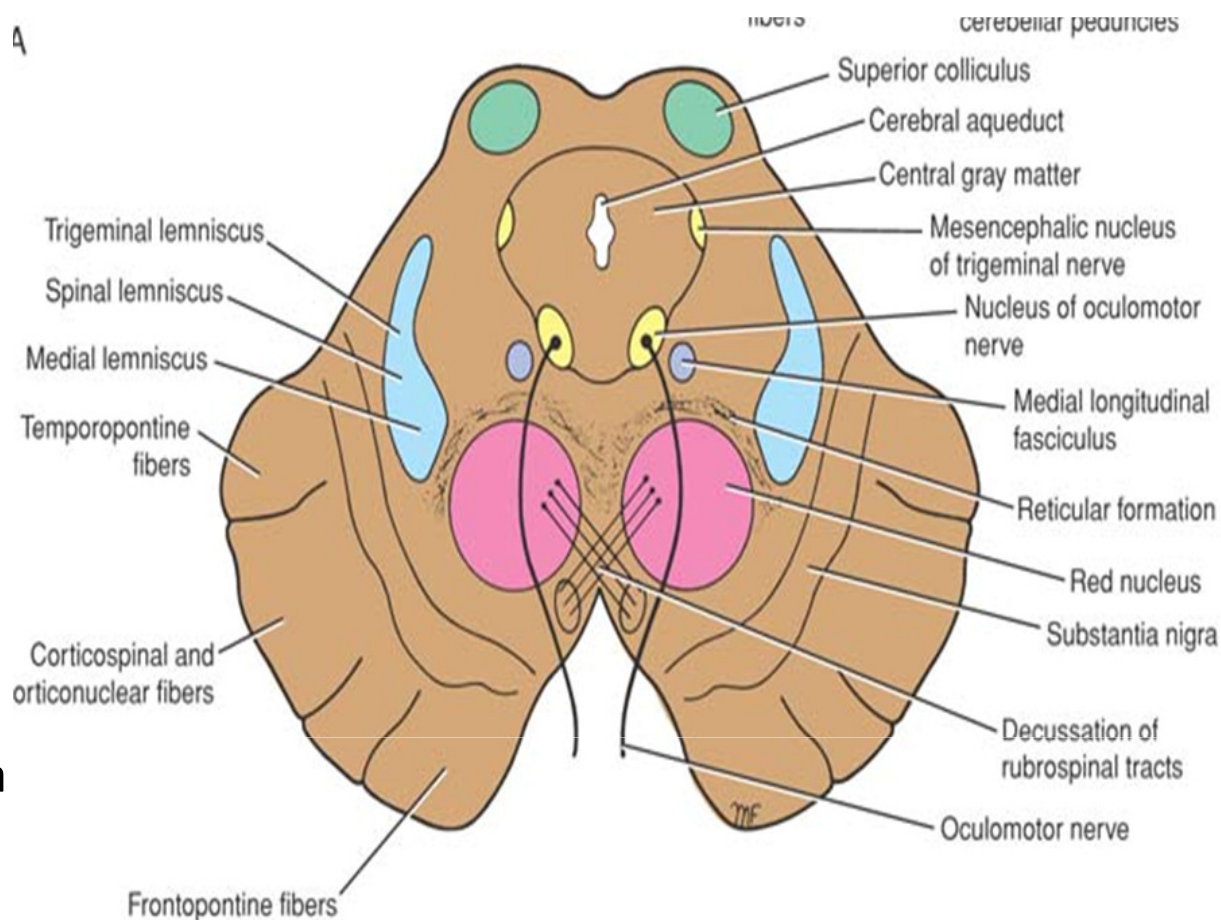


# Red nucleus

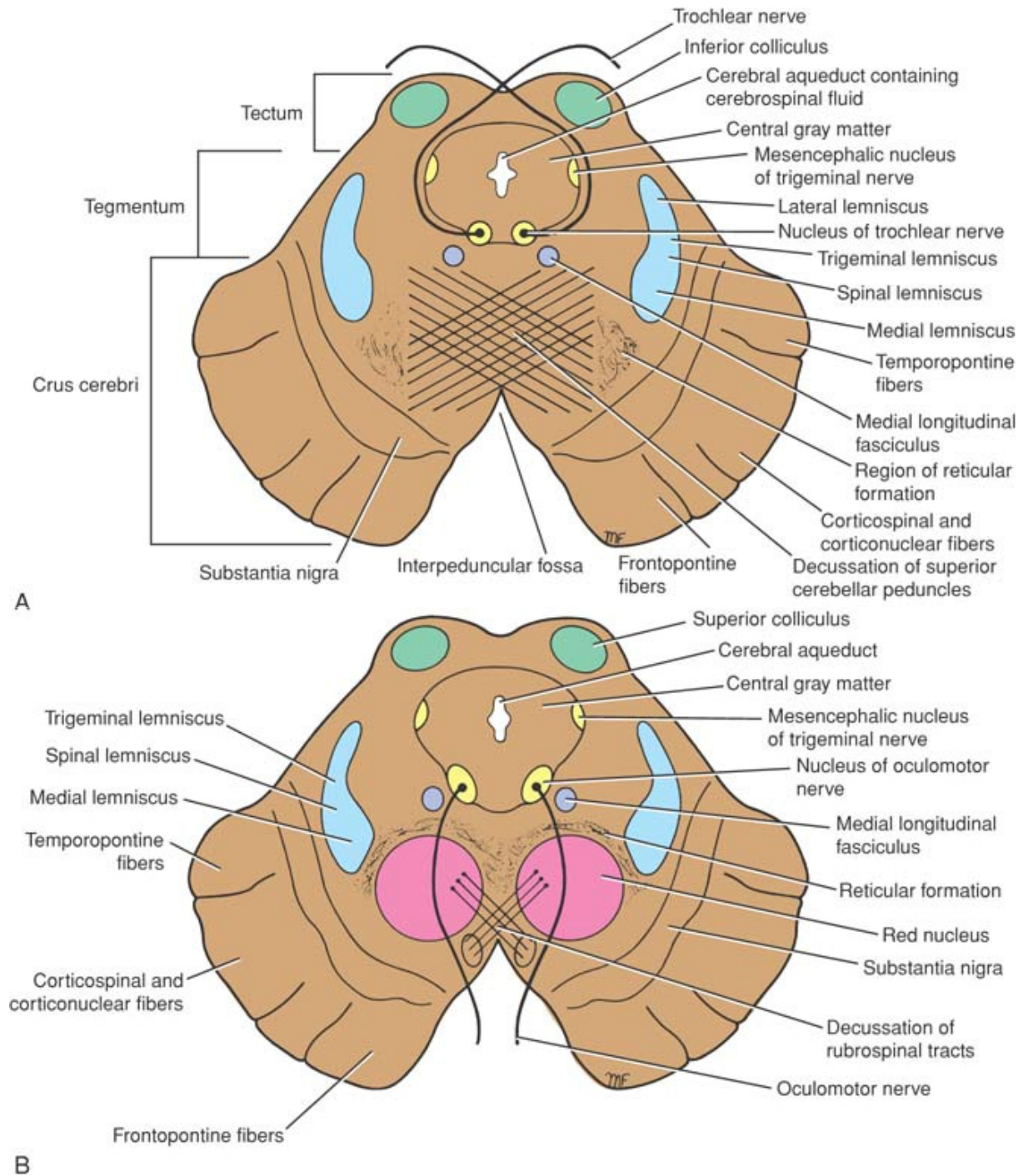
- Rounded mass of gray matter
- Situated bt cerebral aqueduct and substantia nigra
- Reddish blue(vascularity & iron containing pigment)
- Afferents from: cerebral cortex,cerebellum,substantia nigra, thalamic nuclei, spinal cord
- Efferent to: spinal cord, reticular formation. thalamus and substantia nigra
- involved in motor coordination.



# Crus cerebri

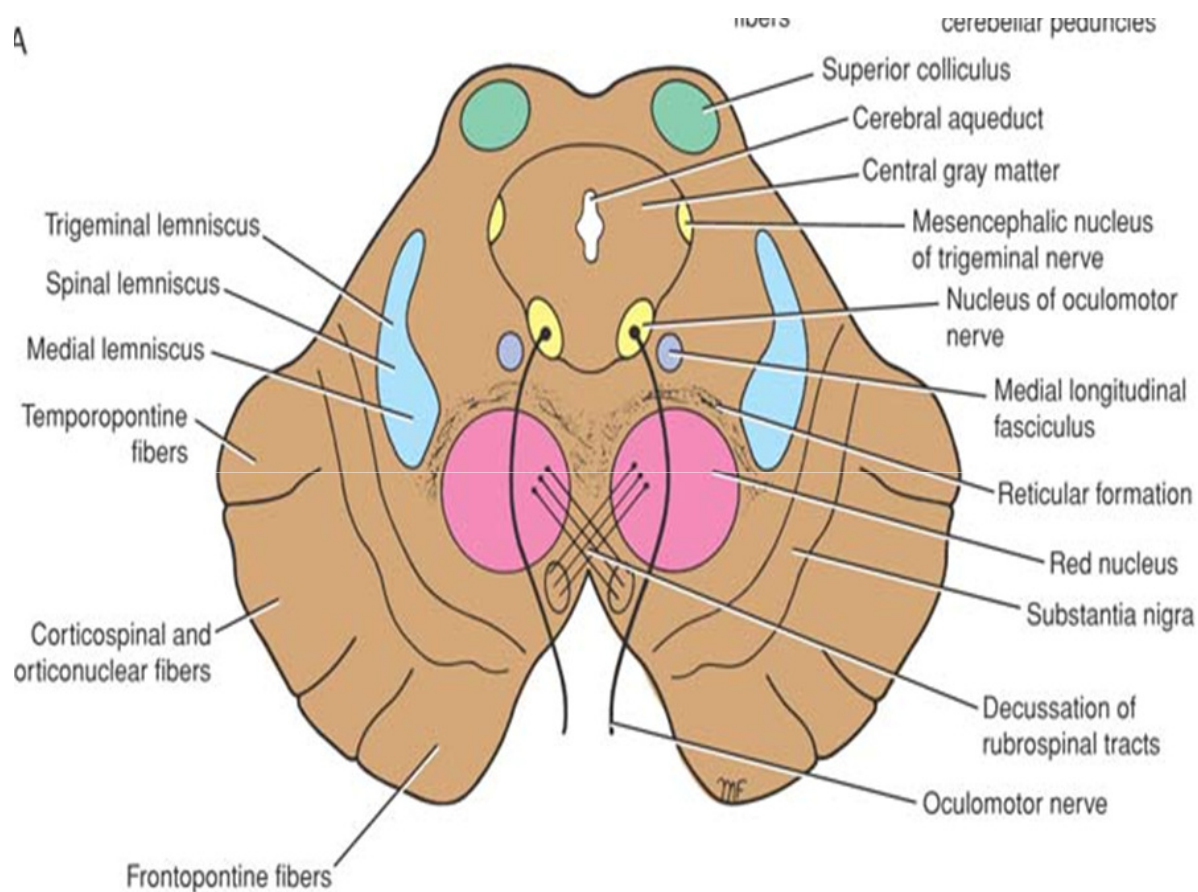
- Corticospinal & corticonuclear fibers (middle)
- Frontopontine fibers (medial)
- Temporopontine fibers (lateral)

these descending tracts connect the cerebral cortex with spinal cord, cranial nerves nuclei, pons & cerebellum



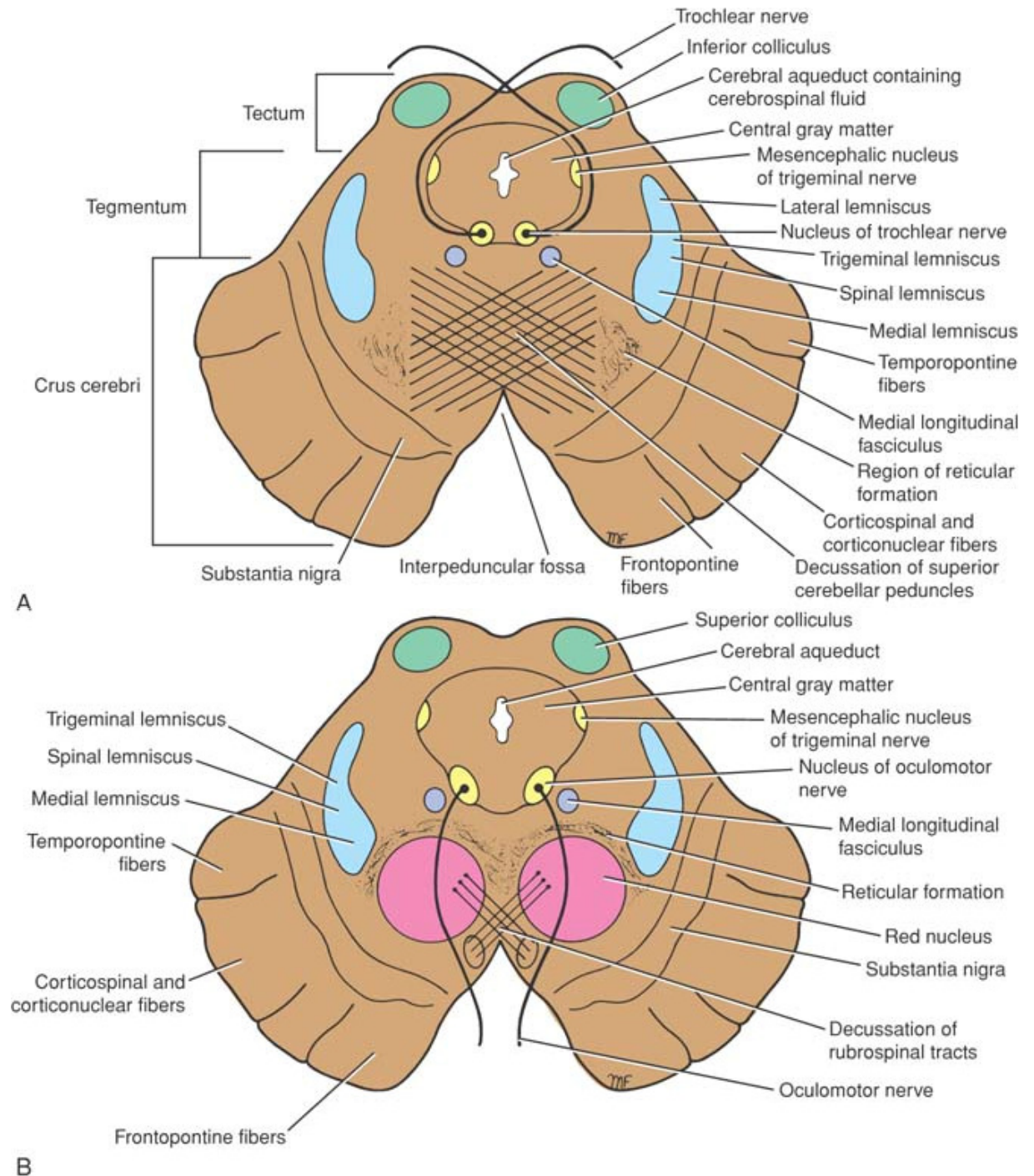
## Level at superior colliculus

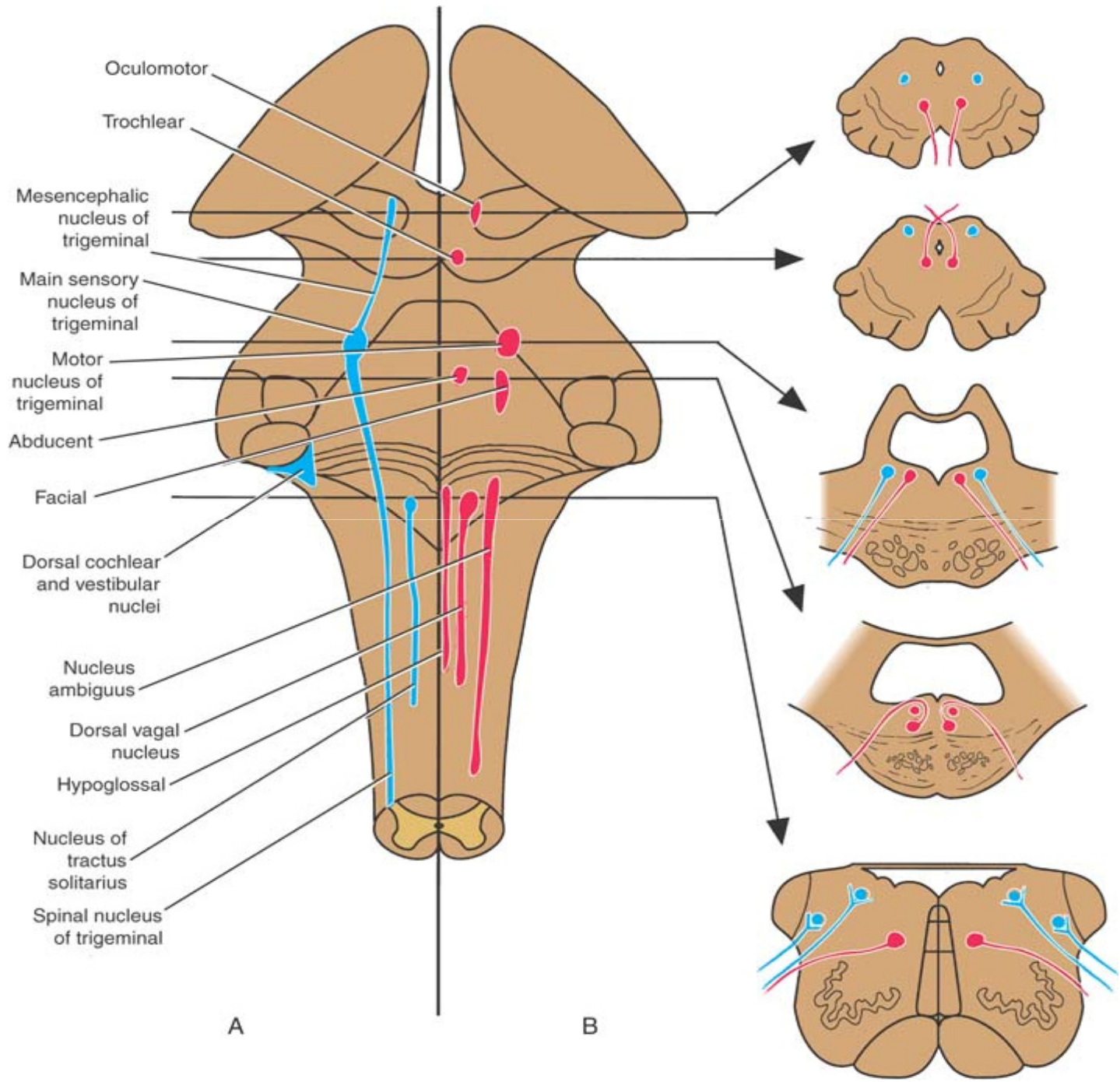
- Superior colliculus
- Oculomotor nucleus (posterior to MLF)
- Oculomotor n emerges through red nucleus
- Edinger-Westphal nucleus
- **pretectal nucleus:** close to the lateral part of the superior colliculus.
- MLF
- Medial, trigeminal, spinal lemniscus (**no** lateral lemniscus)
- Red nucleus
- Substantia nigra
- Crus cerebri
- RF



# Substantia nigra

- Large motor nucleus
- is a brain structure located in the midbrain
- plays an important role in reward, addiction, and movement.
- *Substantia nigra* is Latin for "black substance" due to high levels of melanin
- has connections with basal ganglia ,cerebral cortex
- Concerned with muscle tone
- Parkinson's disease is caused by the death of neurons in the substantia nigra



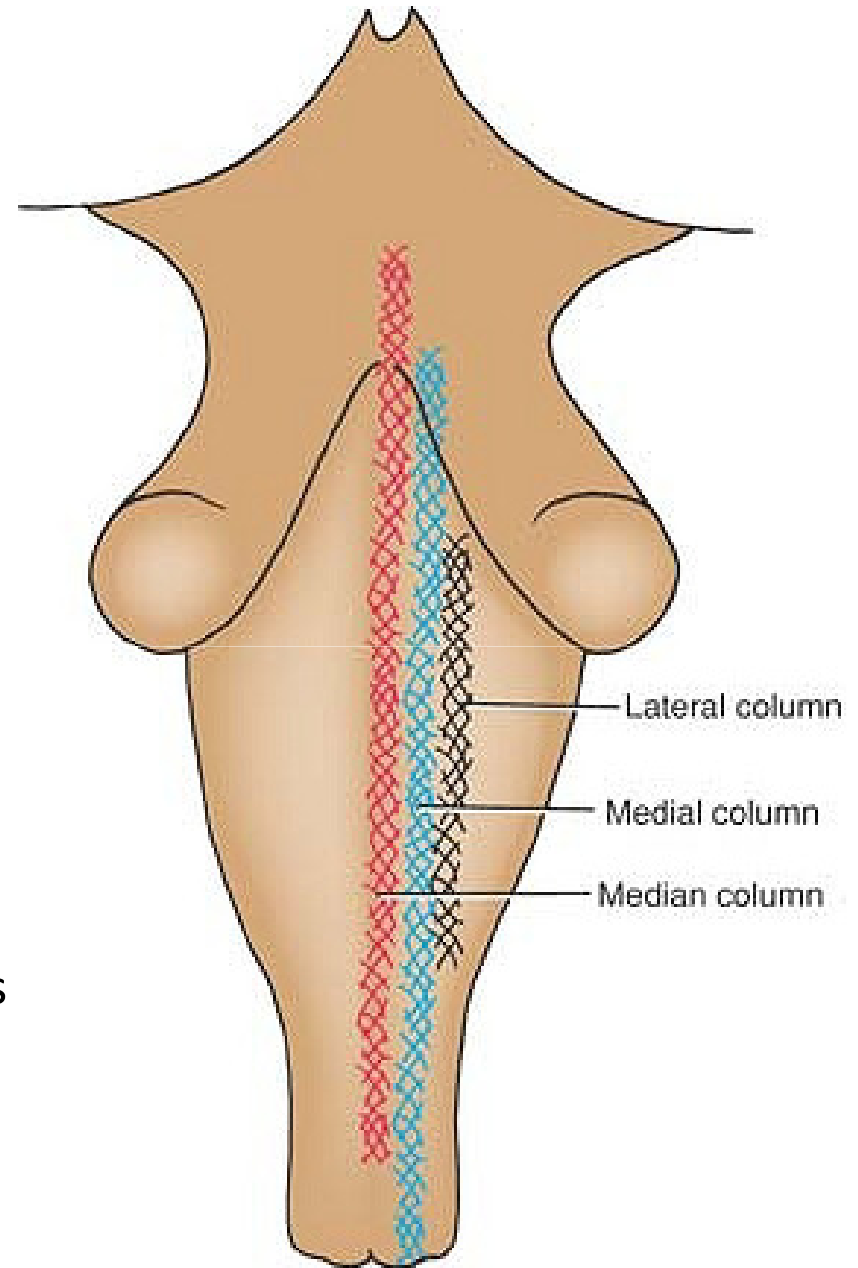


A

B

# Reticular Formation

- Deeply placed continuous network of nerve cells and fibers that extend from the spinal cord through the medulla, the pons, the midbrain, the subthalamus, the hypothalamus, and the thalamus
- Divided into three longitudinal columns:
  - **Median column:** intermediate-size neurons
  - **Medial column:** large neurons
  - **Lateral column:** small neurons
- **General function:**
  - Control of skeletal muscle
  - Control of somatic and visceral sensations
  - Control of the autonomic nervous system
  - The reticular activating system.



# Reticular Formation In Medulla

- **Raphe nuclei**

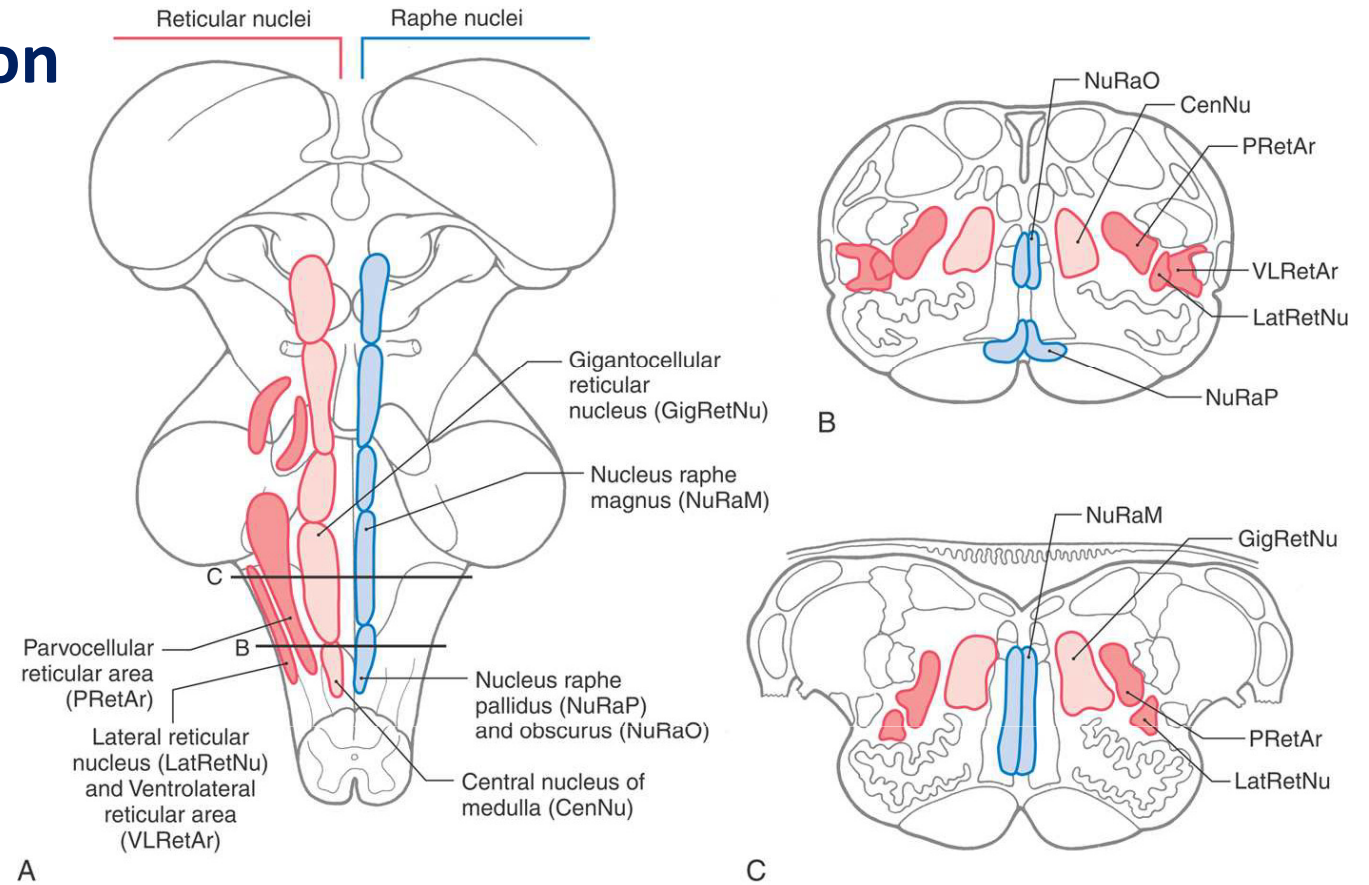
- Pallidus
- Obscurus
- Magnus

- **Medial medullary reticular area**

- Central nucleus of the medulla
- Gigantocellular reticular nucleus

- **Lateral medullary reticular area**

- Ventrolateral reticular area
- Lateral reticular nucleus
- Parvocellular nucleus



# Reticular Formation In Pons

- **Raphe nuclei**

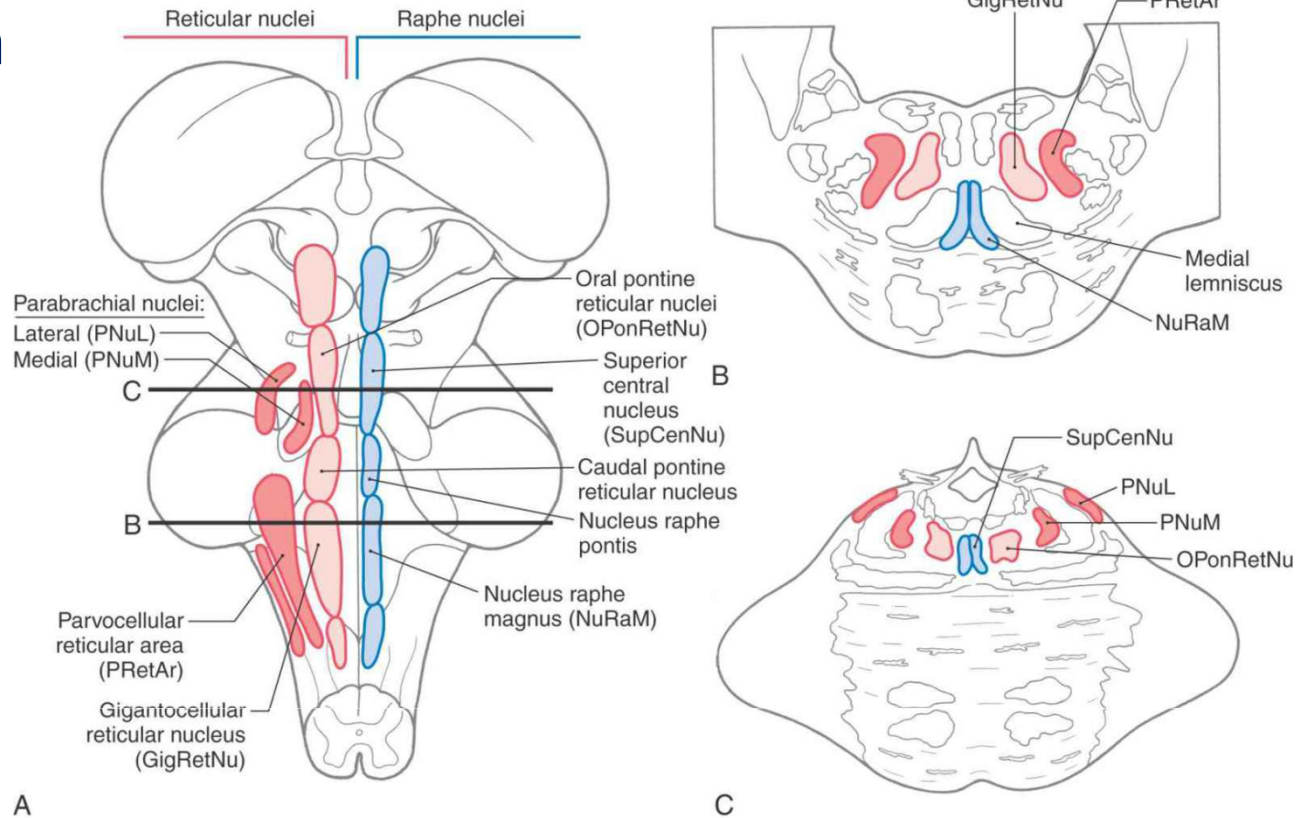
- Magnus
- Pontis
- Superior central
- Dorsal

- **Medial medullary reticular area**

- Gigantocellular reticular nucleus
- Caudal
- Oral

- **Lateral medullary reticular area**

- Parvocellular nucleus
- Medial parabrachial nucleus
- Lateral parabrachial nucleus





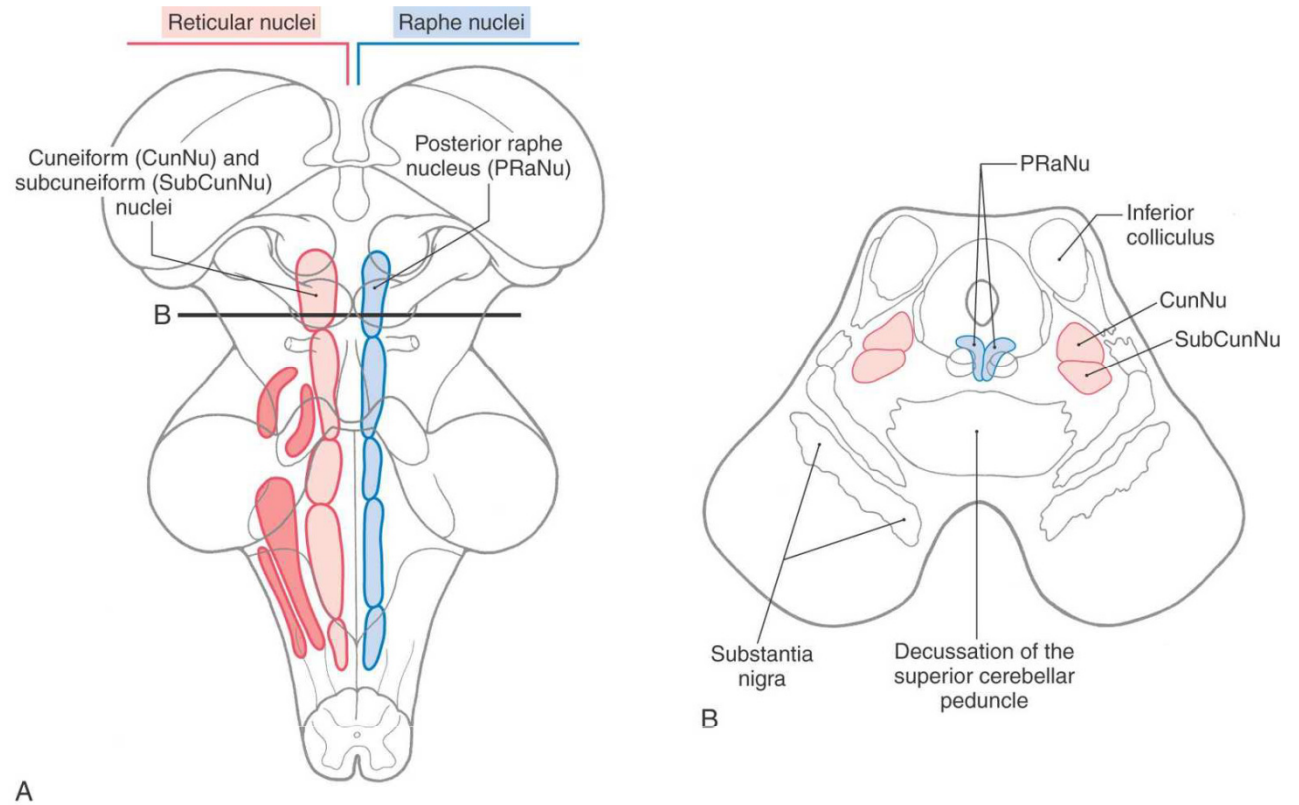
# Reticular Formation In Midbrain

- **Raphe nuclei**

- Posterior (dorsal) raphe nucleus: anterior PAG

- **Medial medullary reticular area**

- Cuneiform nucleus
- Subcuneiform nucleus



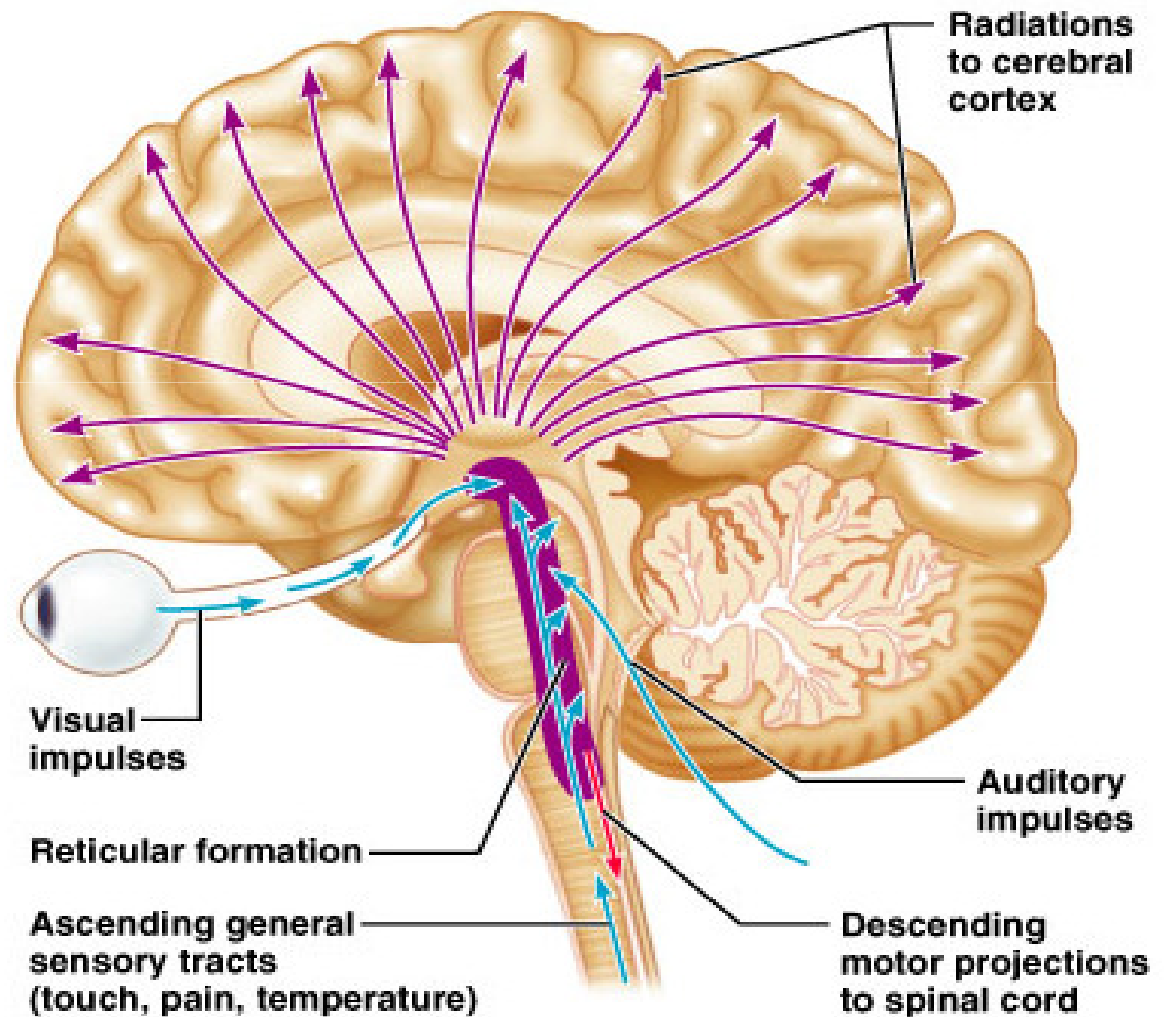
- Participates in the ascending systems that:

- Regulate states of consciousness.
- Project to the thalamus (thalamic reticular nucleus)

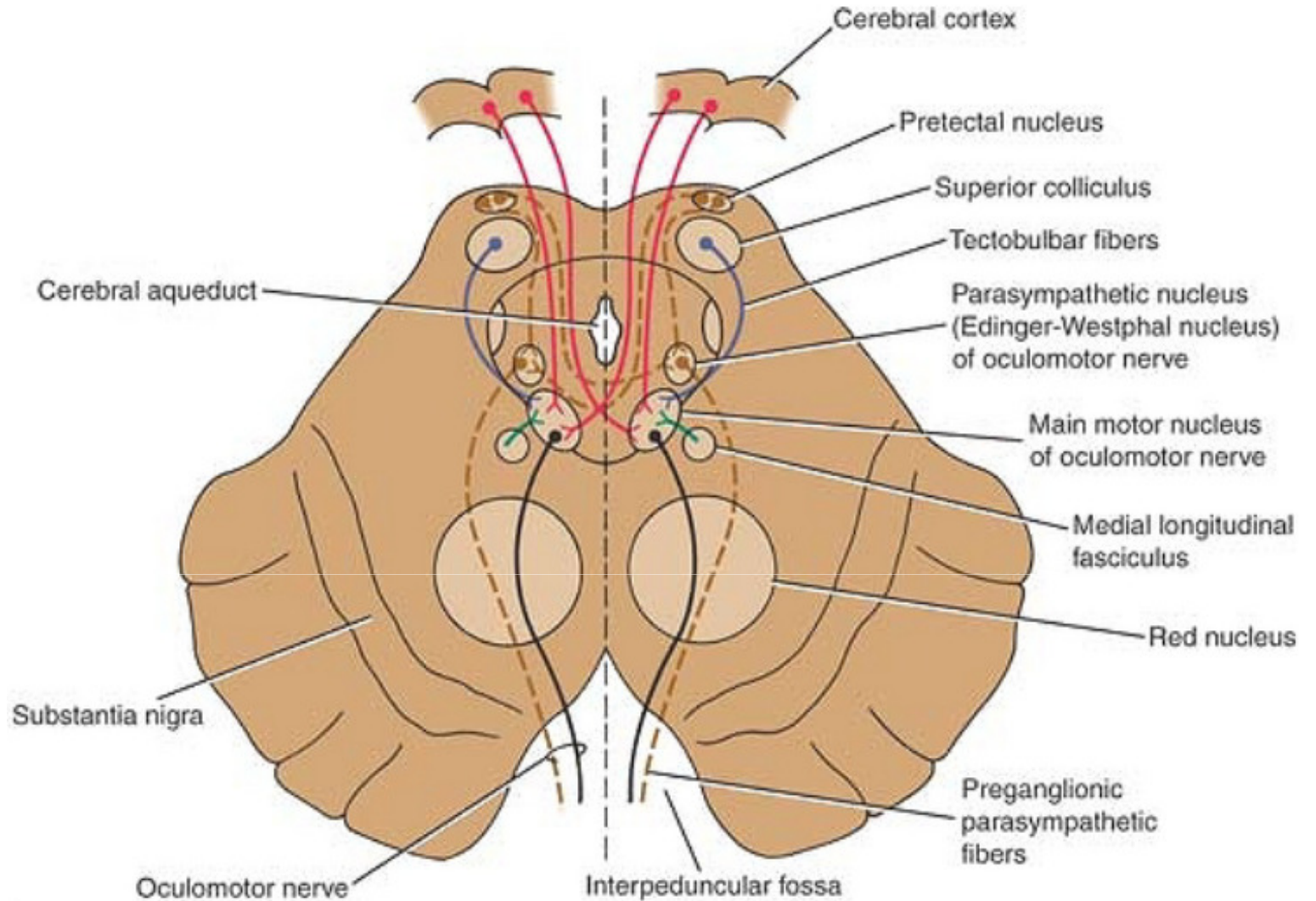
- Ascending fiber system is largely responsible for maintaining an alert, wakeful state and thus forms part of the **ascending reticular activating system**

# Reticular Formation

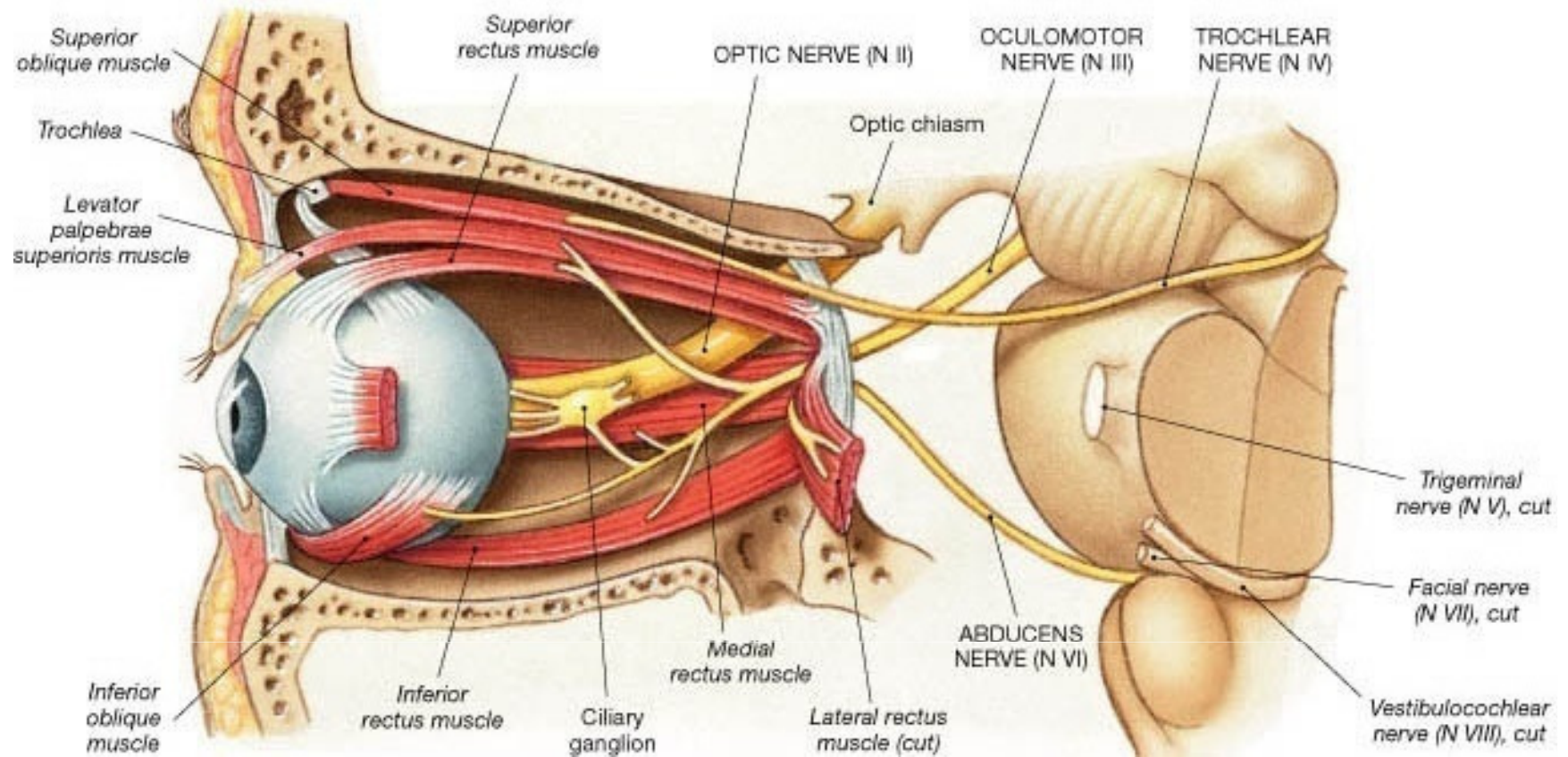
- Deeply placed posterior to the olivary nucleus
- Widespread connections
  - Arousal of the brain as a whole
- Reticular activating system (RAS)
  - Maintains consciousness and alertness



# Oculomotor Nerve (III)



- **Main oculomotor nucleus**
- **Accessory parasympathetic nucleus (Edinger-Westphal nucleus)**



### Course of oculomotor nerve

- Red nucleus
- Interpeduncular fossa
- Middle cranial fossa in the lateral wall of the cavernous sinus (Two rami)
- superior orbital fissure

## Oculomotor Nerve (III)

- **Extrinsic muscles:**

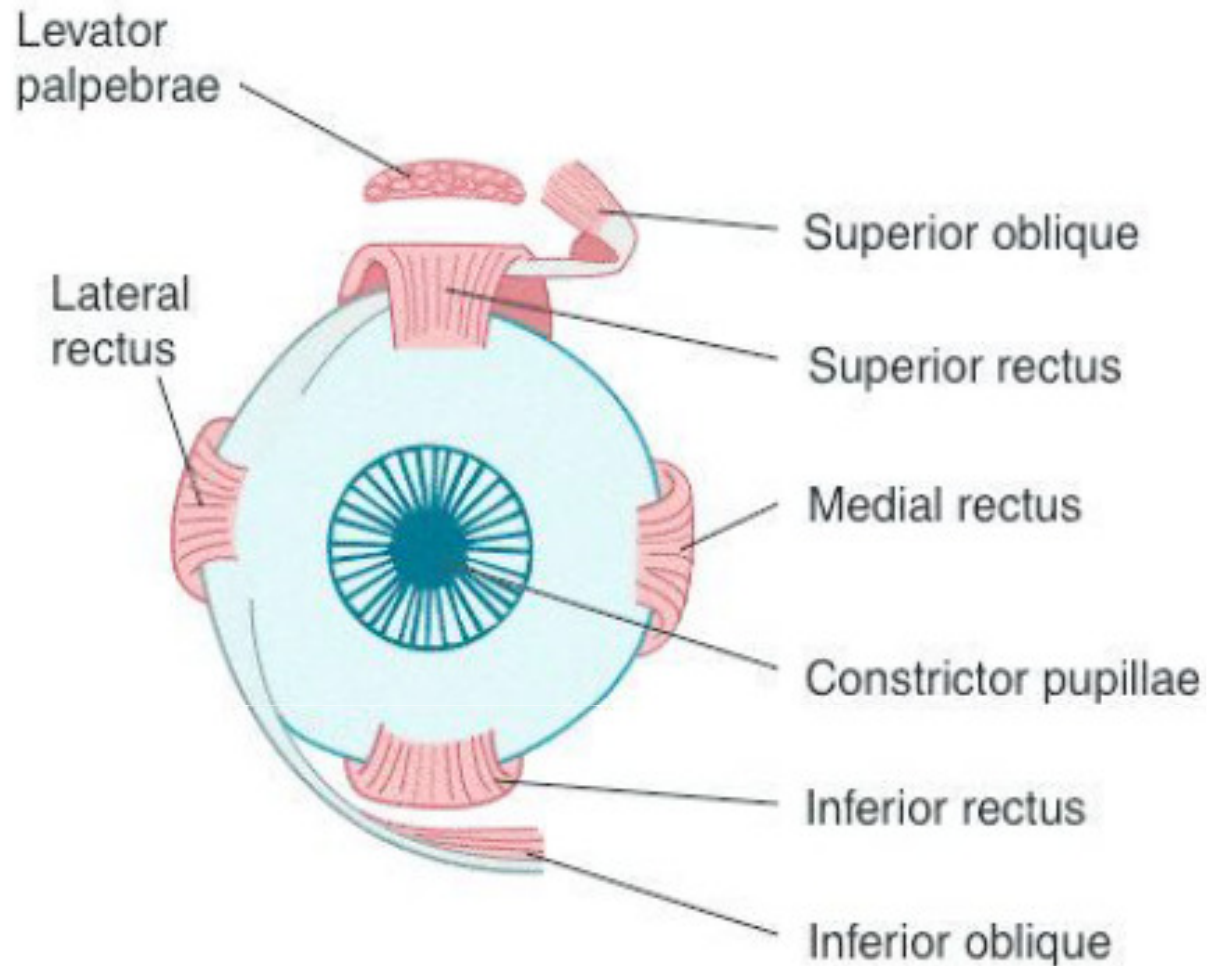
- The levator palpebrae superioris, superior rectus, medial rectus, inferior rectus, and inferior oblique

- **Intrinsic muscles:**

- The constrictor pupillae of the iris and ciliary muscles

- **Action:**

- Lifting the upper eyelid; turning the eye upward, downward, and medially; constricting the pupil; and accommodating the eye



## Oculomotor

### Nerve injury

- **Complete lesion**

- All of the muscles are paralyzed except lateral rectus and superior oblique

- Symptoms:

- External strabismus
- Diplopia
- Ptosis: drooping of the upper eyelid.
- The pupil is widely dilated and nonreactive to light
- Accommodation of the eye is paralyzed.

- **Incomplete lesions:**

- **Internal ophthalmoplegia:** loss of the autonomic innervation of the sphincter pupillae and ciliary muscle
- **External ophthalmoplegia.:** paralysis of the extraocular muscles



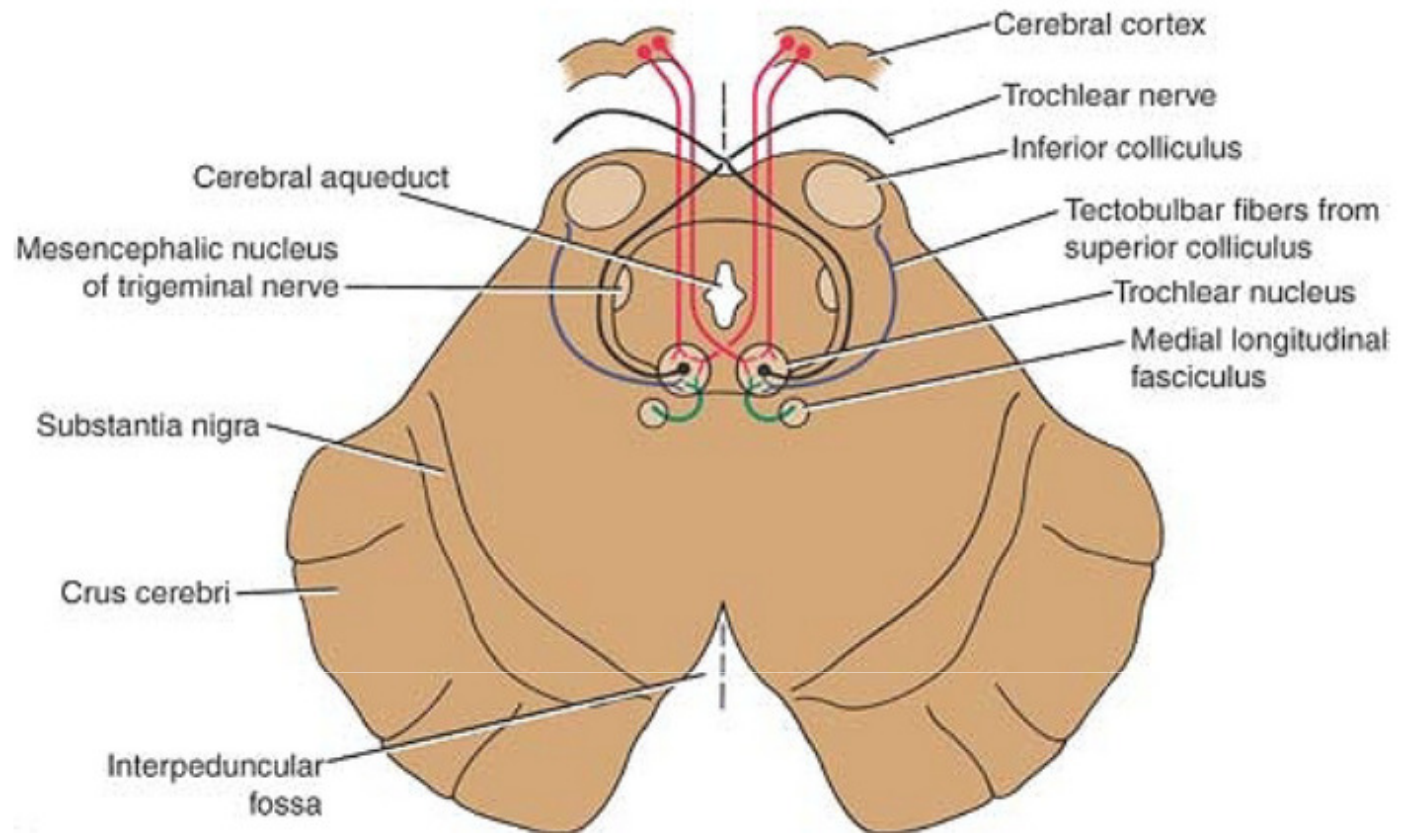
Double Vision

In cases of (diabetic neuropathy), the autonomic fibers are unaffected, whereas the nerves to the extraocular muscles are paralyzed.

# Trochlear Nerve

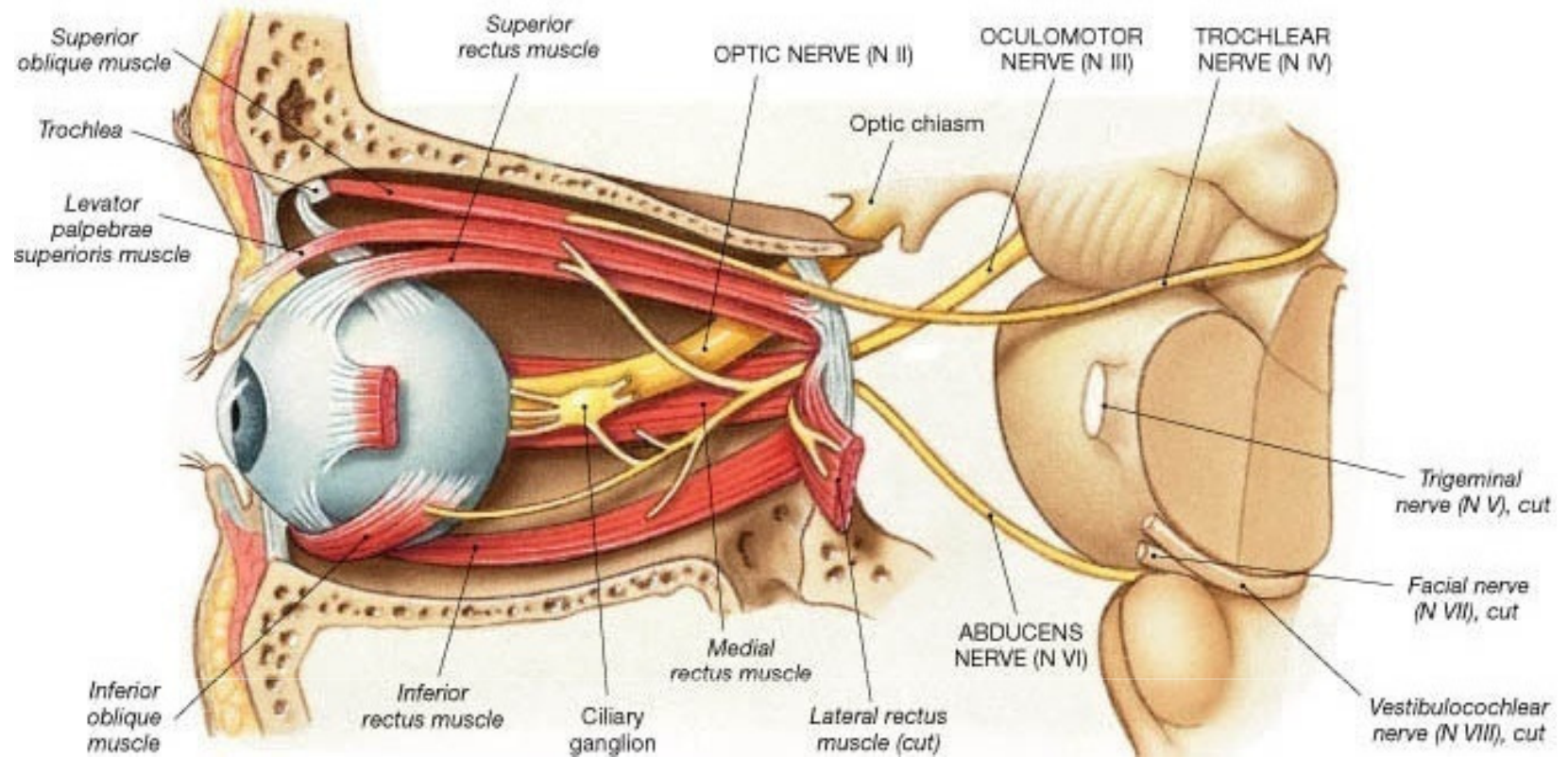
## Nucleus

- **Location**

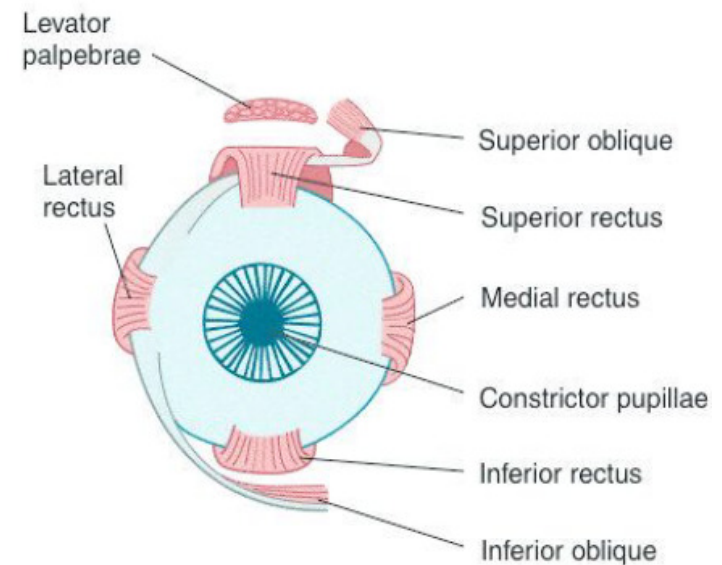


- Pass **posteriorly** around the central gray matter
- Immediately decussates

## Trochlear Nerve



- **Supplies:** superior oblique muscle
- **Action:** turning the eye downward and laterally





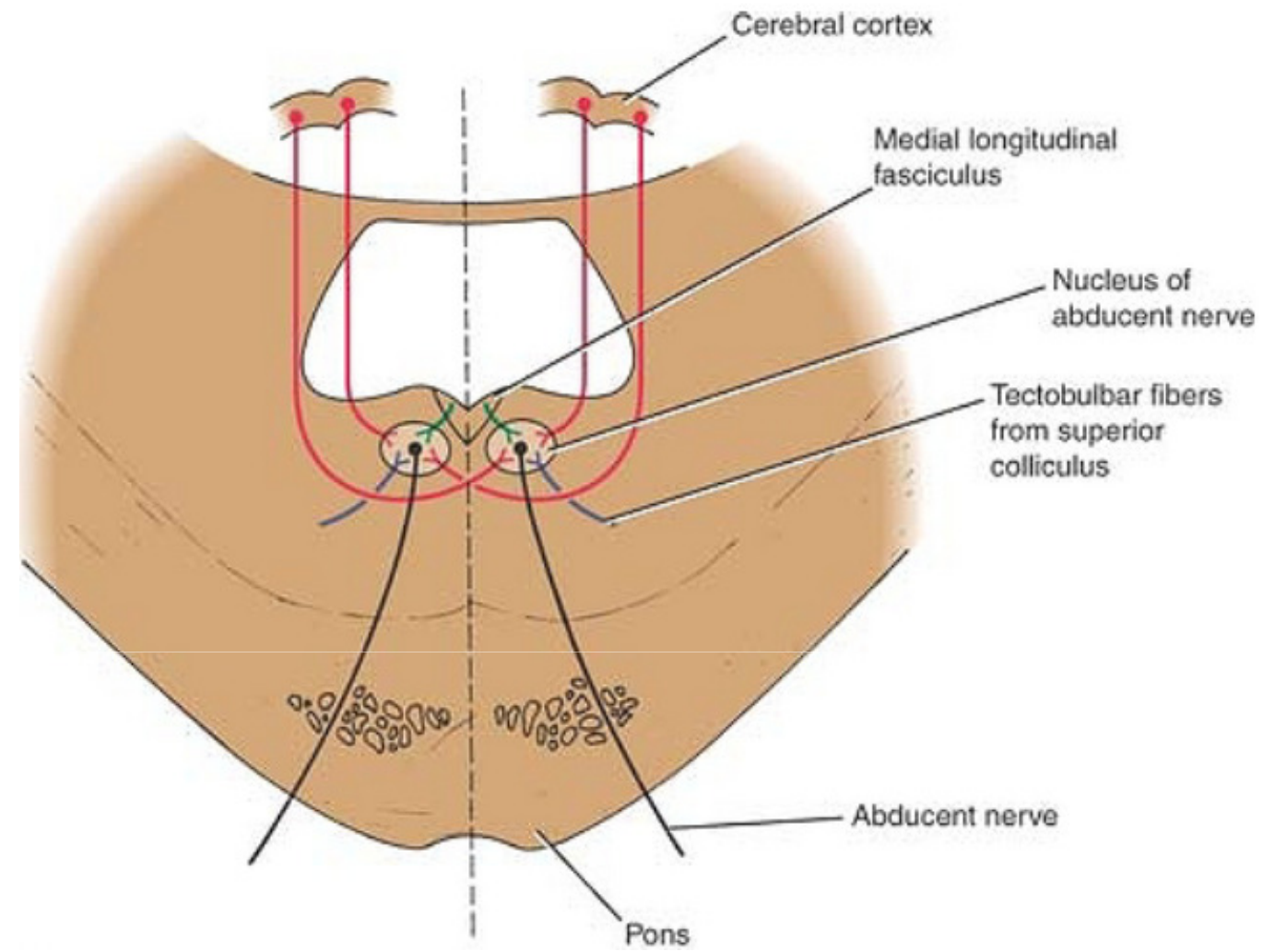
## Trochlear Nerve injury

- Symptoms:
  - Diplopia
  - Difficulty in turning the eye downward and laterally.
  - Difficulty in descending stairs
  - Head tilt to the side opposite the paralysed eye (compensatory adjustment)

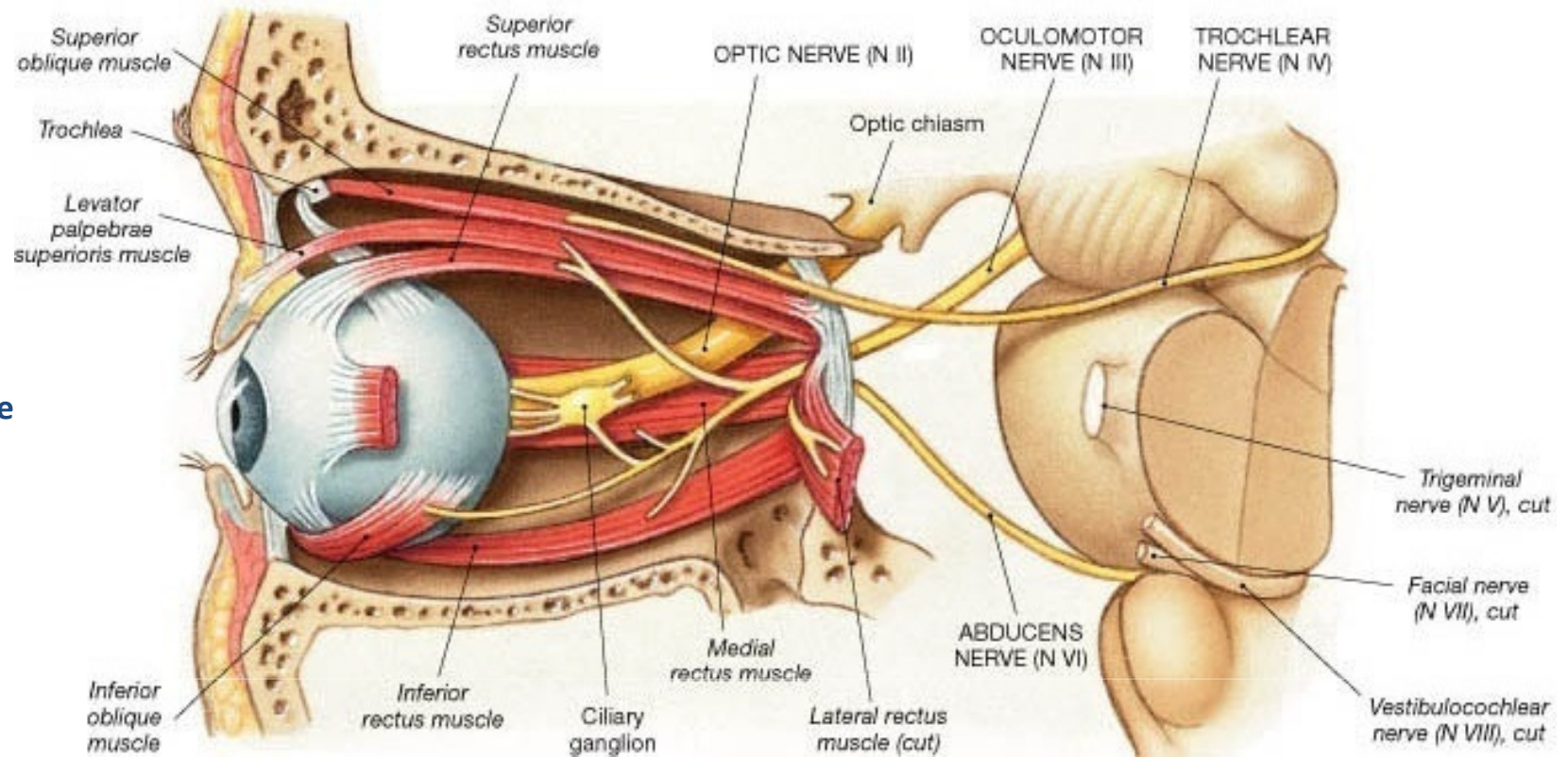


# Abducent Nerve Nucleus

- **Location:**  
beneath the floor  
of the upper part  
of the fourth  
ventricle, close to  
the midline



## Course of Abducent nerve



- Passes anteriorly: groove between the lower border of the pons and the medulla oblongata
- Through the cavernous sinus, below and lateral to the internal carotid artery
- Superior orbital fissure
- Supplies the lateral rectus: turning the eye laterally

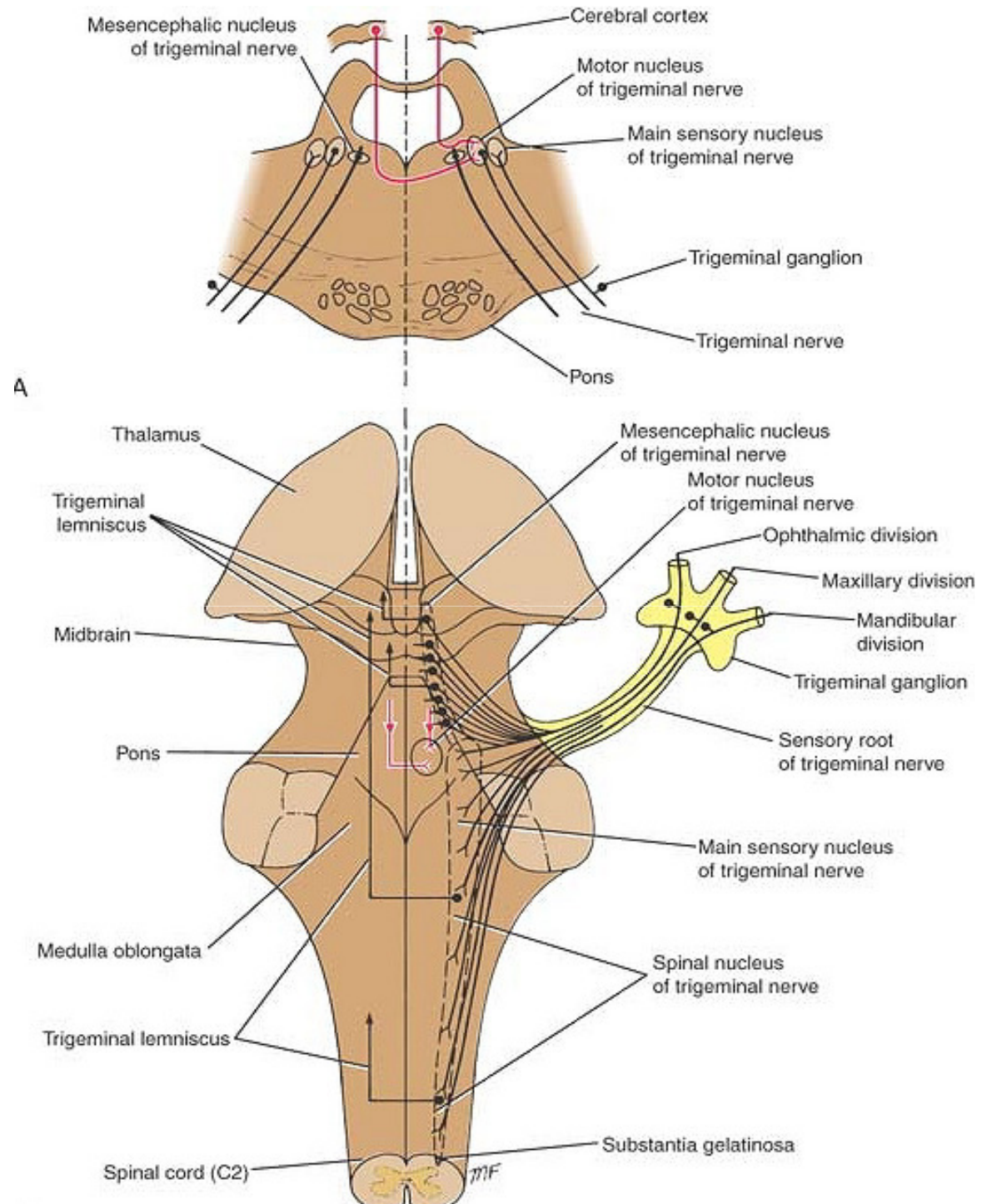
## Abducent Nerve injury

- Symptoms:
  - Diplopia
  - Difficulty in turning the eye laterally.
  - **internal strabismus.**  
unopposed medial rectus pulls the eyeball medially



# Trigeminal Nerve Nuclei

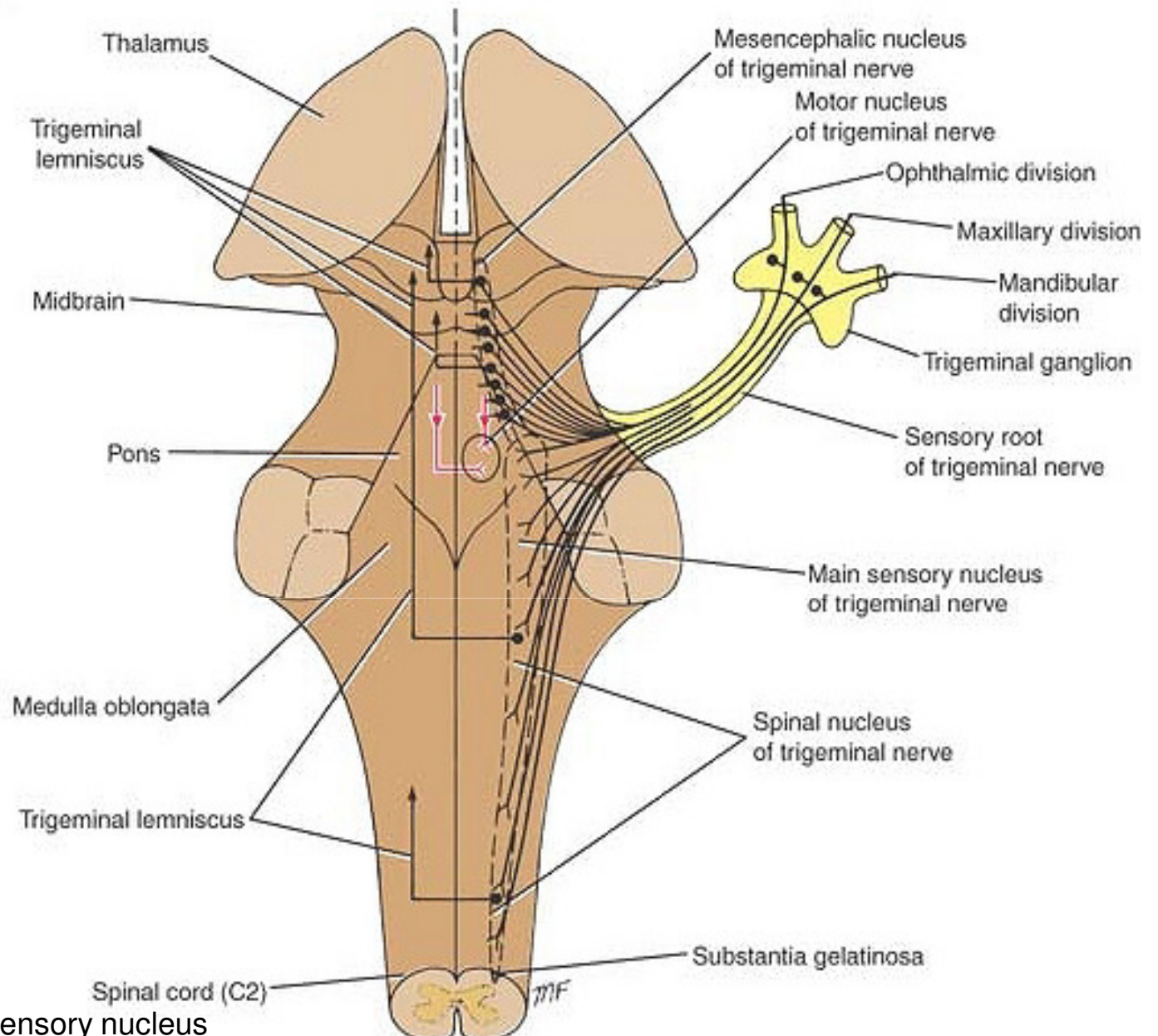
- **Main sensory nucleus**
  - Posterior part of the pons (lateral)
- **Motor nucleus**
  - Posterior part of the pons (Medial)
- **Spinal nucleus**
  - Superiorly: main sensory nucleus
  - Inferiorly: C2 segment
- **Mesencephalic nucleus**
  - Lateral part of the gray matter around the cerebral aqueduct
  - Inferiorly main sensory nucleus

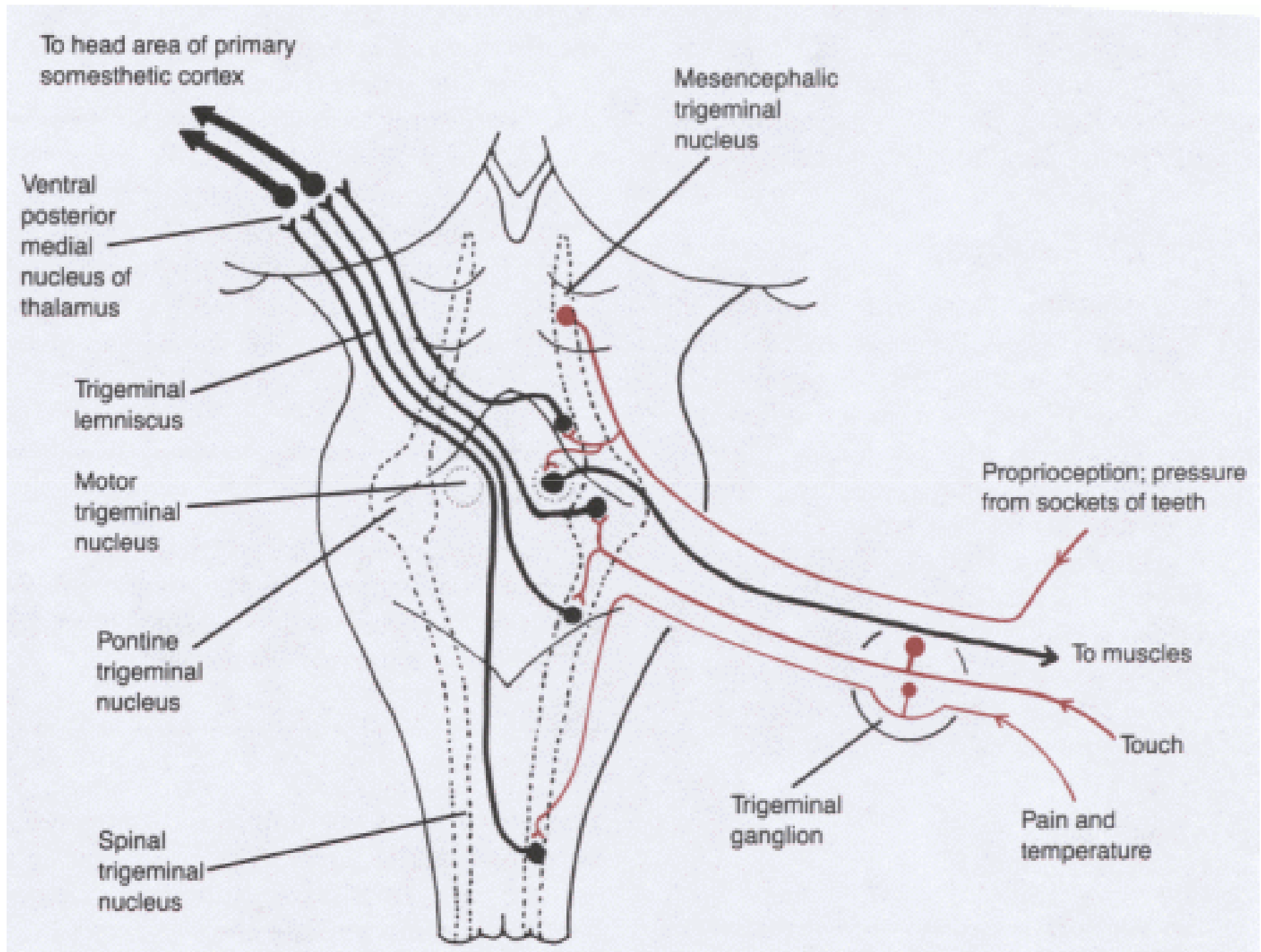


# Sensory

## Components

- Trigeminal sensory ganglion: (Cell bodies)
- Ascending branches: main sensory nucleus
- Descending branches: spinal nucleus
- Division:
  - ophthalmic inferior part of SN
  - Maxillary: middle part of SN
  - Mandibular: superior part of SN
- Touch and pressure: Main sensory nucleus
- Pain and temperature: Spinal nucleus
- Proprioceptive impulses from the muscles: mesencephalic nucleus





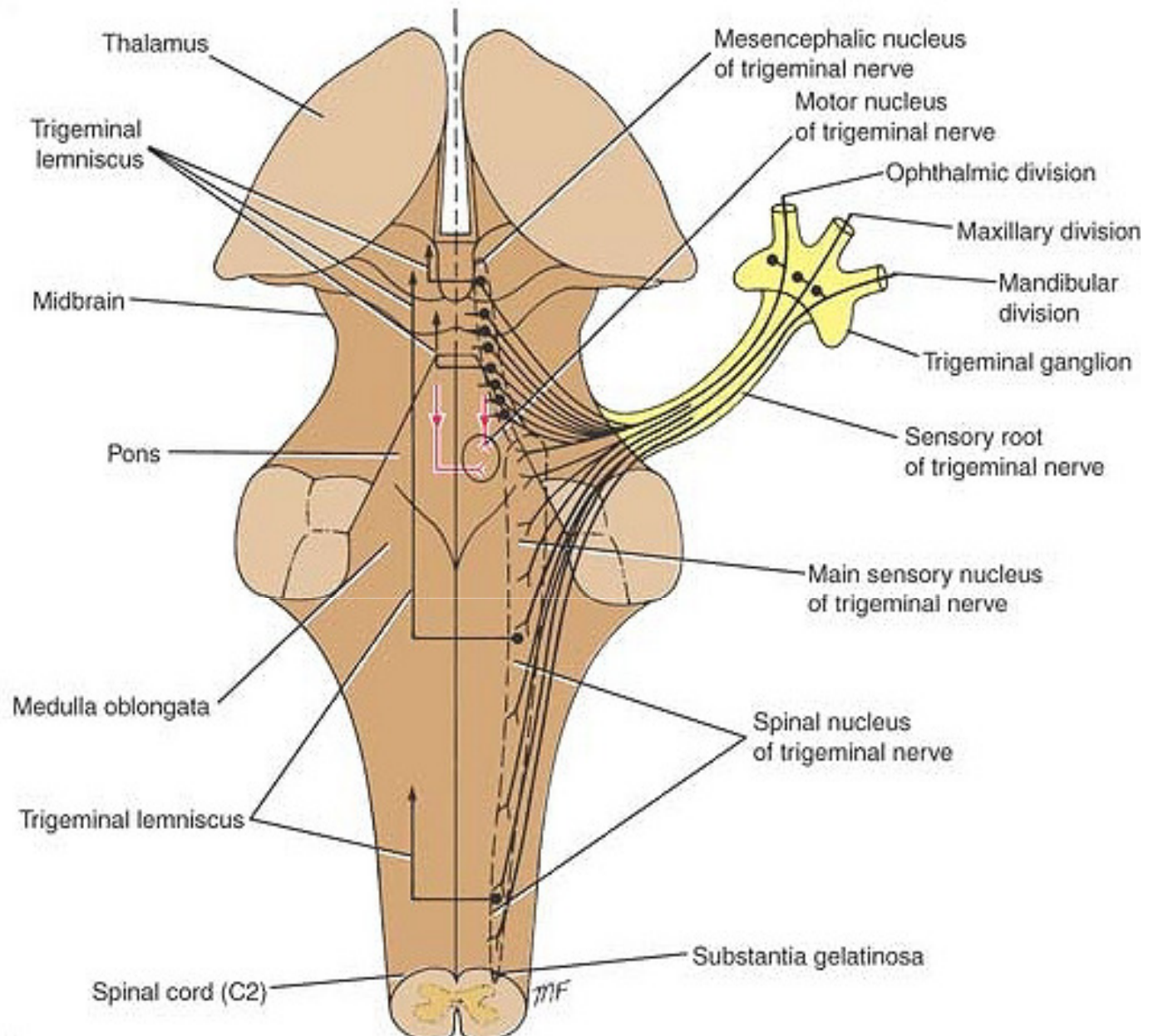
# Motor

## Components

- Motor nucleus receives
  - Corticonuclear fibers
  - Red nucleus
  - Reticular formation
  - Tectum

## Supplies

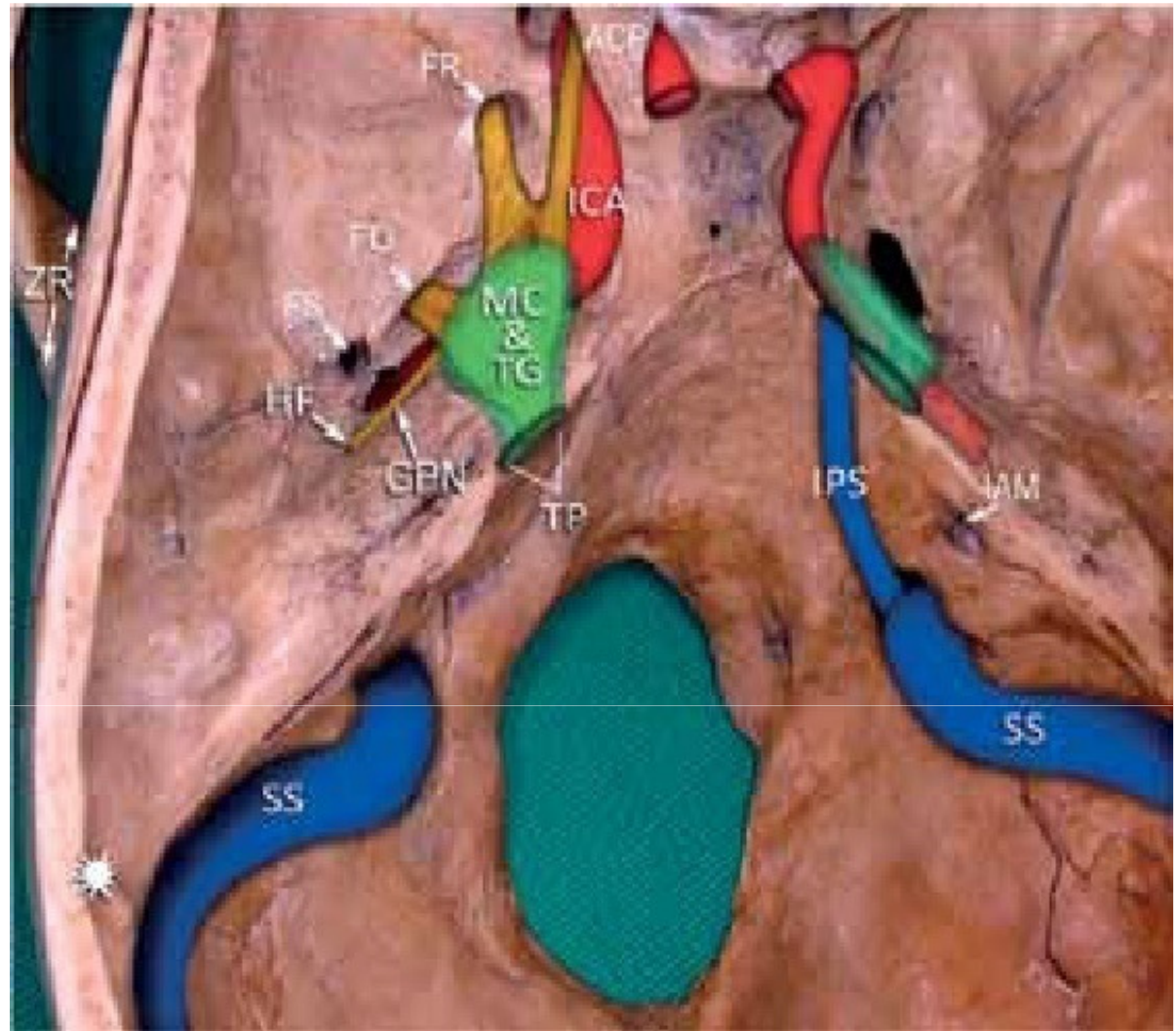
- Muscles of mastication
- Tensor tympani
  - Tensor veli palatini
  - Mylohyoid
  - Anterior belly of the digastric muscle

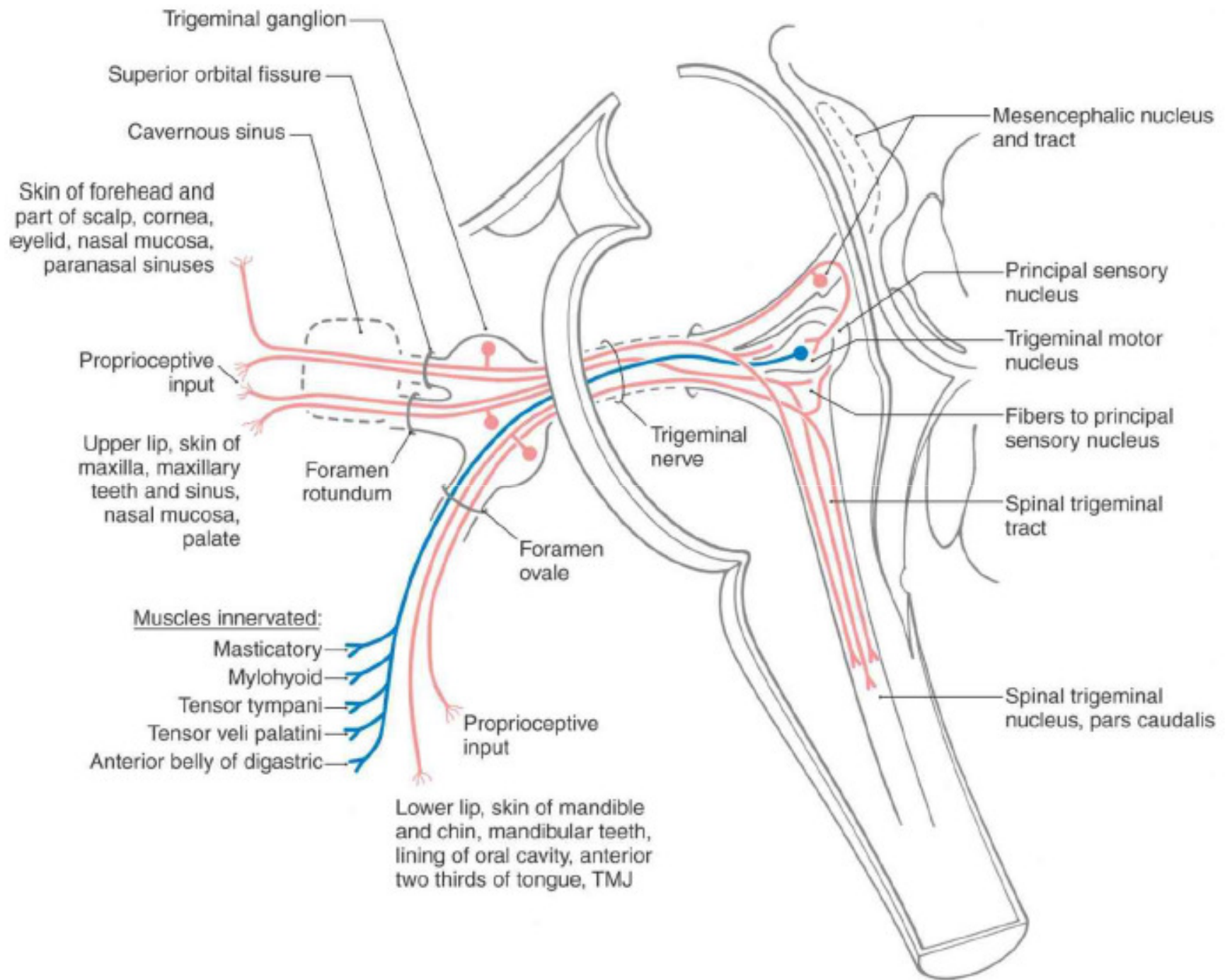


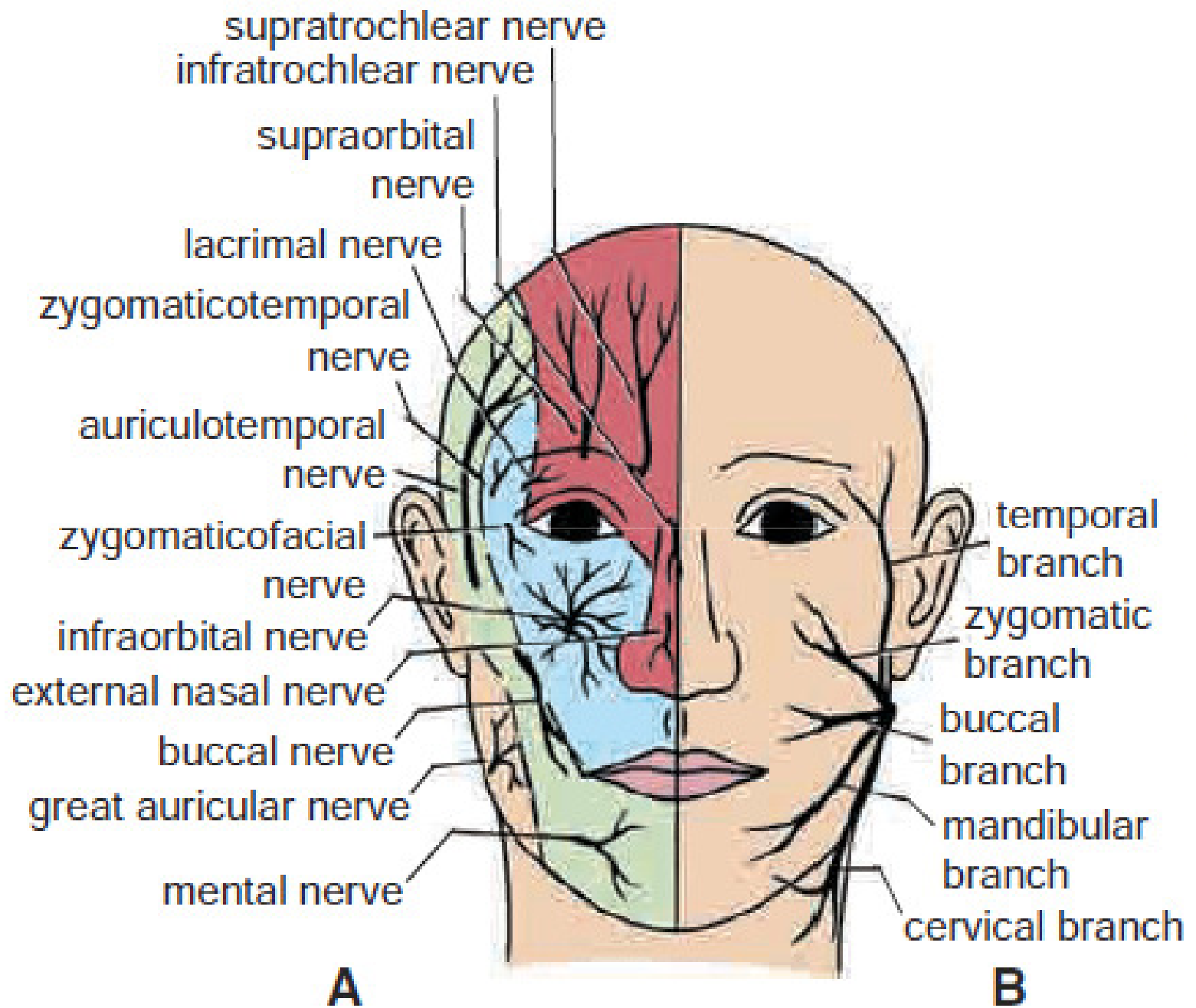


## Course of V

- Anterior aspect of the pons
- Upper surface of the apex of the petrous bone
- Trigeminal ganglion: in **Meckel cave**: pouch of dura mater
- Divisions:
  - Ophthalmic: superior orbital fissure
  - Maxillary: foramen rotundum
  - Mandibular: foramen ovale

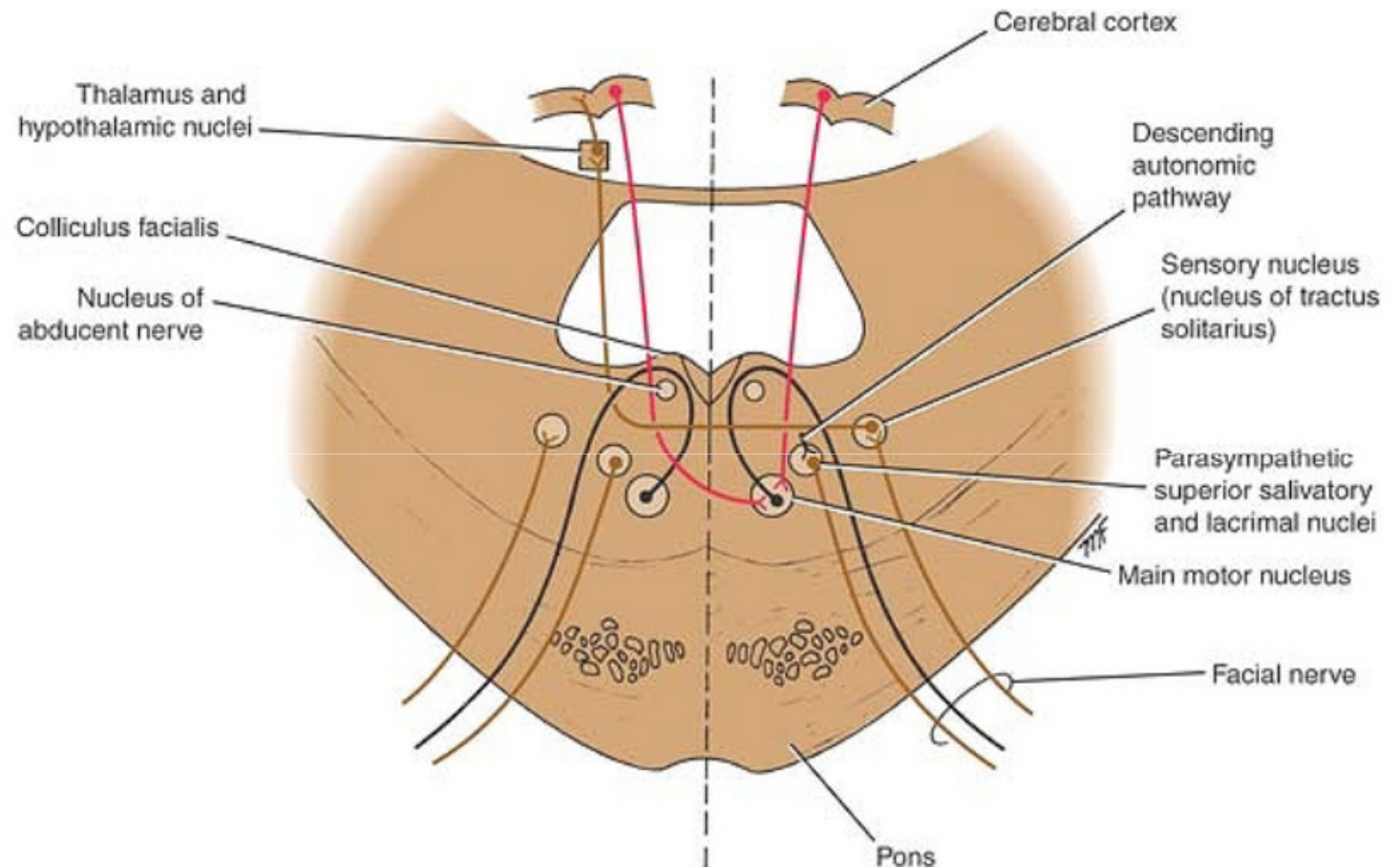






# Facial Nerve Nuclei

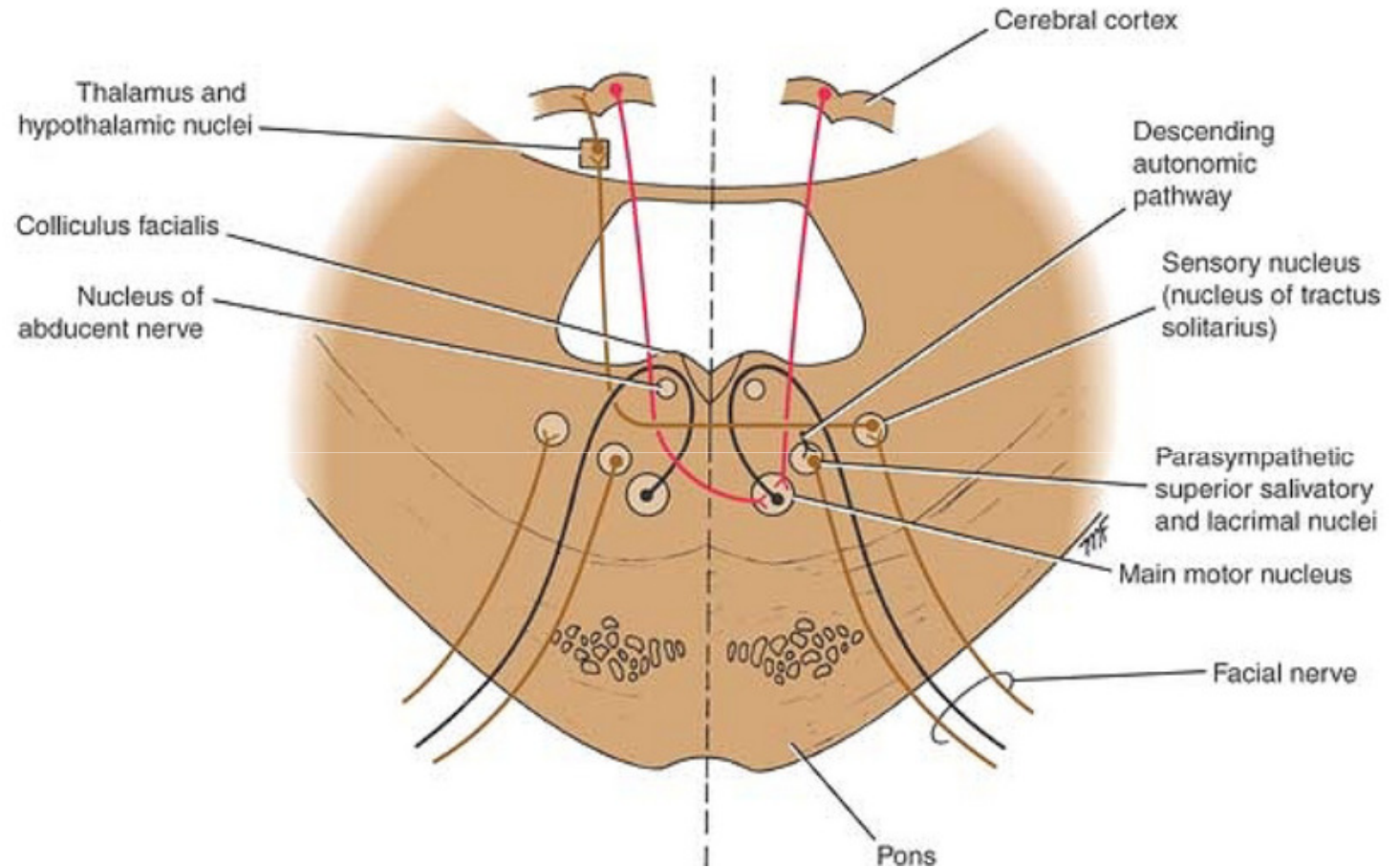
- **Main Motor Nucleus**
- Deep in the reticular formation of the lower part of the pons
- The part of the nucleus that supplies
  - **Upper part** of the face receives corticonuclear fibers from **both** hemispheres.
  - **lower part** of the face receives only corticonuclear fibers from the **opposite** cerebral hemisphere



# Facial Nerve Nuclei

## Parasympathetic Nuclei:

- **Location:**  
Posterolateral to  
the main motor  
nucleus
- **superior  
salivatory:**  
receives from the  
hypothalamus
- **Lacrimal nucleus:**  
receives from
  - hypothalamus  
(Emotional)
  - sensory nuclei of  
the trigeminal  
(reflex )

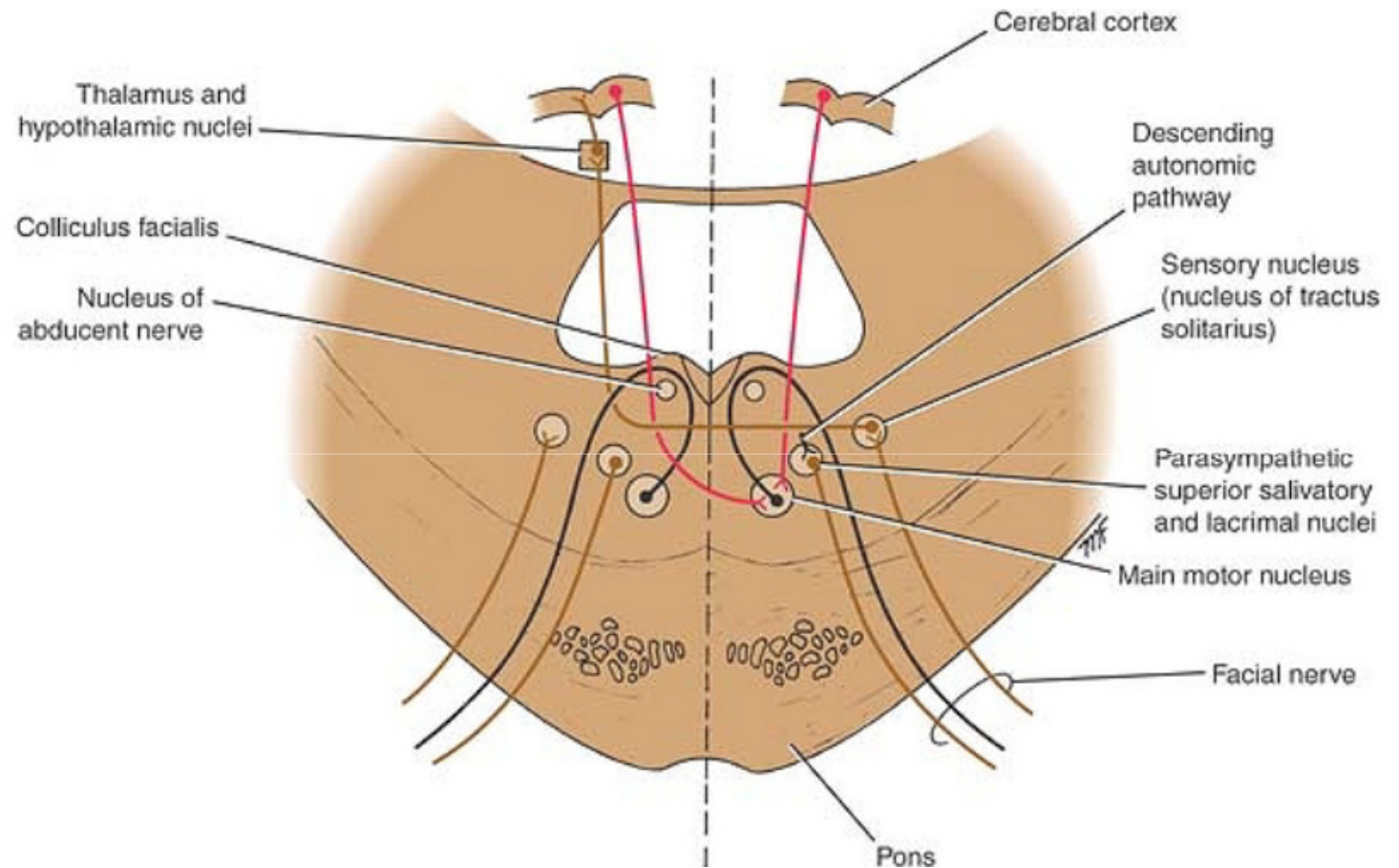


# Facial Nerve

## Nuclei

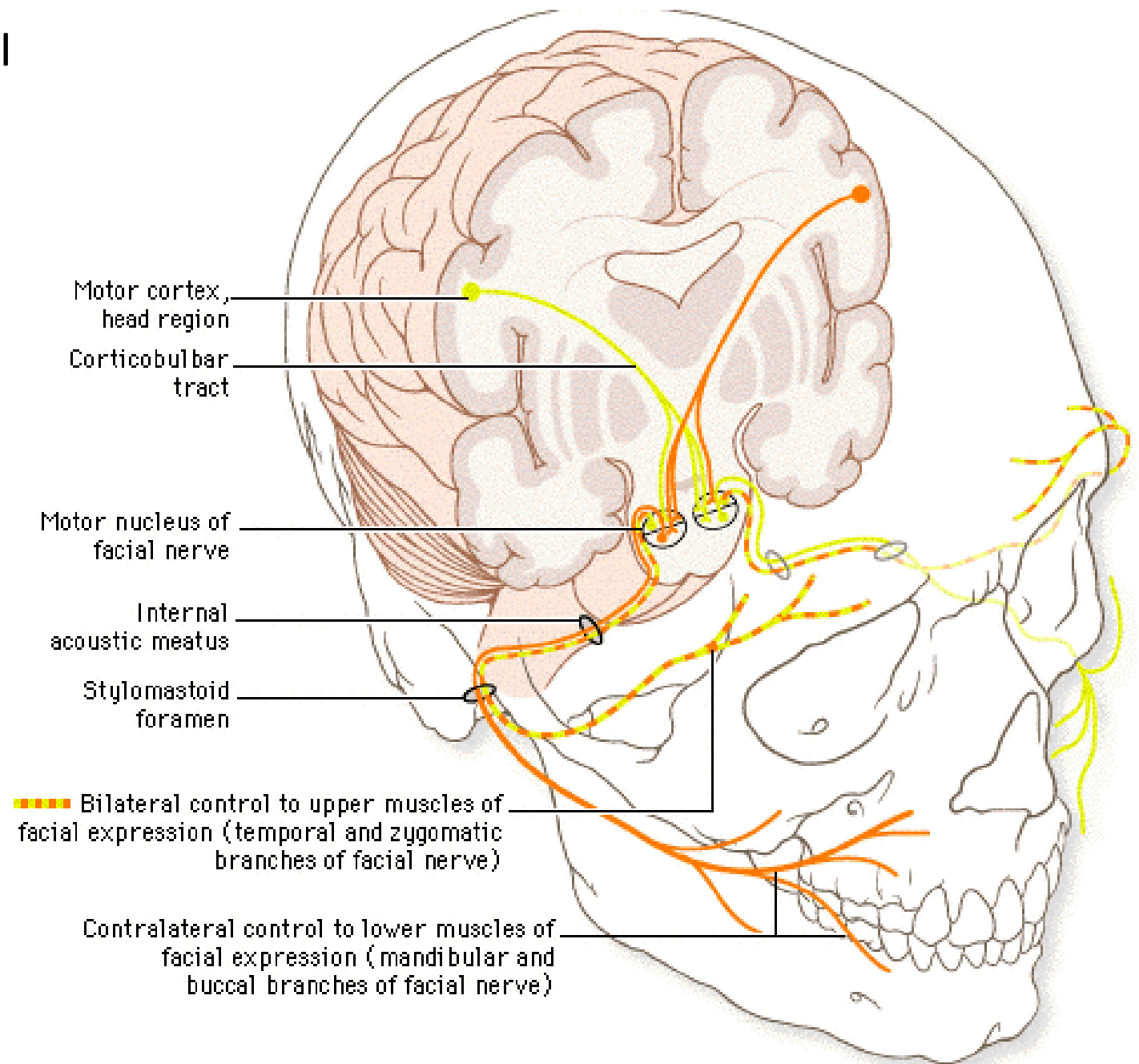
### Sensory Nucleus:

- **Location:** upper part of the nucleus of the tractus solitarius
- Sensations of taste
  - Cell bodies in geniculate ganglion
  - Sensory Nucleus
  - VPM
  - Primary gustatory cortex (area 43)



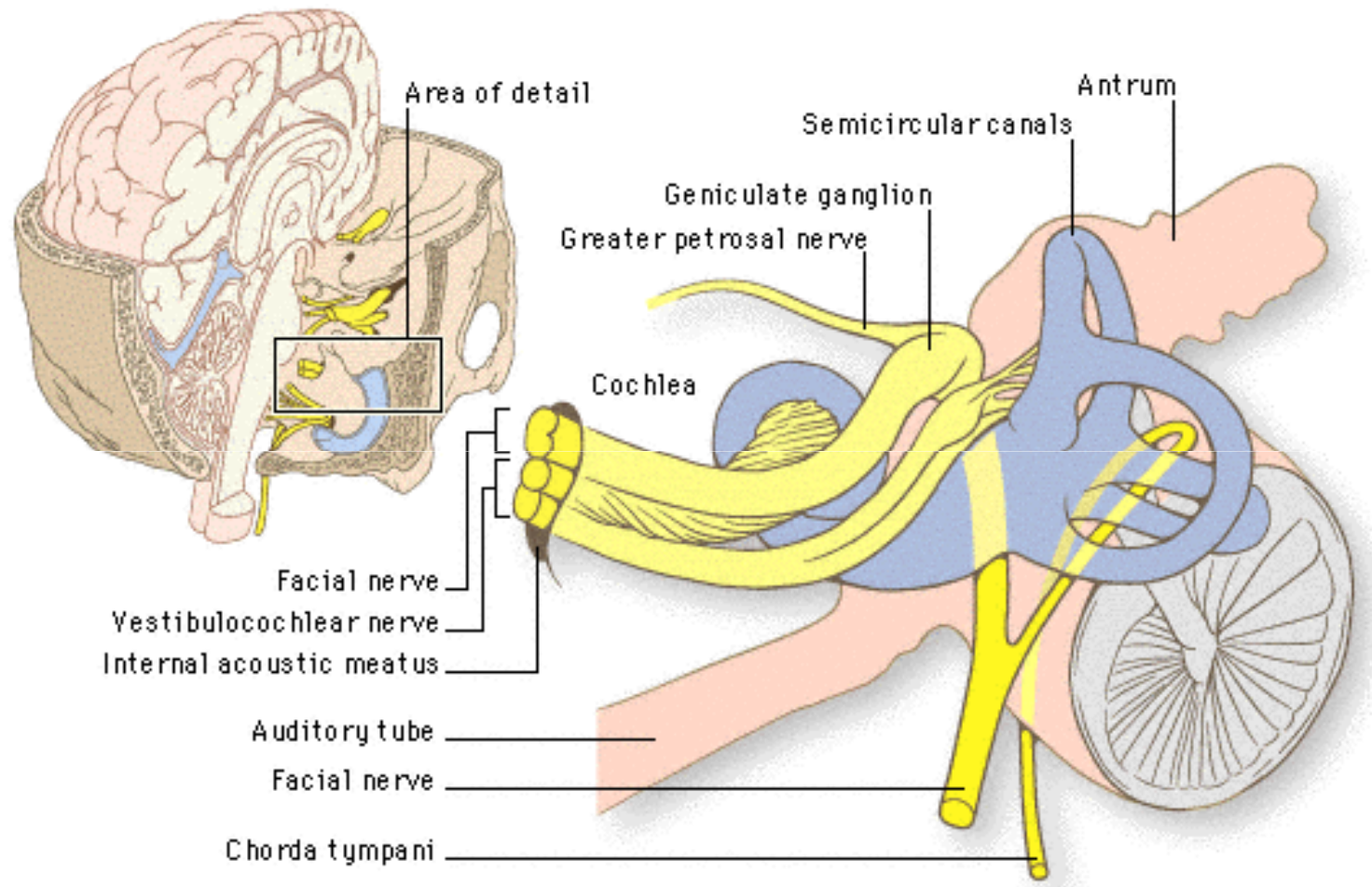
## Course of VII

- Anterior surface between the pons and the medulla oblongata
- Internal acoustic meatus
- facial canal then laterally through the inner ear



## Course of VII

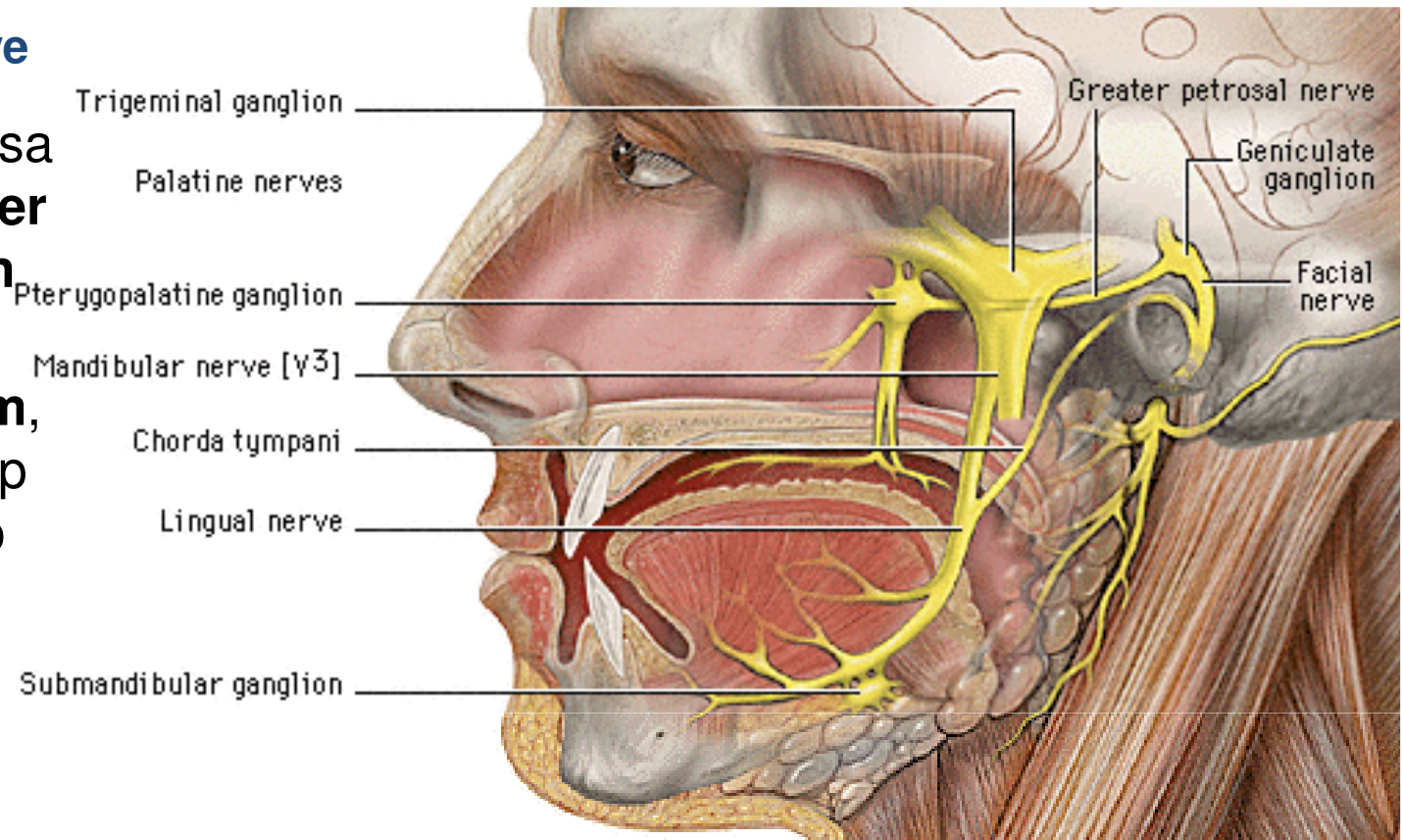
- Medial wall of the tympanic cavity  
**geniculate ganglion**
- Posterior wall of the tympanic cavity
- Emerges from the stylomastoid foramen.





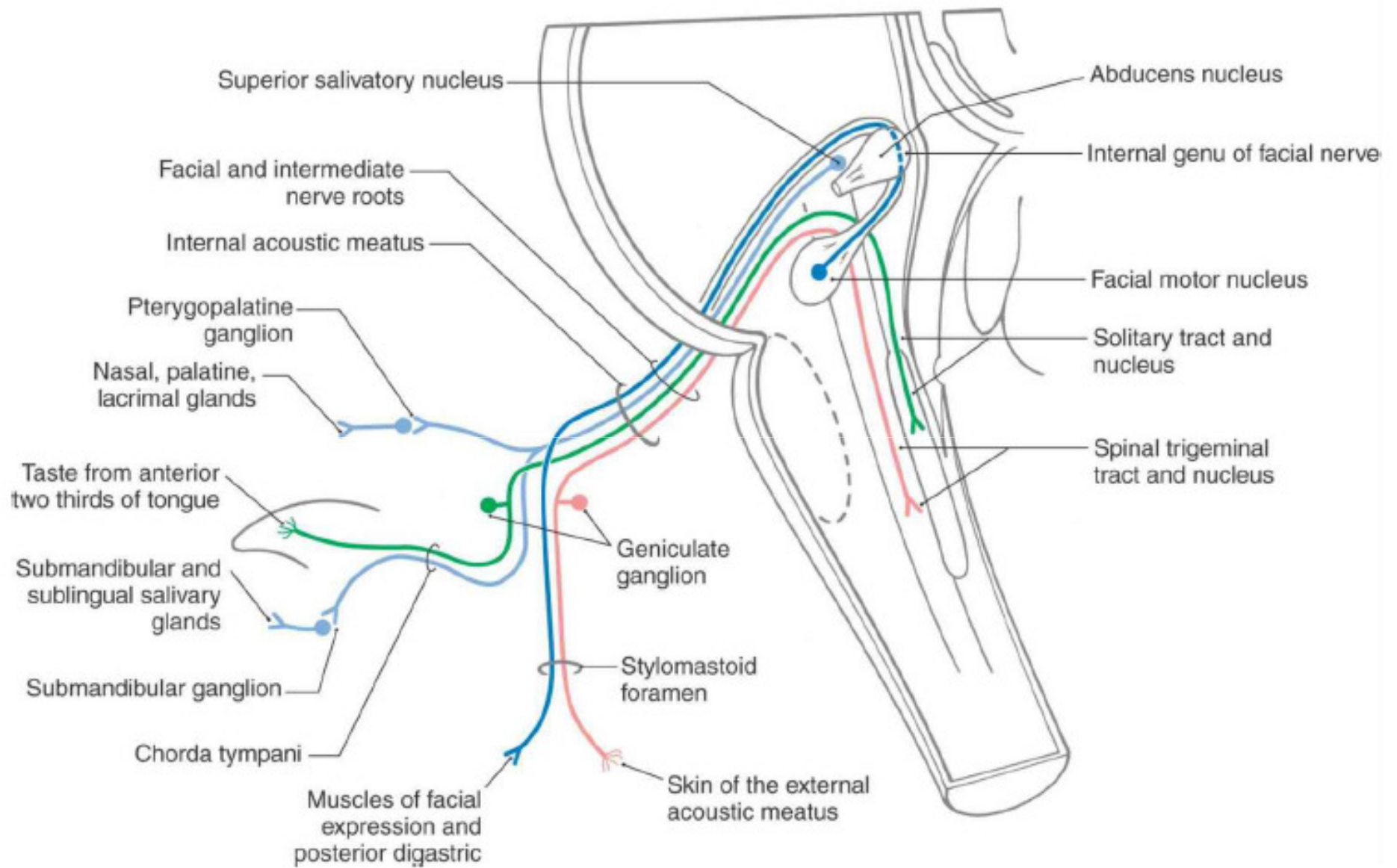
## greater petrosal nerve

- Middle cranial fossa through the **greater petrosal foramen**
- Passes over **Foramen lacerum**, where it joins deep **petrosal nerve** to form the nerve to pterygoid canal
- Pterygoid canal
- Pterygopalatine ganglion
- Maxillary nerve



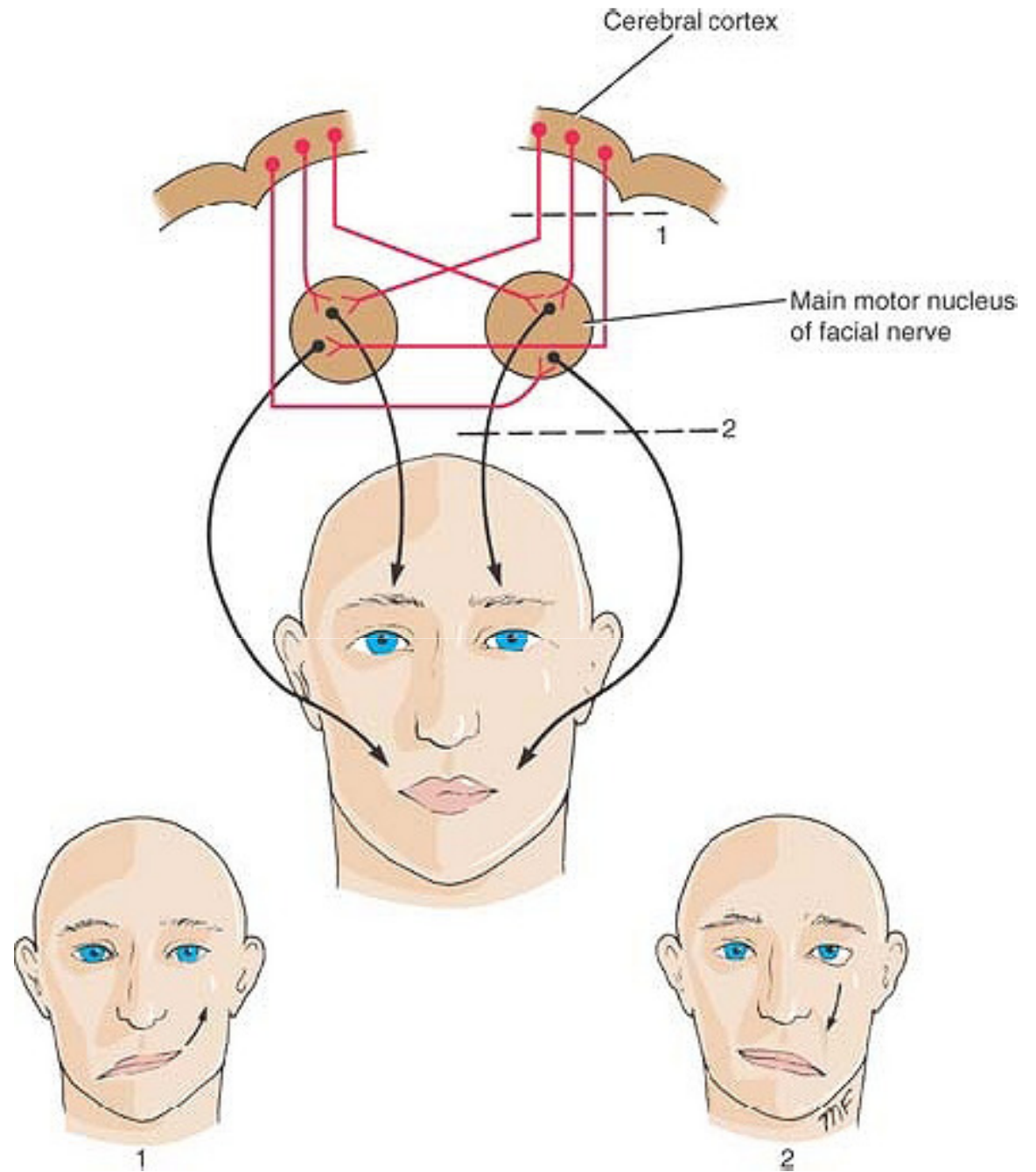
## The chorda tympani nerve

- continues through the petrotympanic fissure after which it emerges from the skull into the infratemporal fossa. It soon combines with the larger lingual nerve (Taste Anterior 2/3 of tongue)



## Facial Nerve injury

- Location of the lesion:
  - Abducent and the facial nerves are not functioning: lesion in the **pons**:
  - Vestibulocochlear and the facial nerves are not functioning: lesion in the **internal acoustic meatus**
  - Loss of taste over the anterior two-thirds: damaged to the **chorda tympani** branch
- Upper vs lower motor neuron injury



## Bell's Palsy

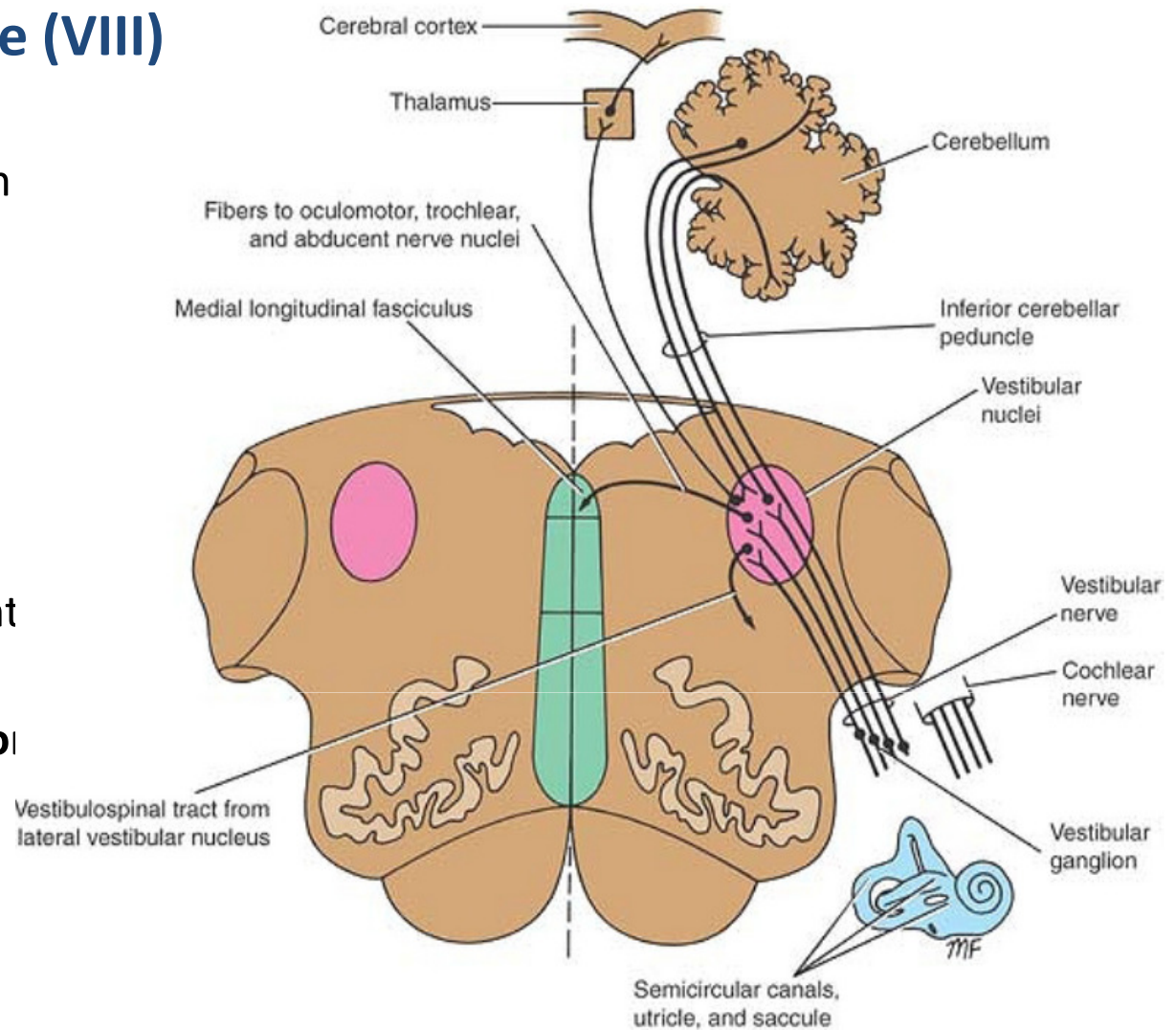
- Usually unilateral
- Lower motor neuron type of facial paralysis.
- Cause is not known,
  - Exposure of the face to a cold draft?
  - Complication of diabetes?
  - Can occur as a result of tumors or AIDS?



# Vestibulocochlear nerve (VIII)

## Vestibular nerve

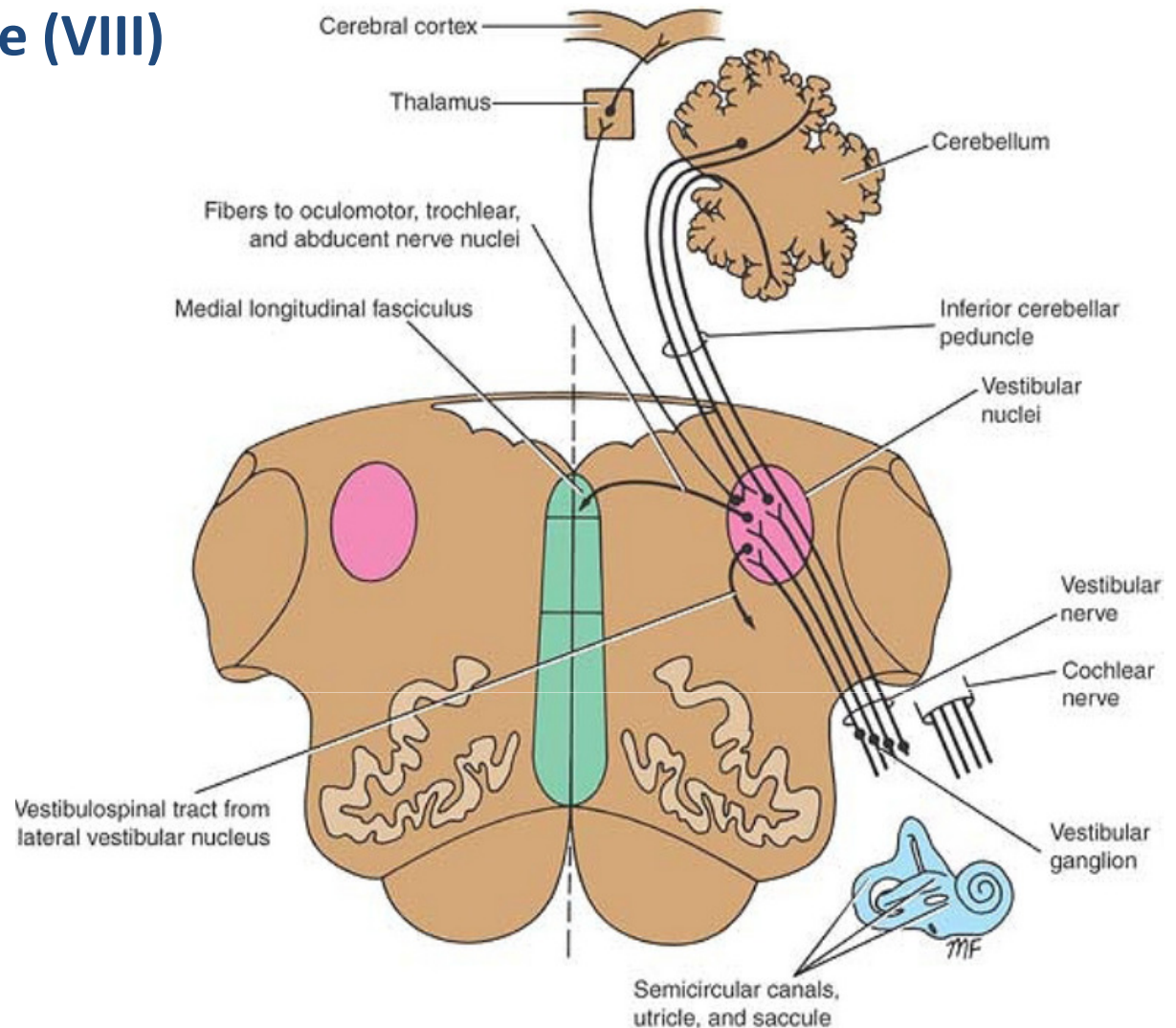
- Conducts nerve impulses from (inner ear)
  - **Utricle and saccule:** orientation of the head relative to gravity (linear accelerations)
  - **Semicircular canals:** rotational head movement (angular accelerations)
- Cell body in **vestibular ganglion (Scarpa )** in internal acoustic meatus
- **Vestibular Nuclear Complex**
  - Lateral
  - Superior
  - Medial
  - Inferior



# Vestibulocochlear nerve (VIII)

## Vestibular nerve

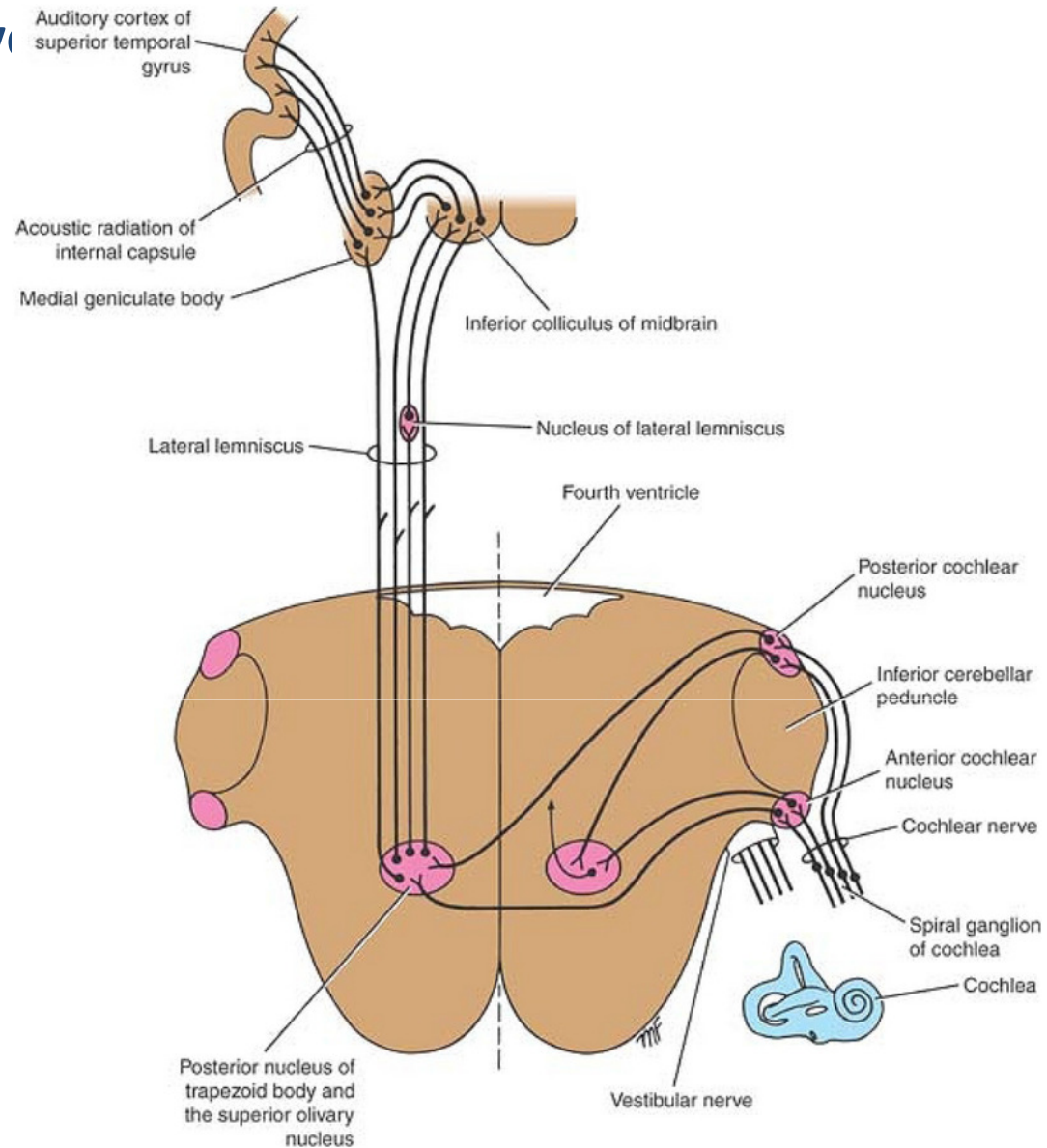
- Efferent fibers from the Vestibular Nuclei
  - **Cerebellum**
  - **Spinal cord** (vestibulospinal tract)
  - **Nuclei of (III, IV, VI)** nerves through the MLF
  - **Cerebral cortex:** vestibular area in the postcentral gyrus just above the lateral fissure via **VPL** of thalamus



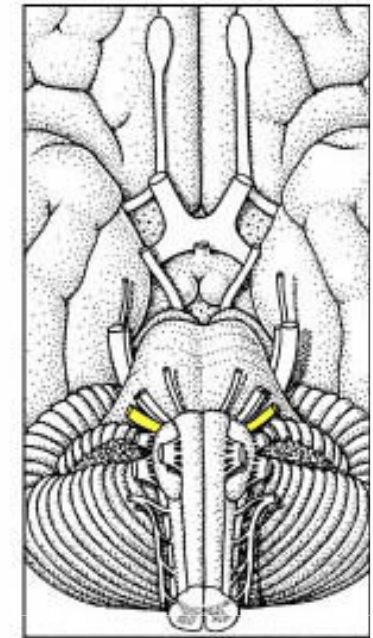
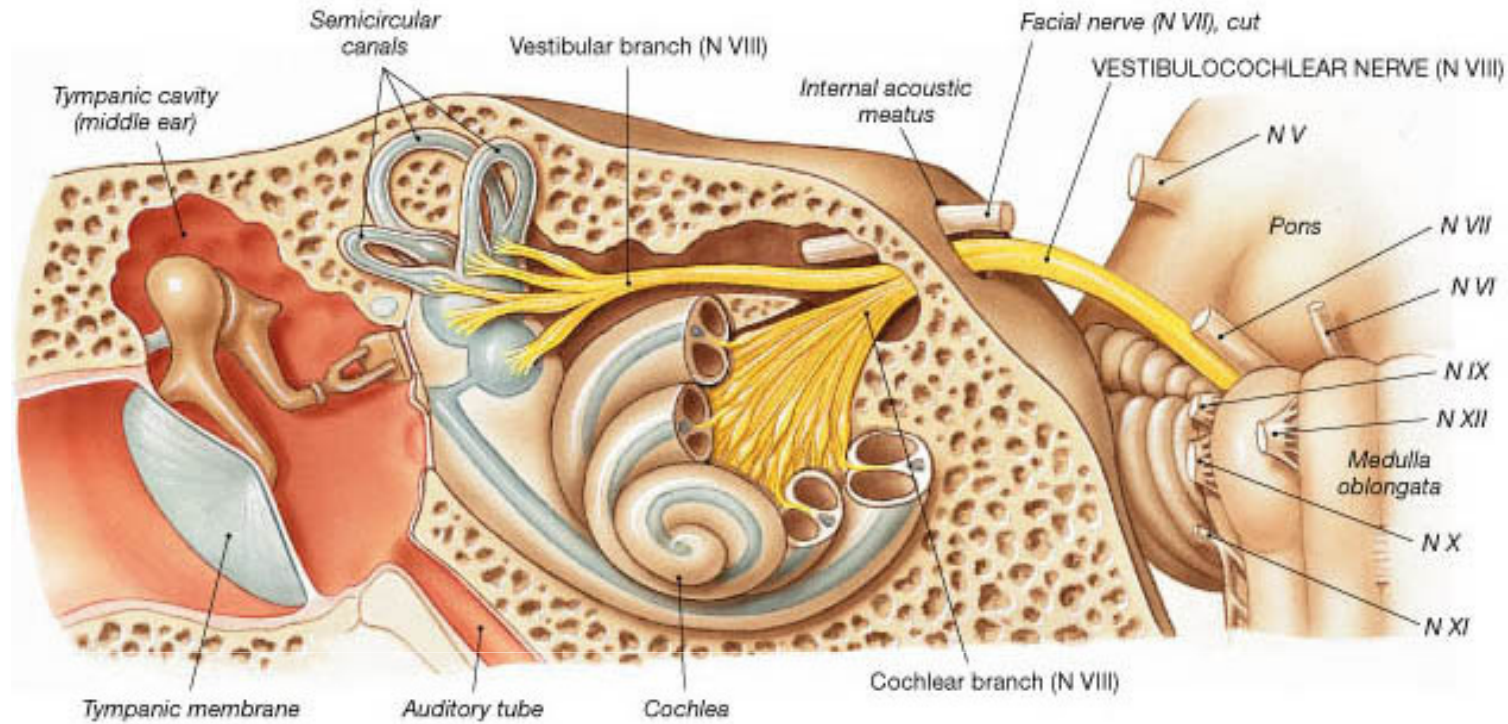
# Vestibulocochlear nerve

## Cochlear nerve

- Conducts nerve impulses from (inner ear)
  - organ of Corti in the **cochlea**
- Cell body in **spiral ganglion of the cochlea**
- **Cochlear Nuclei**
  - **Anterior cochlear nucleus**
  - **Posterior cochlear nucleus**



# Vestibulocochlear nerve (VIII)

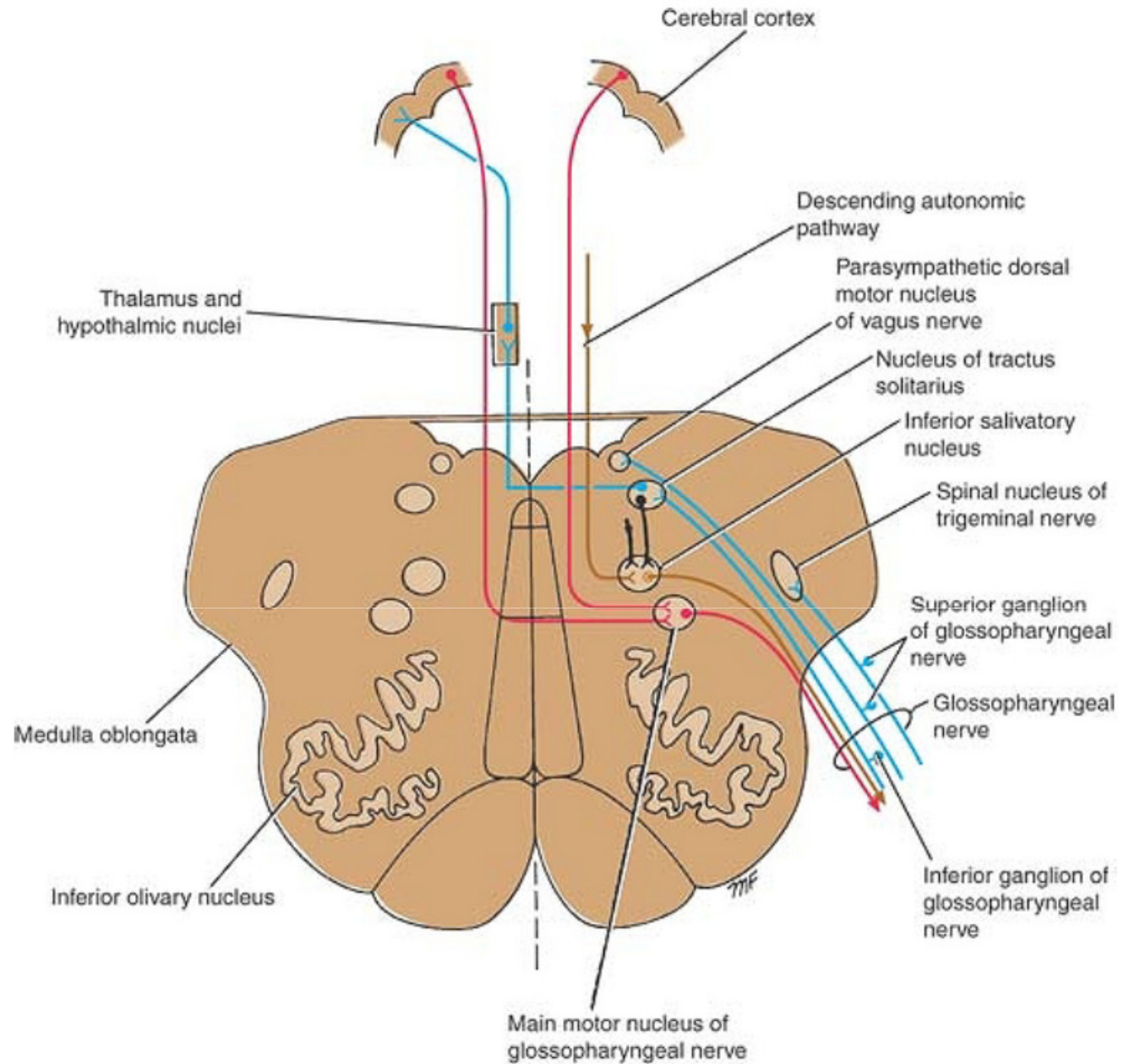


- Emerge from ponto-medullary junction
- Runs laterally in the posterior cranial fossa
- Enter internal acoustic meatus



# Glossopharyngeal Nerve Nuclei

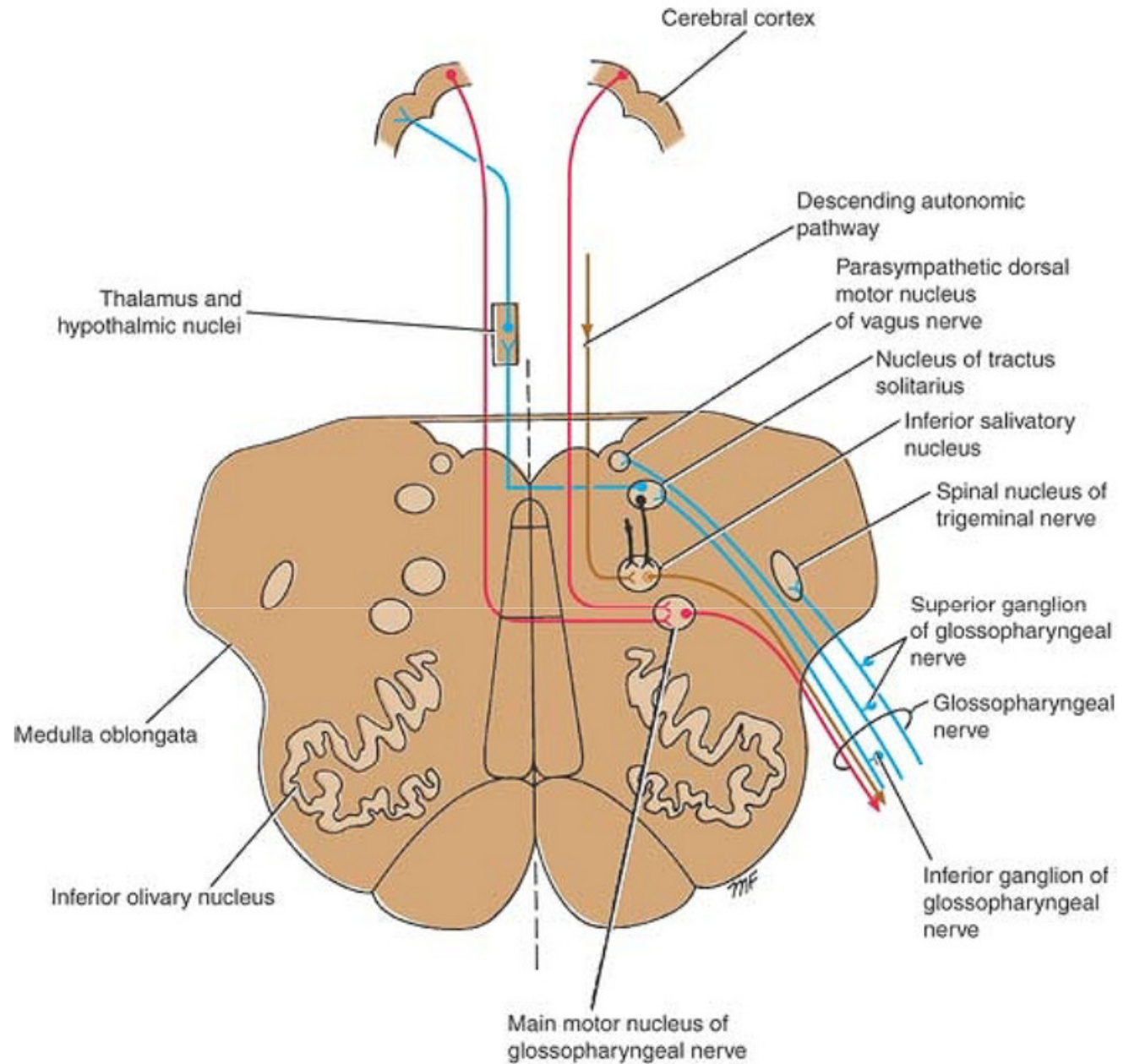
- **Main Motor Nucleus**
- Deep in the reticular formation of the medulla oblongata
- superior end of the nucleus ambiguus
- receives corticonuclear fibers from **both** cerebral hemispheres.
- supply the **stylopharyngeus muscle**



# Glossopharyngeal Nerve Nuclei

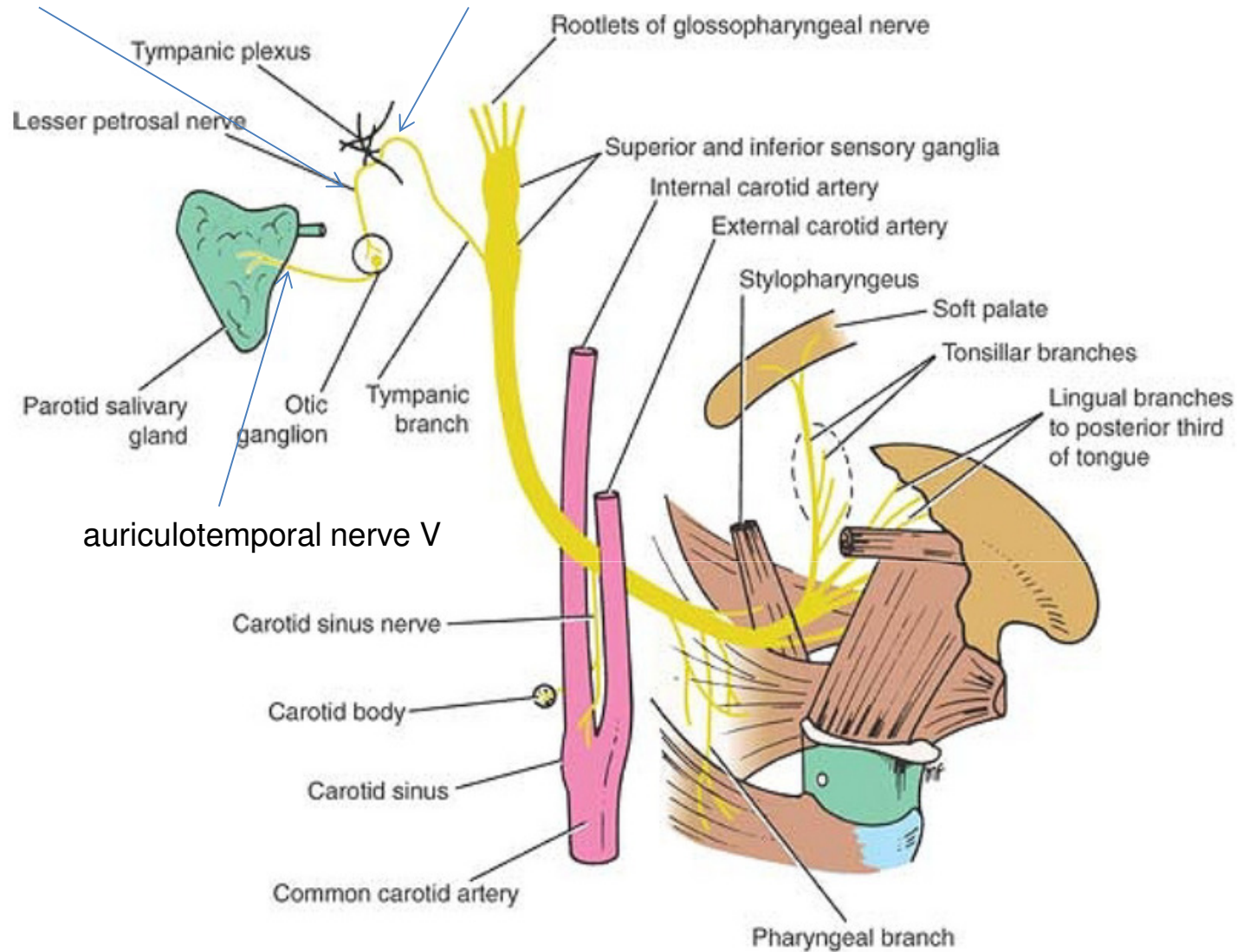
## Parasympathetic Nuclei:

- **Inferior salivatory nucleus**
- receives afferents from the hypothalamus
- efferent preganglionic parasympathetic fibers reach the otic ganglion through the tympanic branch the glossopharyngeal nerve



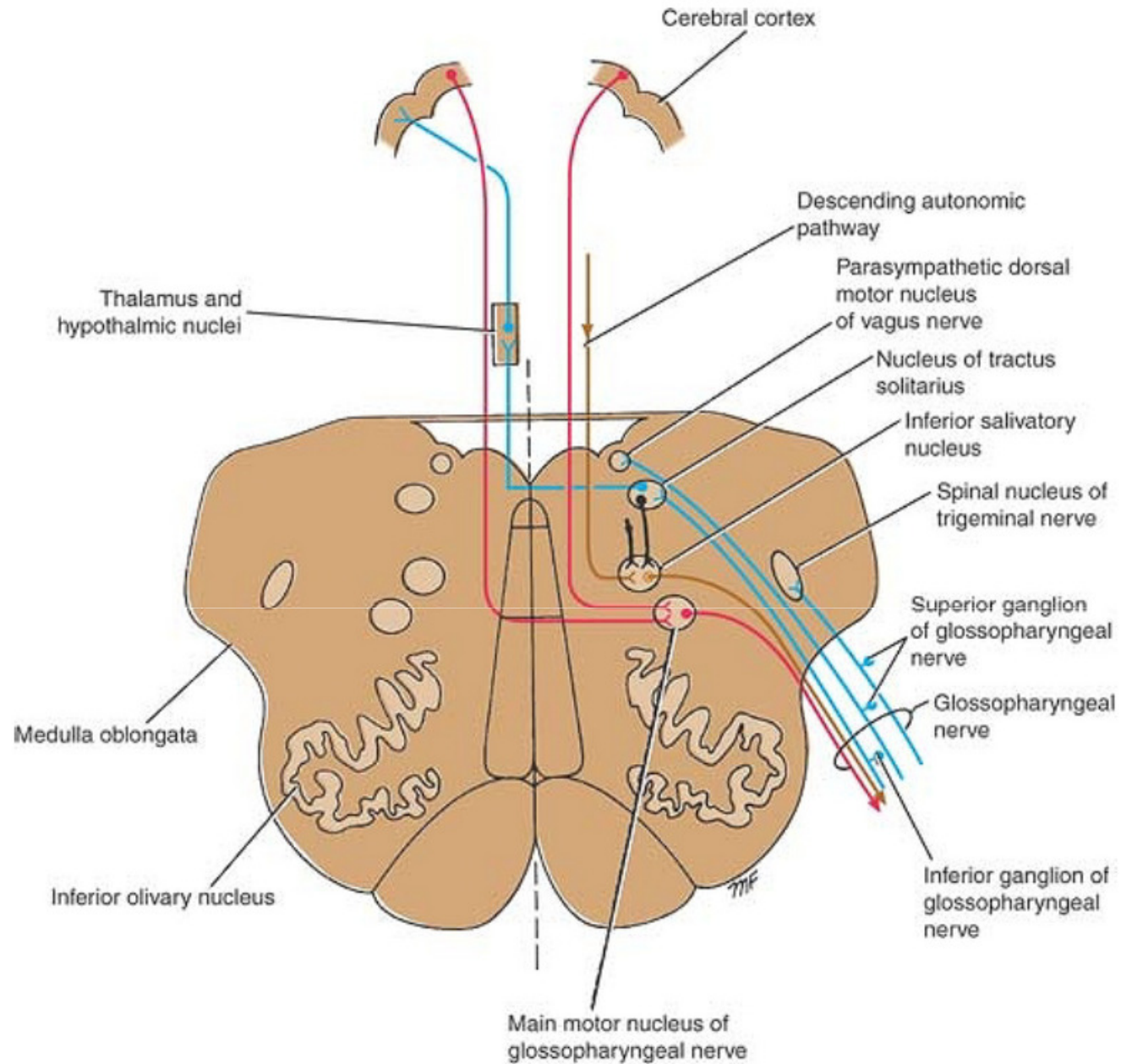
Hiatus for Lesser petrosal nerve      Tympanic canaliculus

- The tympanic plexus, and the lesser petrosal nerve
- Middle cranial fossa, then through foramen ovale to infratemporal fossa
- Postganglionic fibers pass to the parotid salivary gland.



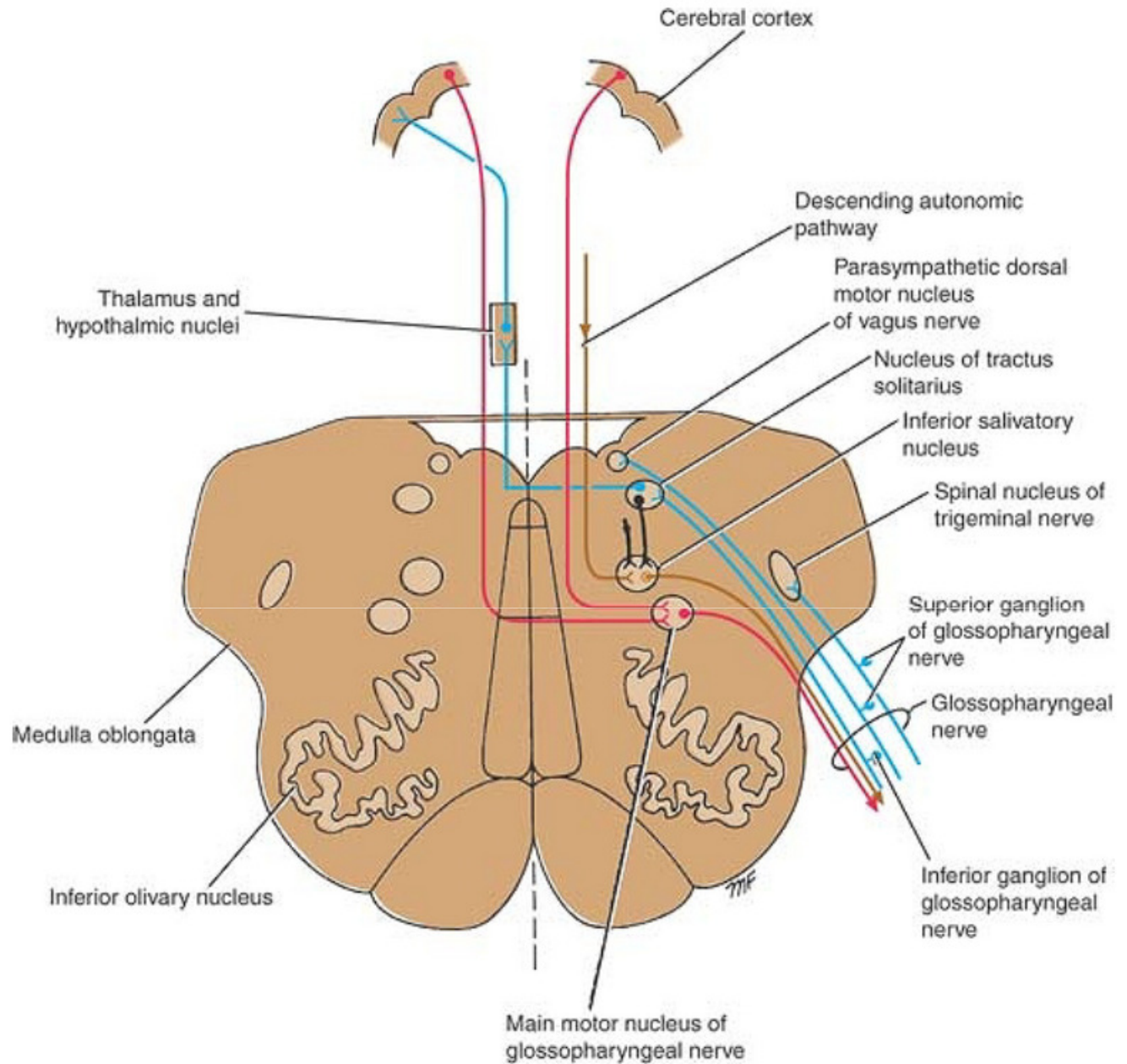
# Glossopharyngeal Nerve Nuclei

- **Sensory Nucleus** part of the nucleus of the tractus solitarius
- **Taste** from posterior 1/3 of tongue
- Cell body in inferior glossopharyngeal ganglion
- Sensory nucleus
- Thalamus
- lower part of the postcentral gyrus



# Glossopharyngeal Nerve Nuclei

- **Sensory Nucleus** part of the nucleus of the tractus solitarius
- Afferent impulses from the **carotid sinus** (baroreceptor)
- Cell body in inferior glossopharyngeal ganglion
- Sensory nucleus
- connected to dorsal nucleus of the vagus nerve (carotid sinus reflex)

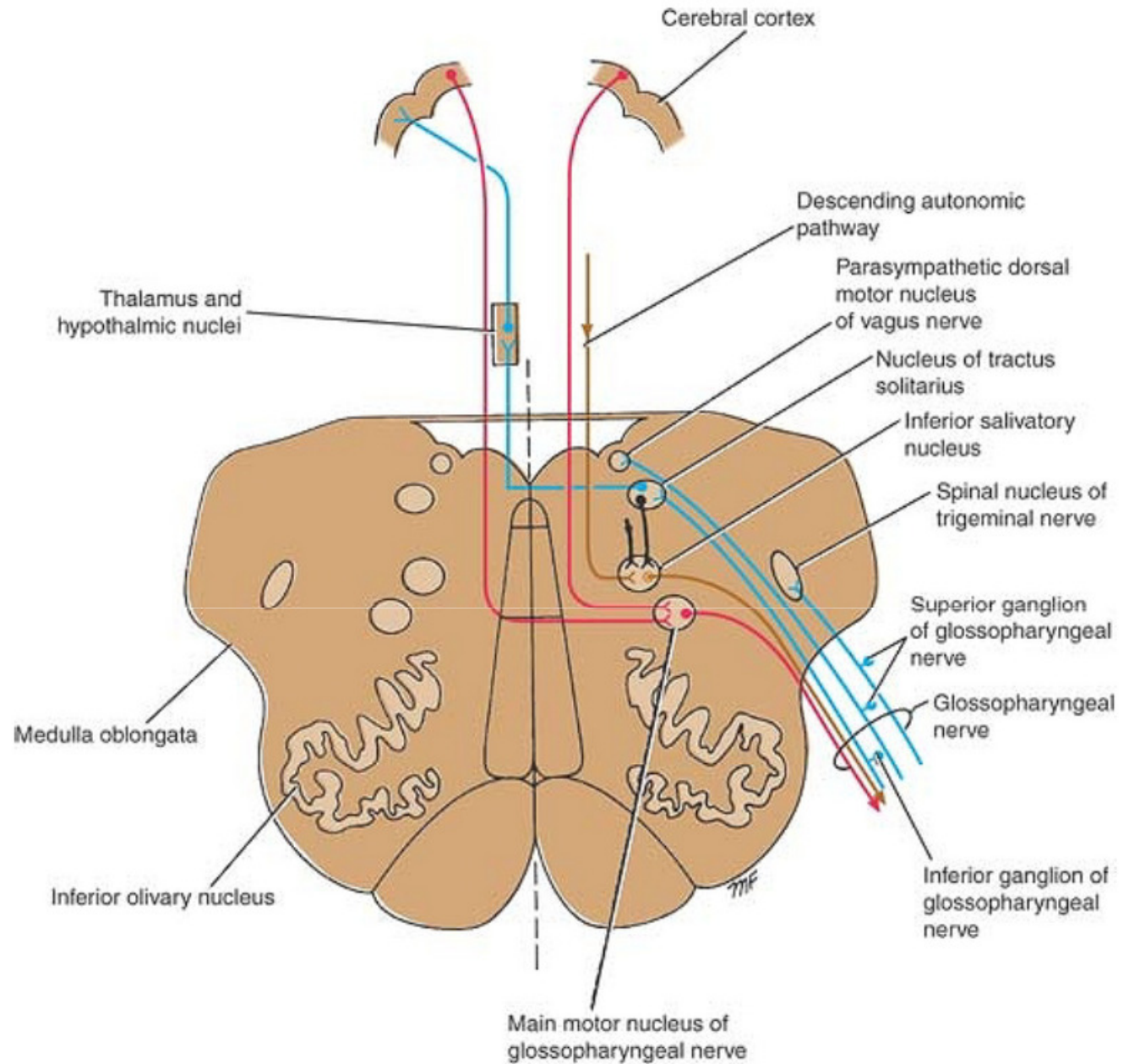


# Glossopharyngeal Nerve Nuclei

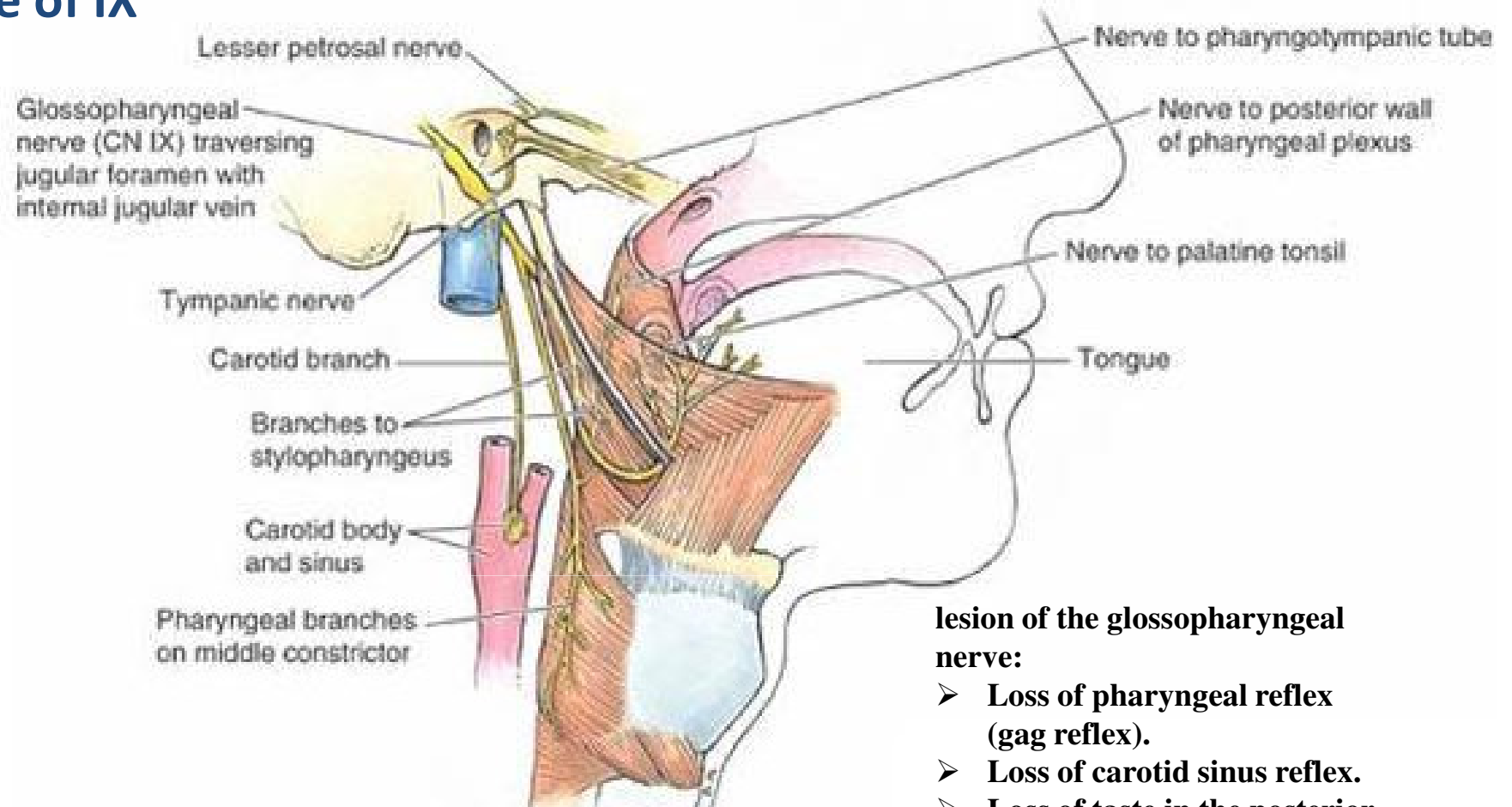
- **Common sensation**
- Cell body in Superior glossopharyngeal ganglion
- spinal nucleus of the trigeminal nerve
- Thalamus
- postcentral gyrus

Sensation from

- middle ear
- Auditory tube
- Pharynx except nasopharynx
- Posterior 1/3 of tongue



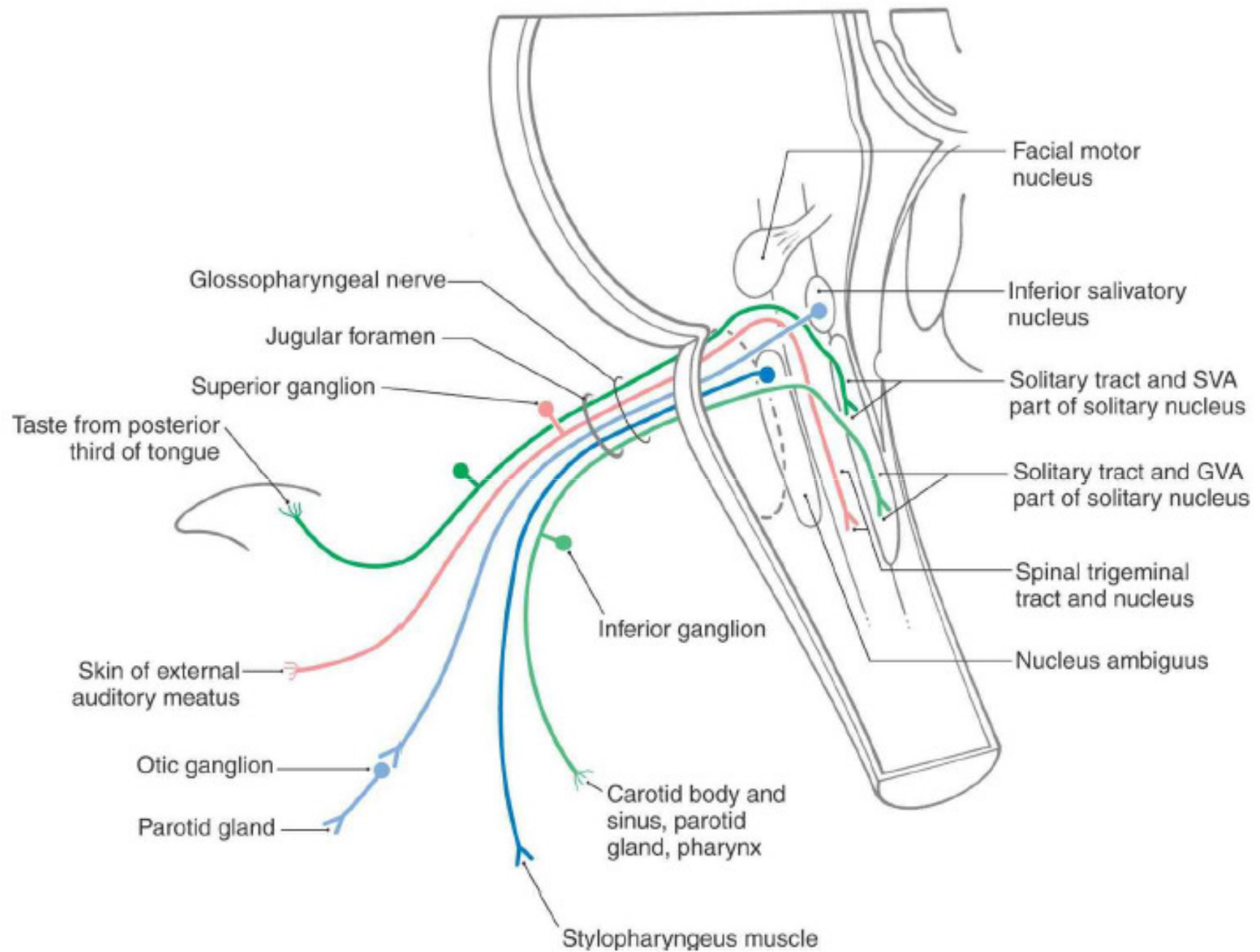
## Course of IX



- Anterolateral surface of the upper part of the medulla oblongata
- Groove between the olive and the inferior cerebellar peduncle
- Leaves the skull through the jugular foramen
- Posterior border of the stylopharyngeus muscle
- Between the superior and middle constrictor
- Sensory to the oropharynx laryngopharynx and the posterior 1/3 of the tongue

### lesion of the glossopharyngeal nerve:

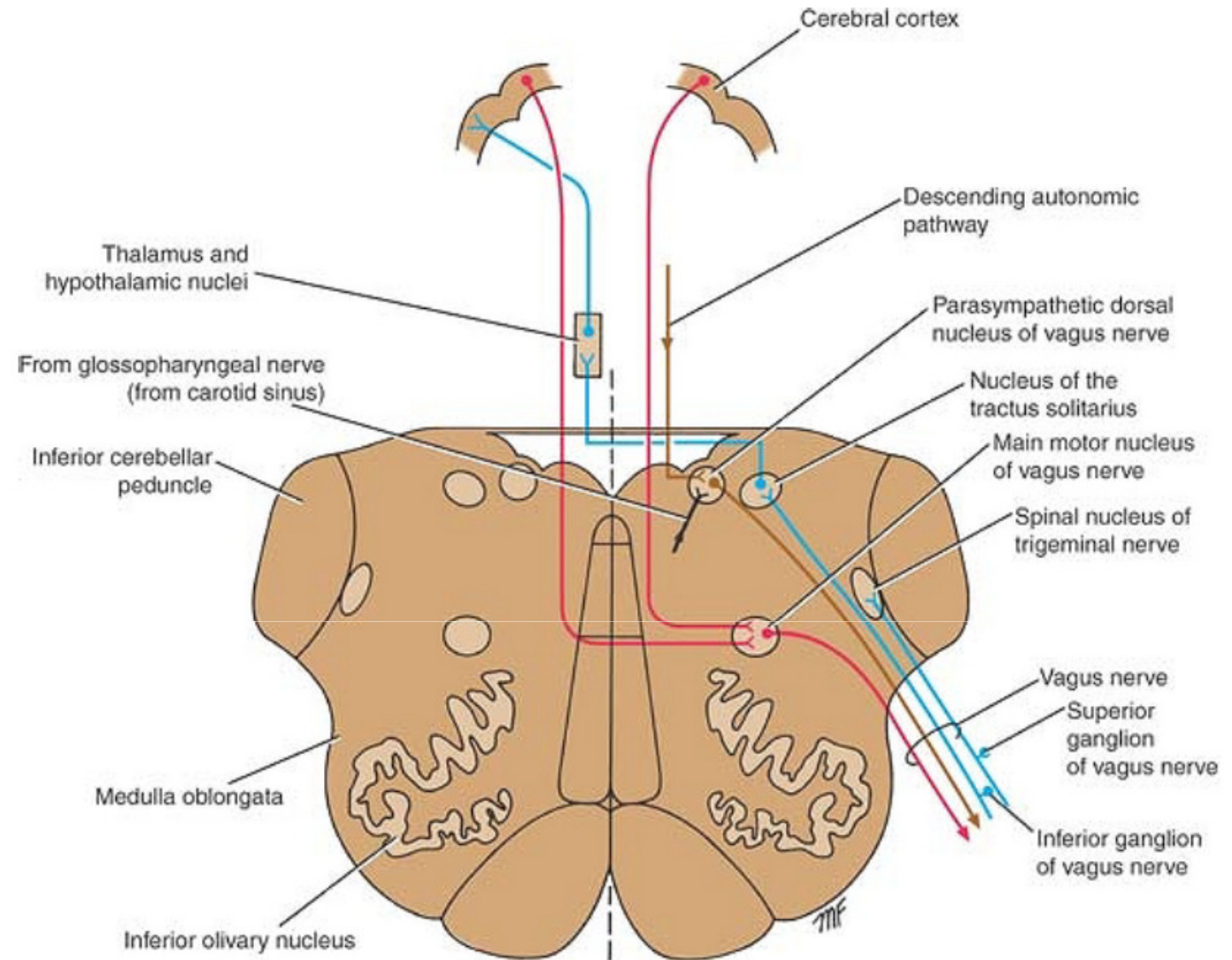
- Loss of pharyngeal reflex (gag reflex).
- Loss of carotid sinus reflex.
- Loss of taste in the posterior third of tongue (Vallate papillae).





# Vagus Nerve Nuclei

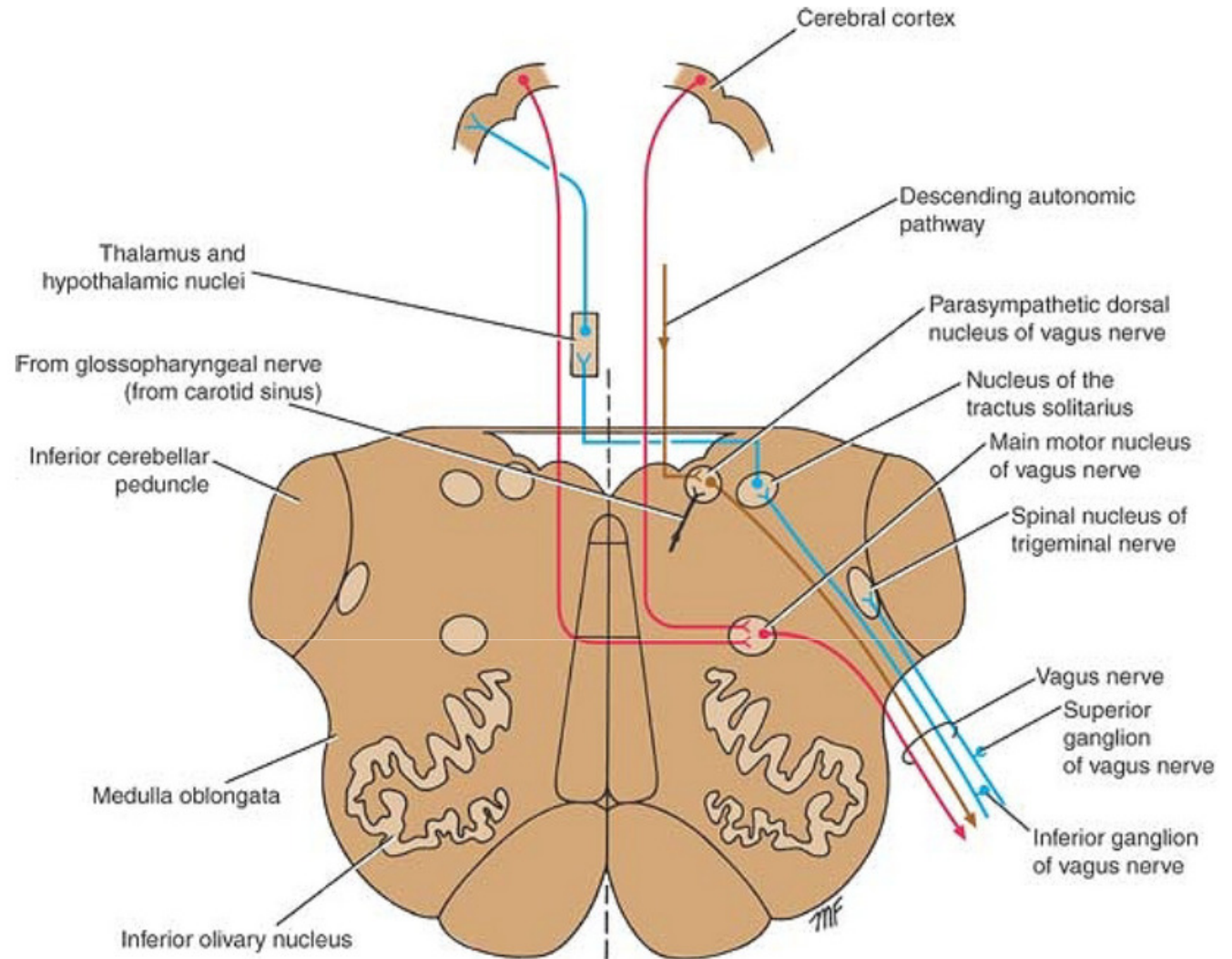
- **Main Motor Nucleus**
- Deep in the reticular formation of the medulla oblongata
- Lower part of nucleus ambiguus
- Receives corticonuclear fibers from **both** cerebral hemispheres.
- Supply the constrictor muscles of the pharynx and the intrinsic muscles of the larynx



# Vagus Nerve Nuclei

## Parasympathetic Nuclei:

- Dorsal nucleus of the vagus
- floor of the lower part of the fourth ventricle
- Receives afferents from:
  - Hypothalamus
  - glossopharyngeal nerve (carotid sinus reflex).



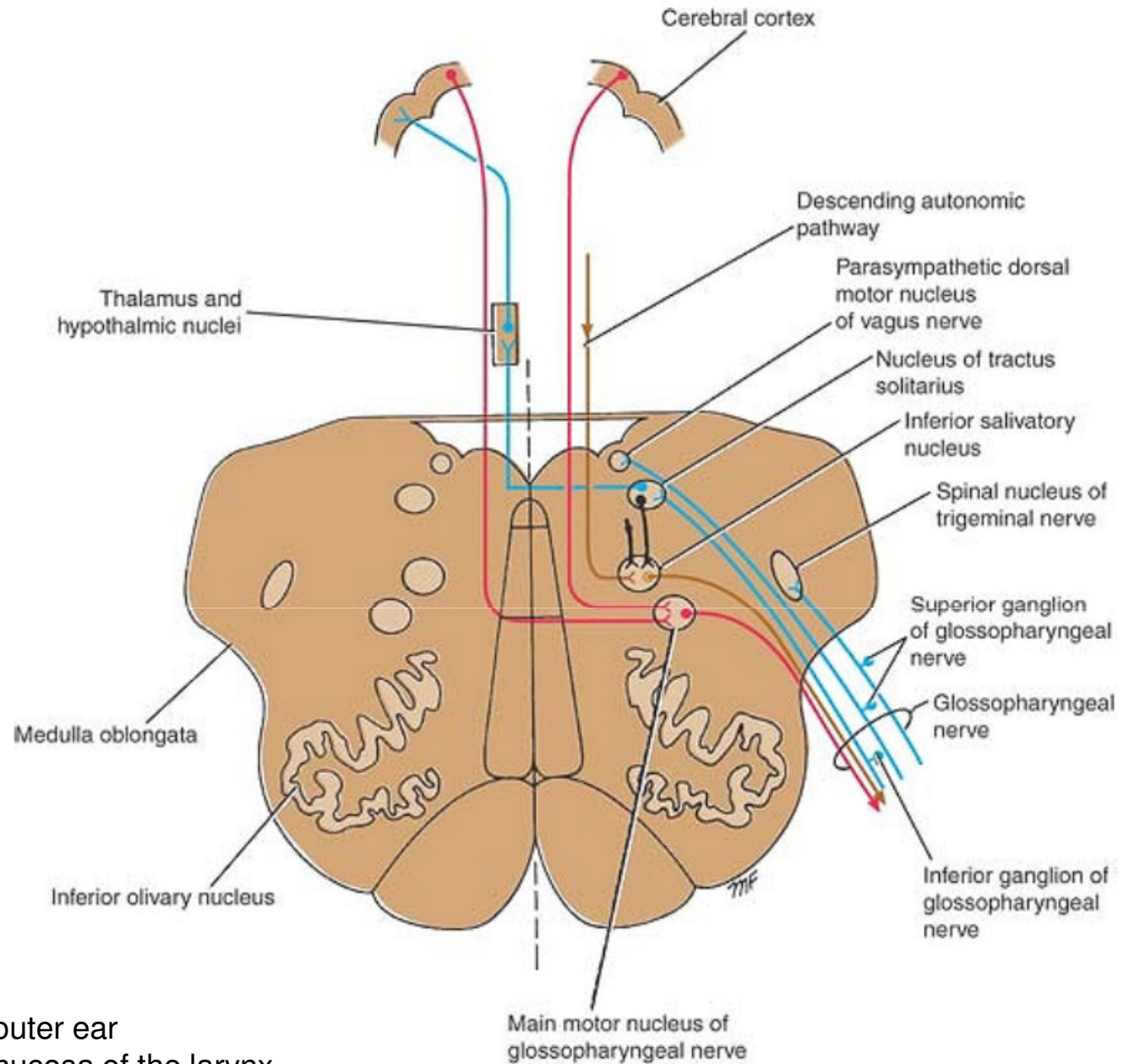
- Efferent to involuntary muscle of the bronchi, heart, esophagus, stomach, small intestine, and large intestine as far as the distal one-third of the transverse colon

# Vagus Nerve

## Nuclei

- **Sensory Nucleus**  
Lower part of the nucleus of the tractus solitarius
- **Taste** from epiglottis.
- Cell body in inferior ganglion of vagus
- Sensory nucleus
- Thalamus
- Postcentral gyrus
- **common sensation**
- superior ganglion of vagus
- Spinal nucleus of the trigeminal nerve.

- outer ear
- mucosa of the larynx
- Dura of Posterior cranial fossa

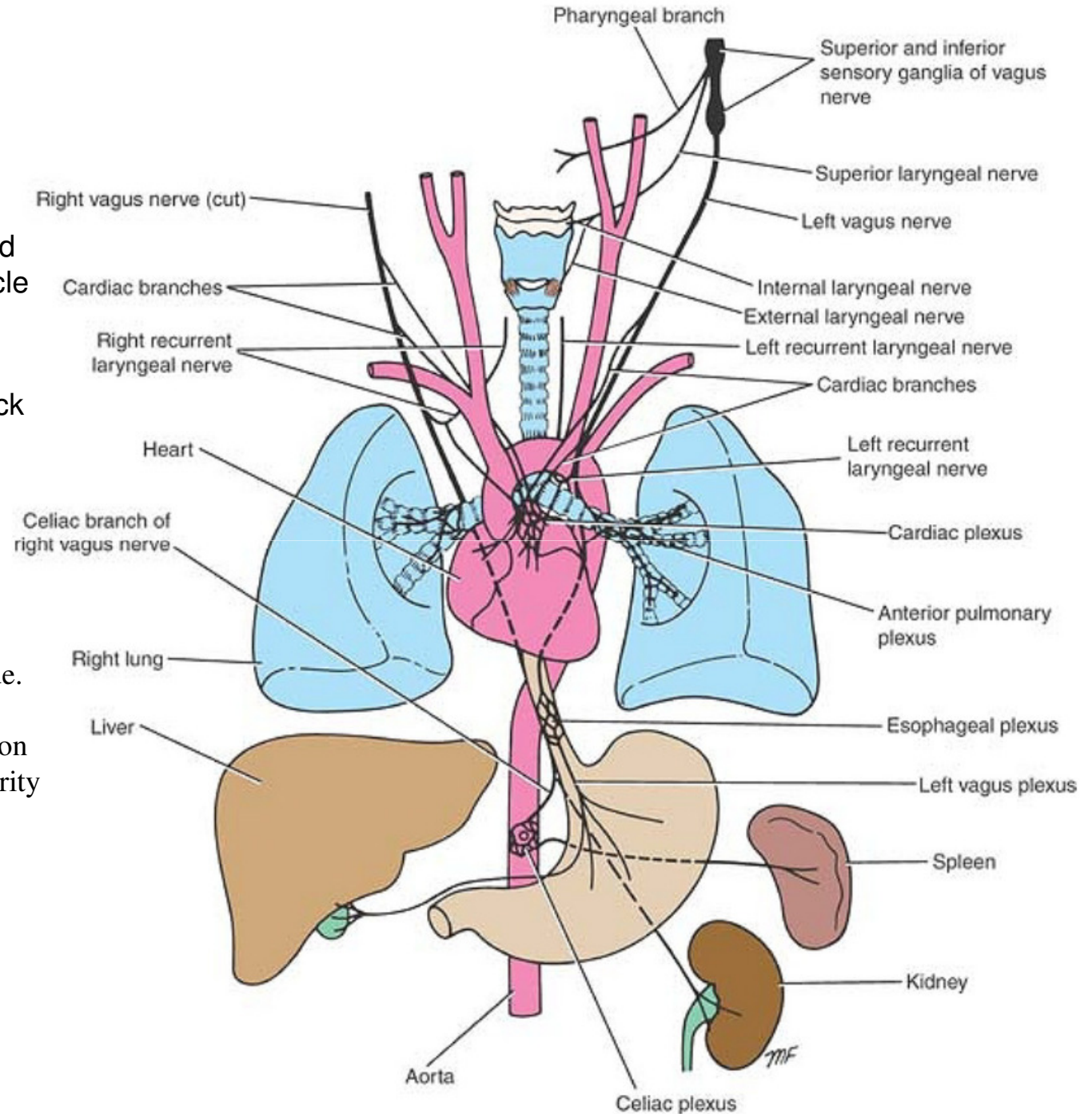


# Course of X

- Anterolateral surface of the upper part of the medulla oblongata
- Groove between the olive and the inferior cerebellar peduncle
- Leaves the skull through the jugular foramen
- descends vertically in the neck within the carotid

## Lesion of Vagus:

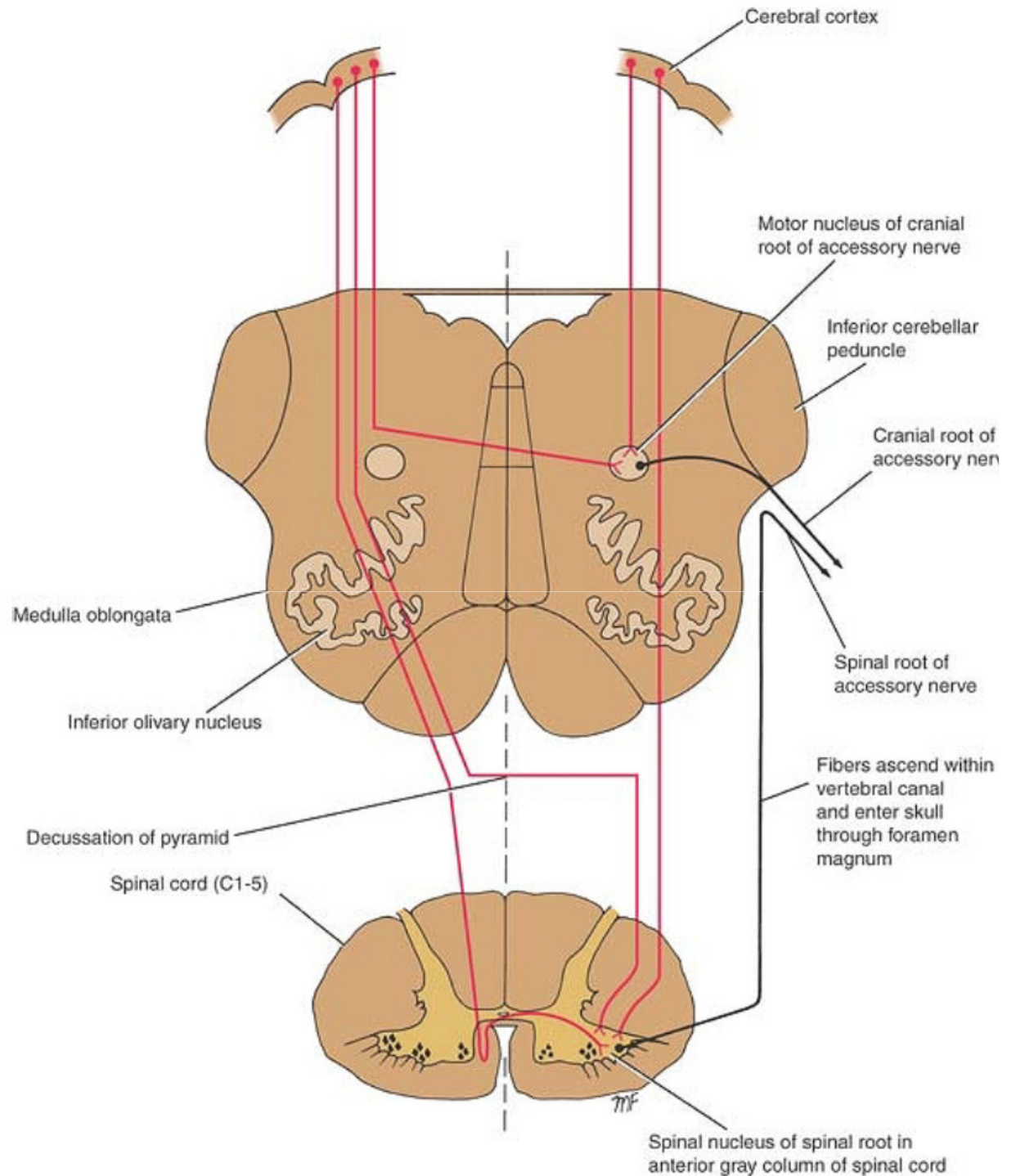
- Uvula deviates to the healthy side.
- Hoarseness of voice
- Dysphagia and nasal regurgitation
- Arrhythmia in heart and irregularity in GI tract because



# Accessory Nerve

## cranial root

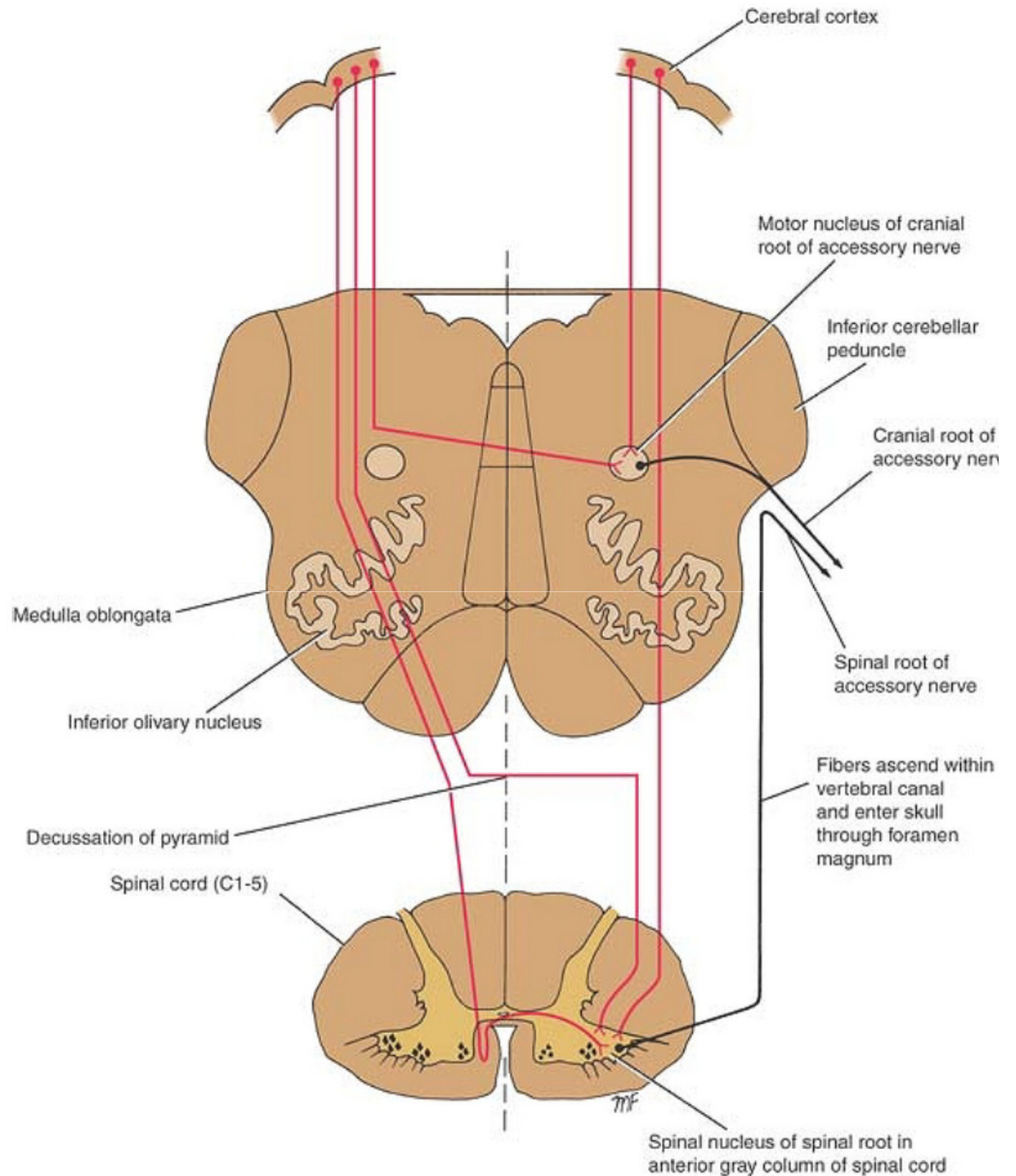
- nucleus ambiguus
- Receives corticonuclear fibers from **both** cerebral hemispheres.
- anterior surface of the medulla oblongata between the olive and the inferior cerebellar peduncle
- joins the vagus nerve



# Accessory Nerve

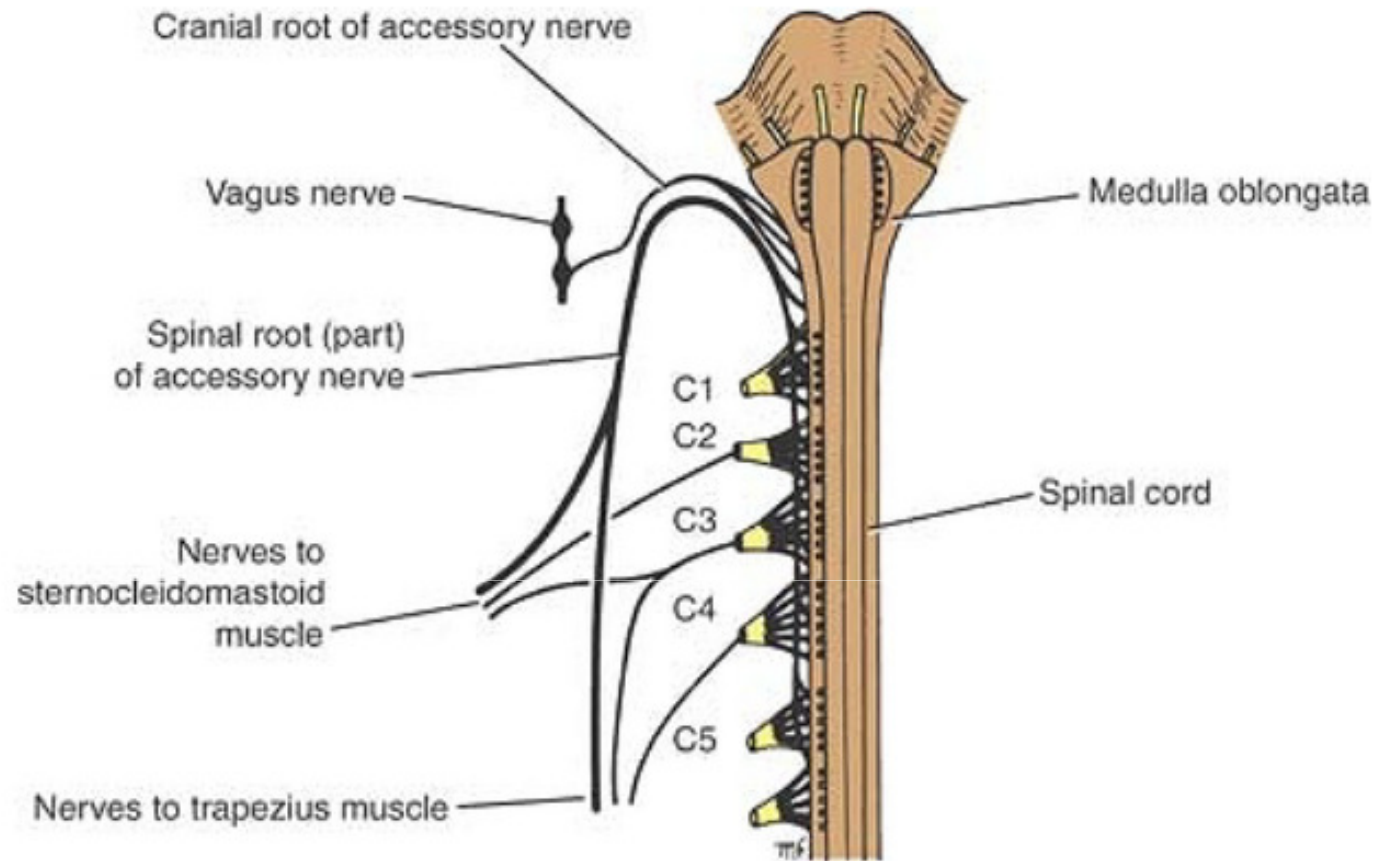
## Spinal root

- **spinal nucleus** (anterior gray column of upper five cervical segments)
- Receives corticospinal fibers from **ipsilateral** cerebral hemisphere.



# Accessory Nerve Course

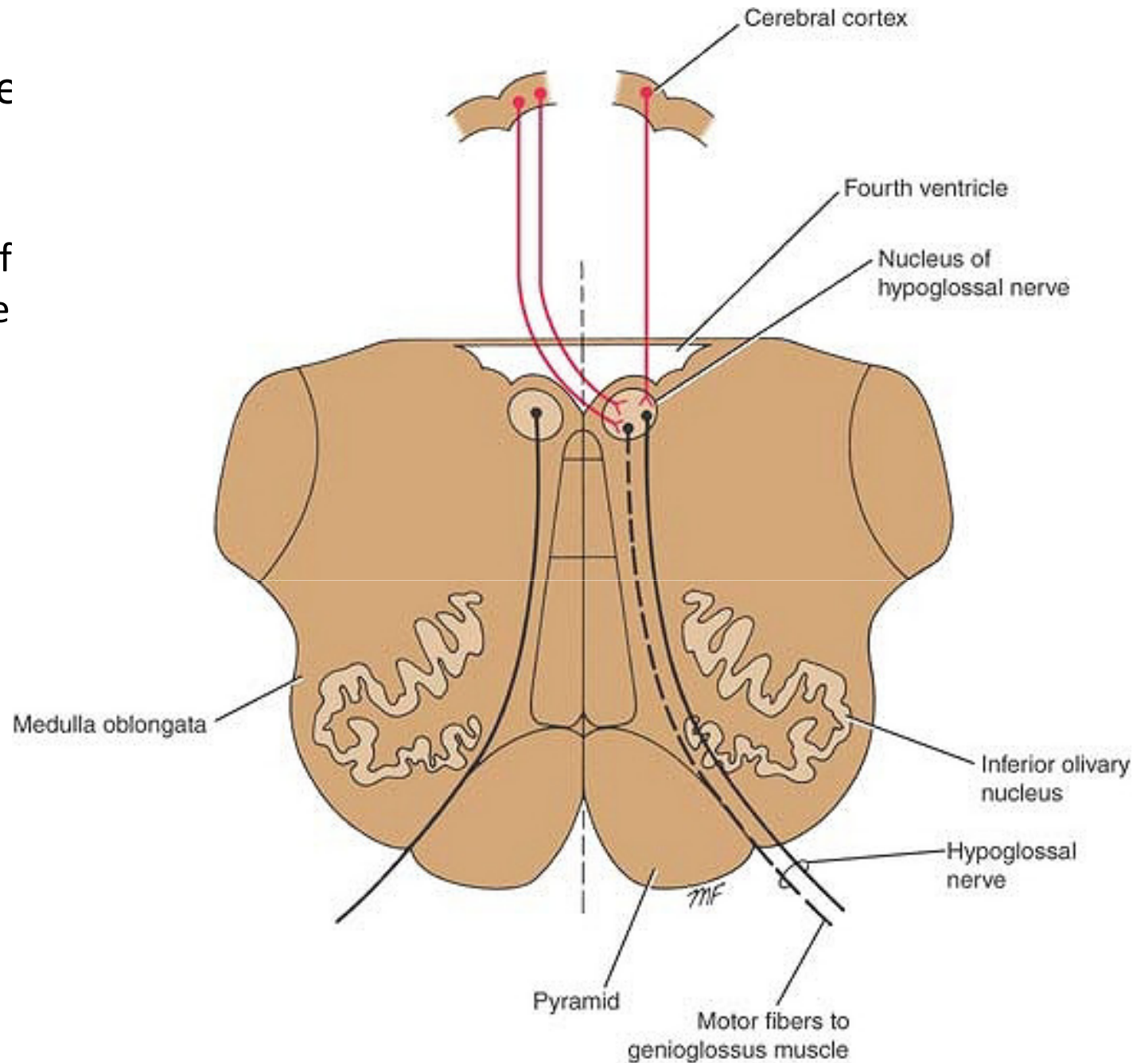
- spinal root emerge from the spinal cord between the anterior and posterior nerve roots of the cervical spinal nerves
- Enters the skull through the foramen magnum
- joins the cranial root



- Leaves the skull through jugular foramen, then separates into:
  - Cranial root: joins the vagus
  - Spinal root: supplies sternocleidomastoid and trapezius muscles

# Hypoglossal nucle

- Beneath the floor of the lower part of the fourth ventricle
- Receives corticonuclear fibers from **both** cerebral hemispheres.
- Cells responsible for supplying the **genioglossus** muscle receives from **opposite** cerebral hemisphere

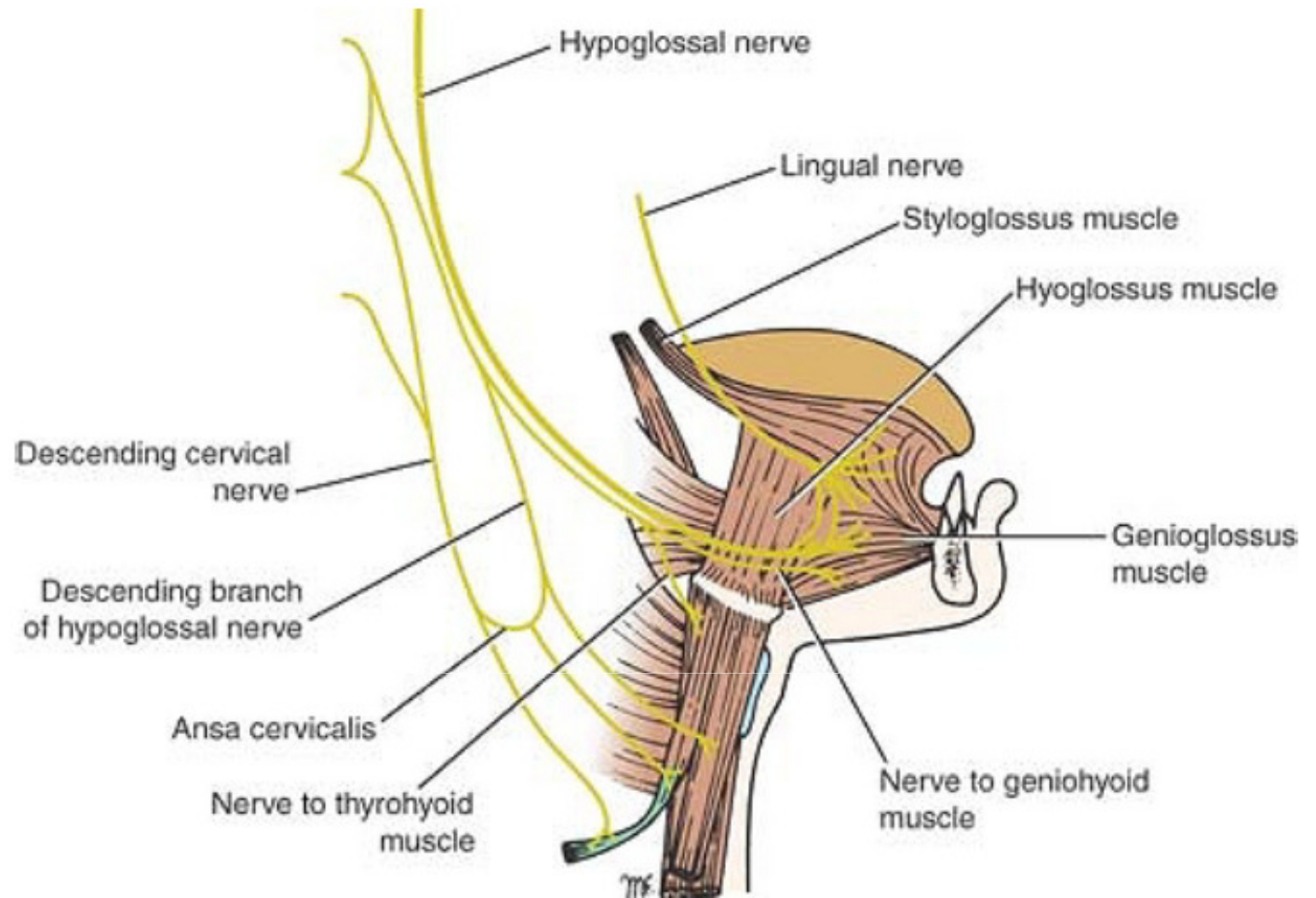




# Hypoglossal Nerve

## Course

- anterior surface of the medulla oblongata
- between the pyramid and the olive
- leaves the skull through the hypoglossal canal
- between the internal carotid artery and the internal jugular vein



## Hypoglossal Nerve injury

- Lower motor neuron lesion
  - Tongue deviation toward the paralyzed side
  - Muscle atrophy (ipsi)
- Upper motor neuron lesion
  - No atrophy
  - On protrusion tongue will deviate to the side opposite the lesion

