

Gross Anatomy of the Nervous System (Brain & Spinal Cord), Skull &

Khalleedd 

Meninges

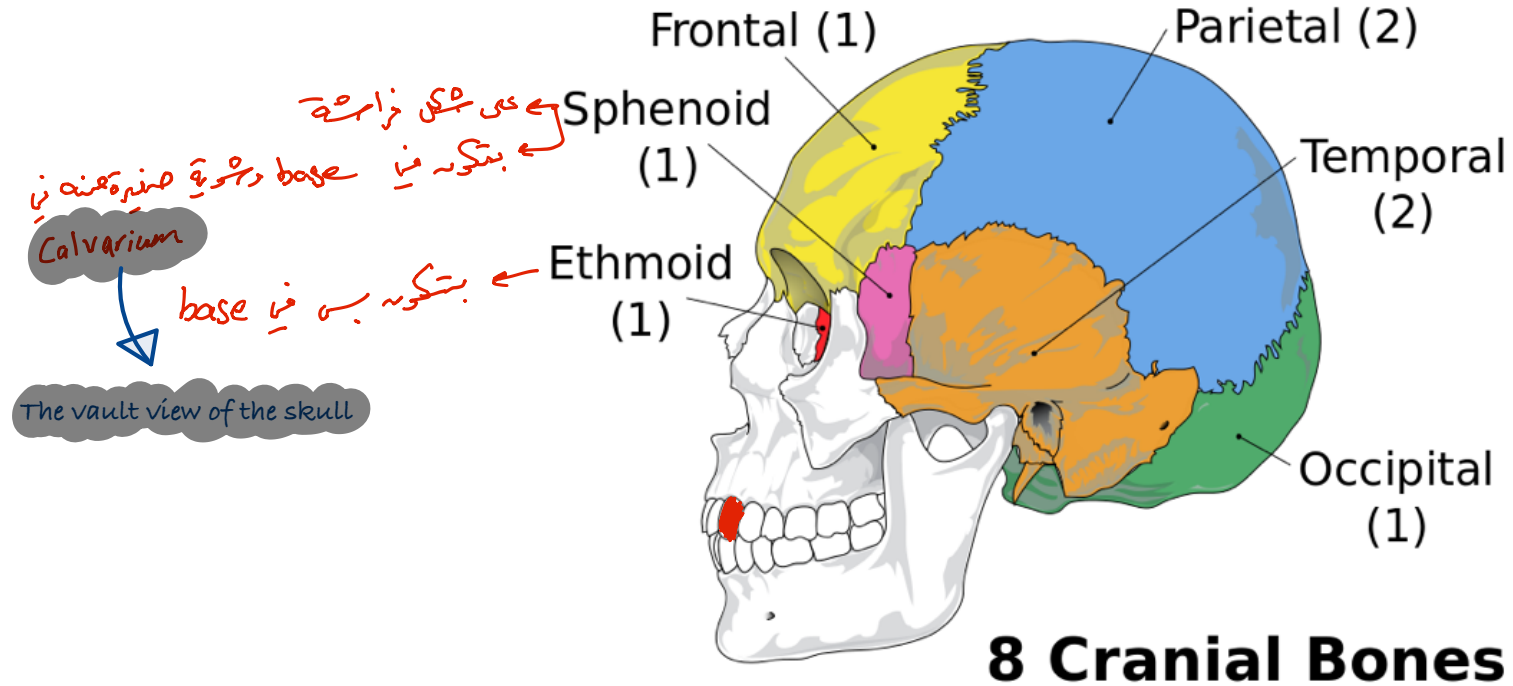
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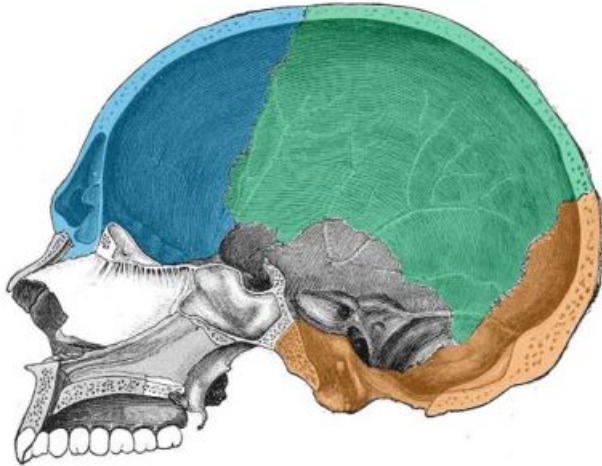
Skull



Skull

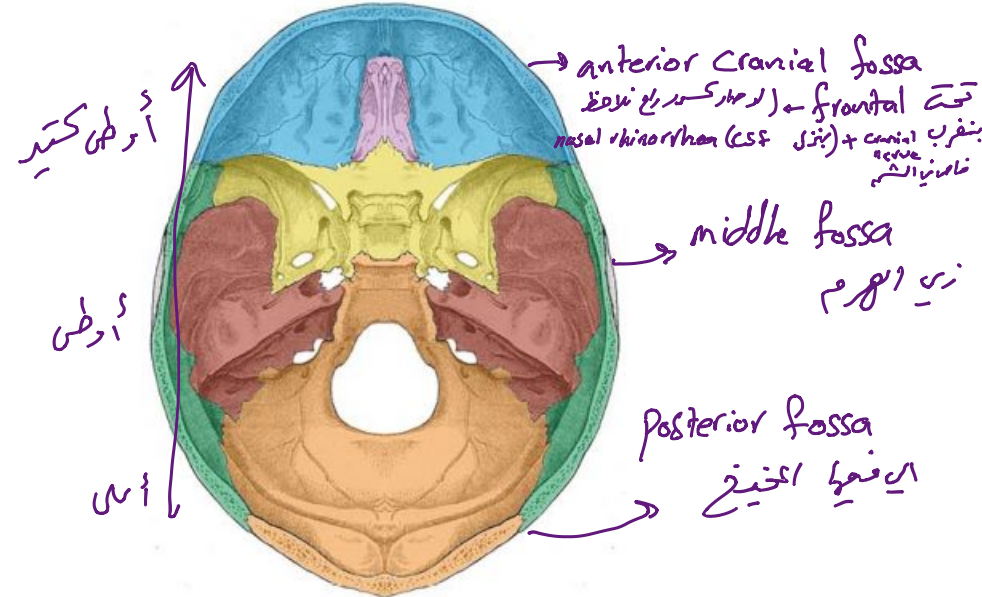
القبة (العقيرة الخارجية)

① The Calvarium (Vault)



② The skull base

تقسيم ٢١ حيزات



① Frontal bone

- Unpaired bone

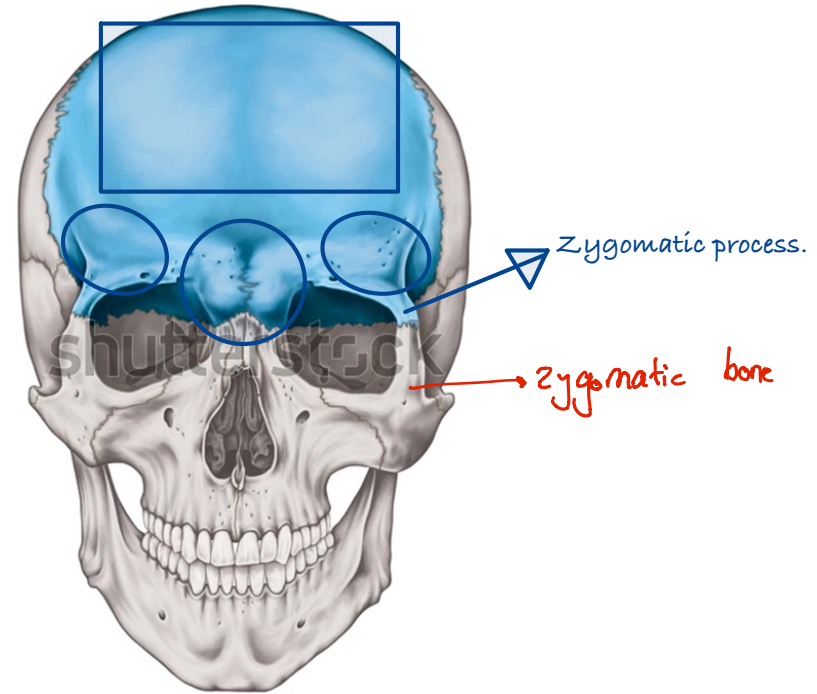
② Parts:

- Squamous part زبي القشرة
- Nasal part
- 2 orbital plates سقف حجرة العين
- 2 zygomatic processes

- Contains 2 frontal air sinuses

Rt & Lt above each eye

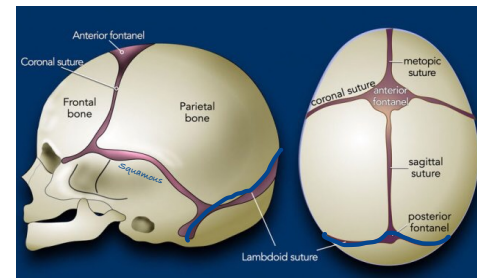
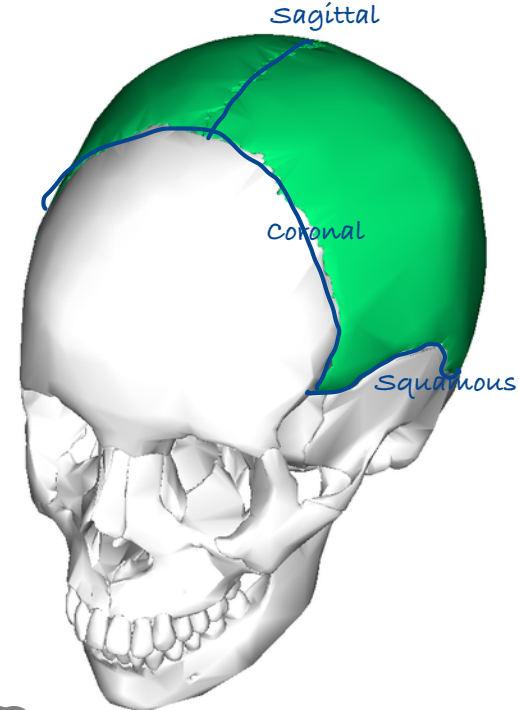
* sinusitis بصير نفيح، التهاب الجيوب
* meningitis دلائكوت هاي العظية بصير عينا



Its clinical importance is that if fractured with dual tear (شخ في غشاء الدماغ) by trauma or surgery it will leak the CSF from nasal cavity and that's called nasal rhinorrhea and its complication may cause meningitis

② Parietal bones

- Paired
- Connects with each other in the midline (sagittal suture)
- Both connects anteriorly with frontal bone (coronal suture)
- Both connects posteriorly with occipital bone (lambdoid suture)
- Each connects down with temporal (squamous suture) & sphenoid bones.



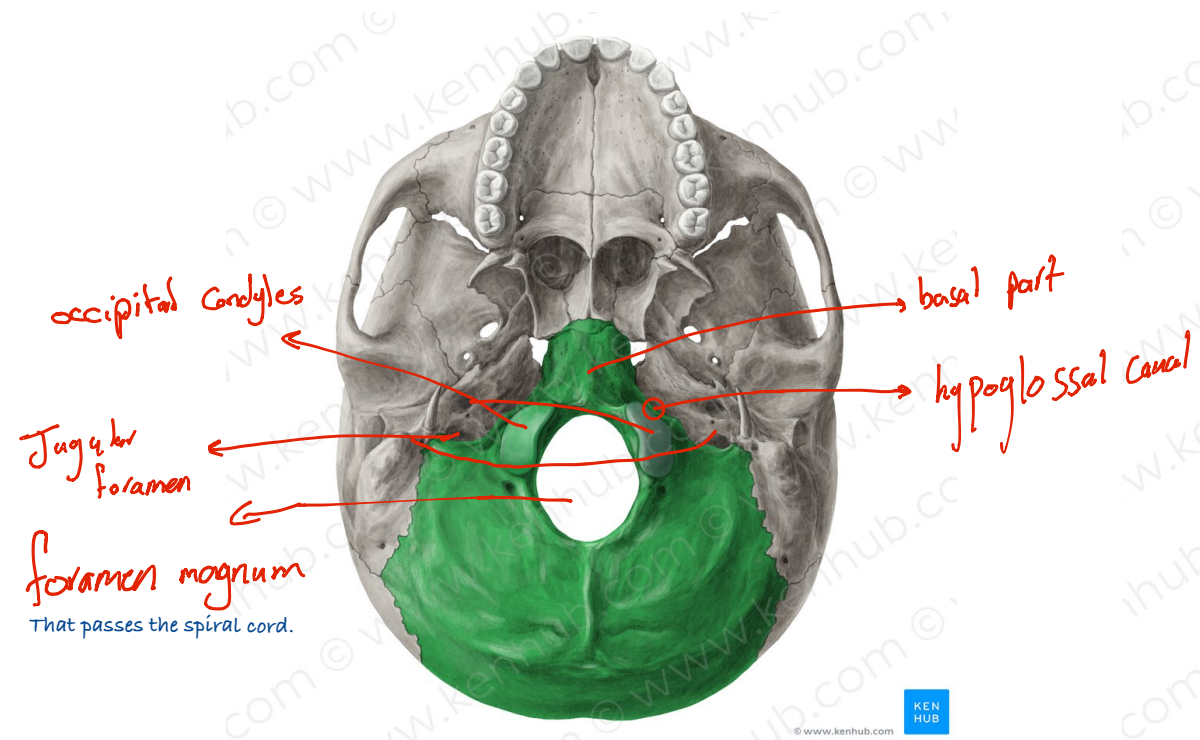
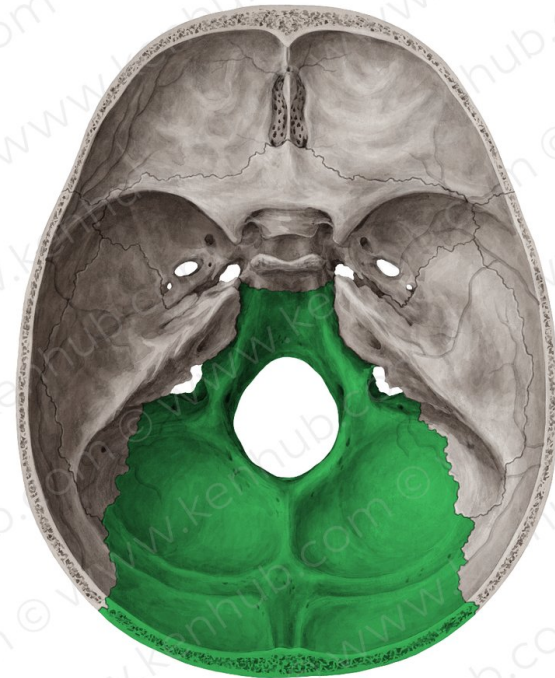
لو حدوث الدزات حدث الغم التنام مبكر جيعمل مشكلة بسلك الجمجمة ويسمى *Craniosynostosis*

5 تمنع النمو ف تعطي نمو موازي للدزاة الي التأثت Prevent the growth

لو مبكر سبل منته *Craniosynostosis*

هذه الدزات
بتكره مفتوحة
في الحظا
١٠ مفاصل عند الولادة
٢٠ تقفر الاربعة
٣٠ دبتلم سد السهم
٤٠ سنتيه مشد ينمر
٥٠ دماغ الطفل
٦٠ دبتلم سد
٧٠ ٩٥% سد جبر دماغ الطفل

③ Occipital bone



Occipital bone

- Unpaired

- ① Squamous part

- ② Basilar part

- Occipital condyles

- * Foramen magnum (sp. Cord, VAs, ant. & post. sp. art., XI n., meninges)

- * Jugular foramen (Int. jugular V., IX, X, XI nerves)

- Hypoglossal canal (XII n.)

Make the joint called Atlanta occipital joint

atlans (C1) بقعر الرأس

① Go out

② Go in

③

vertebral arteries

↓

↓

spinal arteries

9

10

11

12

main venous return from hollow the brain

Go out of the foramen

1 ant. Supplies 2/3

2 post. Supplies 1/3

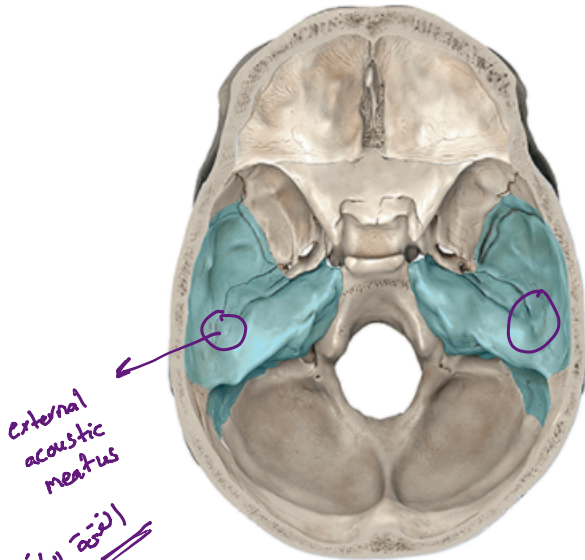
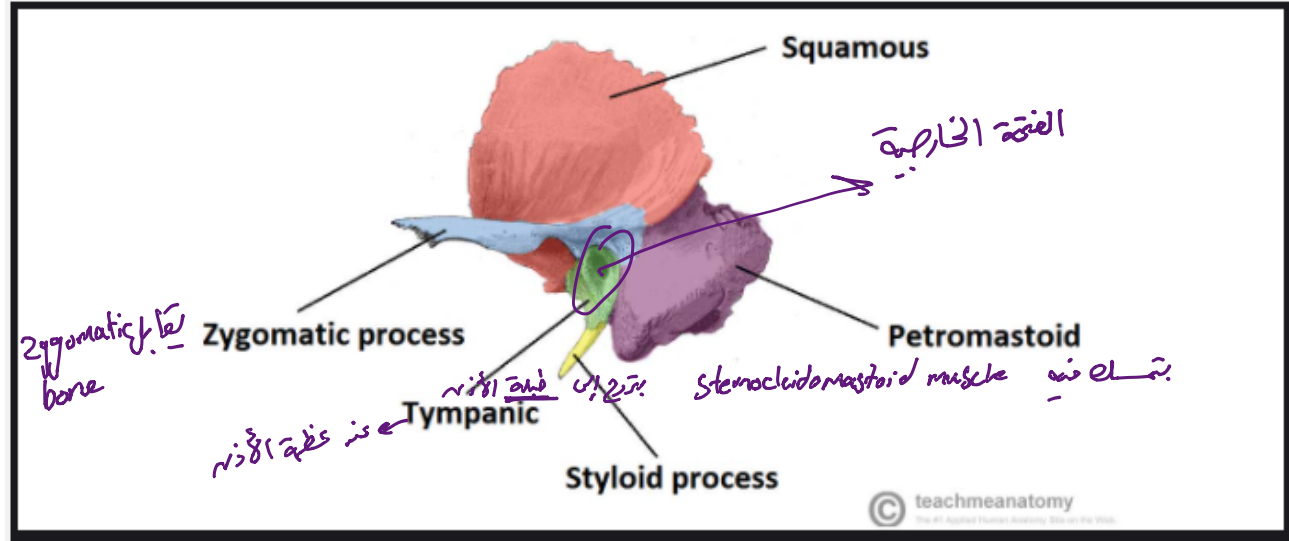
④ Go out

spine ~ سجز

* paired
*

④ Temporal bone

لو انكسرت راجع يغير عندي otorhea



بقلة عظمة حبة ادرها كمنك (iii)

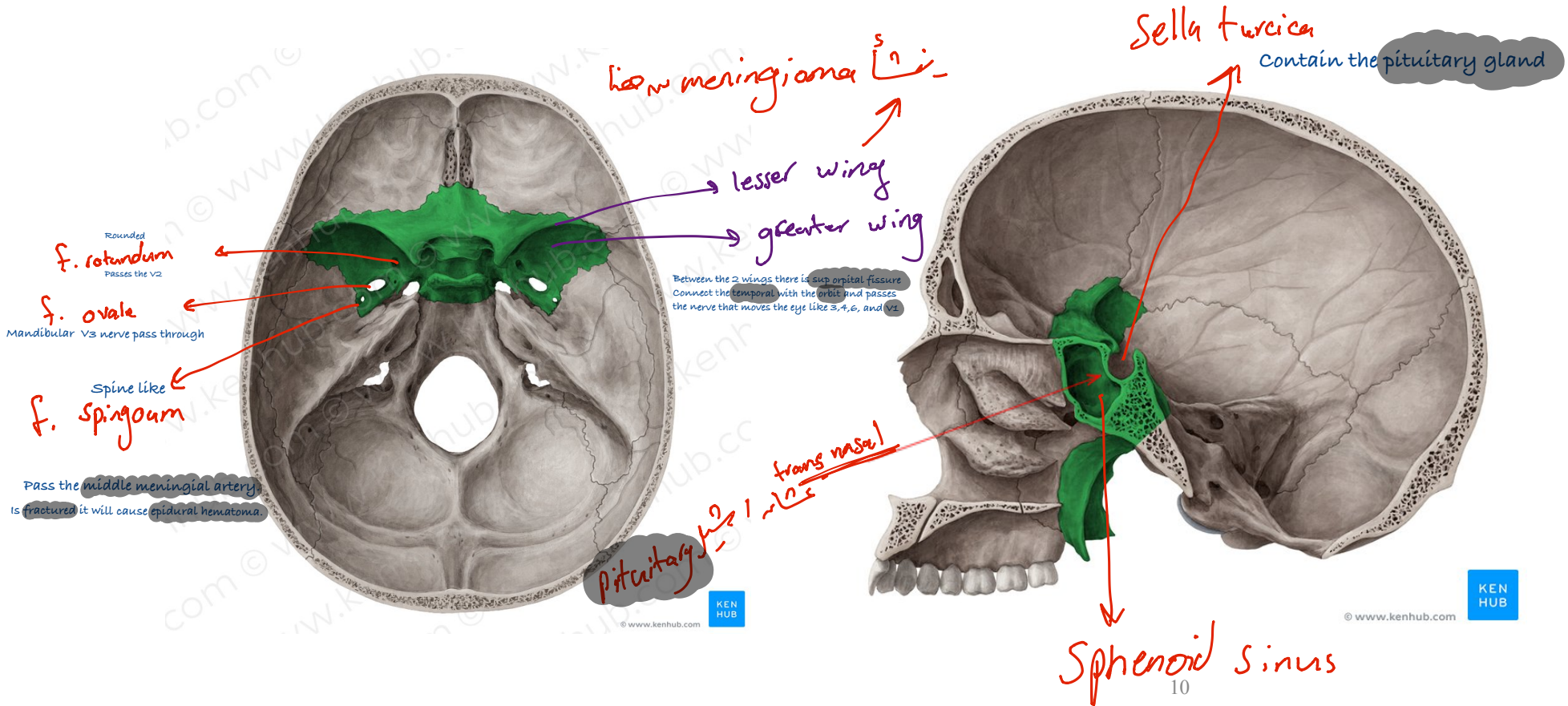
Temporal bone

بعض من العصب السمع والثاني
والعصب السابع معاً

- * External acoustic opening/ meatus
- * Internal acoustic meatus (VII, VIII n., labyrinthine art.)
 - Carotid canal (ICA) *internal carotid artery*
 - Foramen lacerum
 - Stylomastoid foramen (VII n.)
 - Skull fracturs → Otorrhea, VII n. palsy

↓
facial nerve palsy

⑤ Sphenoid bone



Sphenoid bone

- Sella turcica (Pituitary gland)
- Sphenoid sinus
- Optic canal (II n.)
- Superior orbital fissure (between greater & lesser wings, connects middle fossa & orbit. Transmits III, IV, V-1, VI n)
- * Foramen rotundum (V-2) *الغضبي الثاني من الاصب الخامس*
- * Foramen ovale (V-3) *الغضبي الثالث من الاصب الخامس*
- * Foramen spinosum (Middle meningeal artery)

*أعبر رافعي داء لانه
بموت*

له. بتسبب epidural hematoma - بتدوت

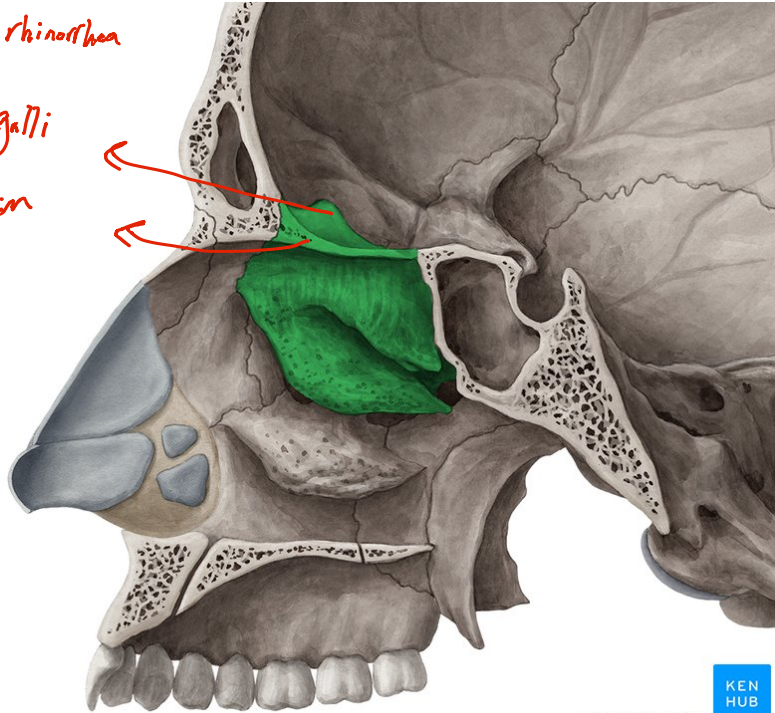
⑥ Ethmoid bone

رقيقته دلو انكرت رايه تعجل *Sausaphica meningitis*

nasal rhinorrhea

crista galli

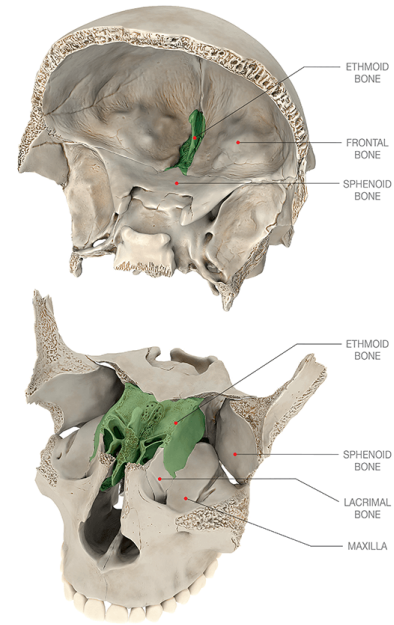
Ciribiform plate



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ETHMOID BONE



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Ethmoid bone

موجودة في مركز قاع الجمجمة

- Unpaired bone, located in the midline of the anterior cranium base
- Separates the anterior cranial fossa & the nasal cavity
- Forms the medial orbital walls ← جناحها اليسرى واليمين ←
- Cribriform plate (CN I). Fracture → Rhinorrhea, Anosmia
CSF leaks Loss of smell sensation
- Crista galli (attachment point for the falx cerebri) ← From anterior

منقبة عظم
يطلع منها
Olfactory nerve

تثبت فيها
يفصل بين الدماغ اليسرى واليمين

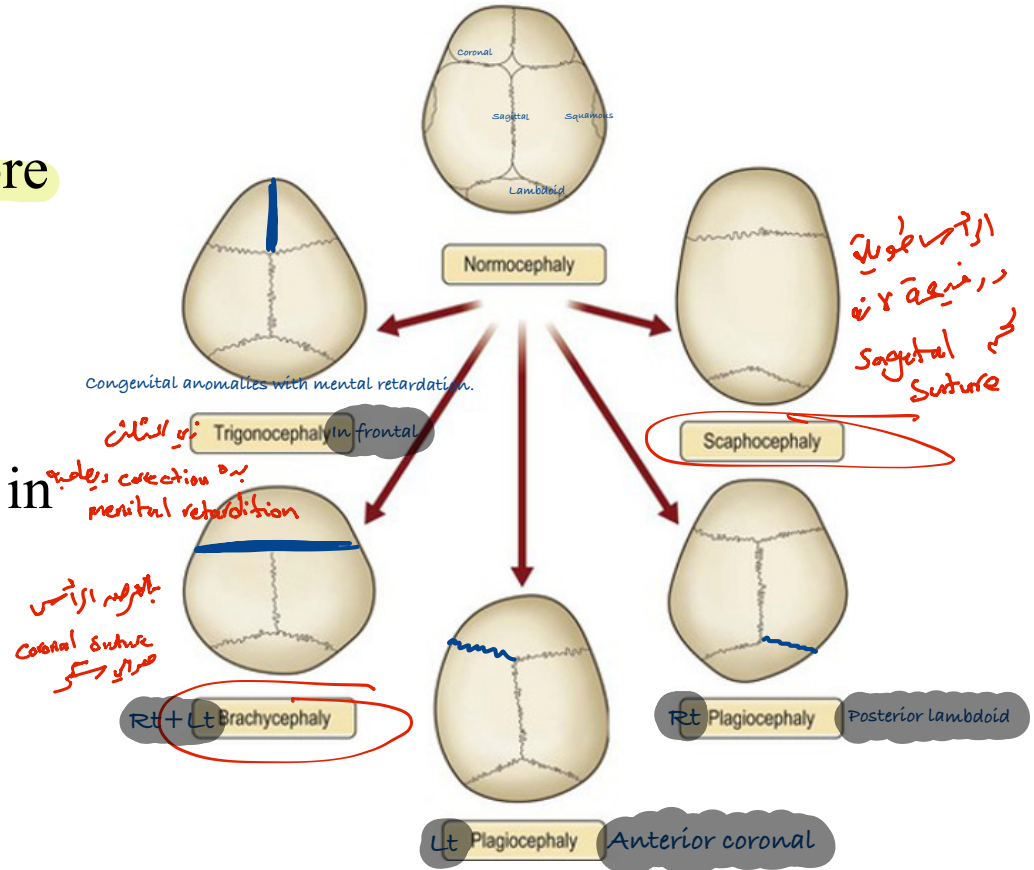
In some cases it may be congenitally absent and may cause spontaneous rhinorrhea and need surgery to heal

It is cribriform to pass the olfactory fibers and it may be the origin of olfactory group meningioma

Clinical scenarios

Craniosynostosis

- Premature closure of one or more cranial sutures in newborns
- Irregular head shape
- Sometimes high ICP
- Surgical correction is indicated in certain cases



Skull fractures

- The fracture itself is usually of little consequence
- More important: brain injury and secondary complications

Associated complications like epidural or subdural hematomas

نزيء مشرفه د بلغم لحاله لا يحتاج لجس ولا جت
باجر اذا صار جرح لعمق associated معه
* مع ثلث middle meningeal artery

• Classification:

* Closed (simple) or open (compound) According to skin if it is intact or not.

→ risk of infection

High risk

At the same level.

* Linear (fissure) or depressed

Need elevation surgery

→ If significant depression more than 1cm
Or more than full thickness of a bone

* Vault or base fractures

القبة

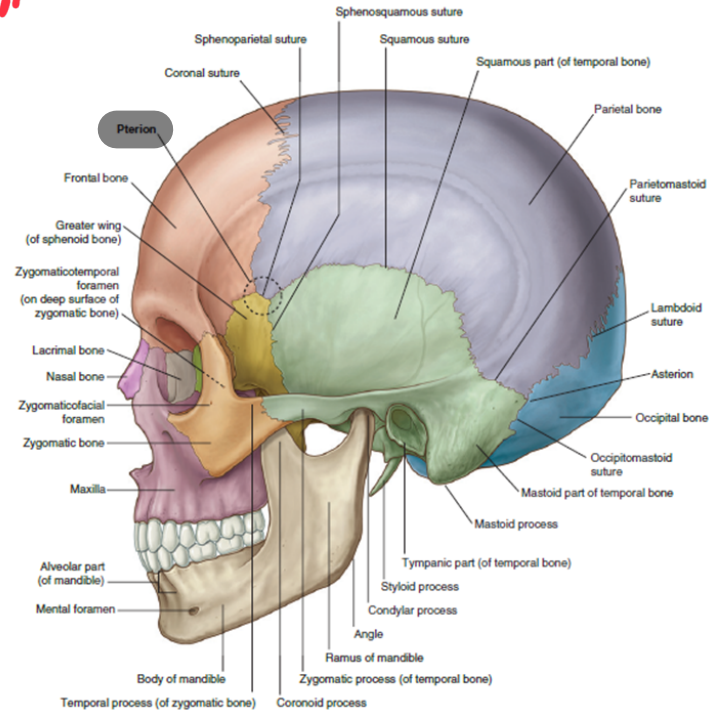
سكتيكي meningitis
nerve injury

With CSF leak and increased risk of meningitis
Or injury to the cranial nerves → ant means olfactory
→ post means 7th and 8th

Pterion

A connection point between 4 cranial bones
temporal parietal frontal sphenoid

- Skull fracture → Injury to anterior branch of middle meningeal artery → EDH *epidural hematoma*
Cause epidural hematoma.
- Pterional craniotomy (Common access to several intracranial pathologies)



Meninges

- Surround the brain & the spinal cord
- 3 layers

- The dura: tough, outer layer *Thickest and strongest.*

- The arachnoid: a delicate avascular, middle layer *very thin*

- The pia: an inner layer *ملتصقة بالبنية* firmly attached to the surface of the brain

- The cranial dura consists of two layers: periosteal & meningeal

- The spinal dural: one layer only (meningeal)

under arachnoid there is a space called subarachnoid contain vessels that supplies the brain it may injured by a trauma or aneurysmal ruptured then cuz subarachnoid hemorrhage

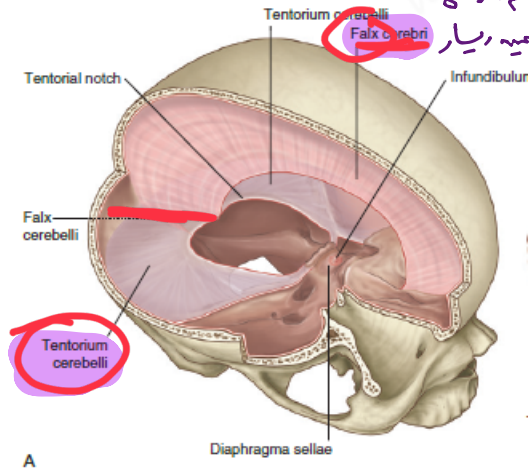
Outer

Inner

The Cranial Dura

بقية
intercranial cavity
الاقسام

Dural partitions



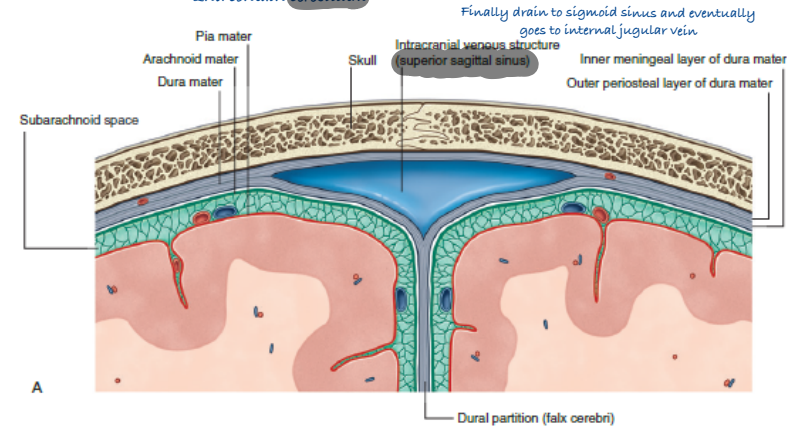
3 examples
Falx cerebri
Falx cerebelli
Tentorium cerebelli

Rt and Lt hemisphere
Anterior attached to crista galli and
posterior attached to tentorium

It divided the skull horizontally to supratentorial and
infratentorial spaces
1st contain cerebrum
2nd contain cerebellum

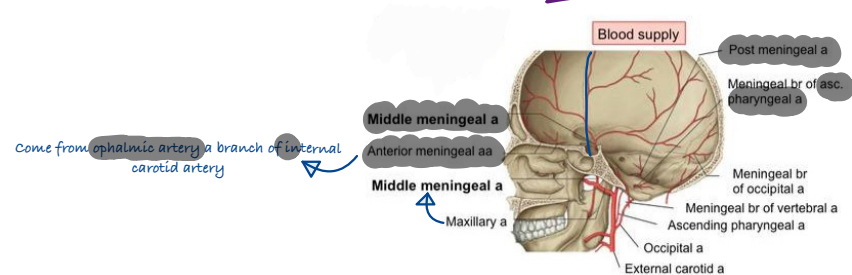
Venous sinuses

Between the outer (periosteal) and inner (meningeal) layers of dura



Blood supply of the cranial dura mainly external carotid and less amount take from internal carotid.

- Anterior cranial fossa: anterior meningeal arteries from ophthalmic artery from ICA
- The middle cranial fossa: middle meningeal arteries from maxillary artery from ECA
- The posterior cranial fossa: posterior meningeal artery from ascending pharyngeal artery from ECA



Clinical scenarios

- Extradural (Epidural hematoma) *Has relation to supply* *بـ الدم و dura*
- Subdural hematoma *تحت dura وغشاء arachnoid*
- Subarachnoid hemorrhage (traumatic or aneurysmal)
- CSF leak (posttraumatic, spontaneous, iatrogenic)
- Meningitis (infection of the leptomeninges)
- Meningioma (extra-axial tumor, originate from arachnoid cap cells)

يتسبب في نزف الأوعية major vessels

Olfactory group meningioma originate from cribriform plate

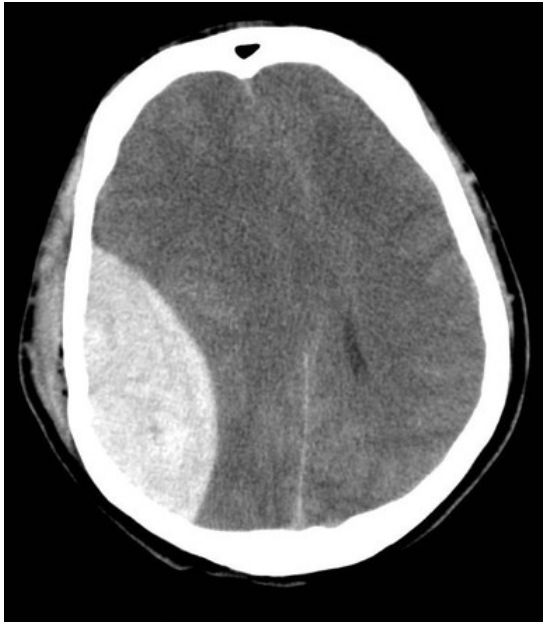
ابنها على CT
اسود القزاني

Extradural & Subdural hematoma

Dura attached to the skull from sutures so if there is bleeding it will cause dissection in the areas that has no attachment, and at the area that attached it will stop.

Extradural

قشري



Convex lenti-form shape

Here the bleeding take the bone shape (crescentlike)

Subdural

قشرية القزاني



في حالات معينة ما يتغير نمطها ونصنفها الى نوع في نسميها وقتها extraaxial يعني خارج الدماغ
وهو الـ 2 ناجية بالاساس له

Subarachnoid hemorrhage

The rupture of major vessels at the base of skull circle of Willis

Spontaneous (aneurysmal)



Cortical sulci filled with blood

Traumatic

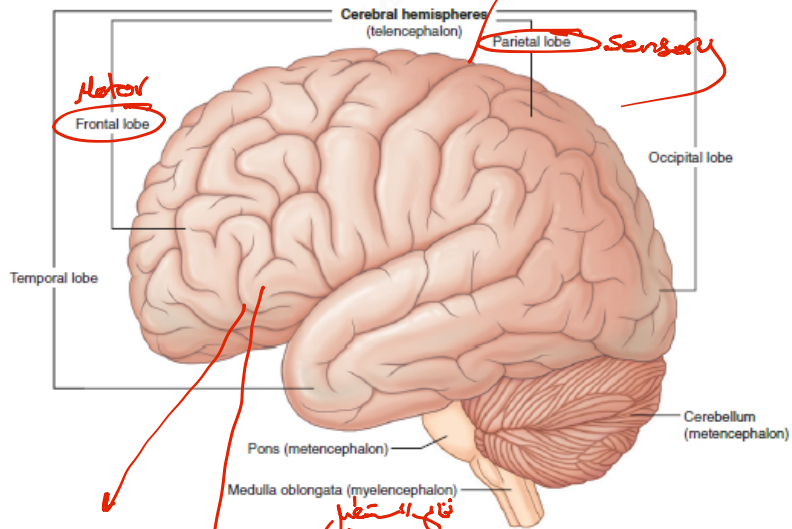


Most common subarachnoid hemorrhage is traumatic while most common non traumatic or spontaneous is aneurysmal.

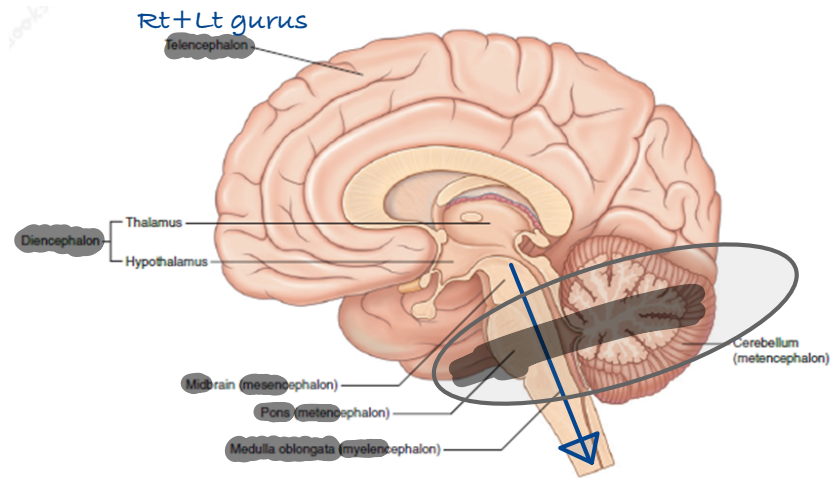
Brain

- Telencephalon (cerebrum) Rt+Lt hemispheres
- Diencephalon (thalamus, hypothalamus) Thalamus related structures
- Mesencephalon (midbrain)
- Metencephalon (Pons & Cerebellum)
- Myelencephalon (medulla oblongata)

Brain



Lateral view



Mid sagittal view

There is overlap between the bones and the lobes under it

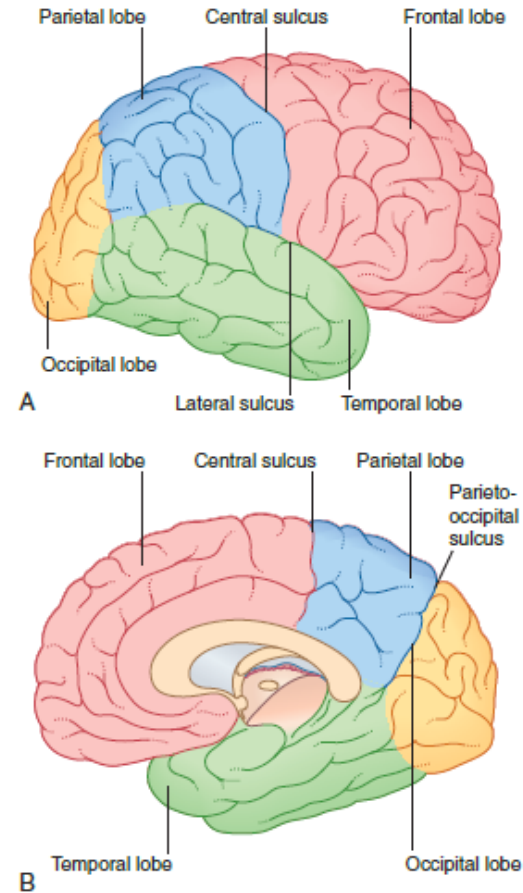
Cerebrum

telenecphelon

- 2 hemispheres

- 4 lobes in each hemisphere

- Frontal
- Parietal
- Temporal
- Occipital



Frontal lobe

Motor function

- Contralateral weakness
- Motor **Broca's** dysphasia (in dominant side damage)
- Behavior changes
- Gaze paralysis to contralateral side

حركة العينين مع بعض

Conjugate movement.

area 8 في Rb side يتحكم في العينين على Lt
Rb " " " " Lt side " " = Lt

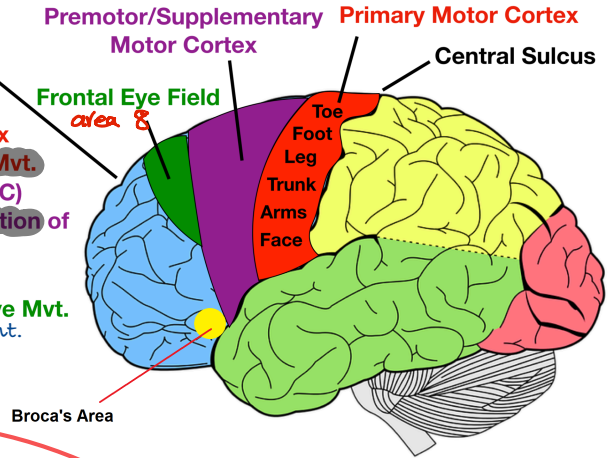
Frontal eye field.

2ndry werniks area

Frontal

Functional Areas

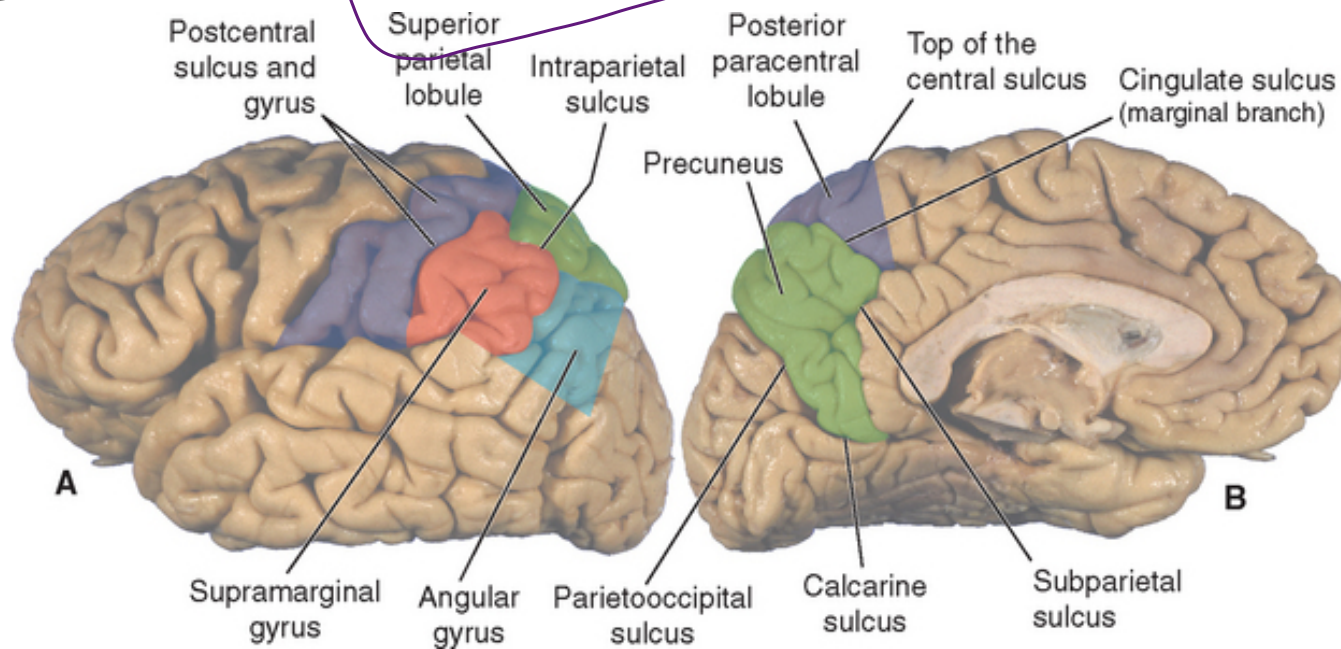
- Primary Motor Cortex
- Voluntary Muscle Mvt.
- Premotor/S.M.C (MAC)
- Planning/Coordination of Movement
- Frontal Eye Field
- Voluntary Rapid Eye Mvt. Conjugate movement.



Eyes looking to the lesion if destructive lesions it will cause seizures and the lesion will be contralateral to the eyes movement.

Parietal lobe

- Sensory cortex in the postcentral gyrus

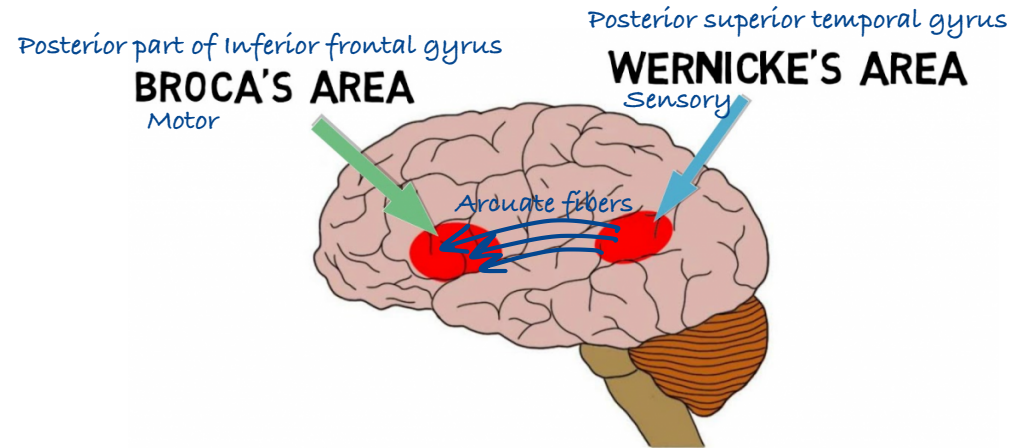


Temporal lobe

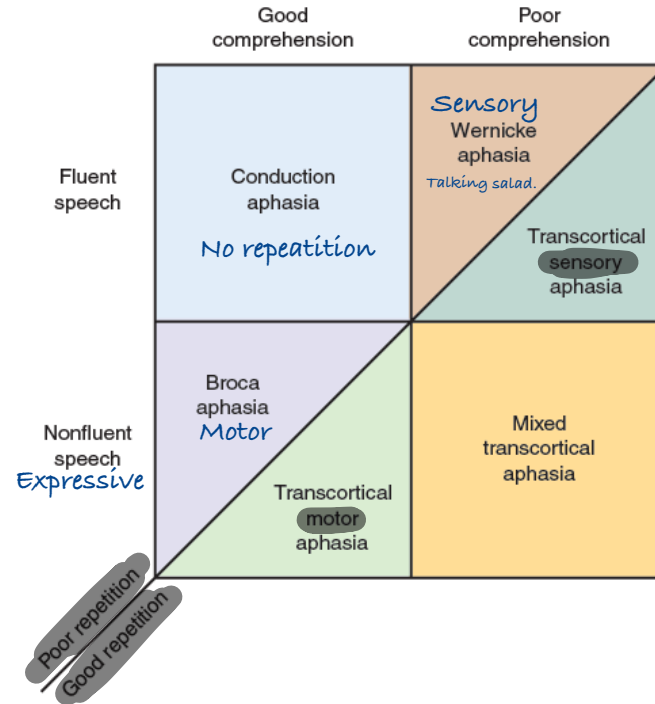
✂ Sensory dysphasia (Wernicke's)

✂ Auditory cortex

✂ Olfactory cortex



The Aphasia square



2 parts in between them there is **calcarine sulcus**
upon above it **cuneus** and below **lingual gyrus**

Occipital lobe

vision is in the medial aspect of occipital

- **Visual cortex**, controlling **contralateral visual field**

(contralateral hemianopia)

- **Cuneus**: **lower quadrant**

(contralateral lower quadrantanopia)

- **Lingual**: **upper quadrant**

(contralateral upper quadrantanopia)

Contralateral means:

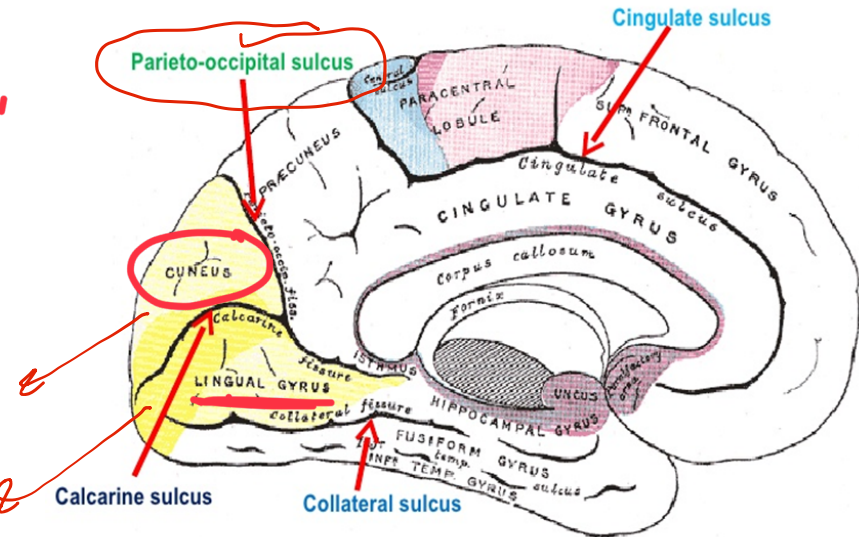
Rt hemisphere to Lt eye

Cuneus → lower quadrant.

Lingual → upper quadrant.

عموماً منطقة القذبيع والرؤية يتشغل بشكل عكسي دائماً اليمين يأتى عالى اليسار
والى فوق يأتى على الي تحت والدنيا ما تشبه عندهم بالعكس
الكلام مش عى الشبكة طبعاً

Sulcus in the medial surface



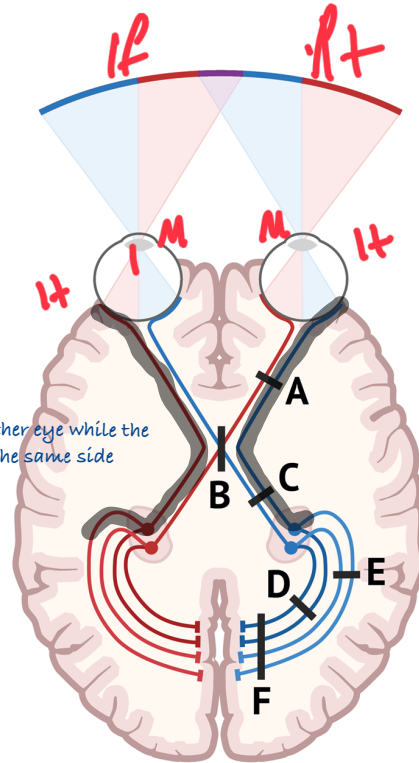
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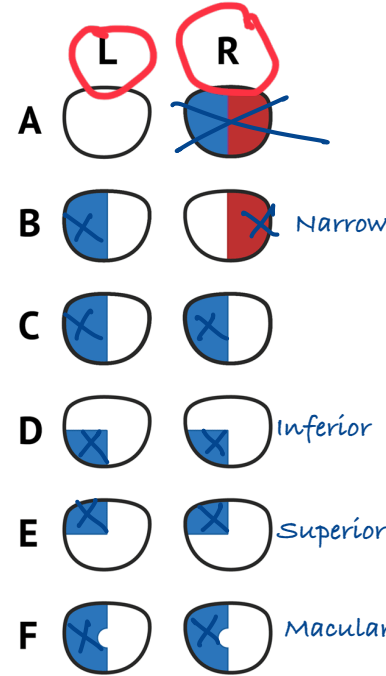
Visual pathway field defects

لازم از کوف
فوق

The inner fibers cross to other eye while the outer fibers is still at the same side



A Optic nerve
B optic chiasm
C optic tract
D Cuneus
E lingual



Narrow vision

Bitemporal hemianopia it affect the medial fibers that goes to retina and no lateral visual field

Inferior

Superior

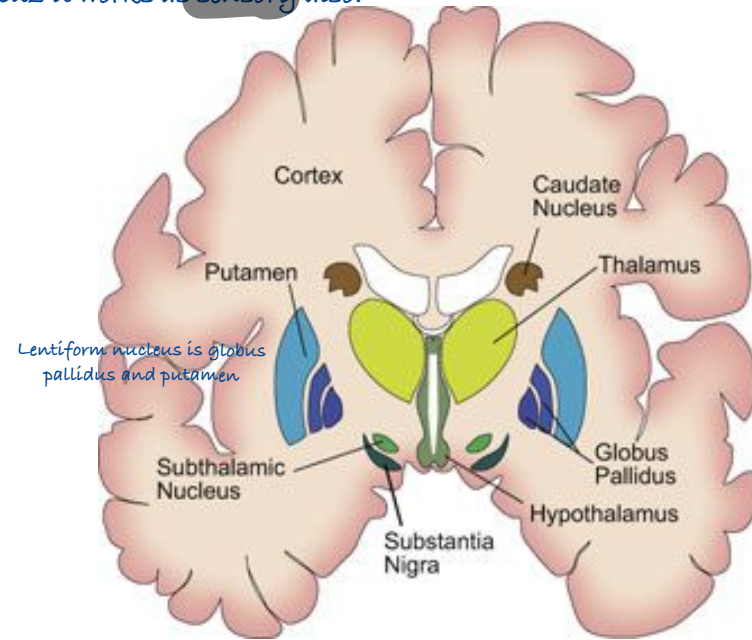
Macular sparing cuz it has dual blood supply

الرسمه هاه معموله على حالة انه المسئلة غالباً بتحل بسبب ischemia مش تدمر الـ F
تماماً لانه لو تدمر تماماً ف ختصير الصورة نفس الـ C لانه هاه معناها انو بسبب ischemia

Brain Basal Ganglia

- A group of subcortical nuclei responsible primarily for motor control *neurons عصبونات*
- Caudate nucleus, putamen, and globus pallidus in the cerebrum
- Subthalamic nucleus in the diencephalon
- Substantia nigra in the midbrain

The thalamus has additional function cuz it works as sensory also.



Each lobe has a cavity that is connected together and production and circulation of CSF done there And eventually goes to subarachnoid space to absorb CSF there

تكوين الدماغ فيه جدران جوالها مثل دماغنا

Ventricular System

There is some tumors like choleoid cyst (benign) may arise in **Monro** at ant. sup. part of the third ventricle and may close the way to third ventricle and cause **hydrocephalus** and the worst if it closed the both ways from the lateral ventricle in this case we should either **excision** the tumor or do 2 shunts one for each

- 2 lateral ventricles **C shape**
 - Interventricular foramina (of **Monro**) 2 foremen's to each lateral ventricle
- 3rd ventricle **square like shape**
 - Cerebral aqueduct (aqueduct of **Sylvius**)
- 4th ventricle
 - Central canal of the **spinal cord**
 - 3 foramina in its roof, with the subarachnoid space (2 **Luschka**, 1 **Magendie**)

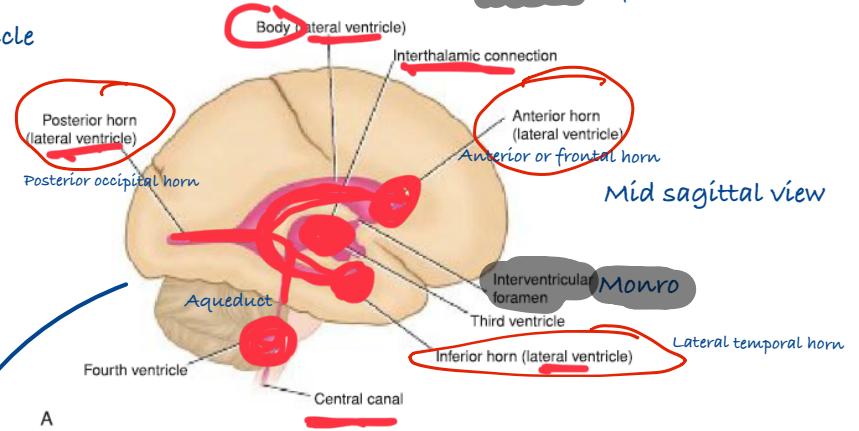
CSF circulation is very important cuz every day we produce 500 ml and in the body there is 150 ml half in the brain and the other in spinal cord.

لنقدن بيتن انتاج ٣ اضعاف الكمية الي الدماغ معنى هذا الكلام انو كل يوم يتنصل الدماغ ٥٠٠ مل
CSF is produced in the **ventricles**

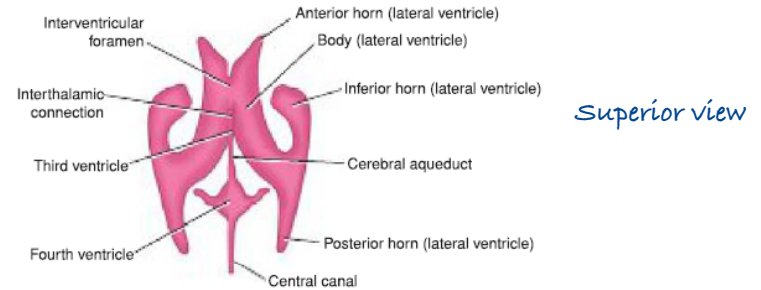
Any obstruction of this pathway it will cause dilatation of the ventricles and increase ICP and decompensation and may cause death. And the patient a shunt surgery.

The obstruction that cause **hydrocephalus** is very emergent in the **adults** because their skull is a fixed space but in children less than 2 years its not

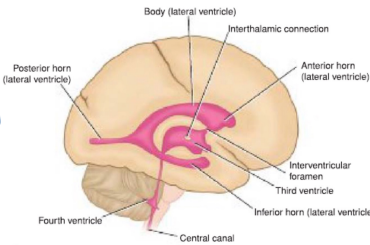
Its relation to 3rd ventricle



A



Superior view



A

Thalamus

Its a relay center for all directions motor and sensory between brain stem and spinal cords from inf to the cortex at the superior

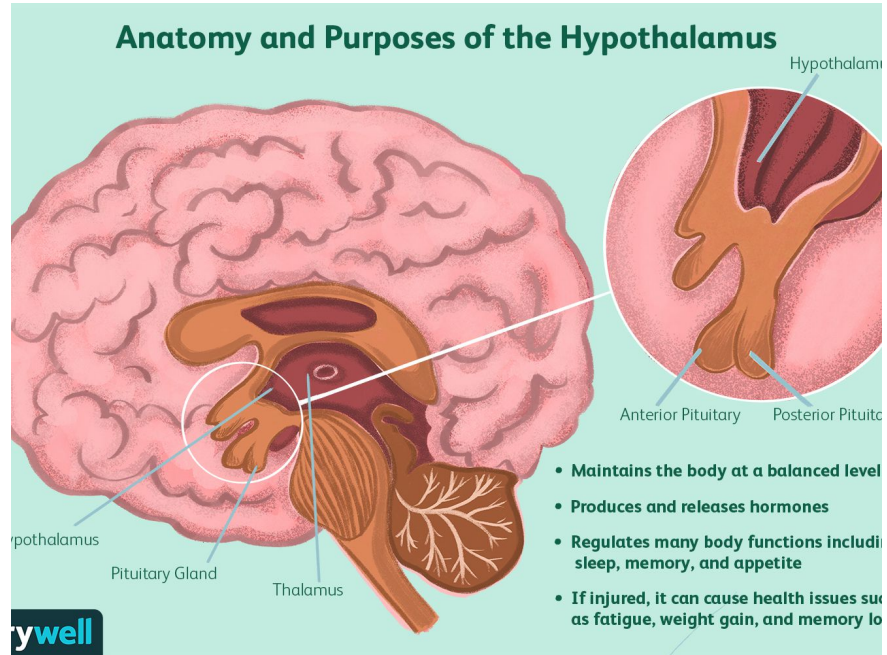
- Paired gray matter structure located near the center of the brain *3rd ventricle*
- It is above the midbrain, allowing for nerve fiber connections to the cerebral cortex in all directions (relay motor and sensory signals to the cerebral cortex)



Hypothalamus

- Small area located above the pituitary gland and below the thalamus & attached to the pituitary gland by a small stalk
- Releasing & controlling hormones
- Controlling appetite
- Managing sexual behavior
- Regulating body temperature
- Fluid and electrolyte balance, including thirst

Adenohypophysis ant. Gland related by a portal venous system
Neurohypophysis post. Gland related by a nerve fibers called stalk



يحتوي على الأنوية تحت الـ cranial nerves بتتبع اثنين بعده اربعة بعده اربعة، تحتاني
 طبيب دنايل التبرق الاول والثاني حقله انو هذول ما الهم أنوية وهذول عبارة عنه أكستشنه للدماغ

تفرع الدماغ

Brainstem

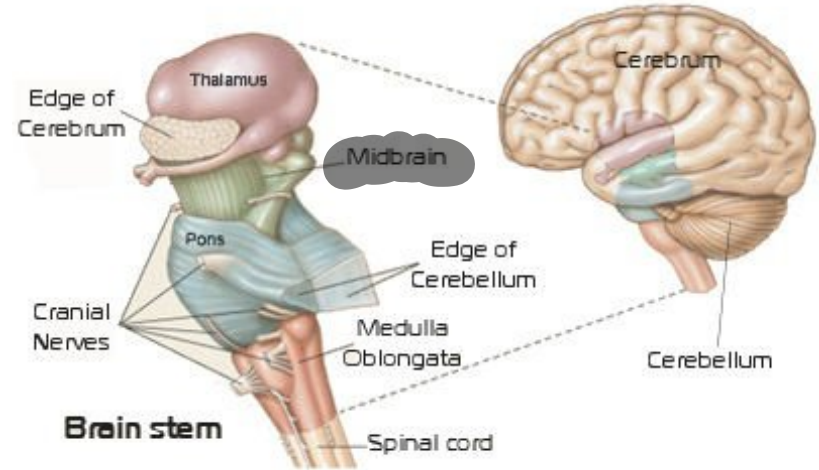
3 parts: Midbrain → pons → medulla oblongata

- Connects brain to spinal cord
- Contains cranial nerve nuclei III to XII

2-4-4

حاجر 2 و 1

- Regulates respiration, cardiovascular function & consciousness

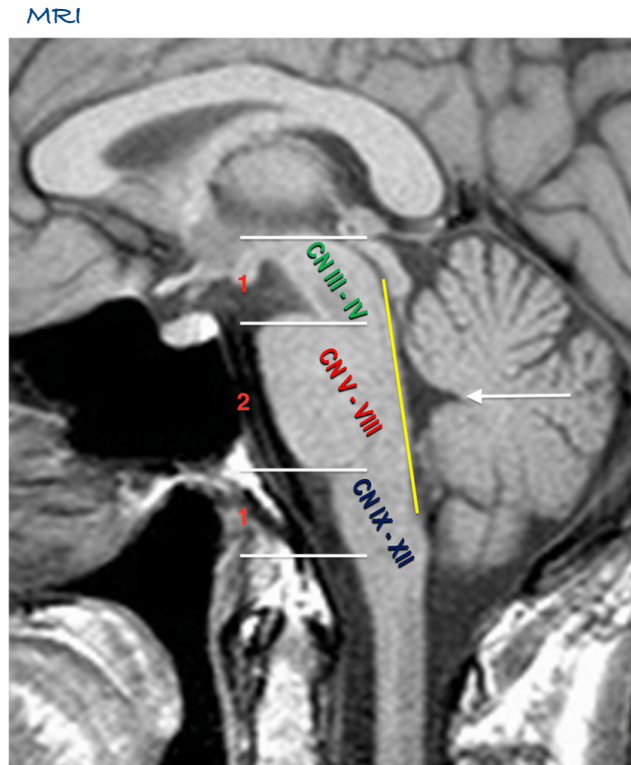


① Midbrain 3-9

② Pons 5-8

② Medulla Oblongata 9-12

Brainstem



Midbrain

Contralateral passageway

Dorsal aspect

Superior Between 3rd and 4th ventricles

- Between 3rd and 4th ventricle

A diagram of the human brainstem, showing the midbrain, pons, and medulla oblongata. The midbrain is the uppermost part, followed by the pons (the large, bumpy structure), and the medulla oblongata (the lower, tapered part). The diagram is labeled with 'Midbrain' and 'Pons'.

ventral aspect

Cerebral peduncle

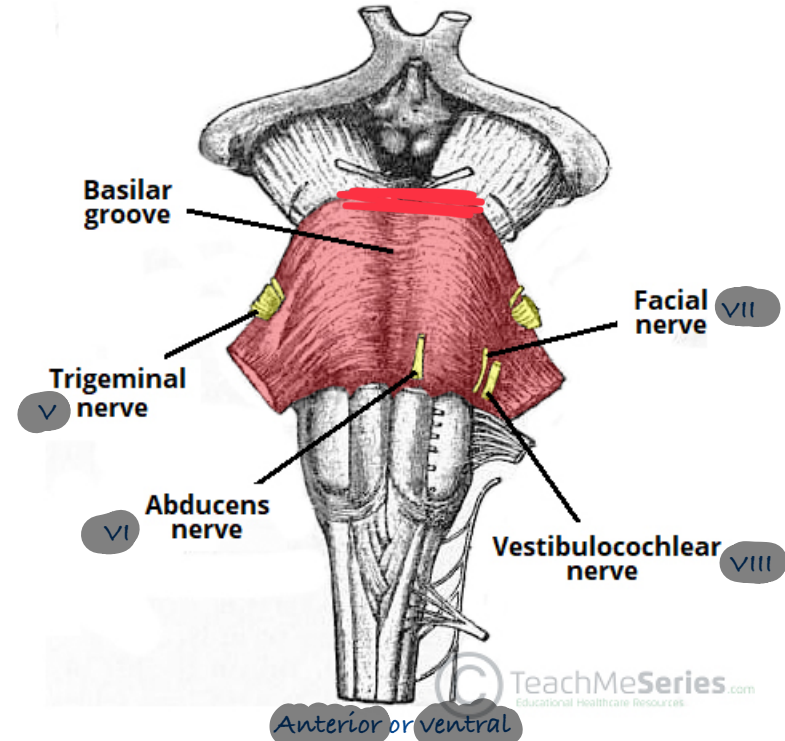
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2nd part of brainstem

Pons

- V, VI, VII, VIII CN
- The posterior surface of the pons faces the cerebellum and forms the upper part of the floor of the fourth ventricle



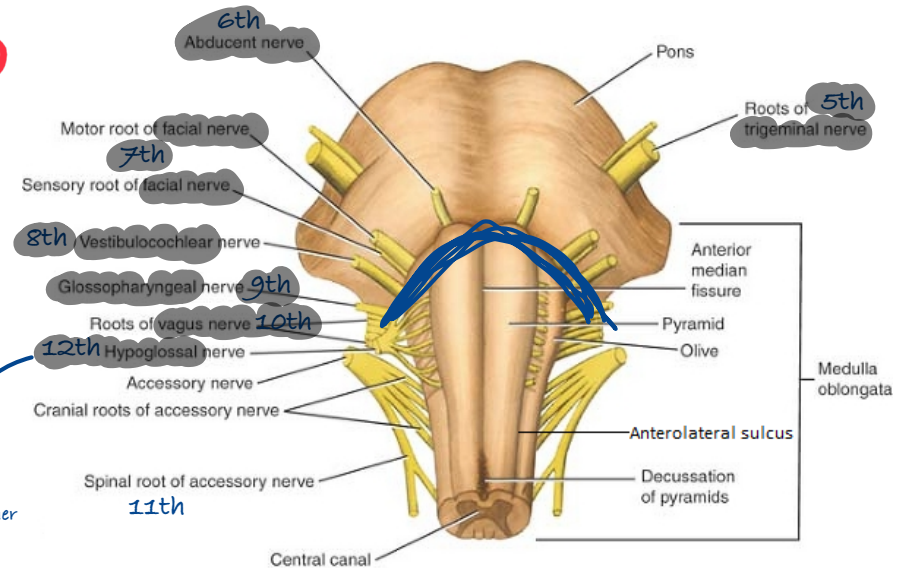
3rd part of brainstem

Medulla oblongata

Important in regulation of respiratory and circulatory

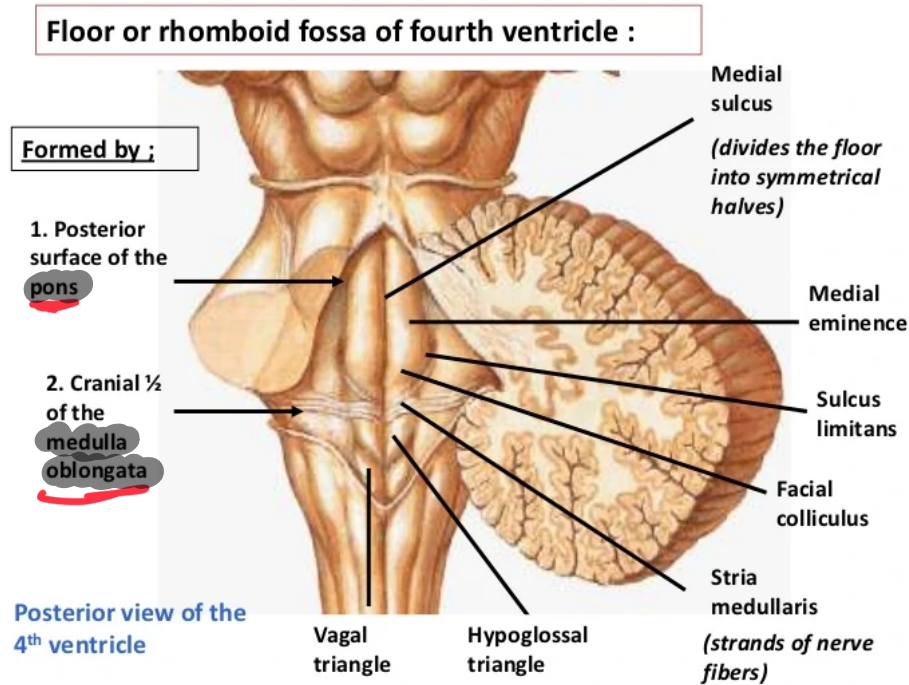
- Connects with the spinal cord at the level of the foramen magnum
- IX, X, XI, XII CN
- The posterior surface of the medulla faces the cerebellum and forms the lower part of the floor of the fourth ventricle

Comes ant to the Olive not like other nerves it has also motor fibers

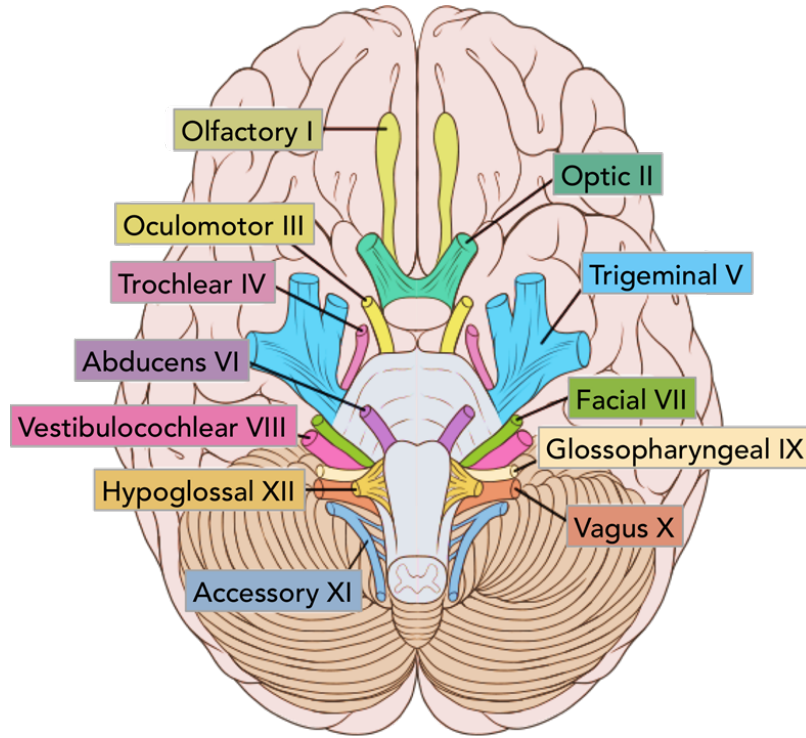


There is rule in innervation that the ant fibers is motor even in spinal cord the ant. horn is motor.

Floor of the 4th ventricle



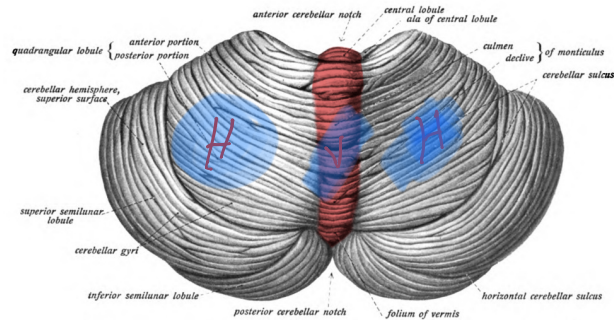
Cranial Nerves



Cerebellum

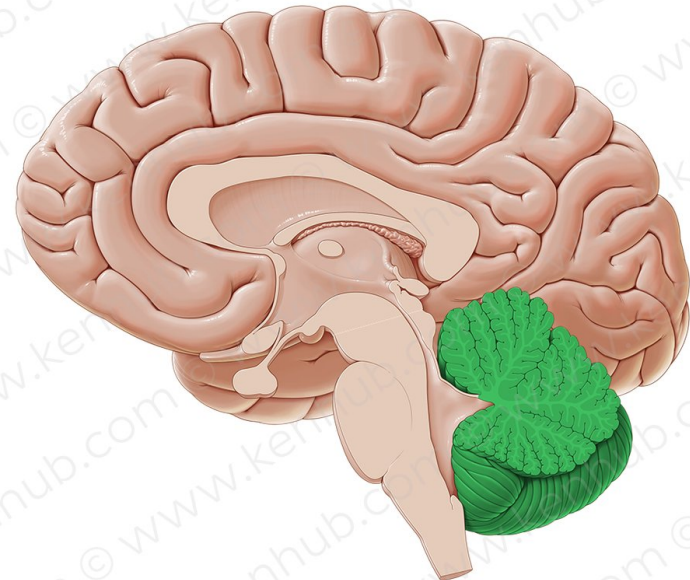
Discooordination means ataxia

- Located in the posterior fossa, infratentorial
- Main function: coordination of motor movement



Cerebellum work us ipsilateral way while cerebrum work as contralateral way

3 parts: -
Rt+Lt hemispheres → Limb ataxia
vermis → trunkal ataxia



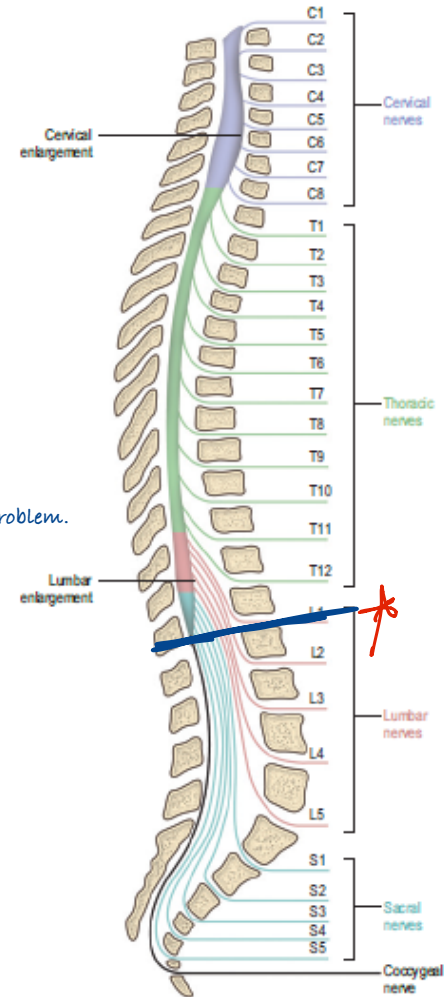
Spinal cord

Continuation to medulla oblongata in spinal canal
Ends at L1 L2

- Occupies the vertebral canal
- Extends from foramen magnum to L1-L2 level *in children it may reach L4 L5*
- Cylindrical in shape
- Numerous ascending and descending axonal tracts
- Like the brain, it is surrounded by 3 concentric meninges *Except dura is one layer*
(ending at S2)

Dura Most outer
Arachnoid Intermediate
Pia Most inner

Any little damage it may cause a big problem.

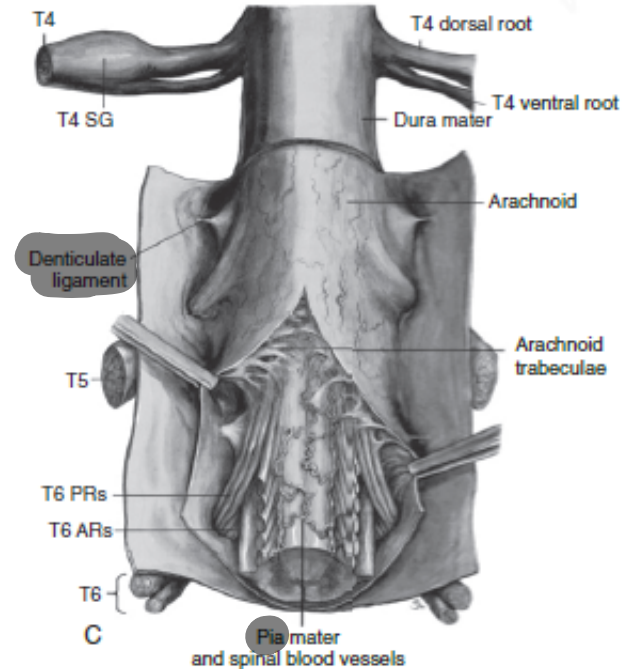


Spinal cord

Denticulate ligaments

- A pia mater sheet *From inner layer*
- Extends between the anterior and posterior roots
- Extend out through the arachnoid mater to attach onto the dura
- Anchor and position the spinal cord within the central area of the subarachnoid space.

Fix the spinal cord.

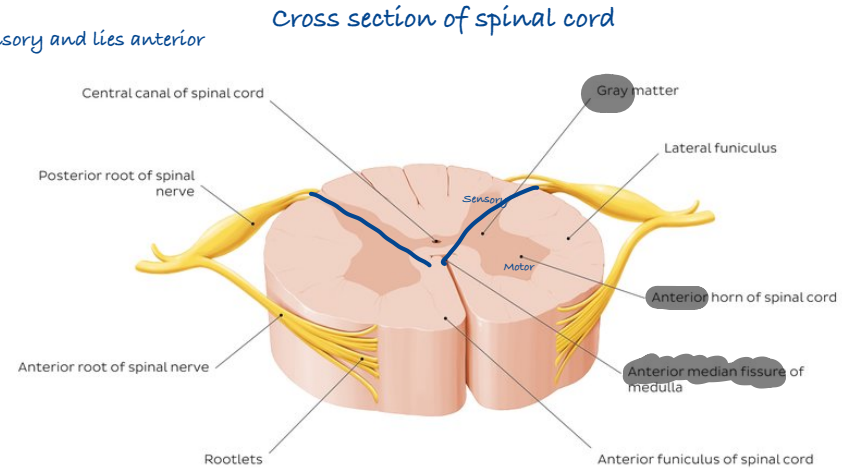


Spinal cord

Cross section

- Anterior median fissure The motor horn larger than sensory and lies anterior
- Posterior median sulcus
- Posterolateral sulcus
- Posterior intermediate sulcus
- Outer white matter columns
- Inner H-shaped gray matter (horns)

Rootlets → Roots from each segment (anterior & posterior) → Spinal nerves (No. 31)

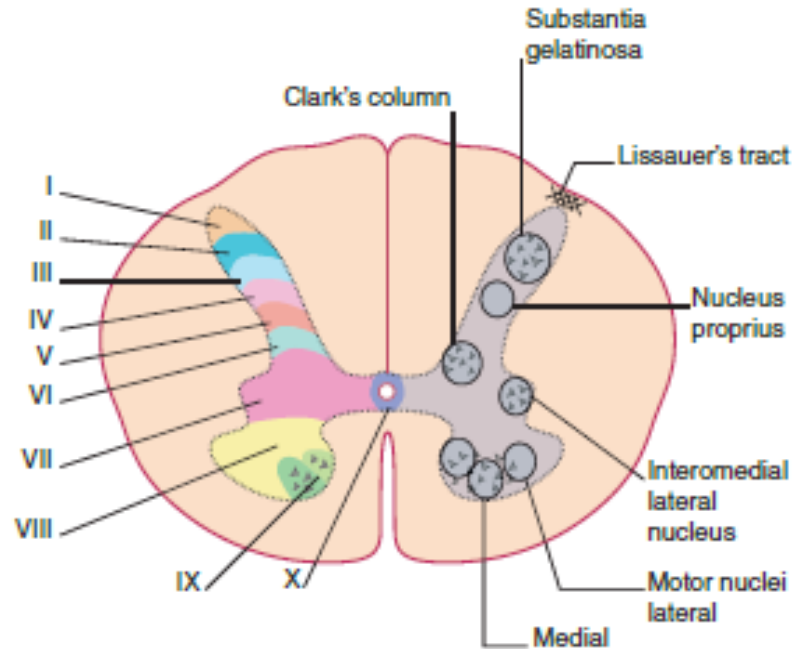


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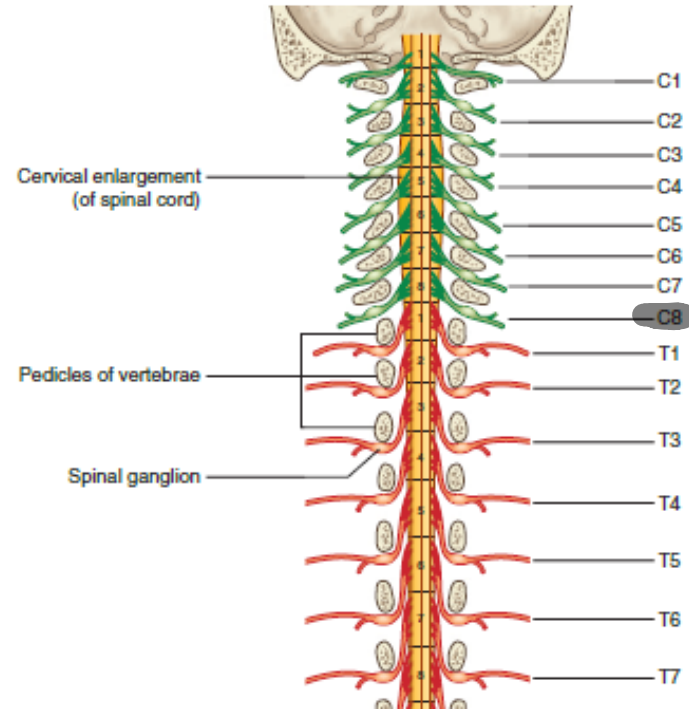
Spinal cord

- The grey matter is divided into 10 zones known as **Rexed's laminae**. The anterior horn contains motor neuron. The posterior horns, sensory.
- The **white matter**: The anterior funiculus (column) consists of motor axons, the posterior consists of sensory.



Spinal cord

- Spinal nerves exit above the corresponding vertebra in Cervical spine, but below it in thoracic & lower spine
- This is because we have 7 cervical vertebrae but 8 cervical cord segments



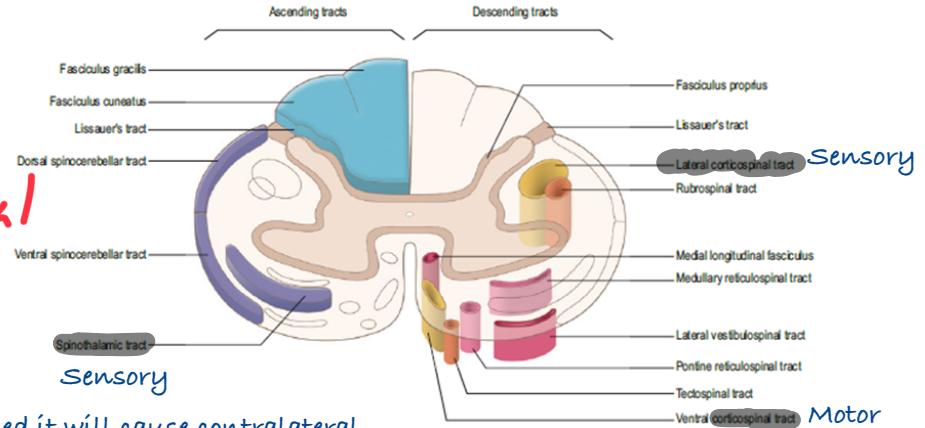
Spinal cord

Before medulla it is contralateral
After medulla it is ipsilateral

ipsi Important tracts: If damaged it will cause ipsilateral effect.

- Lateral corticospinal (Pyramidal) tract (↓ motor)
- Contra • Anterolateral/spinothalamic tract (↑ pain & t⁰) *sensory superficial*
- ipsi • Posterior column–medial lemniscal pathway (↑ conscious proprioception, vibration, and discriminative touch)

deep sensory



Is damaged it will cause contralateral effect because it is ascending tract

