



Anatomy of cerebellum and fourth ventricle

Department of human Anatomy and Embryology
Faculty of Medicine
Mansoura National University, Egypt



By

Dr. Fekry Shata





Intended Learning Outcomes (ILOs)

1. Describe anatomy of the cerebellum.
2. Describe anatomy of the fourth ventricle.





Agenda

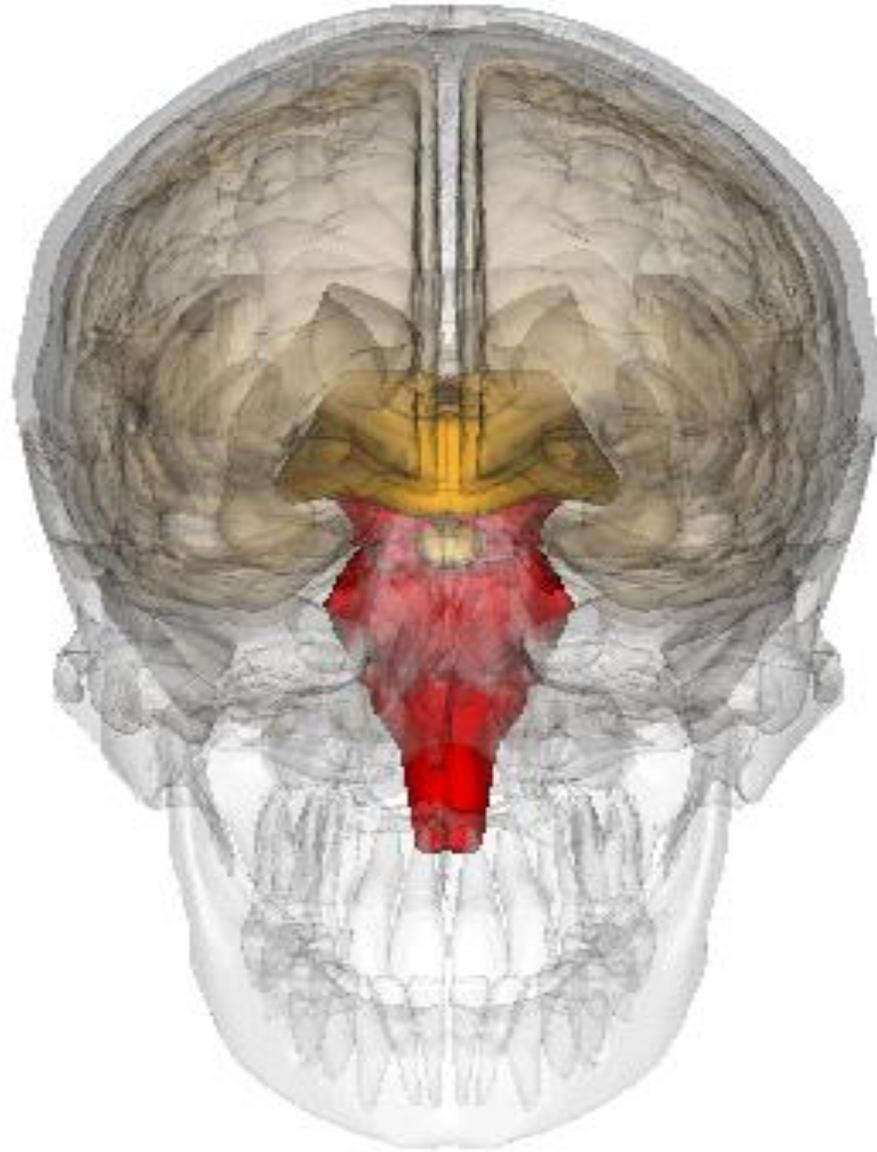
1. Anatomy of the cerebellum (lobes, fissures, divisions & blood supply).
2. Anatomy of the 4th ventricle (boundaries & related cranial nerve nuclei).





Anatomy of Cerebellum



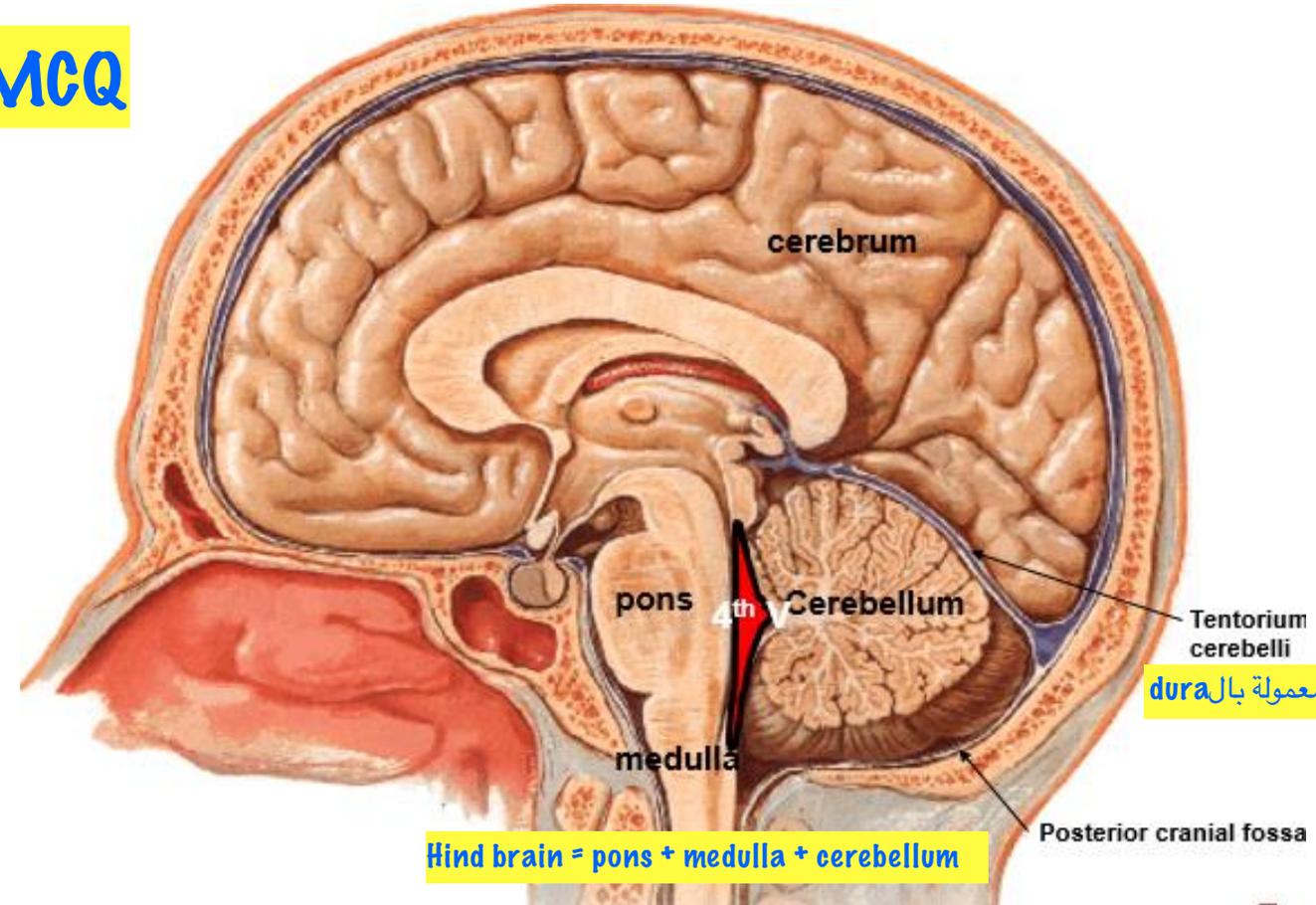


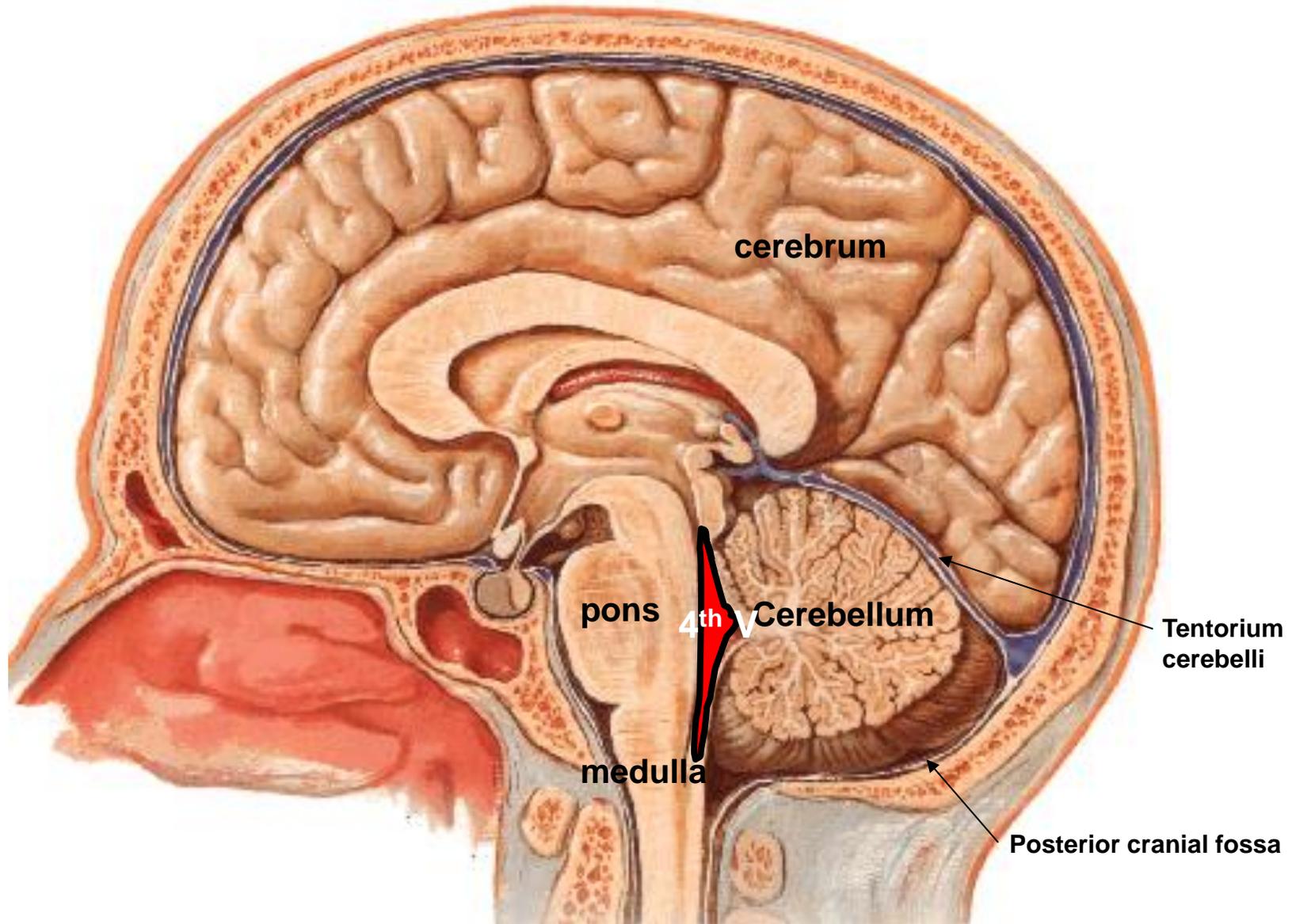
Cerebellum

Largest part of hindbrain MCQ

It is located in the posterior cranial fossa MCQ

- It is separated from the cerebrum by the **tentorium cerebelli**
- It is separated from the pons and medulla by the **cavity of the 4th ventricle**





CEREBELLUM - Superior surface

General features

Vermis

Cerebellar hemisphere

Notches

Fissures

Folia
شبه ال sulci & gyri
بتاع ال brain

Horizontal
Fissure

Anterior Notch
Surrounds brainstem

1ry fissure

Left Cerebellar Hemisphere
Vermis
Right Cerebellar Hemisphere

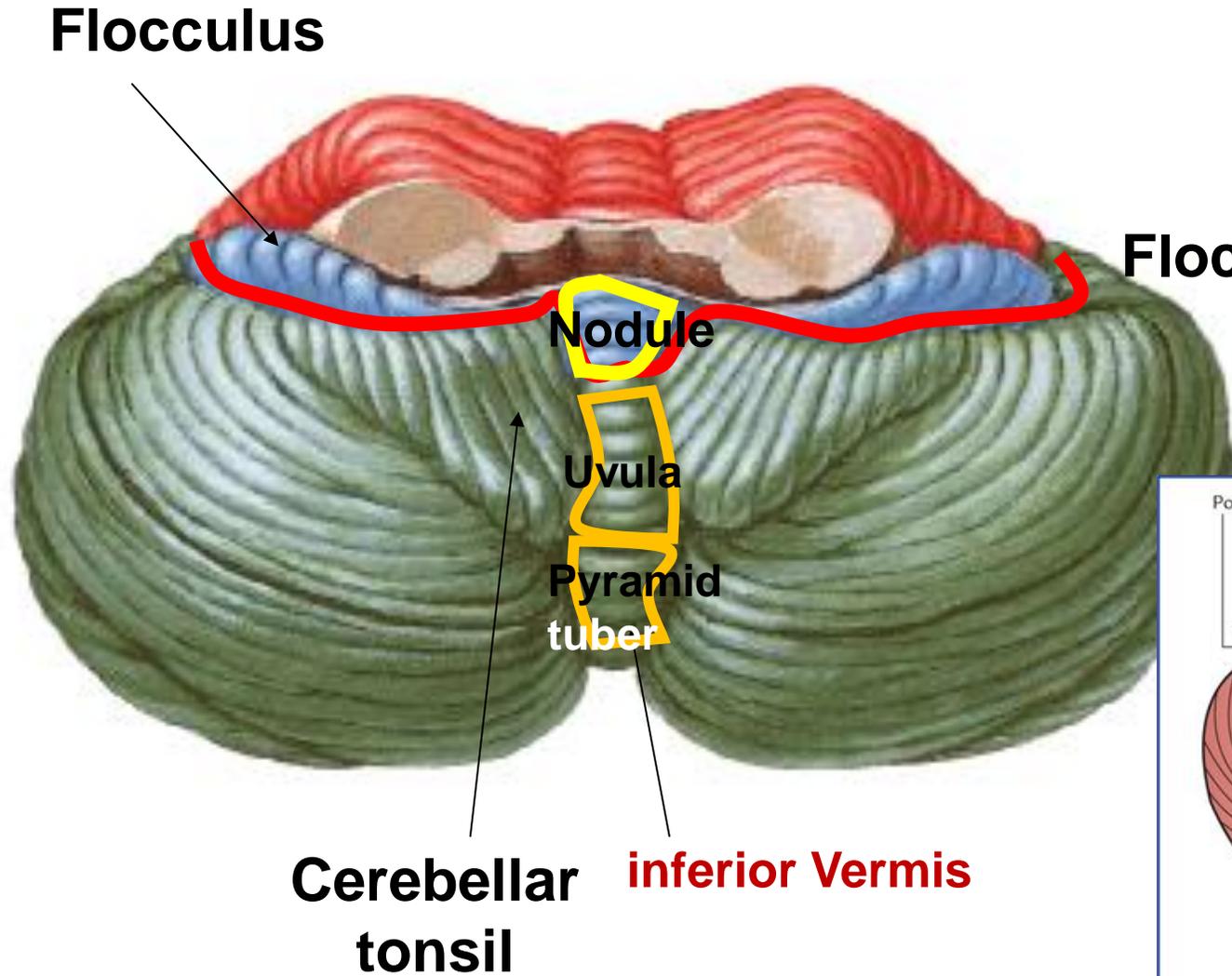
Posterior Notch
Contain falx cerebelli

CEREBELLUM- Inferior surface

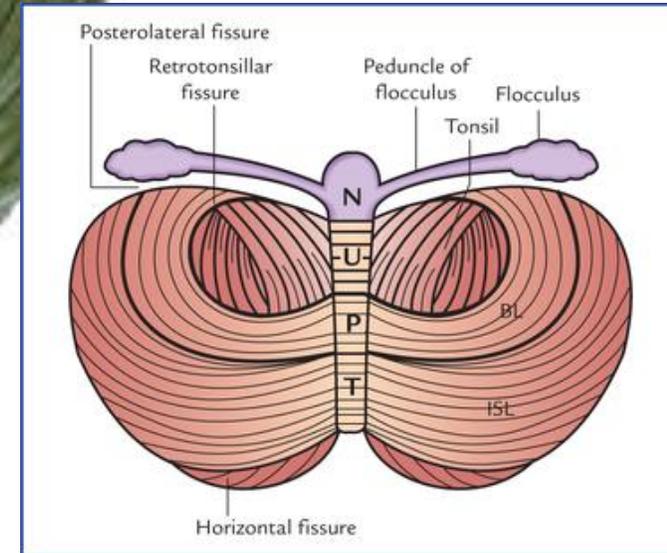
Vermis

Fissures

**Posterolateral
Fissure**



Flocculonodular Lobe

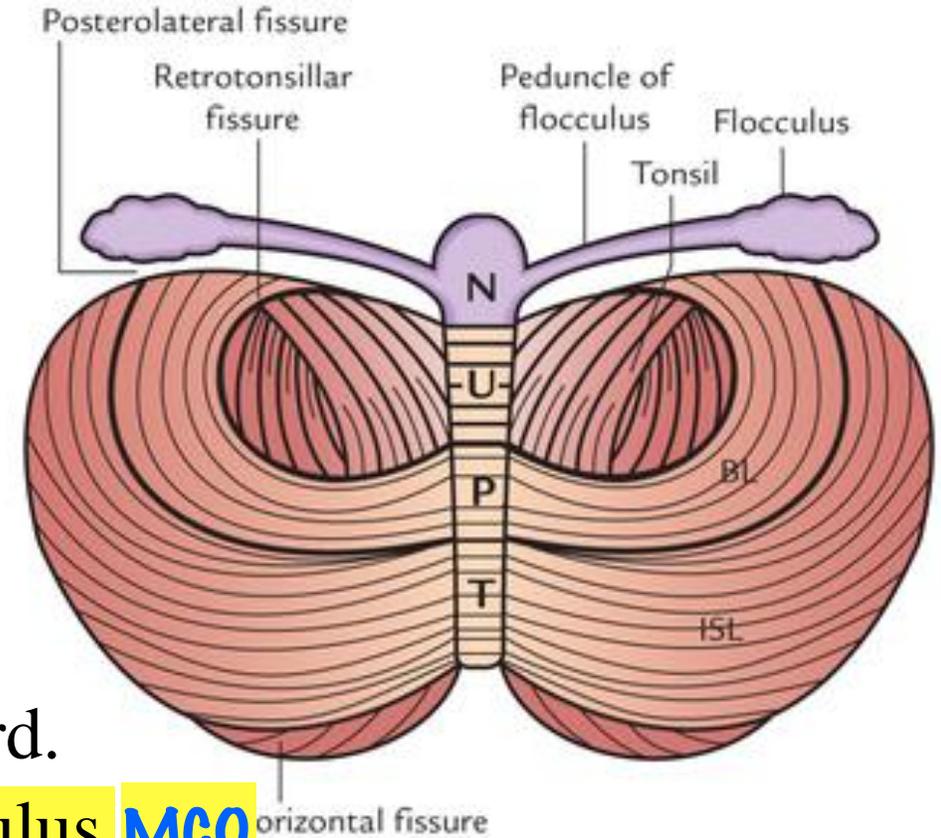


• The vermis: is divided into superior and inferior vermis:

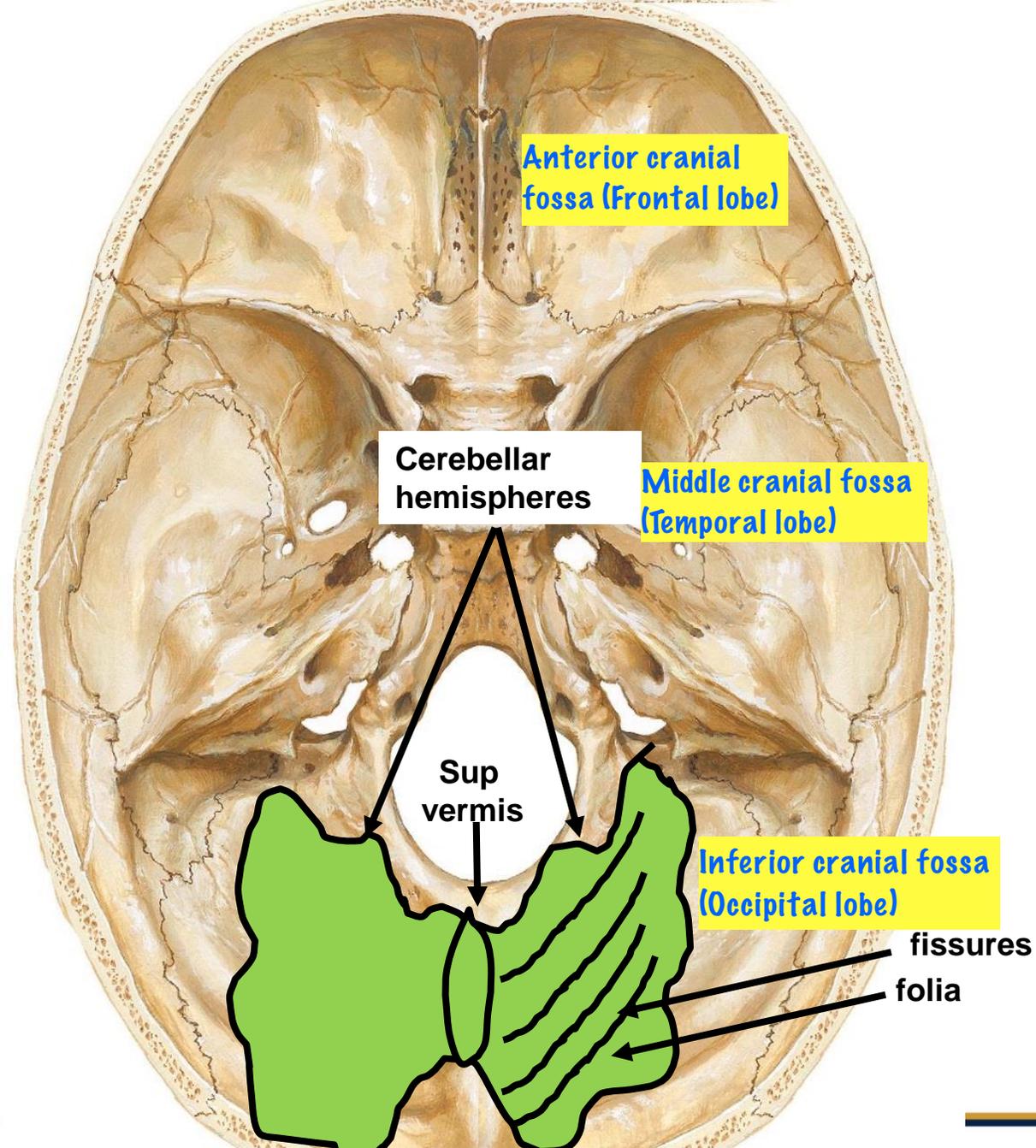
A. **The superior vermis** is present on the superior surface.

B. **The inferior vermis:** present on the inferior surface in a groove called the **vallecula**.

- Formed of **4 lobules:** **nodule**, **uvula**, **pyramid** and **tuber**, from before backward.
- The **nodule** is **continuous** with the **flocculus**. **MCQ**
- The **uvula** is **continuous** with the **cerebellar** **MCQ** **tonsil**.



MCQ : (Nodule - Uvula) is related to which part of cerebellum?



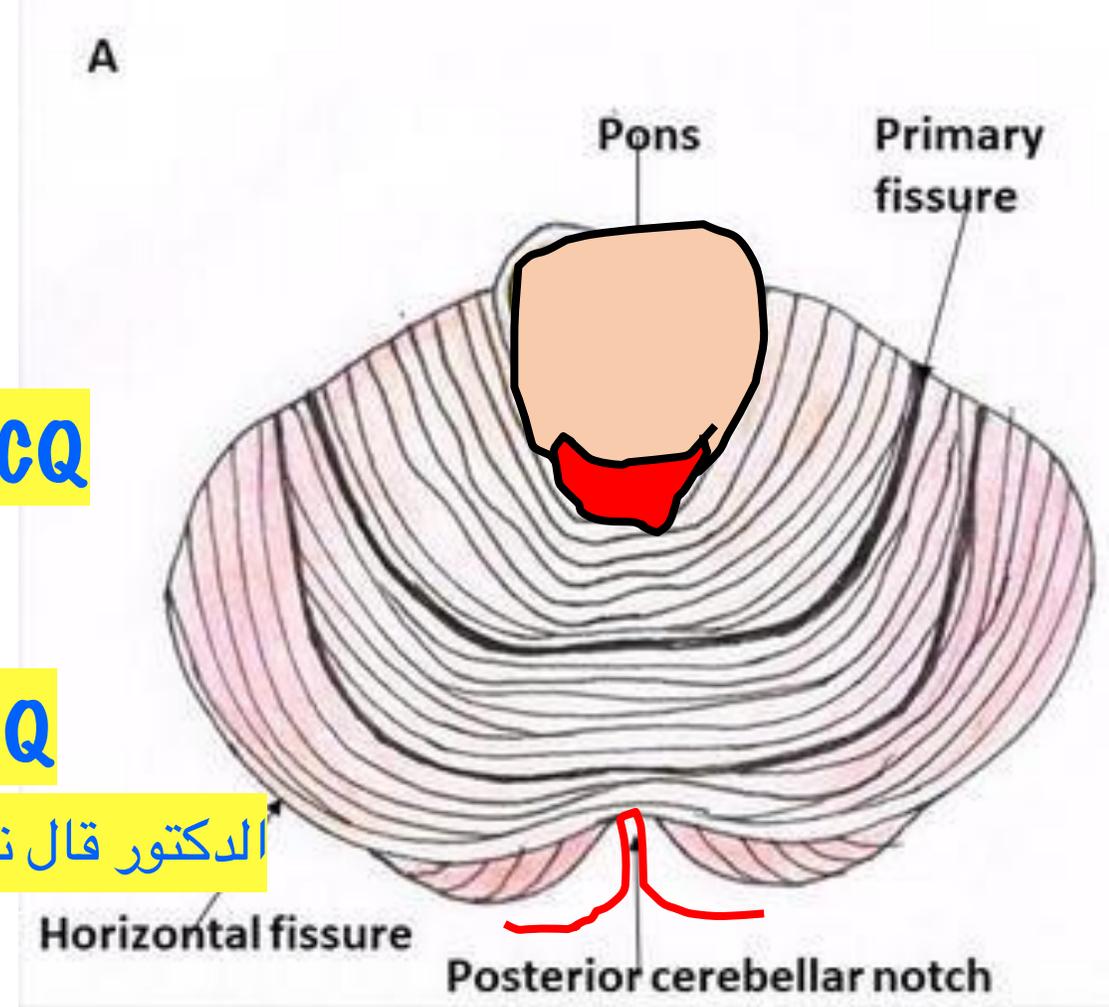
Cerebellum is most inferior part in cranial fossa

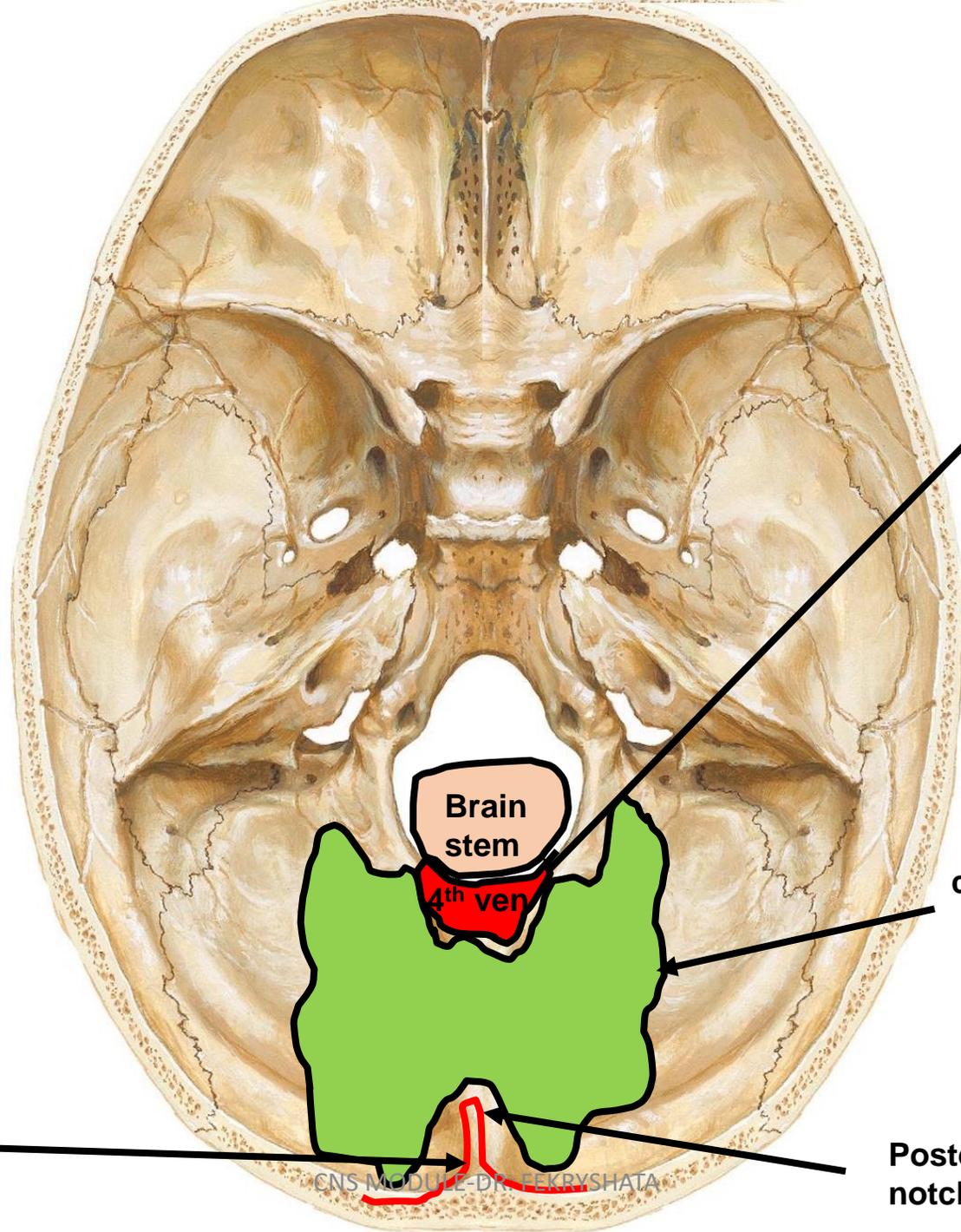
Notches

the cerebellum has 2 notches:

A. **Anterior notch:** surrounds **MCQ** the brainstem. **Mainly pons**

B. **Posterior notch:** contains **MCQ** the falx cerebelli. **الدكتور قال نكتب جنبها Dural fold**





anterior notch

cerebellum

Brain stem

4th ven

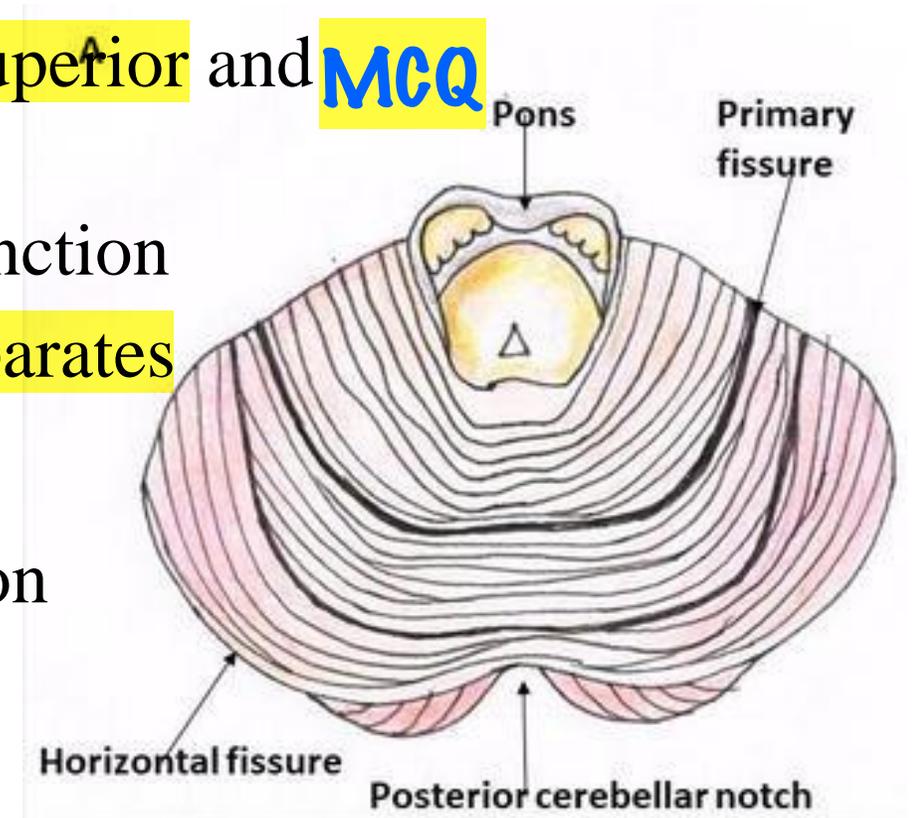
Falx cerebelli

Posterior notch

Fissures

the 3 important fissures are:

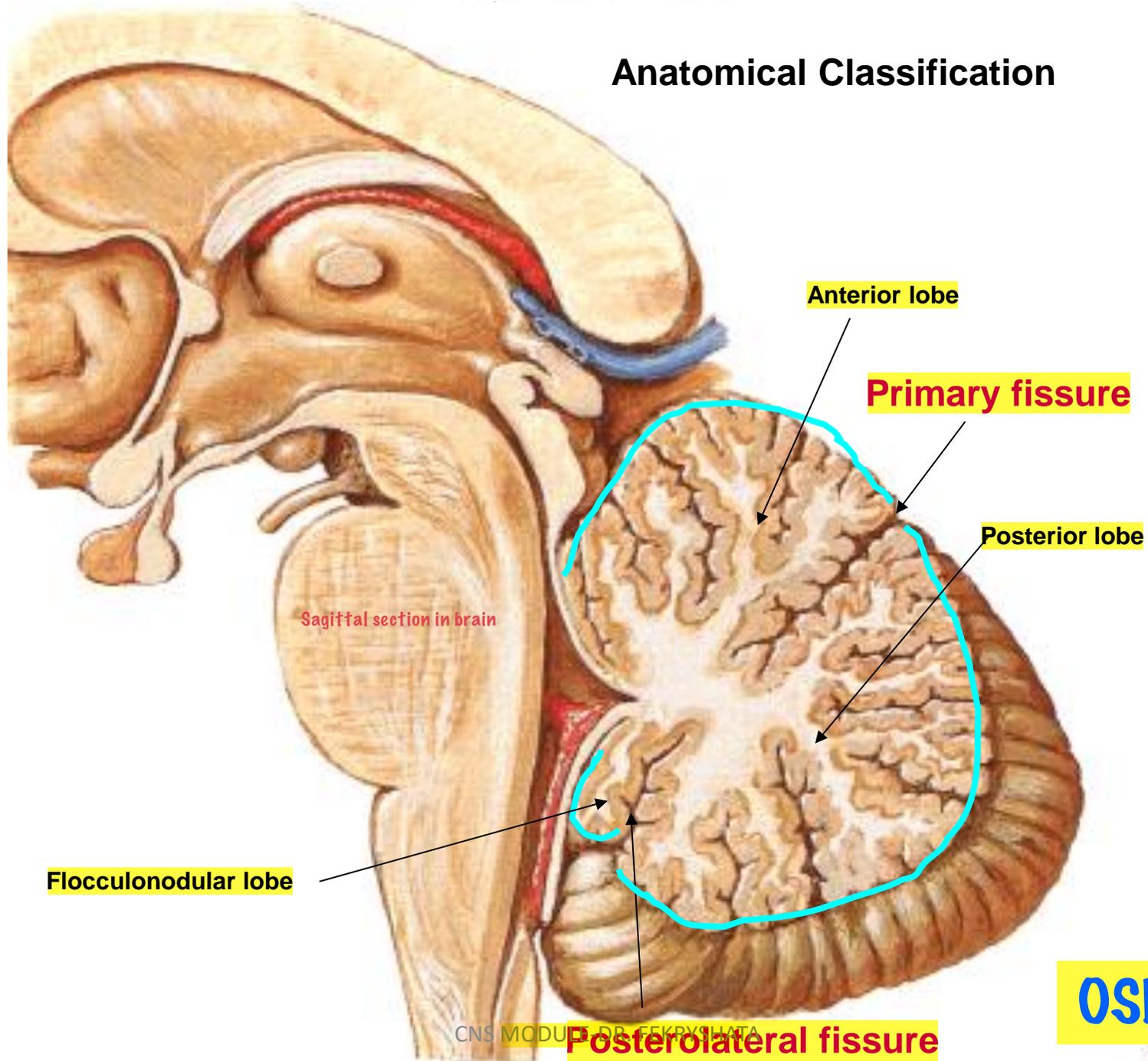
- A. **Horizontal fissure**: divides the cerebellum into superior and inferior surfaces. **MCQ**
- B. **Primary fissure**: on the superior surface at the junction of its anterior third and posterior two-thirds. It separates the anterior lobe from the posterior lobe. **MCQ**
- C. **Posterolateral fissure (uvulo-nodular fissure)**: on the inferior surface separating the nodule from the uvula, and the posterior lobe from the flocculonodular lobe. **MCQ**



MCQ : (Horizontal - longitudinal - uvulo-nodular) fissure separate ?

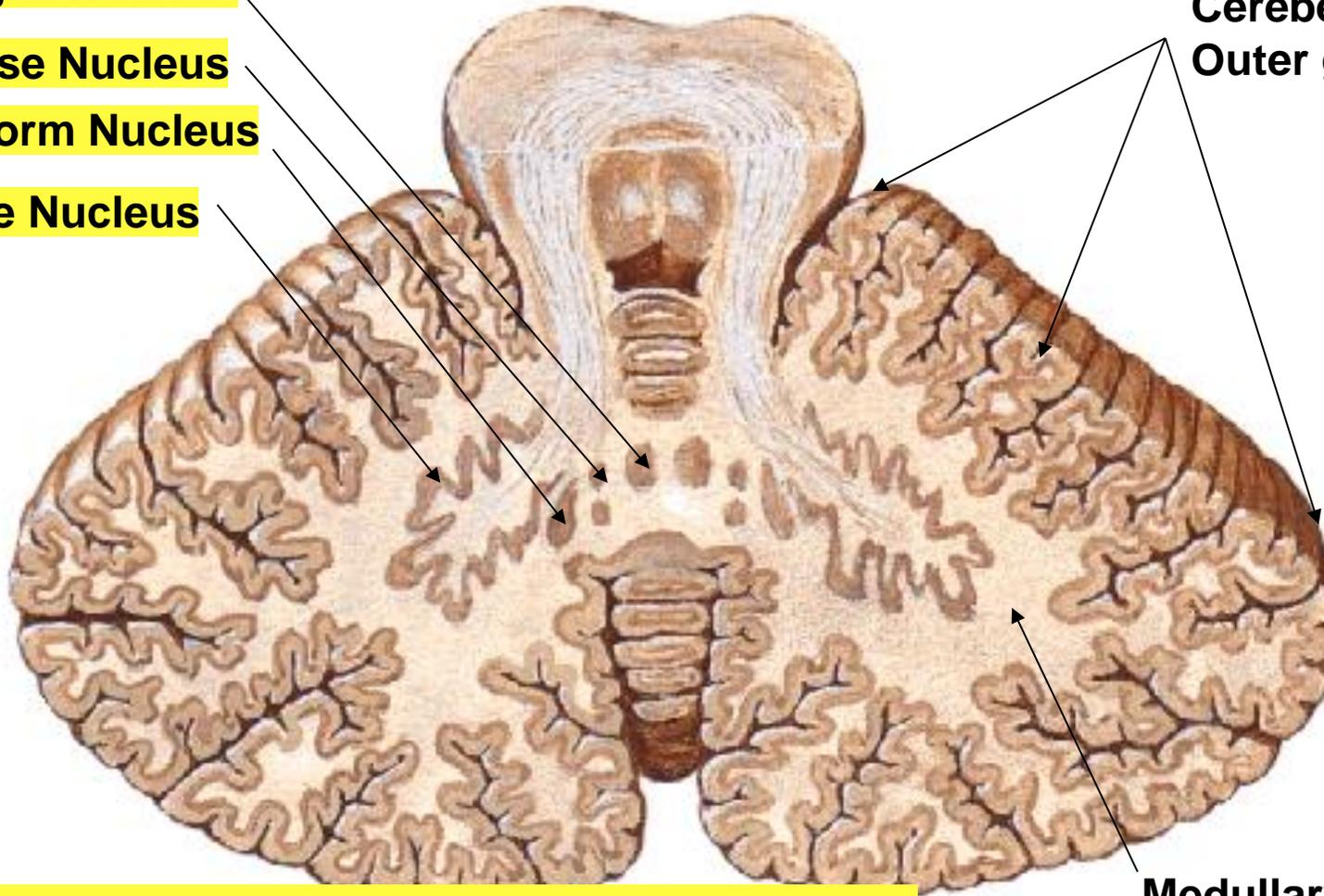


Anatomical Classification



Cerebellar Nuclei

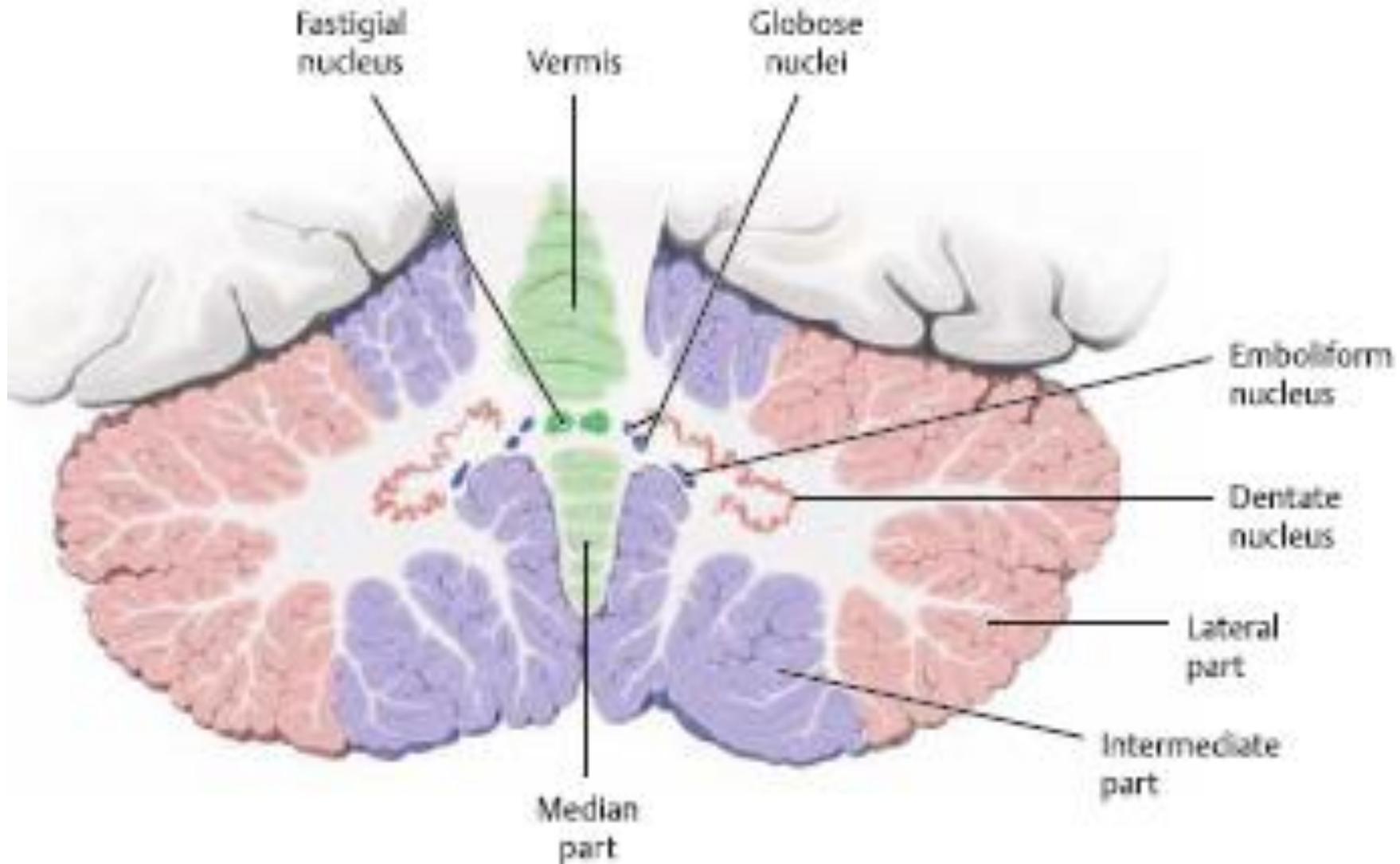
- 1- Fastigial Nucleus
- 2- Globose Nucleus
- 3- Emboliform Nucleus
- 4- Dentate Nucleus



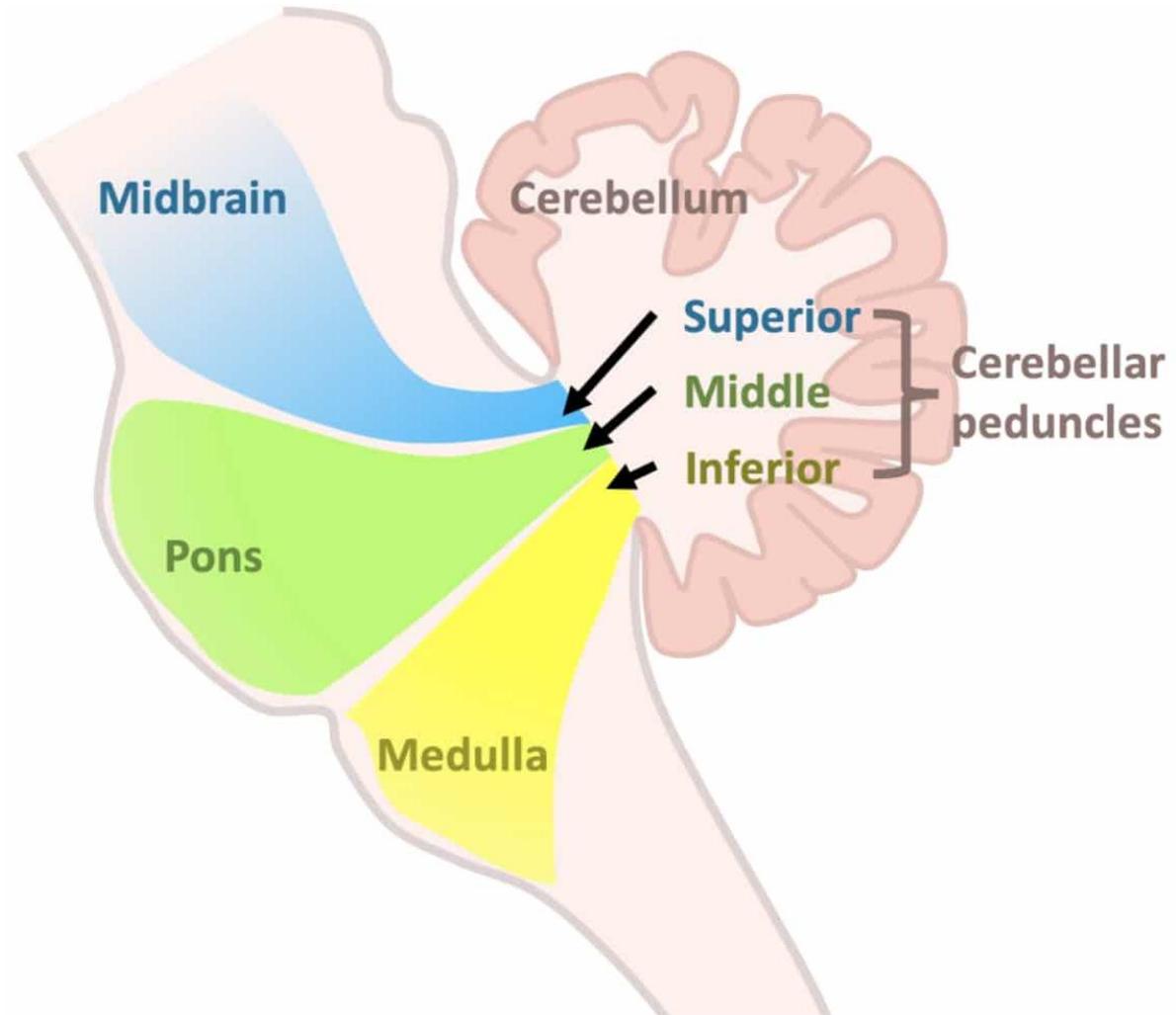
Cerebellar Cortex
Outer grey matter

Medullary Centre
(White Matter)

SAQ مهم : List the cerebellar nuclei ?



Cerebellar peduncles



Cerebellar peduncles

Superior cerebellar peduncle:
Connects cerebellum with midbrain

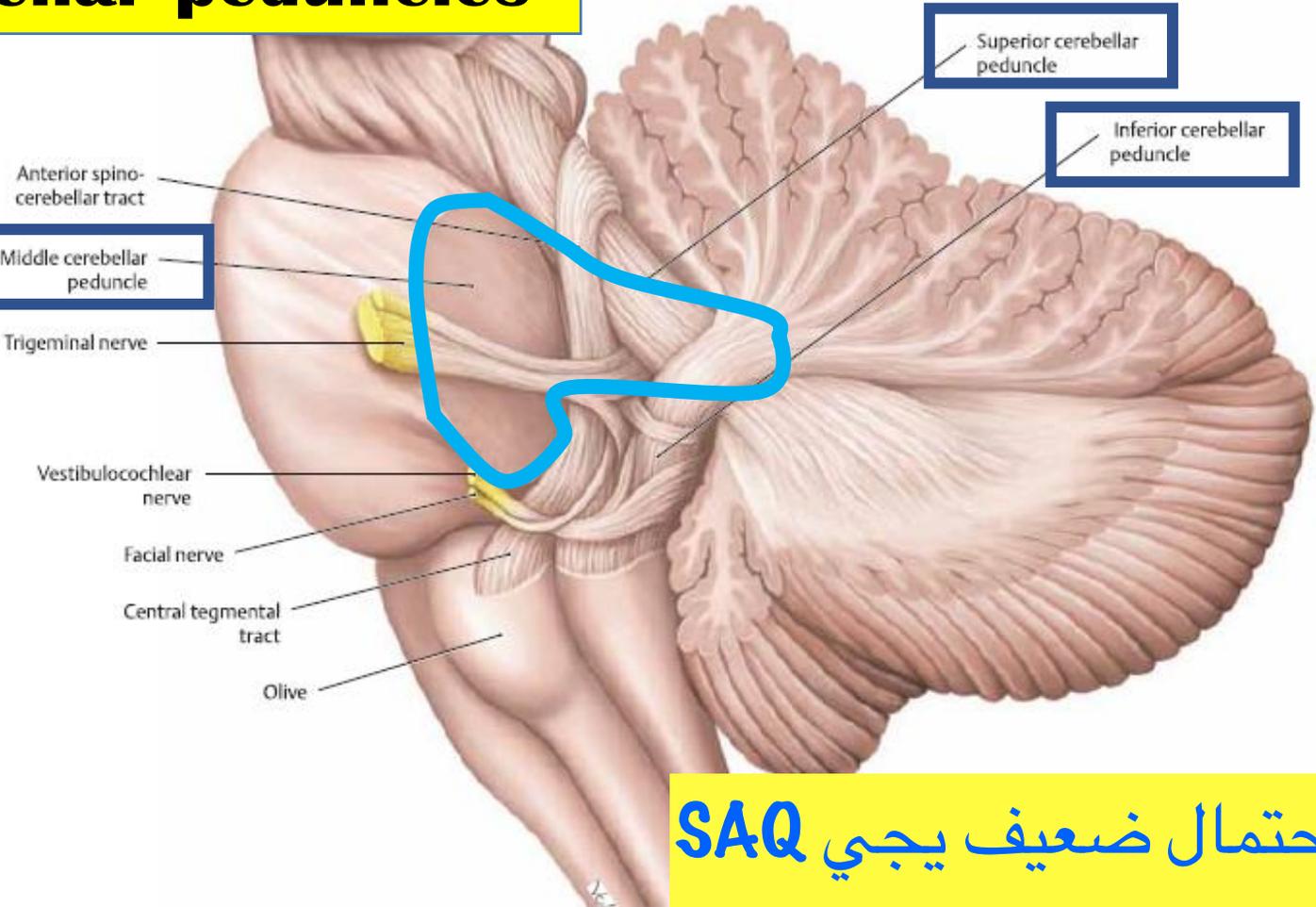
MCQ

Middle cerebellar peduncle:
Connects cerebellum with pons

MCQ

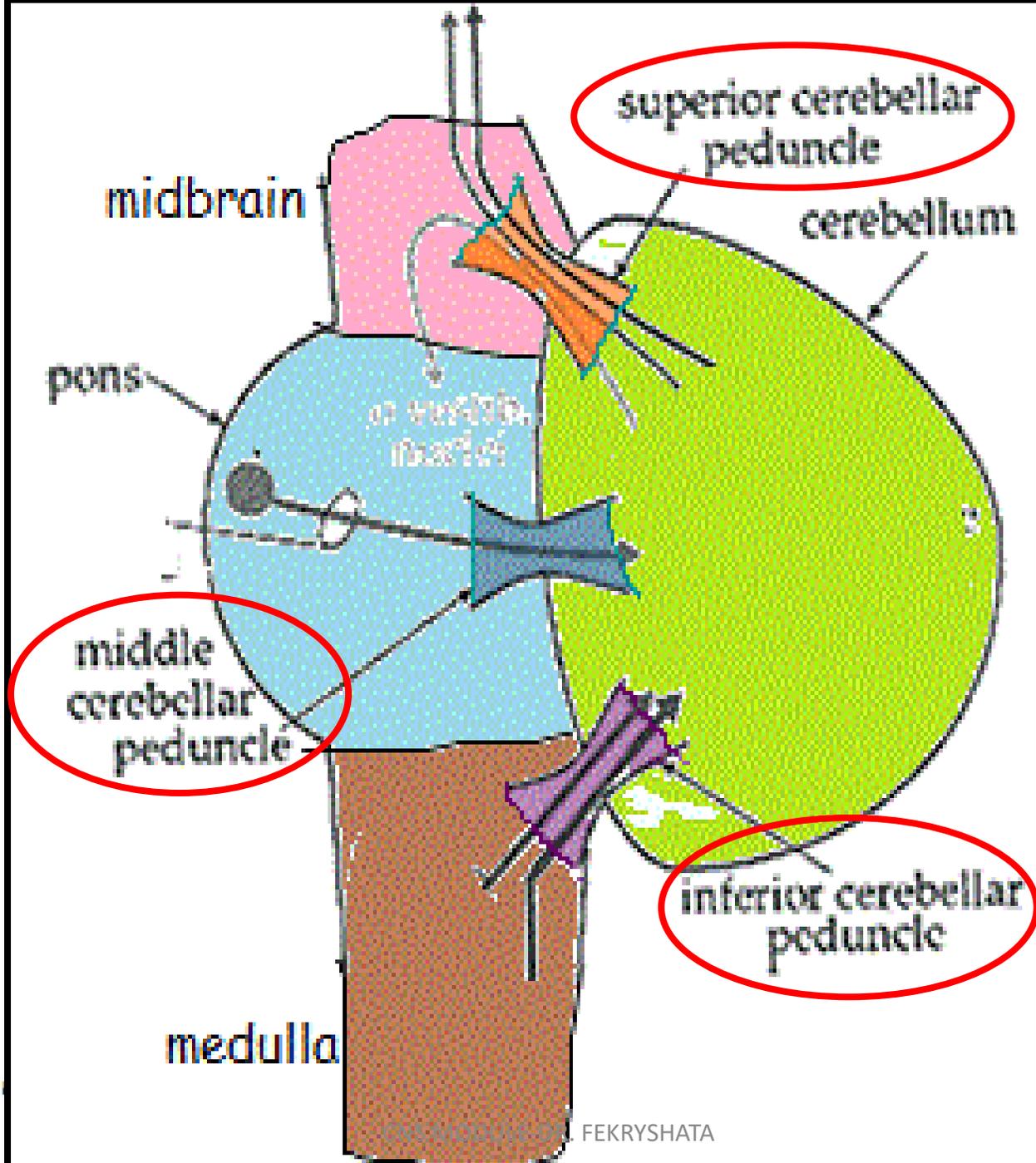
inferior cerebellar peduncle:
Connects cerebellum with medulla

MCQ



احتمال ضعيف يجي SAQ
وغالبا بتيجي MCQ

SAQ : List the cerebellar peduncles ?





أهم حاجة في
المحاضرة

Divisions of the cerebellum



1. Anatomical divisions

The cerebellum is composed of 3 lobes:

The cerebellum is divided by the **primary fissure** and the **posterolateral fissure** into:

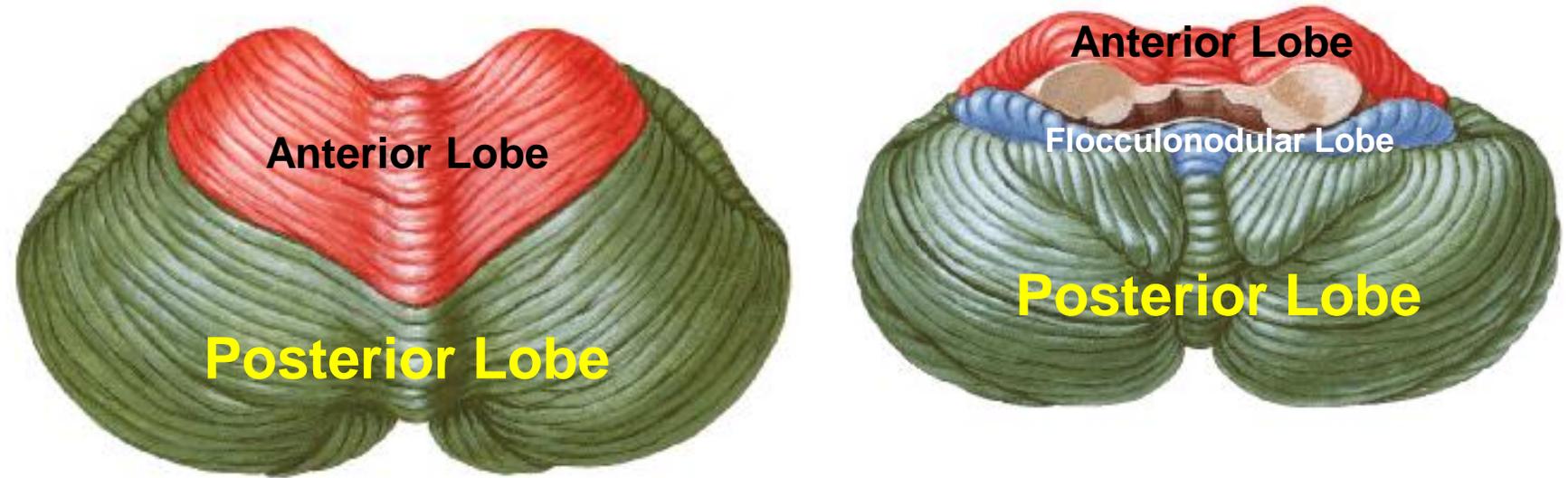
- 1. Anterior lobe:** lies **cranial** to the **primary fissure**.
- 2. Posterior lobe:** lies **between** the **primary fissure** and the **posterolateral fissure**.
- 3. Flocculonodular lobe:** is formed of the **nodule** and the **two flocculi**.



Lobes

Superior surface Inferior surface

بنشوف فيه الثلاثة lobes



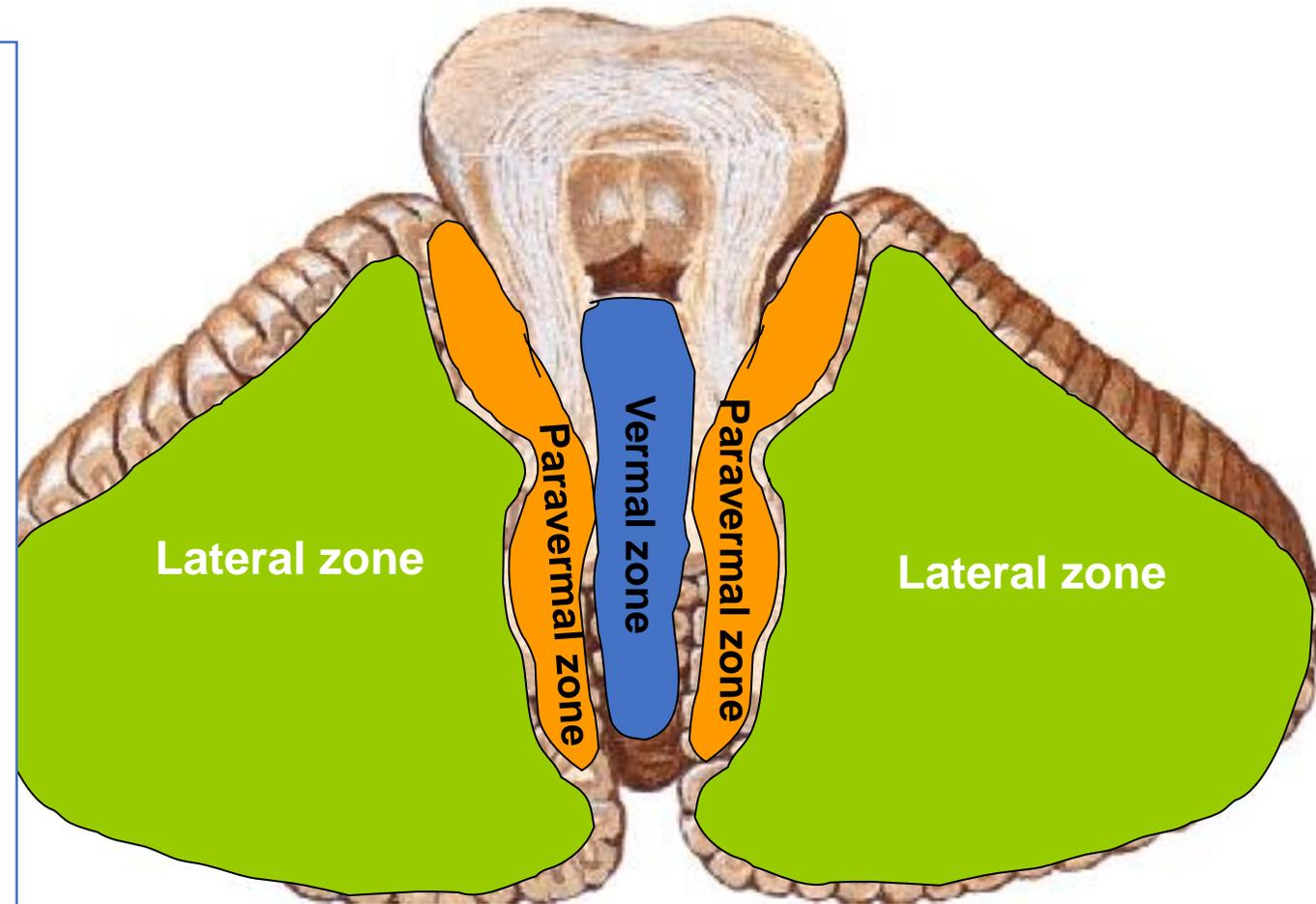
2. Longitudinal divisions

According to the connections of the deep cerebellar nuclei

Vermal zone: the cerebellar cortex projects to the **fastigial nucleus**.

Paravermal zone: the cerebellar cortex projects to the **interposed nuclei (emboliform and globose nuclei)**.

Lateral zone: the cerebellar cortex projects to the **dentate nucleus**.



3. Functional divisions

The cerebellum is composed of 3 functional zones:

1. Archicerebellum (vestibulocerebellum):

- Consists of the **flocculonodular lobe**.
- Connected with the **vestibular** system
- Concerned with **equilibrium**.

أهم حاجة على الإطلاق

اللي بالأحمر الأسئلة والإجابات بتاعتها

2. Paleocerebellum (spinocerebellum):

- Consists of the **vermal & paravermal zones** of the anterior and posterior lobes.
- Connected with **spinal cord**.
- Concerned with **regulation of muscle tone** and **muscle coordination**.

3. Neocerebellum (cerebrocerebellum):

- Consists of the **lateral zone** of the cerebellar hemisphere.
- Connected with the **cerebral cortex**.
- Concerned with **automatic** control of movement.

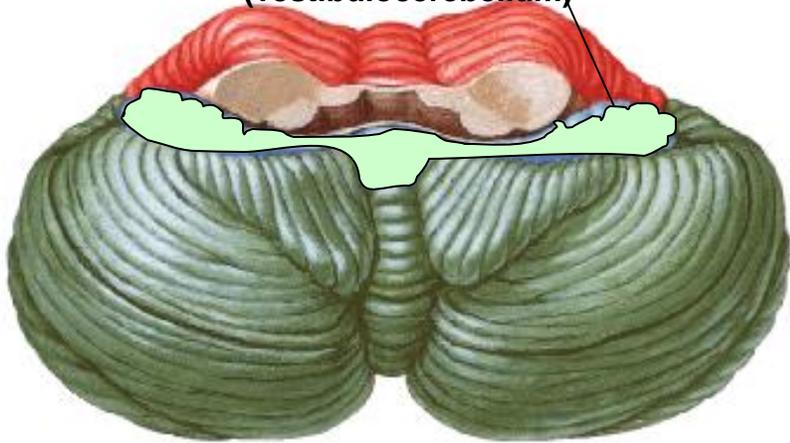
ده أعلى واحد فيهم

High control وأقوى واحد

SAQ مهم جدااا جدا : Enumerate/ Describe the three functional zones of the cerebellum ?

Functional Classification

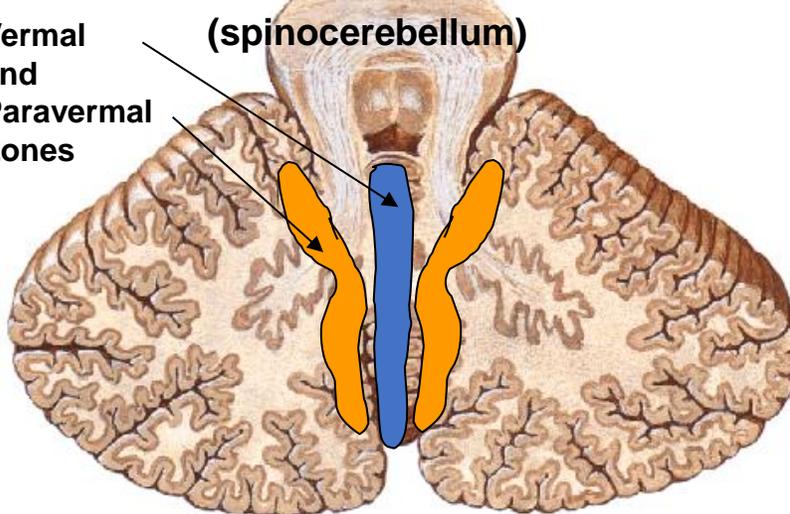
Archicerebellum (vestibulocerebellum)



Equilibrium

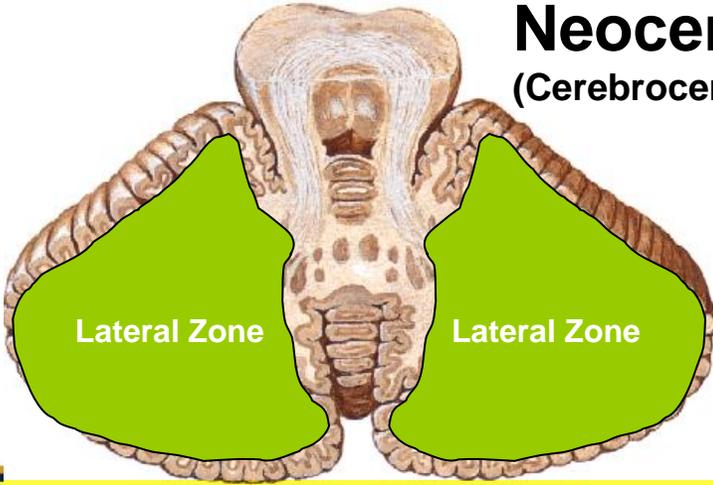
Paleocerebellum (spinocerebellum)

Vermal and
Paravermal
Zones

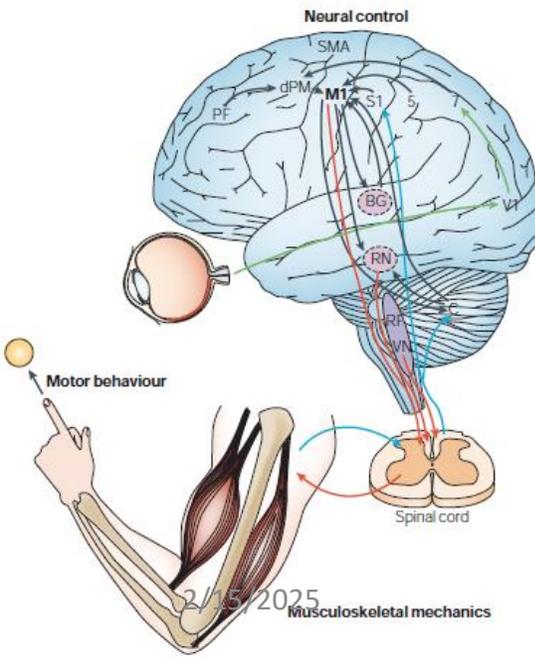


Muscle tone and muscle co-ordination

Neocerebellum (Cerebrocerebellum)



Planning and automatic control of movement



Lesion in cerebellum
lead to :

Symptoms Of Ataxic Gait

- Lack of proper coordination
- Unsteady gait with a potential to stumble and fall
- Frequent falling episode





Blood Supply



Arterial supply of the cerebellum

The cerebellum is supplied by:

1. Superior cerebellar artery:

- Branch of the **basilar artery**
- It supplies the **superior surface** and the **superior cerebellar peduncle**.

2. Anterior inferior cerebellar artery (Aica):

- Branch of the **basilar artery**.
- It supplies the **anterior part of the inferior surface** and the **middle cerebellar peduncle**.

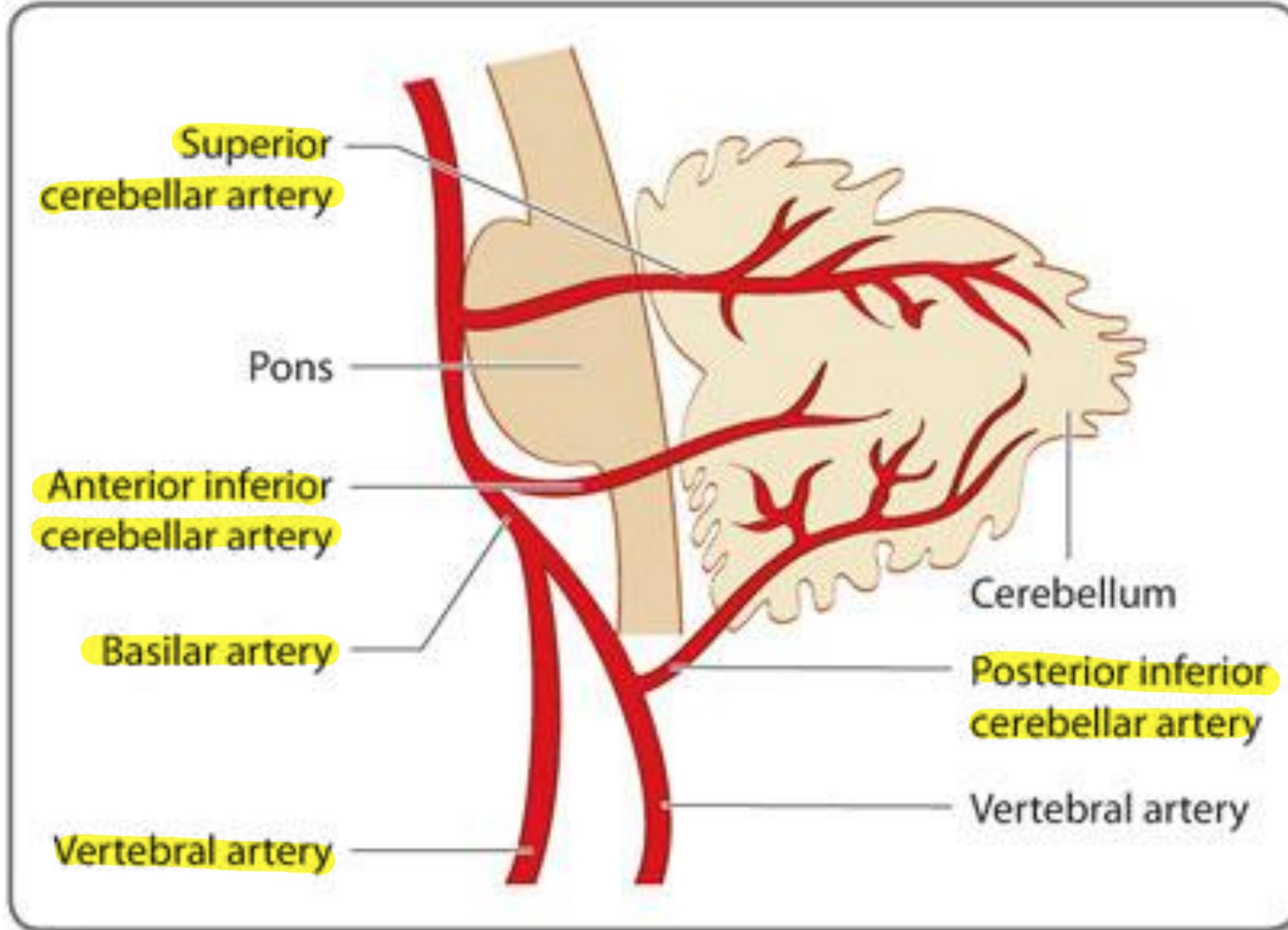
3. Posterior inferior cerebellar artery (Pica):

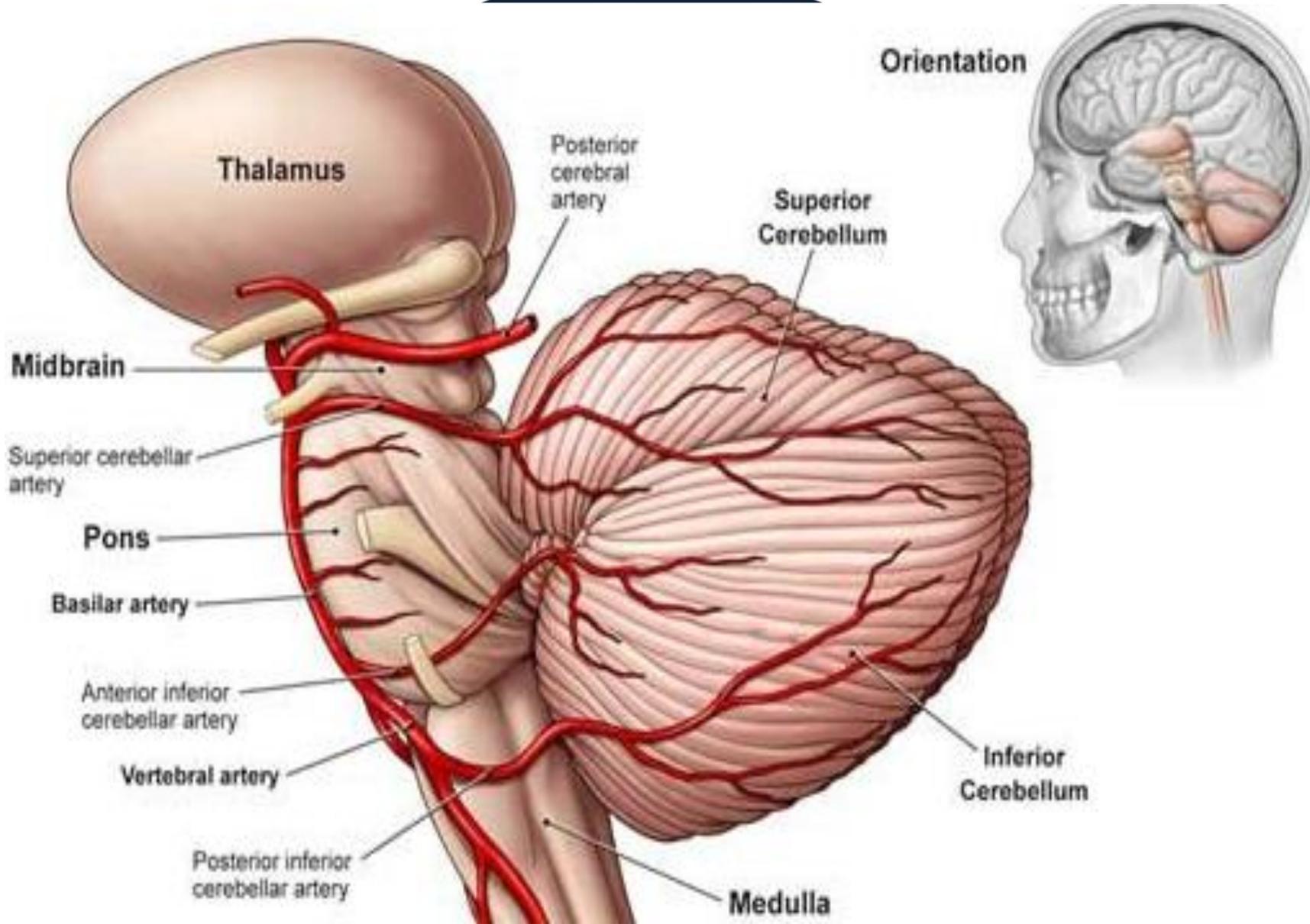
- Branch of the **vertebral artery**.
- It supplies the **posterior part of the inferior surface** and the **inferior cerebellar peduncle**.

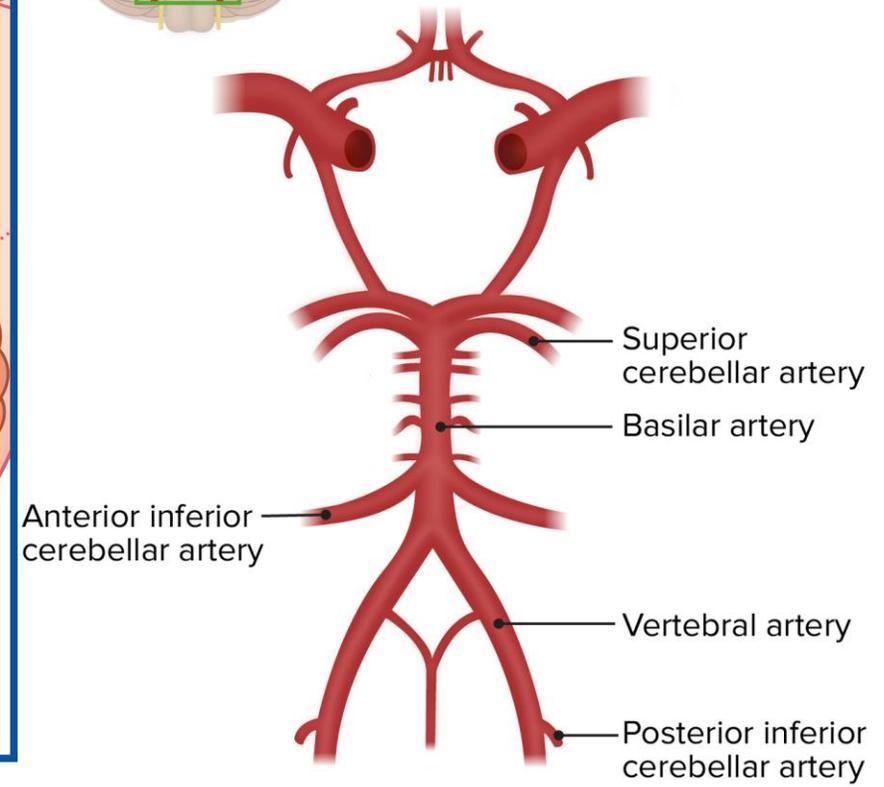
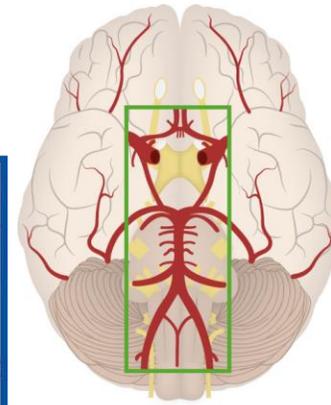
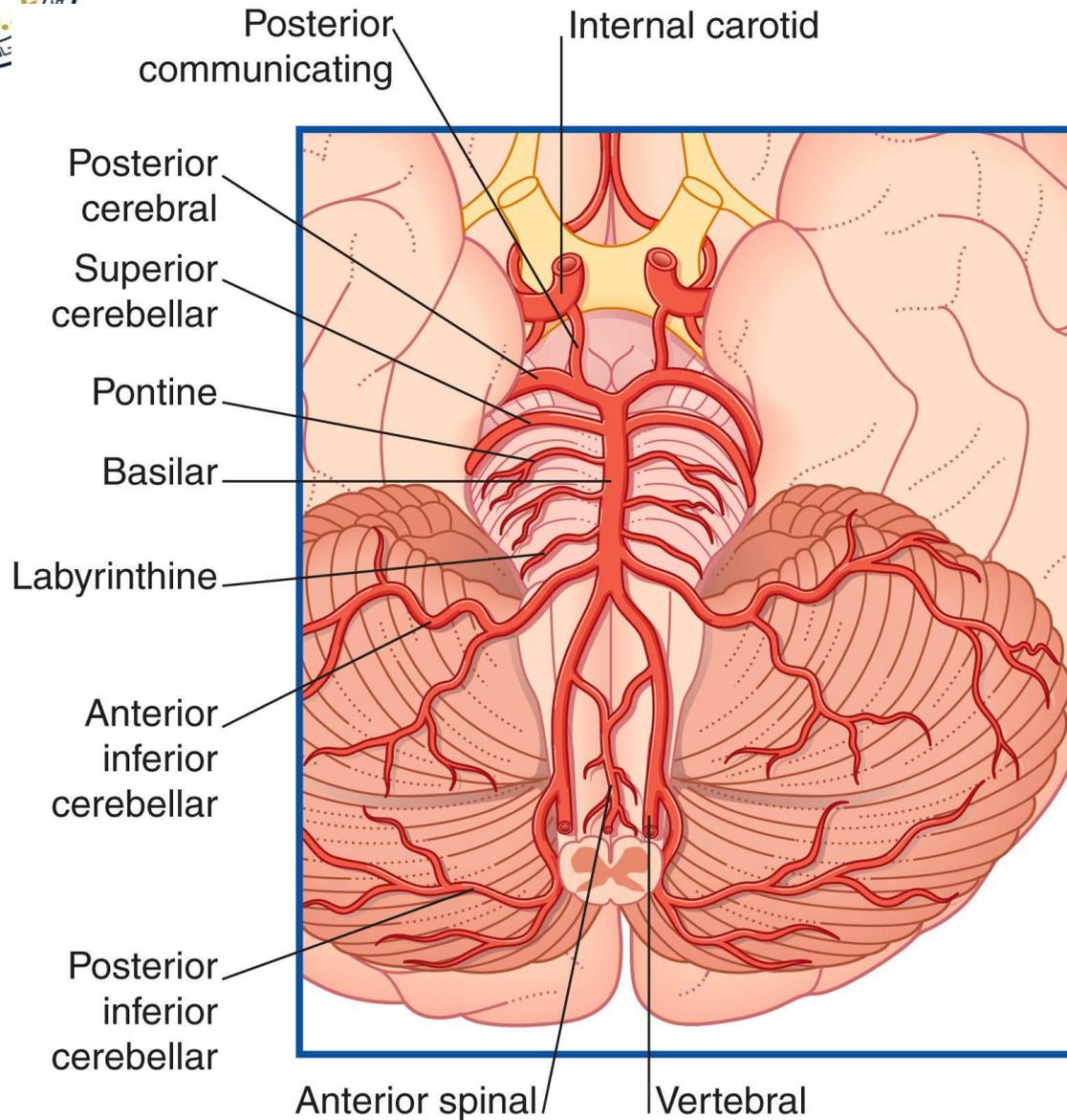
احفظه زي اسمك بيحي سؤال
Written على بعضه أو
MCQ

SAQ : Describe arterial supply of the cerebellum ?









Quiz

1. Superior cerebellar artery arises from
- a. Vertebral
 - b. Basilar
 - c. Internal iliac
 - d. External iliac
 - e. Subclavian

وممكن يسألك عن الـ AICA أو الـ PICA

Answer: b



Quiz

2. **Superior cerebellar peduncle** connects cerebellum with

a. Cerebrum

b. Midbrain

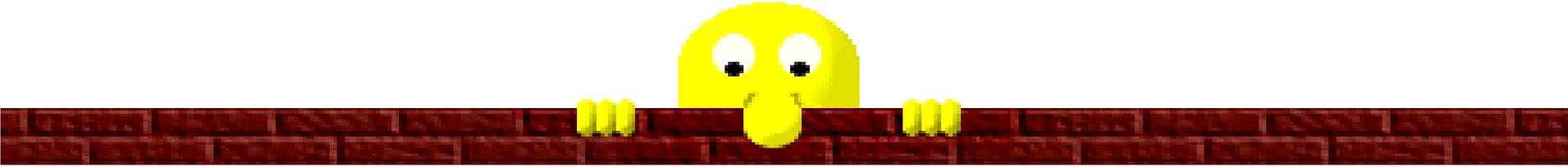
c. Pons

d. Medulla

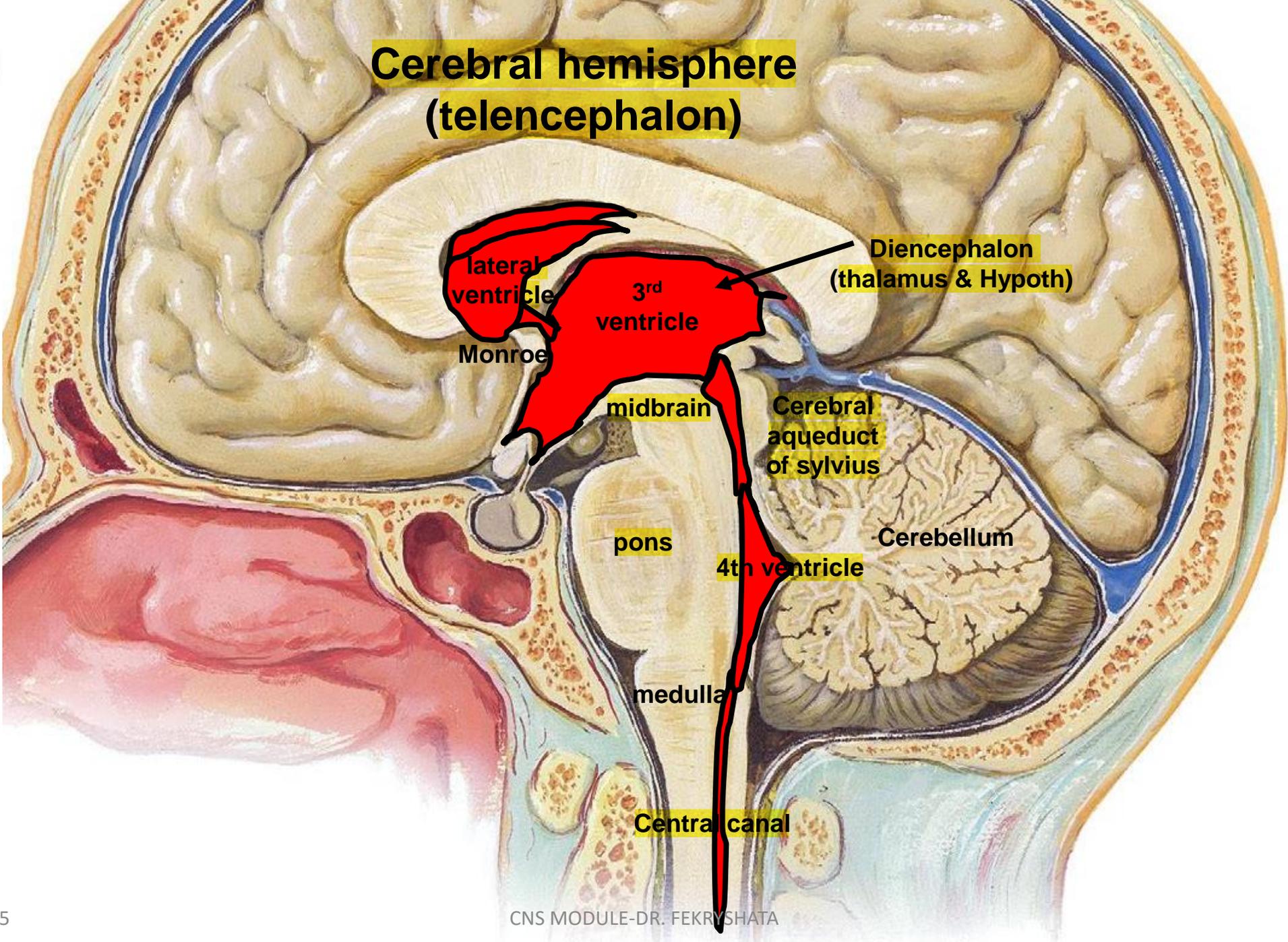
e. Spinal cord

ويمكن يسألك عن الmiddle أو الinferior

Answer: b



4th ventricle



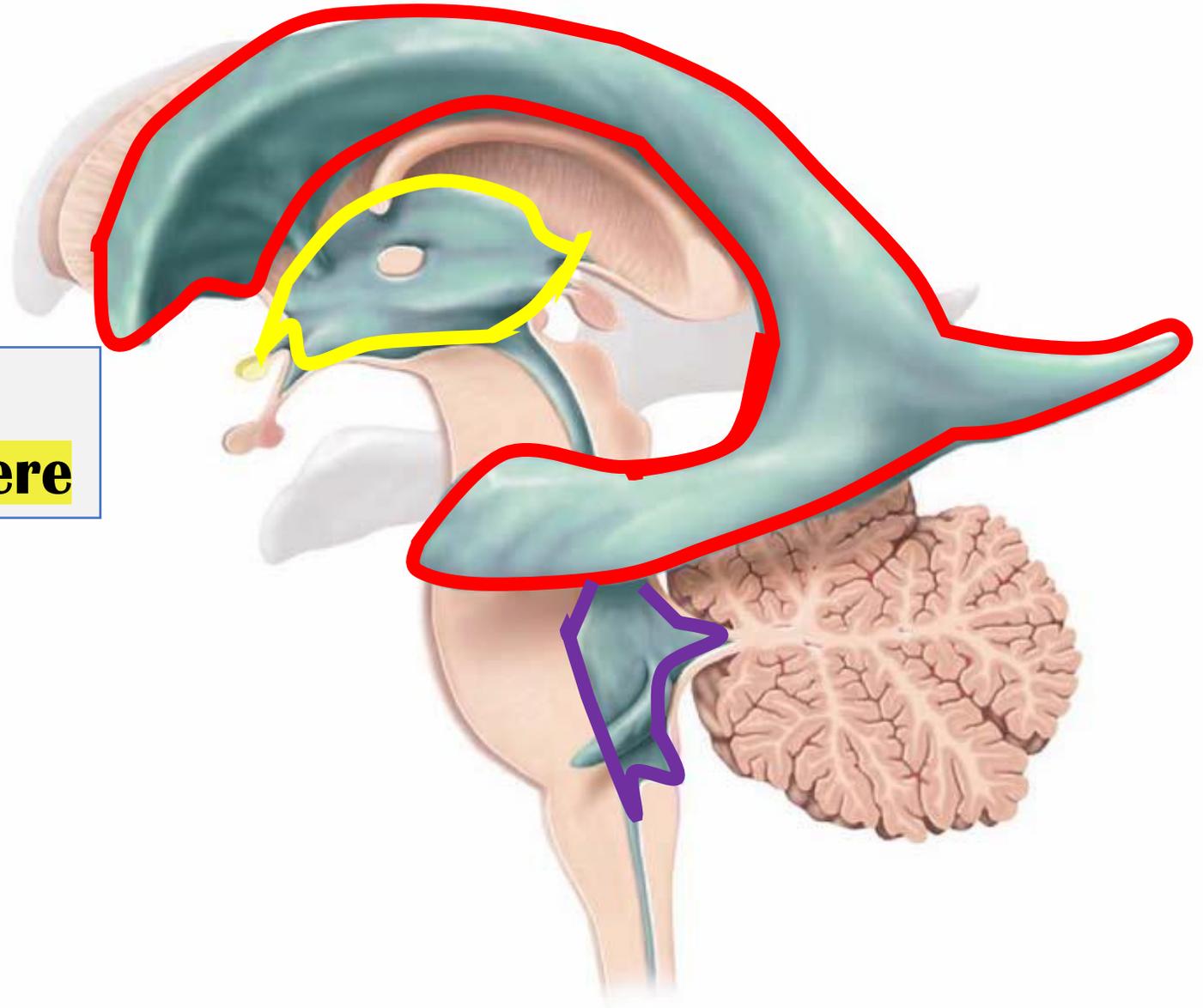
Ventricular system

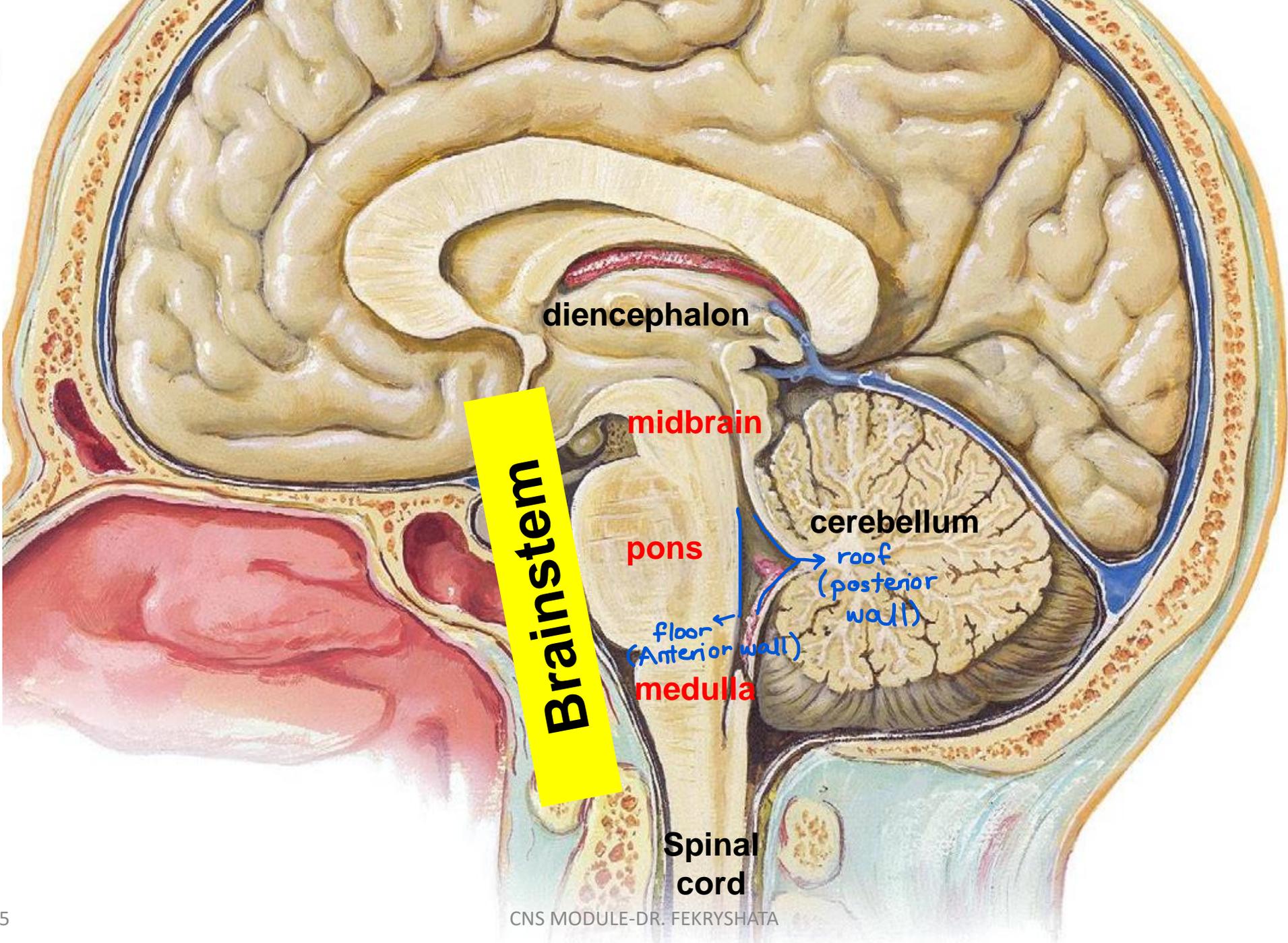
Pathway of CSF

Lateral ventricle:
Cavity of the **Cerebral Hemisphere**

3rd ventricle:
Cavity of the **Diencephalon**

4th ventricle:
Cavity of the **Hindbrain**





diencephalon

midbrain

pons

medulla

cerebellum

roof
(posterior
wall)

floor
(Anterior wall)

Spinal
cord

CNS MODULE-DR. FEKRYSHATA

دايما بييجي في الامتحان وخصوصا ال floor

Boundaries of the 4th ventricle

مكتوبة كدا في كتاب السنة اللي فاتت
فضفتها للي حابب يطلع عليها

Boundaries of the 4th ventricle:

A. Lateral borders:

- ☒ **Superiorly:** the superior cerebellar peduncle.
- ☒ **Inferiorly:** the inferior cerebellar peduncle and the gracile and cuneate tubercles.
- ☒ **In the middle:** the lateral angle forming the lateral recess.

B. Roof (posterior wall):

- ☒ **Superiorly:** superior medullary velum connecting the two superior cerebellar peduncles.
- ☒ **Inferiorly:** inferior medullary velum connecting the two inferior cerebellar peduncles.
- ☒ **In the middle:** the cerebellum.

C. Floor (anterior wall):

- ☒ The floor is divided into two similar halves by the **median sulcus**.
- ☒ It is divided by the **stria medullaris** into upper pontine part & lower medullary part:

1. Upper pontine part: contains the following from the medial to the lateral side:

- **Medial eminence:** on each side of the median sulcus. The **facial colliculus** is a small swelling at the lower end of the medial eminence and is produced by the abducent nucleus and the encircling facial nerve fibers.
- **Sulcus limitans (superior fovea):** contains a pigmented area called **locus ceruleus** at its upper end, which secretes noradrenaline.
- **Vestibular area:** overlying the superior and lateral vestibular nuclei.

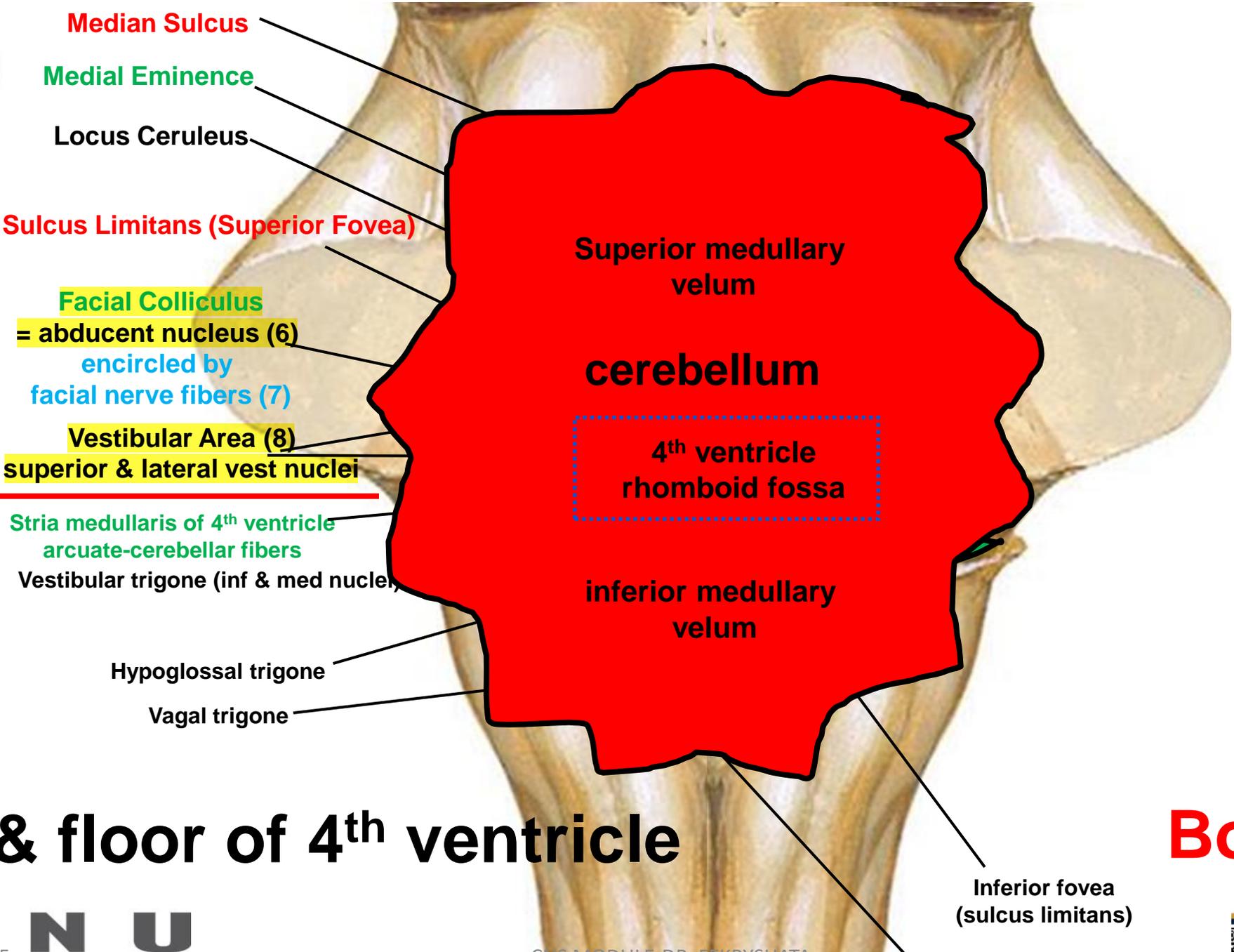
2. Lower medullary part: contains:

- **Sulcus limitans dividing the medullary part into 3 trigones:**
 - a. **Hypoglossal trigone:** medial, overlying the hypoglossal nucleus.
 - b. **Vagal trigone:** middle, overlying the dorsal motor nucleus of the vagus.
 - c. **Vestibular trigone:** formed by the medial & inferior vestibular nuclei.
- **Area postrema:** is a narrow area at the obex between the vagal trigone and the margin of the ventricle. It is the vomiting center.

3. **Intermediate zone:** Formed by the stria medullaris of the 4th ventricle. These transverse fibers are arcuatocerebellar fibers connecting the arcuate nucleus with the cerebellum.

SAQ : Describe rhomboid fossa (floor of 4th ventricle) ? مهم جدا !!

SAQ : Describe roof of 4th ventricle ?



Median Sulcus

Medial Eminence

Locus Ceruleus

Sulcus Limitans (Superior Fovea)

Facial Colliculus

= abducent nucleus (6)

encircled by facial nerve fibers (7)

Vestibular Area (8)

superior & lateral vest nuclei

Stria medullaris of 4th ventricle
arcuate-cerebellar fibers

Vestibular trigone (inf & med nuclei)

Hypoglossal trigone

Vagal trigone

Superior medullary velum

cerebellum

4th ventricle
rhomboid fossa

inferior medullary velum

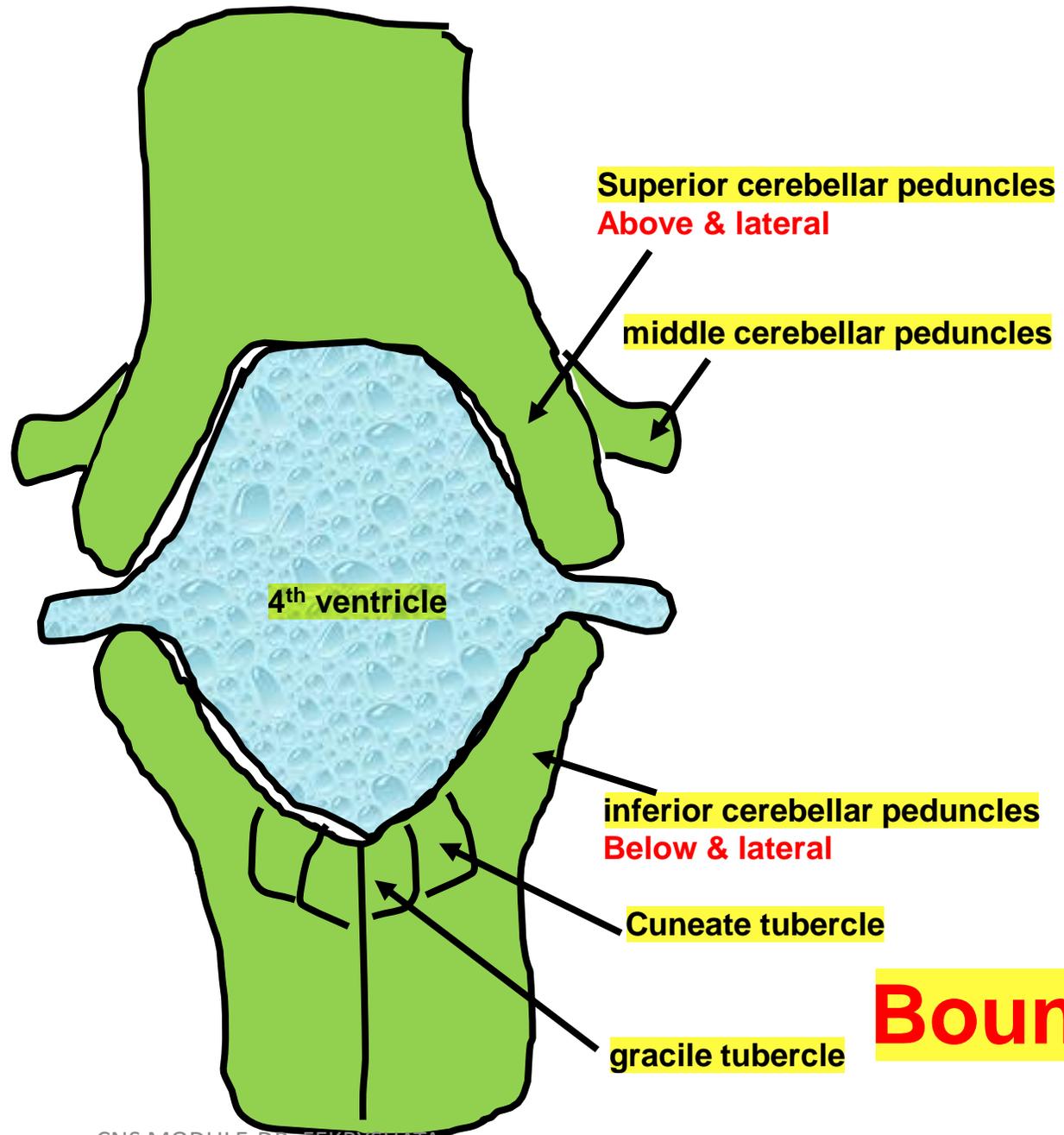
Inferior fovea (sulcus limitans)

Area postrema (obex- vomiting center)

Boundaries

Roof & floor of 4th ventricle





Lateral borders

Boundaries

Cranial nerve nuclei in the floor of the 4th ventricle

مهم جدا جدا

- A. **Abducent nucleus**: opposite the **facial colliculus** in the pons.
- B. **Hypoglossal nucleus**: in the **hypoglossal trigone** in the medulla.
- C. **Dorsal motor nucleus of the vagus**: in the **vagal trigone** in the medulla.
- D. **Vestibular nuclei**: in the **vestibular trigone** in both the pons and medulla.

SAQ مهم جداا جدا : Enumerate cranial nerve nuclei in the floor of 4th ventricle?

A/ Cranial nerves nucleus of 6 - 8 - 10 - 12 كافي تكتب





Choroid plexus of 4th ventricle

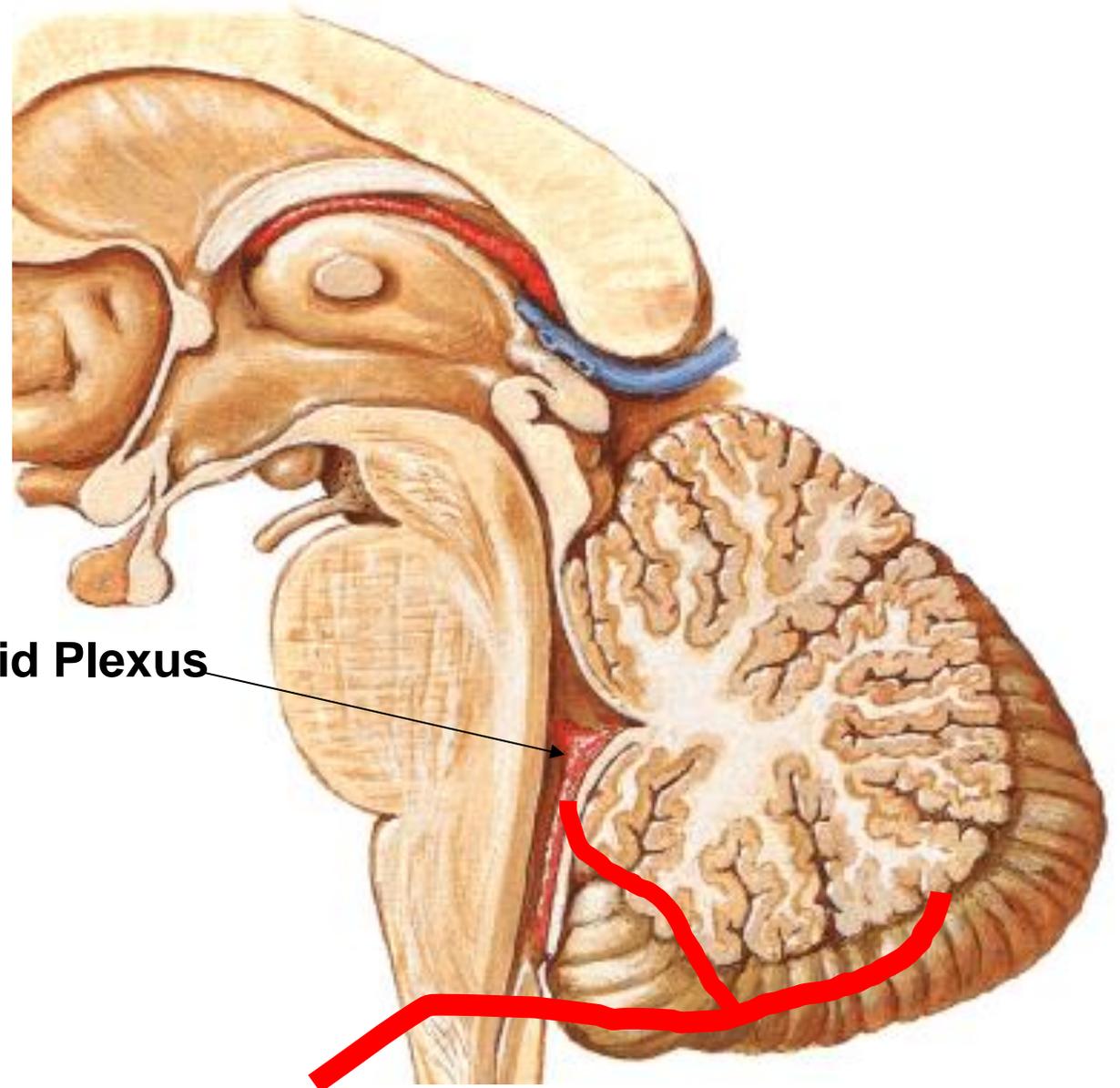


Choroid plexus

Site: inferior medullary velum

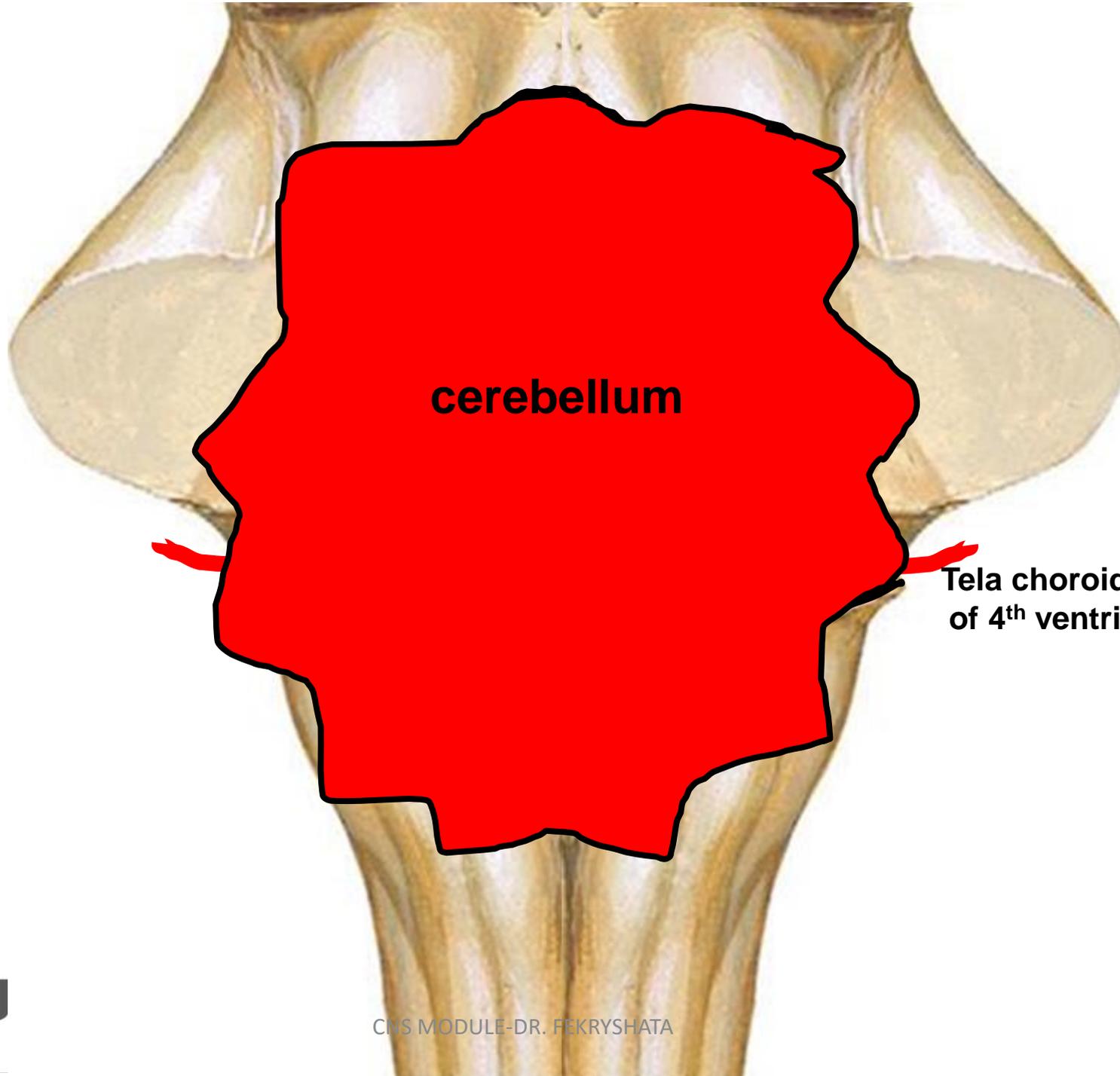
Shape: T-shaped plexus. It has a stem and 2 lateral arms. Each arm extends laterally into the lateral recess

Arterial supply: branch from PICA



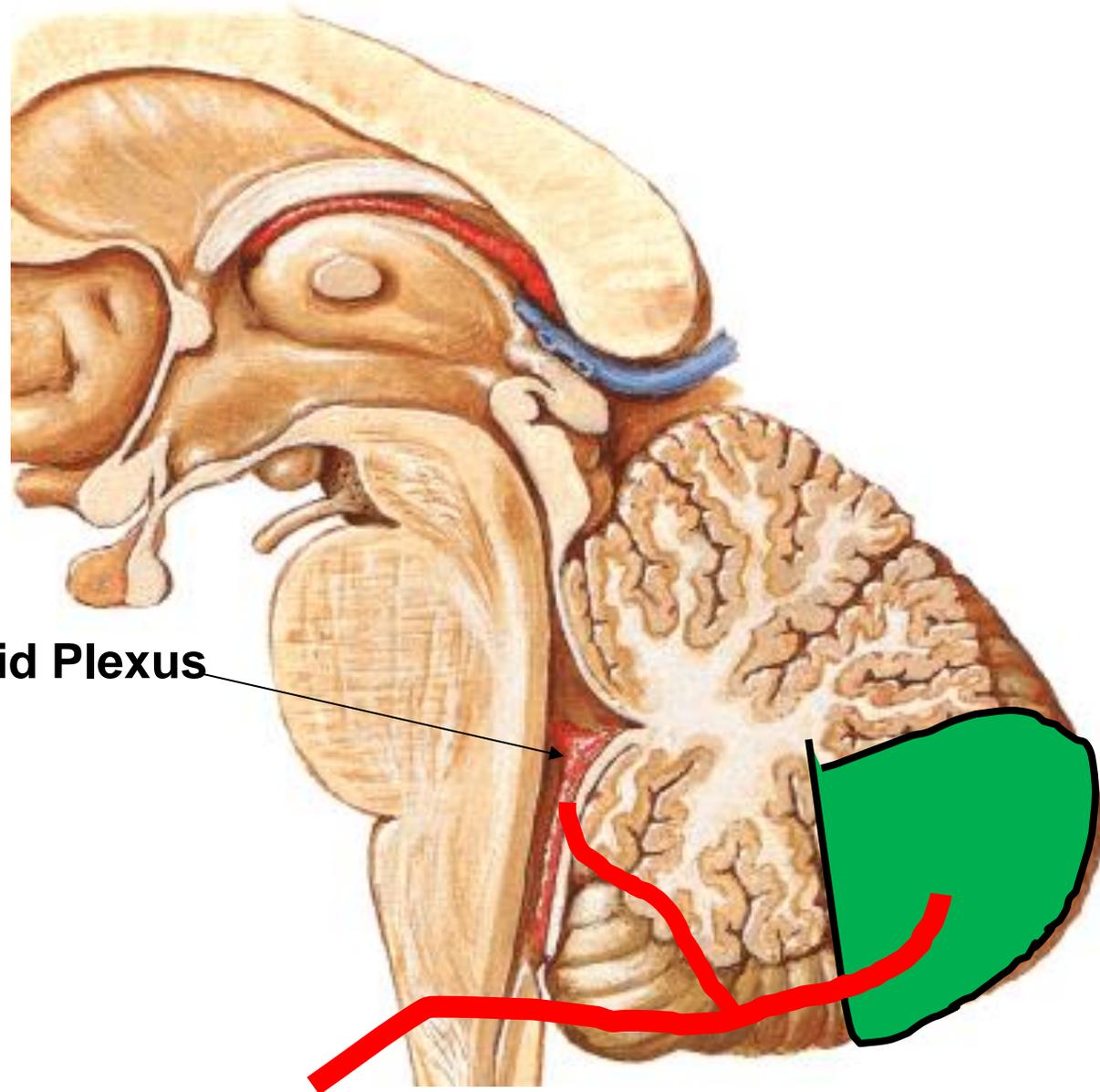
Choroid Plexus

Posterior inferior cerebellar artery (PICA)



cerebellum

**Tela choroidae
of 4th ventricle**



Choroid Plexus

Posterior inferior cerebellar artery (PICA)

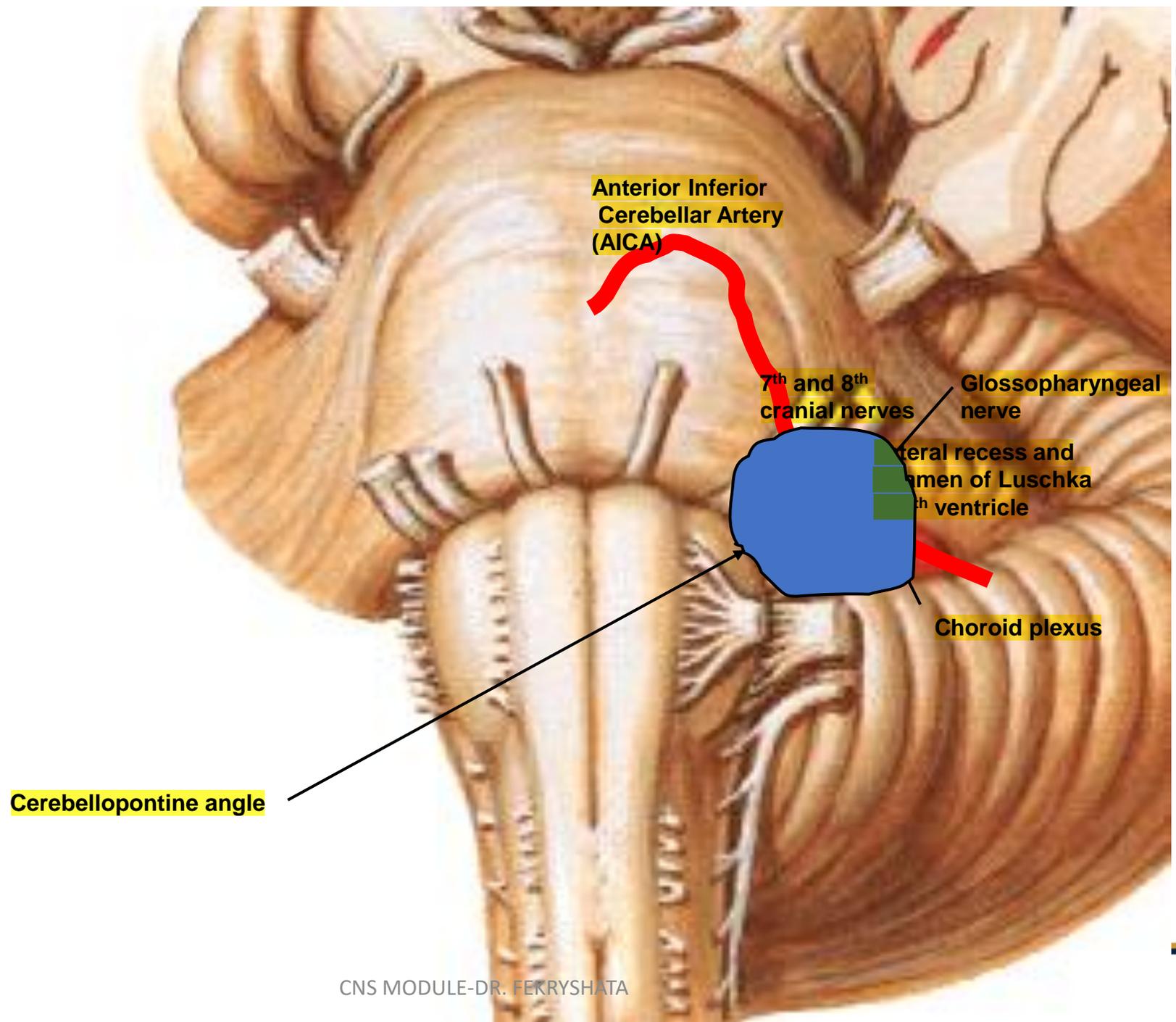




بتيجي في الامتحان سؤال SAQ

Cerebellopontine angle



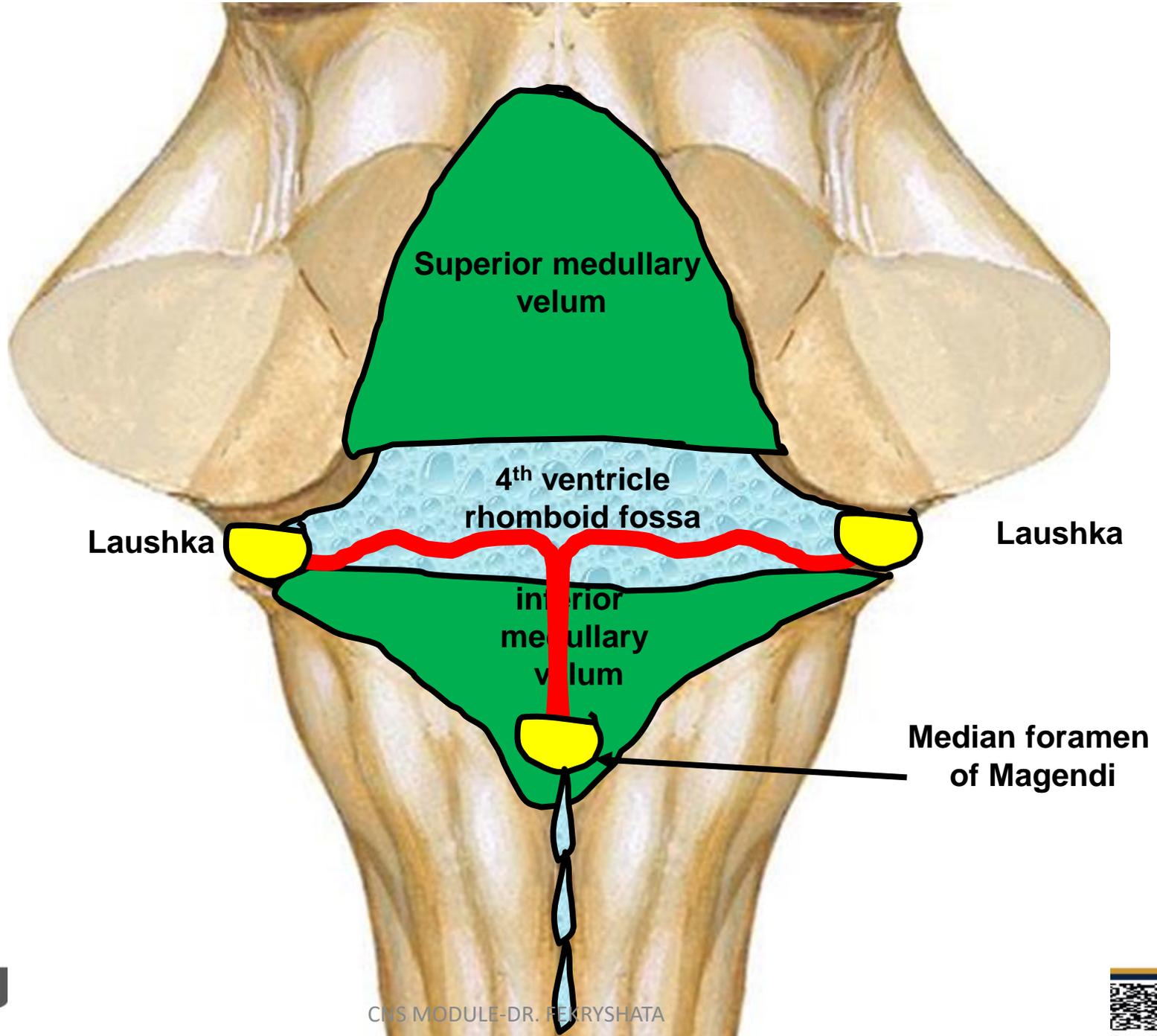


Foramina

Median foramen of Magenddie:
in the inferior medullary velum

Two lateral foramina of Laushka:
in the lateral angle

They connect the
4th ventricle with
the subarachnoid
space





الجزئية دي MCQ

Communication

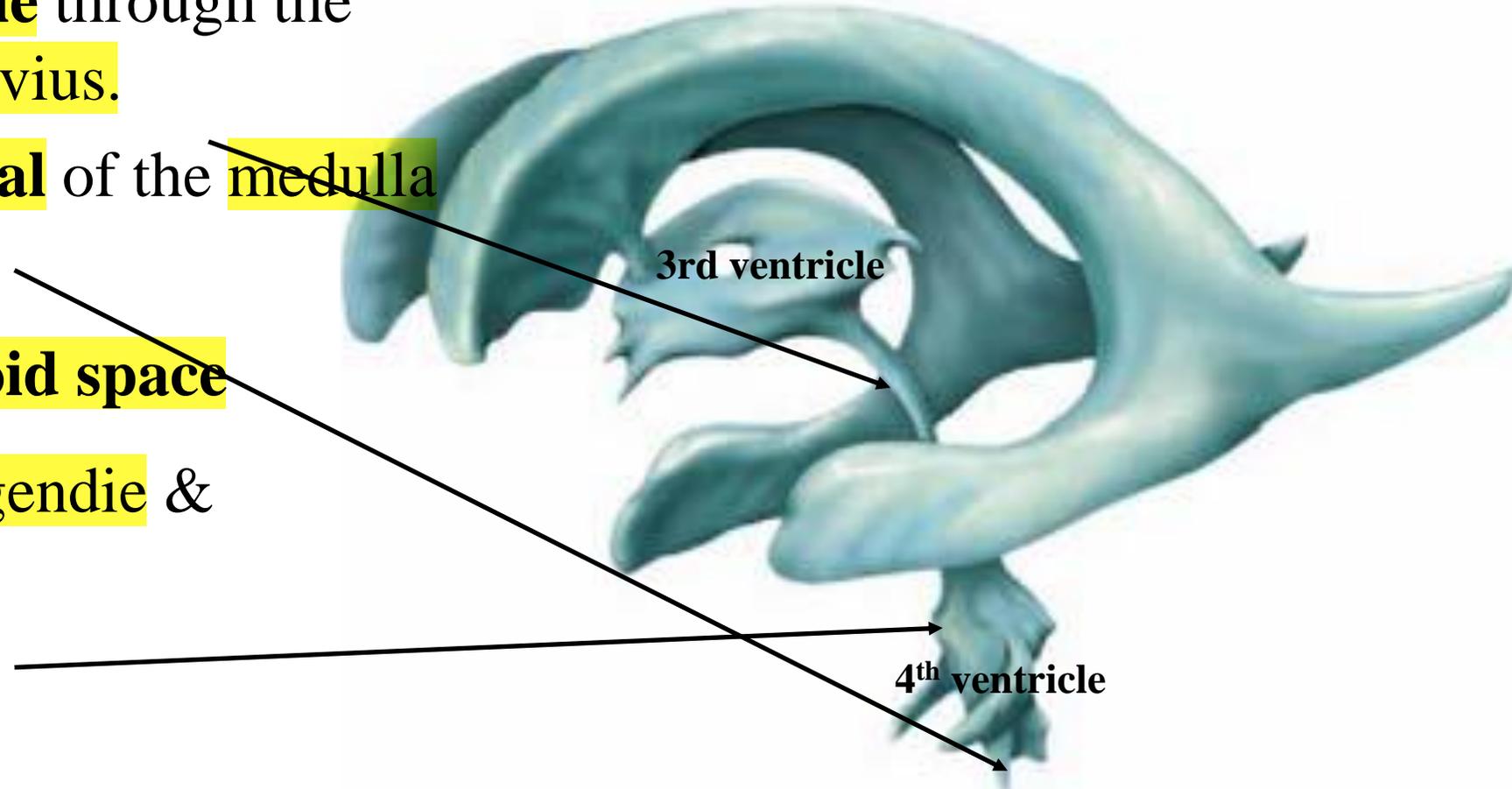


Communication

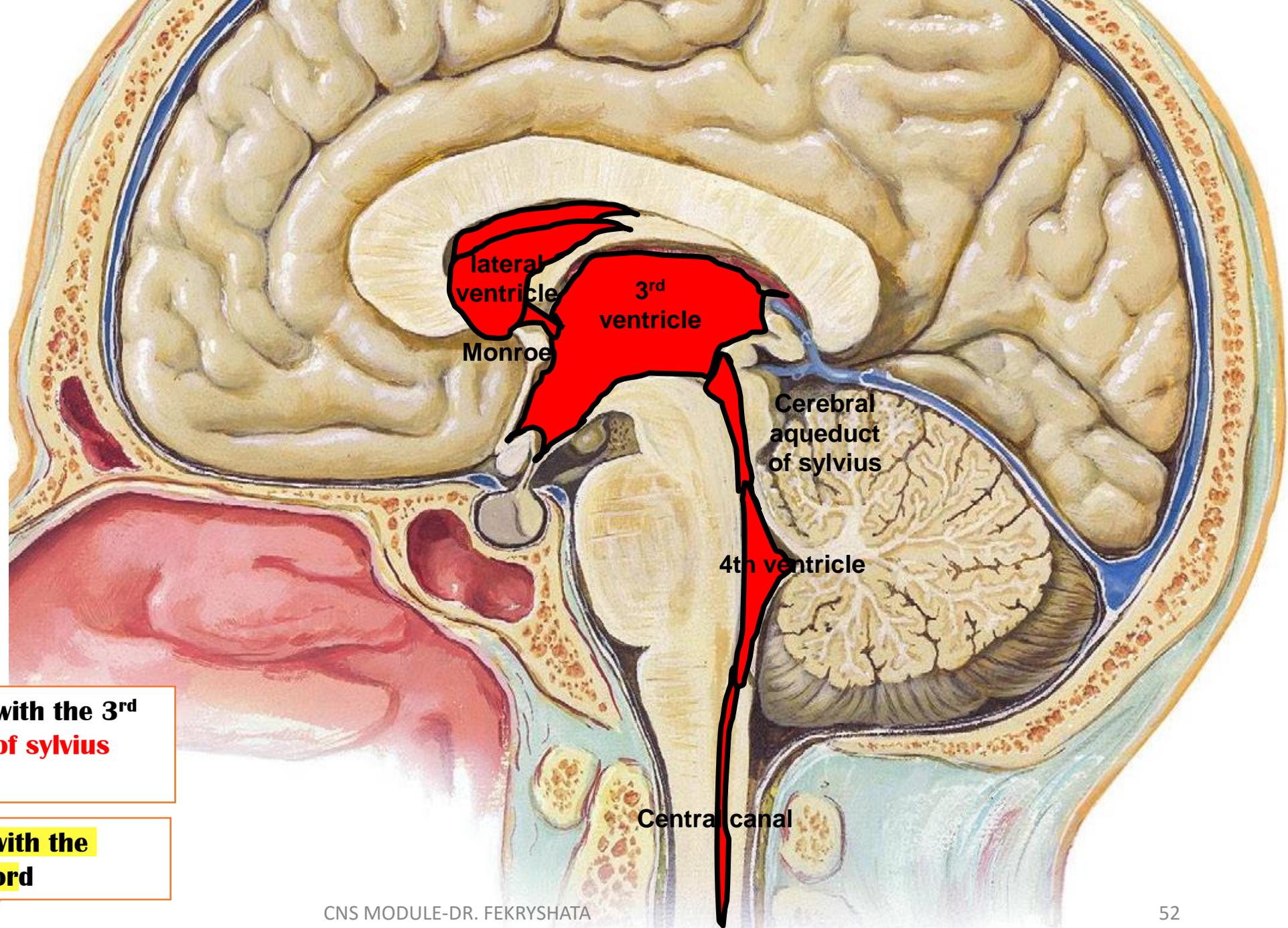
A. With the **3rd ventricle** through the cerebral aqueduct of Sylvius.

B. With the **central canal** of the **medulla** and spinal cord.

C. With the **subarachnoid space** through **foramen of Magendie** & **foramina of Luschka**.



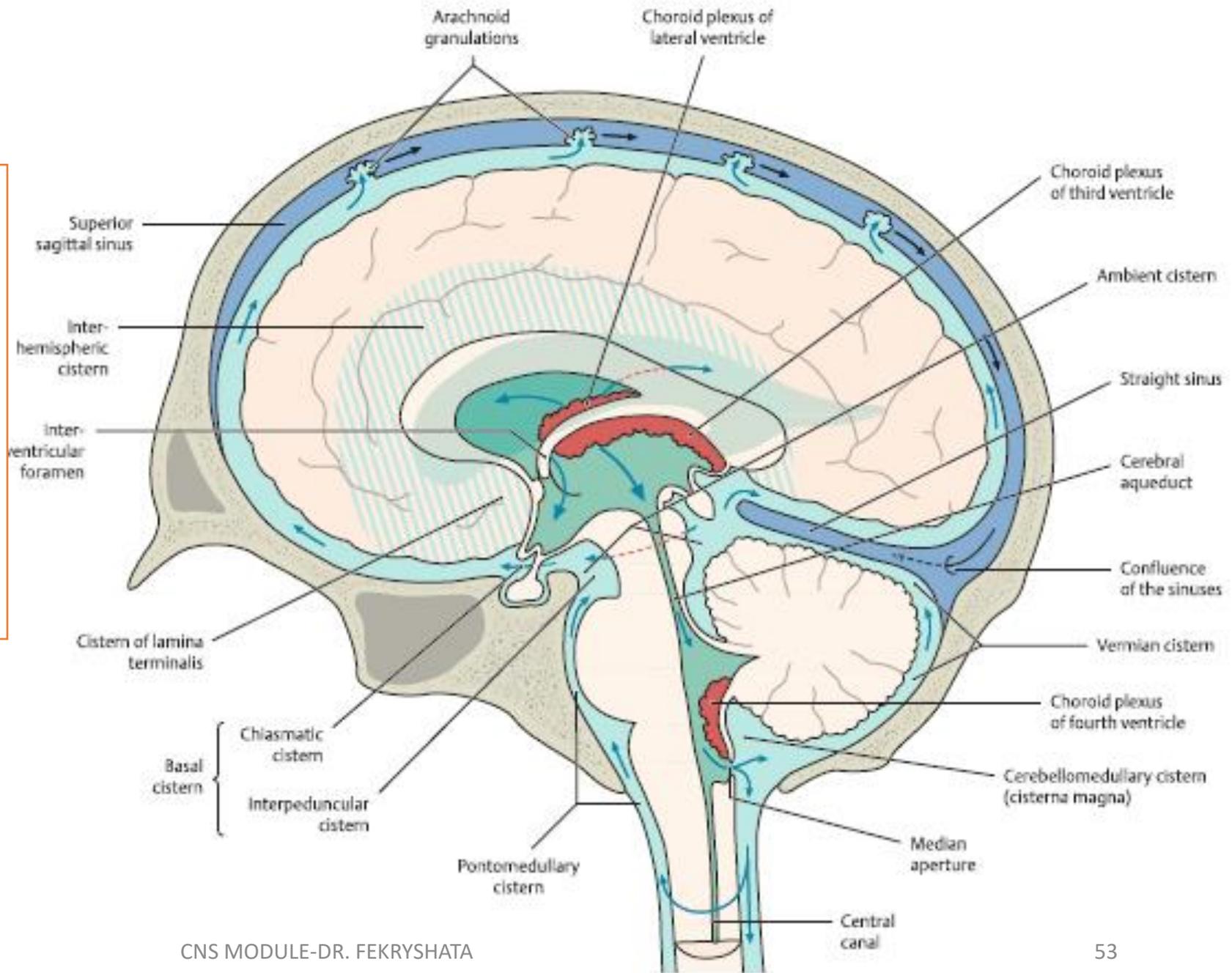
Communication

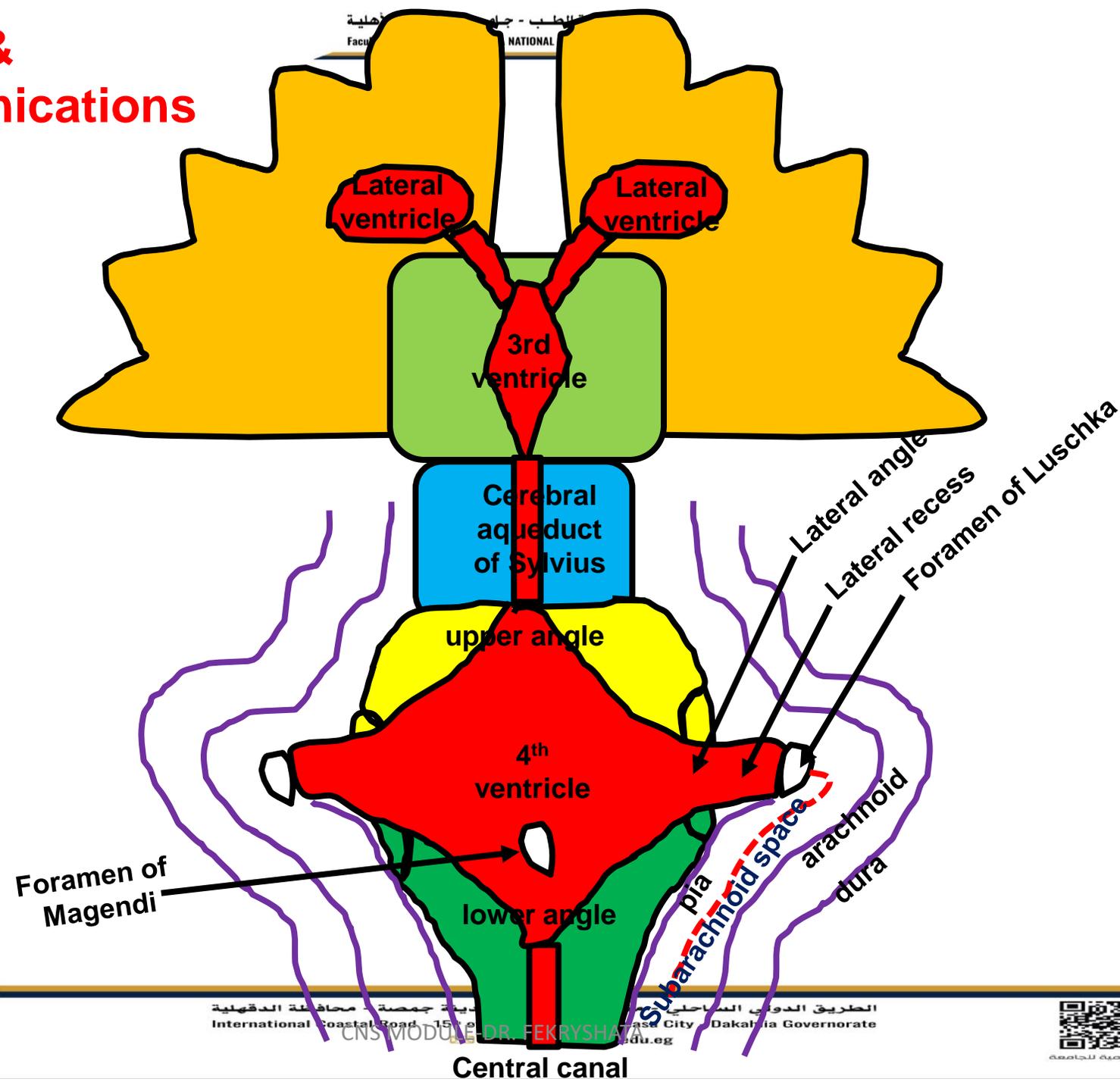


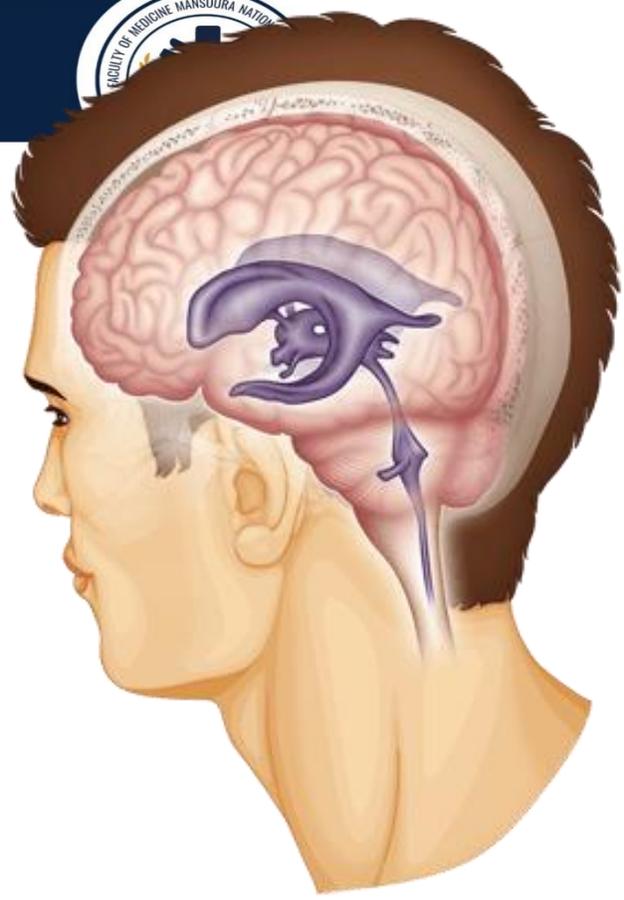
4th ventricle communicates with the 3rd through Cerebral aqueduct of sylvius

4th ventricle communicates with the central canal of the spinal cord

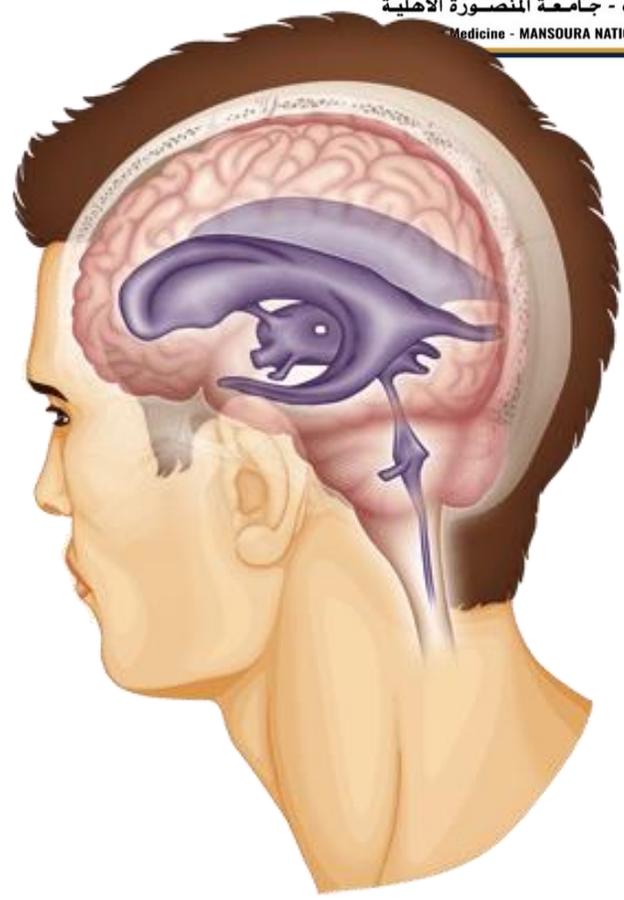
4th ventricle communicates with the subarachnoid space through Median foramen of Magendie and Two lateral foramen of Laushka





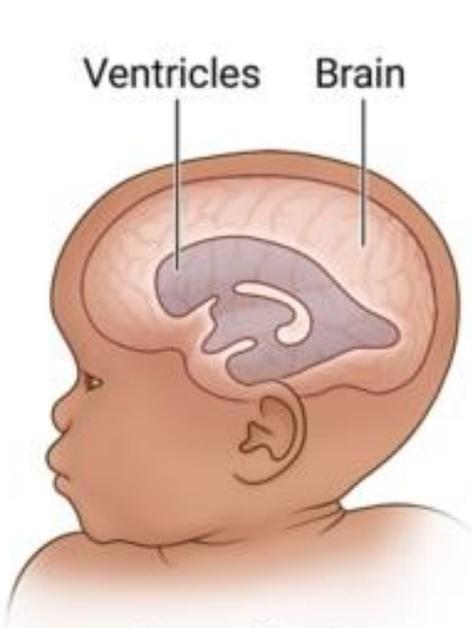


Normal Ventricles

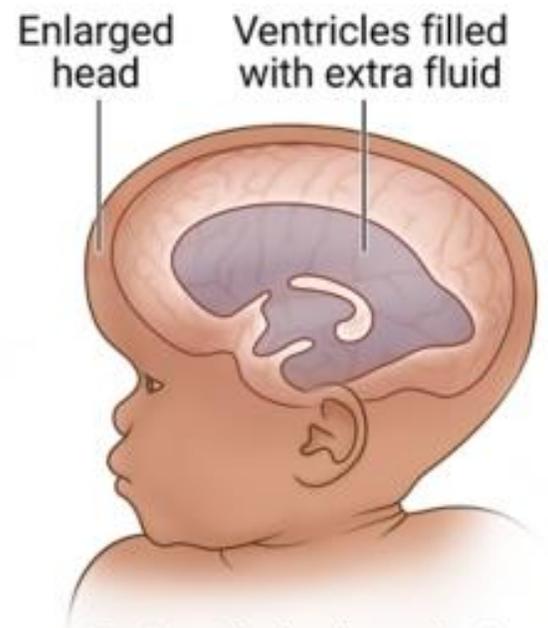


Hydrocephalic Ventricles

© Sophysa – Illustration: Philippe Plateaux



Normal brain



Brain with hydrocephalus

Quiz

1. **Foramena of Laushka** connect
 - a. Lateral with 3rd ventricle
 - b. 3rd with 4th ventricles
 - c. 4th ventricle with central canal
 - d. 4th ventricle with subarachnoid space

Answer: d

Quiz

- 2. Foramen of Magendi connects**
- a. Lateral with 3rd ventricle**
 - b. 3rd with 4th ventricles**
 - c. 4th ventricle with central canal**
 - d. 4th ventricle with subarachnoid space**

Answer: d

References for further readings

- Oxford Handbook of Clinical Medicine (3rd edition).
- Gray's anatomy for students
- The Clinical Practice Of Neurological and Neurosurgical Nursing Fourth Edition.

