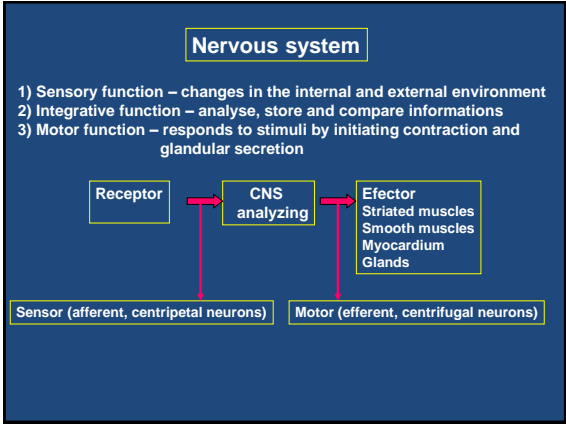
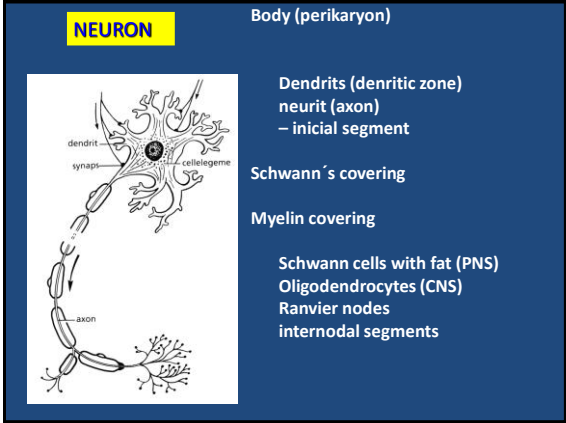


Nervous system

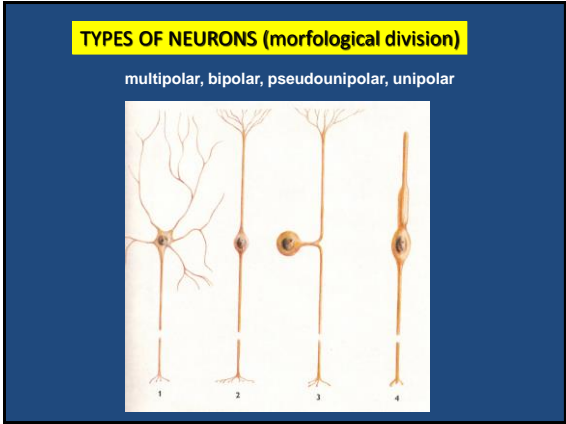


- ### Nervous system divisions
- 1) Central Nervous System (CNS) – brain, spinal cord
 - 2) Peripheral Nervous System (PNS) – cranial nerves (I-XII), spinal nerves (31 pairs), vegetative (visceral or autonomic) system



GLIAL CELLS

- Makroglia (astrocytes) – transport of substances between capillary and neuron
- Oligodendroglia – covering of axons in CNS
- Schwann cells – covering of axons in PNS
- Mikroglia – fagocytation activity
- Ependym – cover ventricles

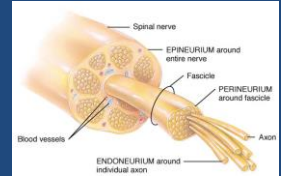


TYPES OF NEURONS (functional division)

1. **SENSORIC** (ascendent, aferent, centripetal)
 - Somatosensoric (proprioception, exteroception)
 - Viscerosensoric (interoception)
2. **MOTOR**
 - Somatomotor (striated muscles)
 - Visceromotor
 - sympaticus, parasympaticus** – vegetativ, autonomic (smooth muscles, heart, glands)
3. **INTERNEURONS**

DIVISION OF NERVOUS SYSTEM

1. **Central (CNS)** – spinal cord, brain
 - Gray matter – bodies of neurons (cortex, nuclei)
 - White matter – myelinated nerve fibres
2. **Peripheral** – spinal, cranial and autonomic nerves (sensoric, motor, mixed) plexuses



Central nervous system

Spinal cord (medulla spinalis)

Brain (cerebrum, encephalon)

Medulla oblongata

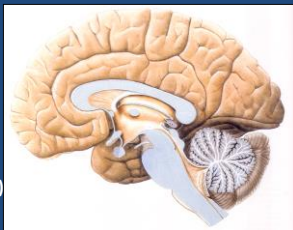
Pons (pons Varoli)

Cerebellum

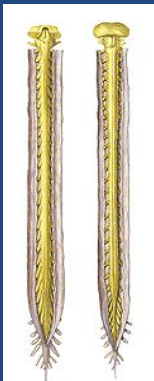
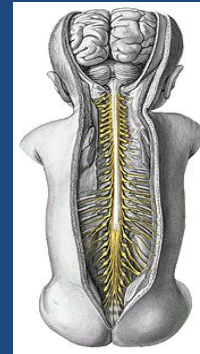
Midbrain (mesencephalon)

Hindbrain (diencephalon)

Telencephalon



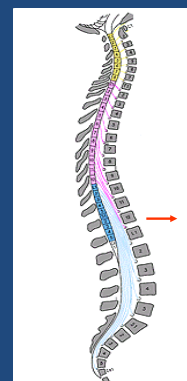
Spinal cord (medulla spinalis)



Decussatio pyramidum, spinal nerves C1

Saccus durae matris

L 1-2 adults, L 3-4 newborns



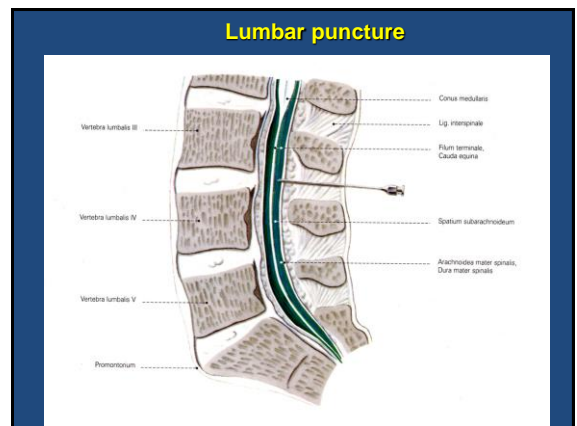
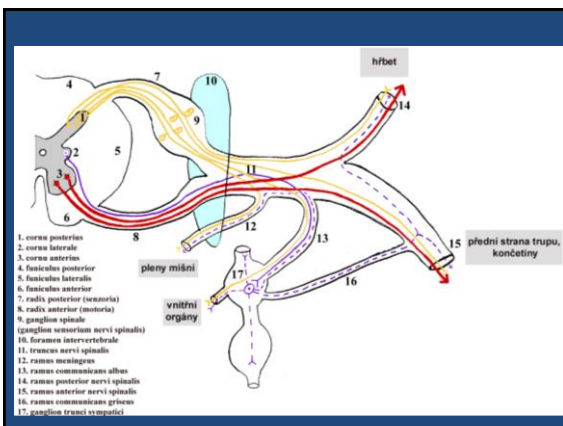
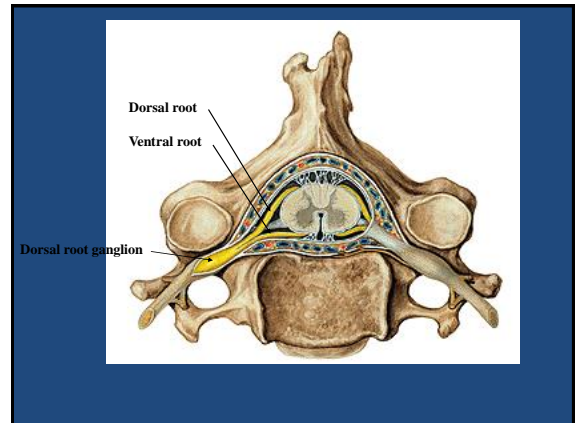
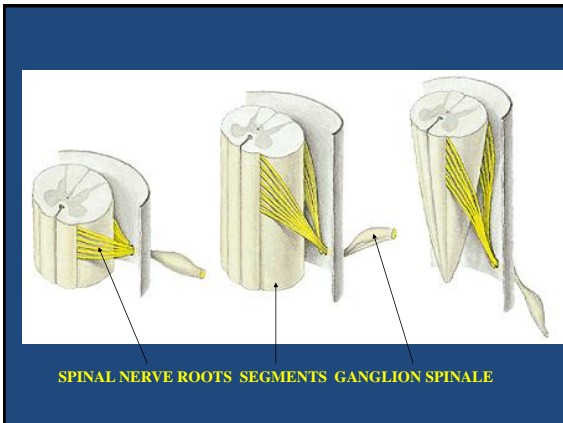
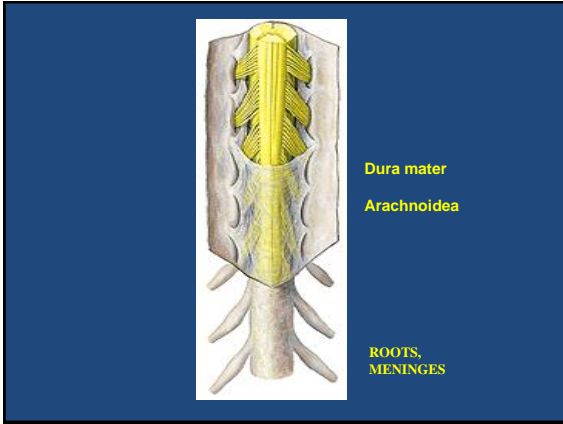
Cervical

Thoracic

Lumbar

Sacral

SEGMENTS



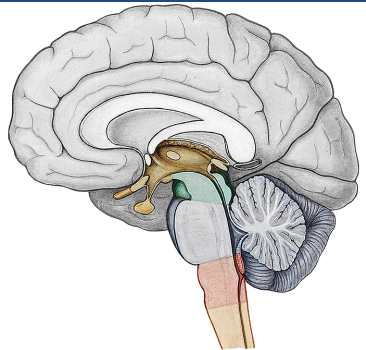
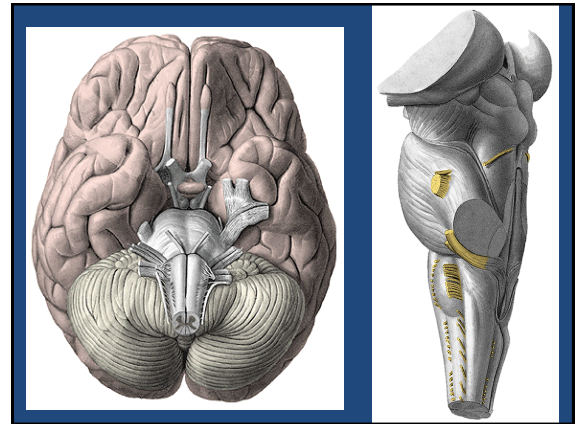
BRAIN STEM

Medulla oblongata

Pons
(pons Varoli)

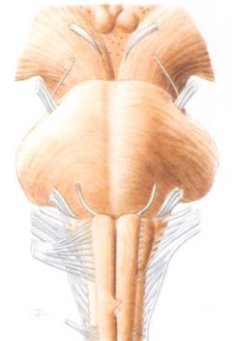
Midbrain
(mesencephalon)

Hindbrain
(diencephalon)

Medulla oblongata

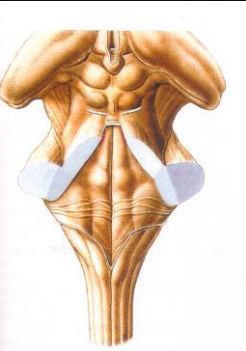
- spinal cord continuation (20–25mm) (bulbus medullae spinalis)
- from 1. pair of spinal nervusu (**decussatio pyramidum**) to pons Varoli
- sulcus bulbopontinus (VI., VII., VIII.)
- sulcus lateralis anterior (XII.)
- sulcus lateralis posterior (IX., X., XI.)
- pyramis medullae oblongatae (Corticospinal tract)



Fossa rhomboidea
Bottom of the fourth ventricle (dorsal side of brain stem)

1. **pars superior** (mesencephalon)
2. **pars intermedia** (pons Varoli)
3. **pars inferior** (medulla oblongata)

between pedunculi cerebellares inf.
sulcus medianus
sulci limitantes (eminentia medialis)
trigonum nervi hypoglossi
trigonum nervi vagi (fovea inferior)



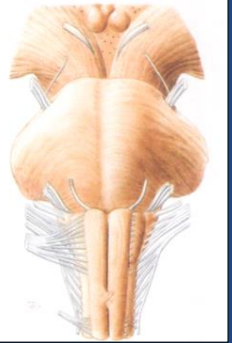
Pons Varoli

sulcus basilaris (a. basilaris)

sulcus bulbopontinus
VI. – **nervus abducens**
VII. – **nervus facialis**
VIII. – **nervus vestibulocochlearis**

pedunculi cerebellares medii

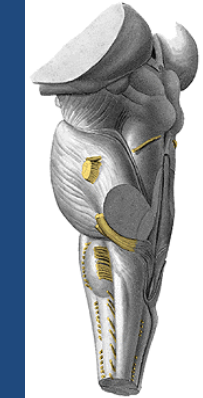
V. – **nervus trigeminus**

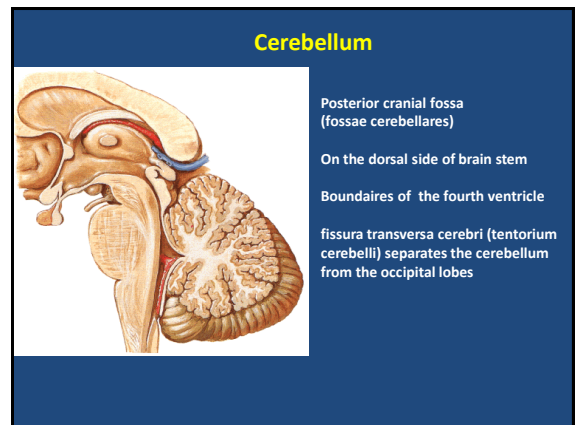
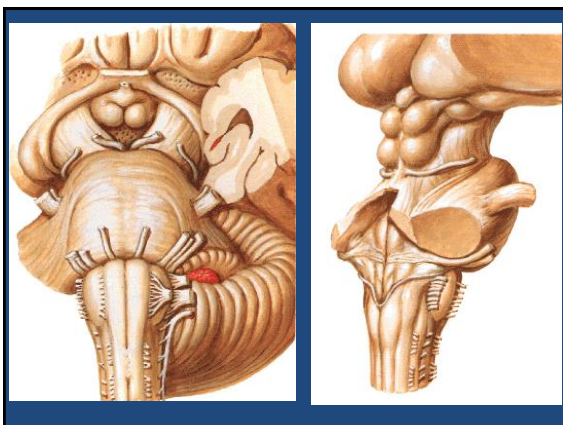
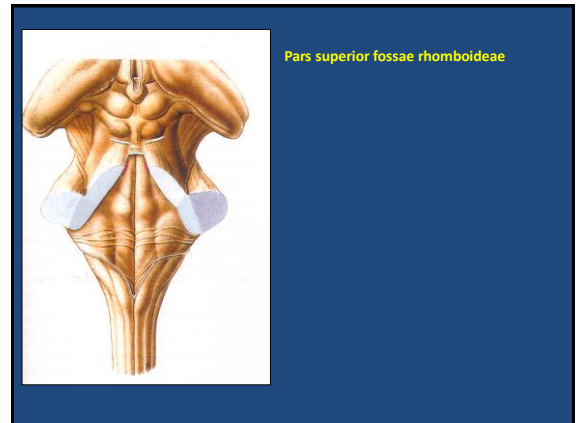
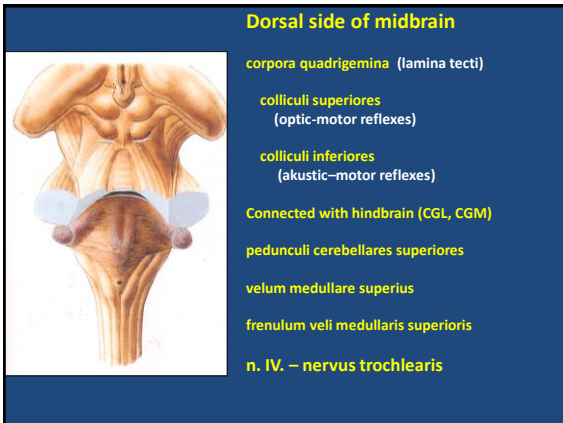
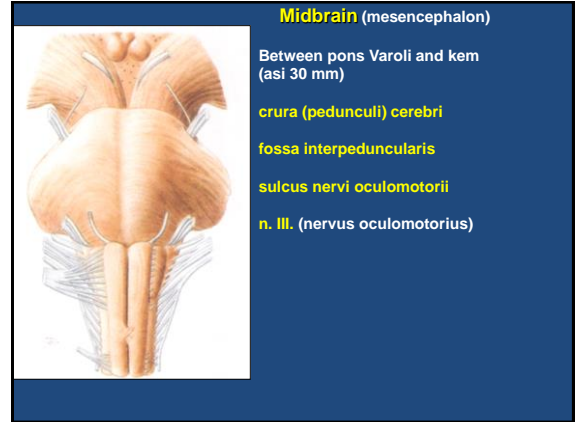
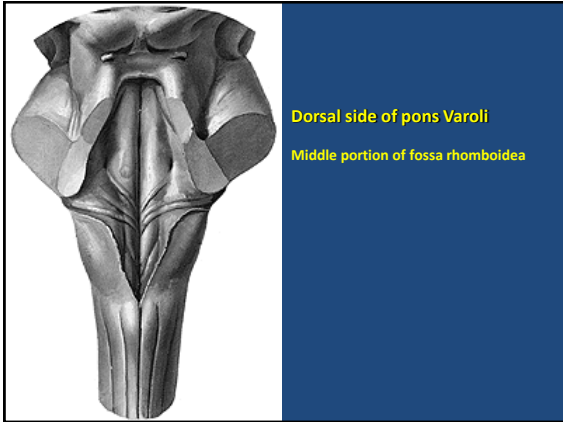


Lateral side of pons Varoli

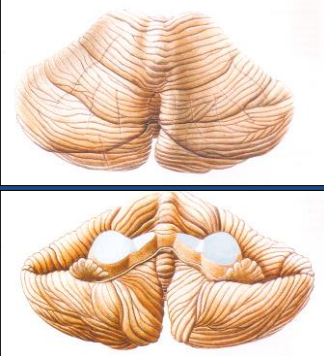
pedunculus cerebellaris medius

nervus trigeminus

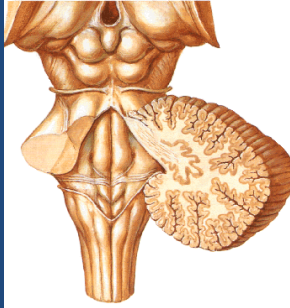




Cerebellum 130-150 g



- Vermis cerebelli
- Hemispheria cerebelli
- Margo anterior (incisura cerebelli ant.)
- Margo posterior (incisura cerebelli post.)
- Pedunculus flocculi
- Flocculus
- Sulci cerebelli
- Folia cerebelli

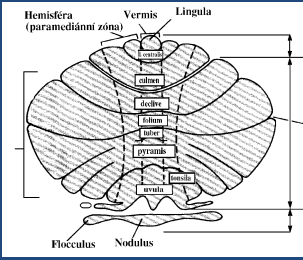
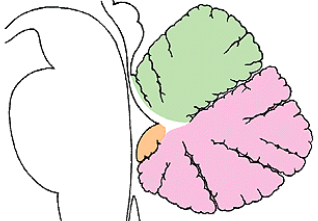


Connected with brain stem by three peduncles:

1. Pedunculi cerebellares sup. (midbrain) velum medullare sup.
2. Pedunculi cerebellares med. (pons Varoli)
3. Pedunculi cerebellares inf. (medulla oblongata) fastigium velum medullare inf.

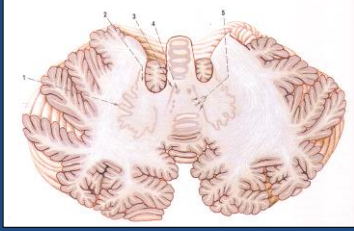
Functional division of cerebellum:

1. vestibular (**archicerebellum**)
lingula, pars nodulofloccularis
2. spinal (**paleocerebellum**)
medial and paramedial zone
lobus anterior and posterior
3. cerebral (**neocerebellum**)
lateral zone lobus anterior and posterior

1. balance
2. tonus
3. coordination length estimation

Archi - paleo - neo - CEREBELLUM
fylogenetick a funkční dělení



GRAY MATTER

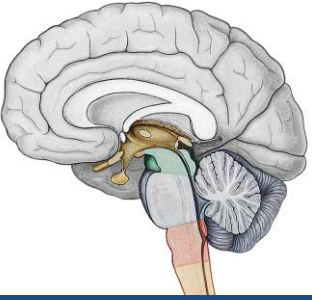
cortex cerebelli on the surface of hemispheria and vermis

nuclei cerebelli (ncl. fastigii, ncl. globosi, ncl. emboliformis, ncl. dentatus)

WHITE MATTER

arbor vitae (tree of life)

Diencephalon (hindbrain)



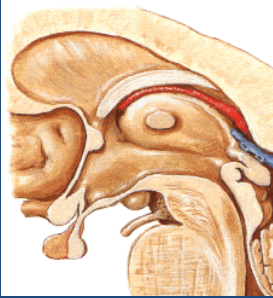
Thalamencephalon

- Thalamus
- Epithalamus
- Metathalamus

sulcus hypothalamicus („sulcus limitans“)

Hypothalamus a subthalamus

ROSTRAL SIDE OF DIENCEPHALON

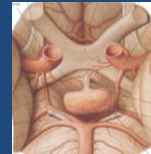
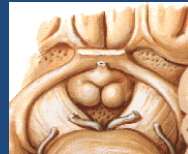


Lamina terminalis (between commissura anterior and chiasma opticum)

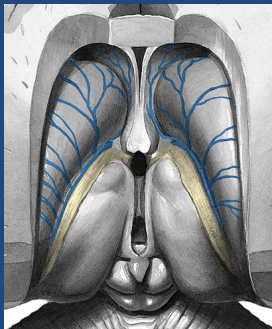
BASAL SIDE OF DIENCEPHALON



- Chiasma opticum
- Hypophysis cerebri
- Corpora mamillaria



DORSAL SIDE OF DIENCEPHALON



- Thalamus**
- Tuberculum thalami anterius
 - Pulvinar thalami
 - Stria terminalis (vena thalamostriata)
 - Taenia choroidea (tela choroidea ventriculi lateralis)
 - Stria medullaris thalami (tela choroidea ventriculi tertii)
- Epithalamus**

Epithalamus

- Corpus pineale (epiphysis)

CHANGING OF THE DAY AND NIGHT

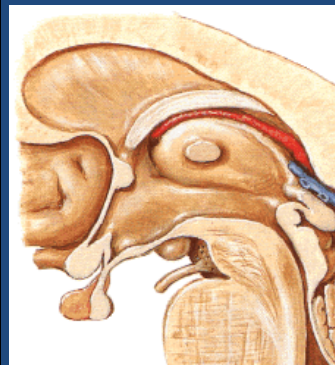


Metathalamus

- corpus geniculatum mediale (auditory tract)
- corpus geniculatum laterale (optic tract)

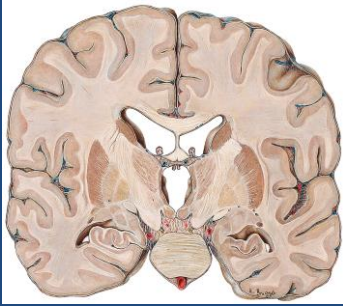


MEDIAL SIDE OF DIENCEPHALON



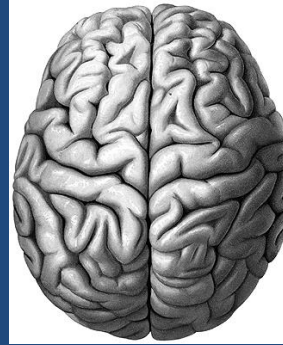
- lateral side of III. ventricle
- sulcus hypothalamicus (foramen interventriculare - aqueductus cerebri)
- adhesio interthalamica

LATERAL SIDE OF DIENCEPHALON



Connected with structures of telencephalon (capsula interna, nucleus caudatus)

TELENCEPHALON

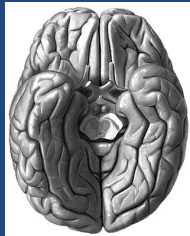


- Hemisphaeria cerebri
- Fissura longitudinalis cerebri
- Cortex cerebri
- Sulci cerebri
- Gyri cerebri
- Polus frontalis
- Polus occipitalis
- Polus temporalis

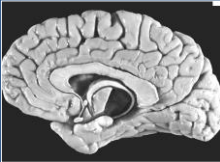
Hemisphaeria cerebri



facies superolateralis (convexa)



facies inferior



facies medialis

margo superior

margo inferior

margo medialis

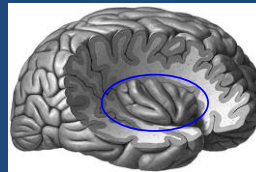
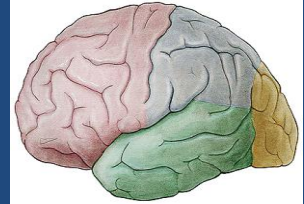
Lobes of telencephalon:

Sulcus lateralis
ramus ant., ascen., post.

Sulcus centralis

Sulcus parietooccipitalis

Incisura praeoccipitalis
(impresio petrosa)



Lobus frontalis

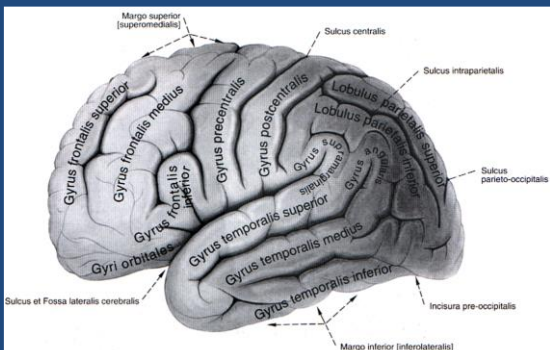
Lobus parietalis

Lobus occipitalis

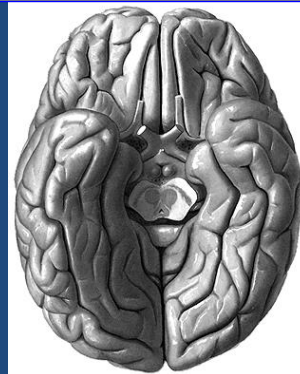
Lobus temporalis

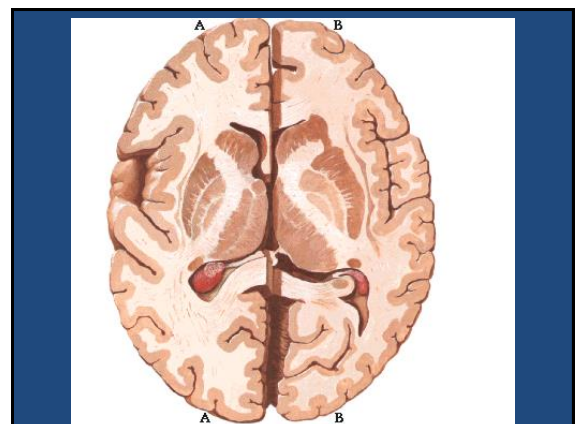
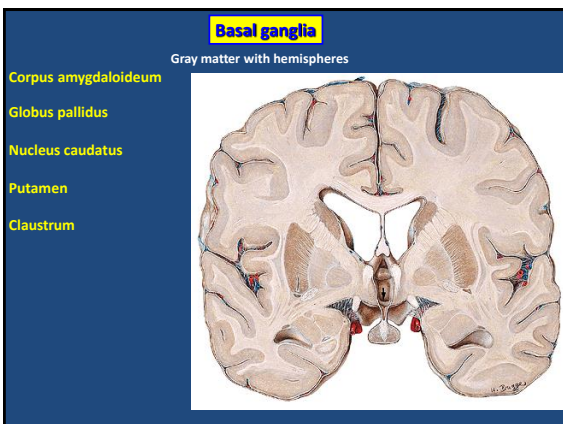
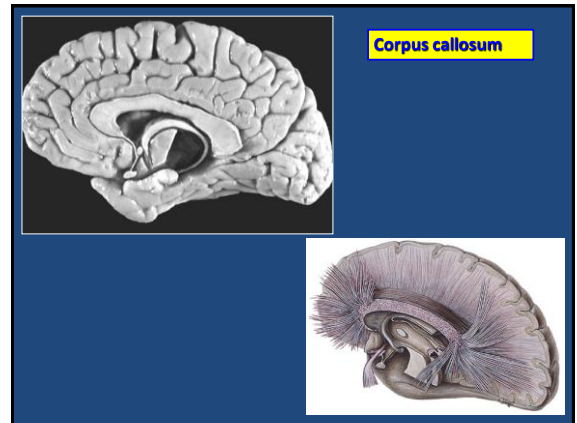
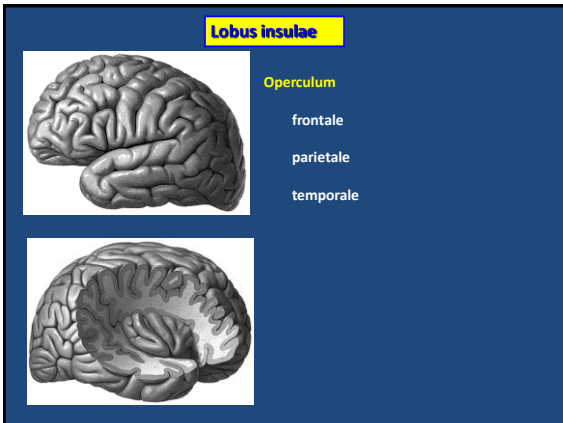
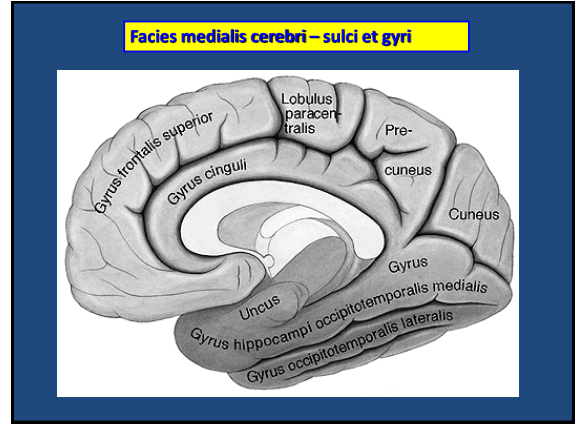
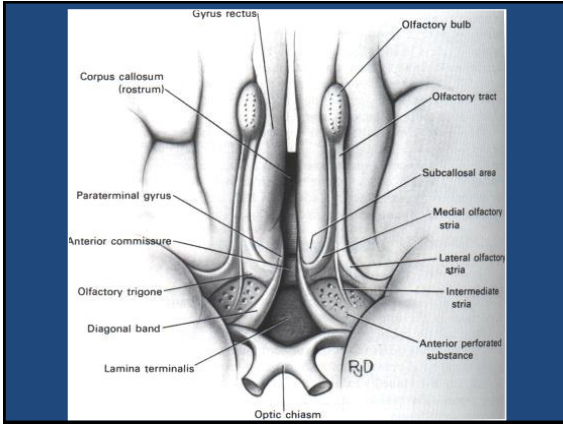
Lobus insulae

Facies superolateralis cerebri – gyruses

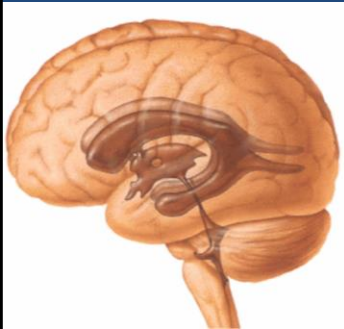


Facies inferior cerebri – sulci et gyri





Ventricles of the brain



- Ventriculi laterales**
- foramen interventriculare
- Ventriculus tertius**
- aqueductus mesencephali
- Ventriculus quartus**
- canalis centralis

THE FOURTH VENTRICLE

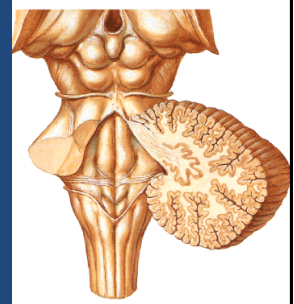
Between the brain stem and cerebellum

Fossa rhomboidea

- sulcus medianus
- sulci limitantes
- eminentia medialis
- pars superior, intermedia, inferior

Tegmen ventriculi quarti

- velum medullare superius
- fastigium
- velum medullare inferius



Pars superior

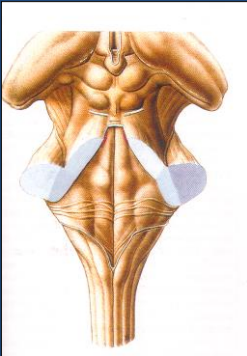
- fovea superior (n. V.)
- locus coeruleus

Pars intermedia

- stria medullaris, recessus lat.
- colliculus facialis (n. VI.)
- area vestibularis
- tuberculum acusticum

Pars inferior

- trigonum nervi hypoglossi
- trigonum nervi vagi (fovea inferior)



THE THIRD VENTRICLE

In the midline between both hemispheres

Lateral wall:

Thalamus

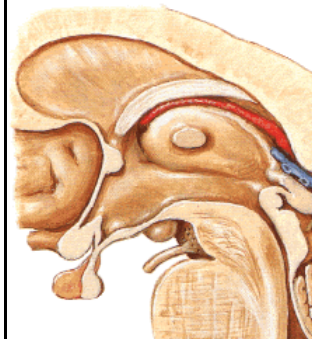
- adhesio interthalamica
- sulcus hypothalamicus
- foramen interventriculare

Hypothalamus

Basal wall:

Hypothalamus

- Recessus opticus
- Recessus infundibularis

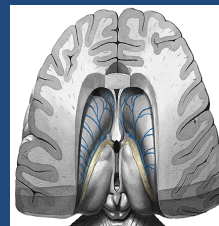
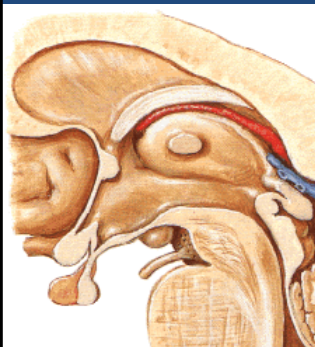


Anterior wall:

- lamina terminalis
- commisura ant.
- pars libera columnae fornicis

Posterior wall:

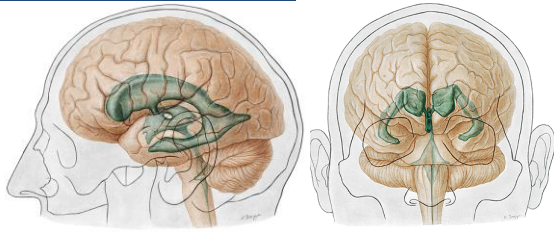
- recessus suprapinealis
- commisura habenularum
- recessus pinealis
- commisura posterior
- aqueductus cerebri



Roof:

- tela choroideae ventriculi III.** (stria medullaris thalami, trigonum habenulae, commissura habenularum)
- recessus suprapinealis

LATERAL VENTRICLE



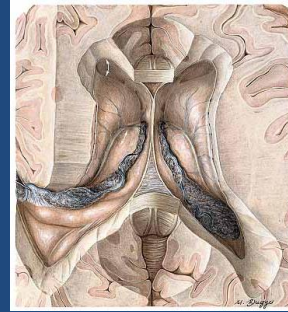
Cornu anterius (lobus frontalis), **pars centralis** (lobus parietalis),
cornu posterius (lobus occipitalis), **cornu inferius** (lobus temporalis)

Cornu anterius (frontal lobe):

- Septum pellucidum**
- Corpus callosum**
- Ncl. caudatus**

Pars centralis:

- Corpus callosum**
- Ncl. caudatus**
- Stria terminalis**



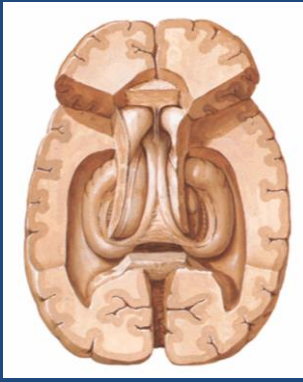
VENTRICULUS LATERALIS

Cornu posterius (occipital lobe):

- Corpus callosum**
- Trigonum collaterale**
- Calcar avis**

Cornu inferius (temporal lobe):

- Corpus callosum**
- Ncl. caudatus**
- Stria terminalis**
(tela choroidea ventriculi lat.)
- Fimbria hippocampi**
- Hippocampus** (pes hippoc.)
- Eminentia collateralis**



MENINGES



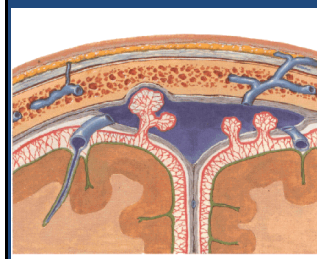
- Spatium epidurale** (spinal cord !)
- Dura mater**
(encephali, spinalis)
- Spatium subdurale**
- Arachnoidea**
- Spatium subachnoidale**
(liquor cerebrospinalis)
- Pia mater**

DURA MATER ENCEPHALI



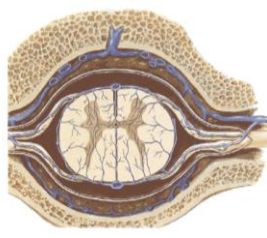
- Falx cerebri**
(fissura longit. cerebri)
- Falx cerebelli**
(incisura cerebelli post.)
- Tentorium cerebelli**
(fissura transv. cerebri)
incisura tentorii
- Diaphragma sellae**
- Cavum trigeminale**
- Vagina nervi optici**
- Sinus durae matris**

LEPTOMENINX ENCEPHALI



- Arachnoidea**
- Granulationes arachnoidales**
- Spatium subarachnoidale**
- Liquor cerebrospinalis**
- Cisternae subarachnoidales**
- Pia mater encephali**
- Tela choroidea ventriculorum**
- Plexus choroidei**
(liquor cerebrospinalis)

MENINGES – MEDULLA SPINALIS



Endorhachis

Spatium epidurale
(plexus venosi vertebrales int.)

Saccus durae matris
(S₂₋₃; filum durae matris)

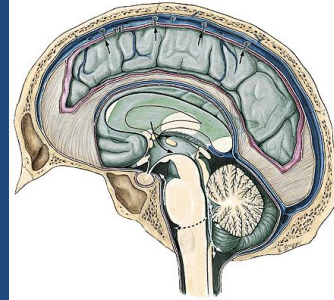
Arachnoidea spinalis (S₂)

Pia mater spinalis
(ligamentum denticulatum)

Spatium subarachnoideale
(cisterna lumbalis – cauda equina)

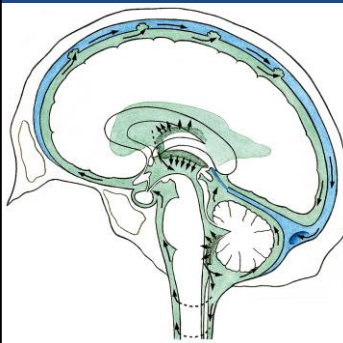
Cisternae subarachnoideales

cerebellomedullaris, fossae lateralis cerebri, interpeduncularis, chiasmatis, ambiens, lumbalis



LIQUOR CEREBROSPINALIS

80-150 ml (500-800 per day)



Plexus choroideus ventriculi lateralis
(ventriculi III., IV.)

foramen interventriculare
(ventriculus III.)

aqueductus cerebri
(ventriculus IV.)

canalis centralis
(medulla spinalis)

apertura mediana, later. ventriculi IV.
(spatium subarachnoideale)

sinus sagittalis superior
vv. radicales

ARTERIES OF THE BRAIN

Arteria carotis interna

Arteria ophthalmica

Arteria choroidea ant.

Arteria comunicans posterior
(circulus arteriosus cerebri)

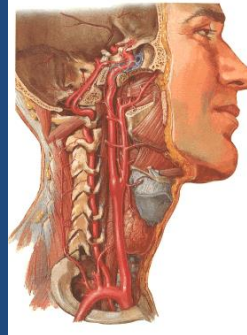
Arteria cerebri media
(circulus arteriosus cerebri)

Arteria cerebri anterior
(circulus arteriosus cerebri)

Arteria vertebralis

r. spinalis

a. basilaris



CIRCULUS ARTERIOSUS CEREBRI

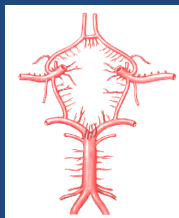
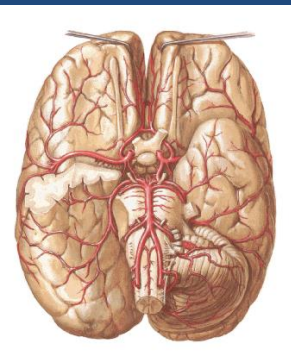
Arteriae cerebri anteriores

Arteria comunicans anterior

Arteriae cerebri mediae

Arteria comunicans posterior

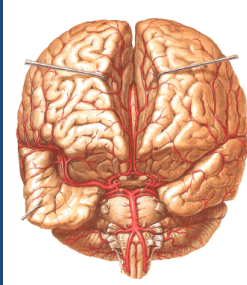
Arteriae cerebri posteriores



Arteria cerebri anterior

Arteria cerebri media

Arteria cerebri posterior



ARTERIES OF THE SPINAL CORD

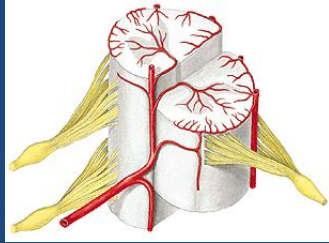
rr. spinales (branches of the adjacent arteries)

aa. radicales ant.

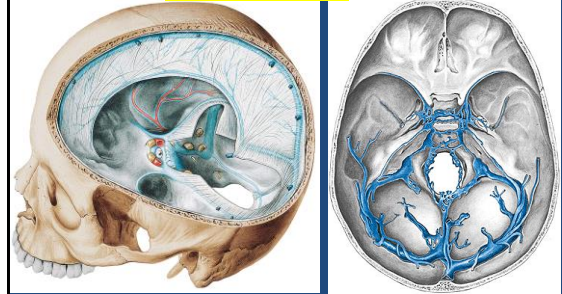
aa. radicales post.

a. spinalis ant.
(fissura mediana ant.)

2 aa. spinales post.
(sulcus medianus post.)

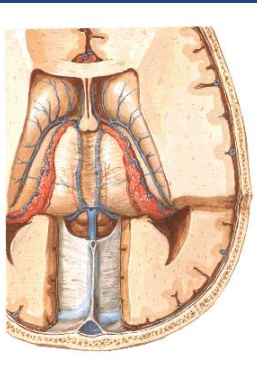


SINUS DURAE MATRIS

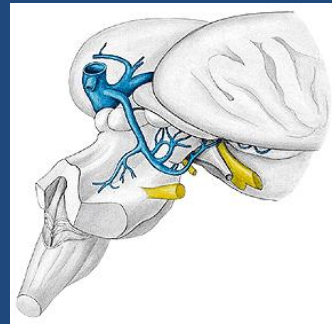


- Sinus sagittalis sup., inf.
- Sinus rectus
- Sinus cavernosus (sinus intercavernosi)
- Sinus sphenoparietalis
- Sinus sigmoideus
- Sinus transversus
- Sinus petrosus sup., inf.
- Plexus basilaris

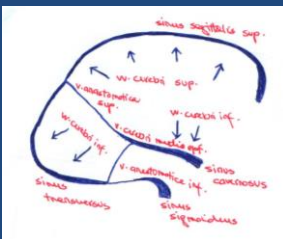
DEEP VEINS OF THE BRAIN



- Vena septi pellucidi +
- Vena choroidea +
- Vena thalamostriata
- ↓
- Vena cerebri interna
- ↓
- Vena cerebri magna
- ↓
- Sinus rectus



SUPERFICIAL VEINS OF THE BRAIN



- Vv. cerebri superiores (sinus sagittalis superior)
- V. cerebri media superficialis (sinus sphenoparietalis nebo sinus cavernosus)
- Vena anastomatica sup.
- Vena anastomatica inf.
- V. cerebri media profunda (vena basalis)
- Vv. cerebri inferiores (sinus transversus)
- Vv. cerebri inferiores form vena basilaris (v. cerebri magna)

VENOUS PLEXUS OF THE SPINAL CANAL

