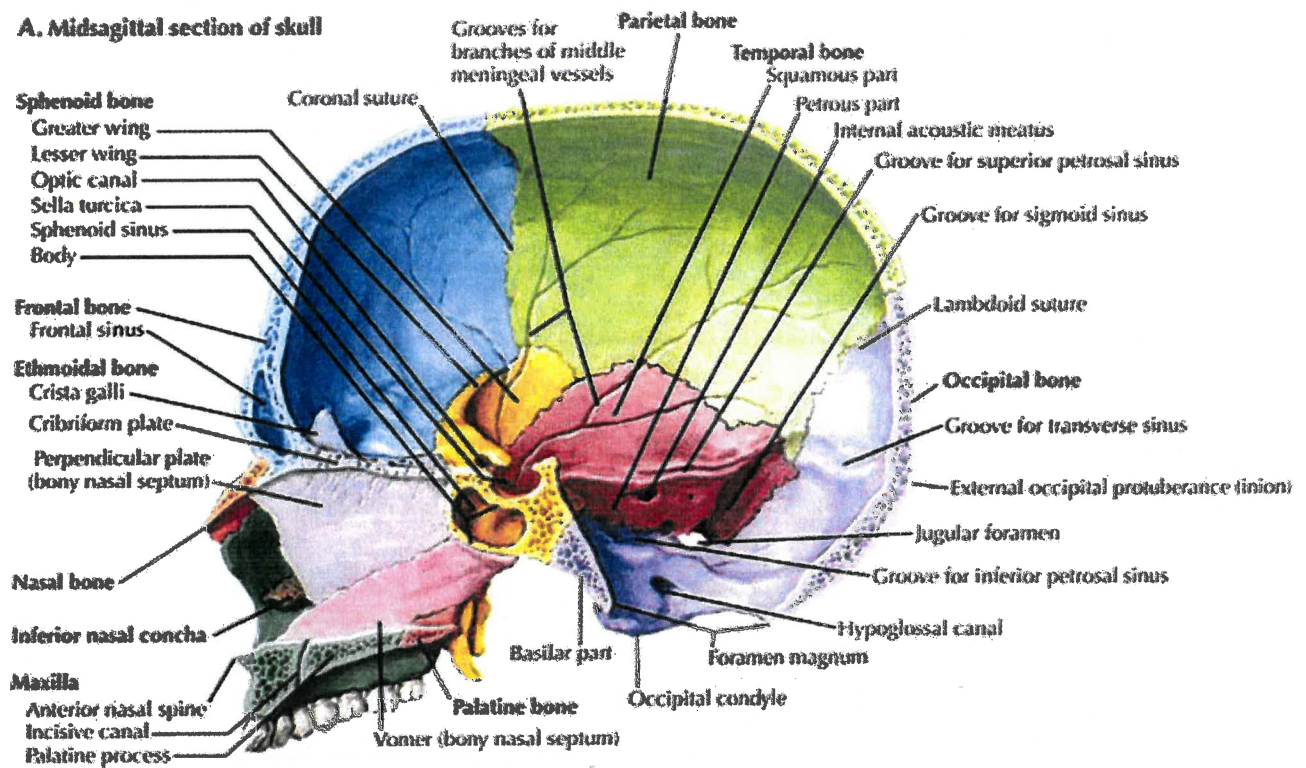
- Point where sphenoid, temporal & frontal bone unite.
- marks **sylvian fissure** (Entry point of aneurysm surgery).

Asterion :

- Few cms above and behind mastoid process.
- Access point for **cerebellopontine angle tumors**.

midsagittal section of skull :

A. Midsagittal section of skull

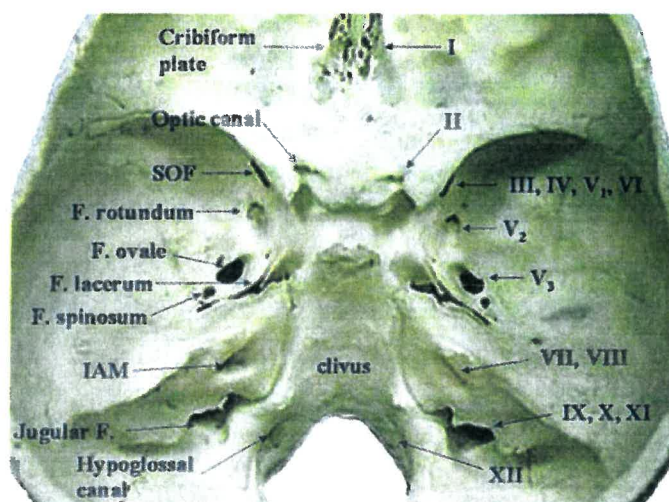
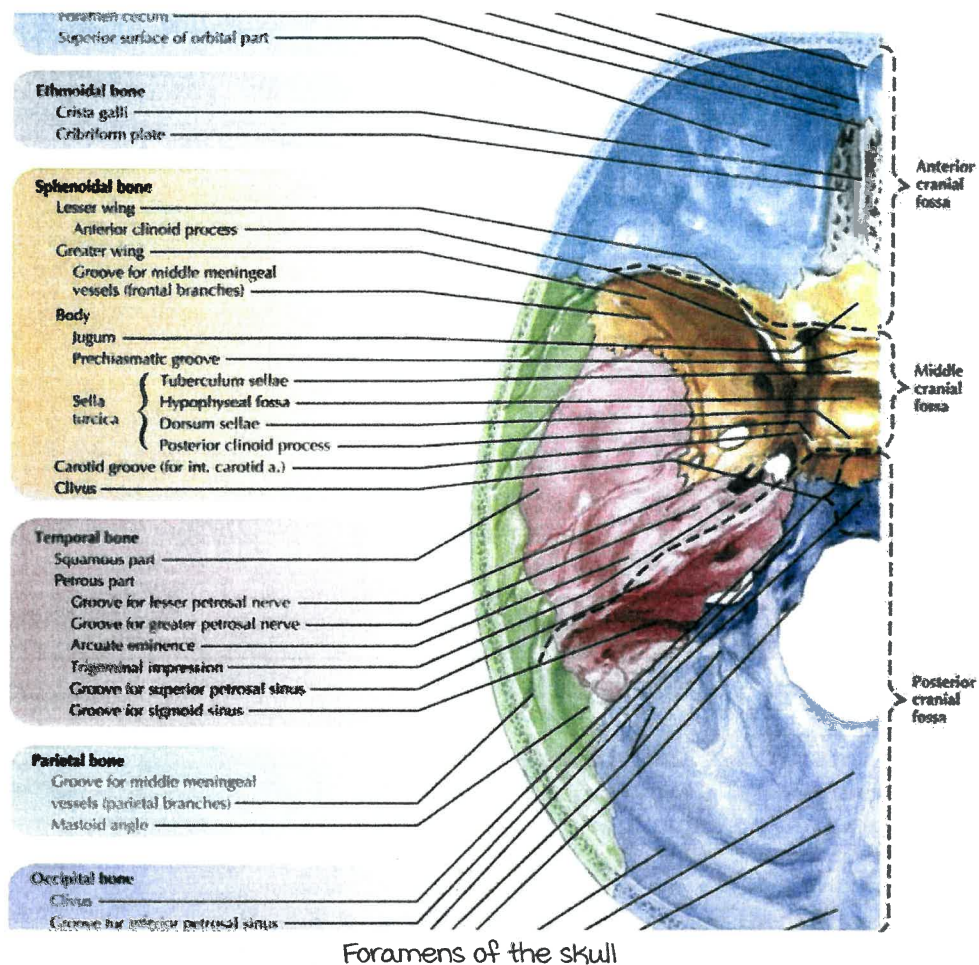


- Ethmoid : Base of anterior part of skull.
- Crista galli : Fin shaped structure.
- Vomer : Helps define trajectory in pituitary surgery.

----- Active space -----

Foramina :

Holes in the base of the skull through which various structures enter the skull.



Foramina in the base of the skull

----- Active space -----

Foramen	Structures
Foramen caecum	Emissary veins
Olfactory foramina	Olfactory nerve
Optic canal	Optic nerve (CNIII), ophthalmic artery, dural sheath of optic nerve
Superior orbital fissure	Oculomotor nerve (CNIII), trochlear nerve (CN IV), ophthalmic division of the trigeminal nerve (CNV), abducent nerve (CNVI), ophthalmic veins
Foramen rotundum	maxillary division of the trigeminal nerve (CN V ₂)
Foramen ovale	mandibular division of the trigeminal nerve (CN V ₃), accessory meningeal branch of maxillary artery, emissary vein (Lesser petrosal nerve)
Foramen spinosum	middle meningeal artery
Foramen lacerum	Greater petrosal nerve
Carotid canal	Internal carotid artery
Internal acoustic foramen	Facial nerve (CNVII), vestibulocochlear nerve (CNVIII)
Jugular foramen	Glossopharyngeal nerve (CNIX), vagus nerve (CNX), descending portion of the spinal accessory nerve (CNXI), internal jugular vein
Hypoglossal canal	Hypoglossal nerve (CNXII)
Foramen magnum	Brainstem/spinal cord, vertebral arteries, ascending portion of the spinal accessory nerve (CNXI)

Anterior fossa : Cribriform plate → Olfactory nerves.

Posterior fossa :

- Clivus with internal acoustic meatus.
 - Significant in vestibular schwannoma surgery.
 - Carries 7th & 8th CN.
- Jugular foramen : Large veins of internal jugular pass through.
- Hypoglossal foramen : Contains Hypoglossal canal → Hypoglossal nerve (CN XII).

middle cranial fossa :

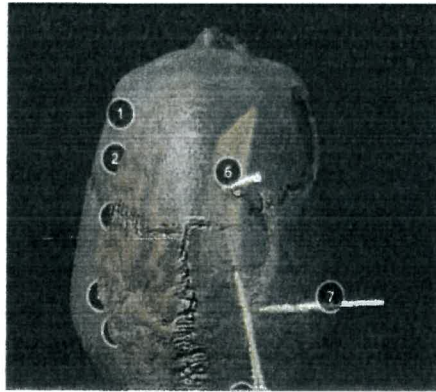
- Optic canal.
- Superior orbital fissure.
- Foramen rotundum.
- Foramen ovale.
- Foramen spinosum.
- Foramen lacerum.

Hydrocephalus :

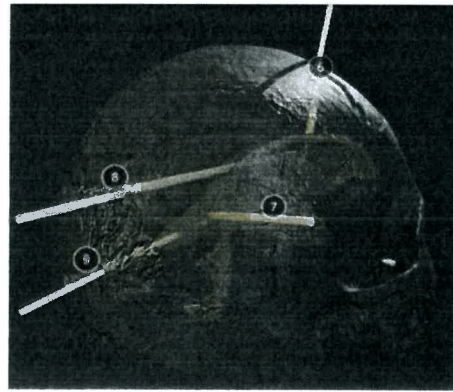
- Blockage of ventricles.
- Drains inserted to relieve pressure.
- Points for insertion of ventricular catheters : Kocher's > Keen's > Frazier's > Dandy's point.
 - Kocher's → 3 cm lateral to midline and 1 cm anterior to coronal suture or 11 cm posterior to nasion.

----- Active space -----

- Keen's → 3 cm above and 3 cm lateral to helix of the pinna.
- Frazier's → 3 cm lateral to midline and 6 cm superior to theinion.
- Dandy's → 3 cm lateral to the midline and 3 cm superior to theinion.



6 : Kocher's point, 7 : Keen's point



8 : Frazier's point, 9 : Dandy's point

Cerebrum

00:21:50

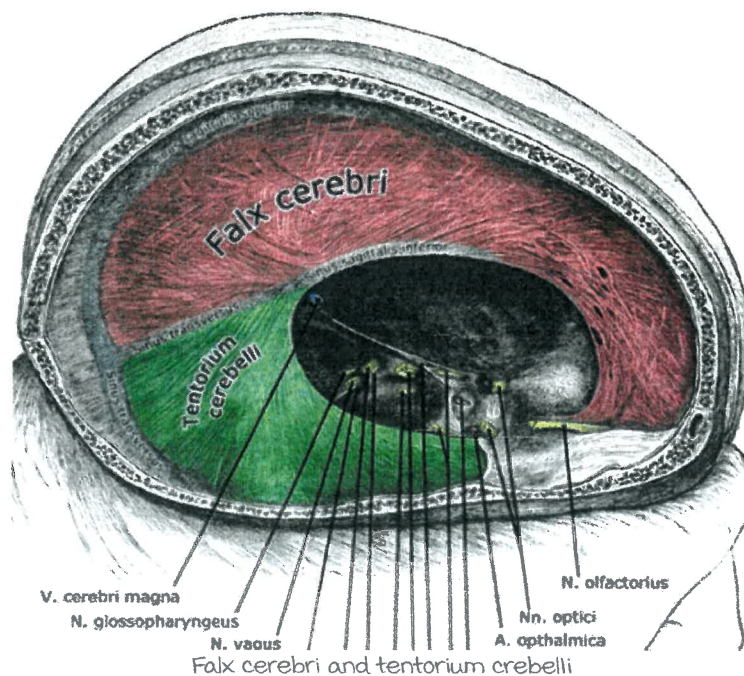
Falx cerebri :

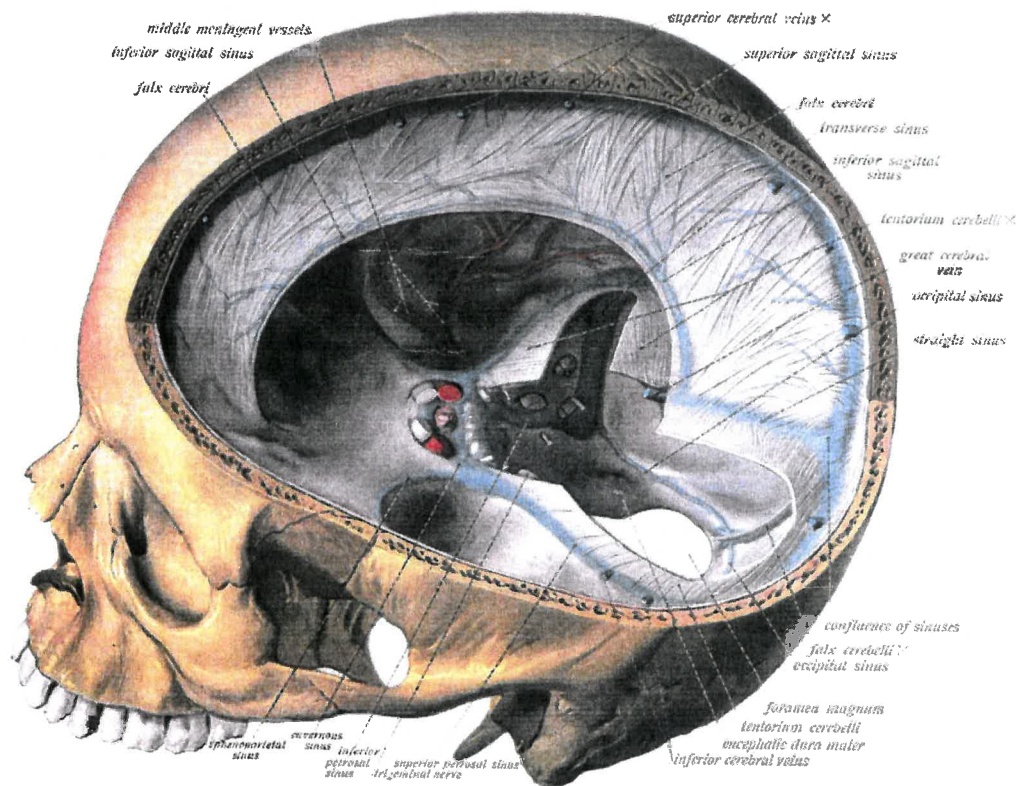
- Dural investation.
- Divides the brain into right and left hemisphere.

Tentorium cerebelli :

Wing like structure below falx cerebri.

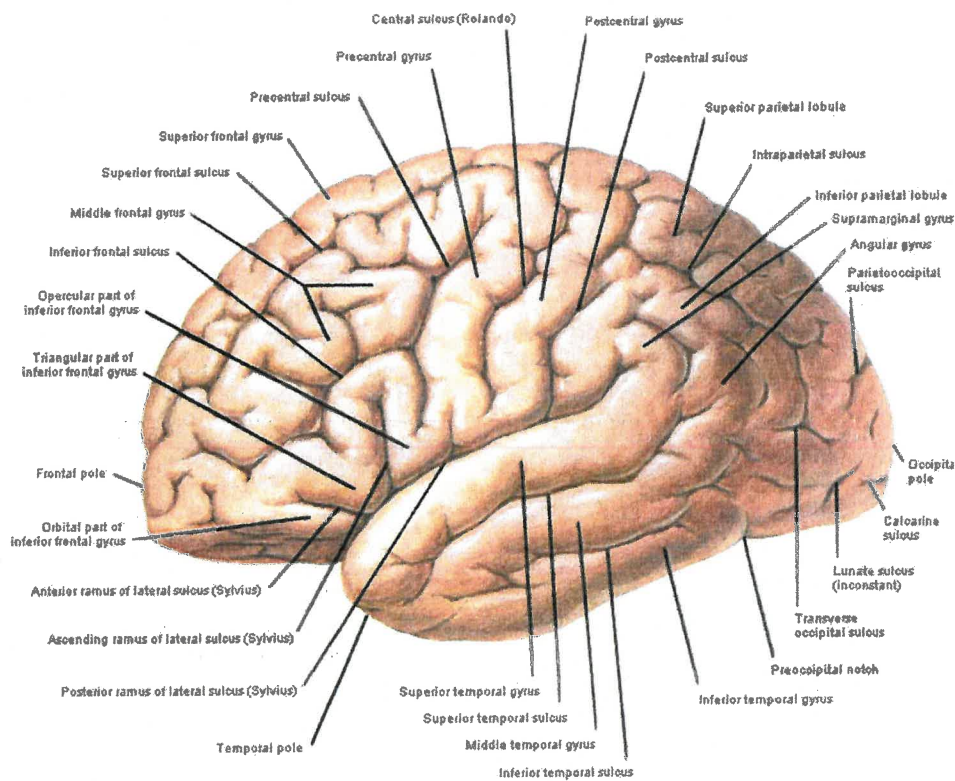
It divides the brain into supratentorial and infratentorial fossa.





----- Active space -----

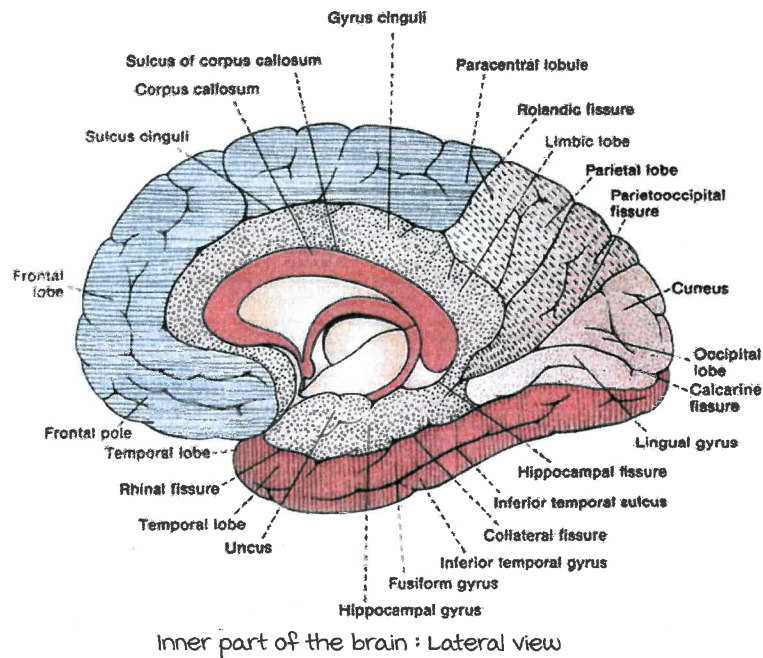
Cerebrum : Lateral view



----- Active space -----

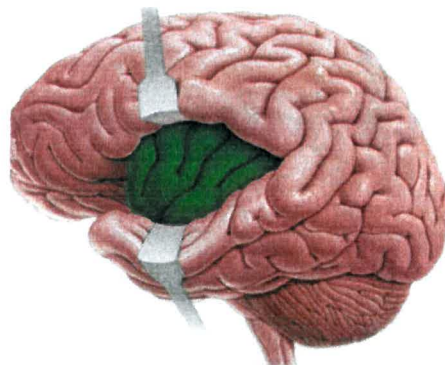
4 lobes/5 lobes including corpus callosum as a lobe.

Central sulcus : Divides frontal & parietal lobe.

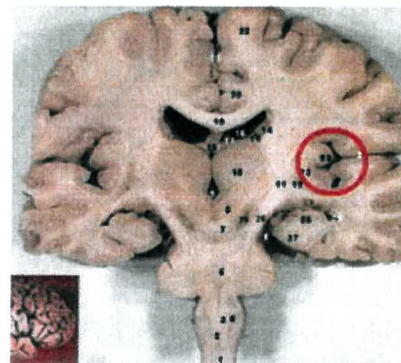


Insula :

- B/w frontal and temporal lobe.
- It contains important structures.
- Insular glioma : Common tumor in this region.



Insular glioma



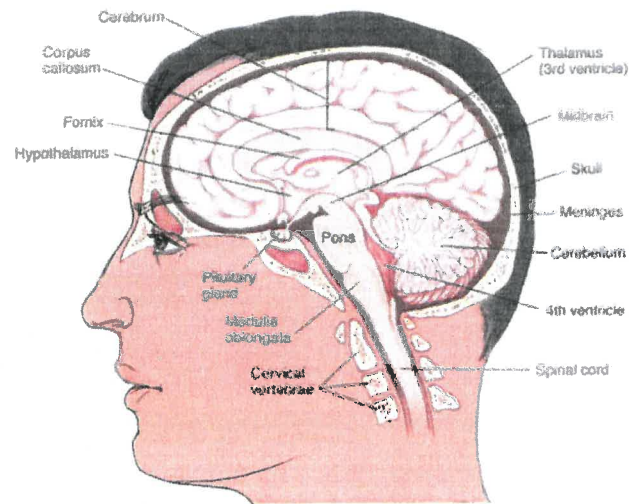
Coronal section of brain : Insula

Deep part of brain :

Cingulate gyrus : Extending from frontal to parietal lobe.

Corpus callosum :

- Lies below cingulate gyrus.
- **Parts :**
 - Rostrum : Anterior beak-like.
 - Genu : Turn.
 - Body.
 - Splenium : Posterior part.
- Thick band of nerve fibres connecting 2 hemispheres.
- If severed → Left & right hemisphere behave separately.
- Example : **Phantom hand syndrome.**



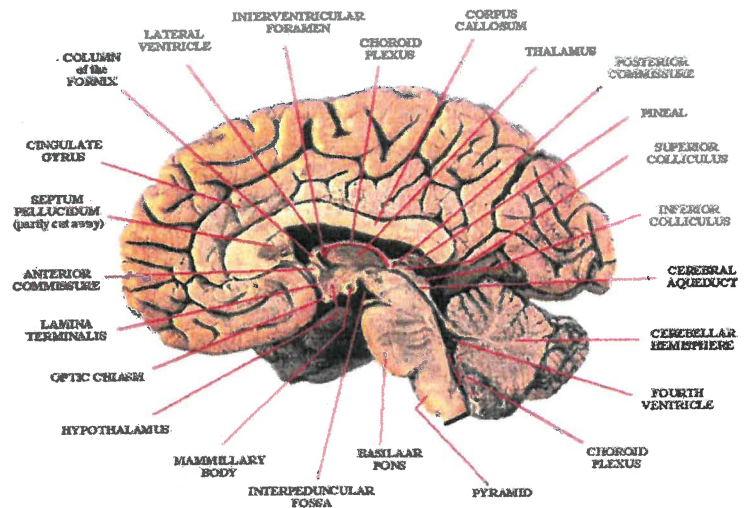
Corpus callosum

Sulci & gyri :

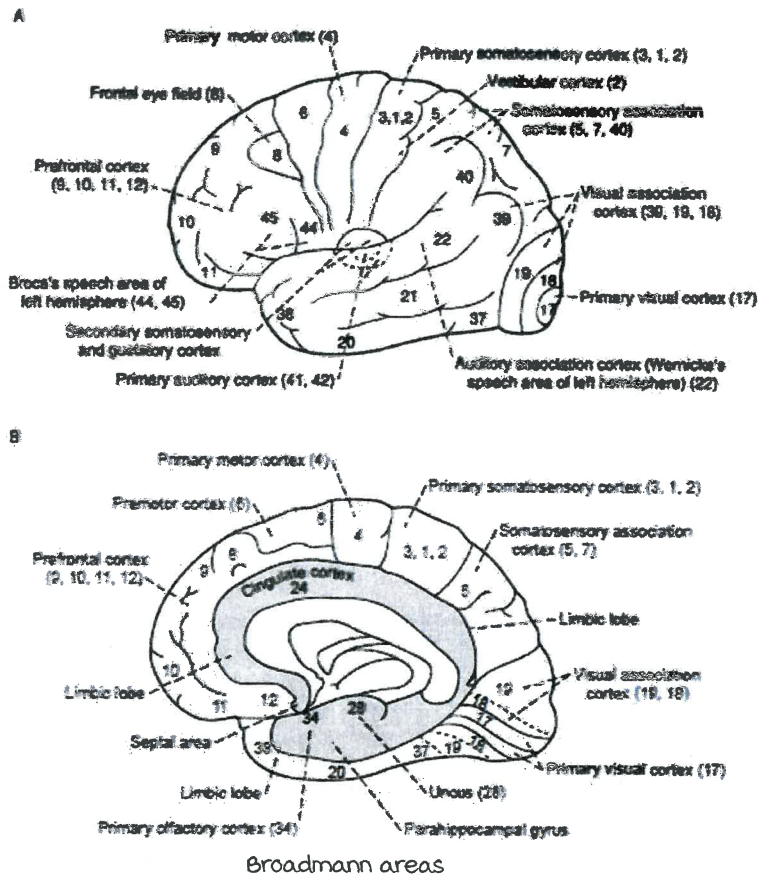
- Frontal lobe gyri : Superior, middle, inferior.
- Temporal lobe gyri : Superior, middle, inferior.

Broadmann areas :

- Primary motor cortex : Area 4 → Controls motor function of opposite side.
- Area 8 :
 - Frontal eye field.
 - Conjugate movement of eye.
 - If defective : Sees only 1 side & ignores other side.
- Speech area → Broca's area → 44 & 45.
- Primary auditory cortex (41, 42) : Close to insular cortex on temporal lobe.
- Wernicke's areas (39, 40).
- Primary visual cortex (17, 18, 19).
- Paracentral lobule → Controls the motor power of the feet.

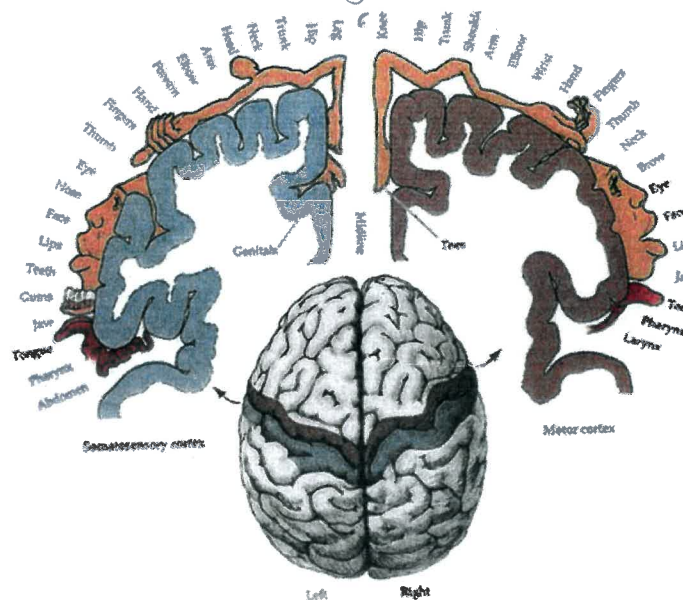


----- Active space -----



Homunculus representation :

- Physical representation of the body in the brain.
- Hands, tongue and face : Higher representation in the motor homunculus.
- Similar representation seen in sensory homunculus.

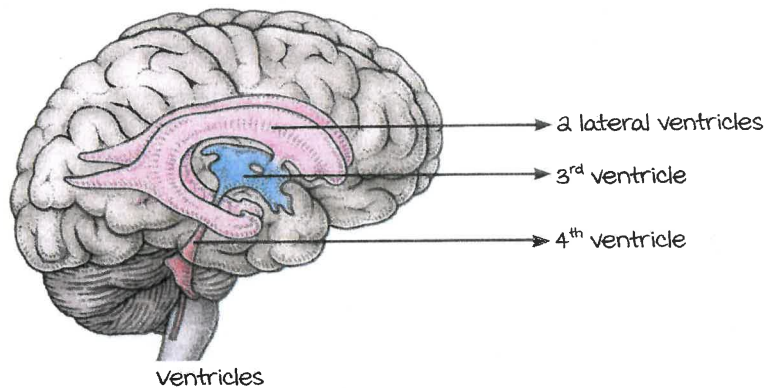


Homunculus representation

Ventricles

00:38:50

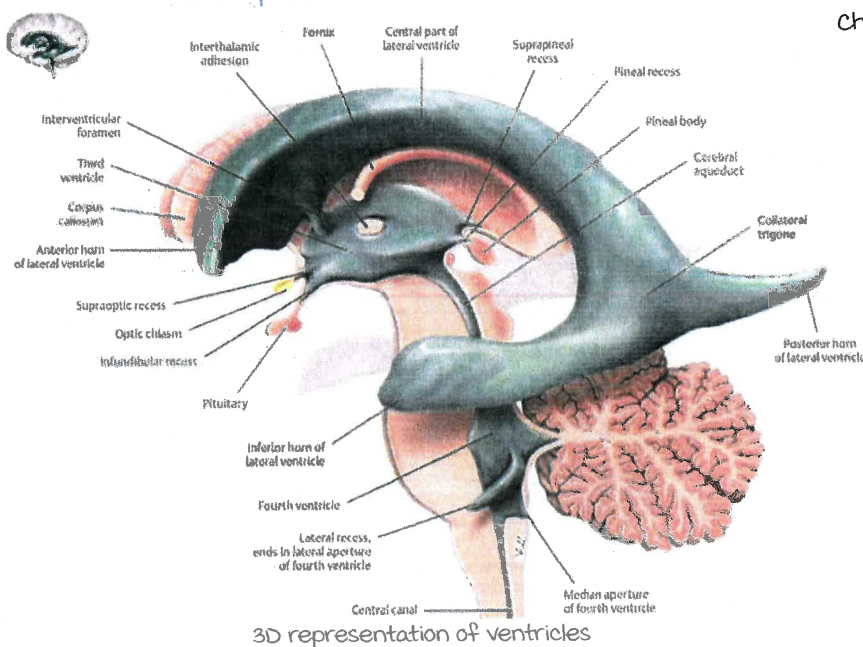
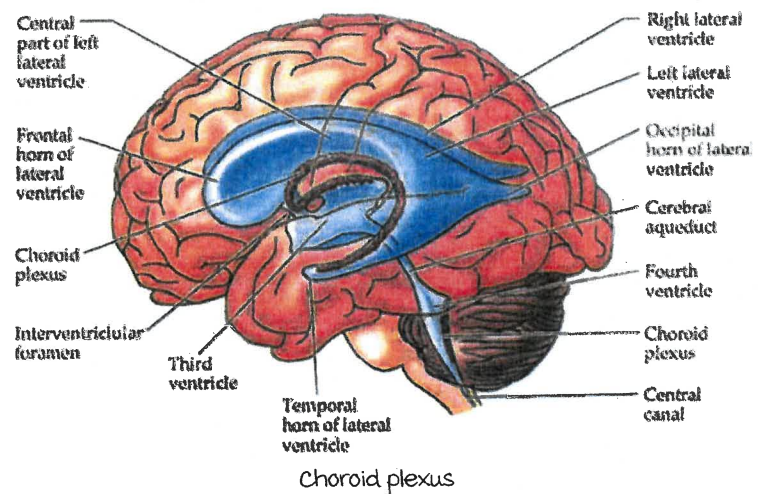
----- Active space -----



Lateral ventricles → Foramen of monroe → 3rd ventricle → Aqueduct of sylvius
 → 4th ventricle → Drains to central canal of spinal cord + Foramen of magendi & Luschka.

Choroid plexus :

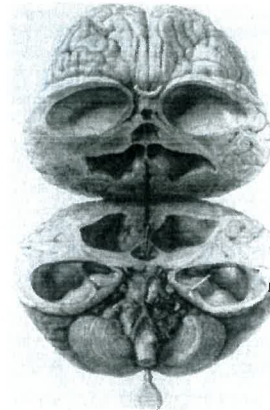
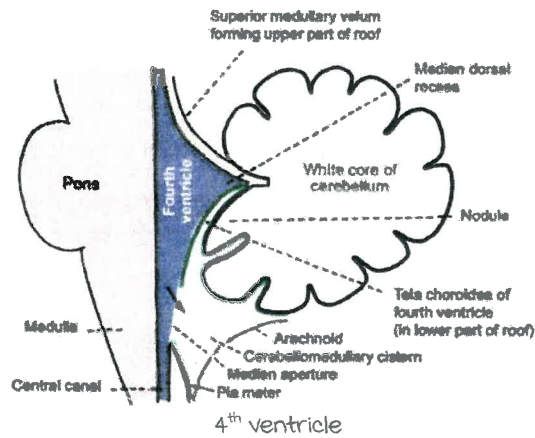
- Produces CSF (Nutritive).
- Present in lateral, 3rd & 4th ventricles.
- Distance of frontal horn from cortical surface :
 - Approximately 3.5-4 cm long in normal brain.
 - Useful to determine the length of tube to be inserted for shunt from focus point.



----- Active space -----

4th ventricle :

- Tent shaped structure.
- Anteriorly : Pons.
- Posteriorly : Cerebellum.
- Roof : Superior medullary velum.
- Floor : Inferior medullary velum.



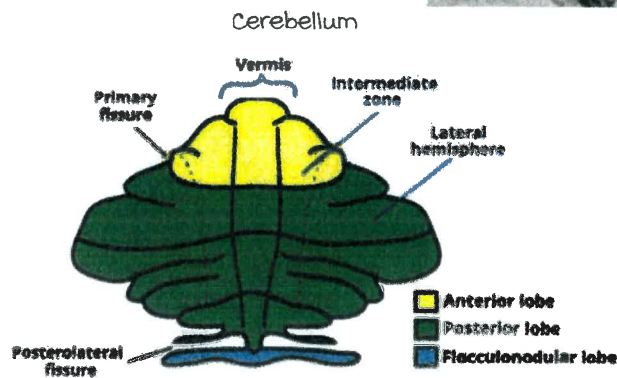
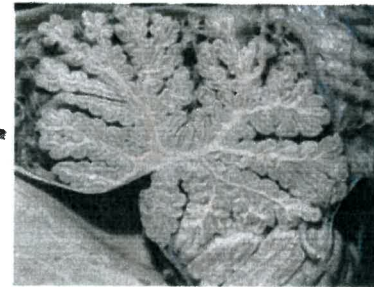
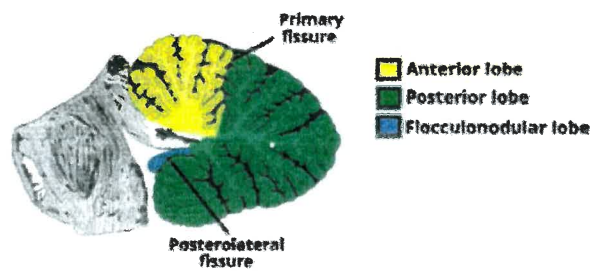
Brain of child with hydrocephalus

Cerebellum

00:44:10

Infratentorial structures :

Cerebellum :



Vermis + appendicular portions

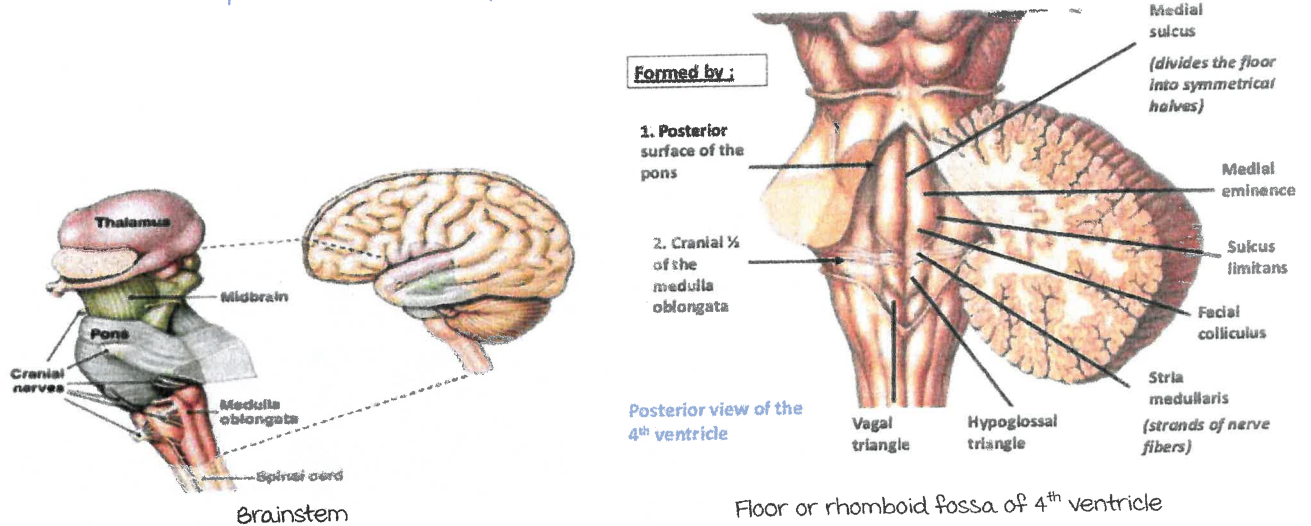
Cut section of cerebellum : Arbor vitae (Tree of life).

Brainstem

00:46:23

----- Active space -----

Brainstem is composed of : midbrain, pons, medulla oblongata



Eminences : Represent location of cranial nerve nucleus & point of entry.

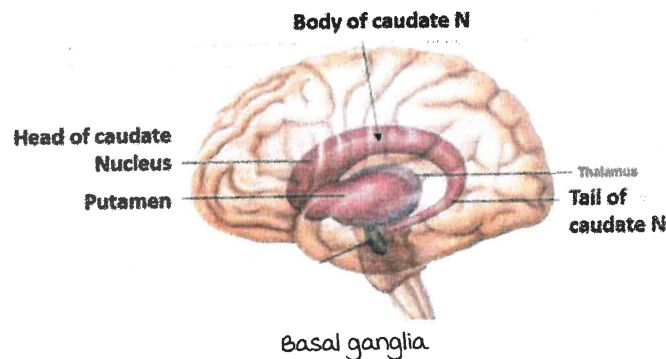
Superior cerebellar, middle cerebellar & inferior cerebellar peduncles connects cerebellum to rest of brain.

Area postrema :

- Is in median.
- In floor of 4th ventricle/obex.
- This area causes nausea.
- Hence, direct stimulation of area postrema/obex → vomiting in stroke/tumor patient.

Basal ganglia

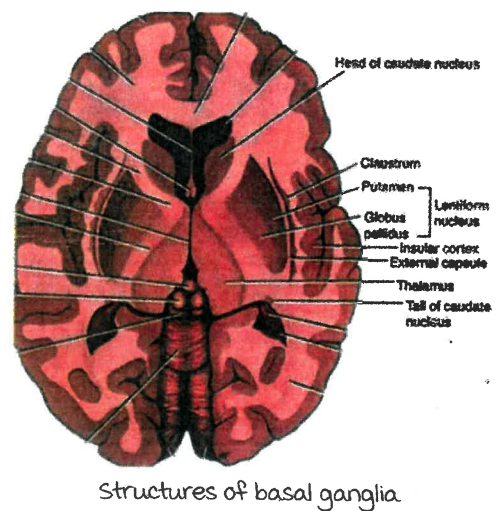
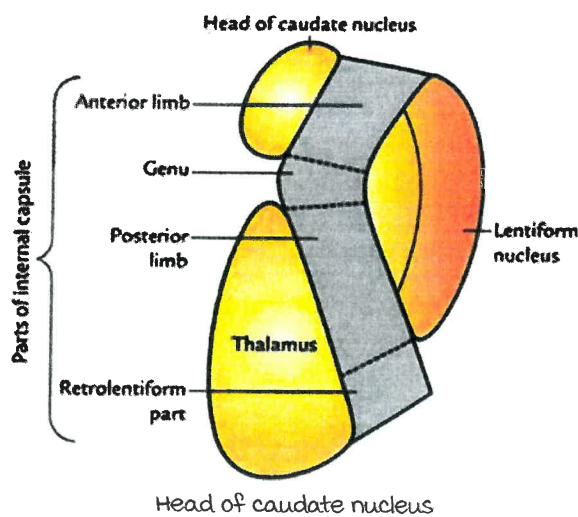
00:49:30



- Thalamus forms part of basal ganglia.

----- Active space -----

- Called basal ganglia as :
 - Cortex contains cell bodies.
 - White matter contains tracts.
- Greyish coloured cells are present in the parenchyma of white matter.
- **Significant :**
 - In parkinsonism.
 - Automatic movement.
 - In deep brain stimulation.
 - Contains caudate nucleus.



Internal capsule :

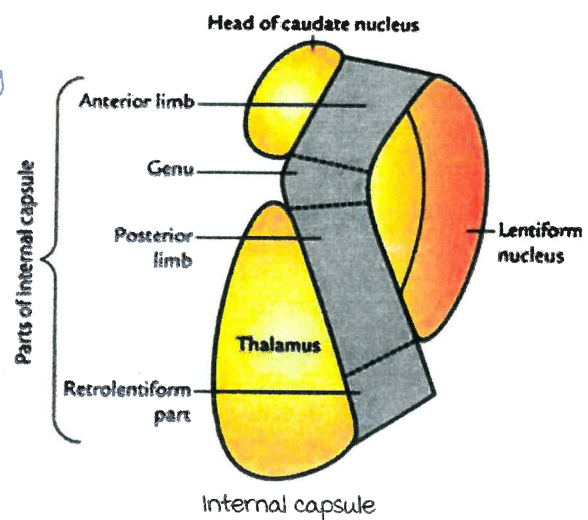
- Large tract of white matter.
- From premotor cortex & sensory cortex to spinal cord in pyramidal tract.

Parts :

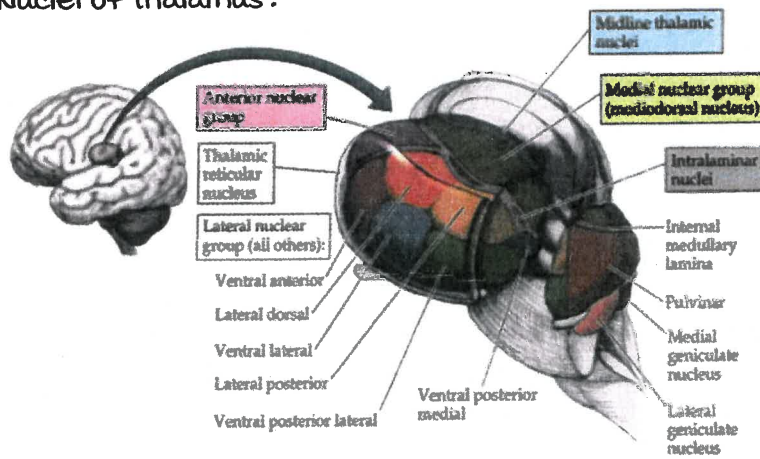
- Anterior limb : Fibres for head & hand.
- Genu : Fibres for trunk & lowerlimb.
- Posterior limb : Fibres for lowerlimbs.
- Retrolentiform part.

Clastrum :

- Thin layer of grey matter .
- Seat of consciousness (Debatable).



Nuclei of thalamus :



Thalamic nuclei

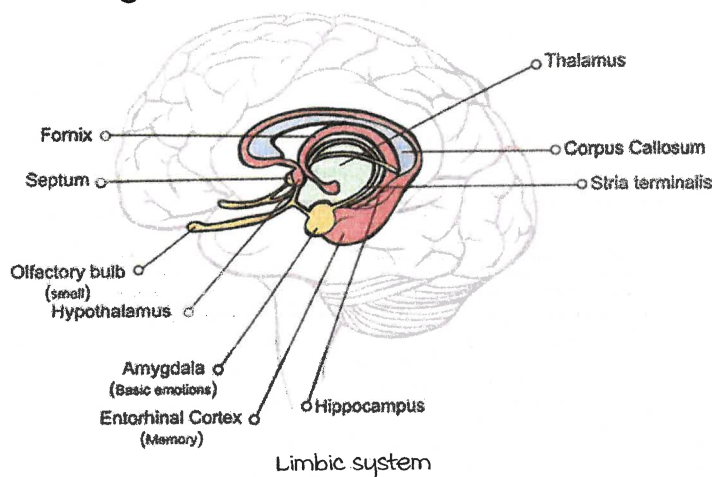
Fornix :

- Deep complex area
- Corpus callosum banded fibres of emotion, memory.
- Genu → Fornix → Hippocampus → Ends in amygdala (Nutmeg).
- These structures define smell, memory. Hence part of Papez circuit.
- Prosencephon : By evolution, oldest preserved part.

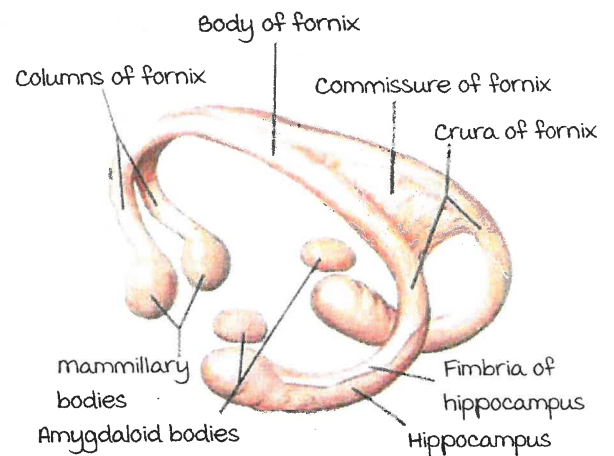
Papez circuit :

- Forms part of limbic system.
- Controls emotion & memory.

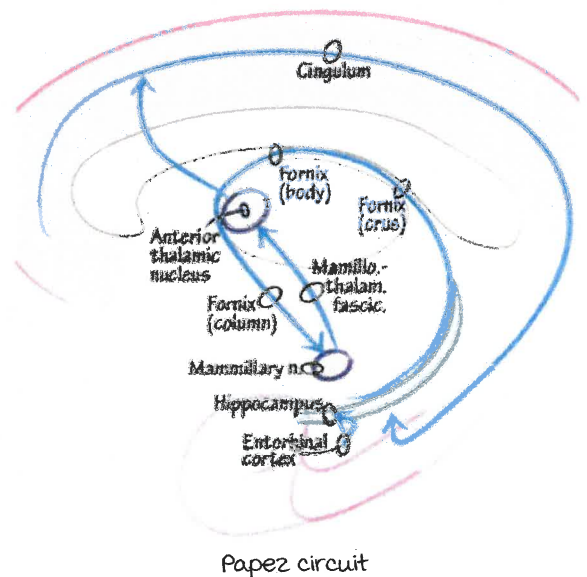
Limbic system :



Limbic system



Fornix : schematic diagram



Papez circuit

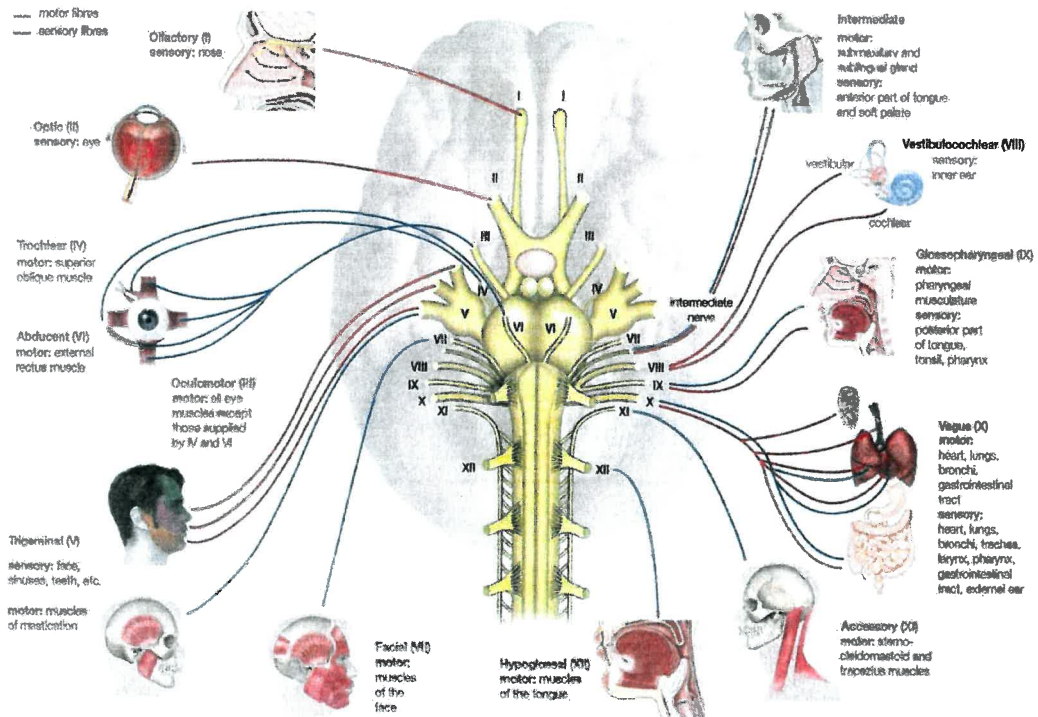
Smell : Important part of distant memory.

----- Active space -----

ANATOMY OF CRANIAL NERVES

Overview

00:01:00



Largest cranial nerve : **vagus nerve.**

Thickest and largest cranial nerve to innervate the cranium : **Trigeminal nerve.**

