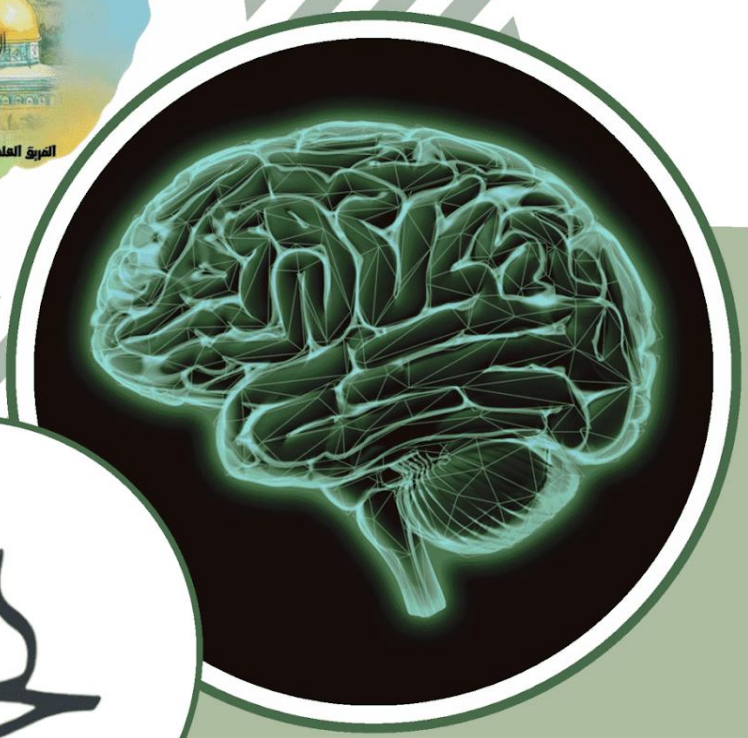
CNS ANATOMY

DOCTOR NOTES



LECTURE NO. 7

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7.1 Revision:

Coronal and Horizontal Sections:

Figure 1 represents a **coronal section** (the only required coronal section in the exam).

The pointed structure here represents:
(1)The body of the corpus callosum,
(2)The body of the lateral ventricle (in red),
(3)The third ventricle (in yellow),
(4)Mammillary bodies (in green).
We can also see the (5) parietal lobe and (6) temporal lobe.

Since the coronal section is taken from the parietal lobe, we are cutting through half of the corpus callosum (its body).

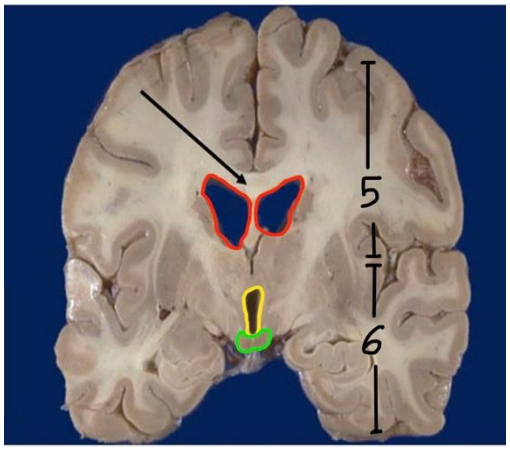


Figure (1)

Figure 2 represents a **horizontal section.**
The red structure represents (1)**the head** of the caudate nucleus, as this is the anterior horn of the lateral ventricle.
The blue structure represents (2)the posterior horn of the lateral ventricle.
Between them, (3)the third ventricle is seen in yellow.
(4)The lentiform nucleus is in green (its lateral part is the putamen, and the medial part is the globus pallidus).
In white, a large white matter structure, (5)the fornix, is visible.
The pointed black structure is (6)the interventricular foramen (IVF), located behind the anterior column of the fornix.
The orange structure is (7)the insula.
Between the insula and the lentiform nucleus lies (8)the claustrum.
(9)The anterior limb of the internal capsule is seen in white matter.
(10)The genu of the internal capsule.
(11)The posterior limb.
(12)The external capsule..

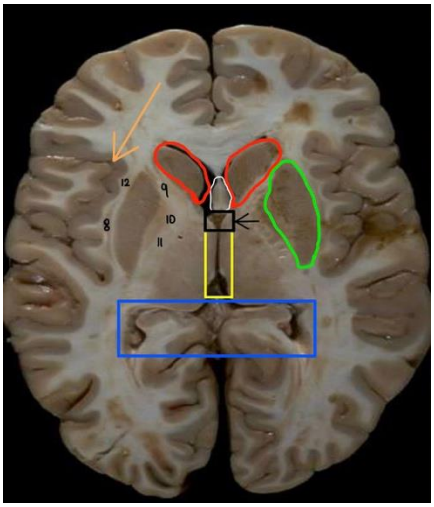


Figure (2)

Note: In the horizontal section, four parts of the internal capsule can be seen.

MCQs:.

1. cerebrospinal fluid communicates with the subarachnoid space via the……..
a. 4th ventricle
b. 3rd ventricle
c. subarachnoid granulations
d. choroids plexus
e. tela choroidia

1. (A) By one Magendie and two Luschka foramina on the inferior roof

2. Regarding the speech centers, chose the correct answer
a. It is supplied by Anterior cerebral artery
b. Broca's area is posterior
c. Wernicke's area controls motor response
d. Damage to Broca's area produces motor aphasia
e. Damage to Wernicke's area produces expressive aphasia

2. (D)

3- One of the following is not sharing in the anterior wall of the third ventricle:
A- anterior commissure
B- optic chiasma
C- lamina terminalis
D- Anterior column of the fornix
E- None of the above

3. (B) The optic chiasm is located on the floor of the third ventricle

7.2 Cerebellum Overview:

The cerebellum (the "little brain") is located in the posterior cranial fossa. A fold called **the tentorium cerebelli** separates it from the cerebrum.

It has two hemispheres (right and left), connected by a very important structure called **the vermis**. The surface has folds that resemble cerebral sulci and gyri, called **folia**, which are transverse striations, each functioning like a gyrus.

The cerebellum has **two surfaces**: superior and inferior.

Figure (3) shows the superior surface, which has **two notches**:
The anterior notch contains the midbrain, hence it's called the midbrain notch.
The posterior notch contains a dural fold called the falx cerebelli, which separates the two cerebellar hemispheres. It is anchored to the internal occipital protuberance and internal occipital crest.

Figure (4) represents the inferior surface.

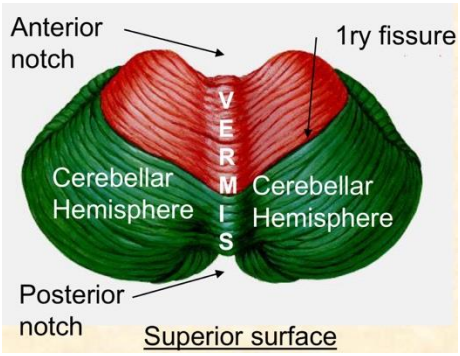


Figure (3)

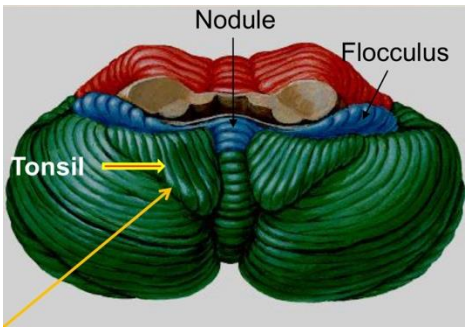


Figure (4)

7.3 Cerebellar Fissures and Lobes:

Fissures are deep sulci. The cerebrum has a lateral fissure (with four parts), including a stem on the inferior surface.

The superior surface of the cerebellum has:
The primary fissure, separating:
The anterior lobe (red, 1/3) and
The posterior lobe (green, 2/3).
(See Figure 5)

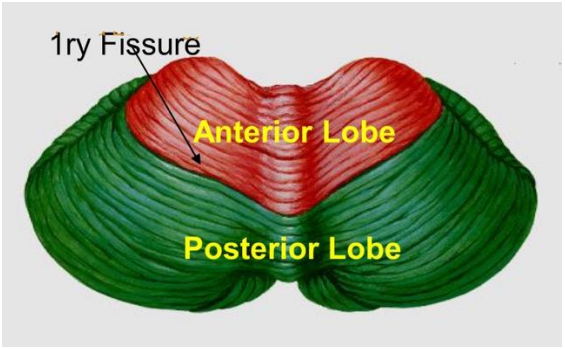


Figure (5)

The horizontal fissure divides the cerebellum into superior and inferior parts.

The vermis on the superior surface is called the **superior vermis,** on the inferior surface it's the **inferior vermis**.

Figure (6) shows **the flocculonodular lobe** (in blue), located at the anterior part of the inferior vermis. The **flocculus** and **paraflocculus** (butterfly-wing-like structures) are connected to the nodulus. This lobe is only visible from the inferior surface.

So, the cerebellum has **three lobes**.

The posterolateral fissure (seen on the inferior surface) separates the flocculonodular lobe from the rest of the cerebellum.

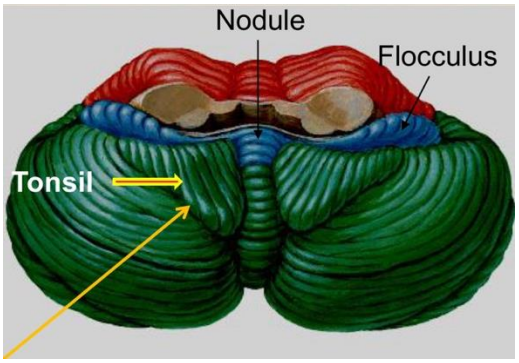


Figure (6)

The yellow arrow in Figure (6) points to one of the **cerebellar tonsils**, located on the inferior surface. These tonsils lie near the foramen magnum, touching the medulla oblongata.
An increase in intracranial pressure can cause tonsillar herniation, compressing medullary centers.

7.4 Unfolded Cerebellum:

Figure (7) shows the unfolded cerebellum (flattened to resemble a sheet). Here, the superior surface faces anteriorly and the inferior surface posteriorly.

This view is used for the physiological classification of the cerebellum.

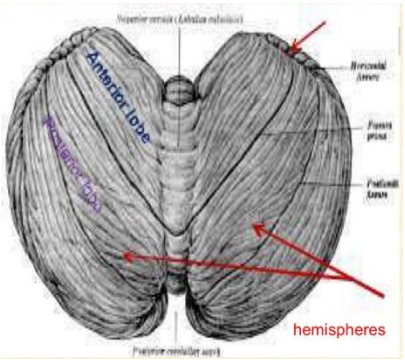


Figure (7)

Figure (8) shows:
The primary fissure
The anterior and posterior lobes
The gray structure represents the flocculonodular lobe
The horizontal and posterior fissures.

A structure called the **paravermis**, located 1 cm lateral to the vermis, contains **deep cerebellar nuclei** arranged from lateral to medial as follows:
Dentate nucleus (lateral cerebellum), Interposed nuclei (**E**mboliform and **G**lobose, paravermis), **F**astigial nucleus (vermis).

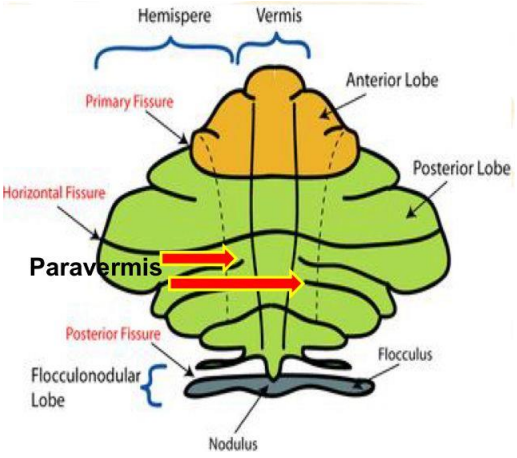


Figure (8)

Mnemonic: Don't **E**at **G**reasy **F**ood

-Each region of the cerebellum is associated with a specific nucleus.

7.5 Functions of the Cerebellum:

1. Balance
2. Coordination (unconscious proprioception)
3. Motor regulation (with basal nuclei for sequencing and anticipation of movement)
Motor signals flow from area 4 (with support from area 6).
4. The cerebellum handles timing, amplitude, and distance of movement; the basal ganglia manage sequencing and preparation.

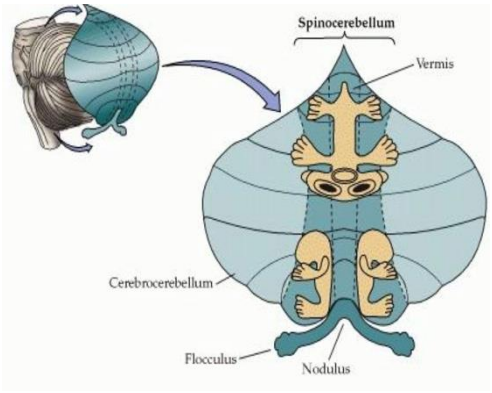


Figure (9)

Figure (9) shows muscle representation: axial muscles on the vermis, limb muscles (distal) on the paravermis.

7.6 Cerebellar Peduncles:

Figure (10) shows the superior, middle, and inferior cerebellar peduncles. Above, we see four colliculi.

The cerebral aqueduct is in the midbrain above; below it is the spinal canal.

-Sub-lobular classifications of the cerebellum are not included in the exam material and the doctor didn't explain it, so skip these slides 11-15.

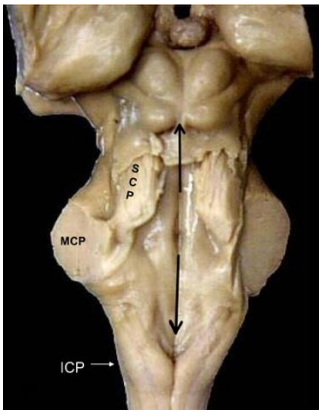


Figure (10)

-Figure (11) represents the structure of the cerebellum that we already have explained. Make sure you identify them all since there are questions in the lab section of the exam will come from this figure.

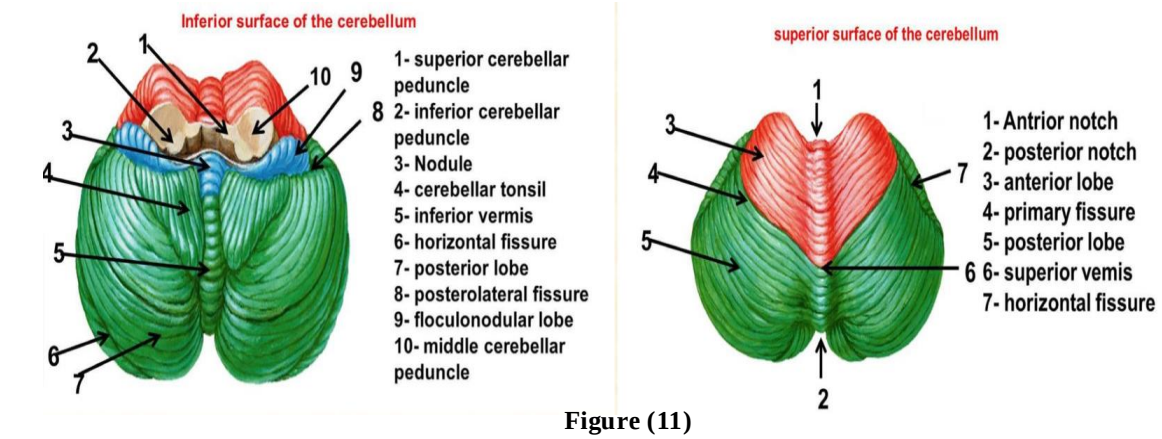


Figure (11)

7.7 Histology of the Cerebellum:

The cerebellar cortex consists of gray matter (outer) and white matter (inner).
Unlike the cerebral cortex (6 layers), the cerebellar cortex has **3 layers**:
Outer molecular layer, middle Purkinje cell layer, inner granular layer
See Figure (12)

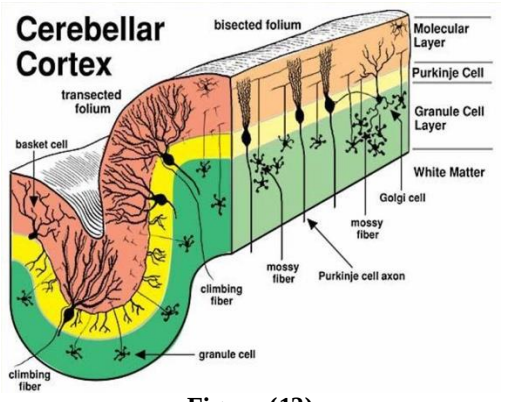


Figure (12)

The Purkinje layer is the most important since **it sends all efferent signals** and receives input from climbing fibers and mossy fibers.

Climbing fibers come from the olivocerebellar tract and directly stimulate Purkinje cells (hence the name they skip a layer(granular layer)).

Mossy fibers stimulate granule cells, which then activate Purkinje cells.

Both fibers ultimately stimulate deep cerebellar nuclei (dentate, interposed and fastigial), which relay signals to the brainstem, spinal cord, or cerebral cortex.

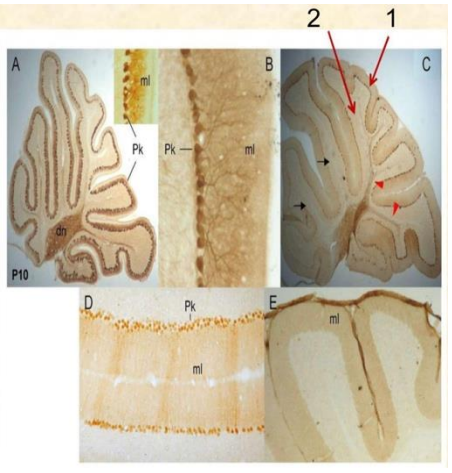


Figure (13)

7.8 Functional Subdivisions:

1. Flocculonodular lobe (vestibulocerebellum):

Maintains balance.
Receives signals from the inner ear.
Involved in the vestibulo-ocular reflex (stabilizing vision during movement via medial longitudinal fasciculus, it is the act of looking in the opposite side to the body and the ear while focusing on a specific object).

2. Paleocerebellum (spinocerebellum):

It is responsible for the muscle tone by tracts of the spinal cord that send impulses to the cerebellum. Anterior and posterior spinocerebellar tracts are responsible for the unconscious proprioception.
The circle starts from the spinal cord from the trunk or axial muscles like neck muscles (medial motor system) to be in contact with the fastigial nucleus on the vermis, or from the upper or lower motor or distal muscles (lateral motor system) to be in contact with the interposed nuclei on the paravermis. If the signal comes from the medial motor system, the anterior corticospinal tract that is projected from motor area 4 will send impulses. If the signal comes from the lateral motor system, the lateral corticospinal tract will send the impulses instead.

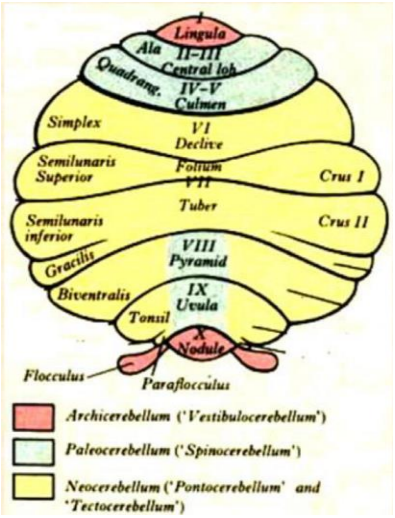


Figure (14)

Related descending tracts:
A. The vestibulospinal tract controls extensor muscles.
B. The rubrospinal tract (red nucleus) controls flexor muscles

3. Neocerebellum (cerebrocerebellum):

Involves the dentate nucleus.

Hence the name (cerebro) it is responsible for many important functions the cortico-ponto-dentato-rubro-thalamo-corticospinal circle is very important for learning new skills, planning, coordination, and timing of movements. Cortico means cerebral cortex (areas 4, 6, 312) sends signals to the pons (hence the name ponto) through the middle cerebellar peduncle from right to left (transverse pontine fibers), then it goes to the cerebellum, specifically the dentate nucleus (dento), then the dentate nucleus sends efferents to the red nucleus (rubro) inside the midbrain through the superior cerebellar peduncle that connects between the midbrain and the cerebellum, then to the thalamus (thalamo), and finally to the cortex (cortico).

Cortico → Pontine → Dentate → Red nucleus → Thalamus → Cortex

-A lesion here will cause intention tremors (when the patient starts moving), timing, onset of movement and planning difficulties.
Intention tremor that is caused by a cerebellar lesion differs from a Parkinson's tremor, since in Parkinson's the patient suffers from resting tremor.

-Slides 26–27 are not included in the exam

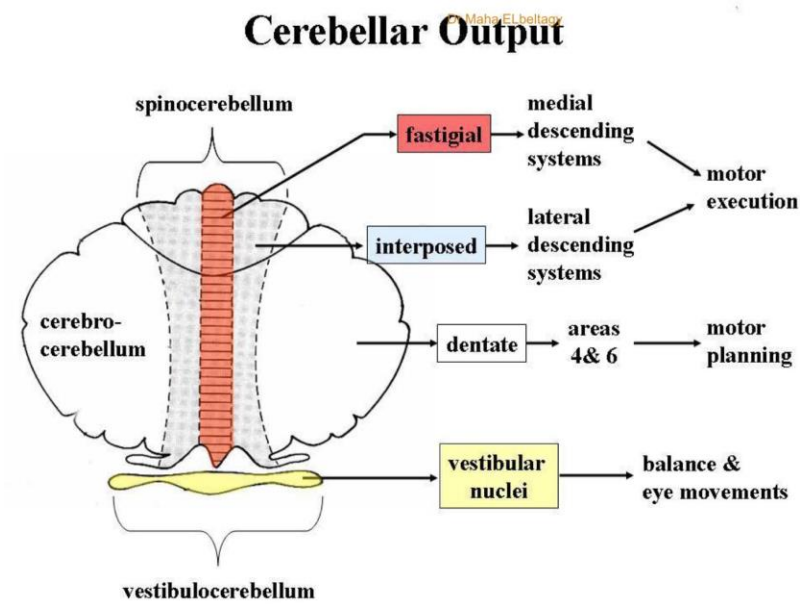


Figure (15): Summary

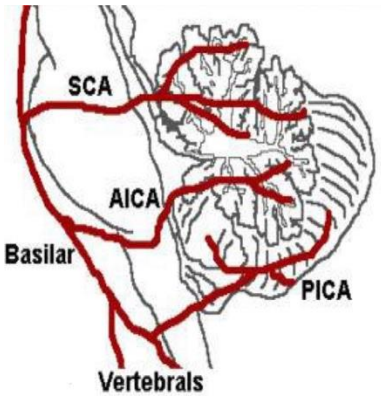
7.9 Cerebellar Blood Supply:

Supplied by **three arteries**:

SCA (Superior Cerebellar Artery) – from basilar artery
AICA (Anterior Inferior Cerebellar Artery) – from basilar artery
PICA (Posterior Inferior Cerebellar Artery) – from vertebral artery; also supplies lateral medulla.

-Slide 29: For your information only, not an exam material.

Figure (16)



7.10 Cerebellar Lesions:

Cause **ataxia** (lack of coordination).
Posterior column lesions can also cause ataxia (seen in gracile and cuneate fasciculi), but differ:
Posterior column ataxia worsens when eyes are closed.
Cerebellar ataxia persists with eyes open or closed.

-Types and symptoms are not included in the exam material. Tests on slide 31 are not required too.

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V3 page 5 highlighted