



# BRAIN STEM II

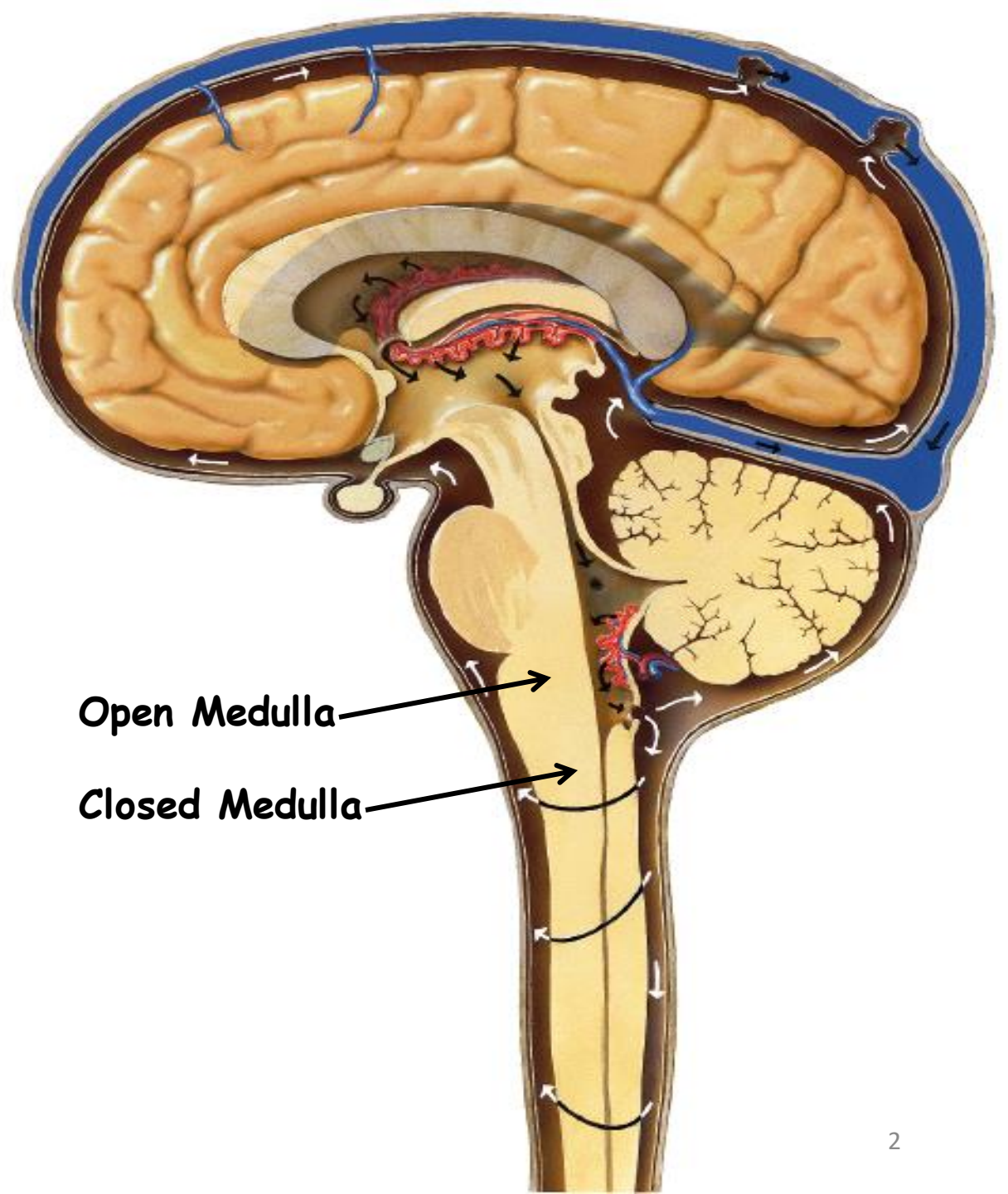
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## Internal features of the medulla

### Open medulla:

This is the upper part of the medulla which is related by its dorsal surface to the cavity of the fourth ventricle.



# MEDULLA OBLONGATA:

## 1. White matter which includes:

### A- Longitudinal fibers:

**1 - Descending tracts:** the pyramidal tract fibers collect into the pyramid in the open medulla then 80% of fibers cross in the motor decussation in the lower level of the closed medulla to form the lateral cortico-spinal tract.

**2-Ascending tracts:** the lateral spinothalamic tract forms the spinal lemniscus while the ventral spinothalamic tract joins the crossed gracile & cuneate axons to form the medial lemniscus.

**B-Association tract:** MLB ,Horizontal fibers: - Decussations (motor & sensory decussations in medulla)  
- Arcuate fibers (internal, ventral external & dorsal external)

## 2. Grey matter which includes:

### A-Cranial nerve nuclei.

1-Nuclei of the lower 4 cranial nerves (IX, X, XI & XII).

2-Descending nuclei from pons (spinal nucleus of trigeminal & some vestibular nuclei)

B-Other nuclei: olivary nuclei, gracile & cuneate nuclei.

## 3. Reticular formation:

# the internal structure of the open medulla.

## 1-Anterior

A-The pyramid

B-arcuate nucleus.

C-(3in number: inferior,, dorsal -accessory & medial accessory olives).

E-Inferior cerebellar Peduncle

## 2-Posterior

A. Fourth ventricle

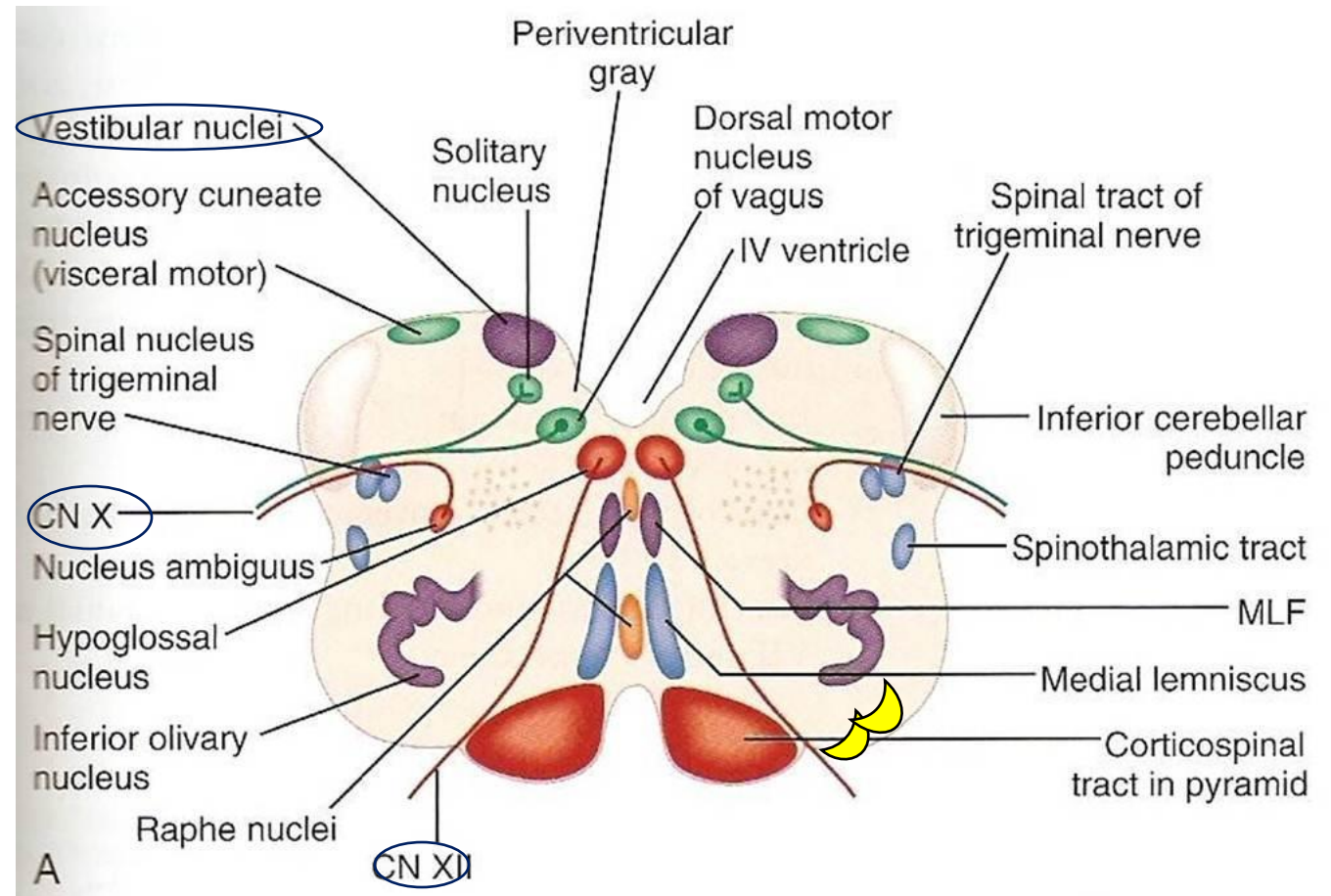
B. Hypoglossal, vagal, vestibular trigones

C. Spinal nucleus of trigeminal

D. Nucleus solitaries

E. Nucleus Ambiguus

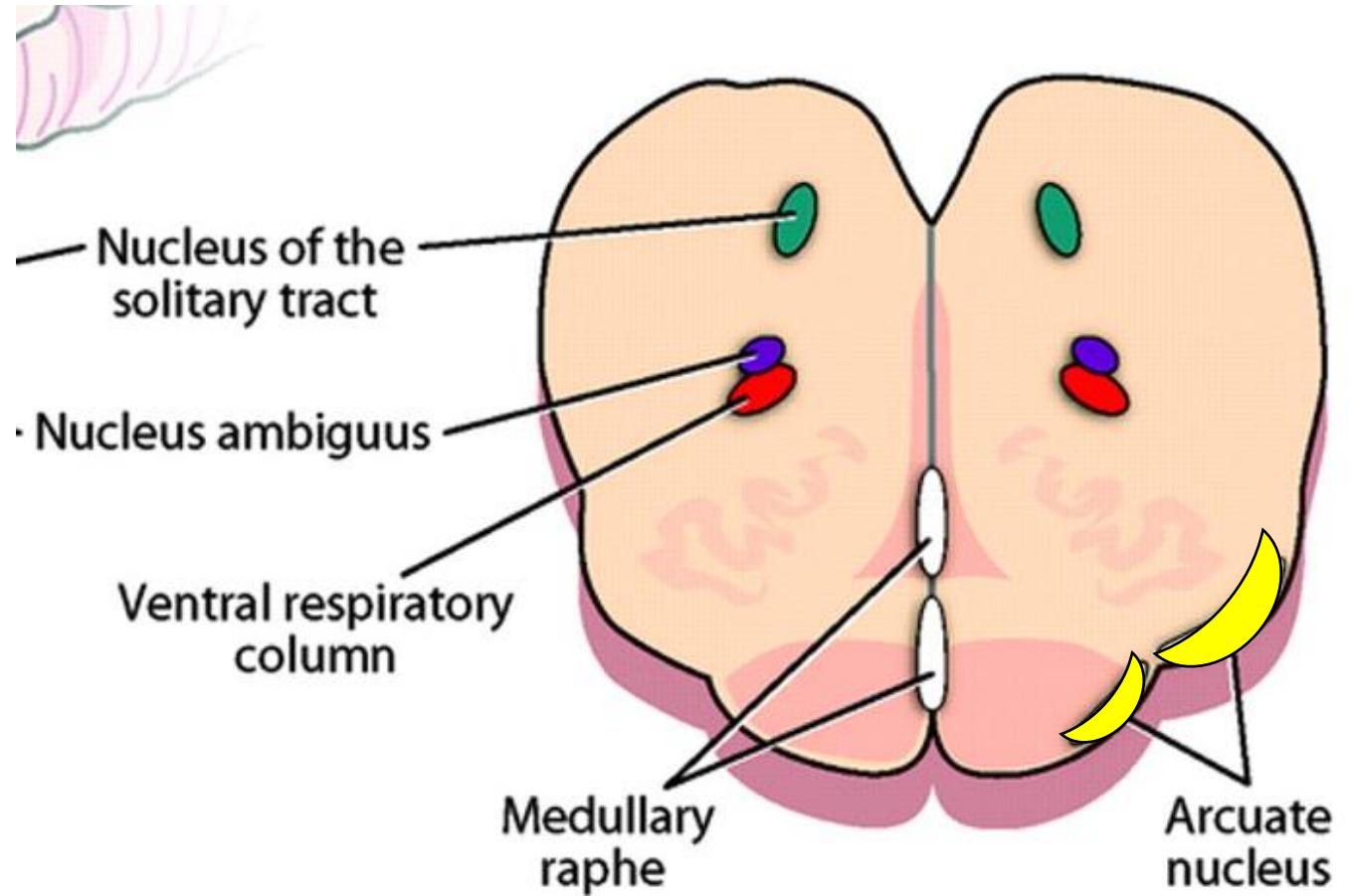
F. Inferior salivatory nucleus:



The **pyramid** is formed by the corticospinal fibers

Anterior to the pyramid lies the **arcuate nucleus**.

Its axons pass to **cerebellum** forming **anterior external arcuate fibers**.



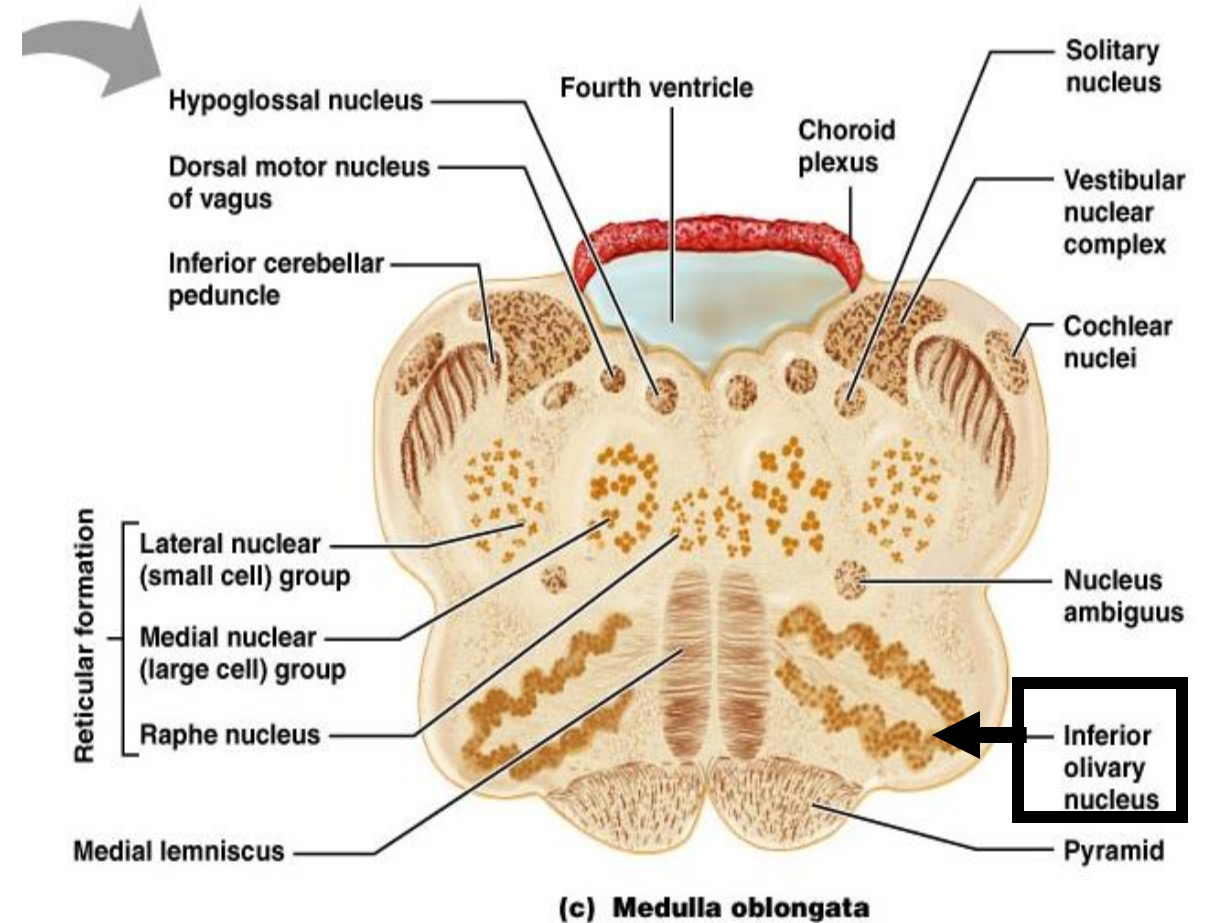
OLIVARY NUCLEI (4 in number: inferior, superior, dorsal accessory & medial accessory olives).

The inferior olive:

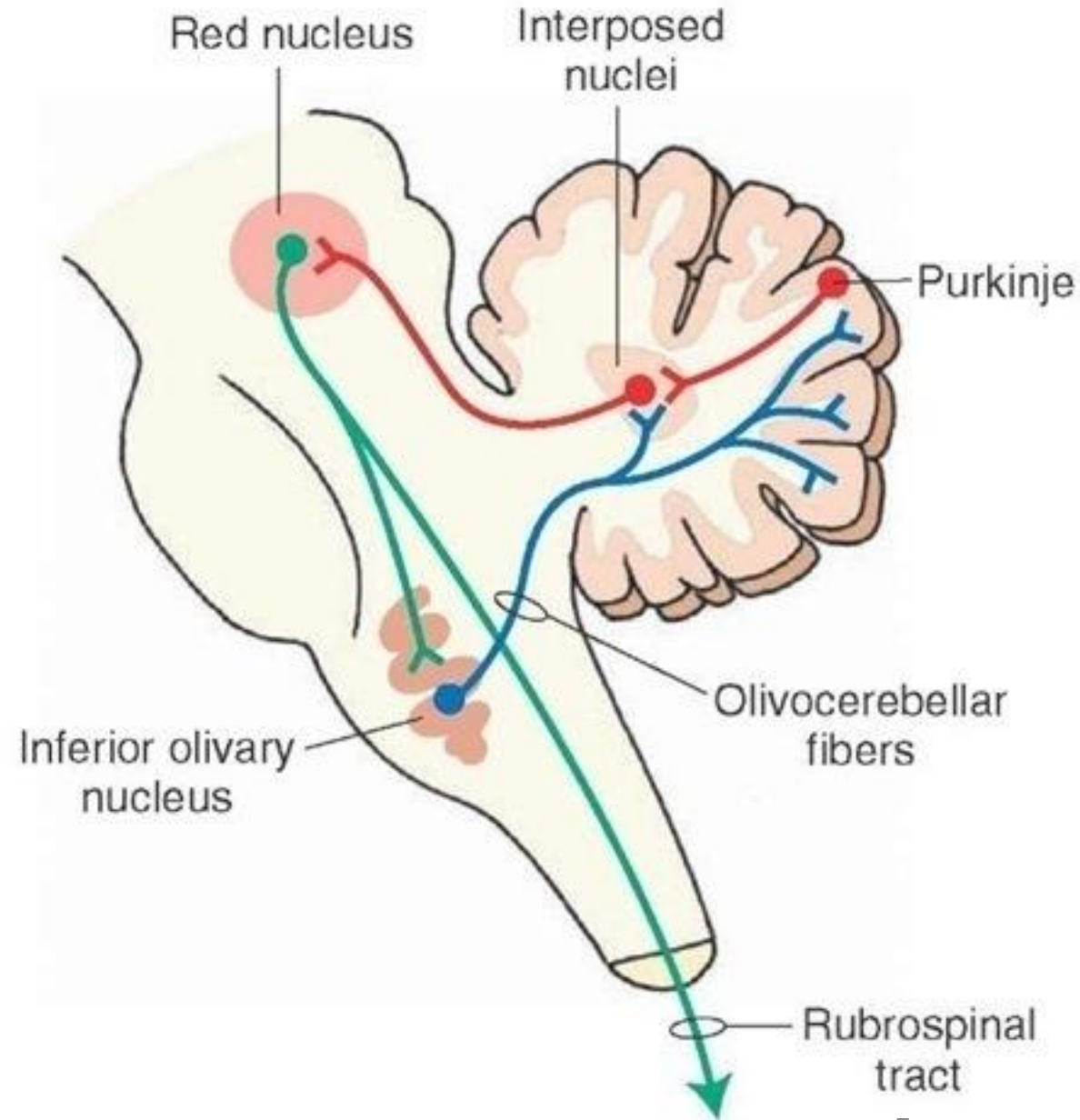
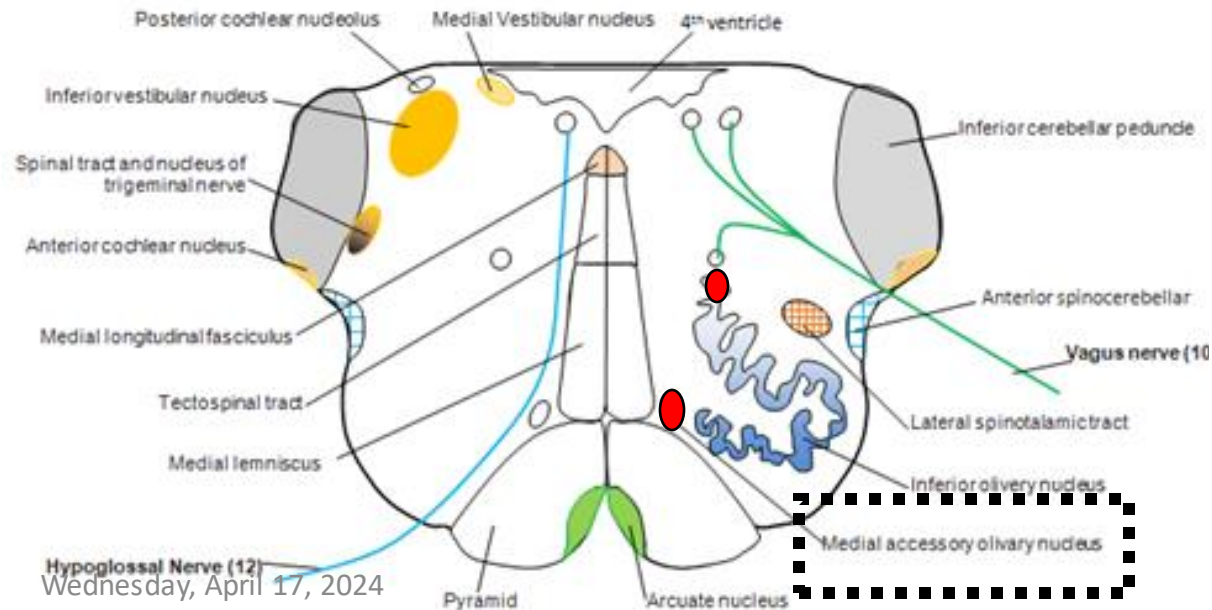
is the largest & appears corrugated with its *hilus* facing dorso-medially.

*Function:*

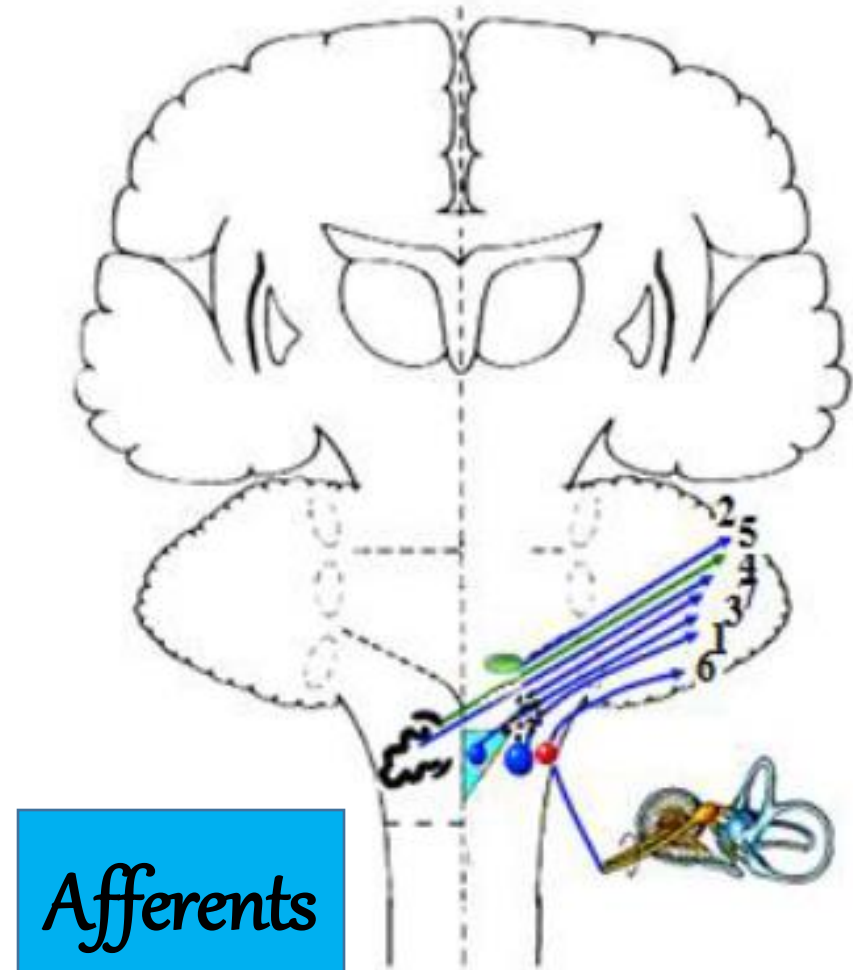
1. Relays proprioception to cerebellum: receives proprioception via the spino-olivary tract & sends olivo-cerebellar fibers that cross & pass via the ICP.
2. Relays newly performed motor information to the cerebellum (involved in motor learning)



The dorsal & medial accessory olives: Both send proprioceptive fibers to the cerebellum (called parolivo-cerebellar fibers) via the ICP.

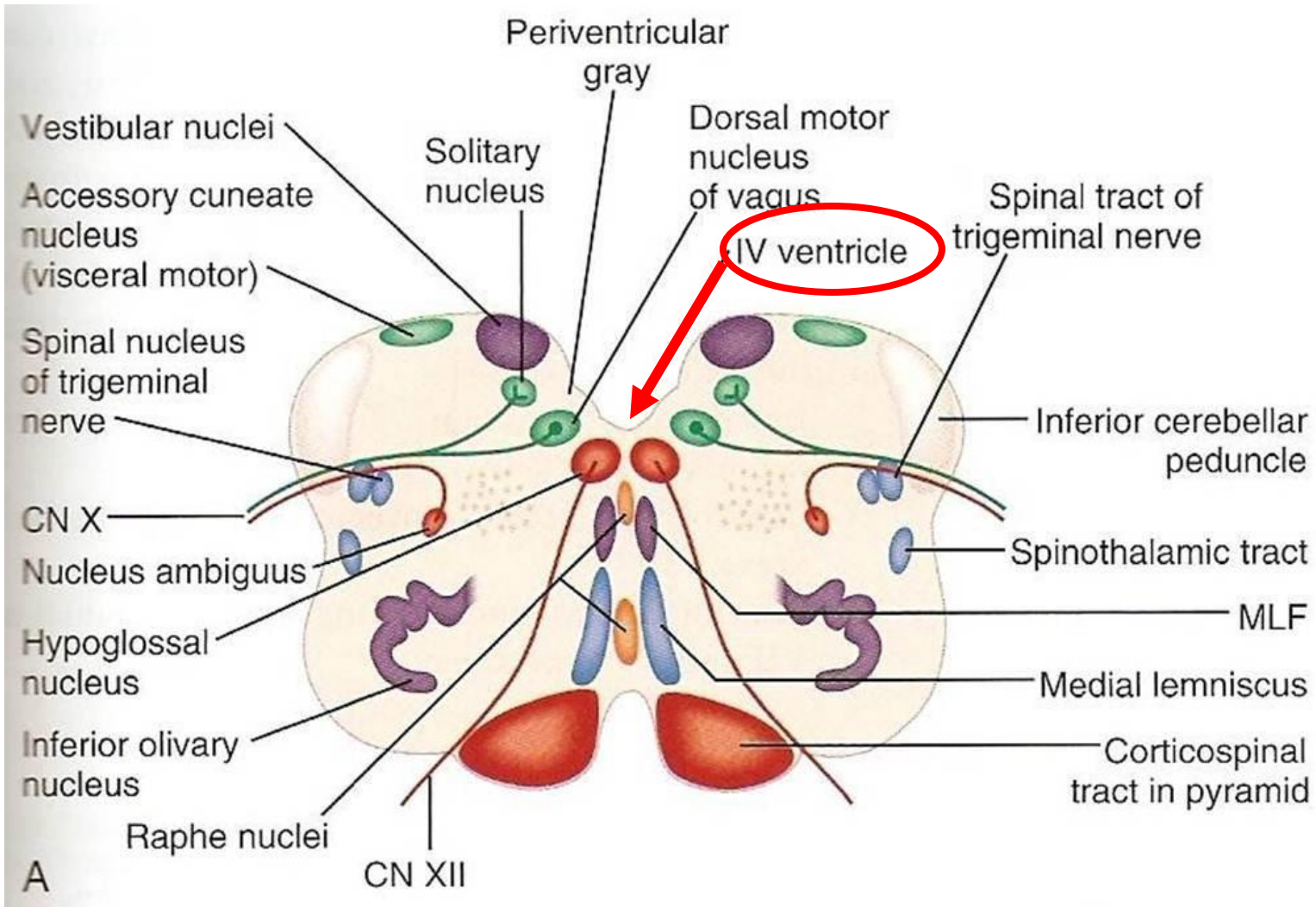


Inferior cerebellar Peduncle: It connects cerebellum to medulla. It is formed mostly of afferent fibers.





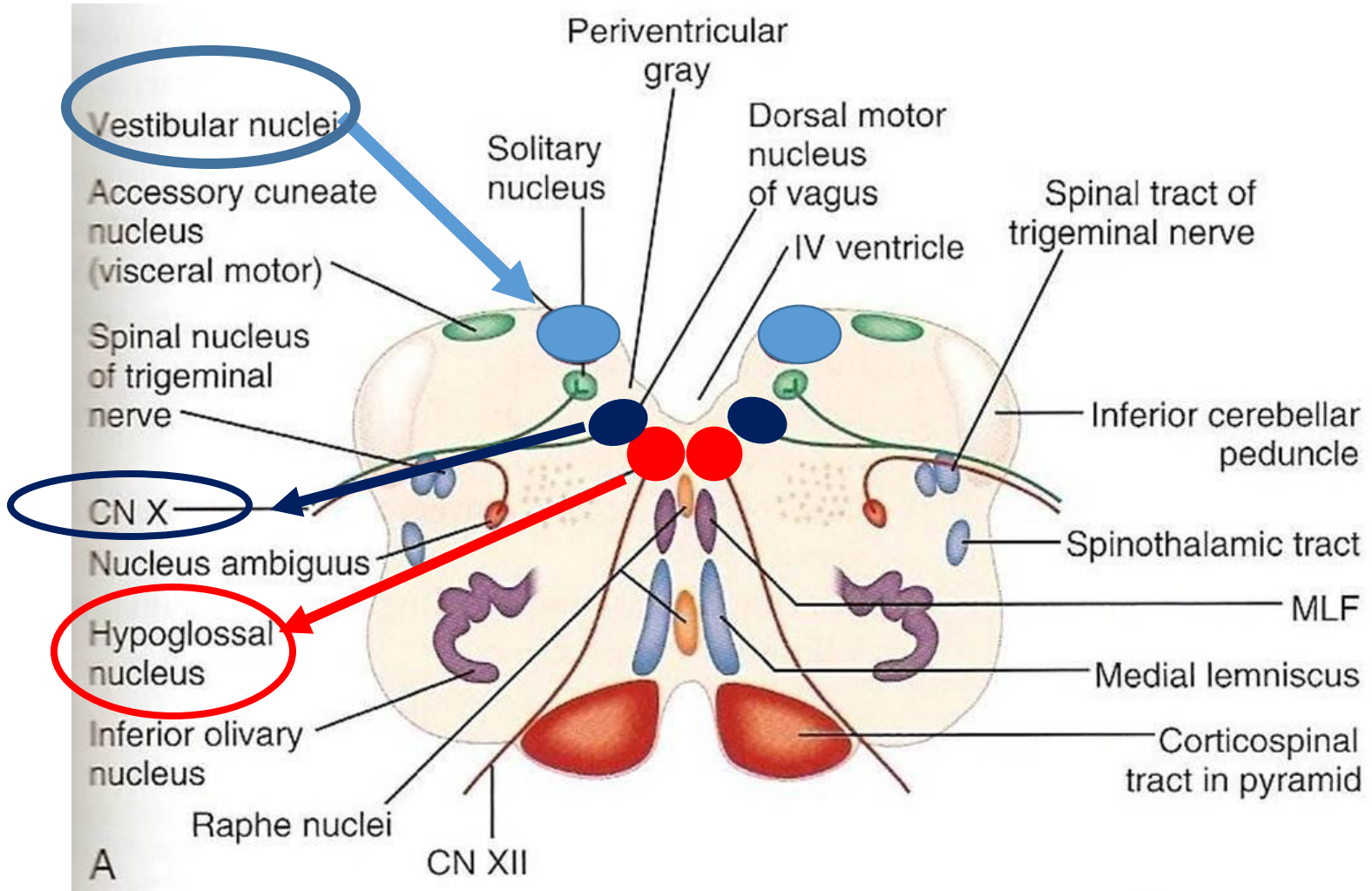
# Posterior



Dorsal surface of medulla faces the *floor of 4th ventricle*

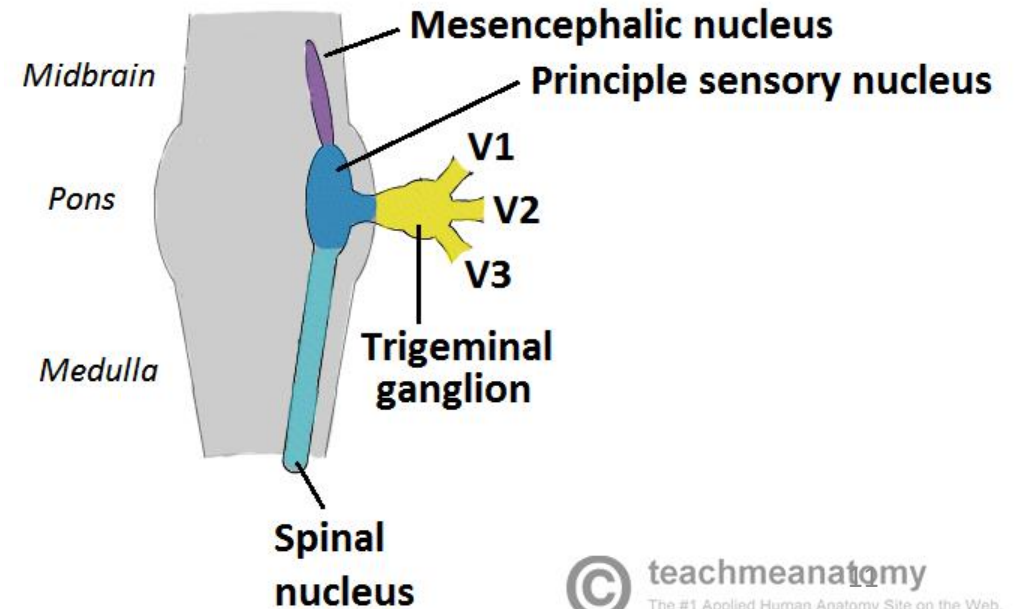
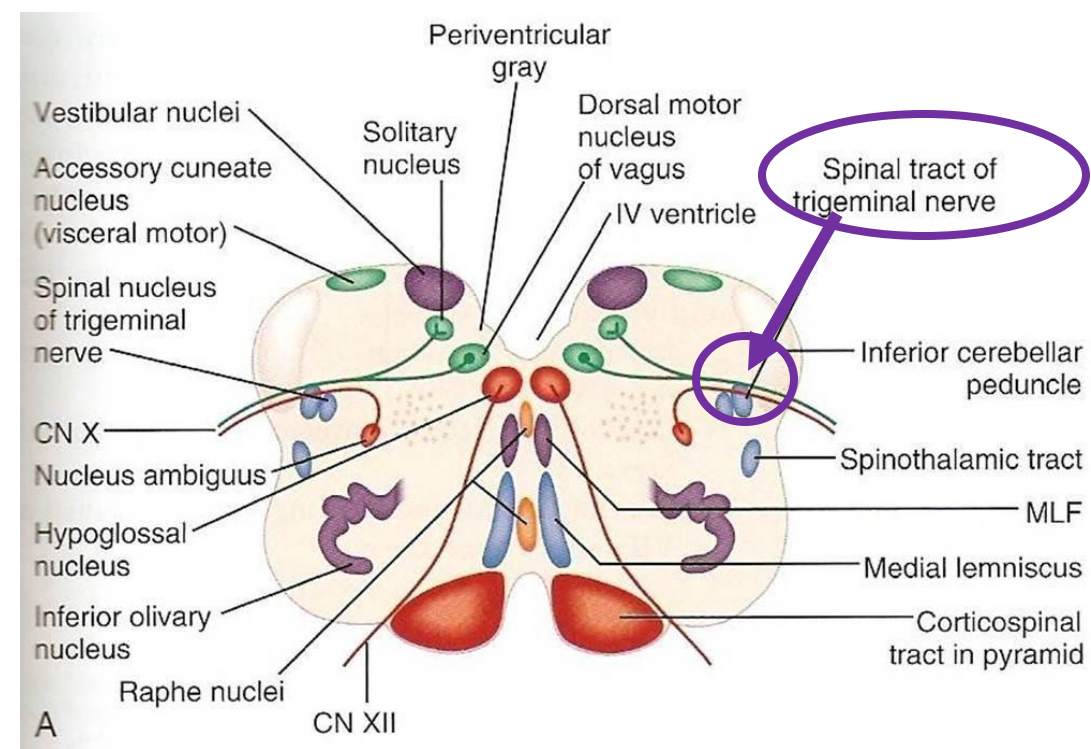
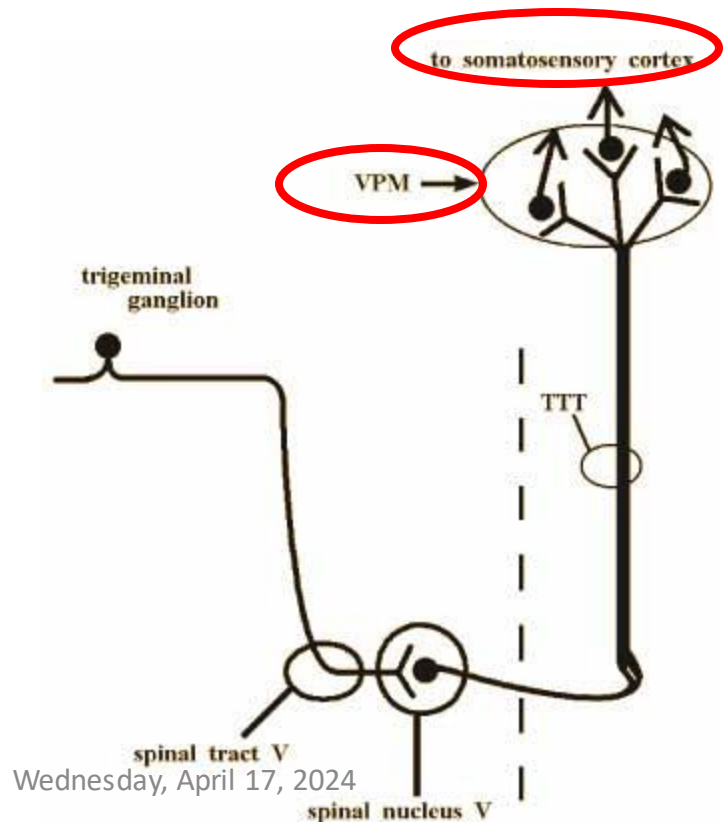
On each side of the median sulcus lies the *inferior fovea*, separating three elevated triangles (trigones):

1. *Hypoglossal Trigone* overlies hypoglossal nucleus.
2. *Vagal Trigone* overlies dorsal vagal nucleus
3. *Vestibular Trigone* overlies vestibular nuclei



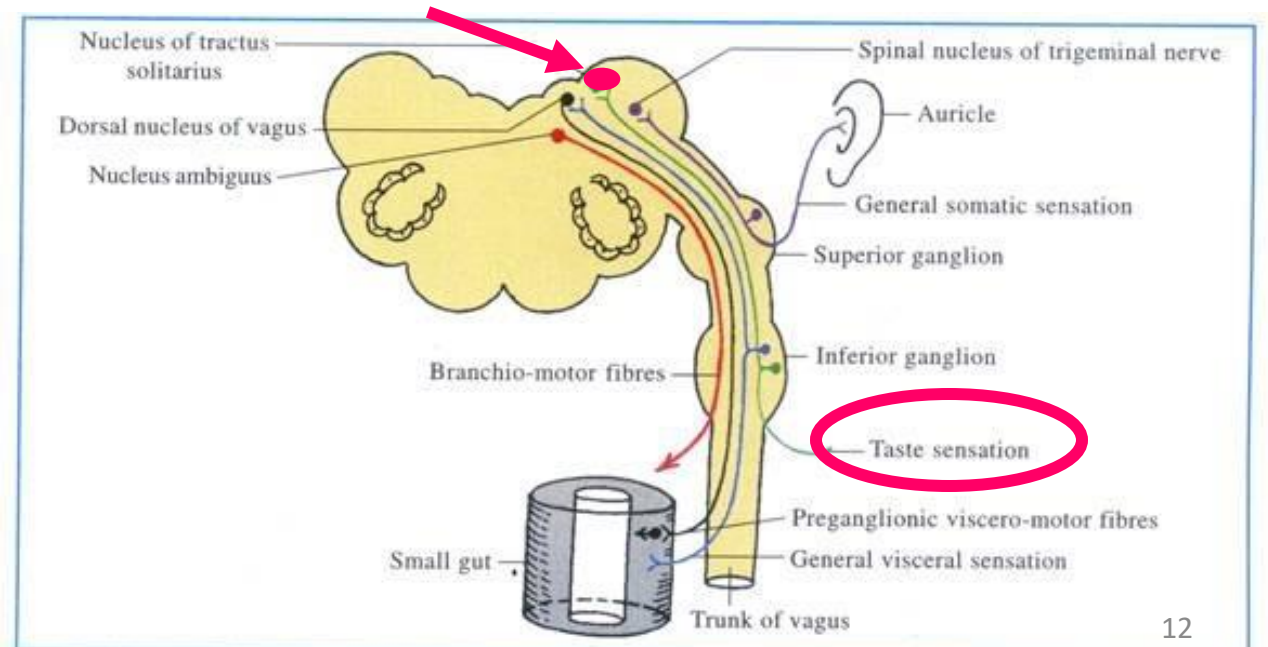
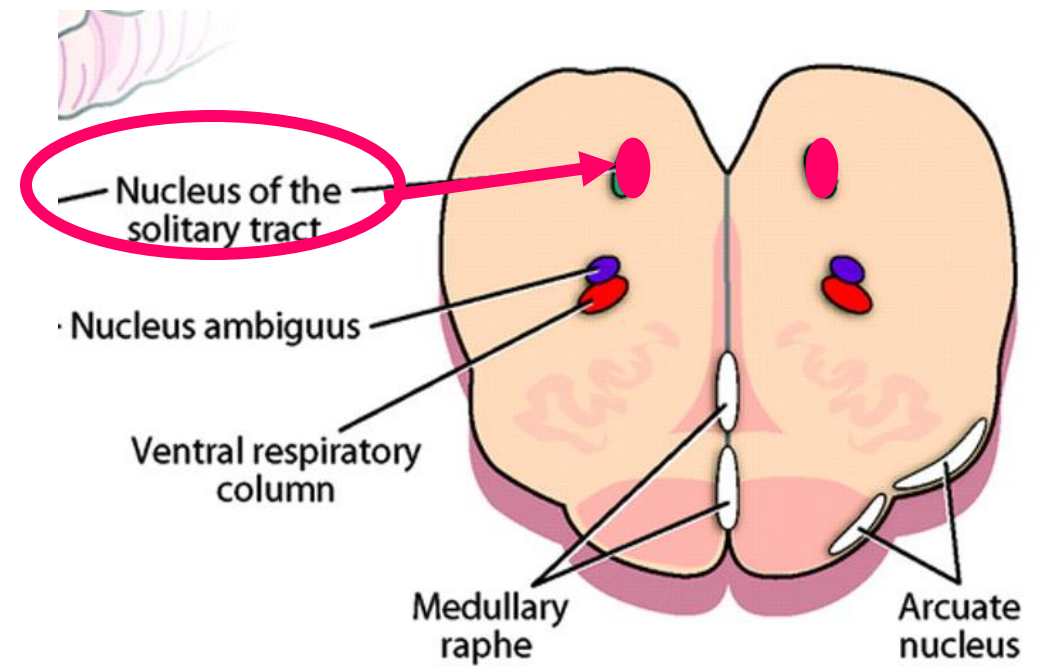
# Spinal nucleus of trigeminal:

Carries pain and temp. from face. its axons cross to the opposite side and ascend to form the trigeminal lemniscus which end on **VPMN** of thalamus.



## Nucleus solitarius:

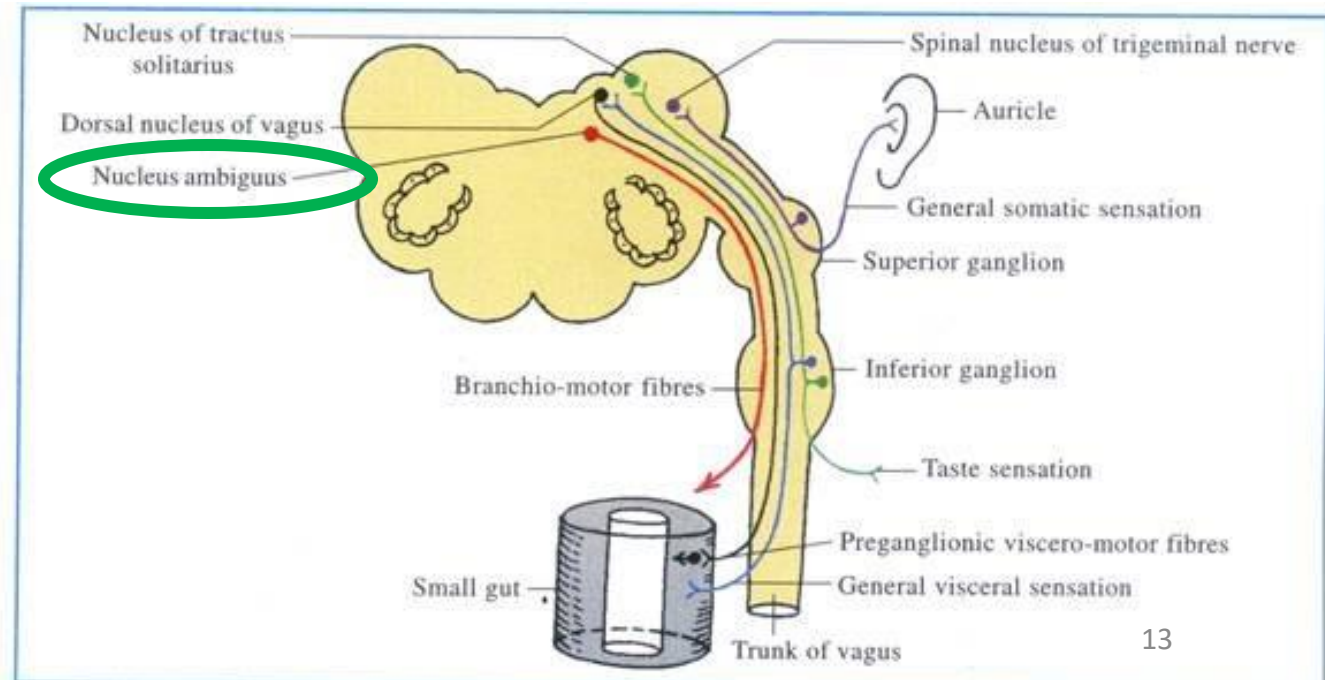
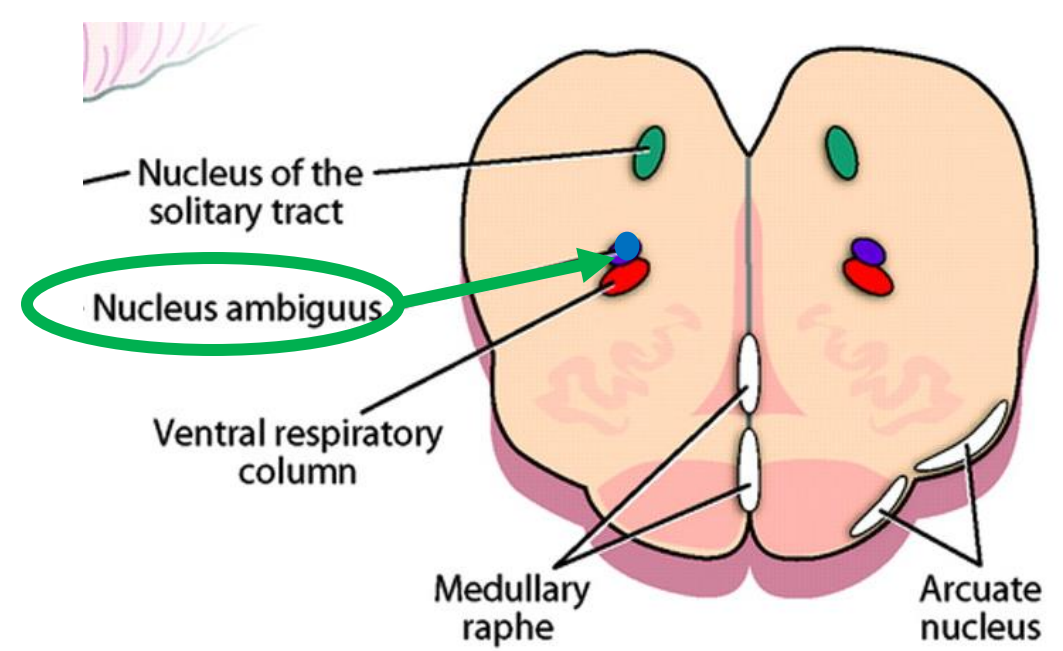
It receives taste sensation from cranial nerves VII, IX, X.



## Nucleus Ambiguus:

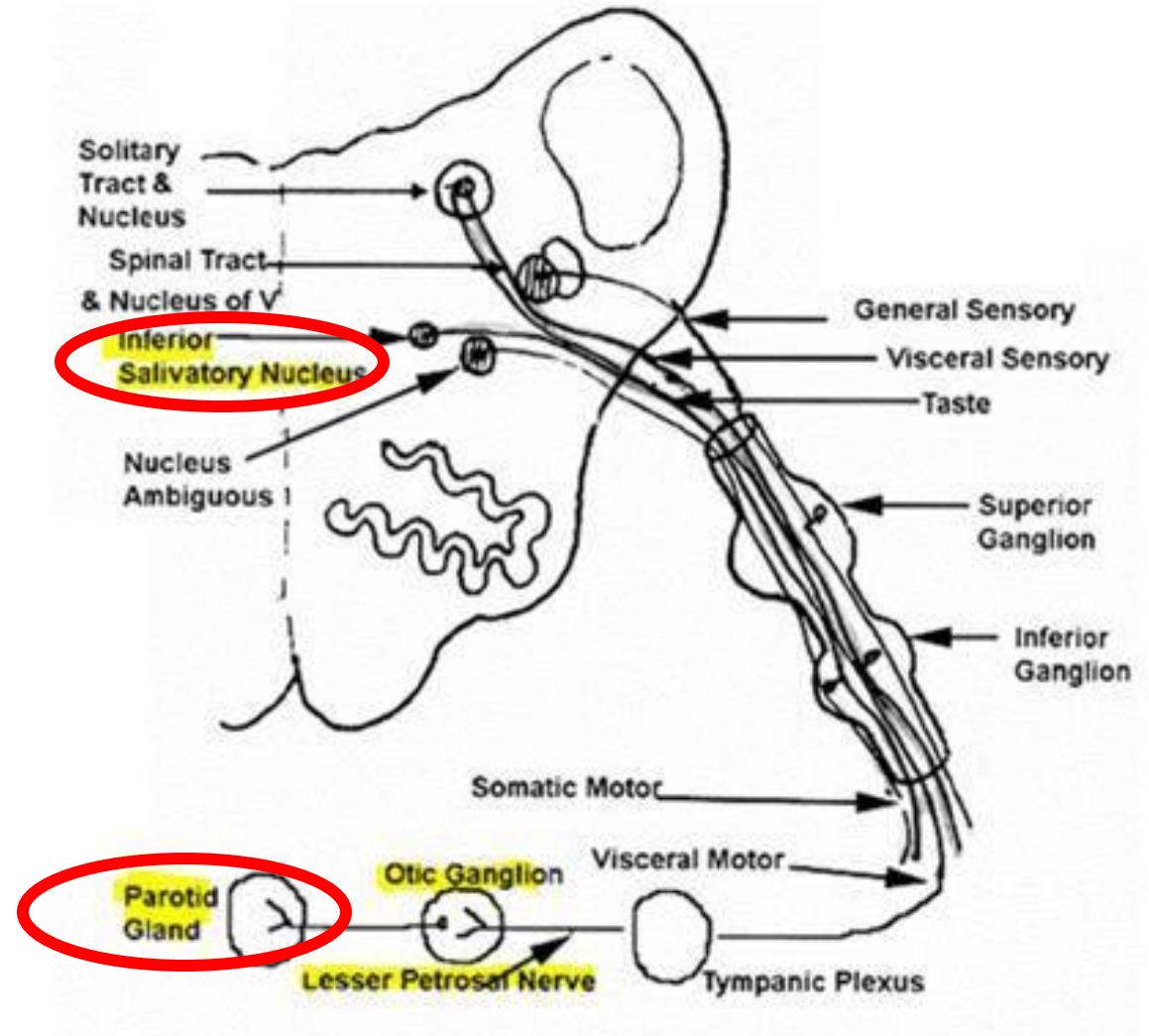
A motor nucleus that innervate muscles of the pharynx, all muscles of palate except tensor palate.

It gives fibers to IX, X, cranial part of XI



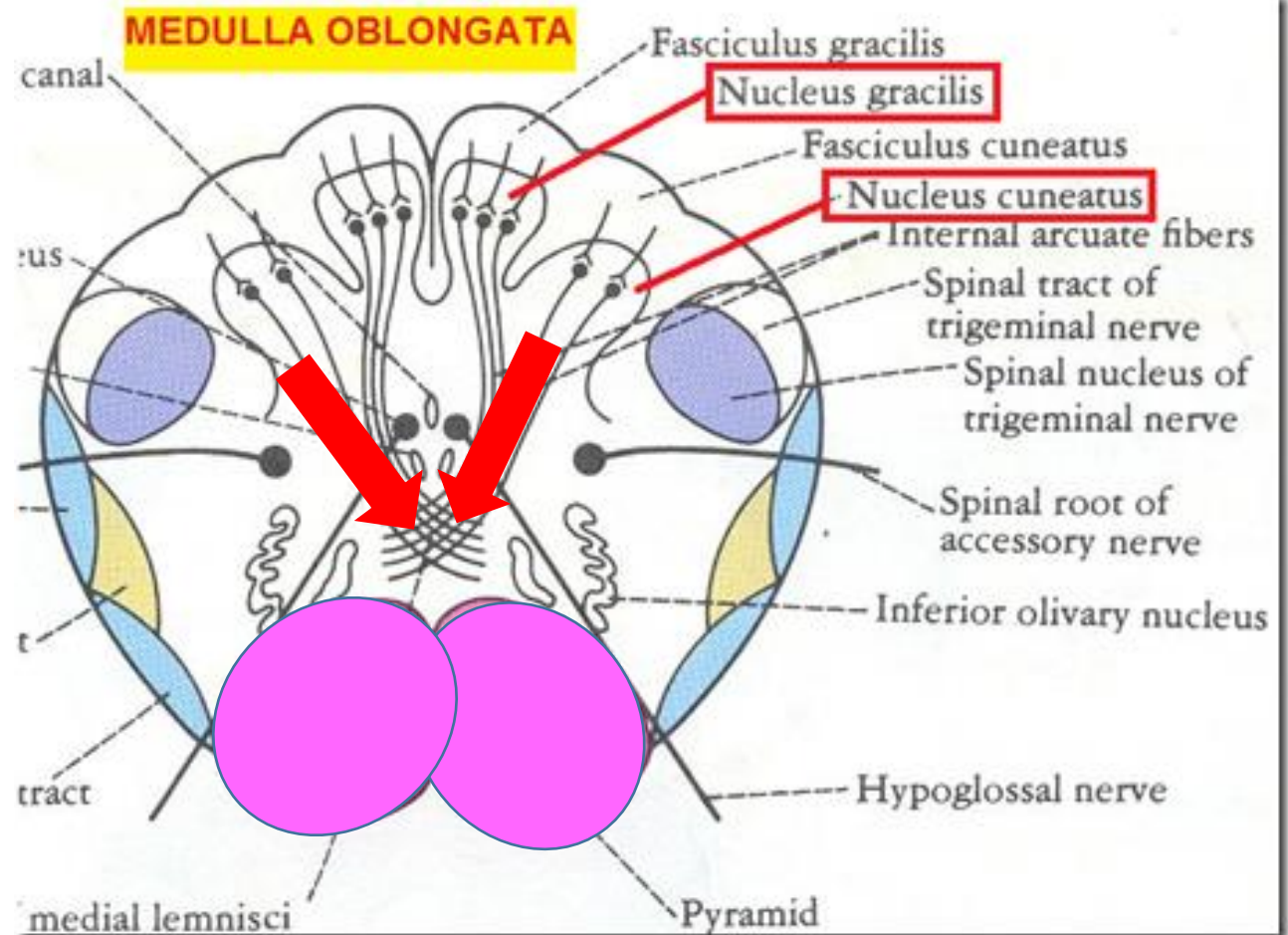
Inferior salivatory nucleus:

Parasympathetic nucleus that supplies parotid gland via IX cranial nerve.



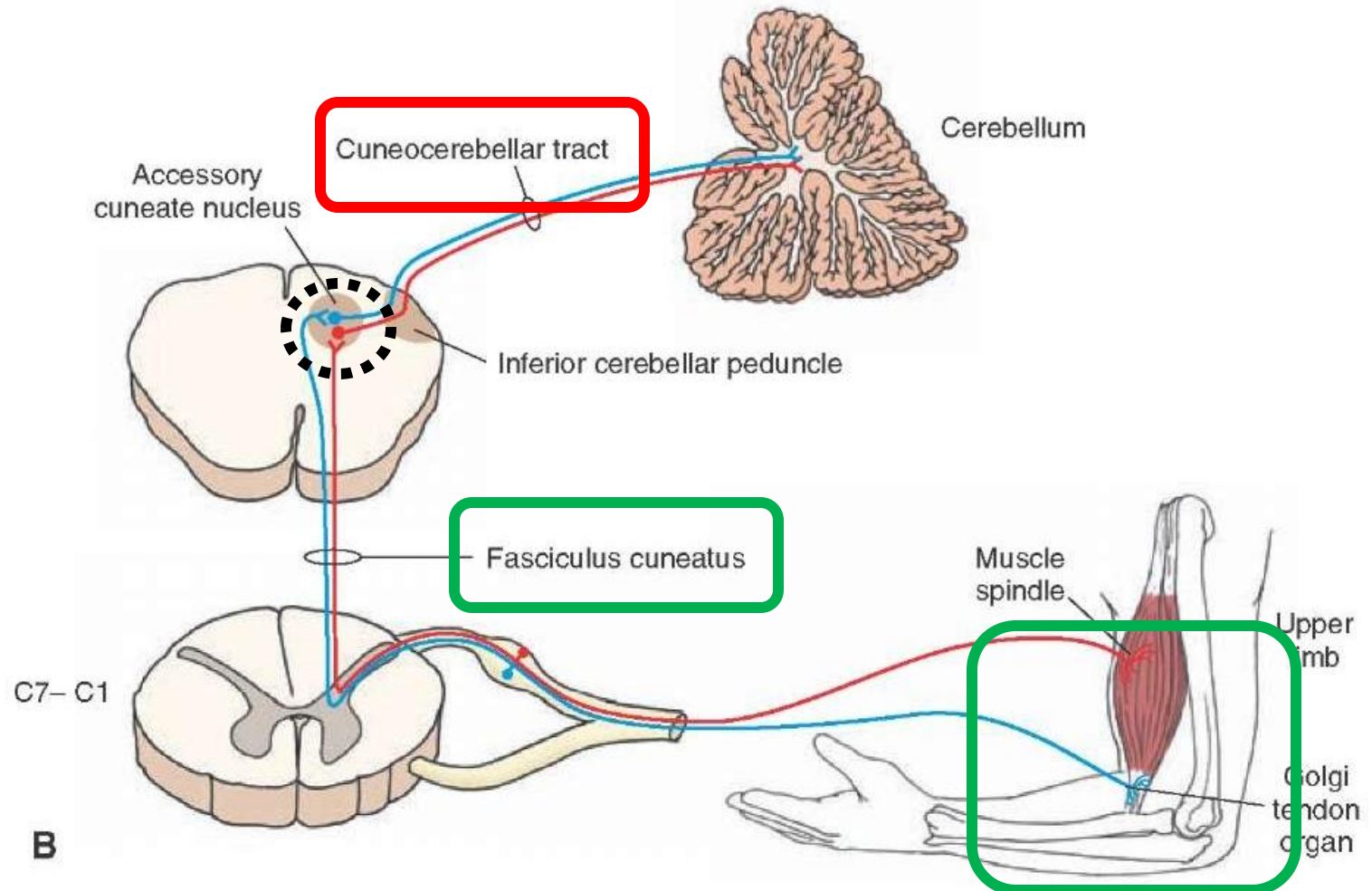
## Closed medulla at level of sensory decussation

Axons of gracile and cuneate nuclei curve anteriorly forming **internal arcuate fibers** to decussate with the fibers of the opposite side  
After decussation fibers ascend as the **medial lemniscus**



Axons of accessory cuneate nucleus form the posterior external arcuate fibers (cuneocerebellar tract) which enter the cerebellum.

Accessory cuneate nucleus receives proprioception from upper limb via cuneate tract

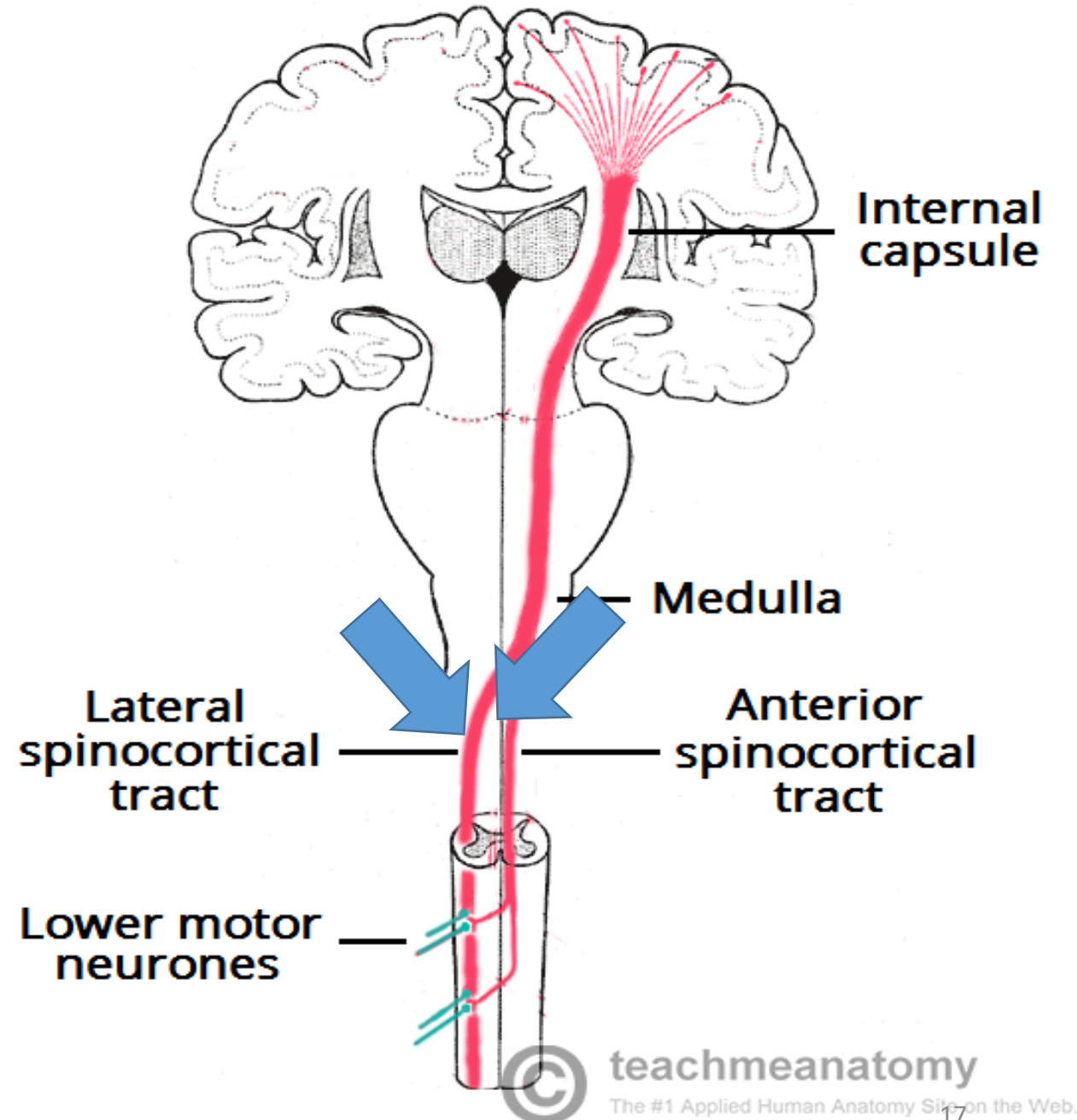




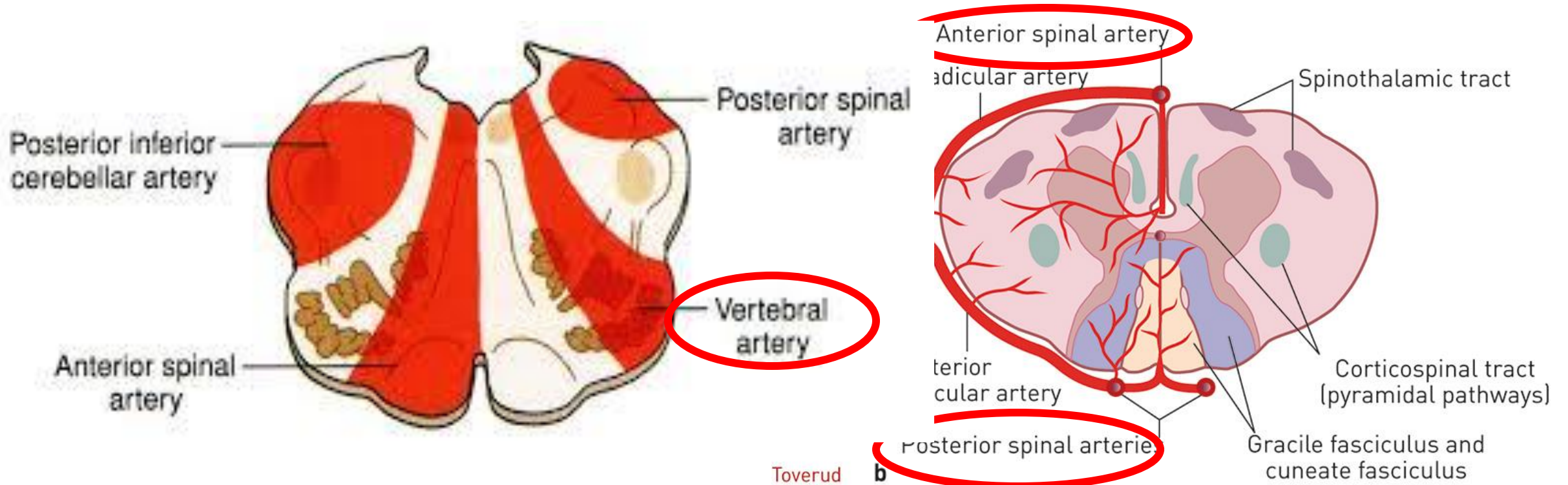
## Closed medulla at level of motor decussation

The pyramid, 80% of its fibers are seen crossing to the opposite side to form the lateral cortico – spinal tract in the lateral white column of the spinal cord.

The uncrossed fibers descend in the spinal cord as the anterior corticospinal tract. The uncrossed corticospinal fibers usually cross at a lower level (in the spinal cord)



# Blood supply of the medulla

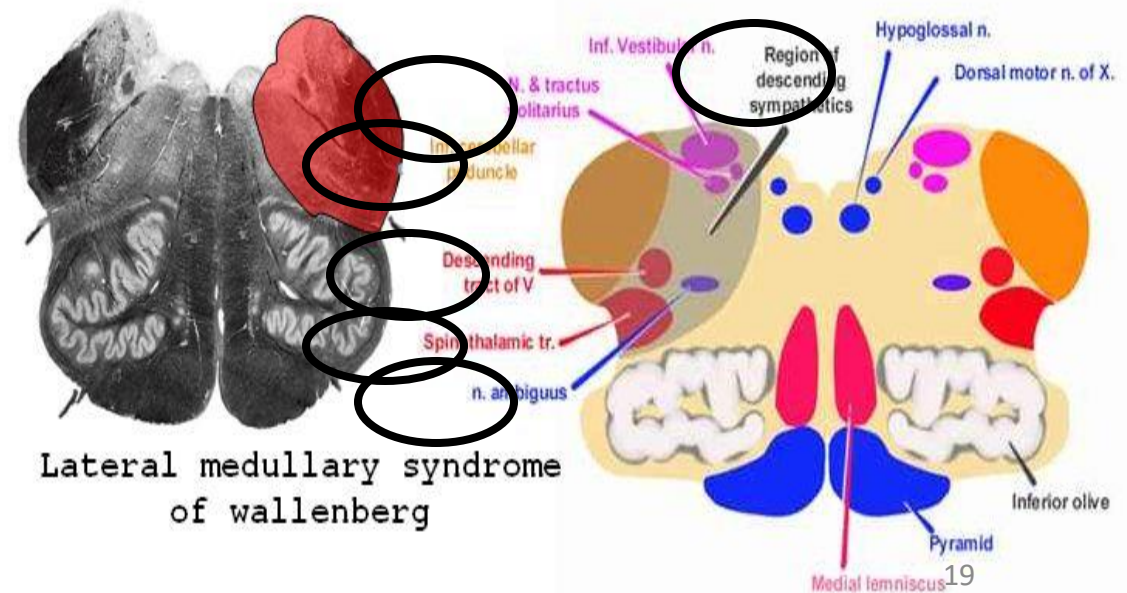
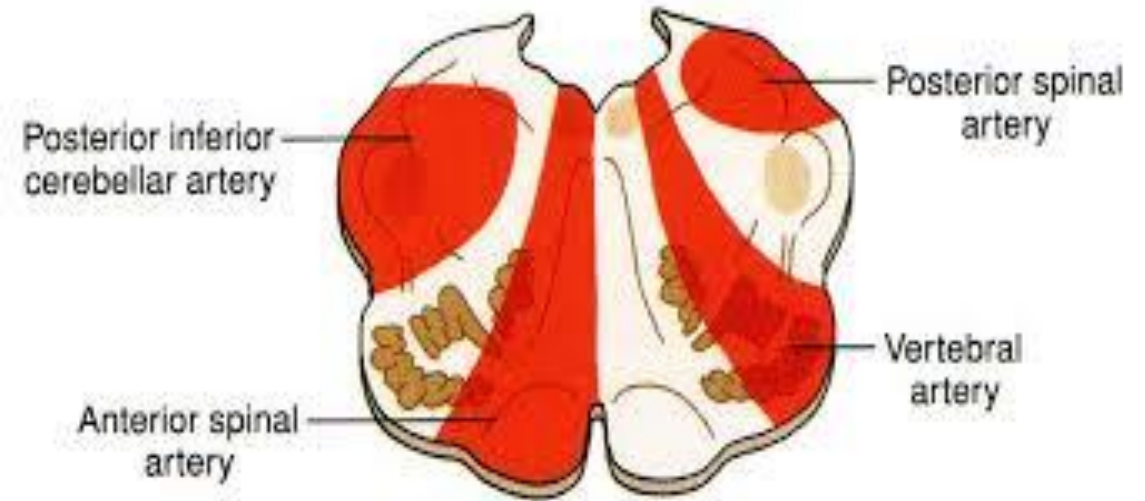


- ❖ Anterior spinal artery supplies parts of MO medial to hypoglossal nerve.
- ❖ Posterior inferior cerebellar artery :supplies lateral part
- ❖ Medullary branches of vertebral artery : Supplies intermediate area
- ❖ Posterior spinal artery : Supplies posterior part

# Lateral medullary syndrome

**PICA** occlusion....**Lateral medullary syndrome** which involves the following:

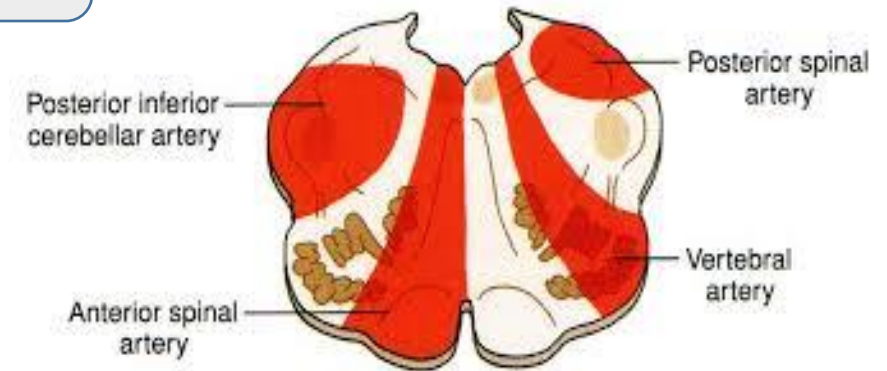
- Spino-cerebellar tract & ICP.... .cerebellar ataxia.
- Spinal N. & tract of V ....loss of pain & temp. from ipsilateral face.
- Spinal lemniscus ...loss of pain & temp. from opposite half of body.
- Nucleus ambiguus ....ipsilateral paralysis of palate, pharynx, larynx.
- Nucleus solitaries.....loss of taste sensation.
- Descending sympathetic fibers ...ipsilateral Horner's syndrome (ptosis, miosis, anhydrosis, enophthalmos).



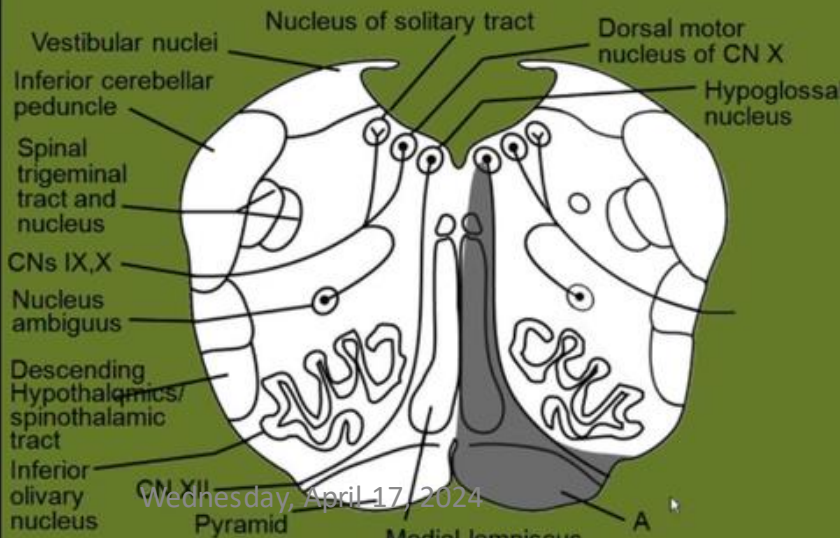
# Medial medullary syndrome

## Oclusionion of anterior spinal artery

- Pyramid...??
- Medial lemniscus...??
- XII nucleus...??



## Medulla Lesions



a. Pyramid ; contralateral hemiplegia of the UMNL type flaccid paralysis??

b. Medial lemniscus : contralateral loss of proprioception & fine touch

c. XII nucleus : ipsilateral LMNL paralysis of tongue muscles (ask patient to protrude tongue, it deviates towards paralyzed side).

**Crossed hemiplegia???**

- **Clinical Significance of the Medulla Oblongata** The medulla oblongata not only contains many cranial nerve nuclei that are concerned with vital functions (e.g., regulation of heart rate and respiration), but it also serves as a conduit for the passage of ascending and descending tracts connecting the spinal cord to the higher centers of the nervous system. These tracts may become involved in demyelinating diseases, neoplasms, and vascular disorders.
- **Raised Pressure in the Posterior Cranial Fossa and Its Effect on the Medulla Oblongata** The medulla oblongata is situated in the posterior cranial fossa, lying beneath the tentorium cerebelli and above the foramen magnum.
- It is related anteriorly to the basal portion of the occipital bone and the upper part of the odontoid process of the axis and posteriorly to the cerebellum.
- through the foramen magnum and a sudden failure of vital functions, resulting from pressure and ischemia of the cranial nerve nuclei present in the medulla oblongata.

In patients with tumors of the posterior cranial fossa, the intracranial pressure is raised, and the brain—that is, the cerebellum and the medulla oblongata—tends to be pushed toward the area of least resistance; there is a downward herniation of the medulla and cerebellar tonsils through the foramen magnum.

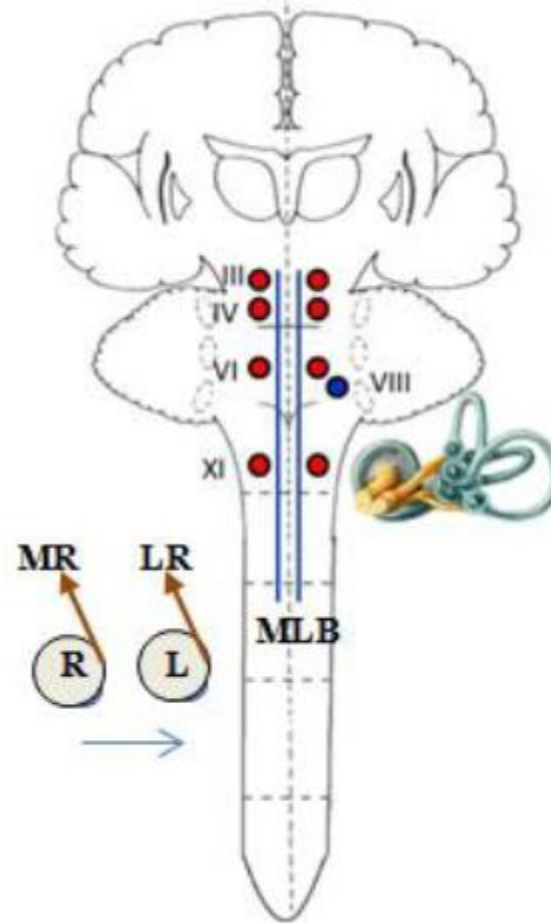
This will produce the symptoms of headache, neck stiffness, and paralysis of the glossopharyngeal, vagus, accessory, and hypoglossal nerves owing to traction. In these circumstances,

it is extremely dangerous to perform a lumbar puncture because the sudden withdrawal of cerebrospinal fluid may precipitate further herniation of the brain

## Medial Longitudinal Bundle: MLB (fasciculus)

A bundle of fibers extending longitudinally in the brainstem on each side of the median plane  
- it continues into the spinal cord as the medial vestibulospinal tract.

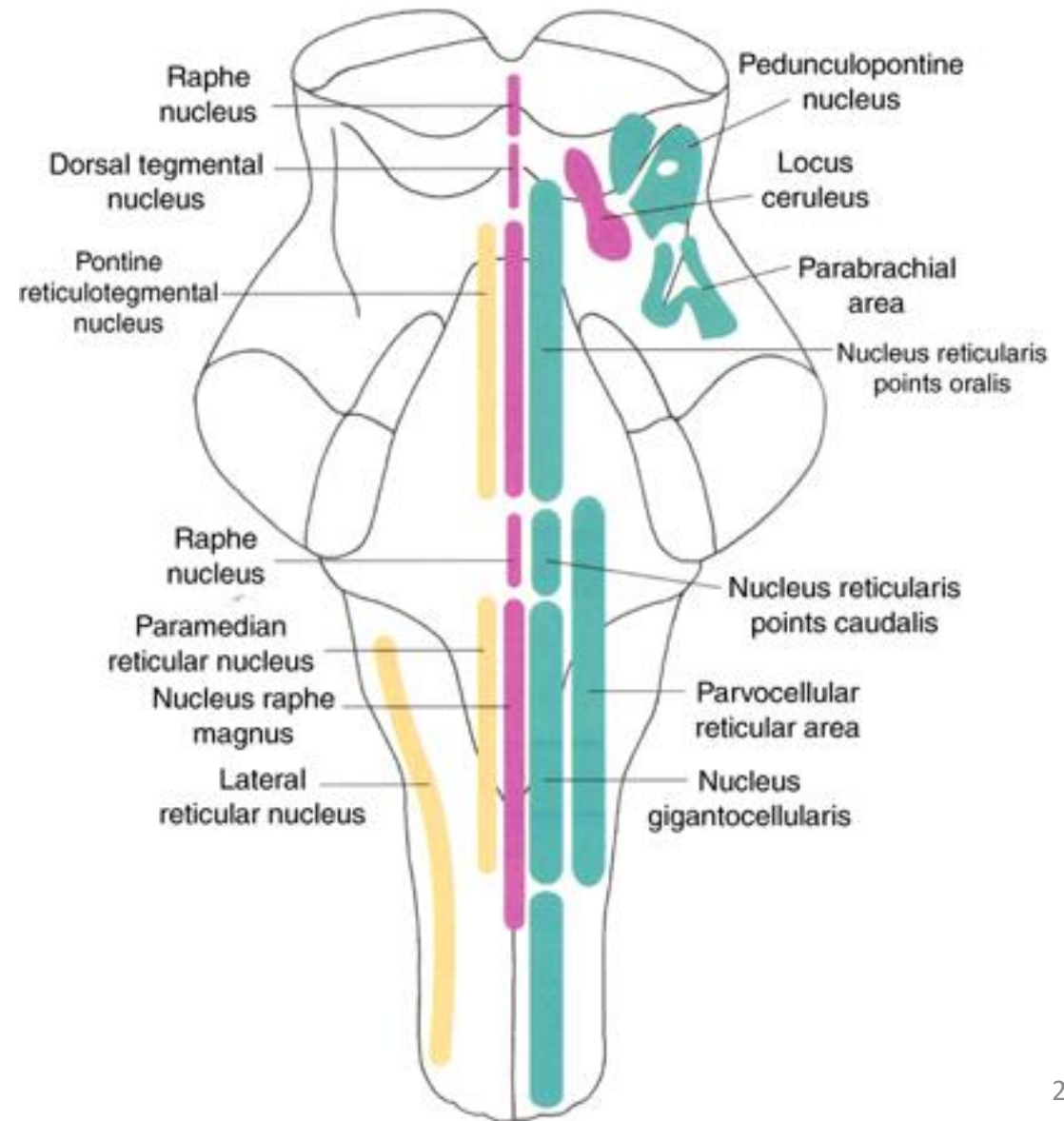
- It connects the vestibular and cochlear nuclei with motor nuclei of cranial nerves that move the eye III, IV, VI and with the spinal nucleus of accessory nerve that moves the neck.



# RETICULAR FORMATION

It consists of nerve cells and nerve fibers scattered within the brain stem extending superiorly to hypothalamus & thalamus and inferiorly to spinal cord. Its neurons are arranged into 3 columns: median, medial & lateral

It is essential for wakening, attention & level of consciousness.





**Thank you**