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Ecological, Economic and Social Sustainability

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NEUROANATOMY

4th week – Medulla Oblongata, Pons, Mesencephalon

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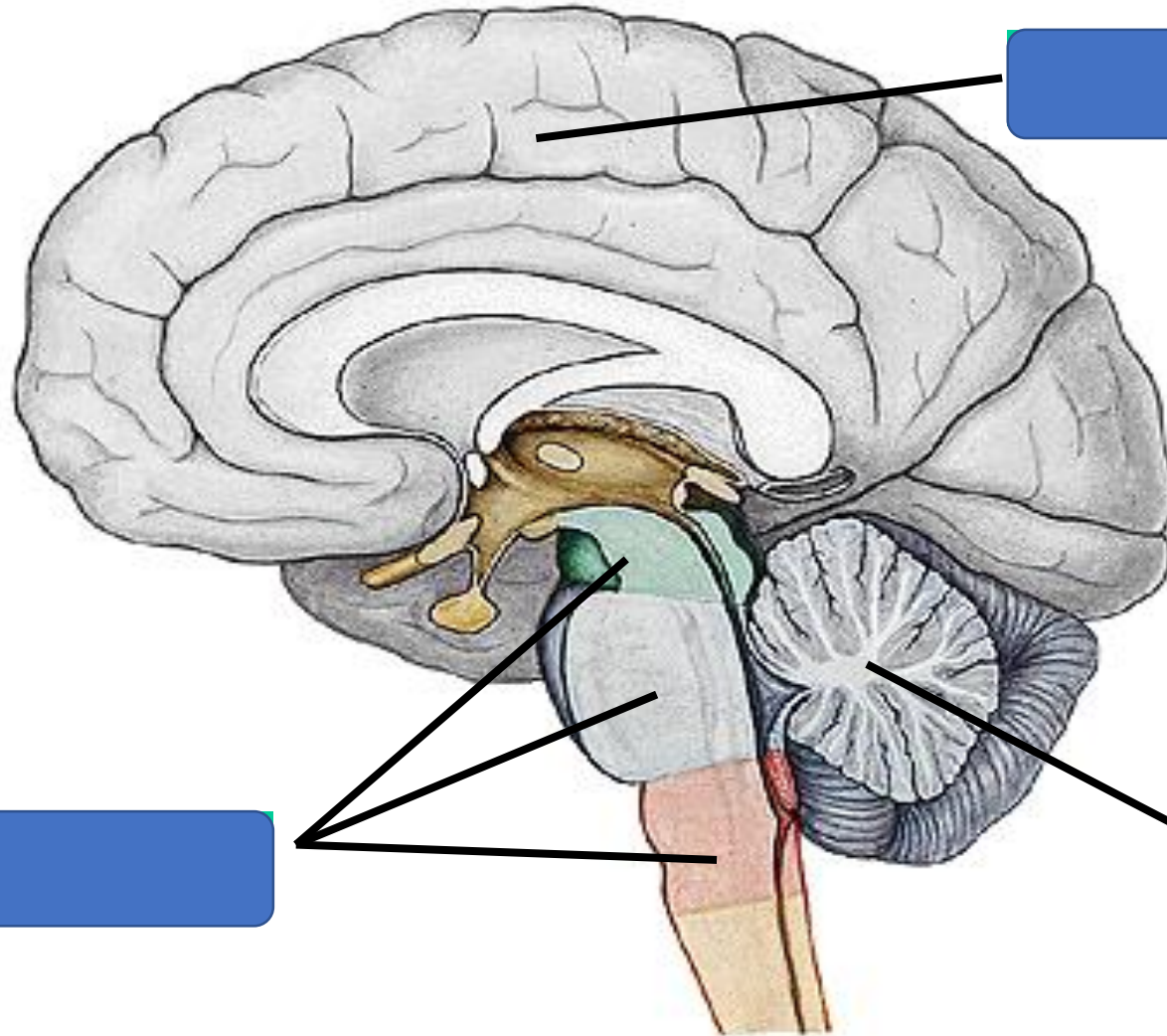
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The brain is macroscopically divided into three main parts: the **cerebral hemispheres**, the **brain stem**, and the **cerebellum**.



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However, in terms of development, it is divided into sections as follows.

1-Rhombencephalon:

- a) Myelencephalon: Medulla oblangata: Bulbus
- b) Metencephalon: Pons + Cerebellum

2-Mesencephalon:

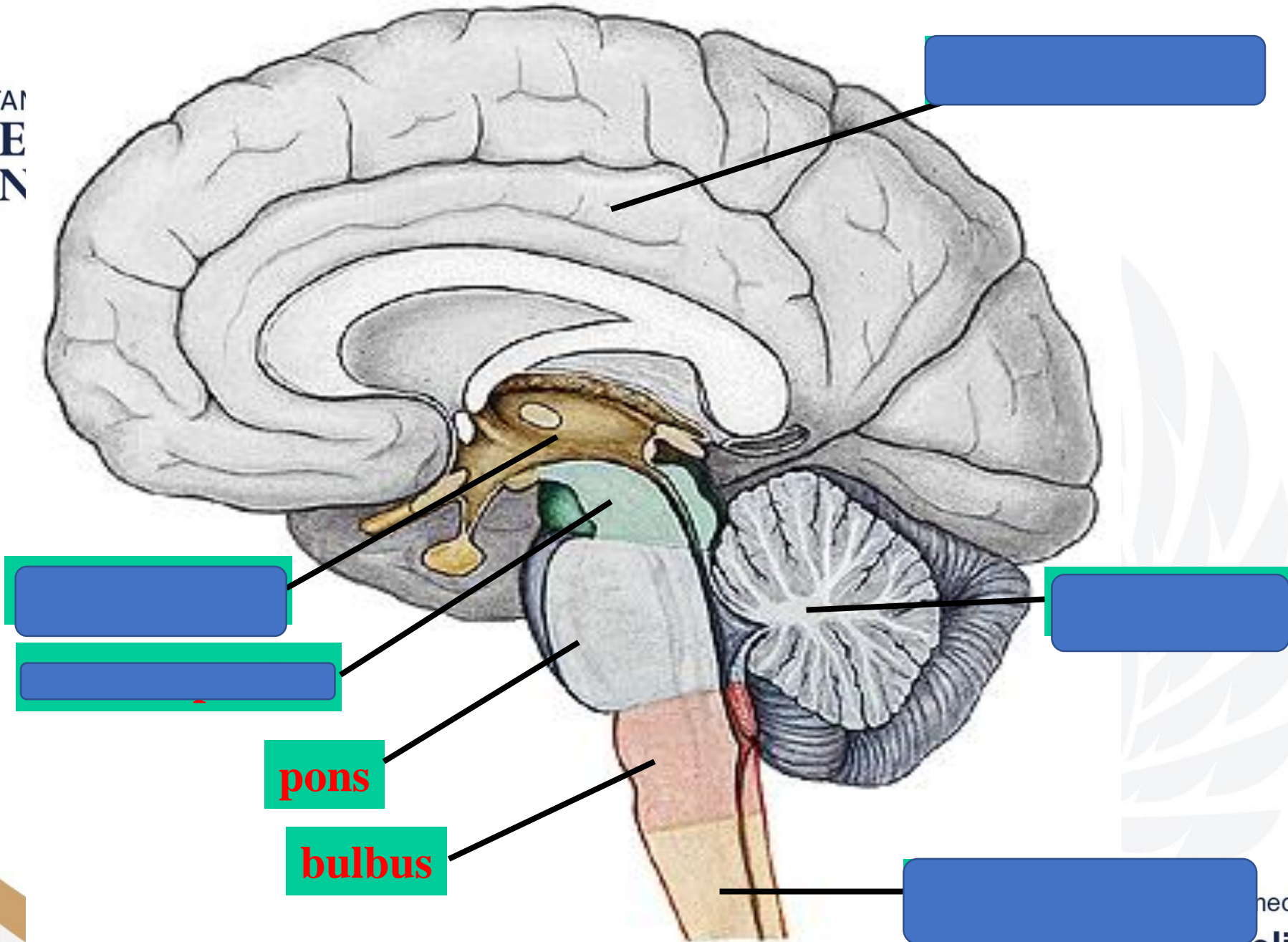
3-Prosencephalon:

- a) Diencephalon
- b) Telencephalon

****Brain stem (truncus cerebri): Medulla oblangata+Pons+Cerebellum**



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pons

bulbus



- The triad of medulla oblongata, pons and mesencephalon is called the **brain stem (truncus encephali)**.
- These three structures have common features.
- The nuclei of the cranial nerves are found in these three structures.
- Some roads run jointly in these three structures.
- The floor of the fourth ventricle is also formed jointly by the bulbus and pons.
- **Rhombencephalon:** It consists of 3 parts: bulbus, pons and cerebellum.



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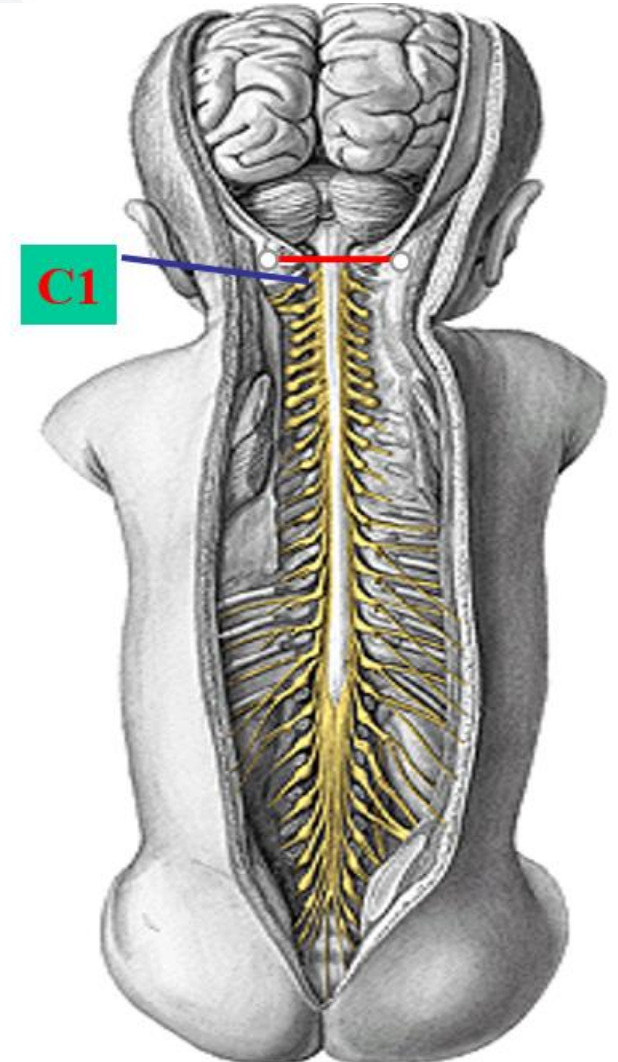
Medulla oblongata: Bulbus

- It is the lowest part of the brain stem.
- The bulbus can be compared to a cone with the base up and the top down.
- Its apex connects with the spinal cord and its base with the pons.



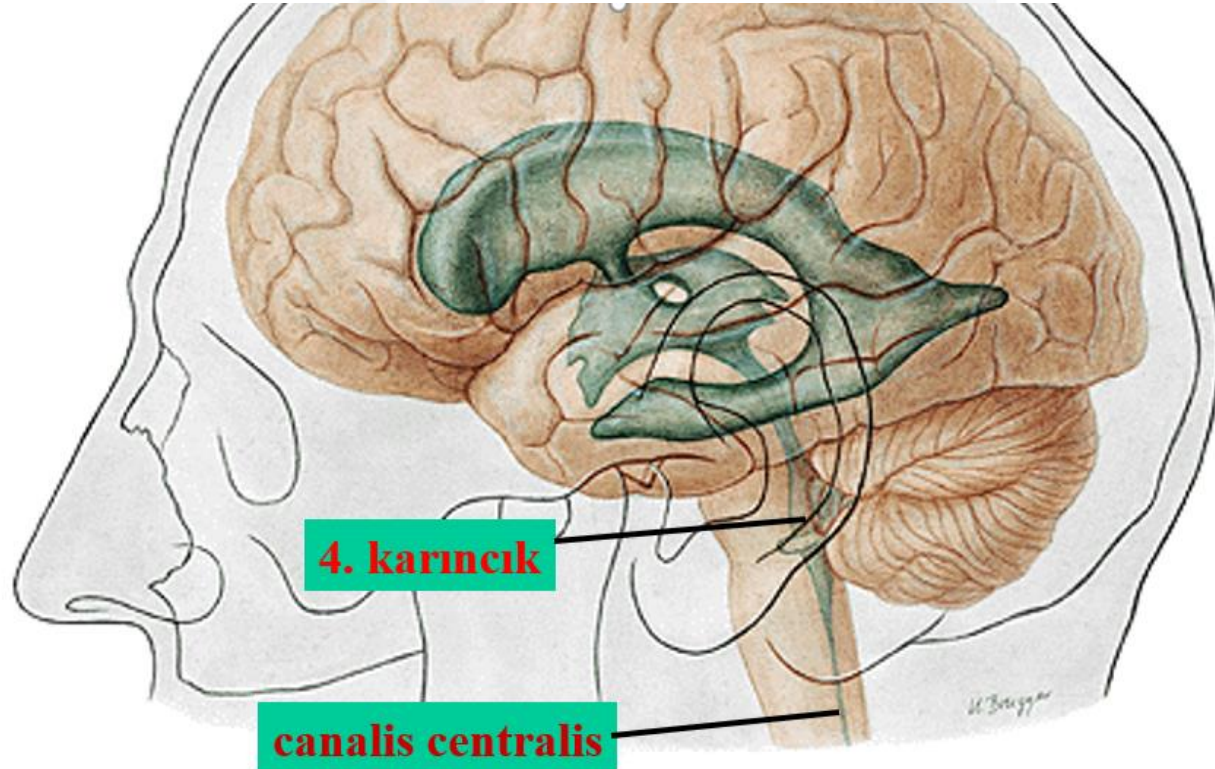


- There is no clear boundary between them and the medulla spinalis.
- However, the exit of the **1st spinal nerve** is considered the border between the two.
- This place is located at the level of the upper edge of the **atlas** according to the skeleton.





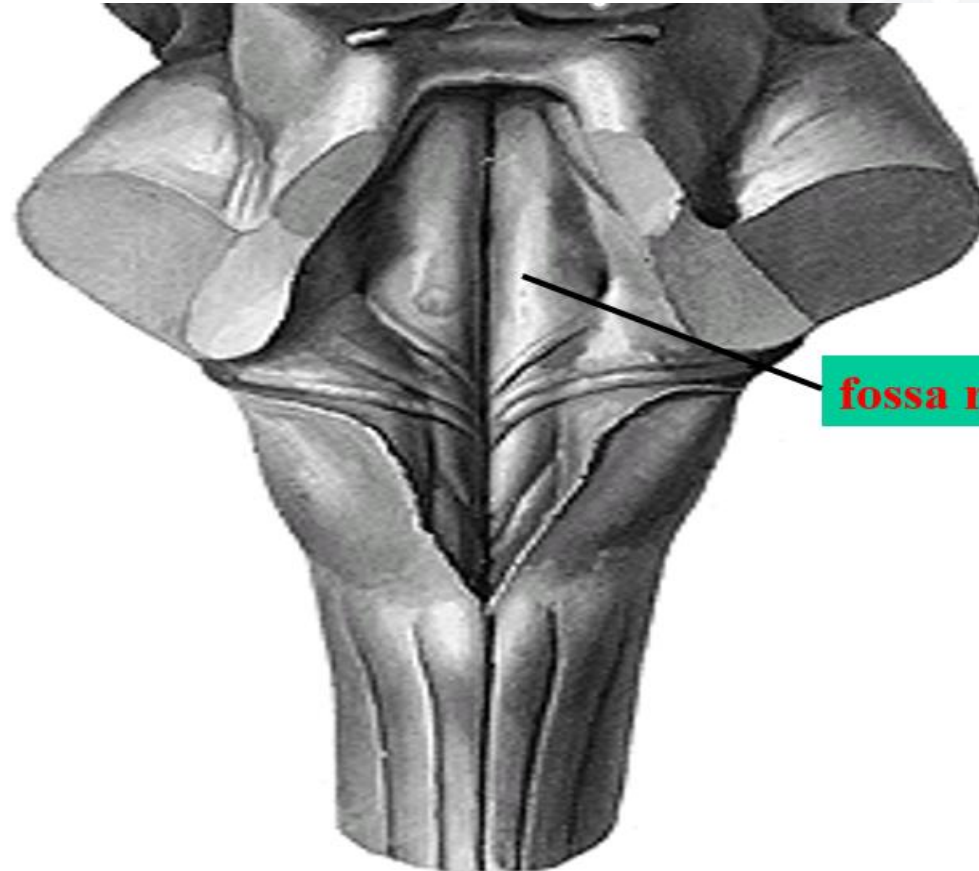
- The **canalis centralis**, located in the spinal cord, continues in the lower half of the bulb in the same way. However, it expands in the upper half and forms the **lower half of the 4th ventricle** posterior to the bulb.





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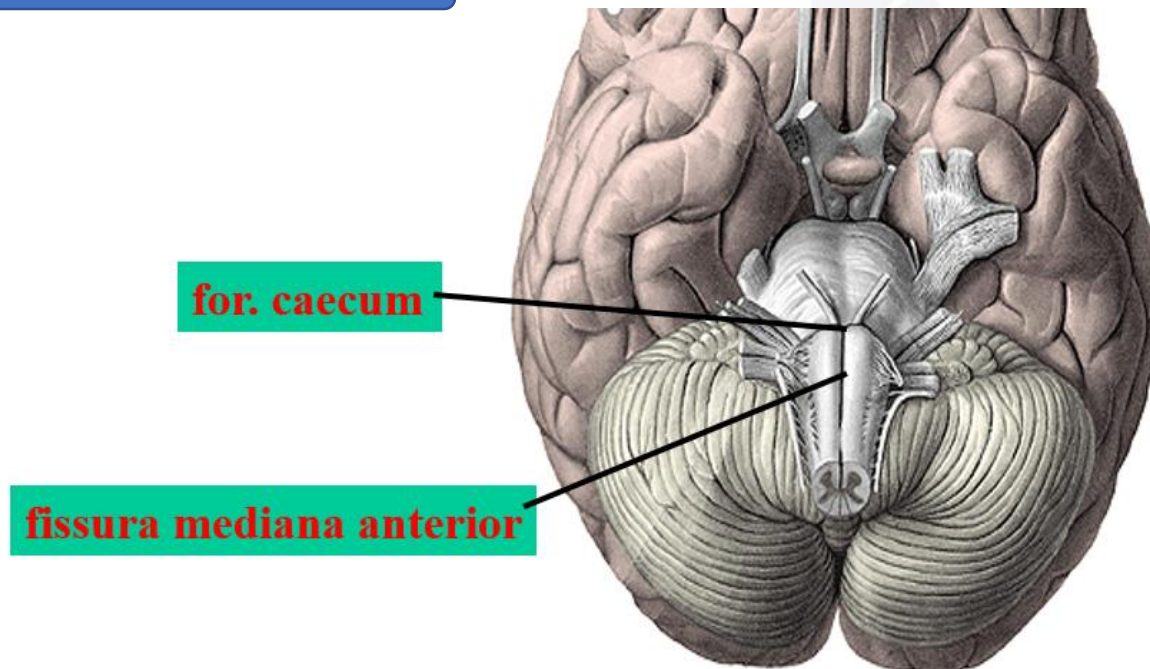
- The upper half of the floor of the **fourth ventricle** forms the posterior surface of the pons.



fossa rhomboidea

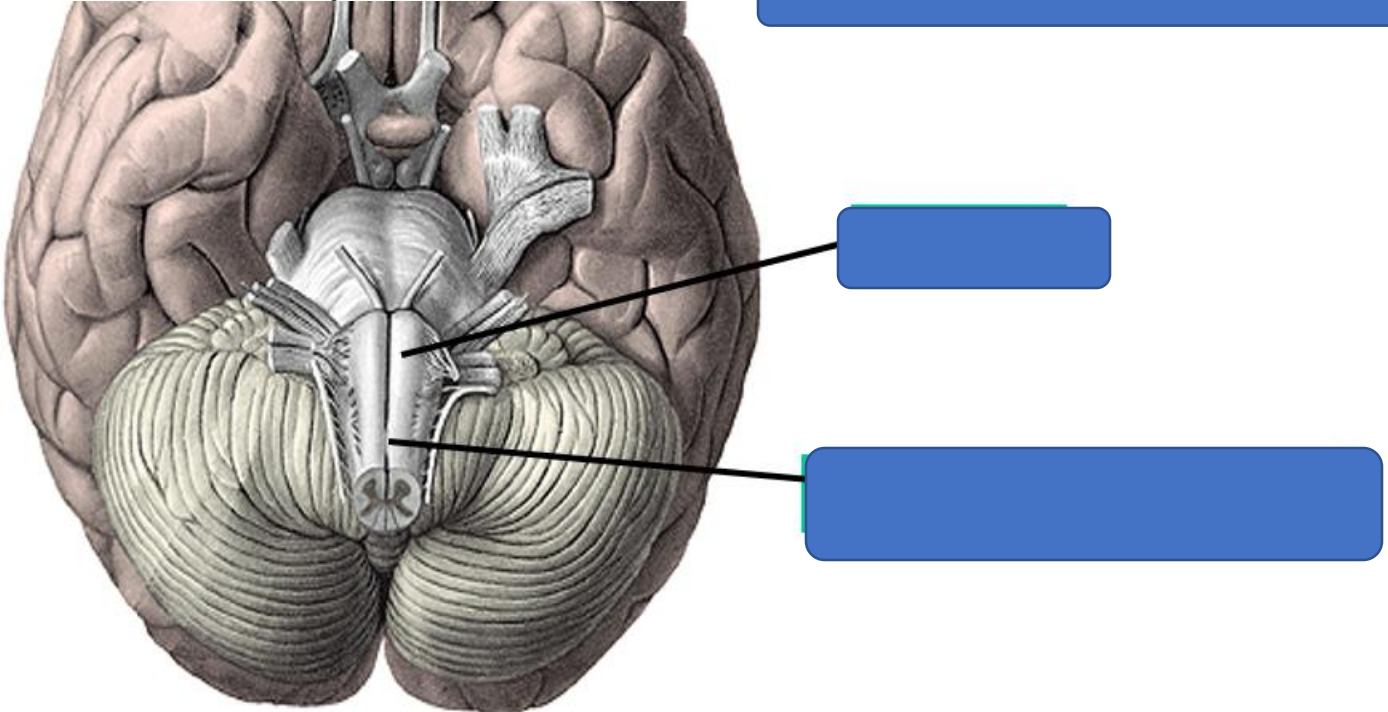


- **[redacted]** located in the middle and anterior surface of the medulla oblongata, is a continuation of the slit of the same name in the spinal cord.
- The fissura mediana anterior extends above to the pons, where it terminates in a pit called the **[redacted]**



The longitudinal ridge on both sides of this cleft is called the pass through it.

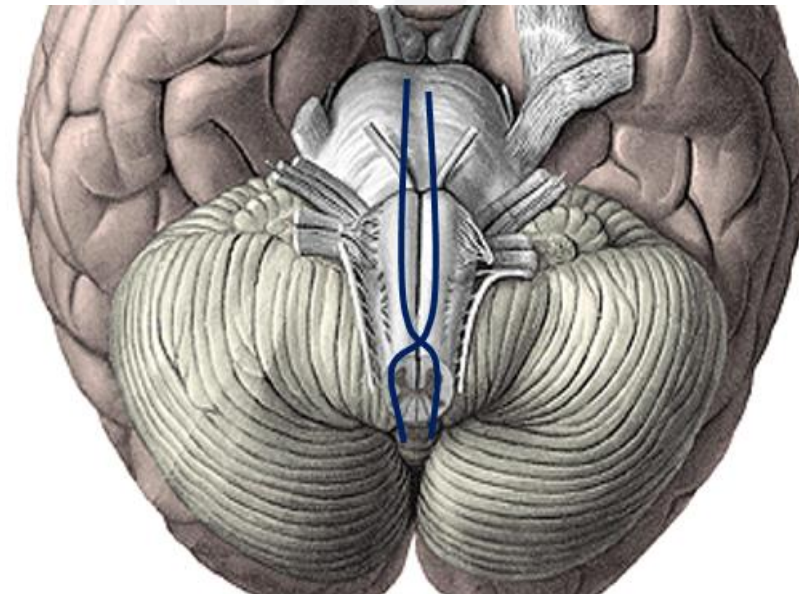
The pyramis tapers downwards and in the lower half of the bulb, the pyramis of the two sides merge with each other. This part is called the





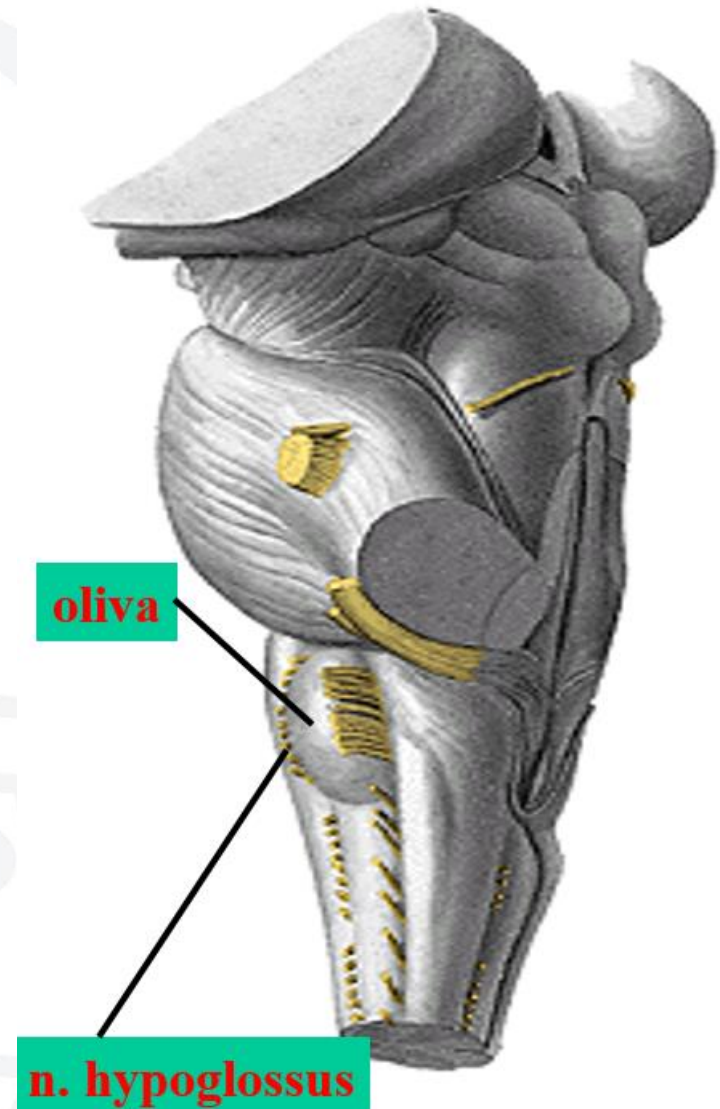
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- Here, **approximately 90% of the somatomotor fibers (tr. corticospinalis)** coming from the cortex and going directly to the medulla spinalis **cross to the opposite side.**
- Some nerve exit from the fissura mediana anterior below the decussatio pyramidum and travel laterally on the anterior surface of the bulb to the pedunculus cerebellaris inferior and the cerebellum.



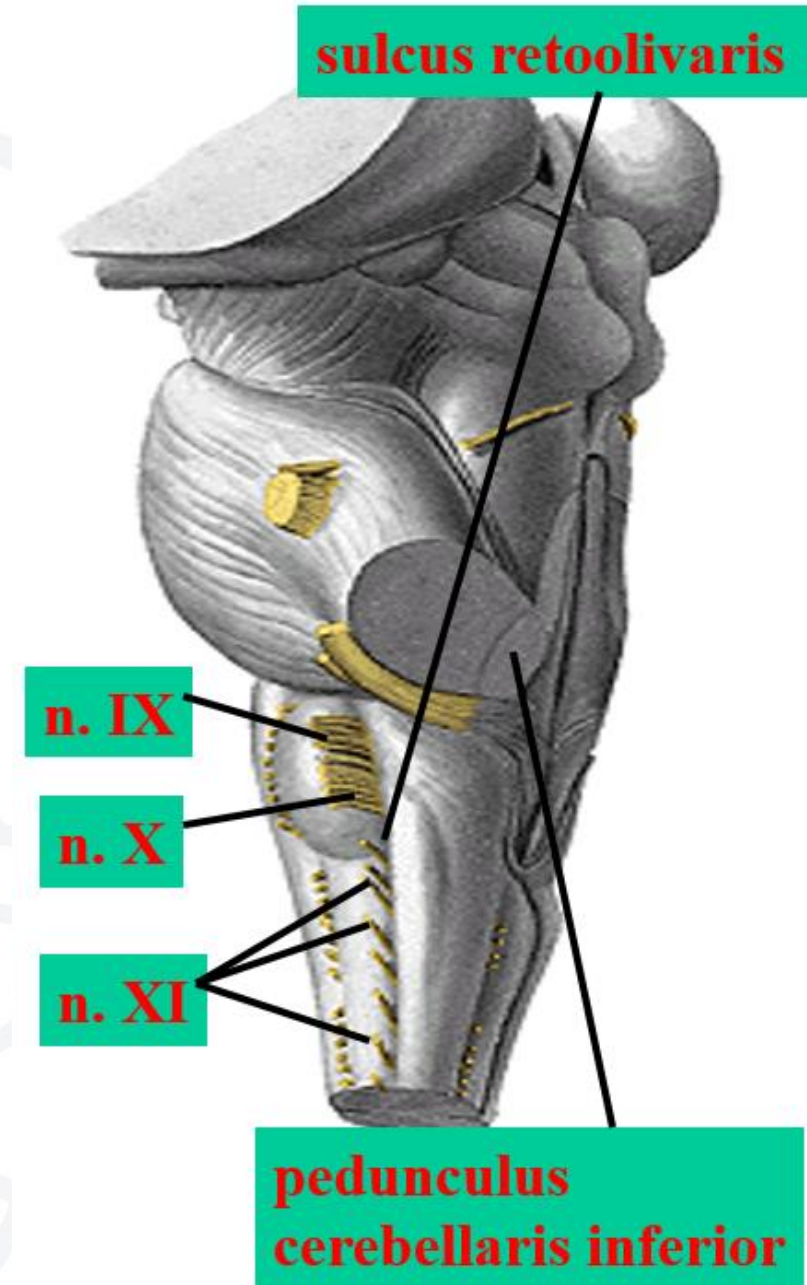


- The olive-like ridge on the lateral side of the Pyramis and the upper part of the bulb is called the **oliva**.
- The fibers of the **n. hypoglossus (XII. cranial pair)** emerge from the groove between this ridge formed by the Nucleus olivaris inferior and the pyramis.
- This groove continues below with the **sulcus anterolateralis**, from which the anterior roots of the spinal nerves emerge.



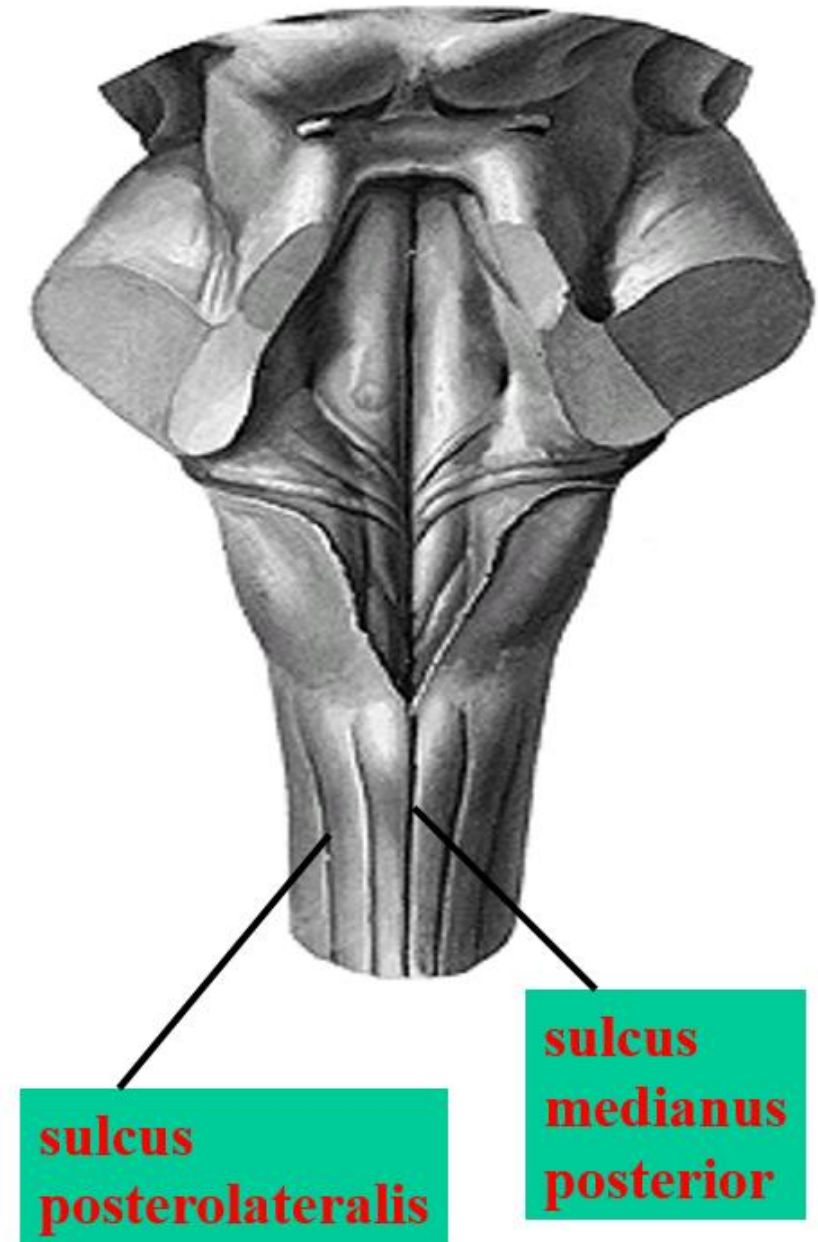


- On the posterior side of the oliva, there is the **pedunculus cerebellaris inferior**, which connects the bulb to the cerebellum, and the groove between the two is called the **sulcus retoolivaris**.
- From this groove, fibers of the **n. glossopharyngeus** and **n. vagus**, and from below, The fibers forming the cranial part of the **n. accessorius** arise between the anterior and posterior roots of the upper cervical spinal nerves.





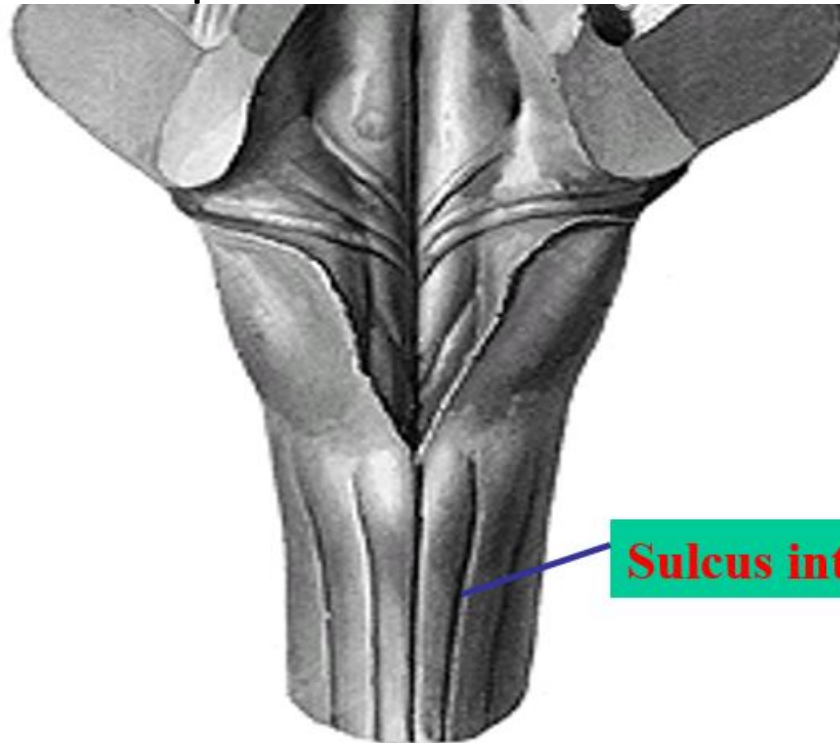
- The lower half of the posterior aspect of the medulla oblongata resembles the posterior aspect of the spinal cord.
- In the middle is the **sulcus medianus posterior** and this groove continues below with the groove of the same name in the spinal cord.
- The **sulcus posterolateralis**, located on the outer side of the posterior surface, also extends below in the spinal cord.





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- Between the sulcus medianus posterior and sulcus posterolateralis, there is a third groove, which is also seen in the upper parts of the spinal cord.
- This groove, called the **sulcus intermedius posterior**, divides the funiculus posterior into two parts.



Sulcus intermedius posterior

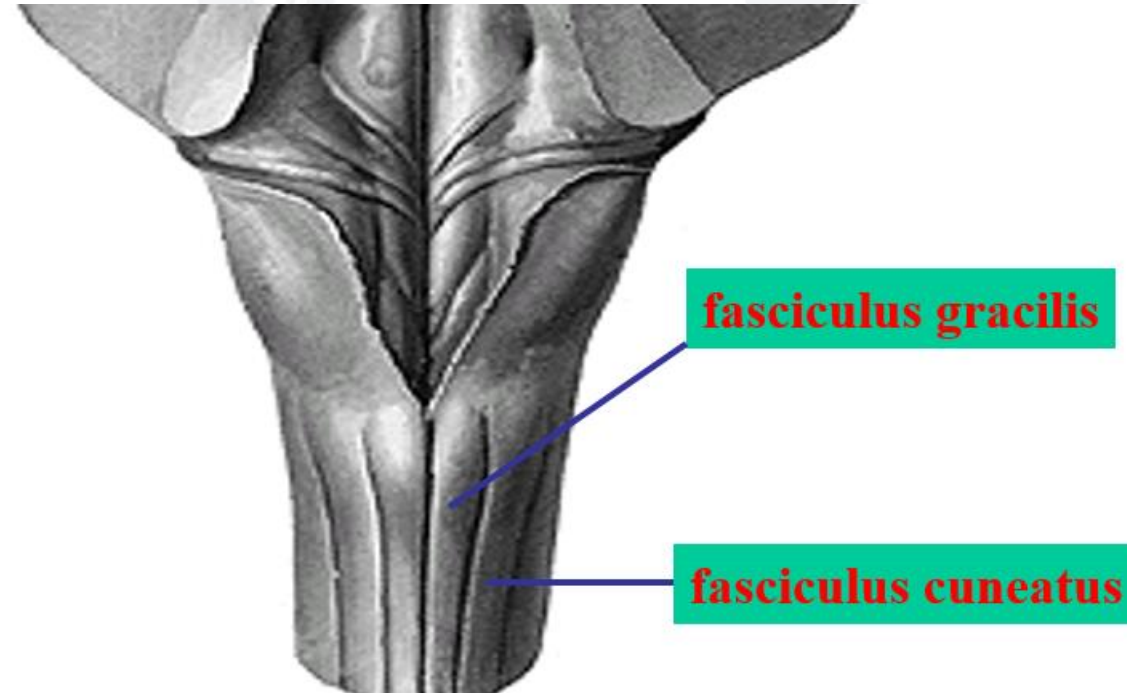
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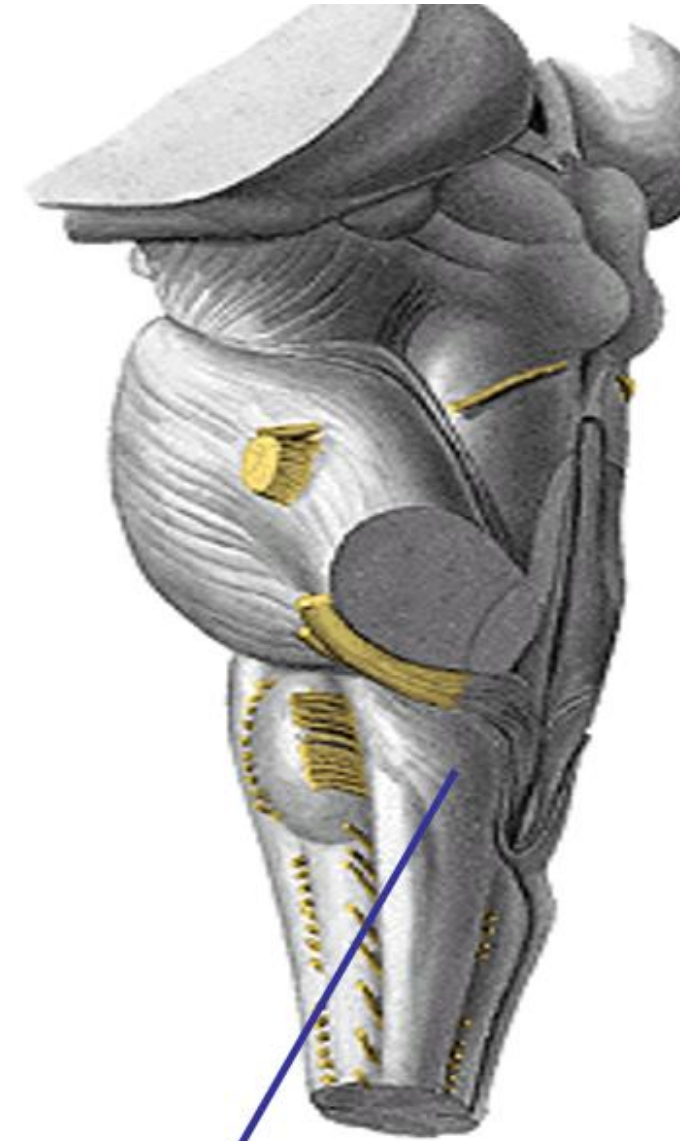
- The inner one is called the **fasciculus gracilis**, and the outer one is called the **fasciculus cuneatus**.
- Fasciculus gracilis and cuneatus end with a ridge above each called tuberculum gracile and tuberculum cuneatum.
- Deep in these bumps, **nuc. gracilis** and **nuc. cuneatus** is found.





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- The ridge behind the groove where the cranial part of the nervus vagus, nervus glossopharyngeus and nervus accessorius emerge is called the **tuberculum trigeminale**.
- In the depth of this ridge, **nuc. spinalis nervi trigemini** and its superficial **tr. spinocerebellaris posterior**.
- The posterior part of the upper half of the bulbus forms the lower half of the floor of the 4th ventricle.

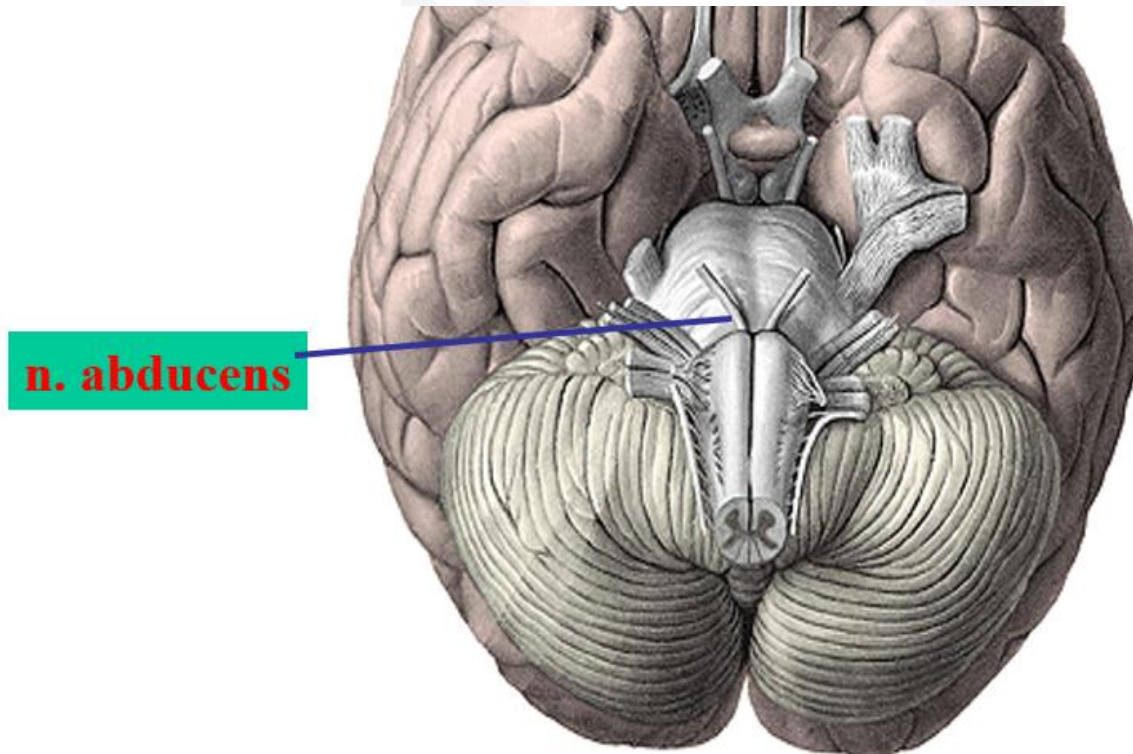


tuberculum trigeminale



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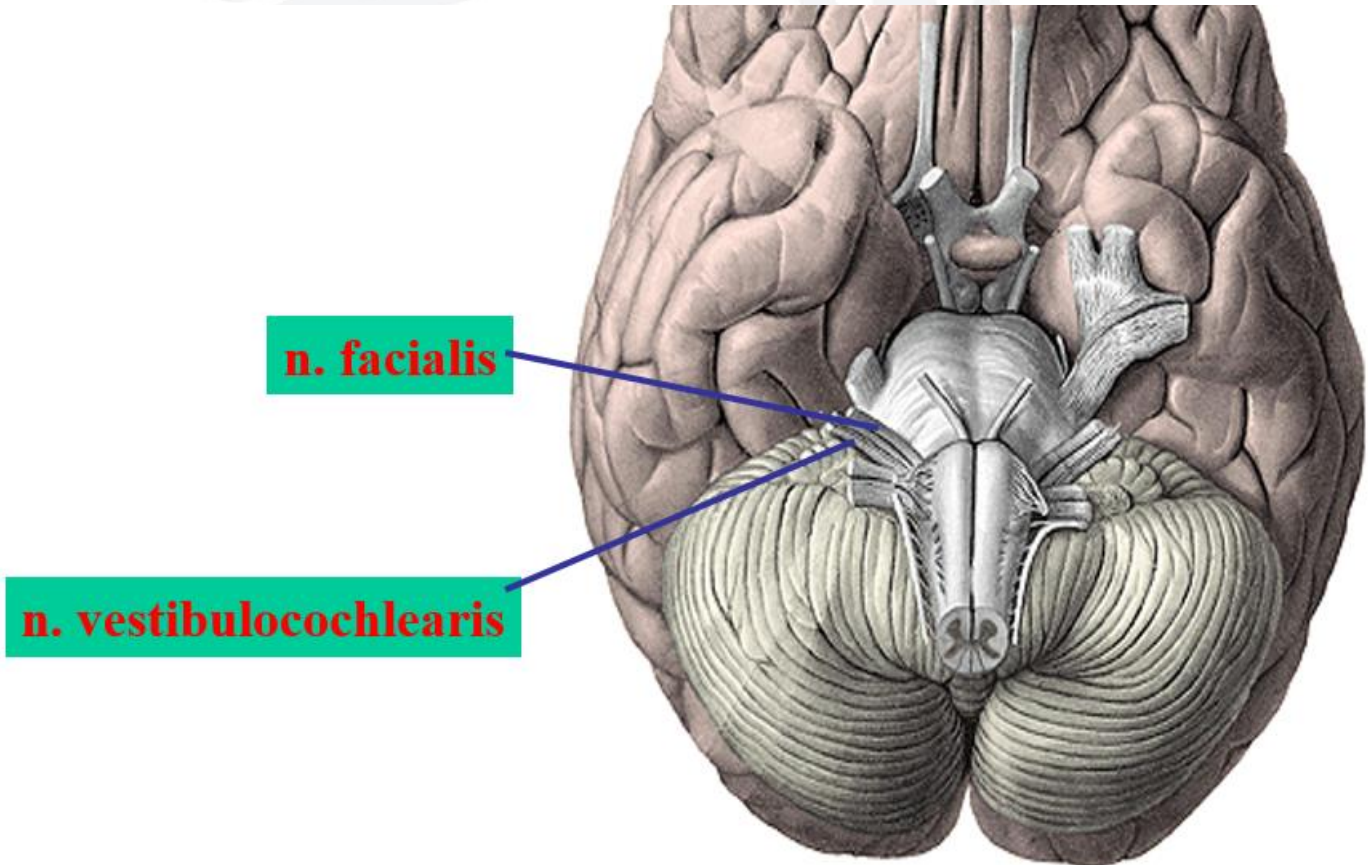
- **The last 6 of the 12 cranial nerves** leave or enter the brain from the medulla oblongata or the sulcus bulbopontinus between them and the pons. However, **the nuclei of the last four are found in the bulb.** **N. abducens** emerges between the pons and the bulb and from the upper end of the pyramis.





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- The **nervus facialis** and **nervus vestibulocochlearis** are also located between the pons and the bulb, but laterally. The nervus facialis is located on the inner side of the nervus vestibulocochlearis.





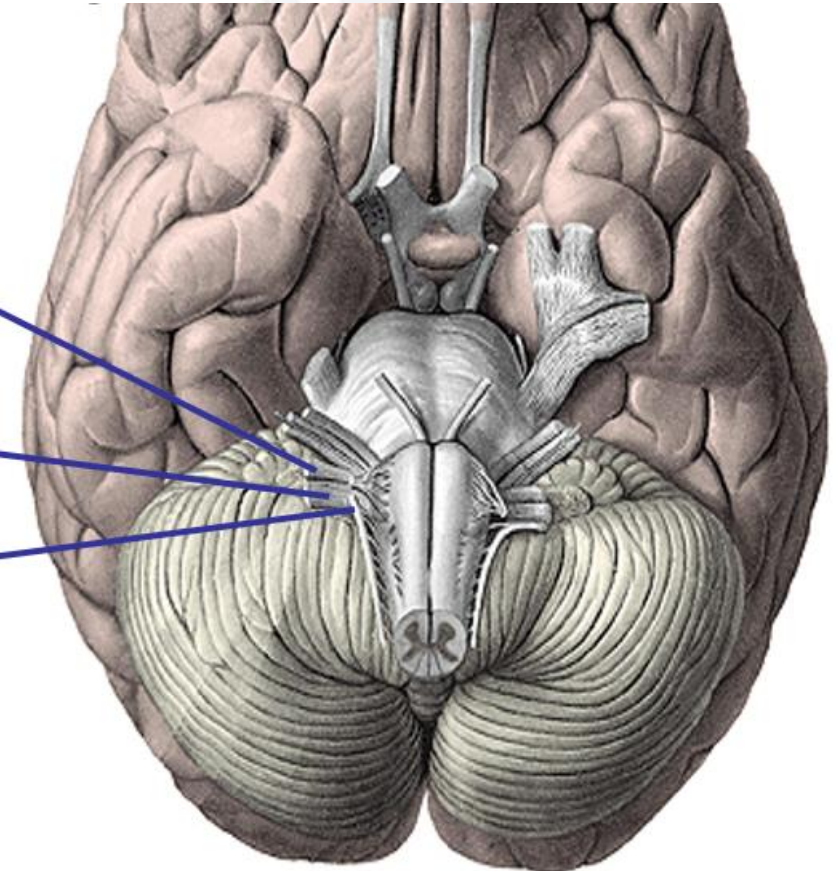
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- **N. glossopharyngeus, n. vagus and the cranial part of the n.accessorius** emerges from the groove (sulcus retroolivaris) between the oliva and the tuberculum trigeminale.

n. glossopharyngeus

n. vagus

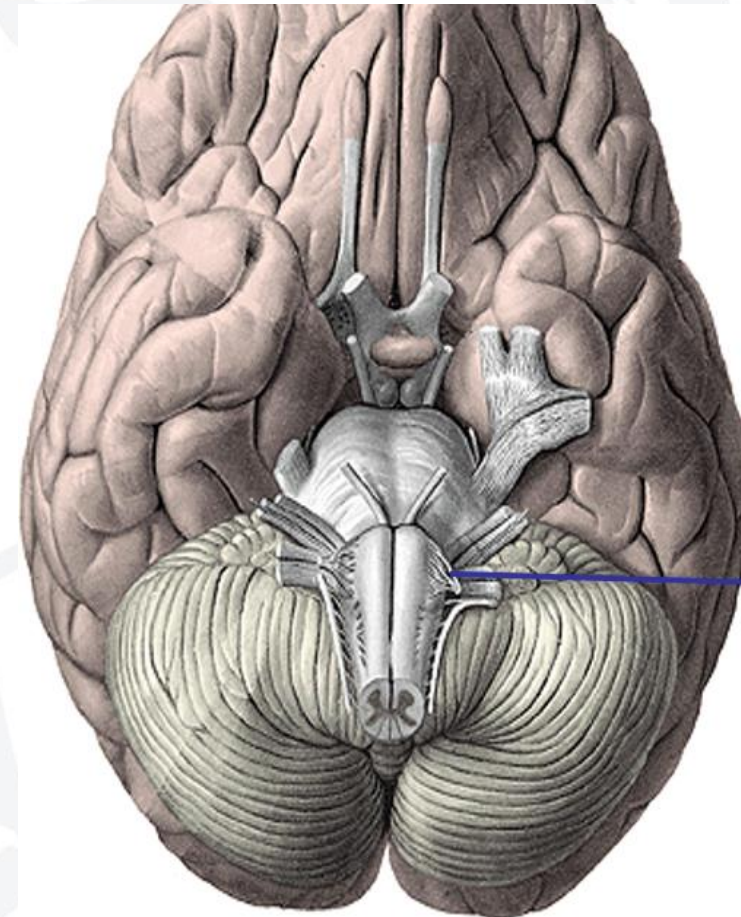
n. accessorius



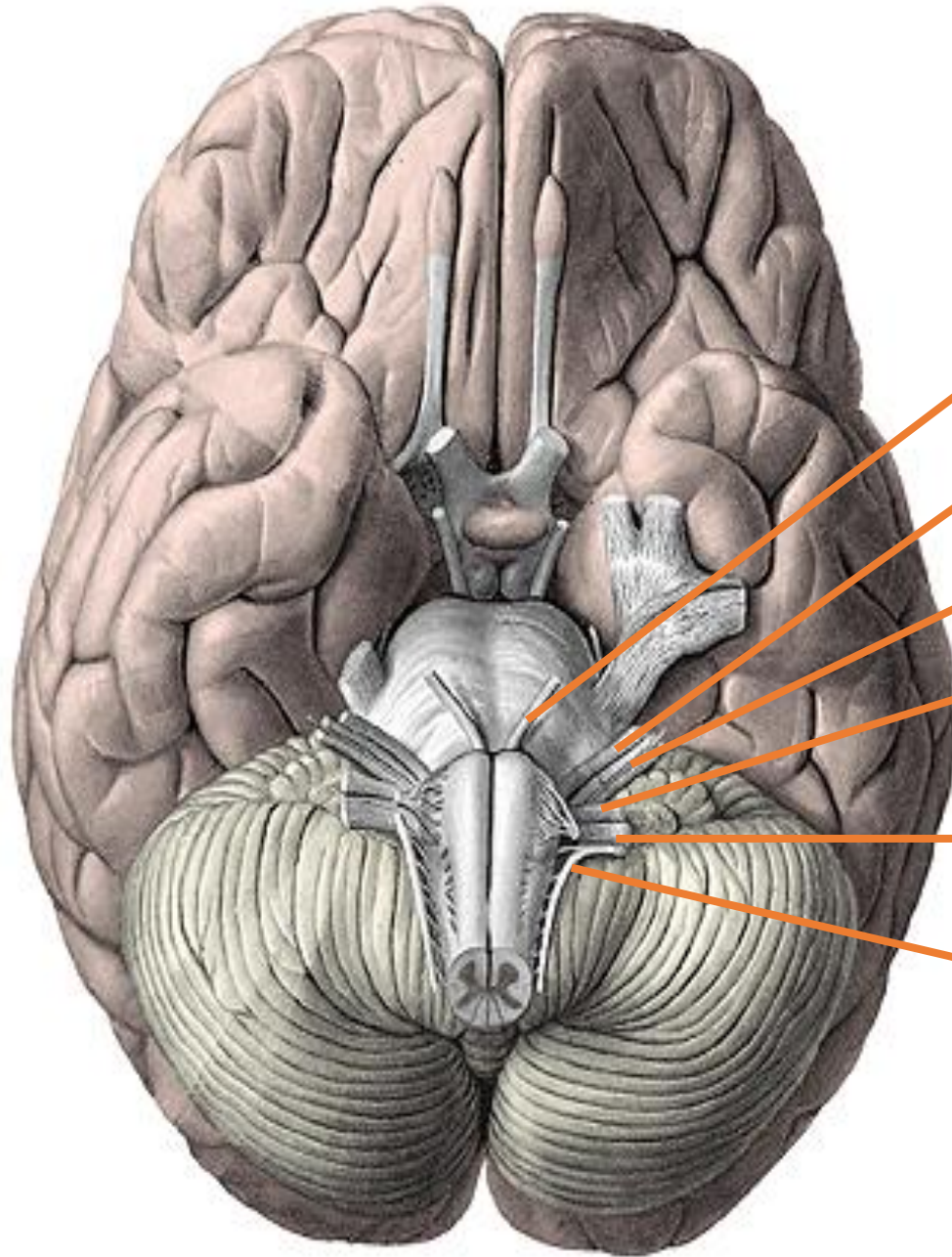


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- **N. hypoglossus** is located in the groove between the **oliva** and the **pyramis**.



n. hypoglossus



n. abducens

n. facialis

n. vestibulocochlearis

n. glossopharyngeus

n. vagus

n. accesorius



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Internal structure of Bulbus:

- As in the medulla spinalis, the bulb is composed of white and gray matter.
- With the emergence of the 4th ventricle in the bulbus, the gray matter section corresponding to the posterior horn in the spinal cord shifted laterally in the upper half of the bulb.

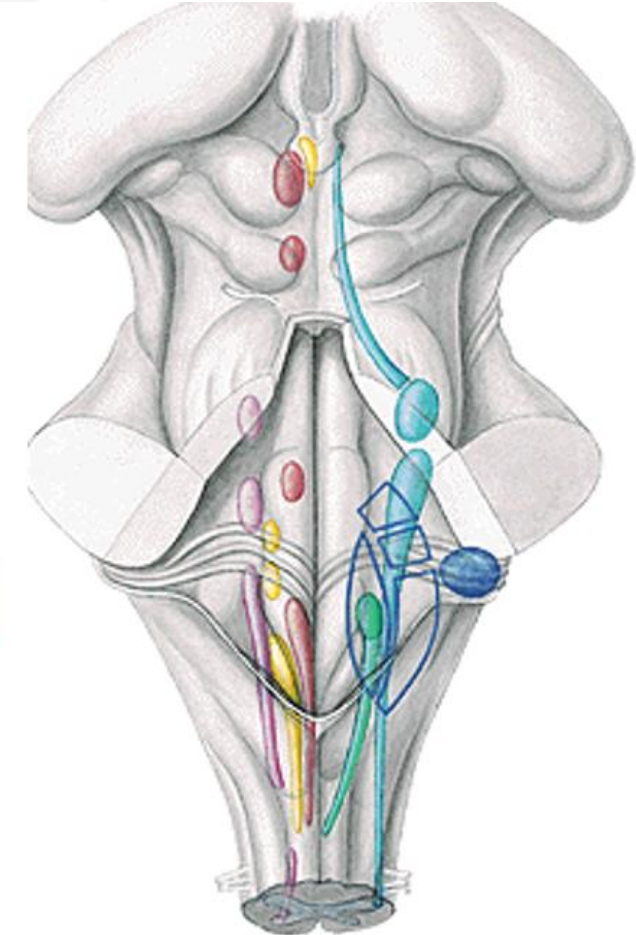


- In this case, each half of the fourth ventricle has **somatomotor** (corresponding to the anterior horn in the spinal cord), **parasymphetic** (corresponding to the lateral horn of the spinal cord) in the middle, and **sensitive nuclei** (corresponding to the posterior horn of the spinal cord) on the outermost side.

somatomotor

parasimpatik

sensitif

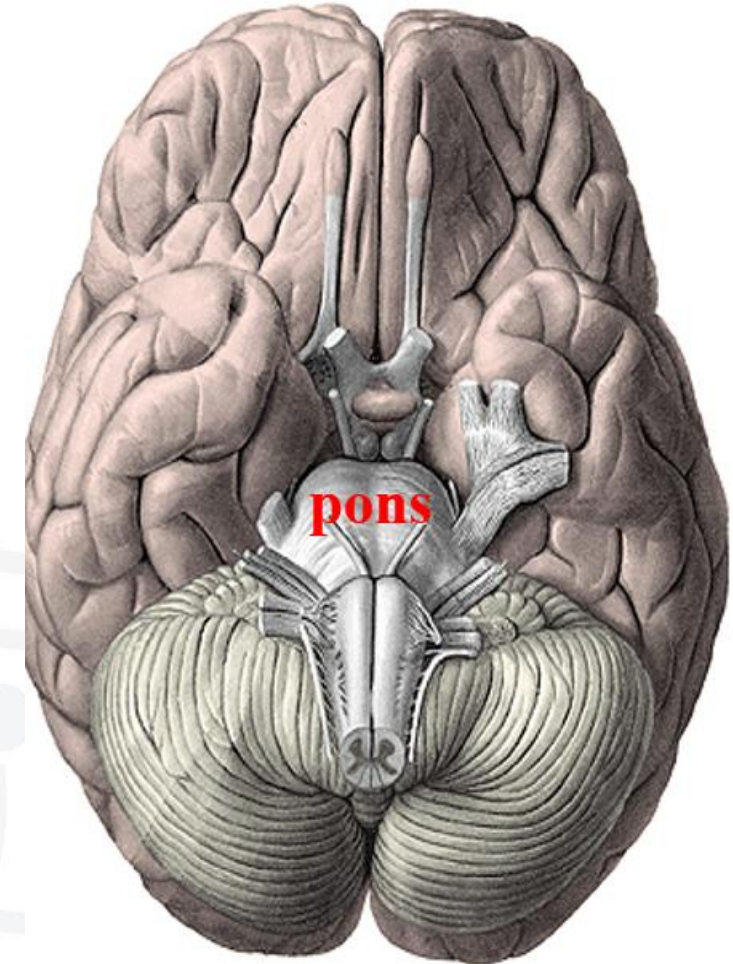




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PONS

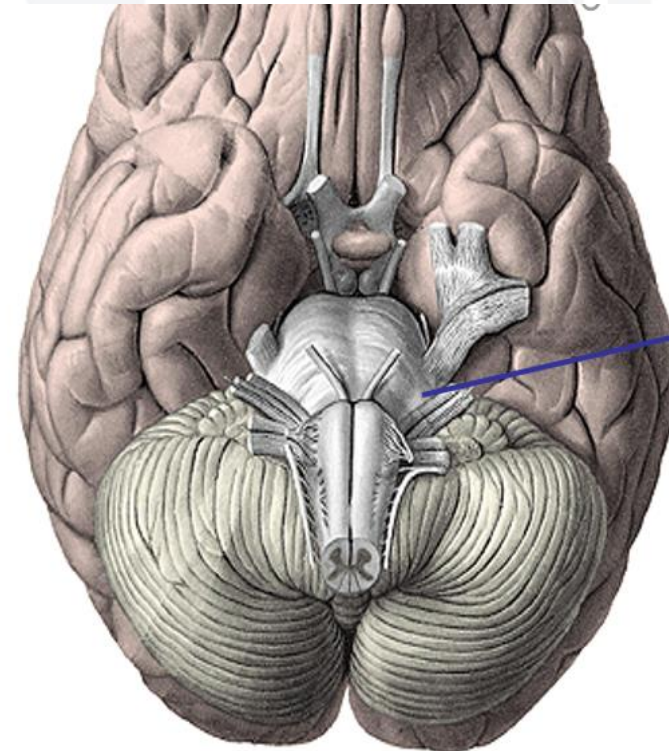
- The pons, which is the middle part of the brain stem, is 2.5 cm long on average. Together with the cerebellum, it forms the metencephalon.
- Because it connects both hemispheres of the cerebellum, it is called the pons, which means bridge.
- The pons is continuous with the medulla oblongata below and with the mesencephalon above, and lies in front of the cerebellum.





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- Its anterior surface is convex, and on both sides there are **pedunculus cerebellaris medius** formed by fibers extending in the transverse direction. The pedunculus cerebellaris medius connects the pons to the cerebellum.

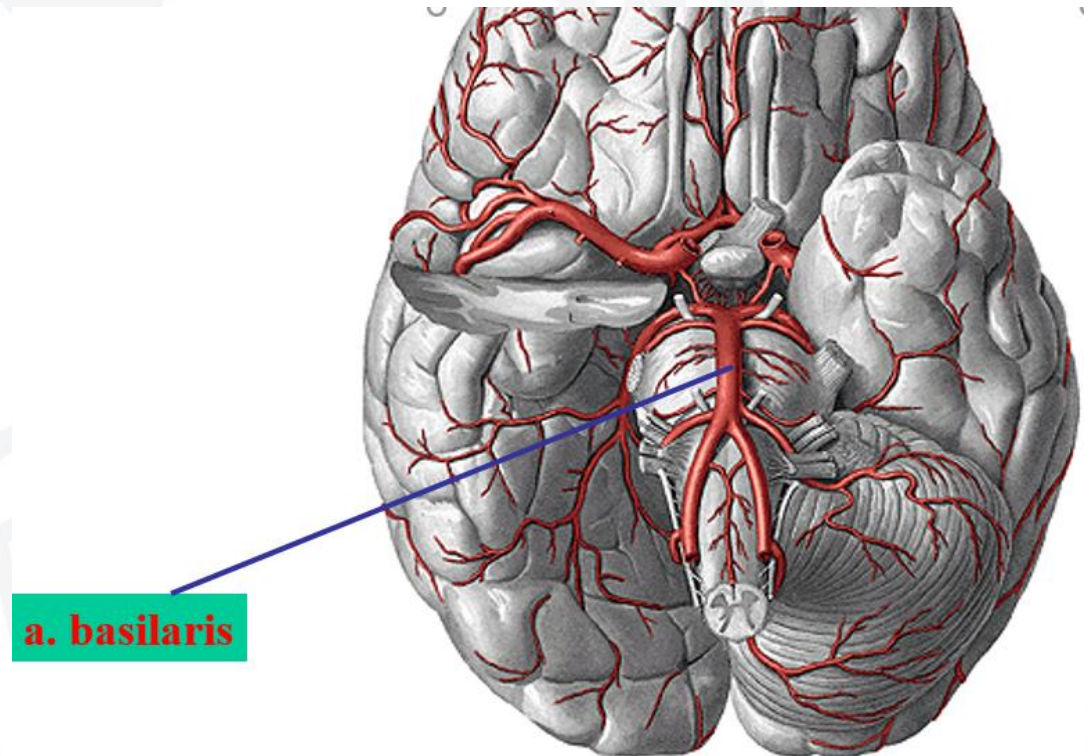


**pedunculus
cerebellaris medius**



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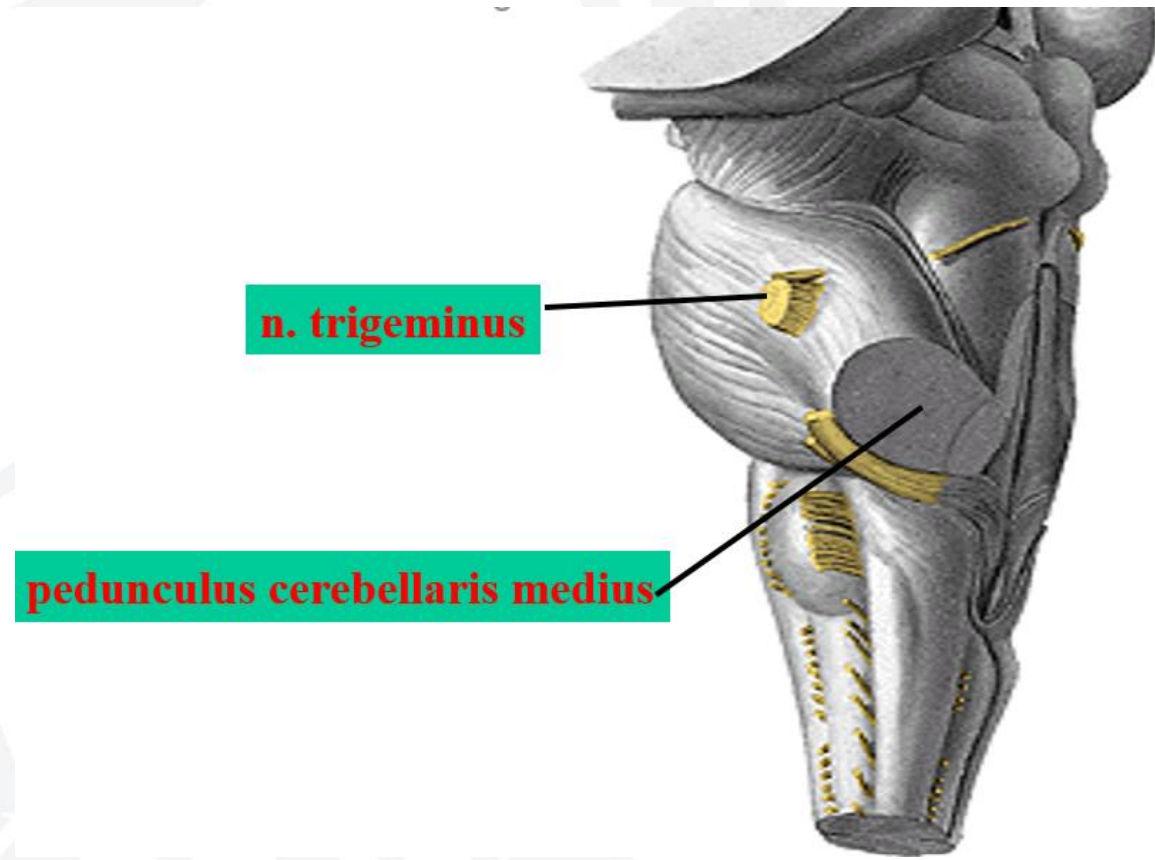
- In the middle of the anterior surface of the pons, there is a groove called sulcus basilaris extending from top to bottom, in this groove **a. basilaris**.





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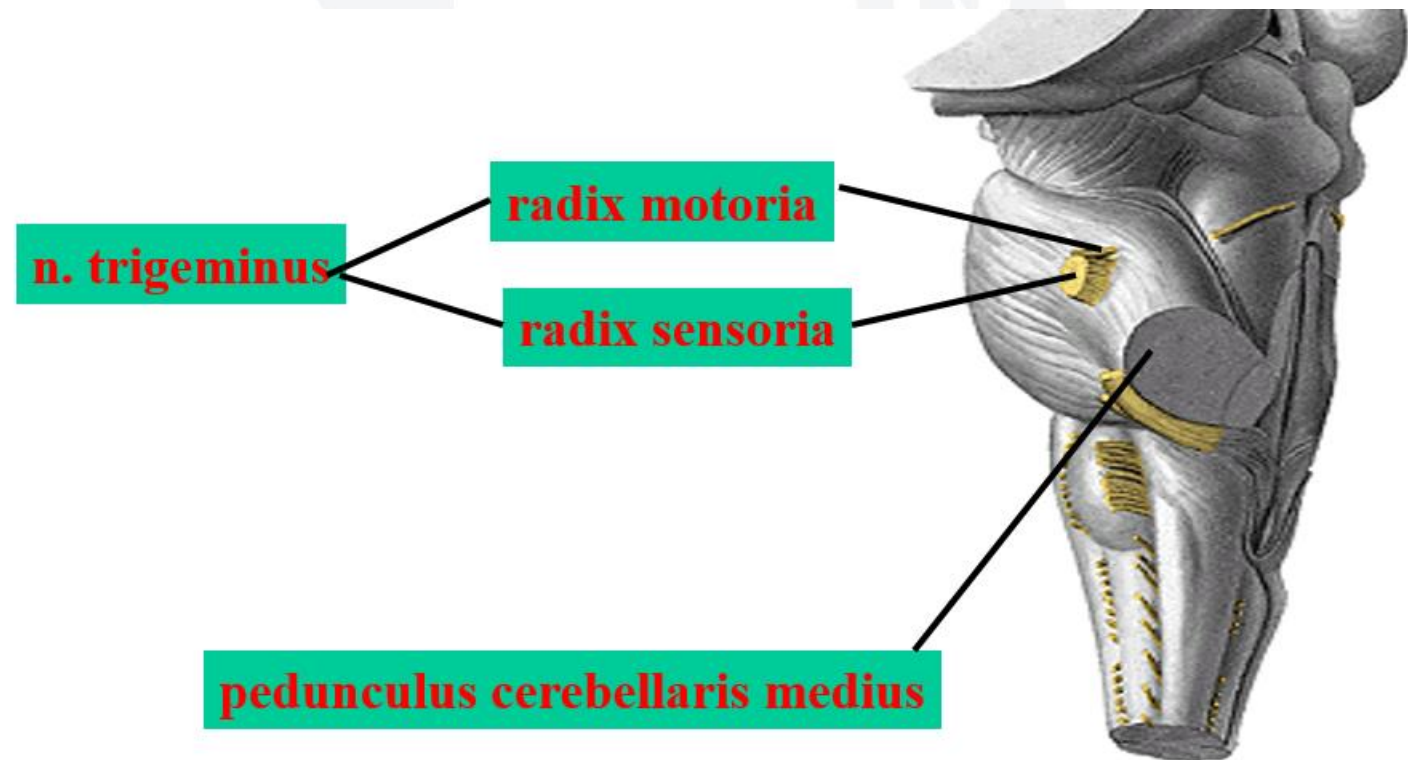
- On the anterior-outer surface of the pons, at the junction of the **pedunculus cerebellaris medius** and the pons **n. trigeminus** is located.





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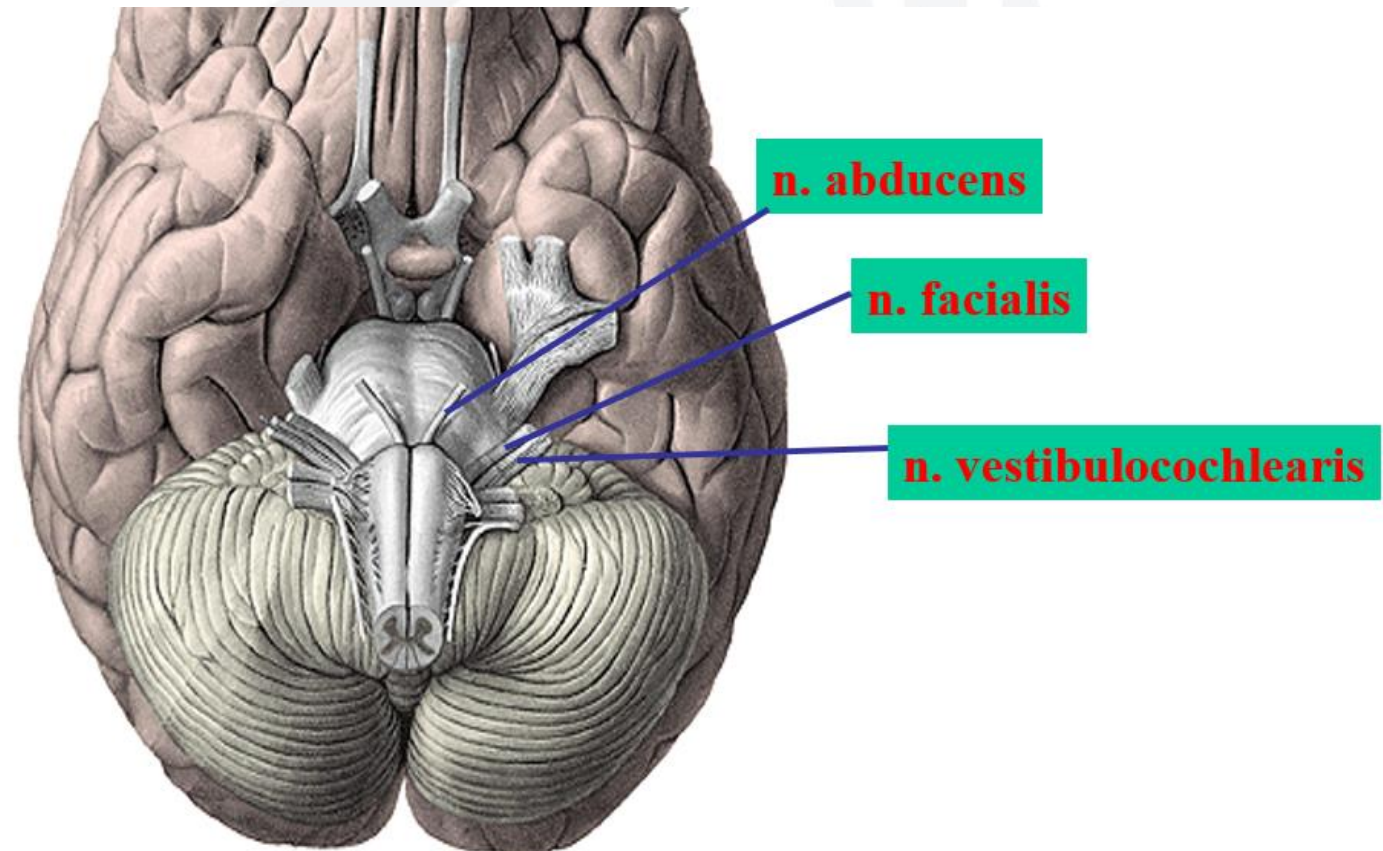
- The smaller medial part of the **N. trigeminus** is called the **radix motoria**, and the larger lateral part is called the **radix sensoria**.





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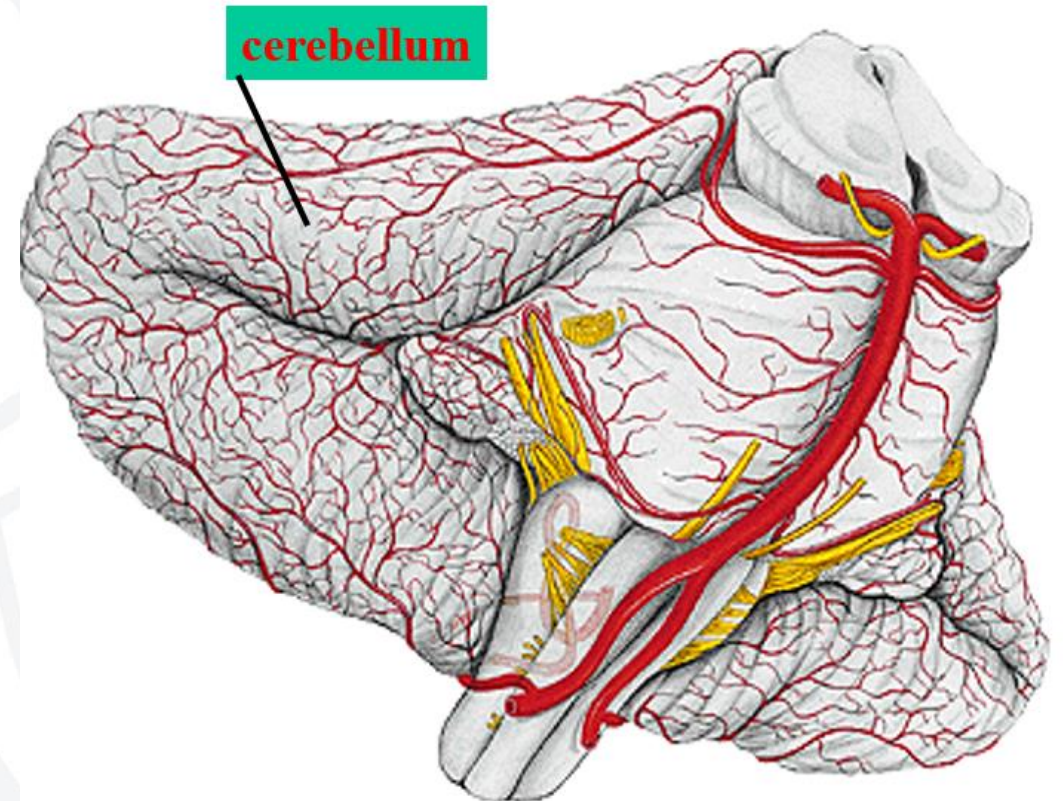
- In sulcus bulbopontinus located between bulbus and pons, **n. abducens, n. facialis and n. vestibulocochlearis.**





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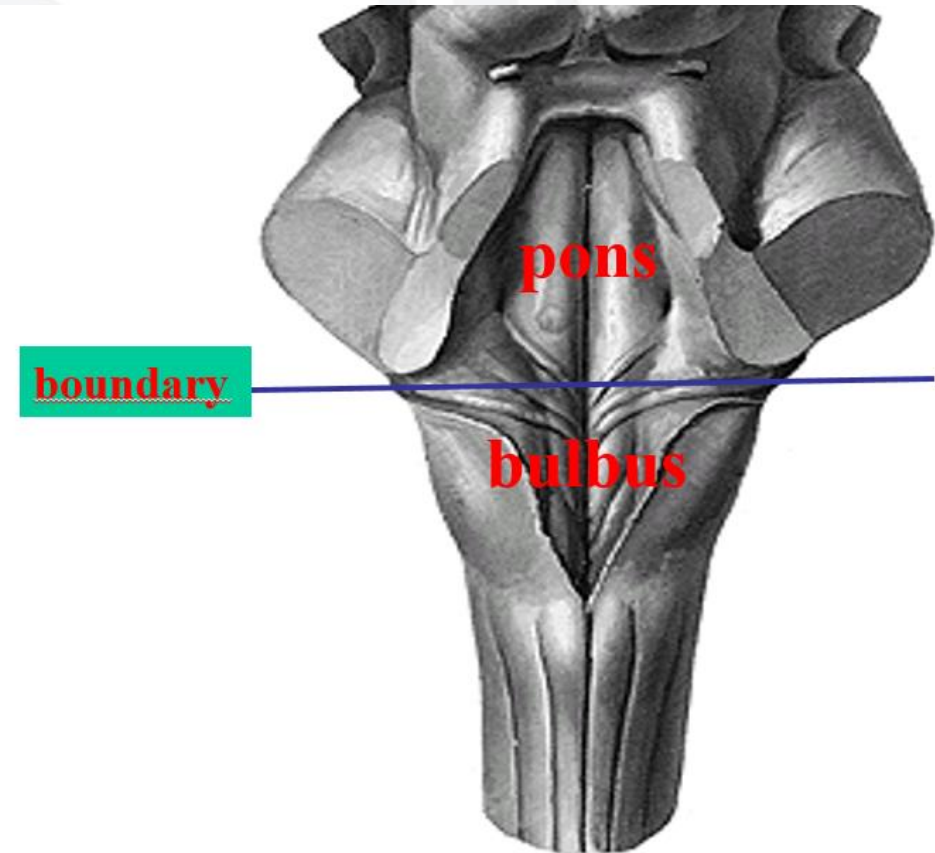
- The posterior aspect of the pons is covered by the **cerebellum**. In order to see this place, it is necessary to remove the cerebellum.





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- The posterior surface of the pons forms the upper half of the **fossa rhomboidea**, the floor of the **fourth ventricle**.



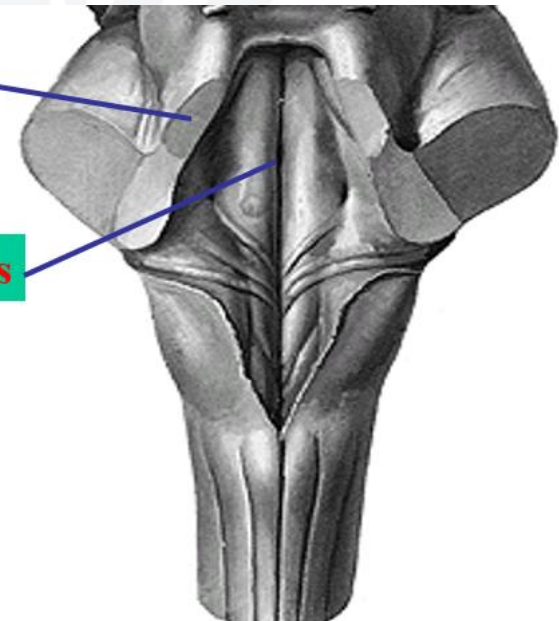


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- This triangular face is bordered laterally by the **pedunculus cerebellaris superioris**.
- The groove located longitudinally in the middle is called the **sulcus medianus**. This groove continues on the posterior surface of the bulbus, which forms the lower half of the **fossa rhomboidea**.

**pedunculus
cerebellaris superior**

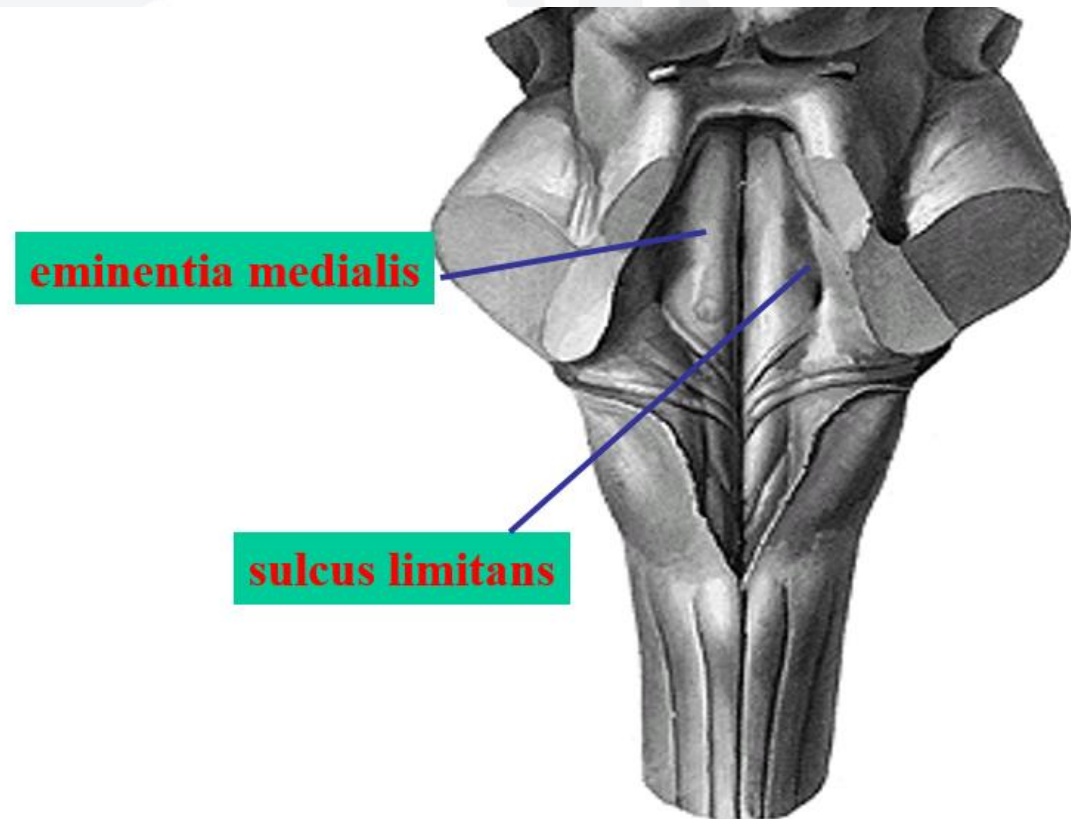
sulcus medianus





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- The longitudinal ridge on both sides of the **sulcus medianus** is called **eminentia medialis** and is bordered laterally by the **sulcus limitans**.





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- The ridge at the tip of **eminetia medialis** is called **colliculus facialis**. The colliculus facialis is formed by fibers of the **nervus facialis**, which rotate around the nucleus of the nervus abducens.



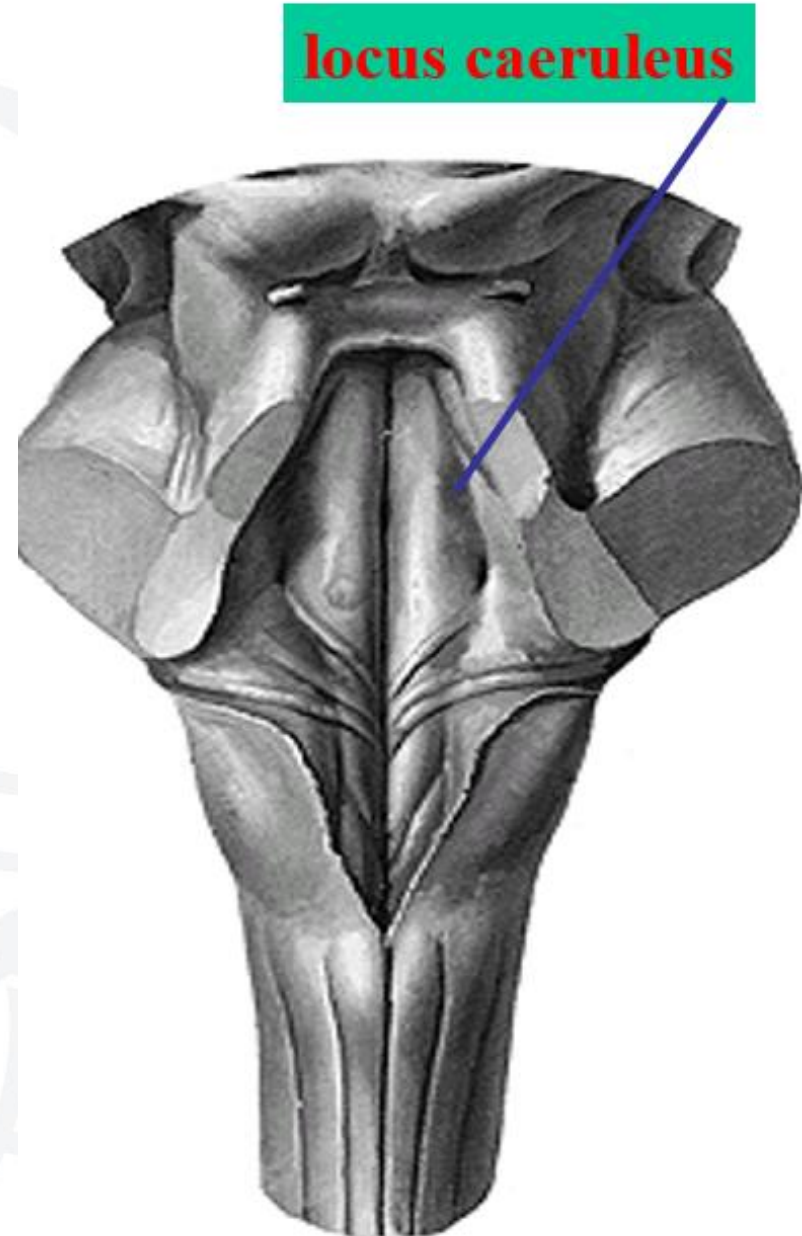
colliculus facialis

The image is a grayscale anatomical diagram of the brainstem, viewed from a superior perspective. A blue line points from a green rectangular label to a specific ridge on the dorsal surface of the brainstem, which is the colliculus facialis. The diagram shows the complex structure of the brainstem, including the midbrain, pons, and medulla oblongata.



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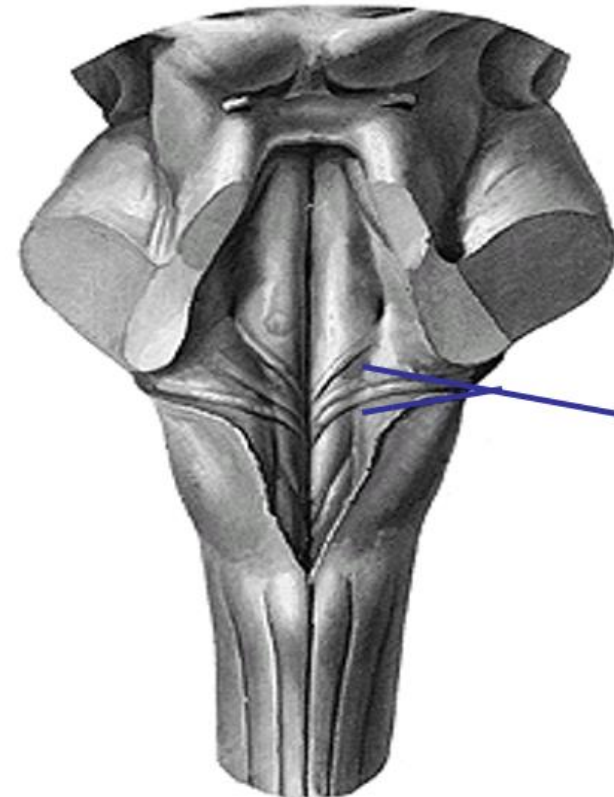
- The gray-bluish colored area on the upper half of Sulcus limitans is called **locus caeruleus**.
- (Their cells contain noradrenaline, and their axons connect with all parts of the brain.)
- It is thought to be involved in the activation or inhibition of sensory neurons, control of cortical activity and paradoxical sleep.)





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- The area on the outside of the sulcus limitans is called the **area vestibularis** because of the **deep vestibular nuclei**.

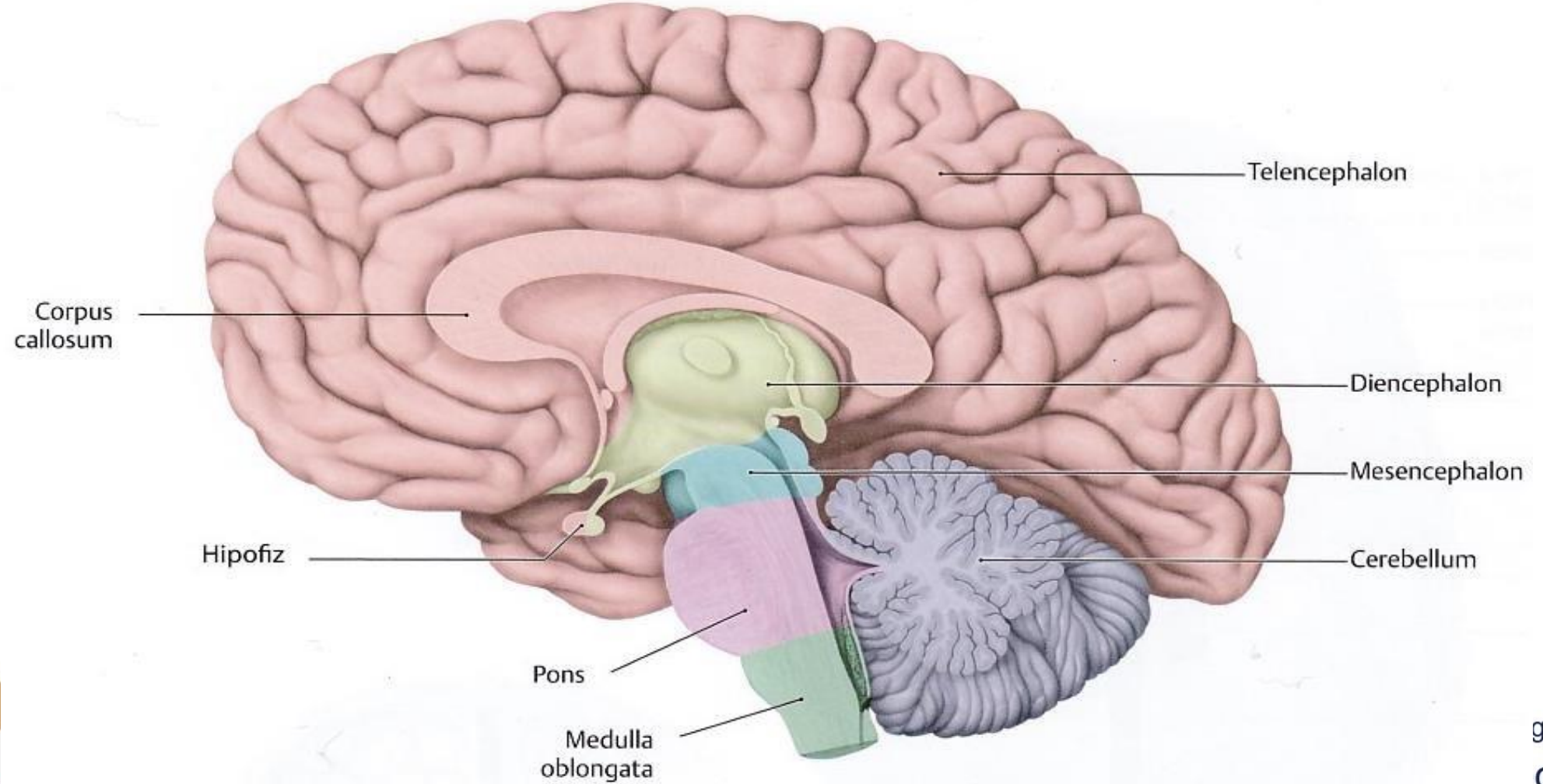


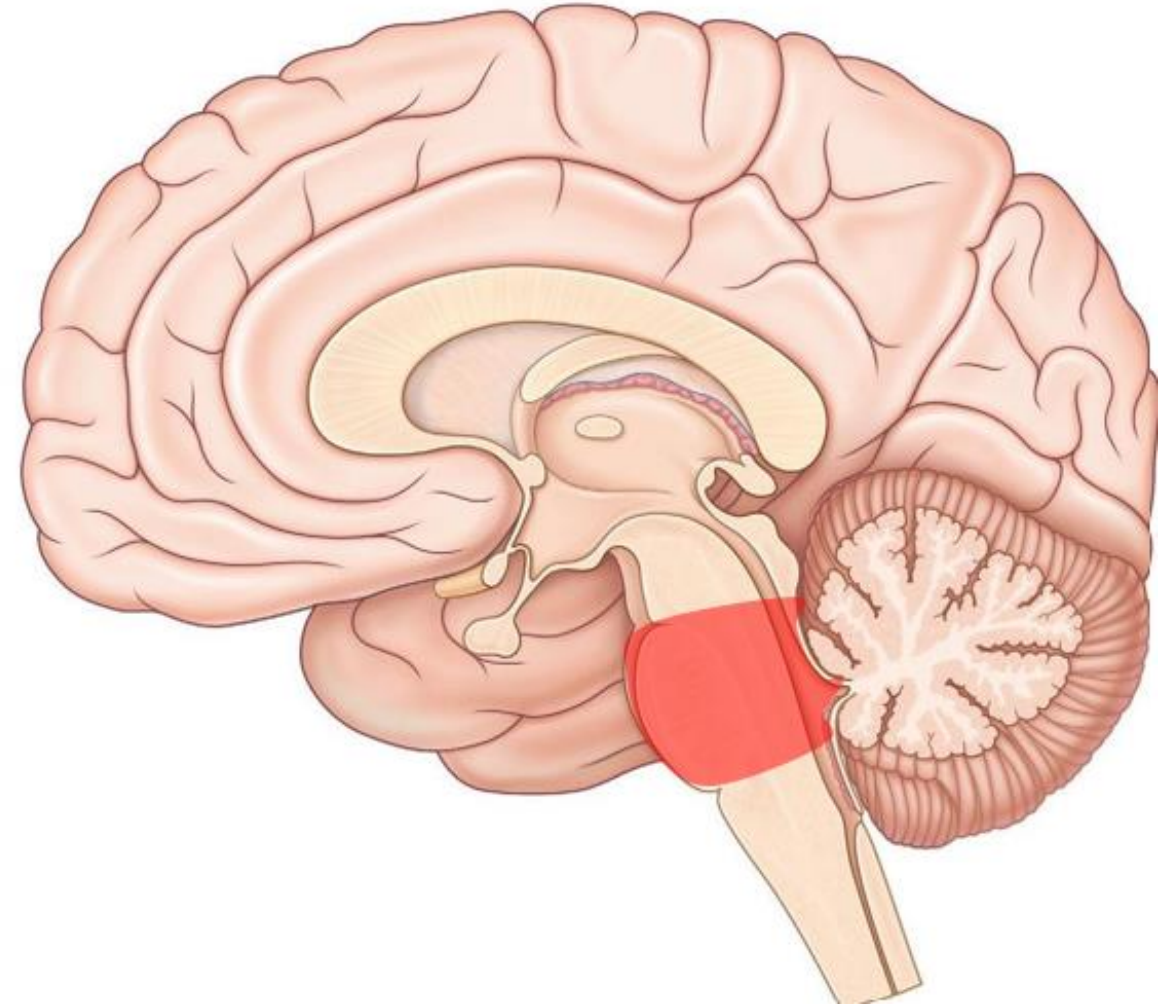
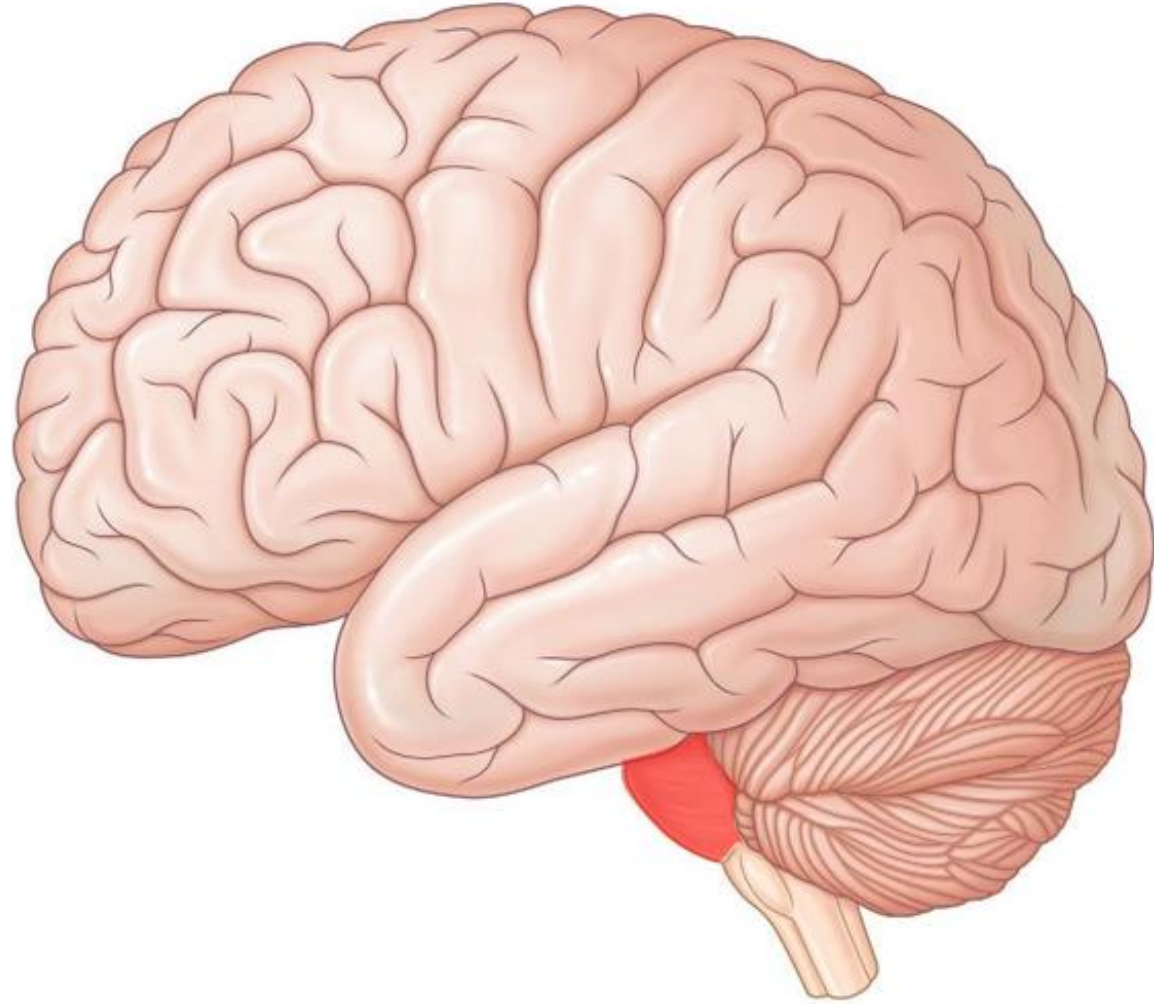
area vestibularis



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PONS







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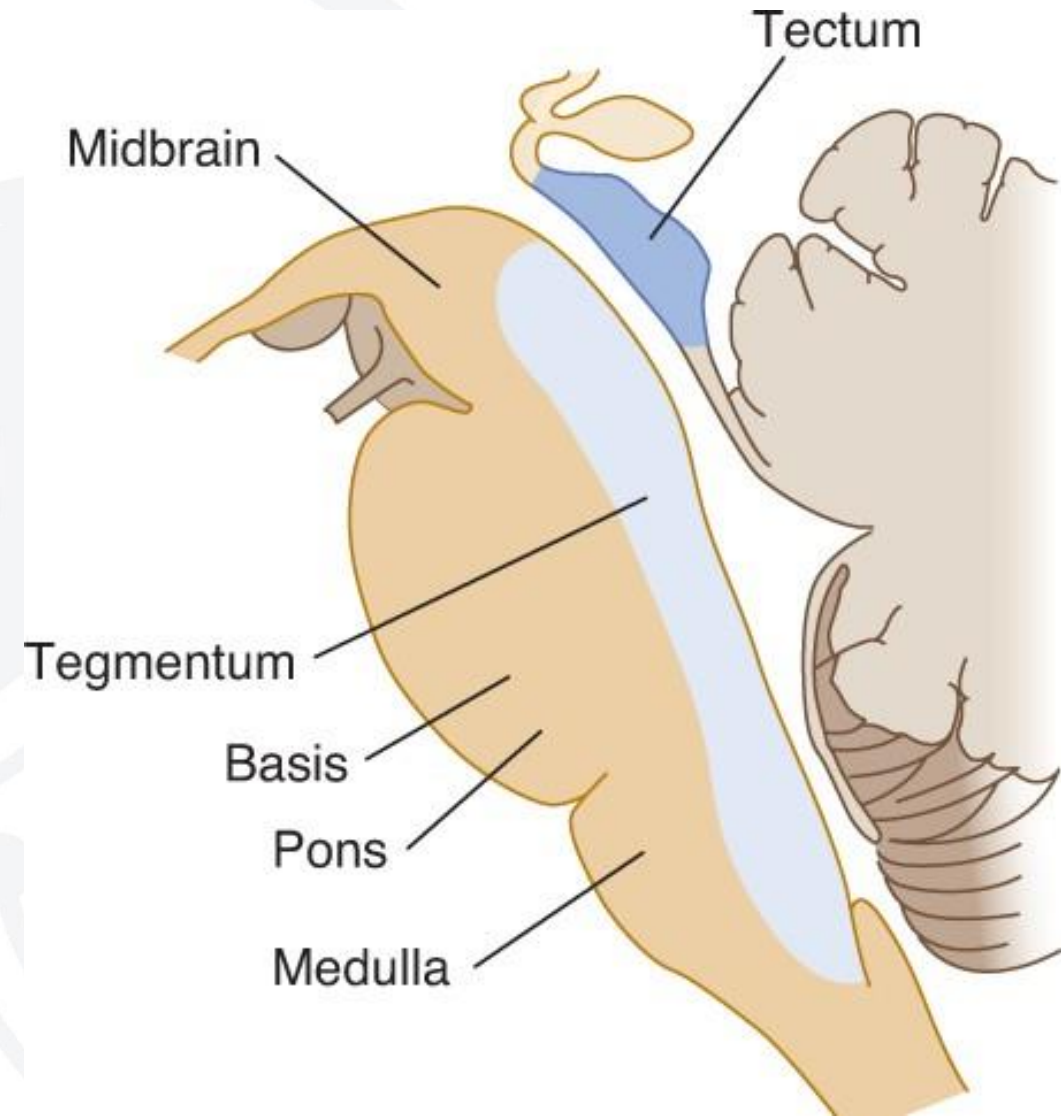


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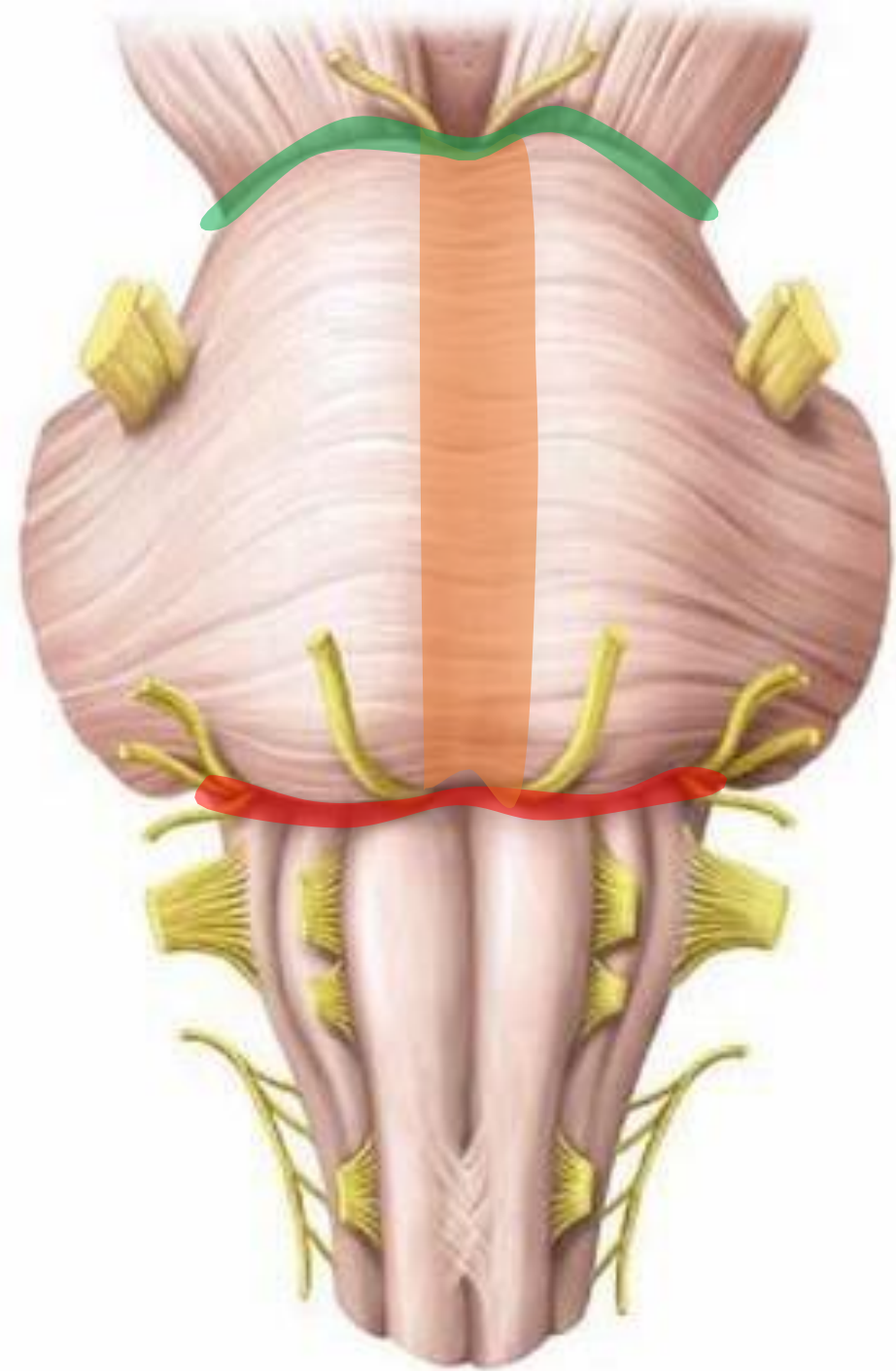
- Pons is the middle part of the brainstem.
- The pons lies rostral to the medulla and caudal to the midbrain.
- It connects to cerebellum with middle cerebellar peduncle.
- Pons has 2 part: Basilar part and tegmentum





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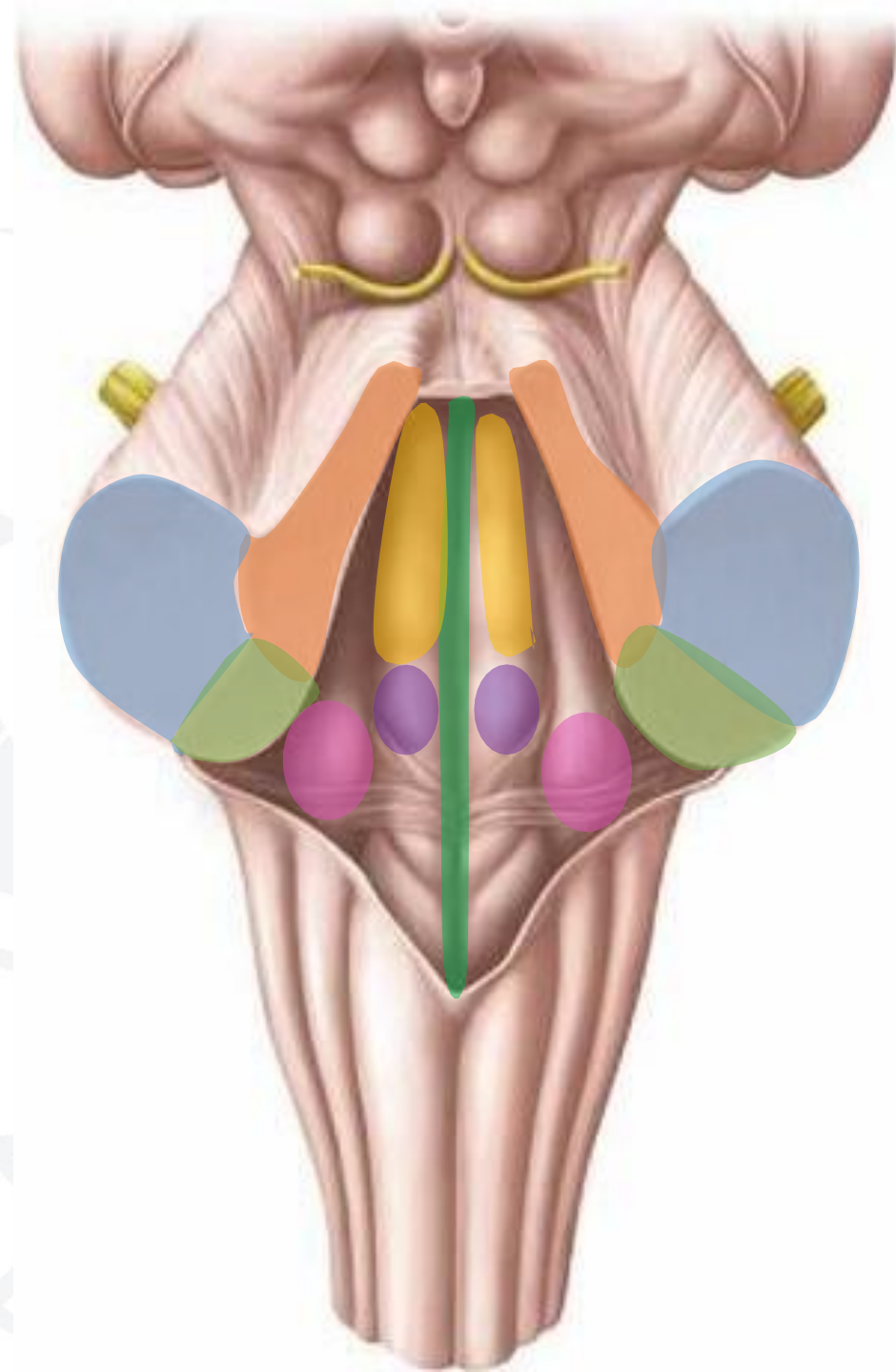
- Bulbopontine sulcus
- Superior pontine sulcus
- Basilar sulcus





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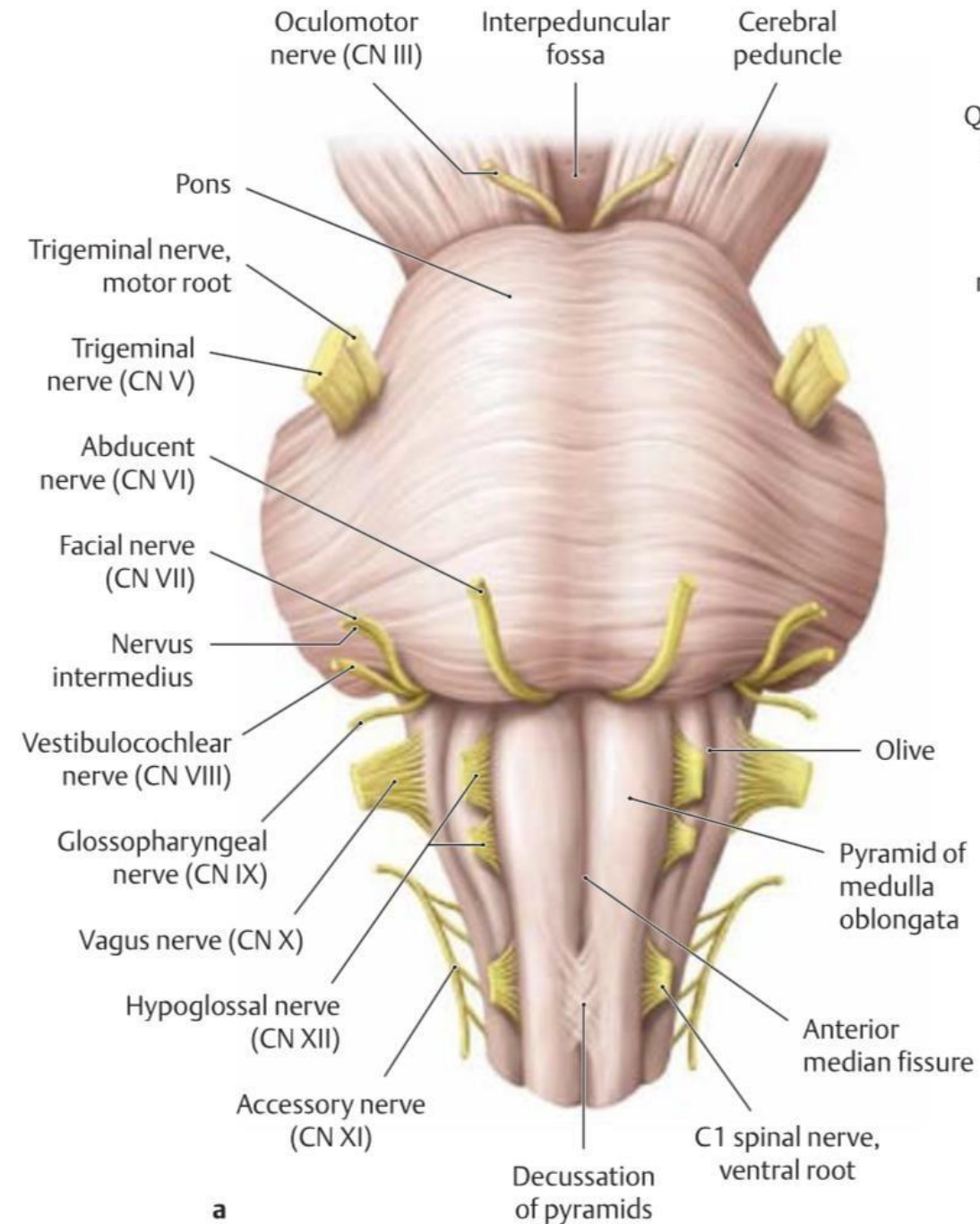
- Median sulcus
- Superior cerebellar peduncle
- Middle cerebellar peduncle
- Inferior cerebellar peduncle
- Medial eminence
- Facial colliculus
- Vestibular area





Cranial Nerve

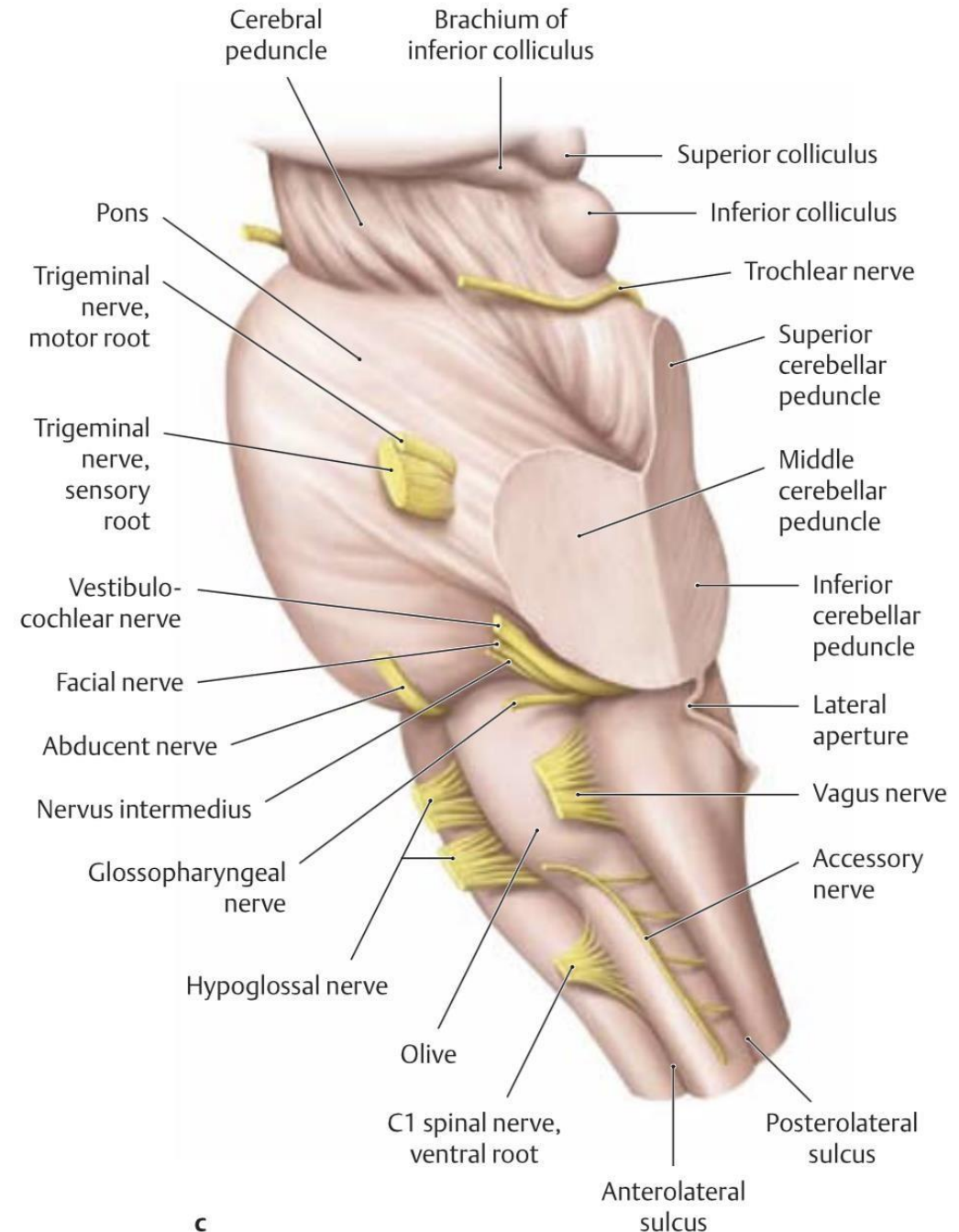
- CN V, VI, VII, VIII leave the brain stem from the pons.
- CN V (trigeminal nerve) exit from anterolateral side of pons
- CN VI, VII, VIII (abducens, facial, vestibulocochlear) exit from bulbopontine sulcus.





Cranial Nerves

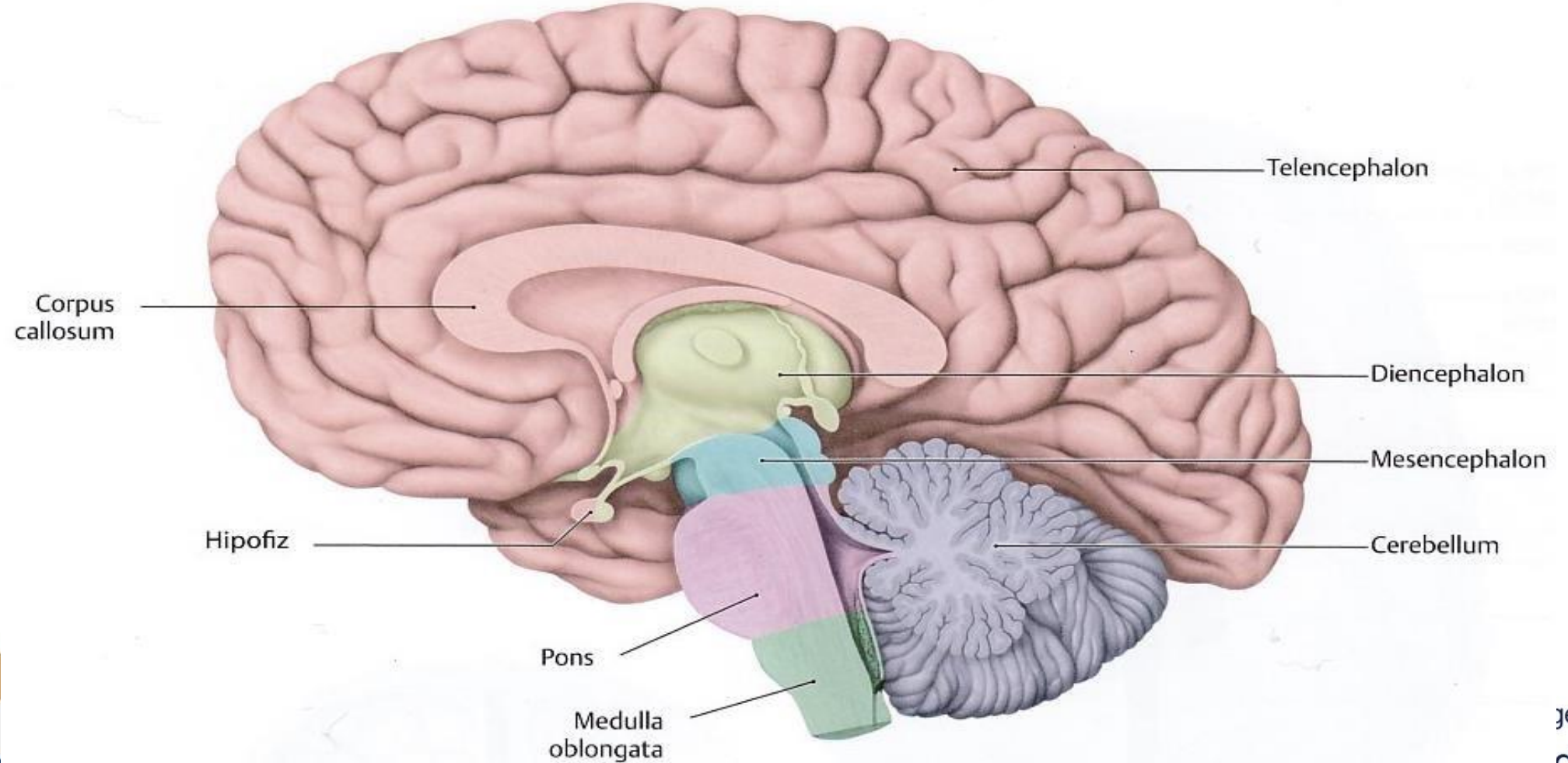
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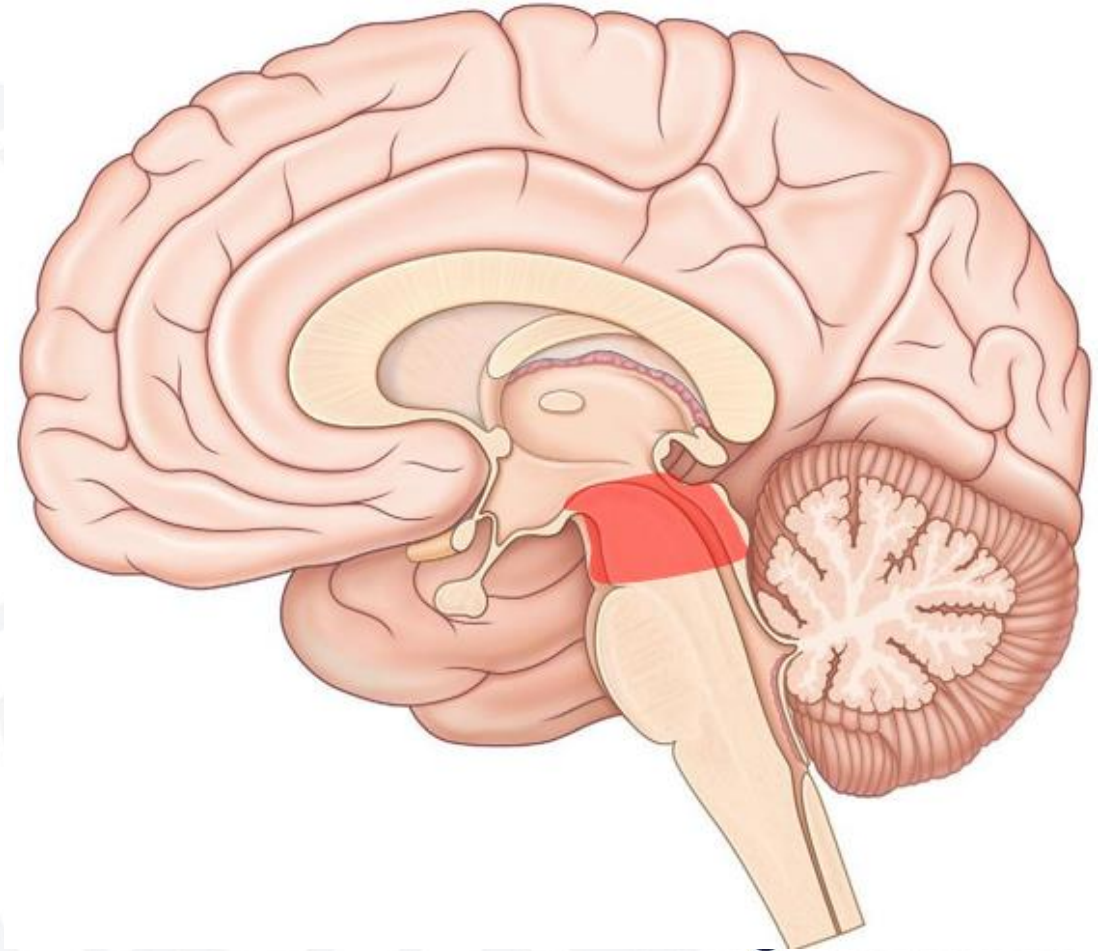
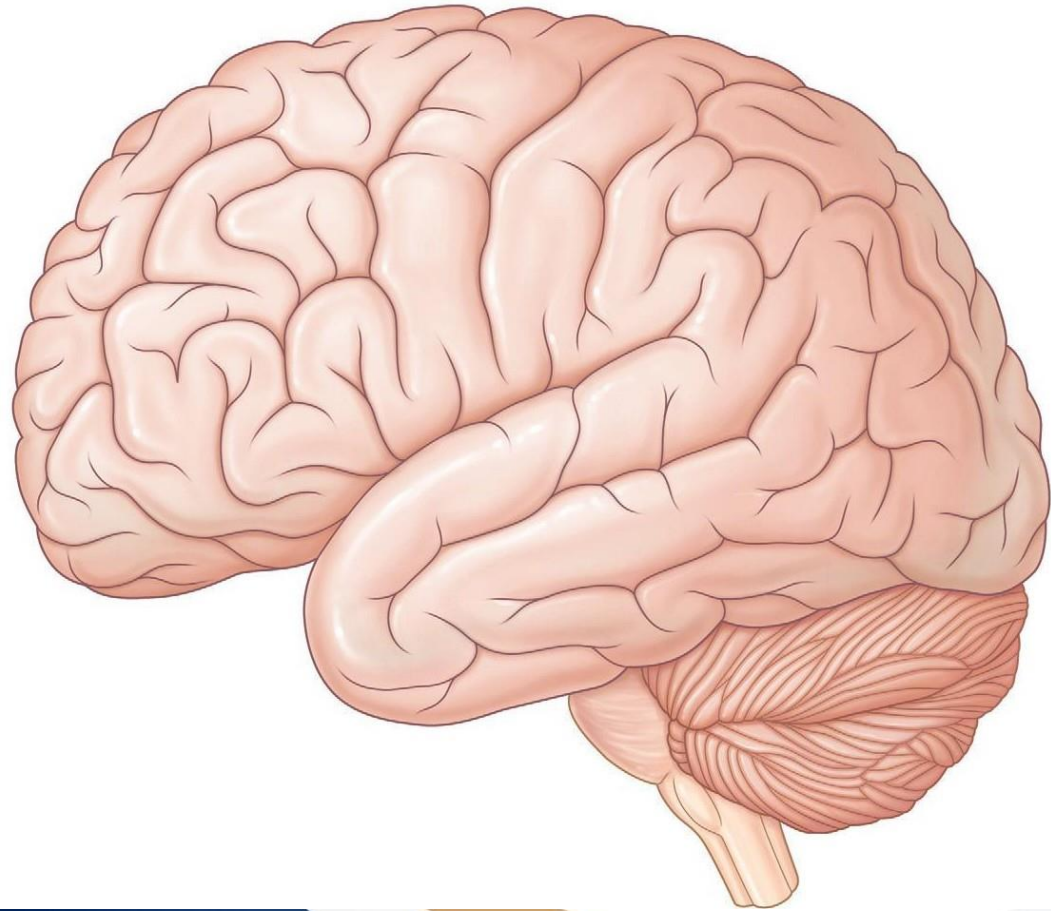
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Midbrain (Mesencephalon)





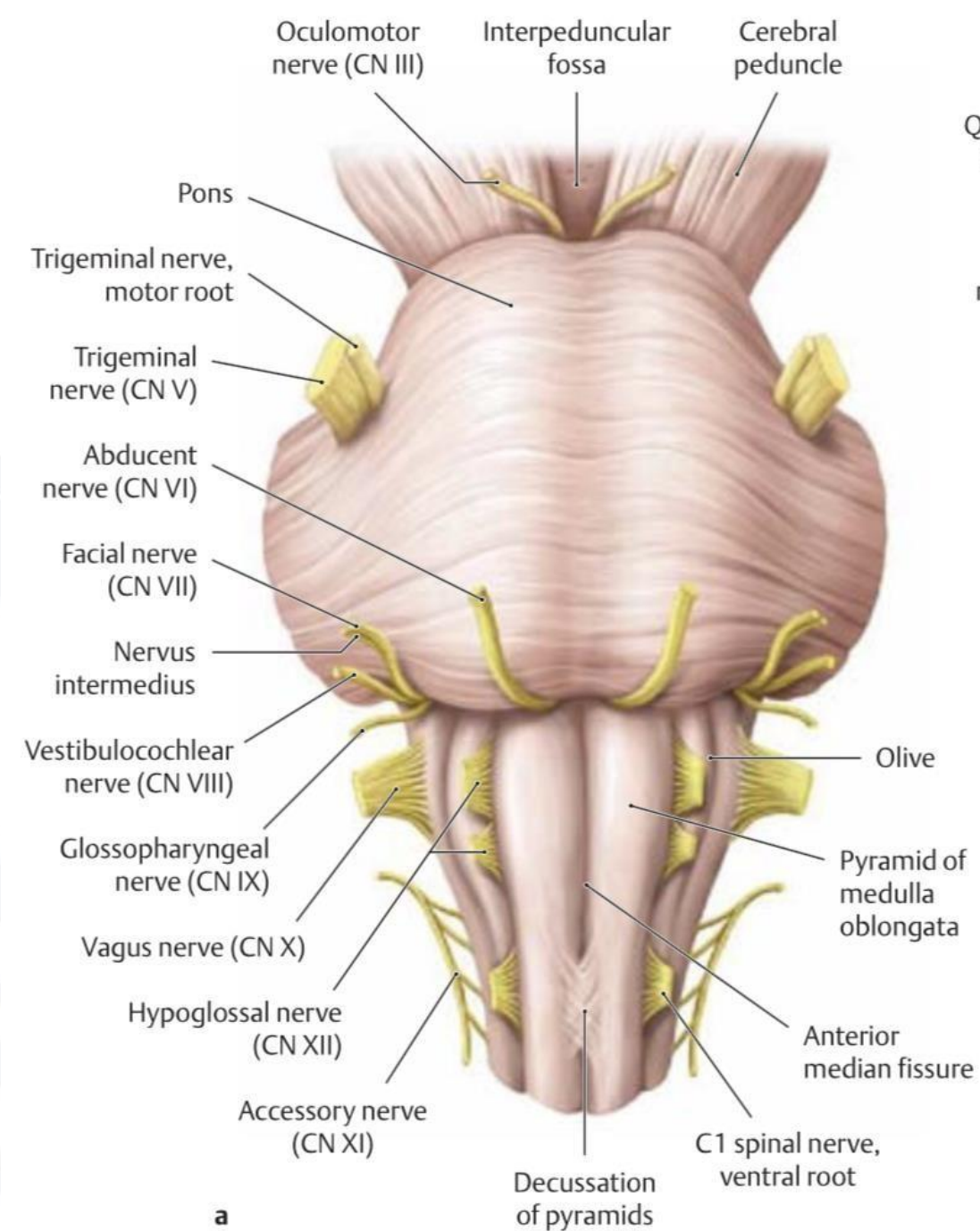
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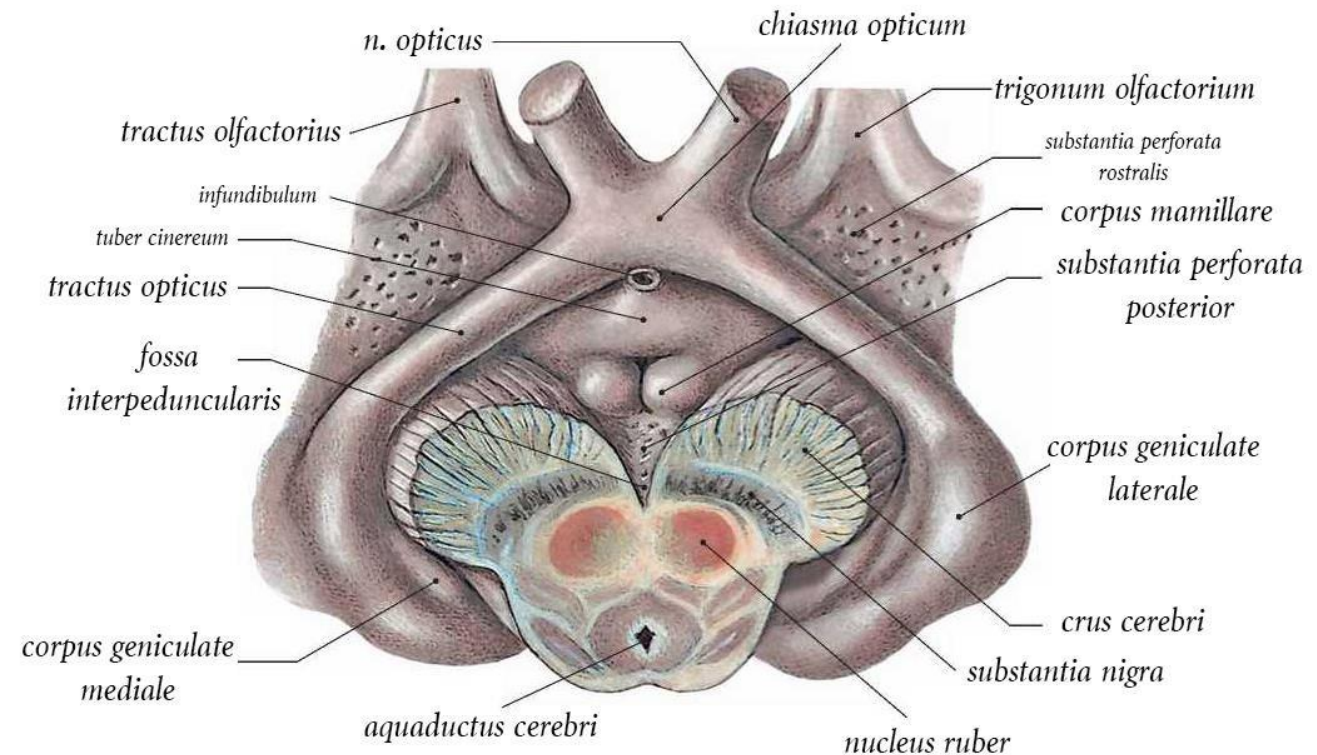
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- It is the most rostral part of the brainstem.
- It connects to cerebellum with superior cerebellar peduncle.
- It is the shortest brainstem segment, not more than 2 cm in length.
- Between midbrain and pons, there is superior pontine sulcus. From this sulcus CN III (oculomotor nerve) leaves the brainstem.



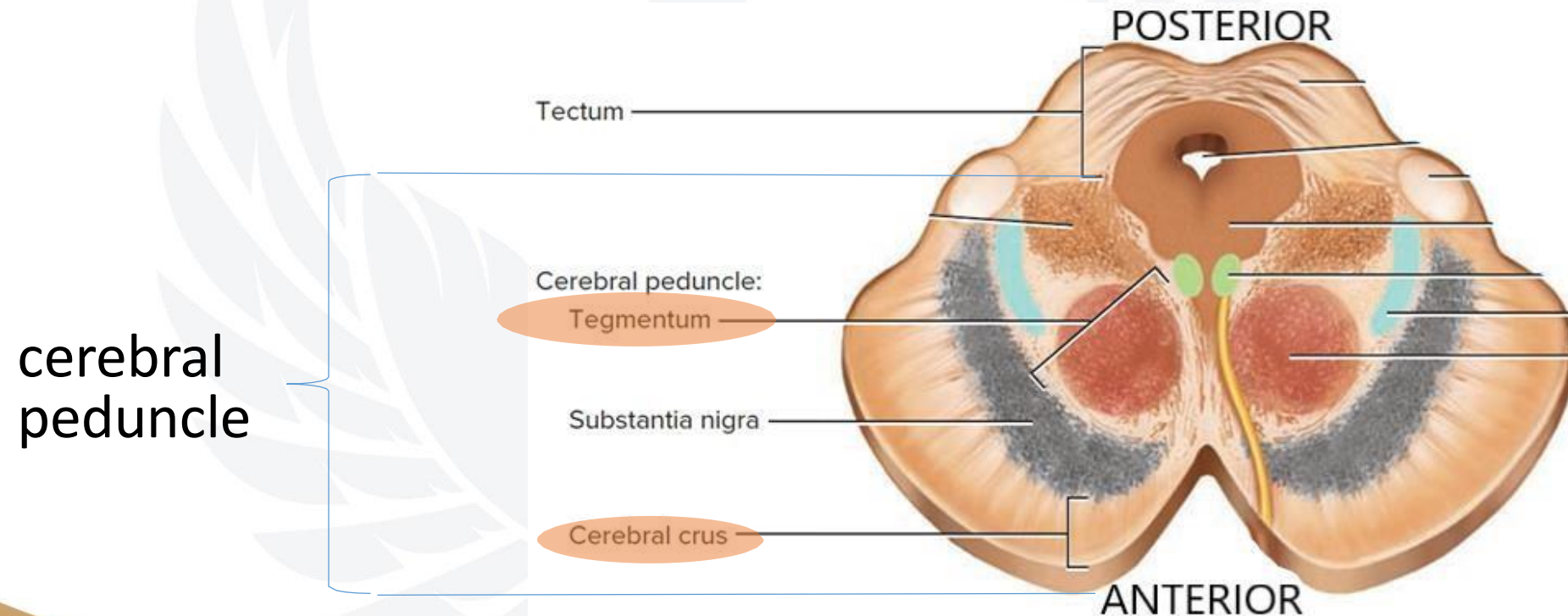


- Midbrain has 2 part: **ventral** and **dorsal** parts
- The **ventral part** is formed by the **cerebral peduncle**.
- The fossa between the cerebral peduncles is called the interpeduncular fossa.





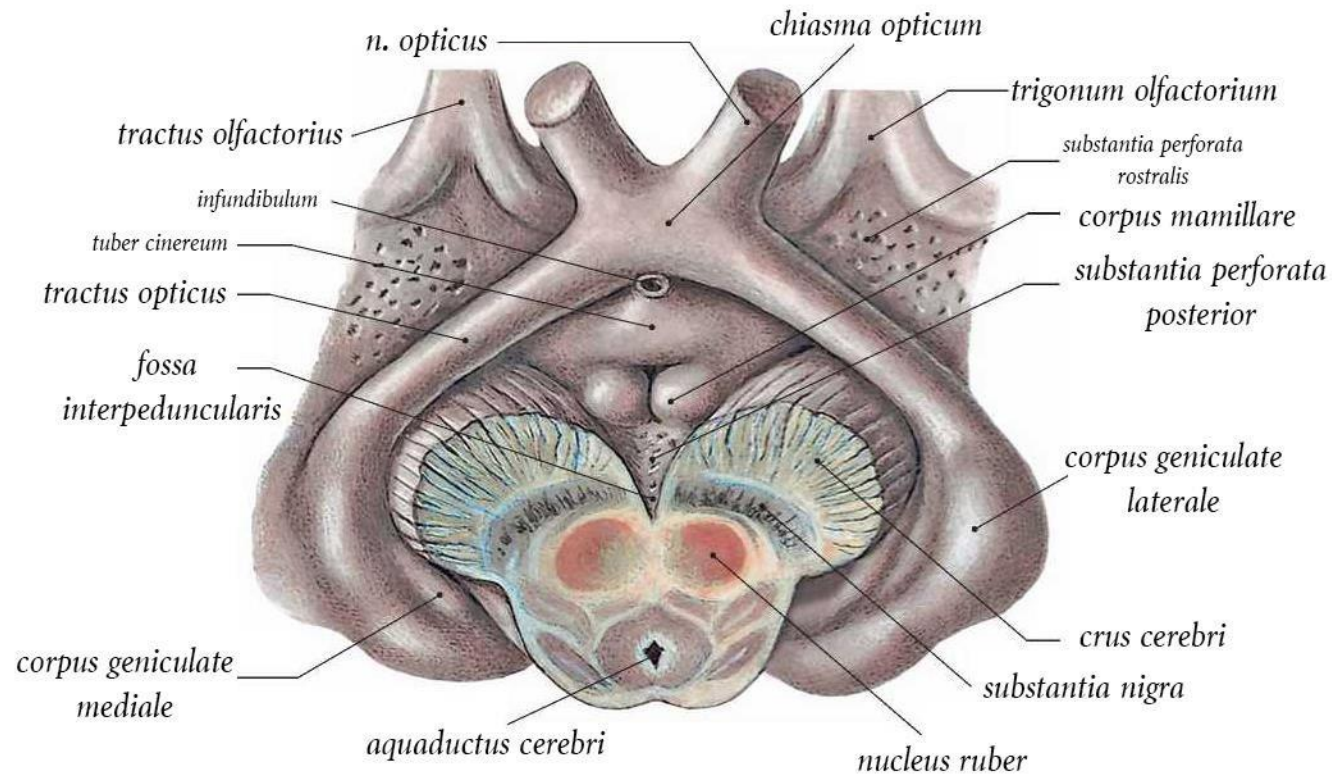
- Each cerebral peduncle is divided into two regions, dorsal and ventral, by a pigmented lamina called the **substantia nigra** in transverse sections.
- The dorsal region is called **tegmentum** of midbrain and the ventral region is called **cerebral crus**.





Cerebral Crus

- Cerebral crus is formed by fibers coming from cerebral cortex.

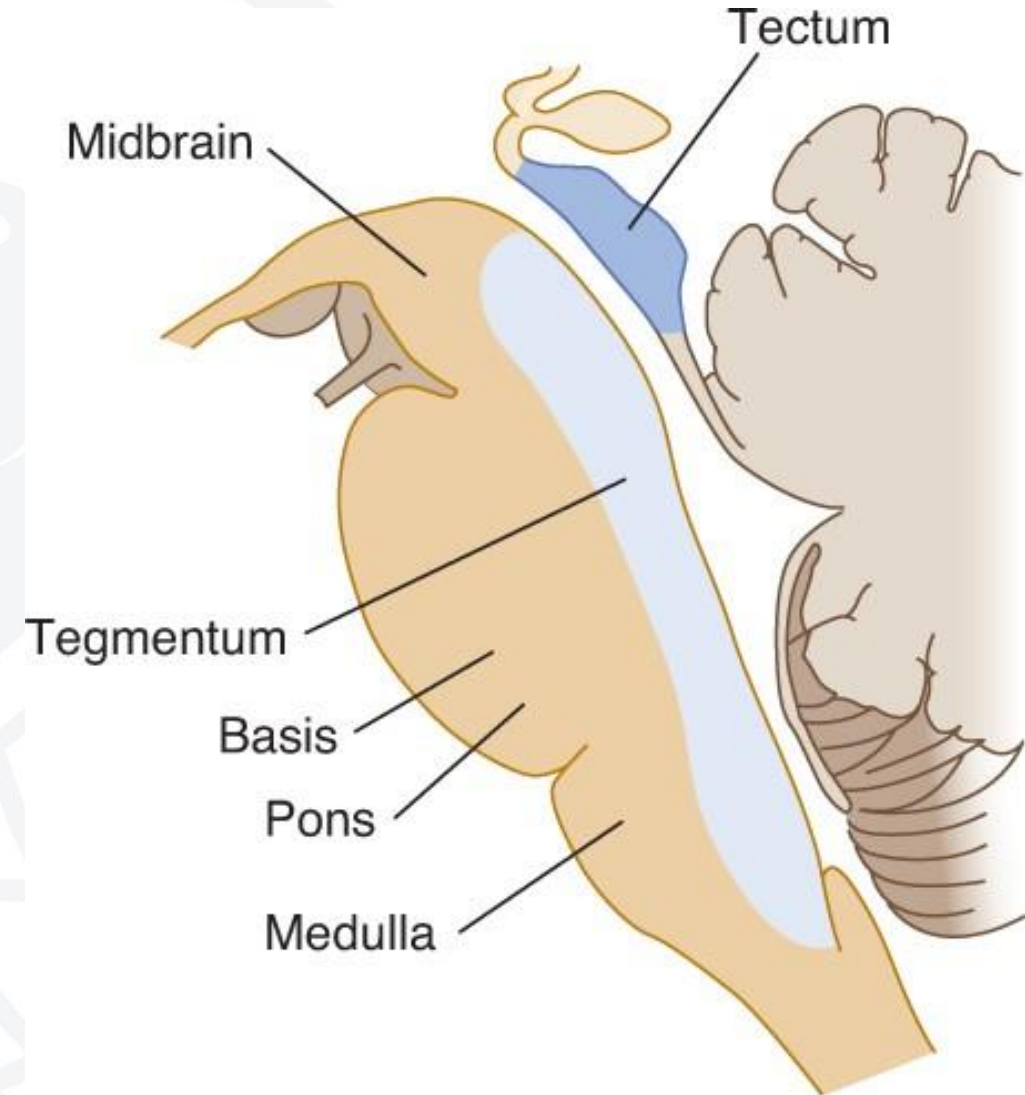




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Tegmentum of Midbrain

- It is the part of the midbrain between the substantia nigra and the tectum.
- The cerebral aqueduct passes through the tegmentum and connects the third ventricle and the fourth ventricle.
- Nucleus of CN III (oculomotor nerve) and CN IV (trochlear nerve) are in tegmentum.

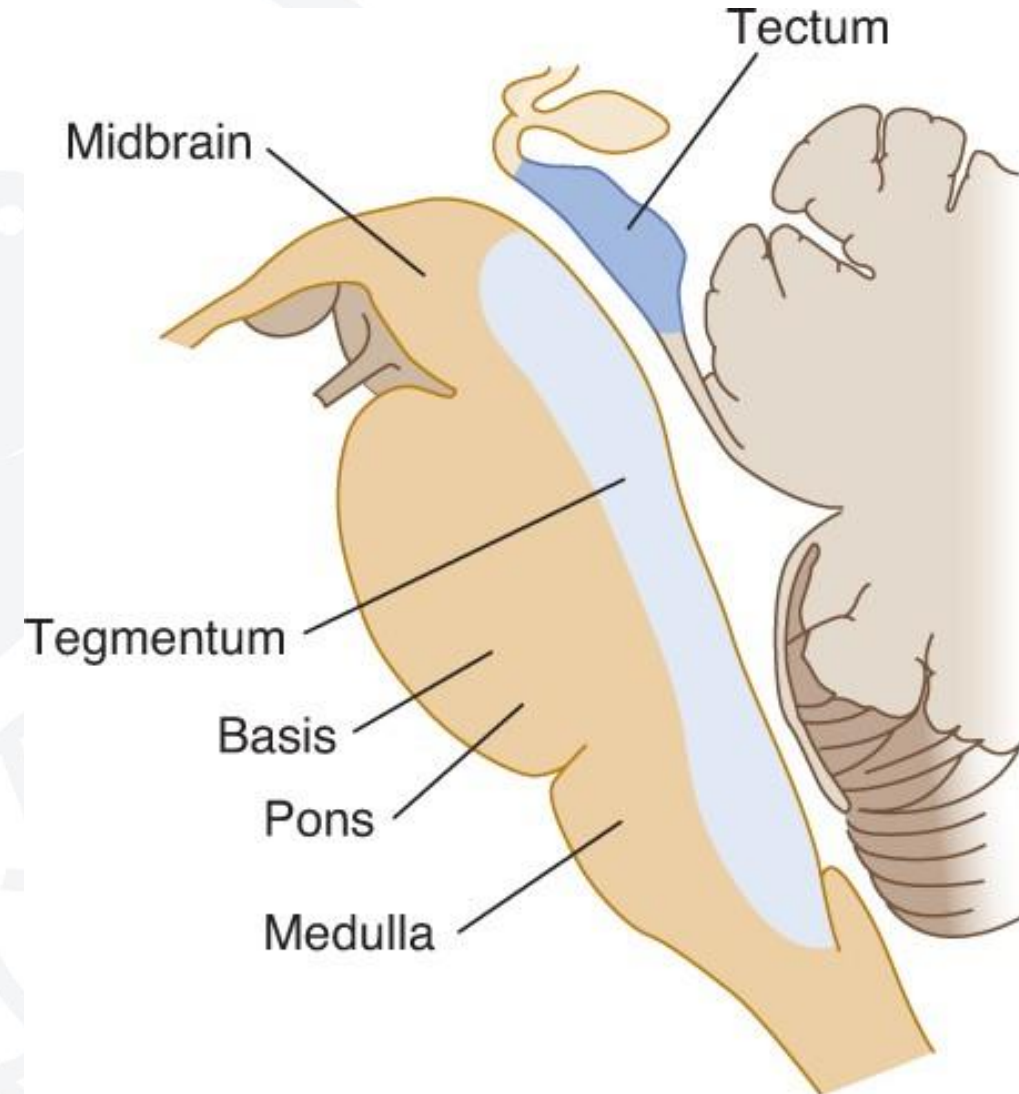




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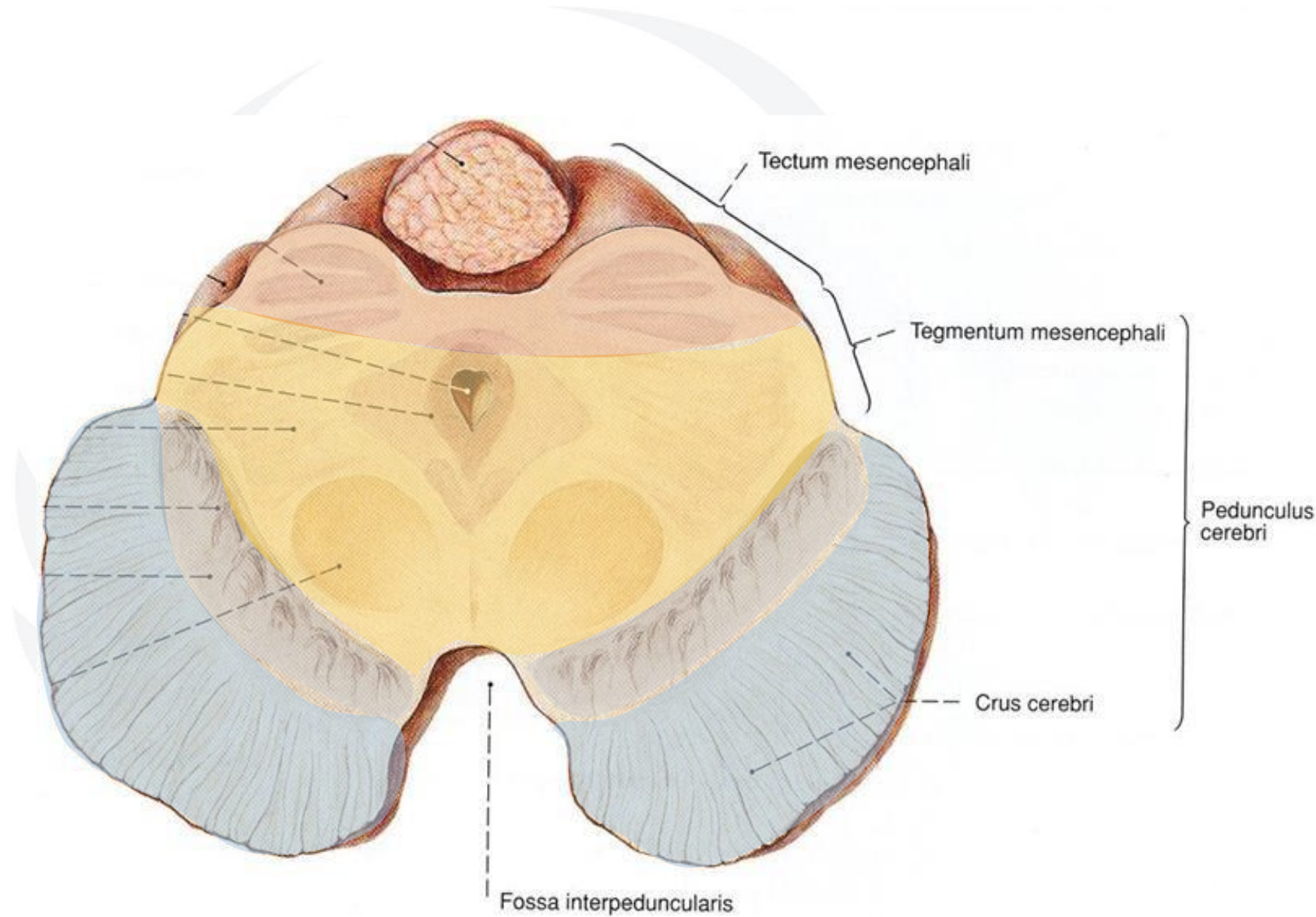
Midbrain - Mesencephalon

- The **dorsal part** is called tectum.





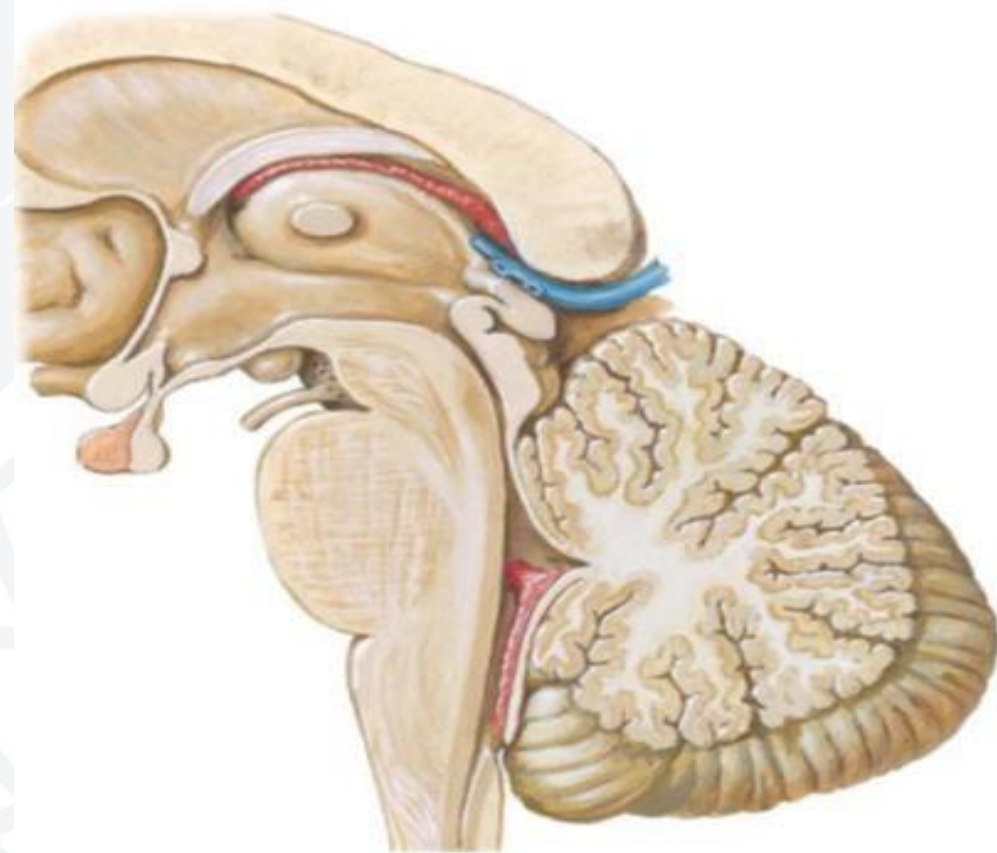
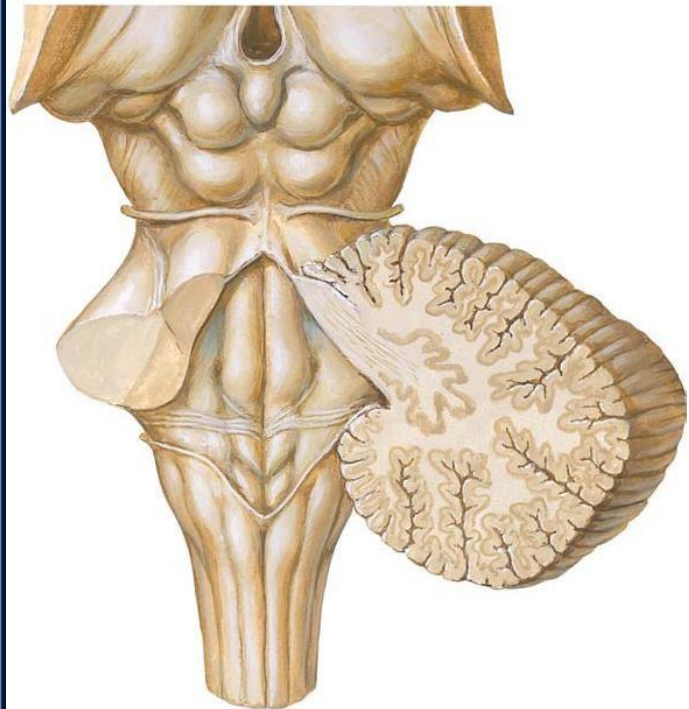
- Cerebral peduncle
 - Cerebral crus
 - Tegmentum
- Tectum





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- It is the dorsal part of the midbrain behind the cerebral aqueduct.
- Here exists corpora quadrigemina.





Corpora Quadrigemina

- It's four little bumps.
- The larger and upper two are called **superior colliculus**. It has a role in reflex movements of the head, neck and eyes, which are caused by **sudden auditory, somatic and visual stimuli**.
- The lower two are called **inferior colliculus** and are related to the auditory pathway. The colliculus inferior is the major **subcortical center that regulates hearing**.
- CN IV (trochlear nerve) leaves the midbrain just below the inferior colliculus.



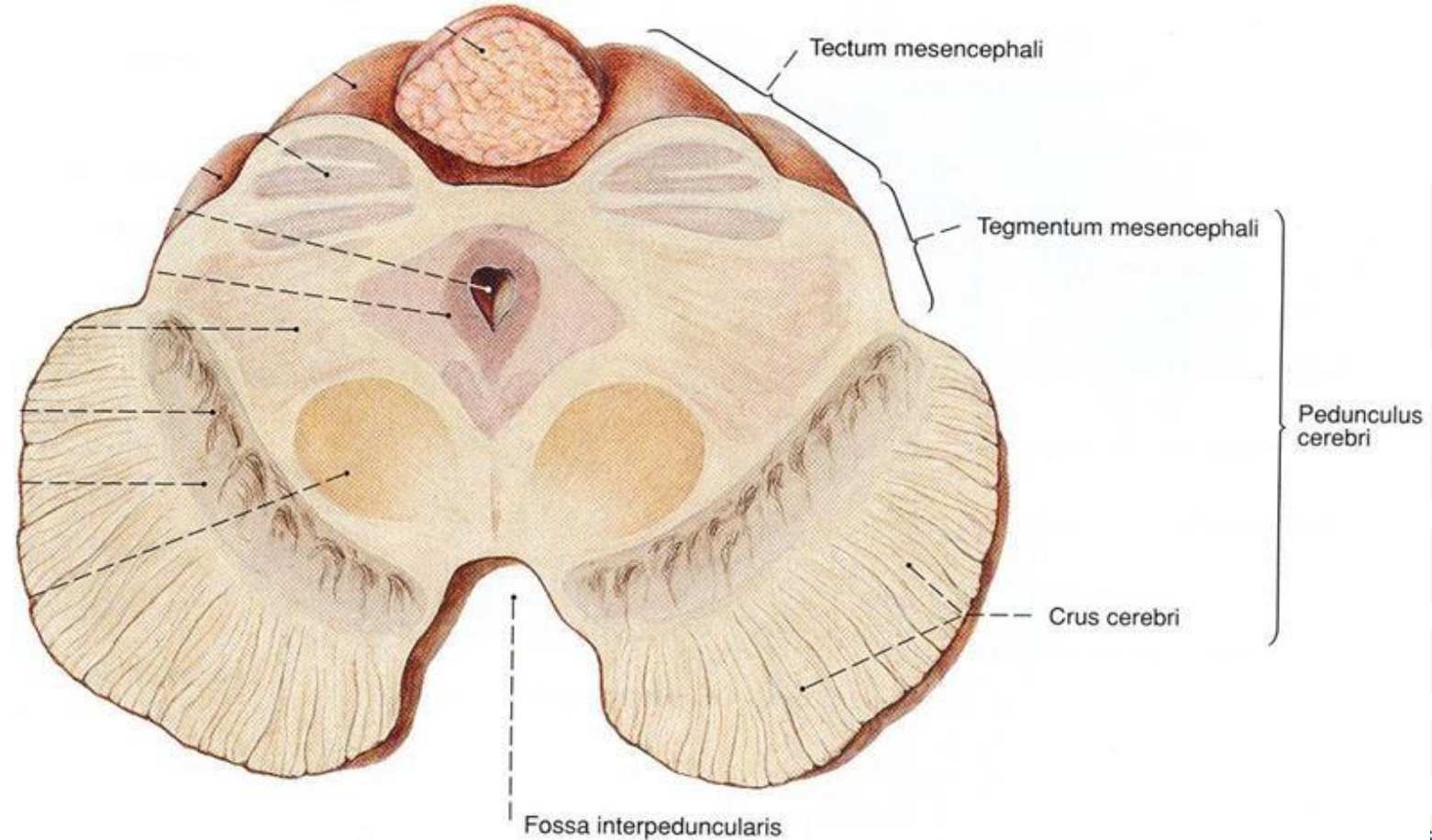
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Substantia Nigra

- The substantia nigra is a basal ganglia structure located in the midbrain that plays an important role in **motor control**.
- **The primary source of dopamine producing neurons is located here.**
- Substantia nigra is Latin for "black substance", reflecting the fact that parts of the substantia nigra appear darker than neighboring areas due to high levels of neuromelanin in dopaminergic neurons.
- **Parkinson's disease** is characterized by the loss of dopaminergic neurons in the substantia nigra.



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Red Nucleus

- The red nucleus or **nucleus ruber** is a structure in the rostral midbrain involved in motor coordination.
- The red nucleus is pale pink, which is believed to be due to the presence of iron in at least two different forms: hemoglobin and ferritin.
- The structure is located in the tegmentum of the midbrain next to the substantia nigra.



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