



Anatomy Team
MED 439

Revised & Approved



MED439
KING SAUD UNIVERSITY

The External Structure of the Brainstem

CNS Block

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Male slides
Female slides
Important
Doctors notes

Extra information, explanation

Don't forget to check the [Editing File](#)

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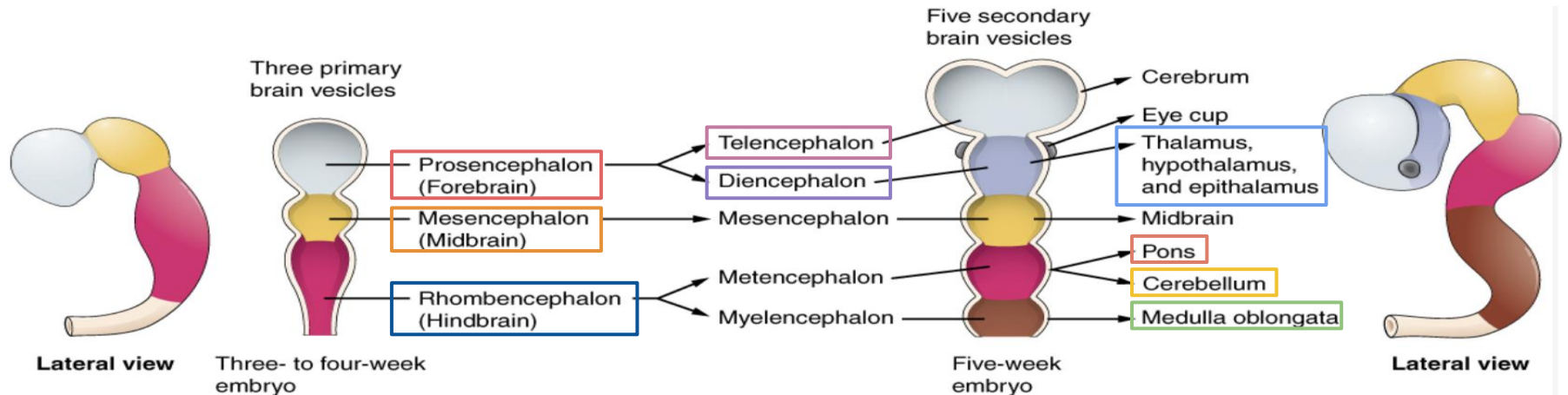
Objectives

At the end of the lecture, students should be able to:

- List the components of brainstem.
- Describe the site of brain stem
- Describe the relations between components of brainstem & their relations to cerebellum.
- Describe the external features of both ventral & dorsal surfaces of brainstem
- List cranial nerves emerging from brain stem
- Describe the site of emergence of each cranial nerve

Development of the brain

The brain develops from the cranial part of the neural tube



The cranial part divides into 3 parts :

Forebrain

Subdivide into:

1-Telencephalon: Two cerebral hemispheres

Cavities: Two lateral ventricles

2- Diencephalon

Cavity: 3rd ventricle **thalamus, hypothalamus, epithalamus, subthalamus**

Midbrain

Cavity: Cerebral aqueduct

Hindbrain

Cavity: 4th ventricle

Subdivides into:

1- Pons

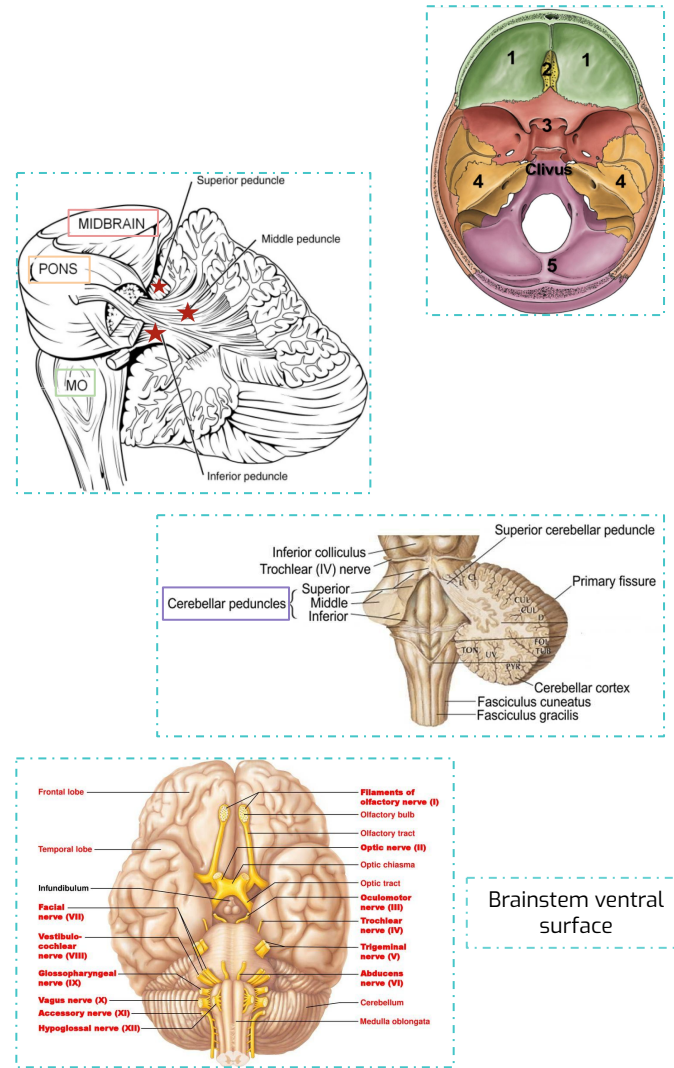
2- Cerebellum

3- Medulla oblongata

The brainstem

The brainstem is the region that connects cerebrum with the spinal cord

<p>Site</p>	<p>Located at the basilar part of the occipital bone (clivus)</p>
<p>Parts</p>	<p>From above downward</p> <ul style="list-style-type: none"> 1- Midbrain 2- Pons 3- Medulla oblongata
<p>Connections with Cerebellum</p>	<p>Each part of the brain stem is connected to cerebellum by cerebellar peduncles (superior, middle, inferior)</p>
<p>Functions</p>	<ul style="list-style-type: none"> 1- Pathway of tracts between the cerebral cortex and spinal cord 2- Site of origin of nuclei of cranial nerves (from 3rd to 12th) 3- Site of emergence of cranial nerves (from 3rd to 12th) 4- Contains groups of nuclei and related fibers known as reticular formation which is responsible for controlling the level of consciousness, pain perception, regulation of cardiovascular and respiratory systems, a vehicle of sensory information



Brainstem ventral surface

Medulla Oblongata - Ventral surface

Ventral median fissure

Continuation of ventral median fissure of spinal cord.
Divides the medulla into two halves.
It's lower part is marked by **decussation of most of pyramidal (corticospinal) fibers** (75%-90%)

Pyramid

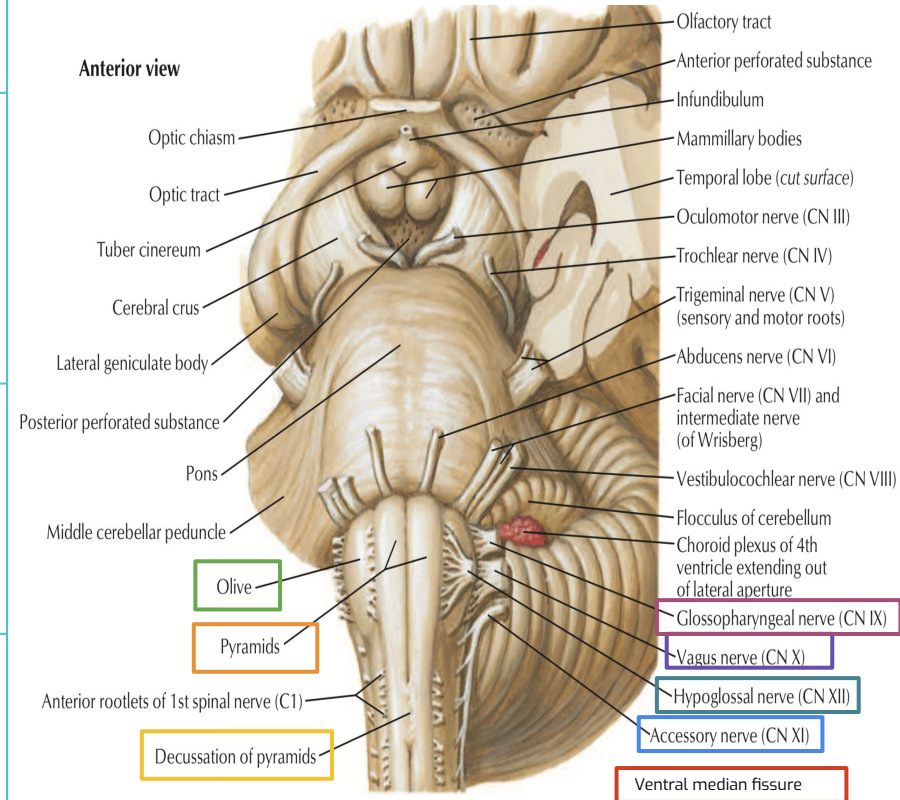
An elevation that lies on either sides of the ventral median fissure.
It is produced by **corticospinal tract**.
These are descending motor fibers

Olive

An elevation that lies lateral to the pyramid
Produced by **inferior olivary nucleus**
(important for control of movement)

Nerves emerging from the medulla(4 nerves)

12th hypoglossal from the sulcus between pyramid and olive
Cranial part of 11th accessory from sulcus dorsolateral to olive
10th vagus from sulcus dorsolateral to olive
9th glossopharyngeal from sulcus dorsolateral to olive



Medulla Oblongata - Dorsal surface

The features differ in the caudal part (closed medulla) and cranial part (opened medulla)

Closed medulla(Caudal)

Cavity: Central canal & is composed of:

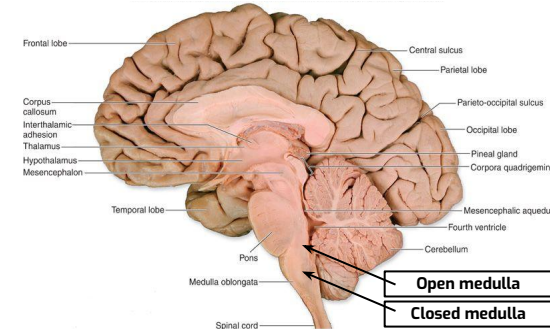
Dorsal median sulcus: divides the closed medulla into two halves.

Fasciculus gracilis: lies on either side of dorsal median sulcus.

Gracile tubercle: an elevation on upper part of fasciculus gracilis that marks the site of gracile nucleus.

Fasciculus cuneatus: on either side of fasciculus gracilis.

Cuneate tubercle: an elevation produced at the upper part of fasciculus cuneate that marks the site of cuneate nucleus



Opened medulla(Rostral)

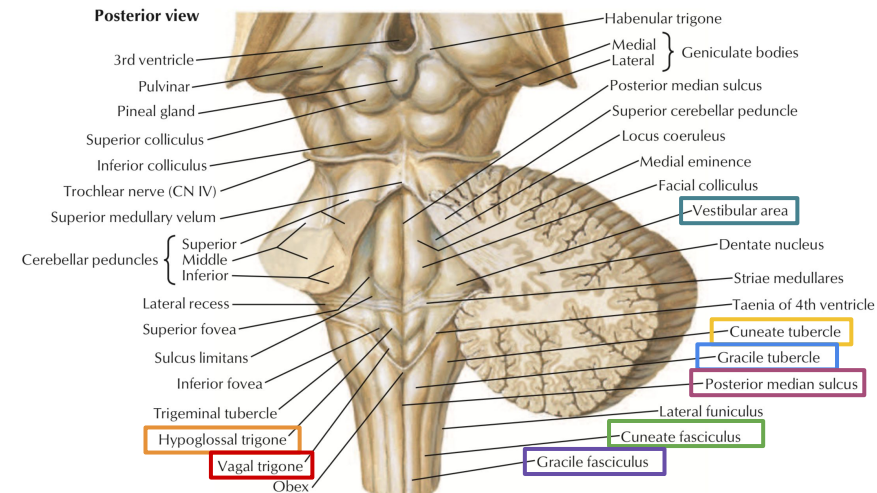
Cavity: 4th ventricle

On either side an inverted v-shaped sulcus divides the area into 3 parts (from medial to lateral)

Hypoglossal triangle: overlies hypoglossal nucleus

Vagal triangle: overlies dorsal vagal nucleus

Vestibular area: overlies vestibular nuclei



Pons

Ventral surface

Basilar sulcus:

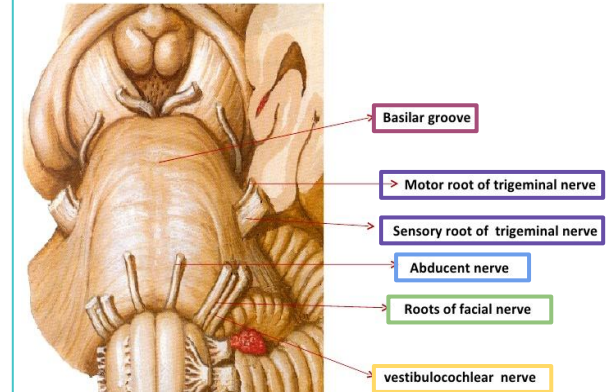
1. It divides the pons into 2 halves (right and left).
2. It is occupied by basilar artery.

- Transverse pontine (pontocerebellar) fibers (الخطوط العرضية):

1. It originates from pontine nuclei (taken next lecture).
2. It cross midline & pass through contralateral middle cerebellar peduncle to enter the opposite cerebellar hemisphere.

- Nerves emerging from Pons (4 nerves):

1. **Trigeminal (5th):** from the middle of ventrolateral aspect of pons, as two roots: a small medial motor root & a large lateral sensory root.
2. **Abducent (6th):** (from sulcus)(at junction) between pons & pyramid.
3. **Facial (7th) & vestibulocochlear (8th):** at cerebellopontine angle (**junction between medulla, pons & cerebellum**)(a common site of tumors). Both nerves emerge as 2 roots: from medial to lateral: motor root of 7th, sensory root of 7th, vestibular part of 8th & cochlear part of 8th



Dorsal surface

- Separated from open medulla by an imaginary line passing between the margins of middle cerebellar peduncle.

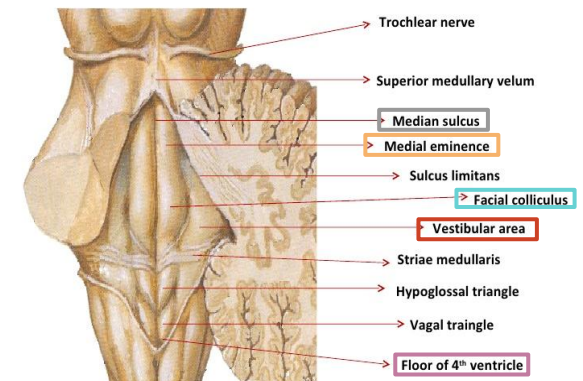
- On either side, a sulcus (called **median sulcus**) divides the area into 2 parts (from medial to lateral):

1. **Medial eminence & facial colliculus:** overlies abducent nucleus.

2. **Vestibular area:** overlies vestibular nuclei.

- The dorsal surfaces of open medulla and pons lie in :

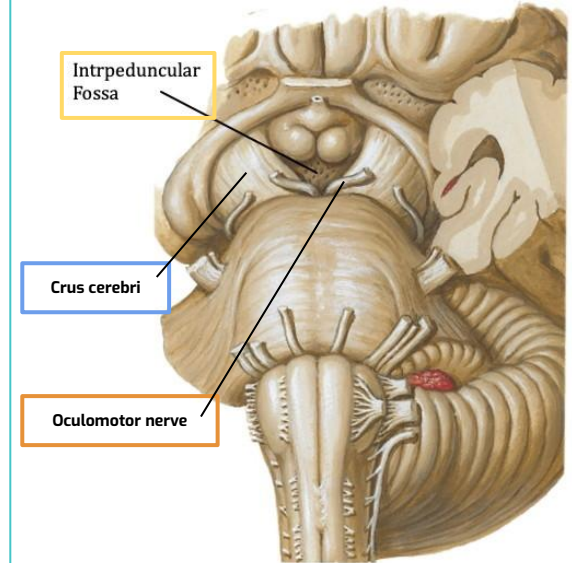
The caudal 1/3 rd and the rostral 2/3rd of the **floor of the 4th ventricle** respectively.



Midbrain

Ventral surface

- It is formed of a large column of descending fibers (**crus cerebri or basis pedunculi**), on either side.
- The 2 crura cerebri are separated by a depression (**interpeduncular fossa**).
- One nerve is emerging from Midbrain: **Oculomotor (3rd) nerve** from medial aspect of crus cerebri.



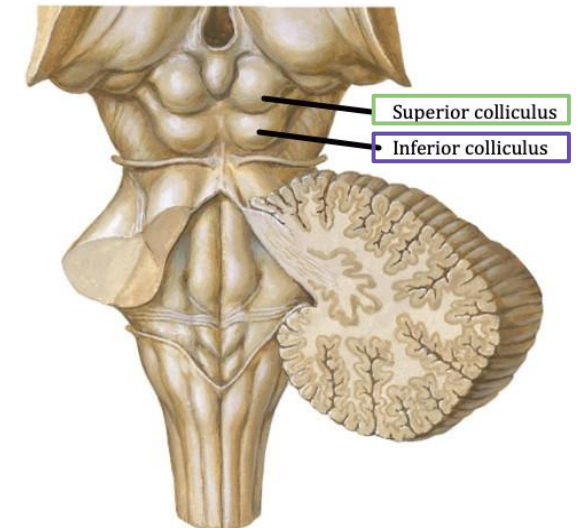
Dorsal surface

Marked by 4 elevations:

1. Two superior colliculi: Concerned with visual reflexes.

2. Two inferior colliculi: Forms part of auditory pathway.

- Nerve emerging from Midbrain (one):
 - Trochlear (4th): just caudal to inferior colliculus (The only cranial nerve emerging from dorsal surface of brainstem).



Summary & Girl slides questions

- The brainstem is composed (*from above downwards*) of: midbrain, pons & medulla oblongata which are continuous with each other, with diencephalon above & with spinal cord below.

- The brainstem is connected with cerebellum through cerebellar peduncles.

- The brainstem is the site of cranial nuclei, the pathway of important ascending & descending tracts & the site of emergence of cranial nerves (from 3rd to 12th).

- Cranial nerves (with the exception of 4th) emerge from ventral surface of brainstem.

Question	Answer
Which cranial cavity does the brainstem lie in?	The posterior cranial fossa
Embryologically, which two vesicles of the neural tube give rise to the brainstem?	1- The mesencephalon (midbrain) 2- The rhombencephalon (hindbrain)
What are the cavities (of the ventricular system) which lie within the brainstem?	1- The cerebral aqueduct 2- The 4th ventricle (IV ventricle)
What is the function of the medullary pyramids?	These are descending motor fibers
What is the function of The decussation of the pyramids?	This is where the descending motor fibers cross over to the contralateral side
Is the inferior part of the posterior medulla the "open" or the "closed" part?	The closed part
What structure does the "open" part of the posterior medulla open onto?	The 4th ventricle (IV ventricle)

MCQ

Q1: Which one of the following cranial nerves emerges from ventral surface of midbrain?

A: Trochlear (4th).

B: Oculomotor (3rd).

C: Abducent (6th).

D: Facial (7th).

Q2: Regarding the medulla oblongata, which one of the following is correct?

A: The pyramid is lateral to olive.

B: The hypoglossal nerve is the most lateral nerve emerging from it.

C: The cuneate tubercle is lateral to gracile tubercle.

D: The cerebellum is connected to it by middle cerebellar peduncle.

Q3: Which one of the following is the site of the inferior colliculus?

A: In the ventral surface of medulla, lateral to the olive.

B: In the dorsal surface of medulla, medial to the vagal triangle.

C: In the ventral surface of midbrain, lateral to the medial eminence.

D: In the dorsal surface of midbrain, above the trochlear nerve

Q4: Transverse pontine originate from?

A: Superior colliculi

B: Medial eminence

C: Pontine nuclei

D: Median sulcus

Q5: The Two superior colliculi are concerned with:

A: Visual reflexes

B: Auditory pathway

C: Abdominal reflexes

D: Withdrawal reflexes

Q6: The Two inferior colliculi are concerned with:

A: Visual reflexes

B: Auditory pathway

C: Abdominal reflexes

D: Withdrawal reflexes

Answer key:
1 (B) , 2 (C) , 3 (D) , 4 (C) , 5 (A) , 6 (B)

MCQ

Q7: Divides the pons into 2 halves (right and left).

A: Interpeduncular fossa

B: Transverse pontine

C: Basilar sulcus

D: Crus cerebri

Q8: Pons, Cerebellum and Medulla oblongata arise from:

A: Midbrain

B: Hindbrain

C: Forebrain

D: Lateral brain

Q9: The brainstem is located in which bone

A: Temporal

B: Occipital

C: Frontal

D: Parietal

Q10: brainstem is the site of emergence of which cranial nerves

A: From 3rd to 12th

B: From 1st to 10th

C: Only 1st and 2nd

D: All cranial nerves

Q11: An elevation that lies on either side of ventral median fissure

A: Olive

B: Gracile tubercle

C: Pyramid

D: Cuneate tubercle

Q12: All of the following are in the open medulla except?

A: Hypoglossal triangle

B: Dorsal median sulcus

C: Vagal triangle

D: Vestibular area

Answer key:
7(C) , 8(B) , 9(B) , 10(A) , 11(C) , 12(B)

SAQ

Q1: mention two of the nerves emerging from the pons

Q2: what are the elevations on the dorsal surface of the midbrain

Q3: what are the function of the brain stem (mention two)

Q4: mention the four nerves emerging from the medulla

Answers

1: 5th trigeminal, 6th abducent

2: two superior colliculi and two inferior colliculi

3: Pathway of tracts between the cerebral cortex and spinal cord
Site of origin of nuclei of cranial nerves (from 3rd to 12th)

4: 12th hypoglossal, Cranial part of 11th accessory, 10th vagus, 9th glossopharyngeal

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