

Brain stem

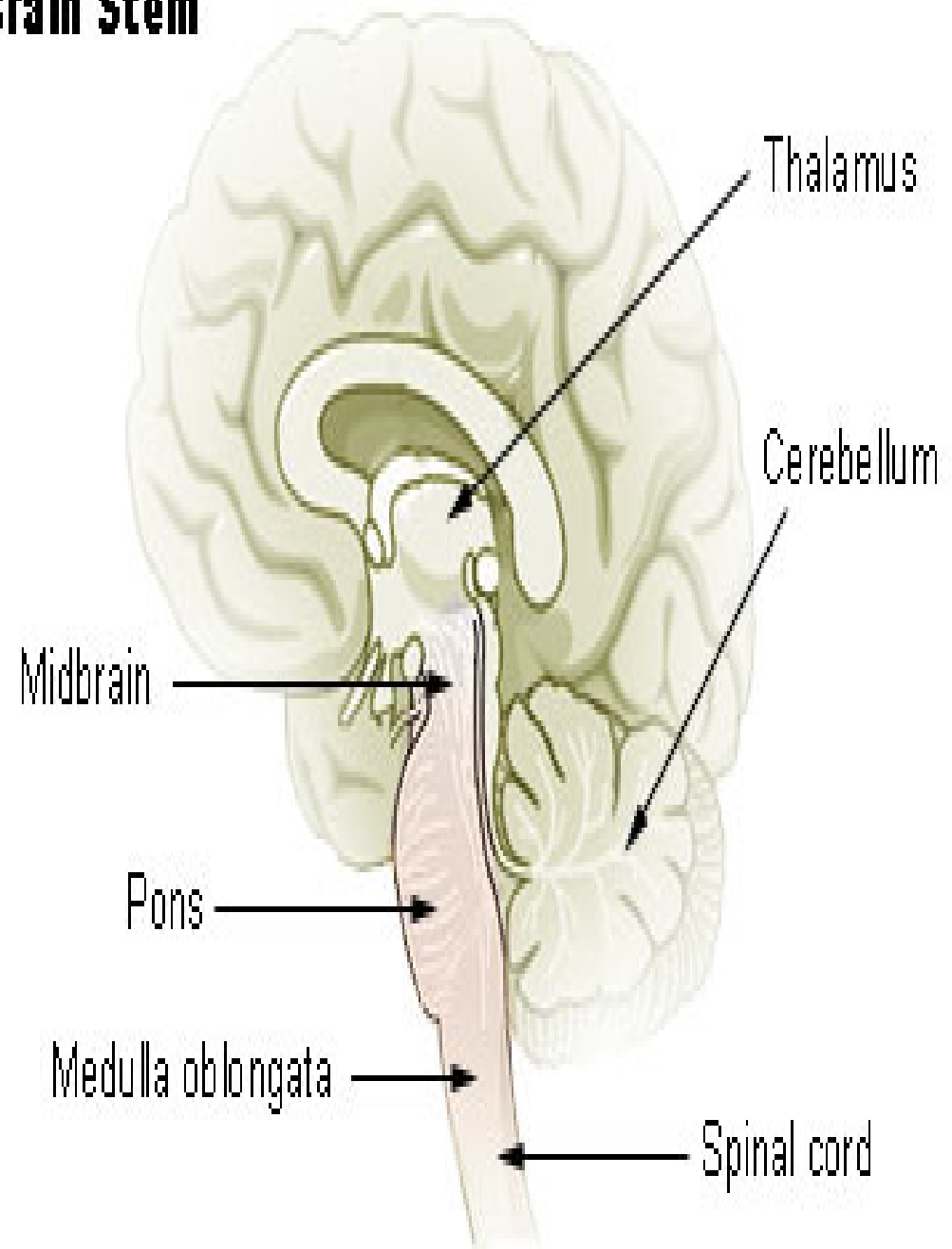
Brain stem

- Stalk like in shape
- Connects spinal cord forebrain

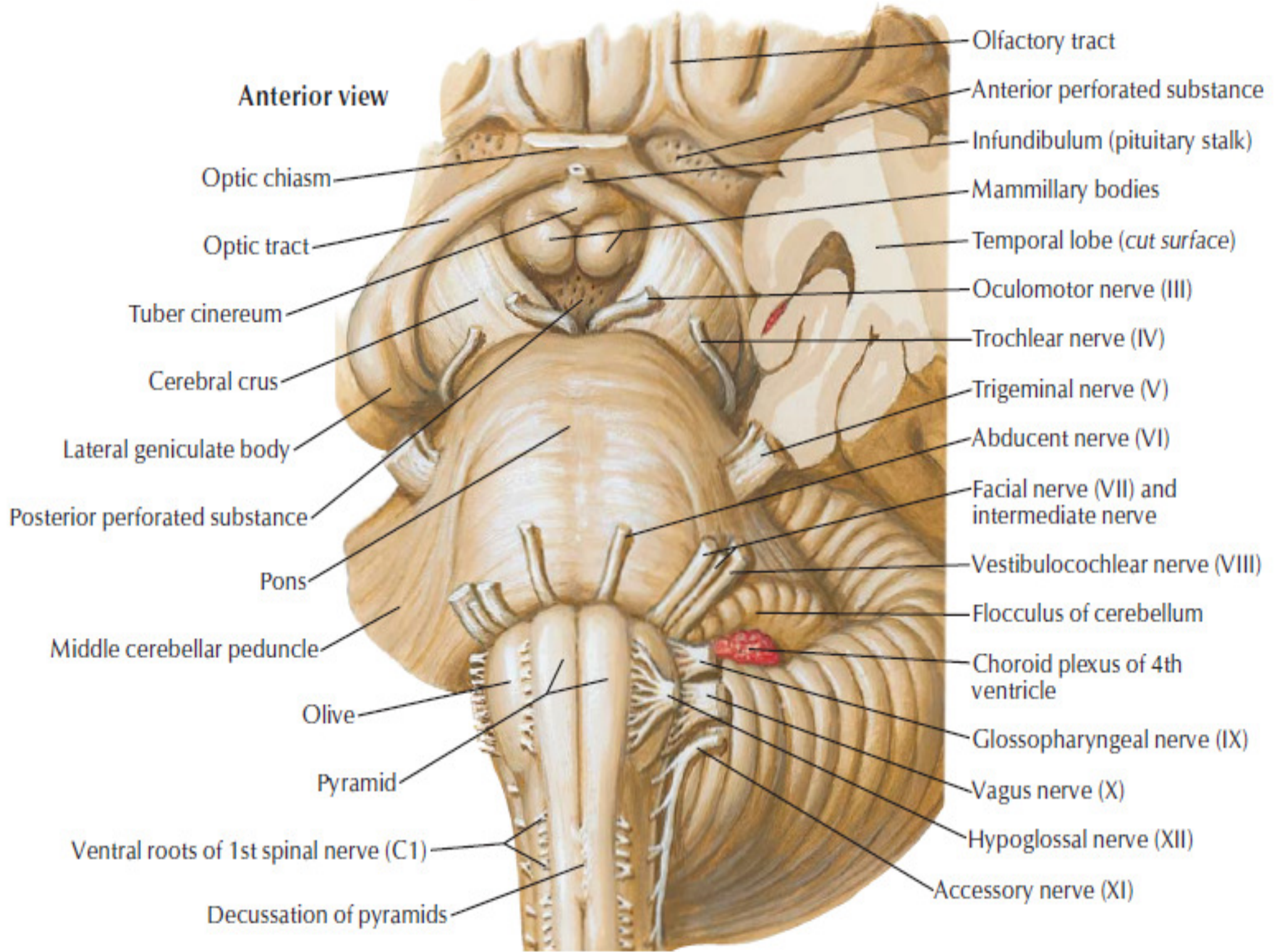
Parts:

1. Medulla oblongata
2. Pons
3. Midbrain

Brain Stem



Anterior view



Optic chiasm

Optic tract

Tuber cinereum

Cerebral crus

Lateral geniculate body

Posterior perforated substance

Pons

Middle cerebellar peduncle

Olive

Pyramid

Ventral roots of 1st spinal nerve (C1)

Decussation of pyramids

Olfactory tract

Anterior perforated substance

Infundibulum (pituitary stalk)

Mammillary bodies

Temporal lobe (cut surface)

Oculomotor nerve (III)

Trochlear nerve (IV)

Trigeminal nerve (V)

Abducent nerve (VI)

Facial nerve (VII) and intermediate nerve

Vestibulocochlear nerve (VIII)

Flocculus of cerebellum

Choroid plexus of 4th ventricle

Glossopharyngeal nerve (IX)

Vagus nerve (X)

Hypoglossal nerve (XII)

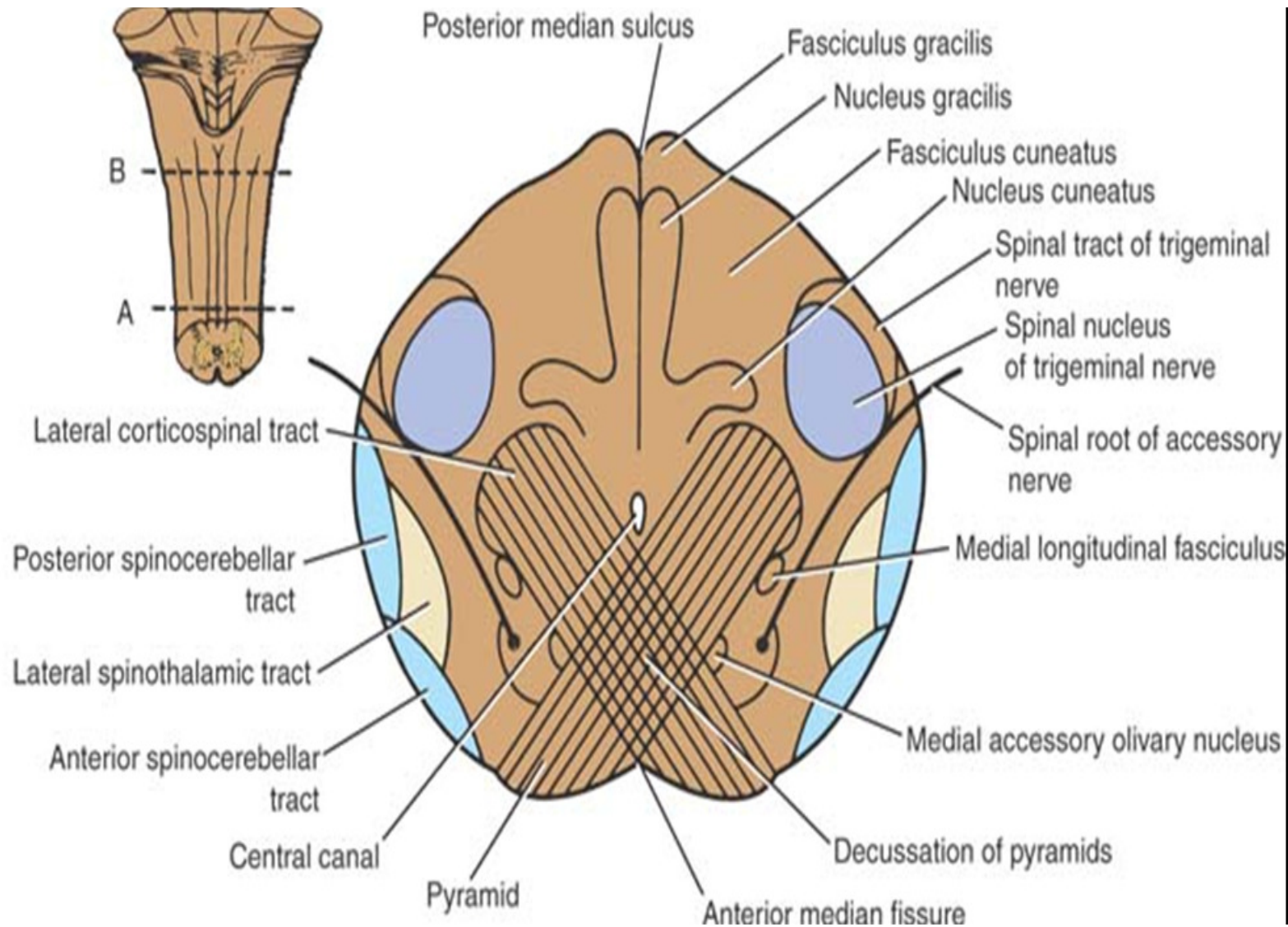
Accessory nerve (XI)

Internal structure of medulla

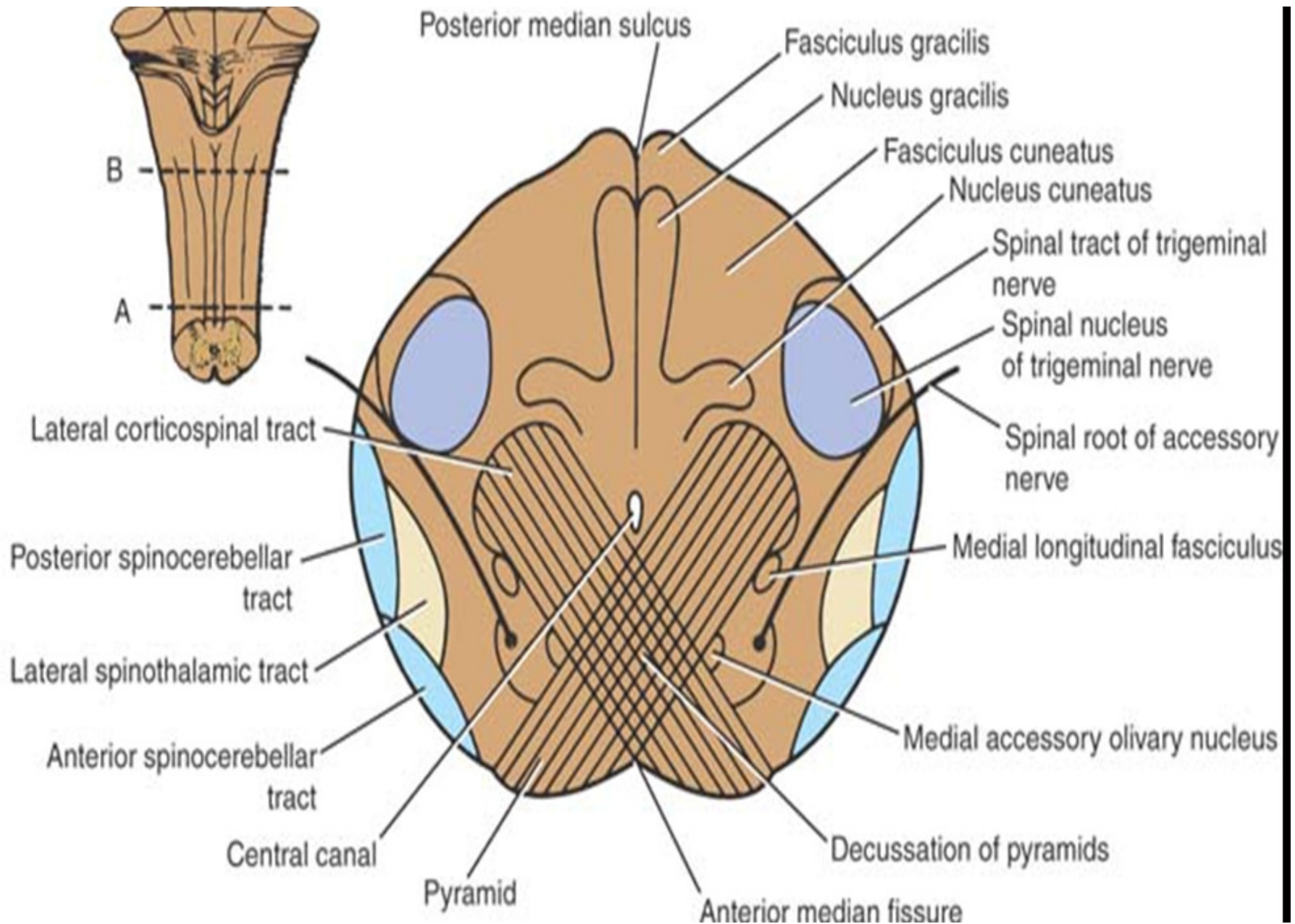
1. Level of decussation of pyramids (motor / close medulla)
2. Level of decussation of lemnisci (sensory / close medulla)
3. Level of olives (open medulla)
4. Level Just Inferior to the Pons

Level of decussation of pyramids

- Decussation of pyramids
- Fasciculus gracilis and the fasciculus cuneatus
- nucleus gracilis and the nucleus cuneatus (posterior to the central gray matter)
- Spinal nucleus of the trigeminal nerve
- Central canal
- The lateral and anterior white columns of the spinal cord is unchanged

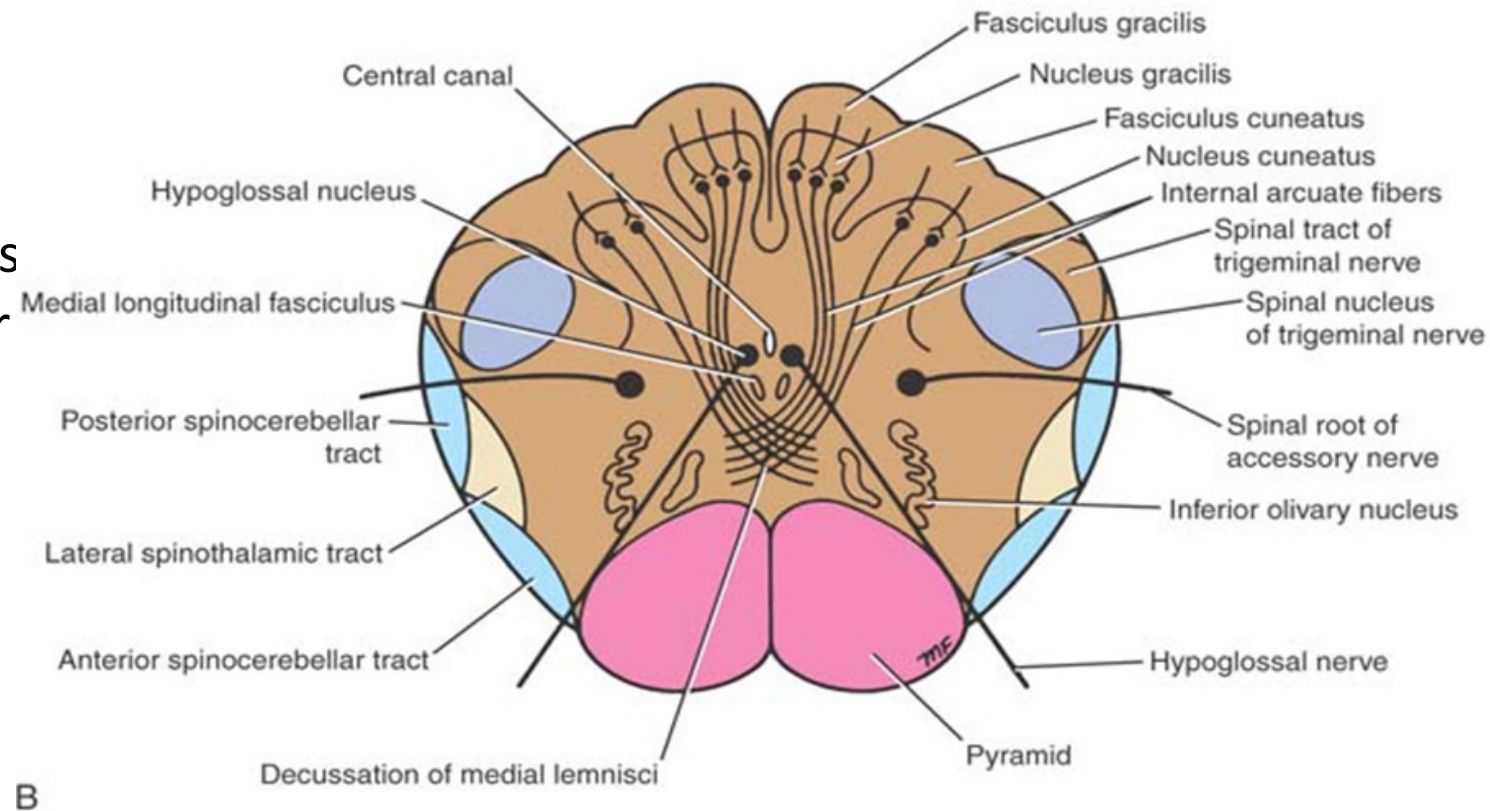


Level of decussation of pyramids



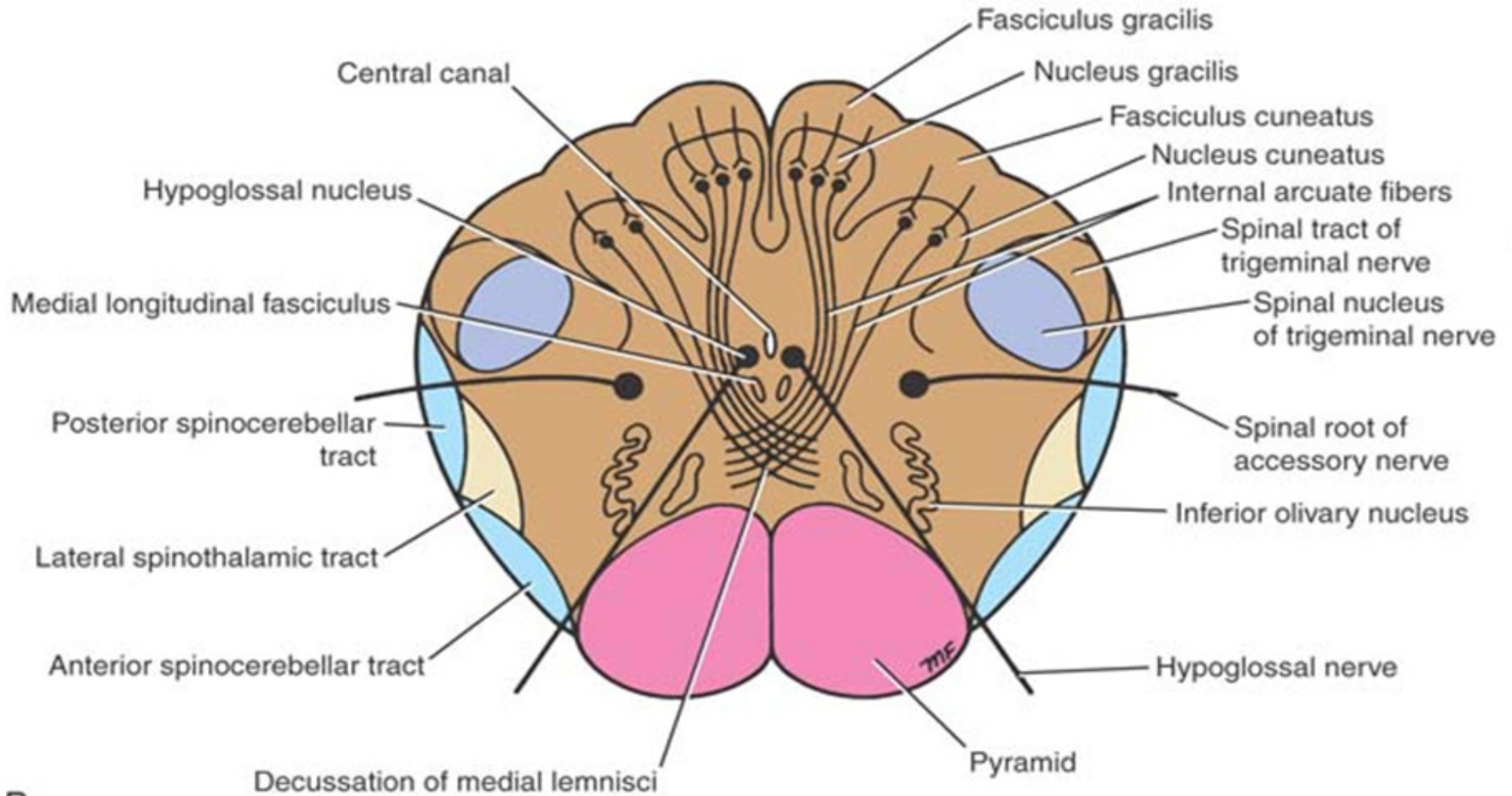
Level of decussation of lemnisci

- Sensory decussation
- Lemnisci are formed by internal arcuate fibers
- internal arcuate fibers emerge from anterior aspect of nucleus gracilis and nucleus cuneatus
- Decussation takes place posterior to pyramids
- Spinal nucleus of the trigeminal nerve (lateral to the internal arcuate fibers)
- spinal lemniscus lateral to the decussation of the lemnisci

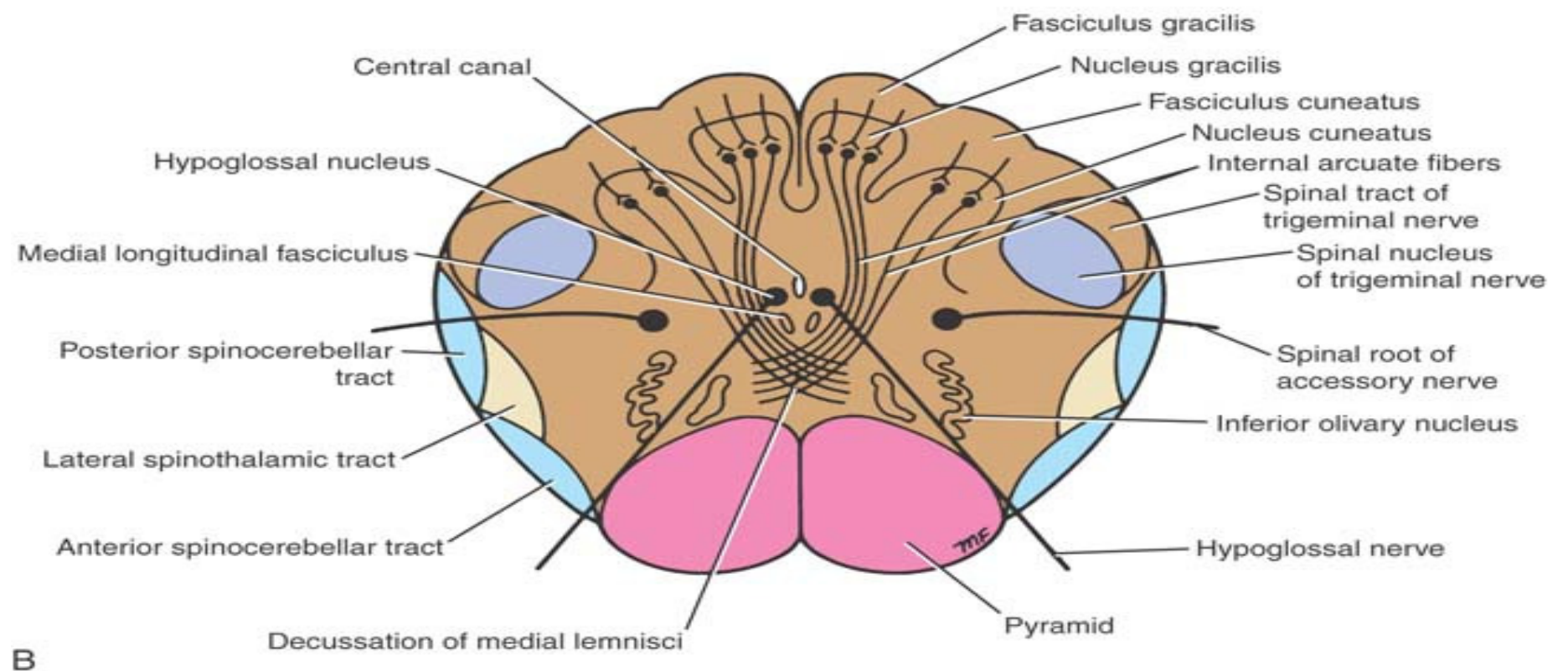
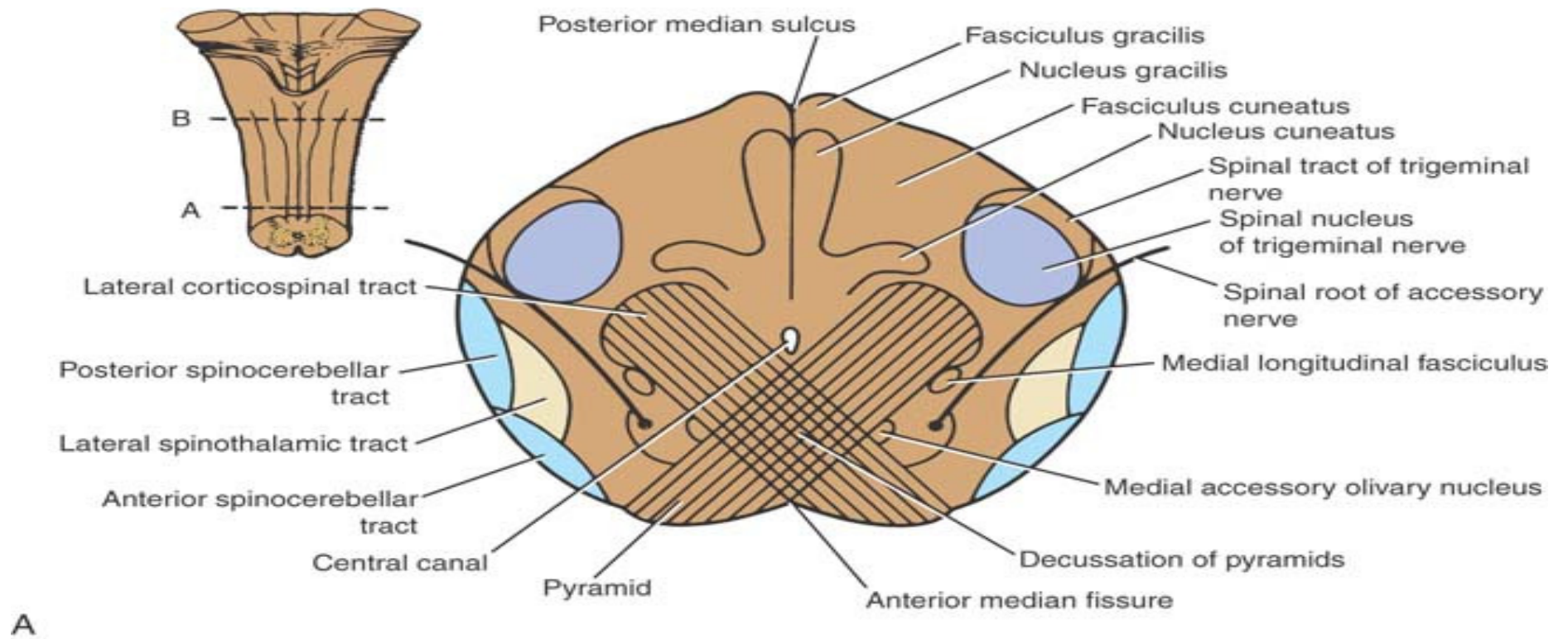


- The spinocerebellar vestibulospinal, and the rubrospinal tracts (anterolateral)
- Central canal

Level of sensory decussation

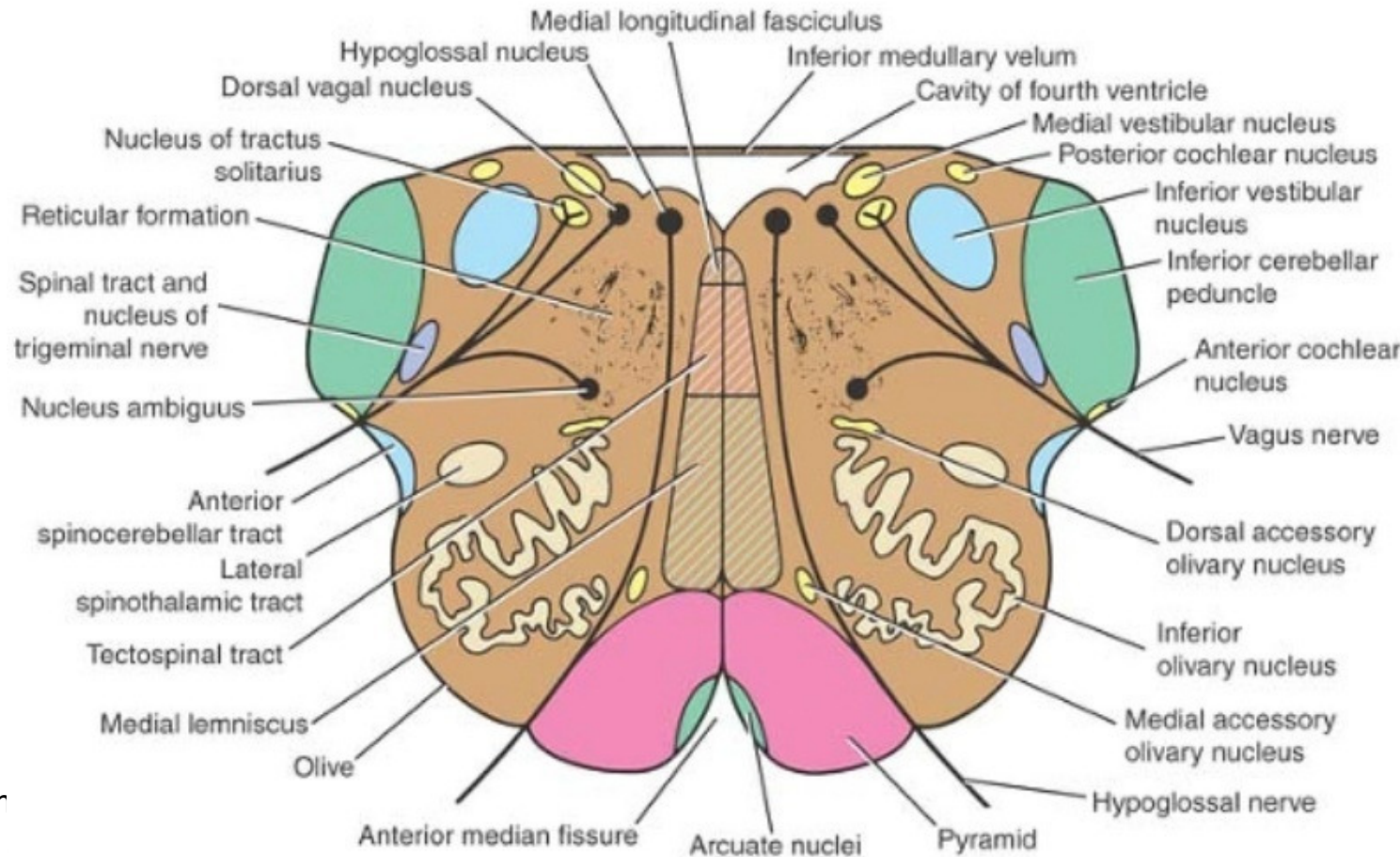


B



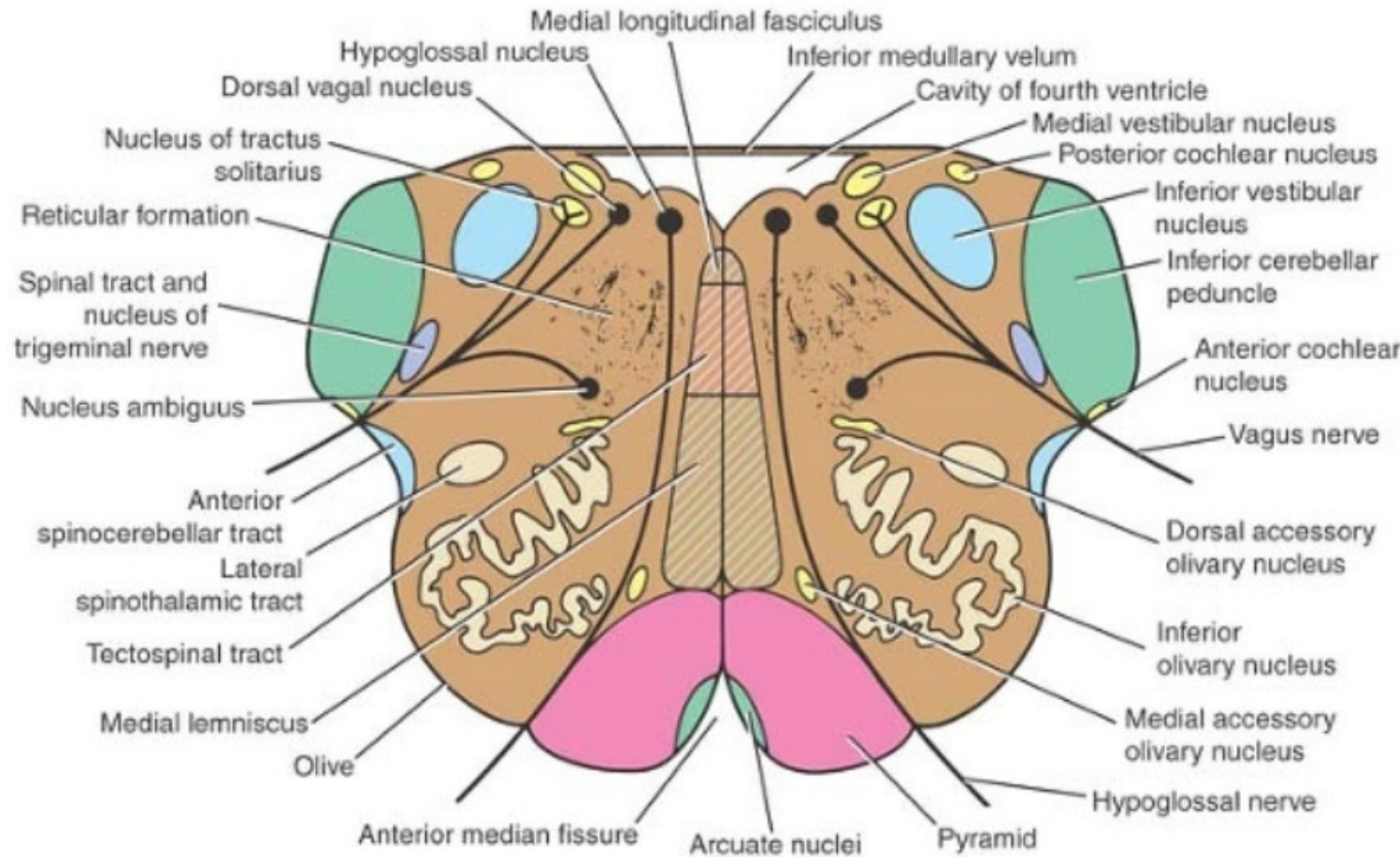
Level of olives (open medulla)

- inferior part of 4th ventricle
- Pyramids
- ICP (posterolateral corner)
- Medial lemniscus
- RF
- Spinal nucleus of trigeminal and its tract (anteriomedial to ICP)
- Nuclei of 12th 11th 10th & 9th
- Inf Olivary nucleus
- Medial longitudinal fasciculus



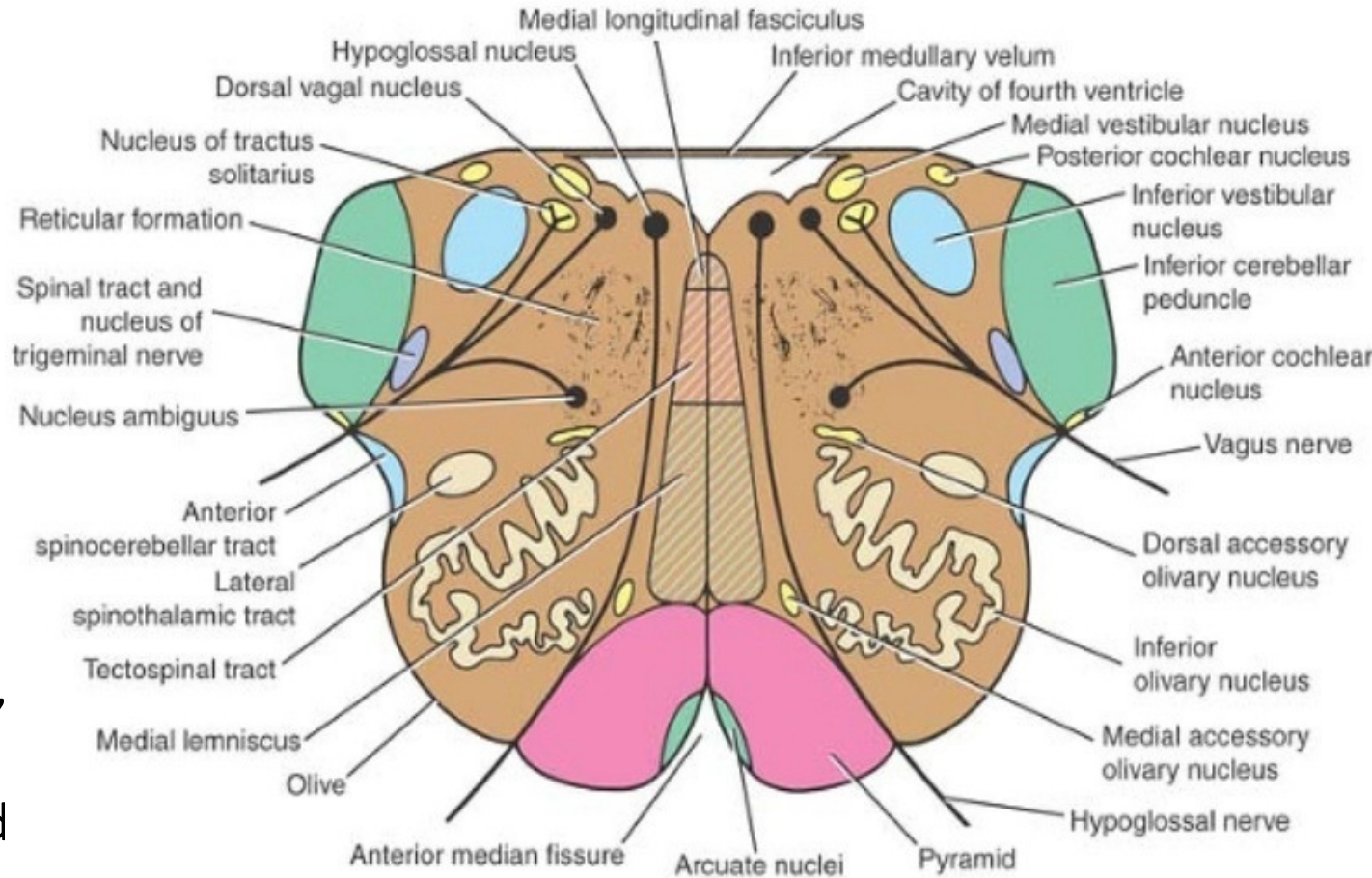
Olivary nuclear complex

- Mainly Inf. Olivary nucleus
- Gray matter is shaped like a crumpled bag with its mouth directed medially
- Responsible of the elevation olive
- Has communications with spinal cord, cerebellum & cortex
- Function is associated with voluntary muscle movement



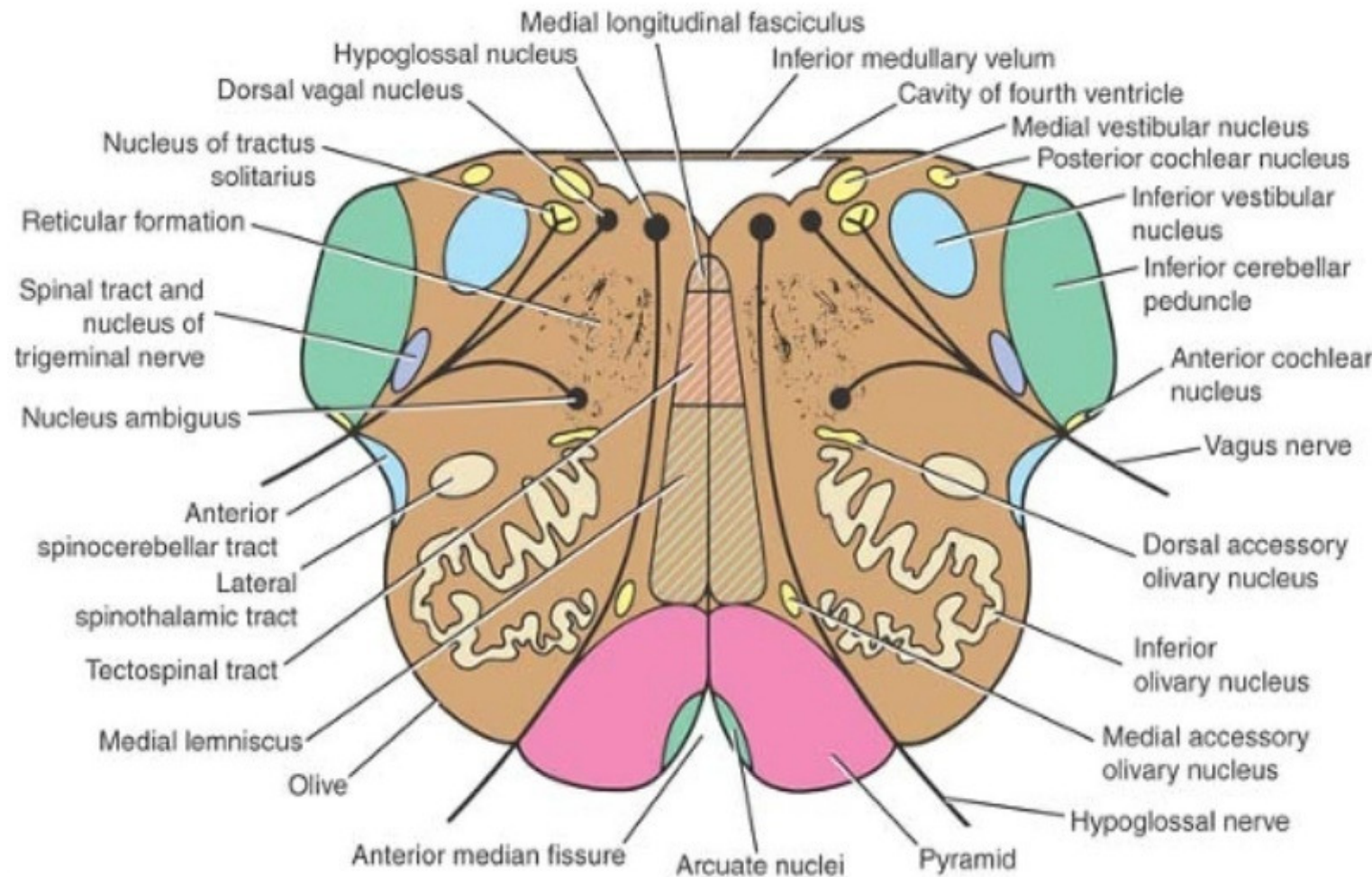
Nucleus ambiguus

- Large motor neurons
- Situated deep in RF
- Emerging fibers join 9th, 10th and 11th (cranial root of accessory)
- An elongated nucleus in the medulla oblongata that gives rise to the motor fibers of the glossopharyngeal, vagus, and accessory (cranial) nerves supplying striated muscle of the larynx and pharynx and soft palate



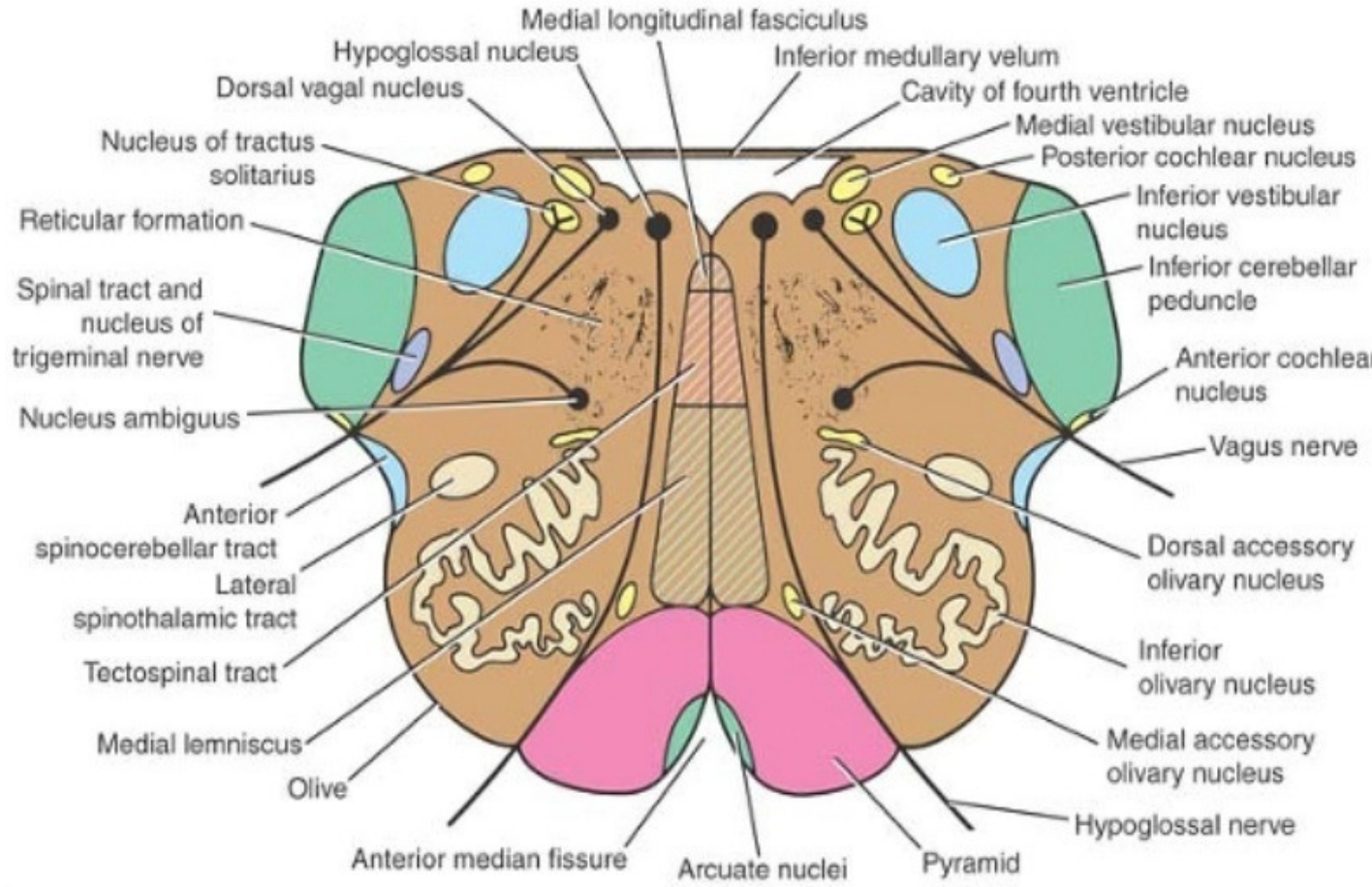
Medial longitudinal fasciculus

- Small tract of nerve fibers
- situated on each side of the midline
- Posterior to med. Lemniscus
- Anterior to 12th nucleus
- It is composed largely of ascending fibers from the vestibular nuclei and cochlear nuclei ascending to the motor nuclei (third, fourth and sixth)

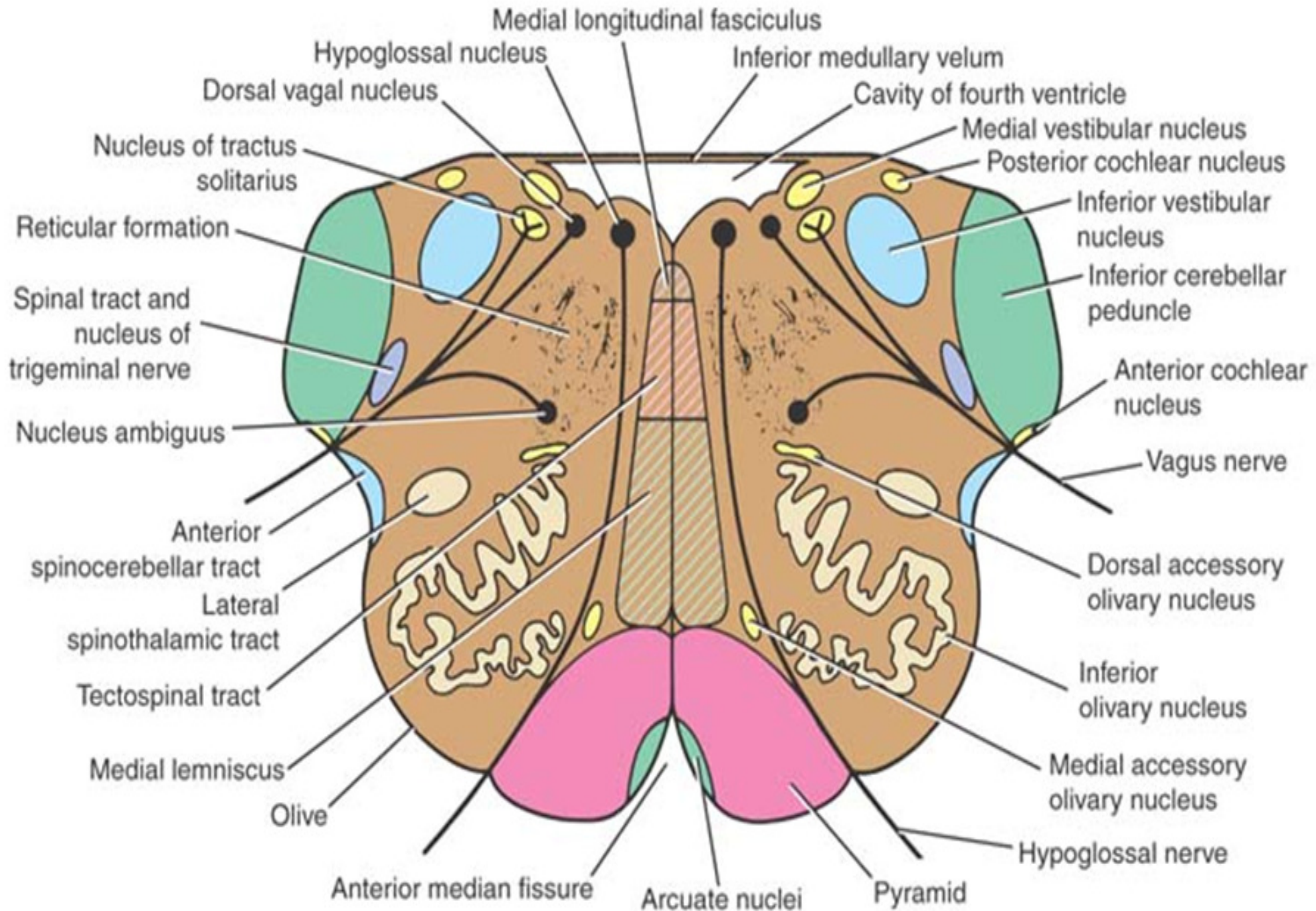


Central gray matter

- Lies beneath the floor of 4th ventricle
- Passing from M to L:
 1. Hypoglossal nucleus
 2. Dorsal nucleus of vagus
 3. Solitary nucleus
 4. Vestibular nuclei (medial and inferior)

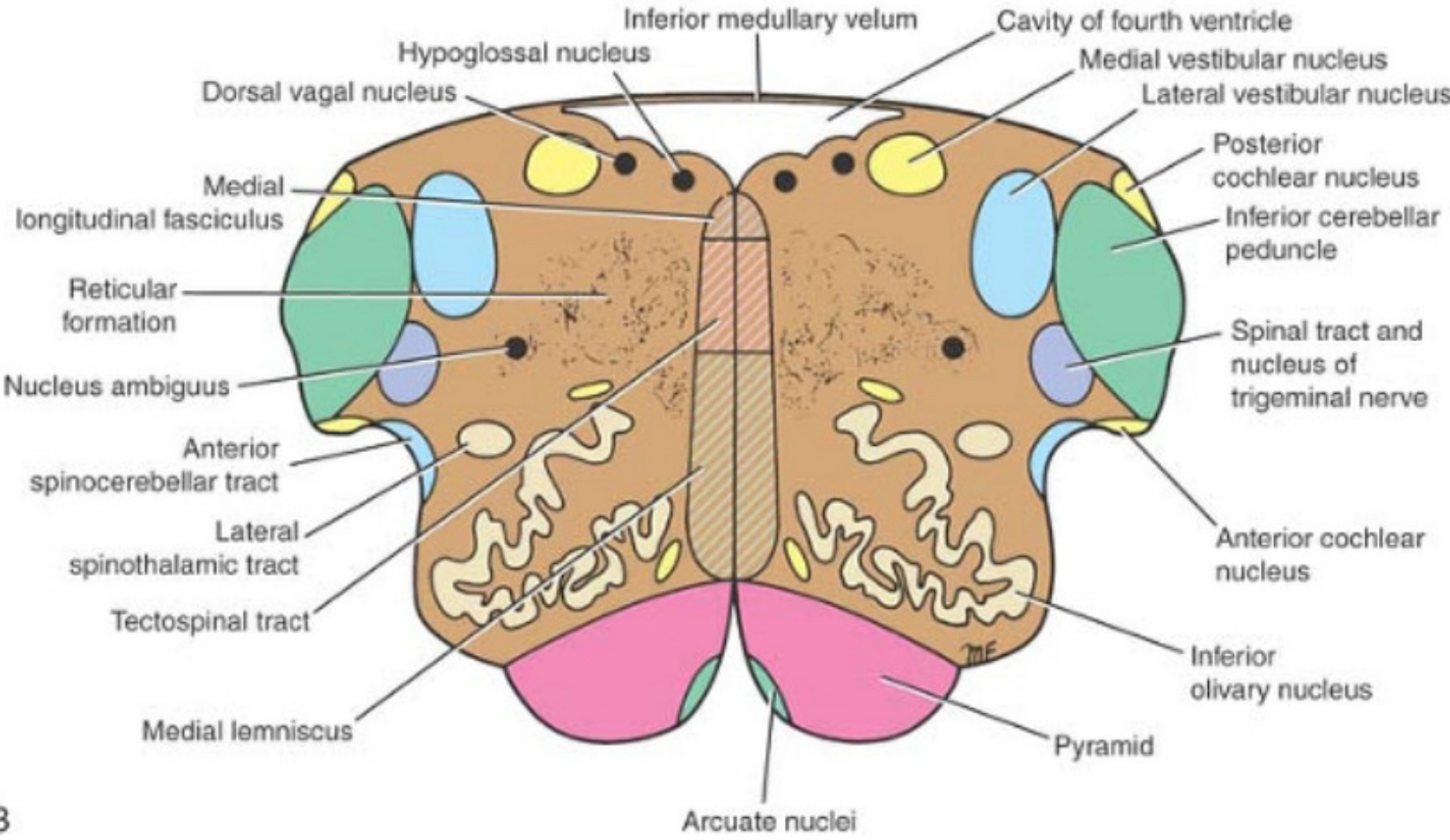


Medulla oblongata at the level of olives



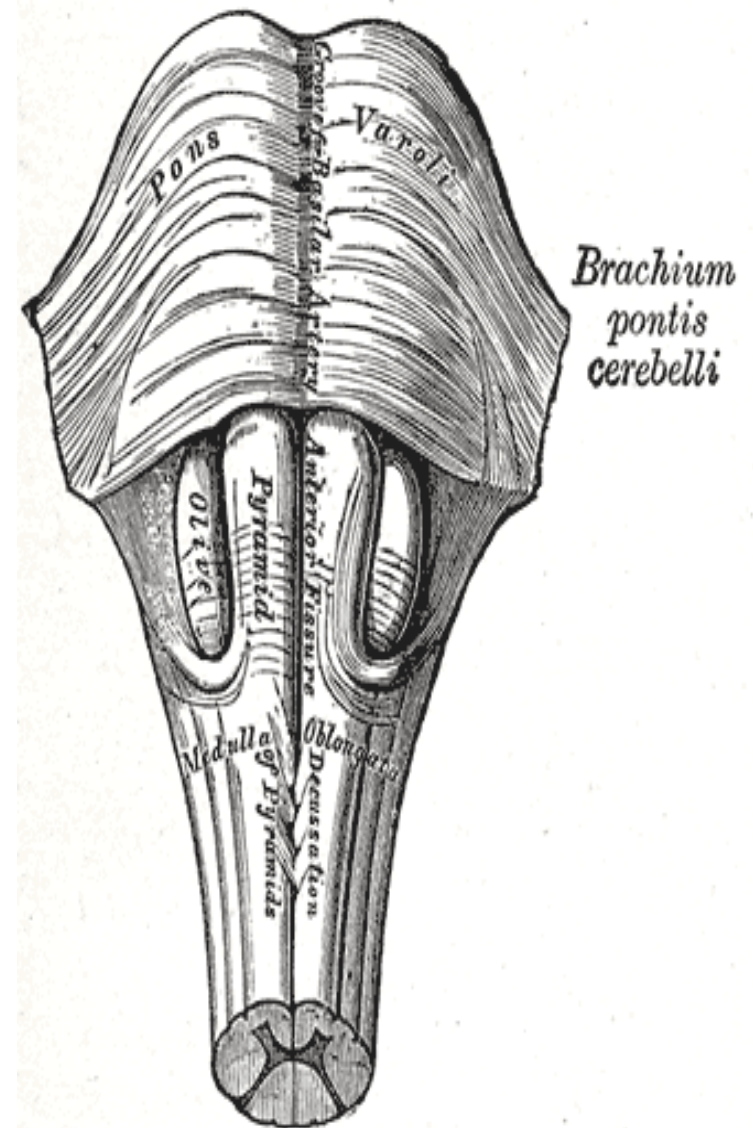
Level Just Inferior to the Pons

- No major changes
- **Lateral vestibular nucleus** replaced the inferior vestibular nucleus
- **Cochlear nuclei** visible on the anterior and posterior surfaces of the inferior cerebellar peduncle.



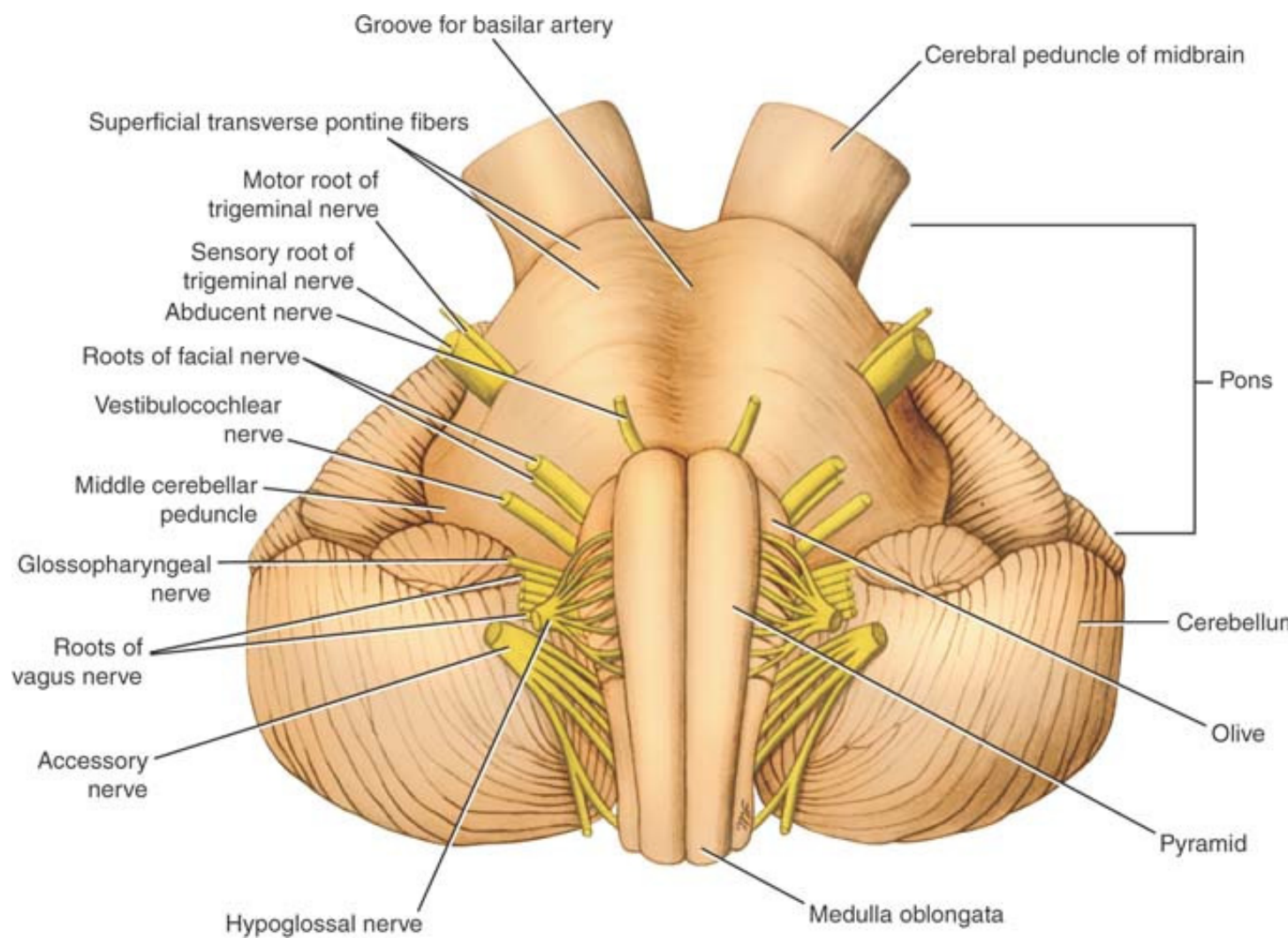
Pons

- Located anterior to cerebellum
- 1 inch long
- Anterior surface is convex & shows transverse fibers that converge on each side to form middle cerebellar peduncle
- Located between the midbrain and medulla oblongata
- Contains the nuclei of cranial nerves V, VI, VII and VIII

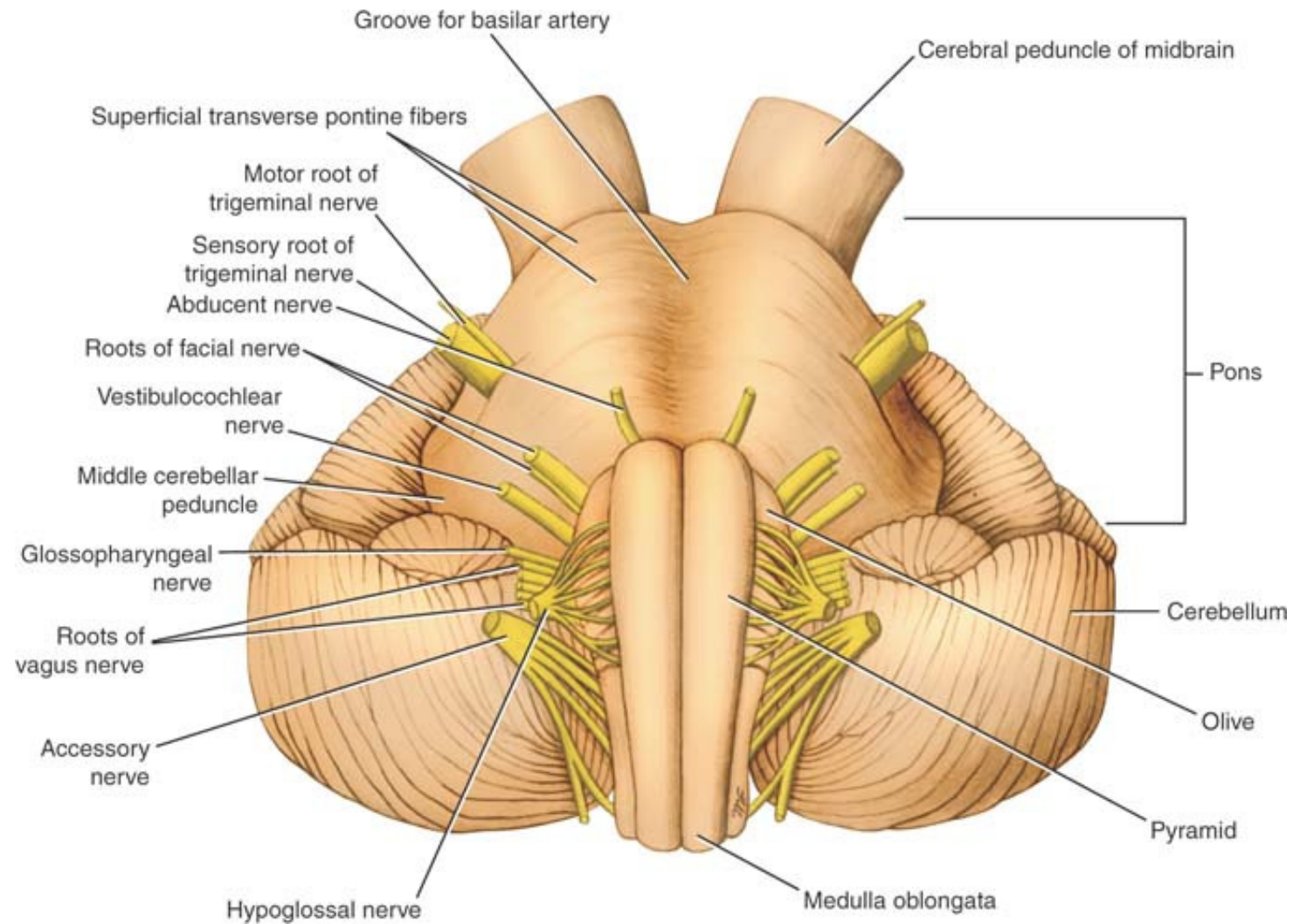


Gross appearance (anterior surface)

- Basilar groove (midline)..lodges basilar artery
- 5th nerve emerges from anterolateral surface (small motor (medial) and large sensory (lateral))
- 6th 7th & 8th emerges at pontomedullary junction M→L

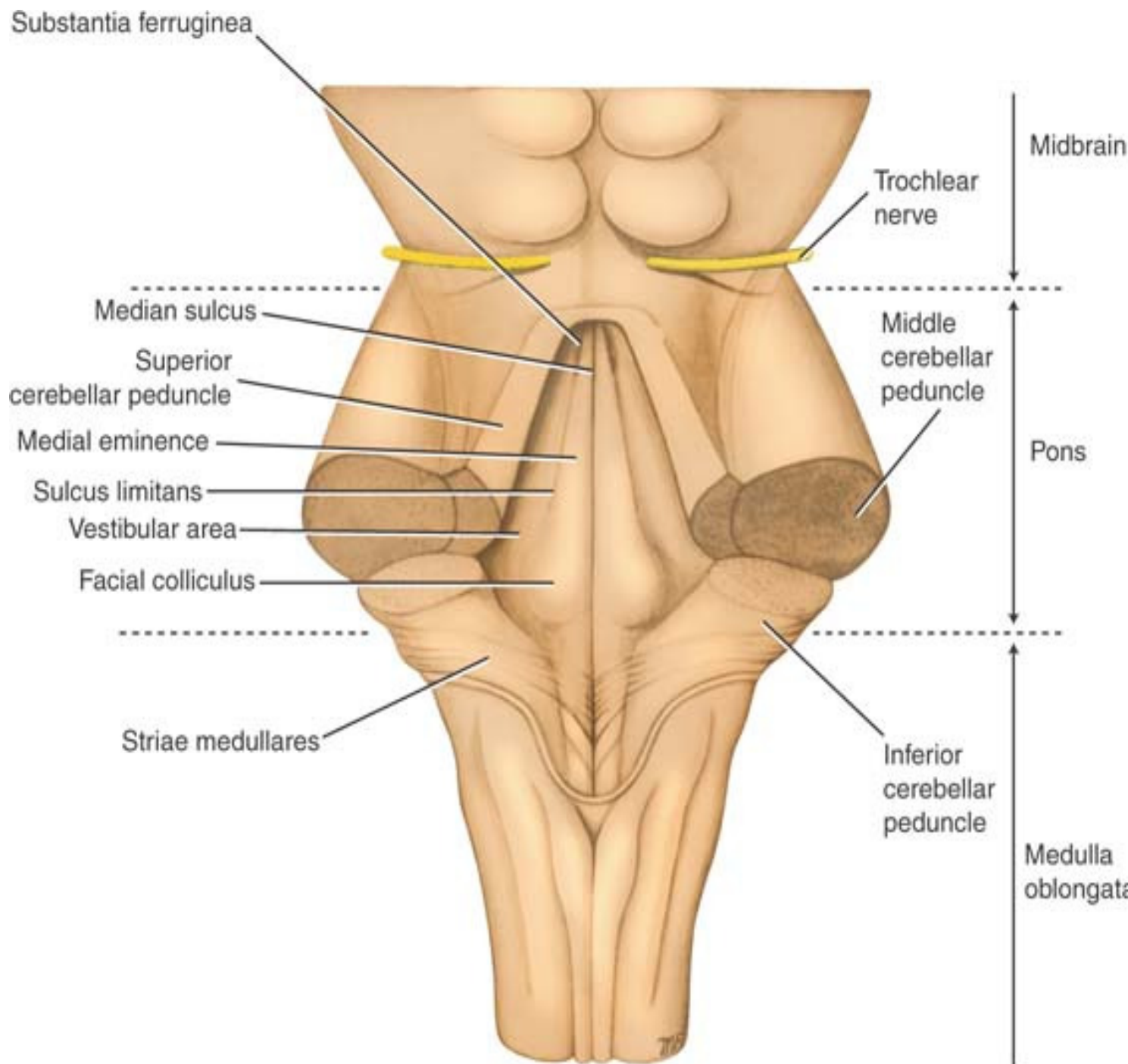


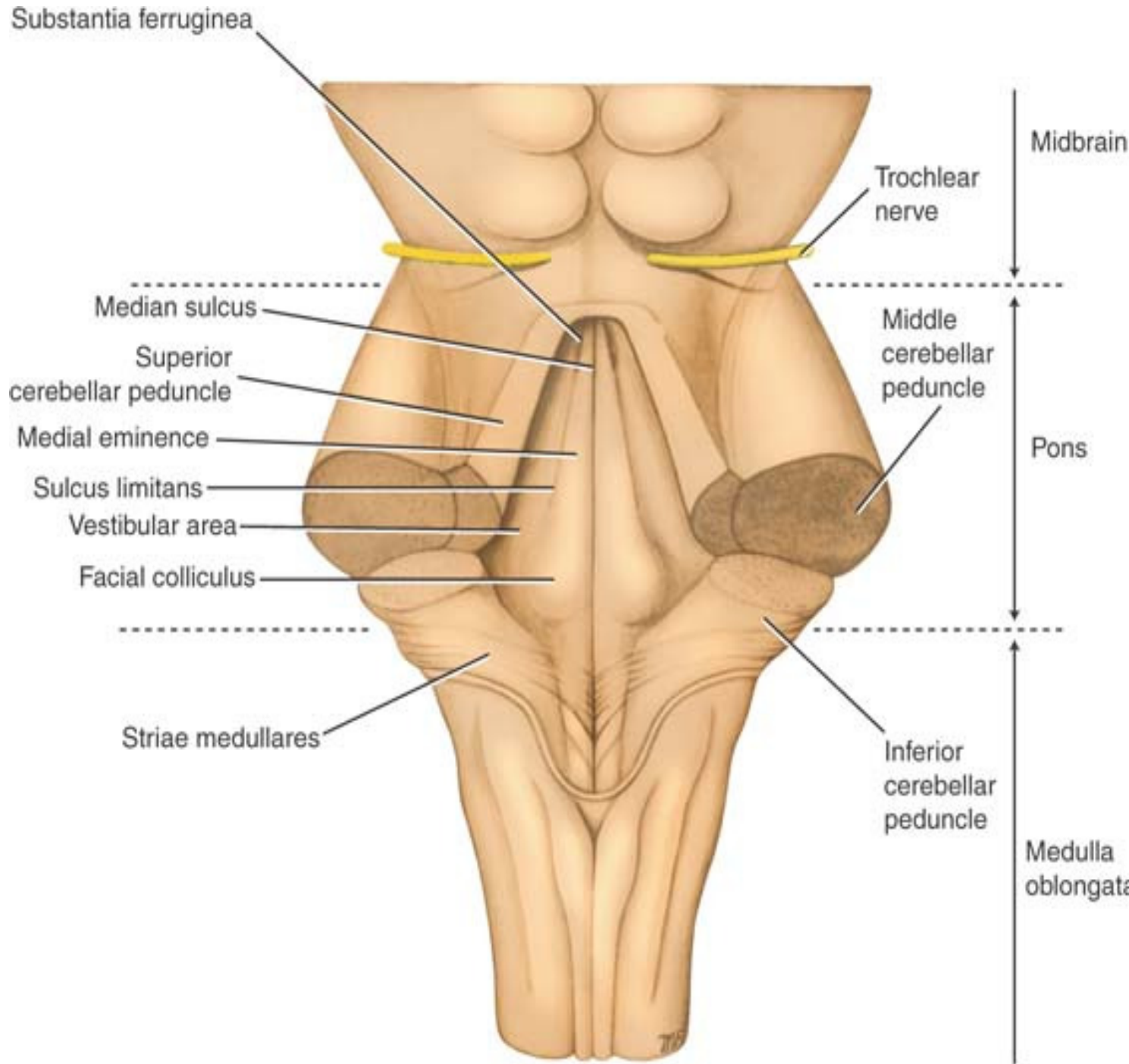
Pons – anterior view



Pons (posterior view)

- Its hidden by from view by cerebellum
- Forms the upper half of floor of 4th ventricle
- Triangular in shape
- Median sulcus
- Medial eminence
- Sulcus limitans
- Facial colliculus (inf end of medial eminence)
- Area vestibuli (Lateral to sulcus limitans)





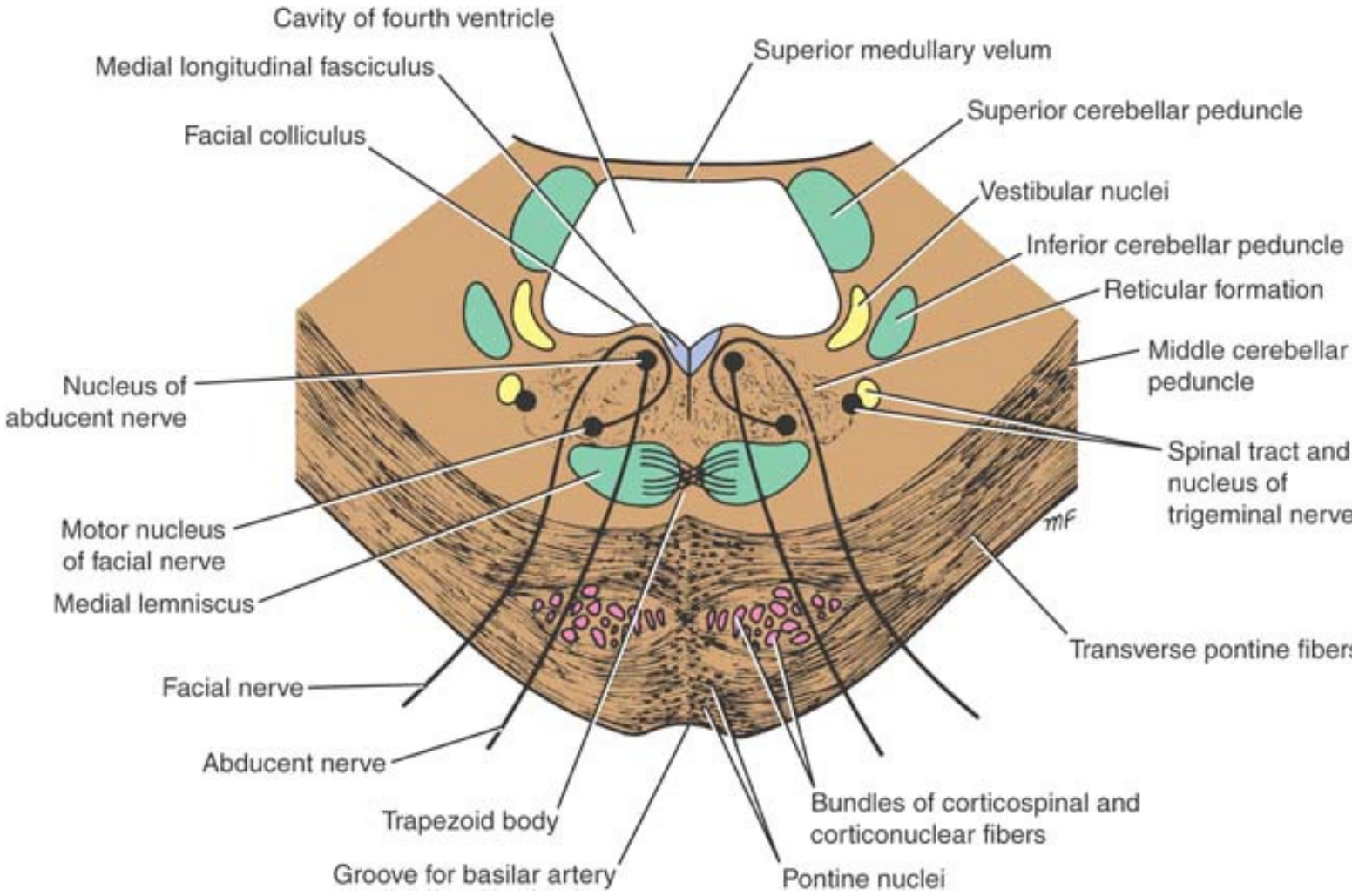
Internal structure of pons

- Its divided by transversely running fibers of trapezoid body into:

1. Tegmentum (post part)
2. Basal part (ant part)

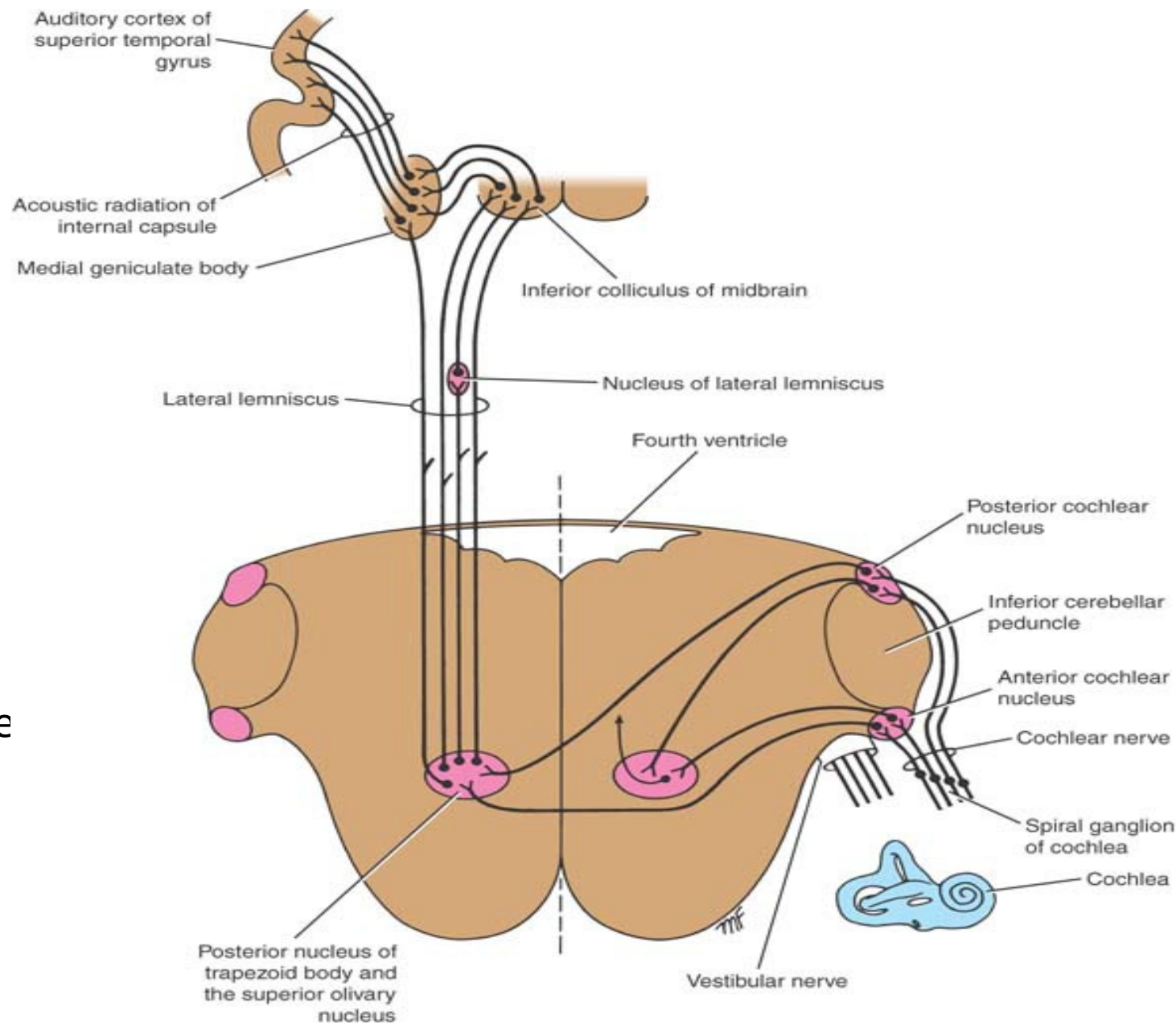
levels

- Level through caudal part (facial colliculus)
- Level through cranial part (trigeminal nuclei)



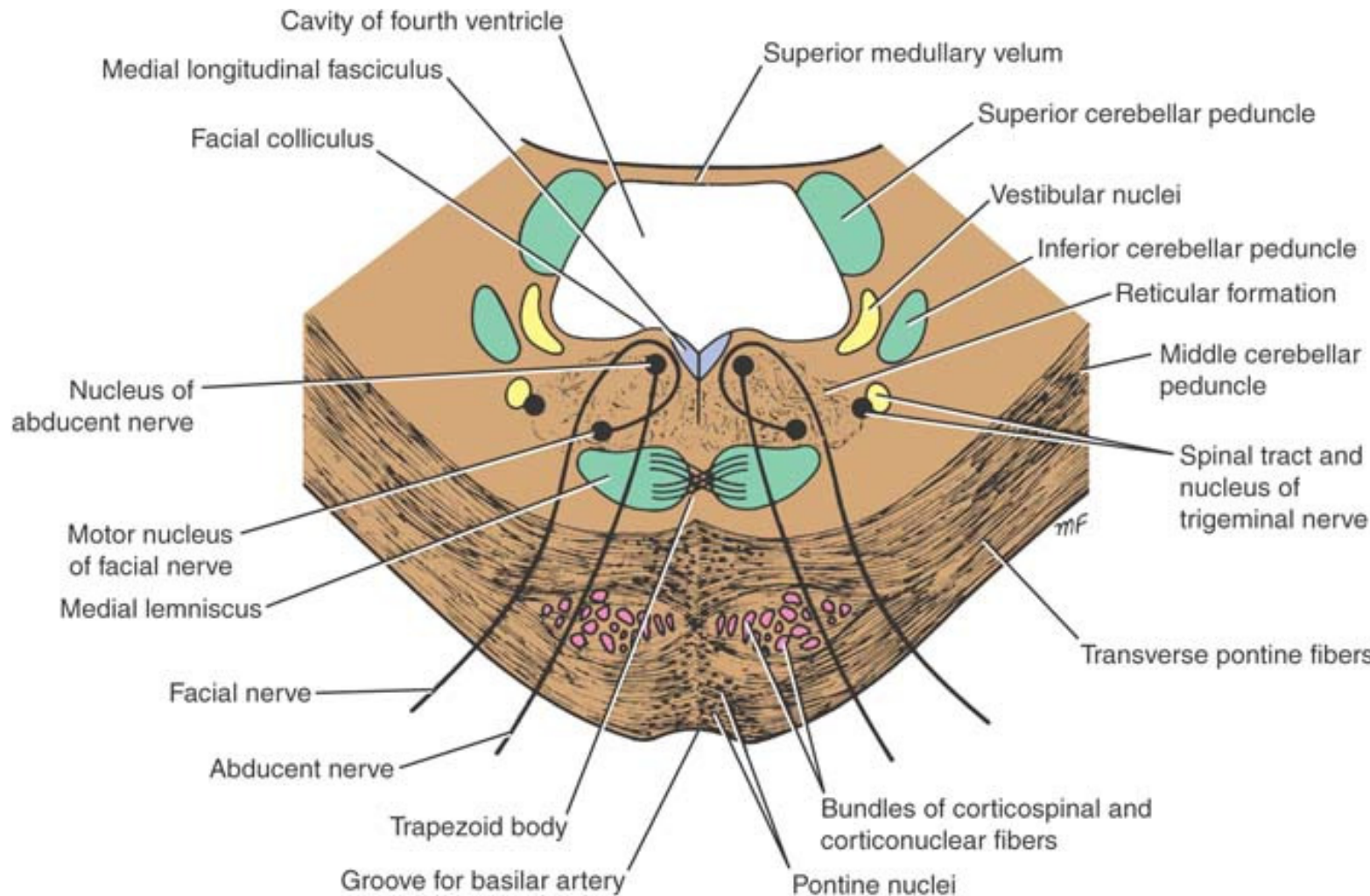
The trapezoid body

- is part of the acoustic pathway
- Made up of fibers derived from cochlear nuclei
- **lateral lemniscus:** tract of axons in the brainstem that carries information about sound from the cochlear nucleus to the contralateral inferior colliculus of the midbrain
- Cochlear nuclei----trapezoid body----lateral lemniscus----inf colliculus-----medial geniculate body-----auditory cortex



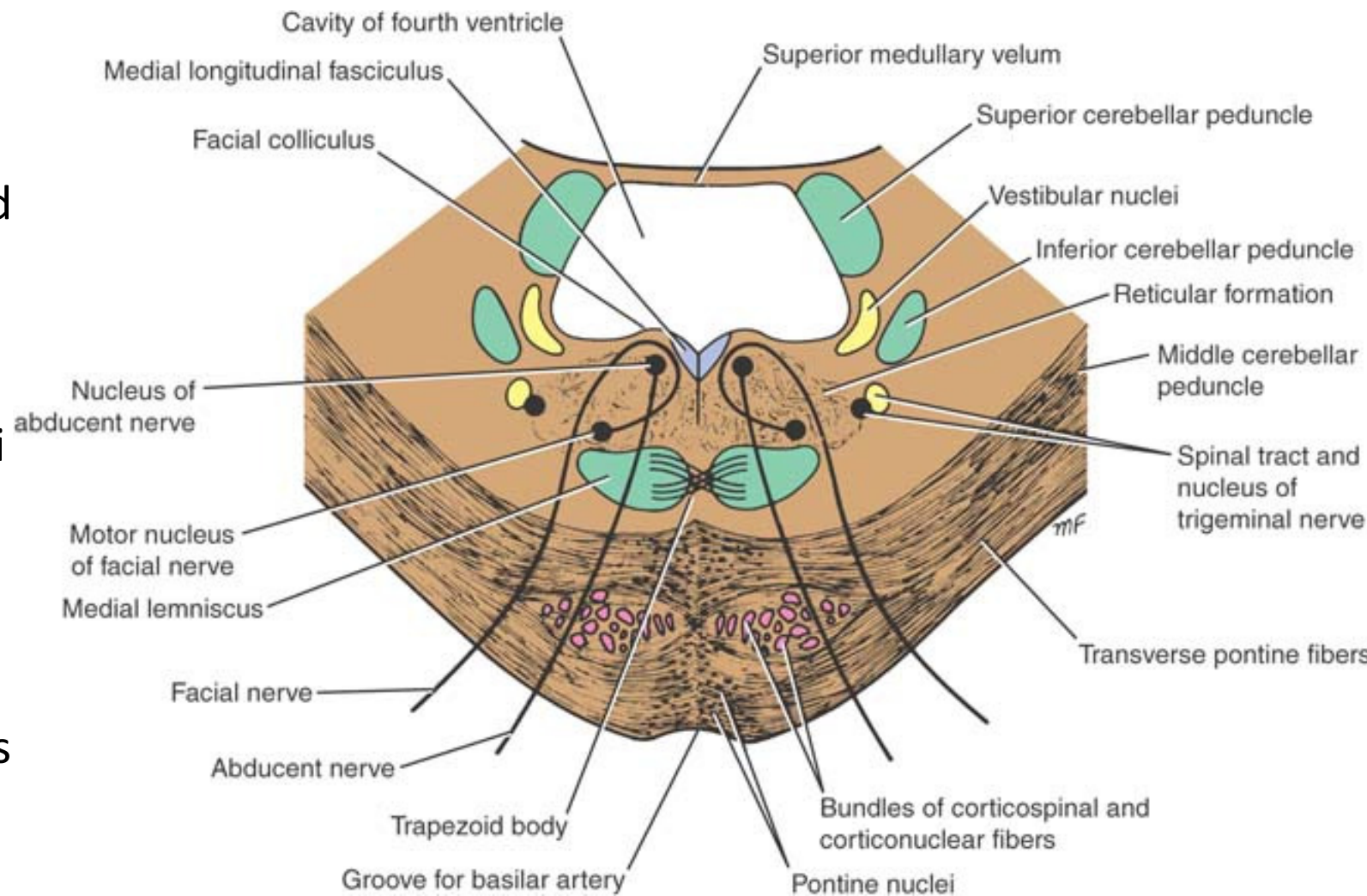
Level through caudal part (facial colliculus)

- **Medial lemniscus**
most anterior part of the tegmentum, long axis running transversely
- **Facial nucleus**
posterior to the lateral part of the medial lemniscus
- **MLF:** beneath the floor of the fourth ventricle on either side of the midline
- **Abducent nucleus:** beneath the floor of the upper part of the fourth
- **Spinal nucleus** of trigeminal and its tract: anteromedial aspect of ICP
- **Medial vestibular nucleus:** lateral to the abducent nucleus



Level through caudal part (facial colliculus)

- Basilar part of pons contain small masses of nerve cells called pontine nuclei
- Corticopontine fibers terminate in pontine nuclei
- Axons of these cells give origin to transverse fibers of the pons which cross the midline and intersect the corticospinal & corticonuclear tracts, breaking them into small bundles

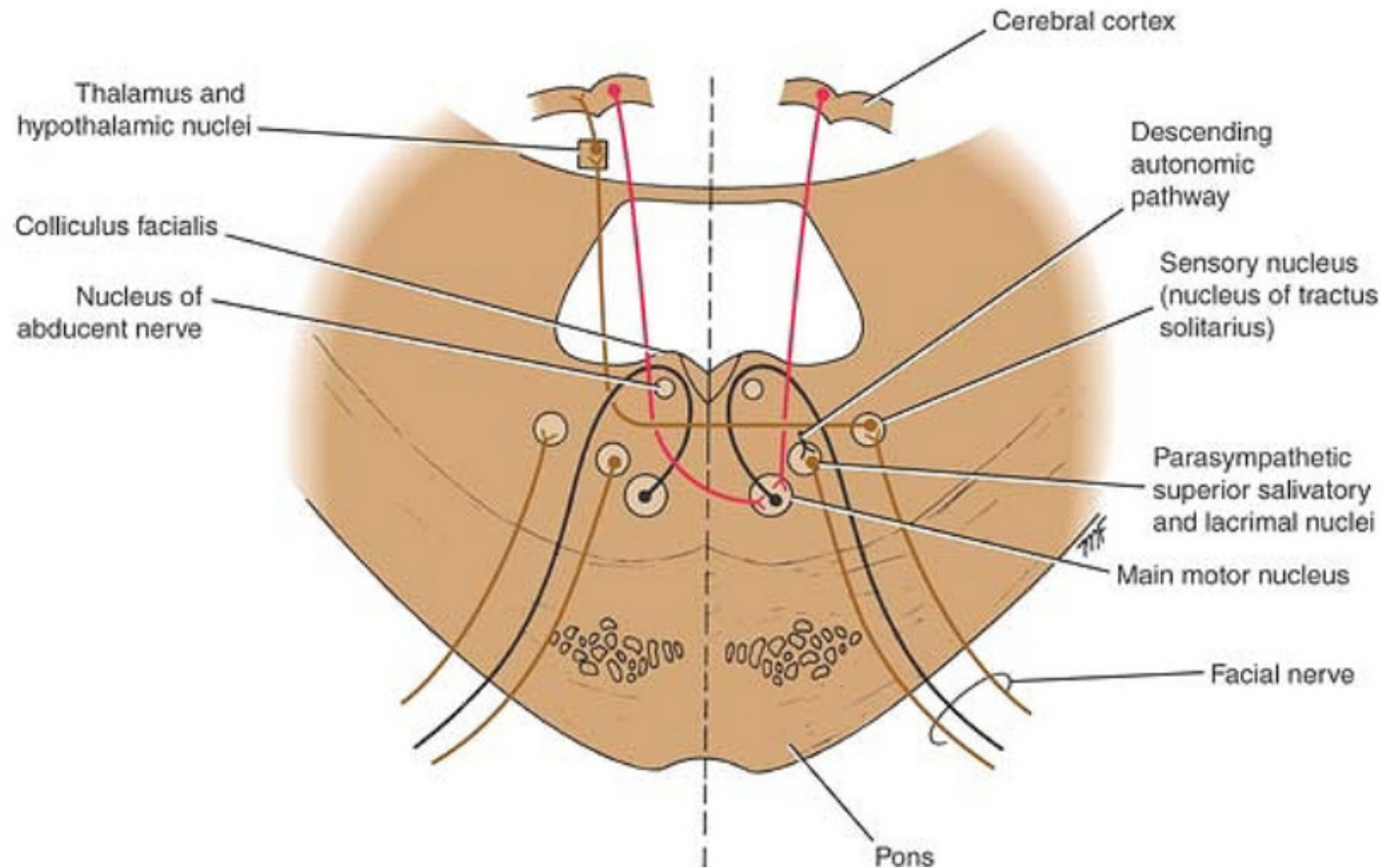


- Transverse fibers enter MCP to cerebellum
- This connection is the main pathway linking cerebellum to cerebral cortex

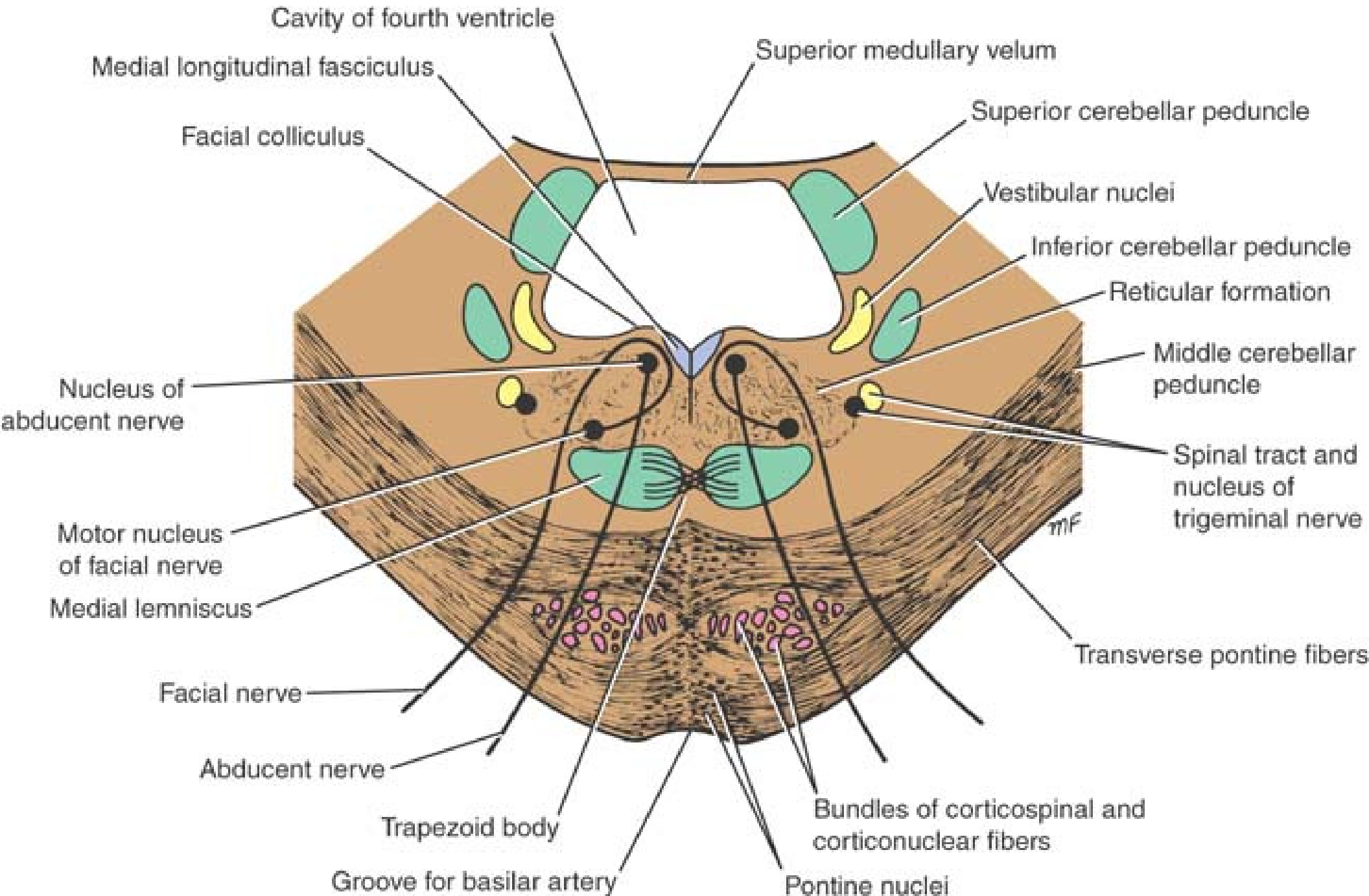
Facial Nerve Nuclei

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)

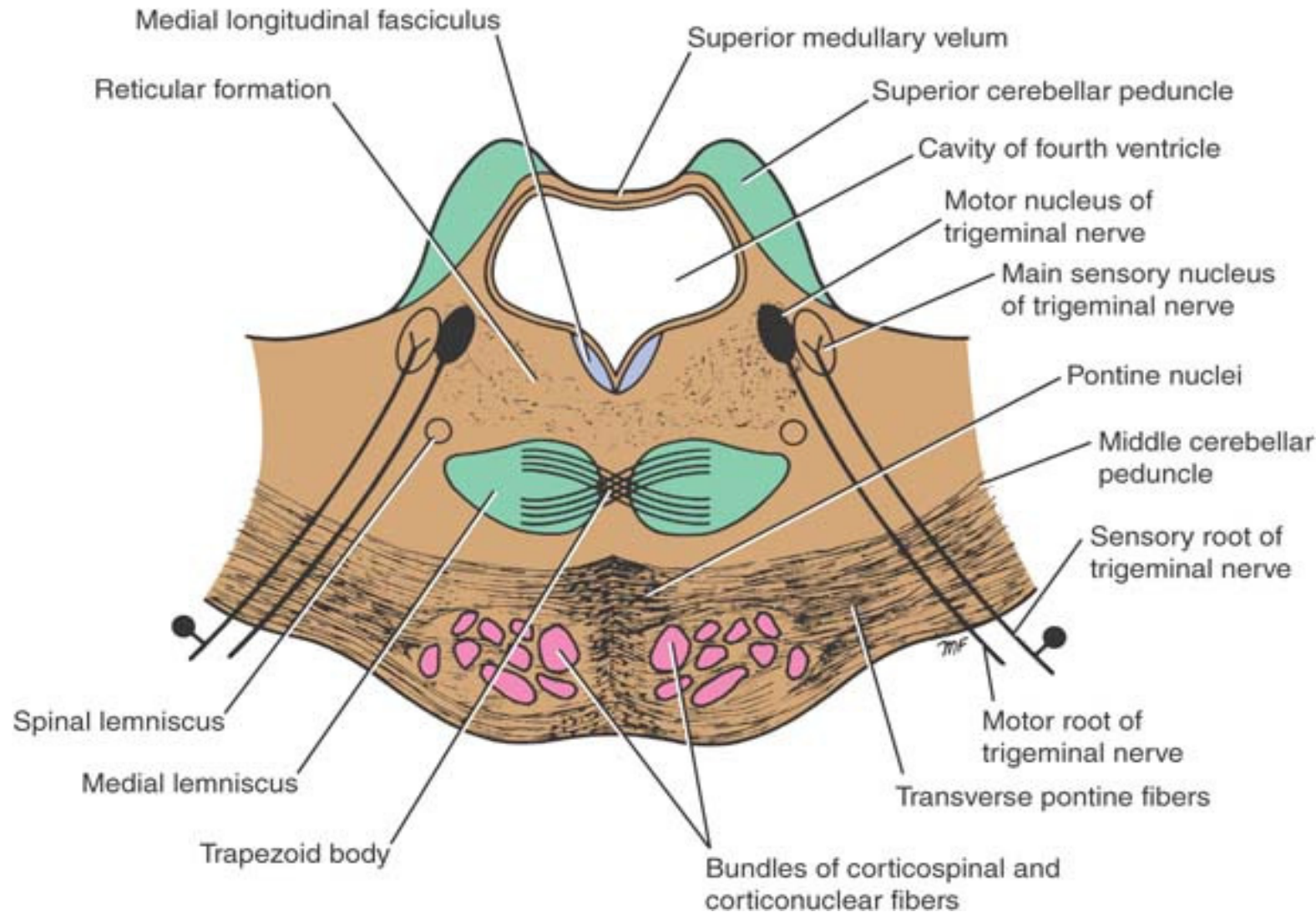


Level through caudal part (facial colliculus)

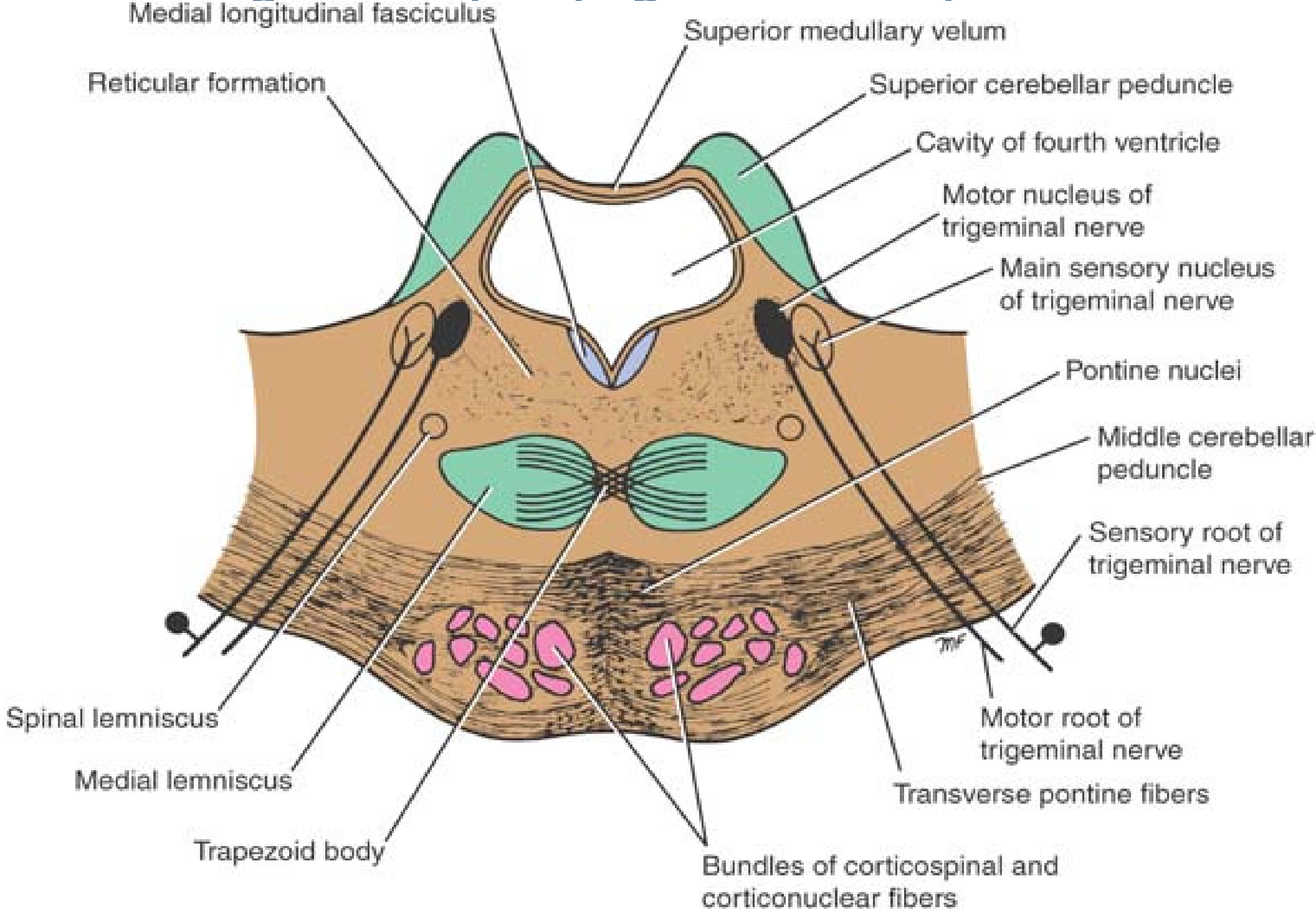


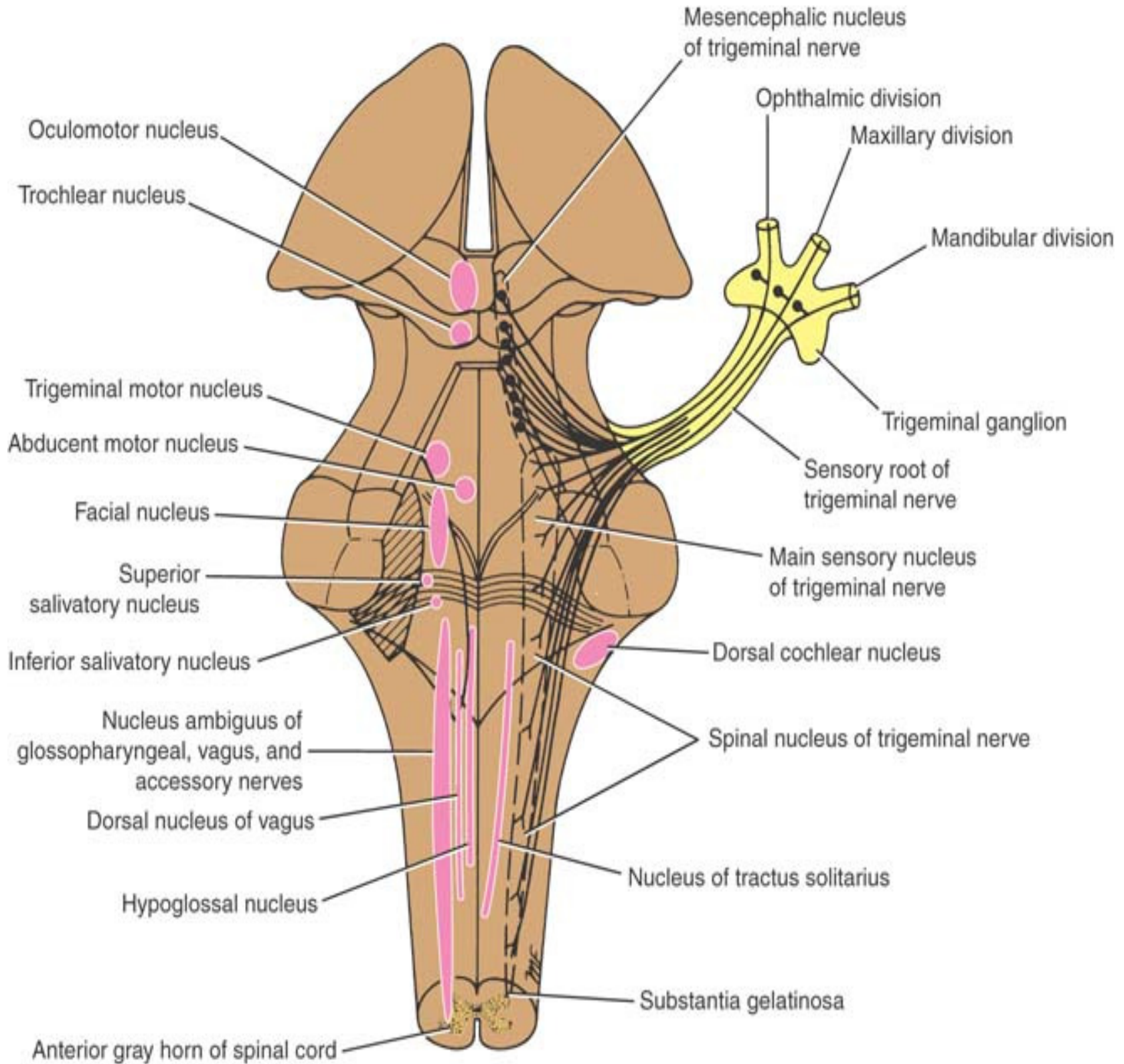
Level through cranial part (trigeminal nuclei)

- **Motor nucleus** of trigeminal n: beneath the lateral part of the fourth ventricle within the reticular formation
- **Main Sensory nucleus** of trigeminal n (*lateral*)
- **SCP:** posterolateral to the motor nucleus of V
- **Trapezoid body**
- **Medial lemniscus**
- **Lateral lemniscus, Spinal lemniscus:** lateral extremity of the medial lemniscus



Level through cranial part (trigeminal nuclei)





To head area of primary somesthetic cortex

Mesencephalic trigeminal nucleus

Ventral posterior medial nucleus of thalamus

Trigeminal lemniscus

Motor trigeminal nucleus

Pontine trigeminal nucleus

Spinal trigeminal nucleus

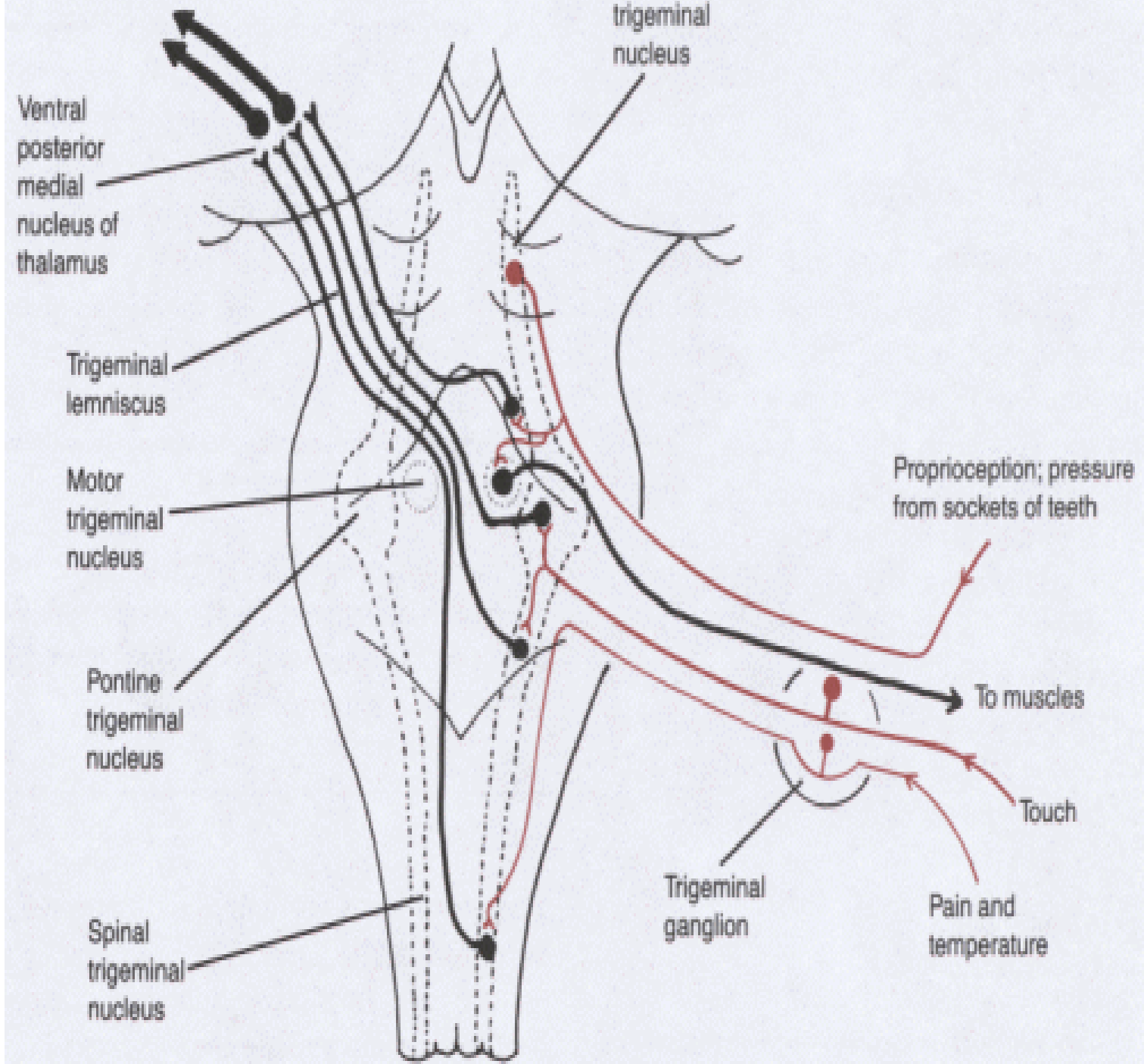
Proprioception; pressure from sockets of teeth

To muscles

Touch

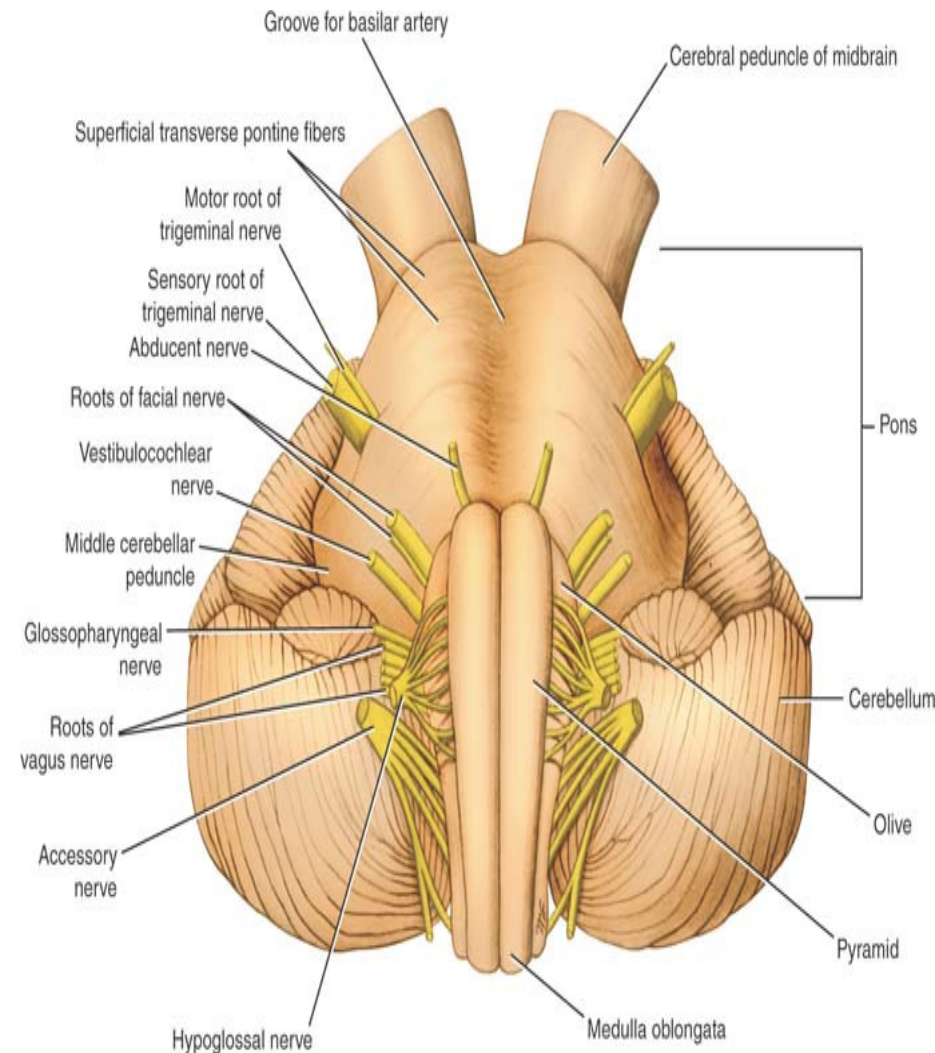
Pain and temperature

Trigeminal ganglion

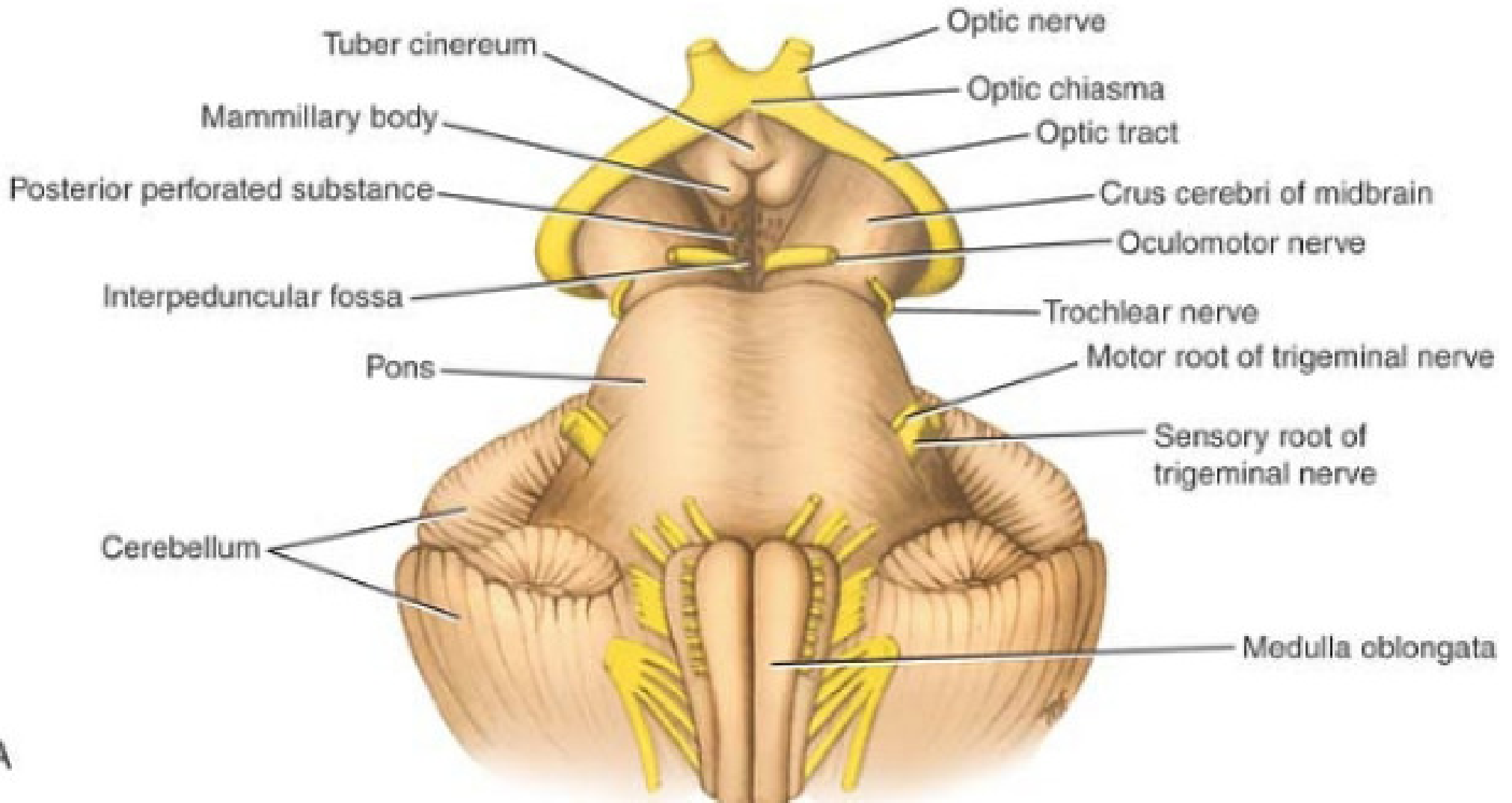


The Brain Stem – The Midbrain

- Lies between the diencephalon and the pons
- Central cavity – the **cerebral aqueduct**
- Cerebral peduncles located on the ventral surface of the brain divided by the **substantia nigra** into:
 - **Crus cerebri: Anterior**
 - **Tegmentum: Posterior**
 - Contain pyramidal (corticospinal) tracts
- Superior cerebellar peduncles
 - Connect midbrain to the cerebellum



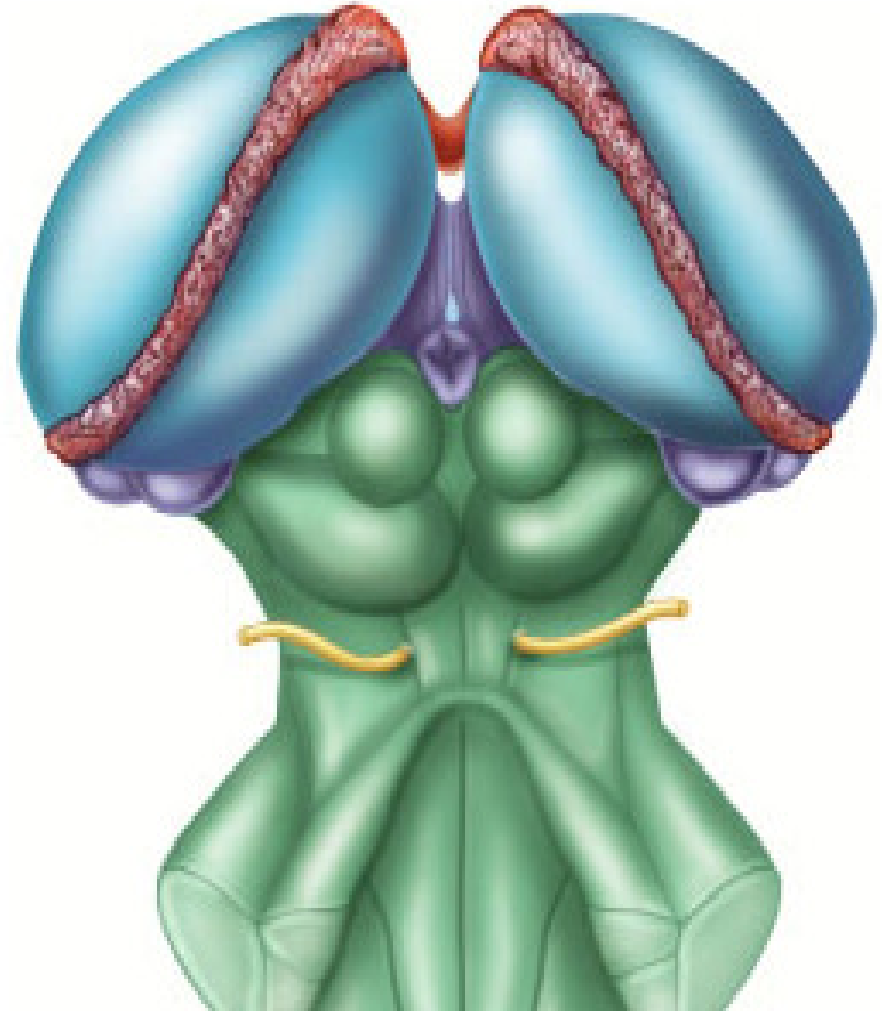
Midbrain ant. View



- Interpeduncular fossa
- Crus cerebri
- 3rd nerve emerges from medial side of crus cerebri in the interpeduncular fossa

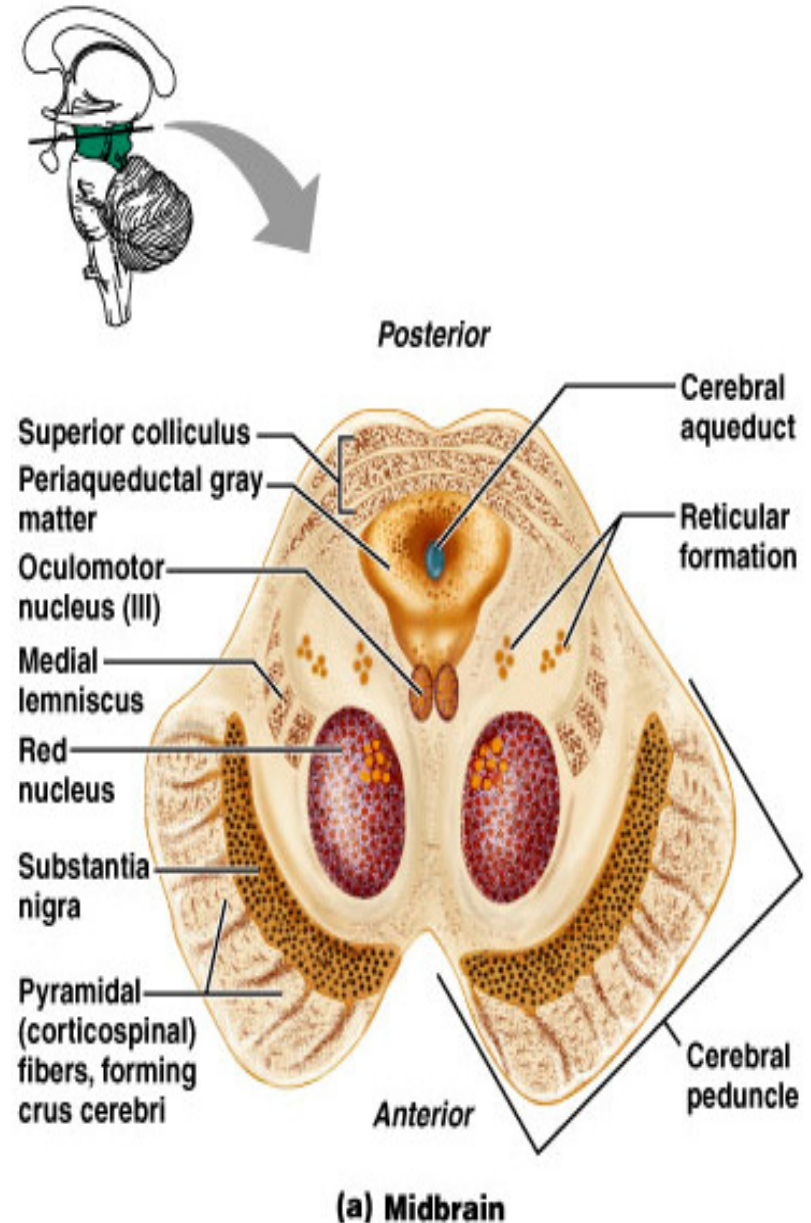
The Midbrain-posterior view

- Corpora quadrigemina – the largest nuclei
 - Divided into the superior and inferior colliculi
 - Superior colliculi – nuclei that act in visual reflexes
 - Inferior colliculi – nuclei that act in auditory reflexes
- Trochlear nerve emerges below the level of inf. Colliculus (from posterior surface)
- Oculomotor nerve emerges at the level of sup. colliculus
- Sup.brachium (to lateral geniculate body)
- Inf. Brachium (to medial geniculate body)
- 4th emerges

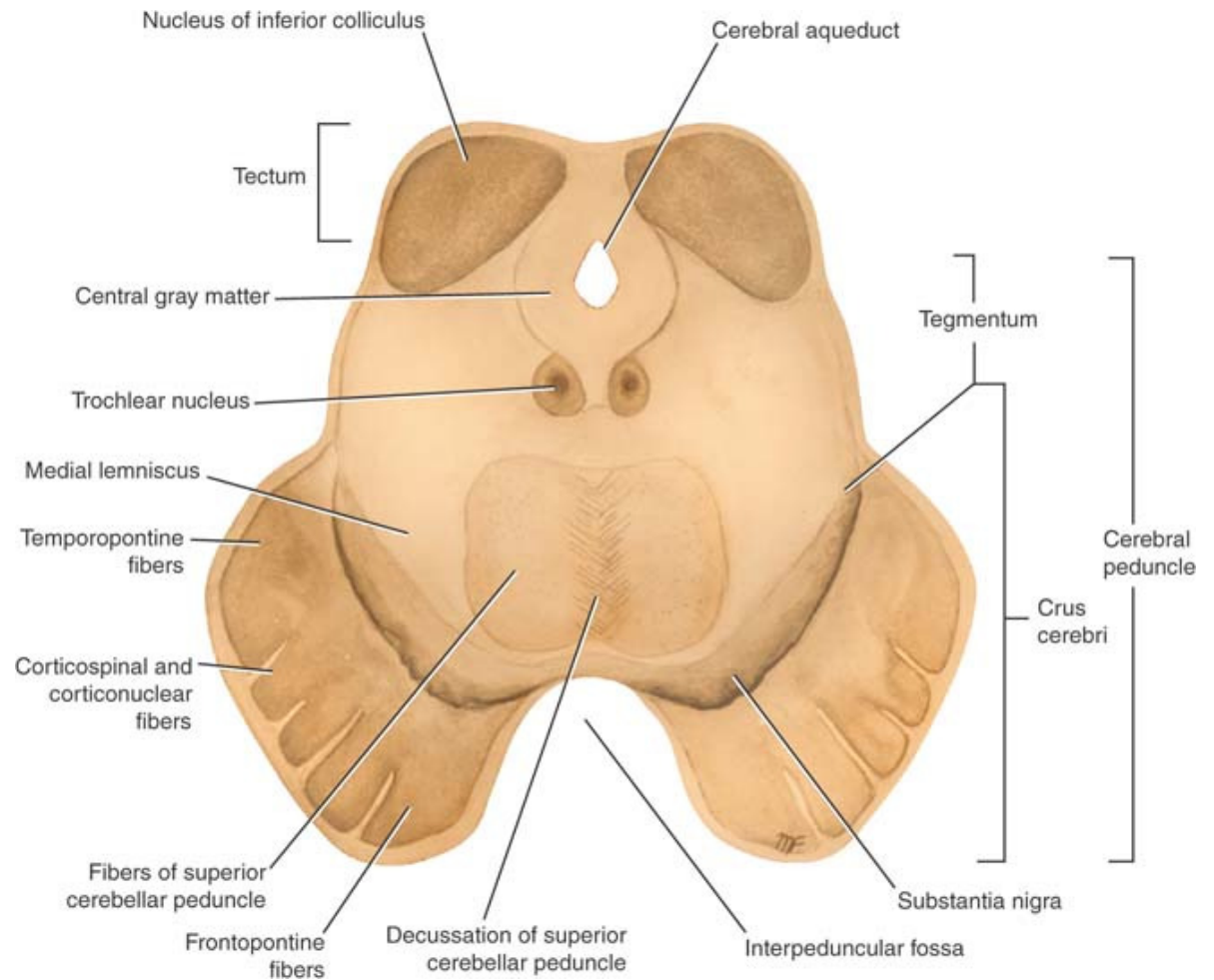


The Brain Stem – The Midbrain

- Imbedded in the white matter of the midbrain
 - Two pigmented nuclei
 - Substantia nigra – neuronal cell bodies contain melanin
 - Functionally linked to the basal nuclei
 - Red nucleus – lies deep to the substantia nigra
 - Largest nucleus of the reticular formation



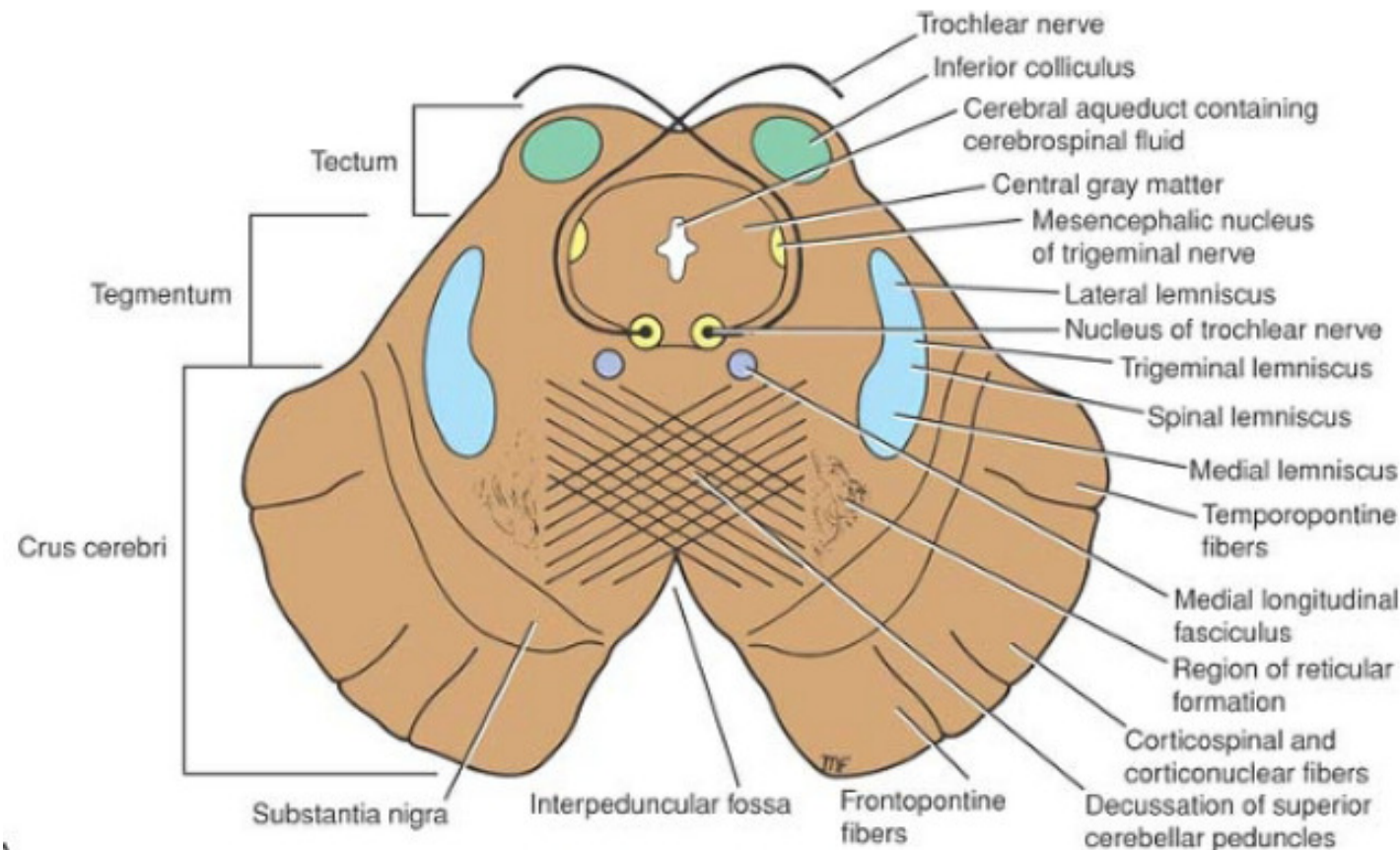
Cerebral peduncle is divided into crus cerebri (ant) & tegmentum (post)
Tectum is post to cerebral aqueduct



Substantia nigra is situated between the tegmentum and crus cerebri

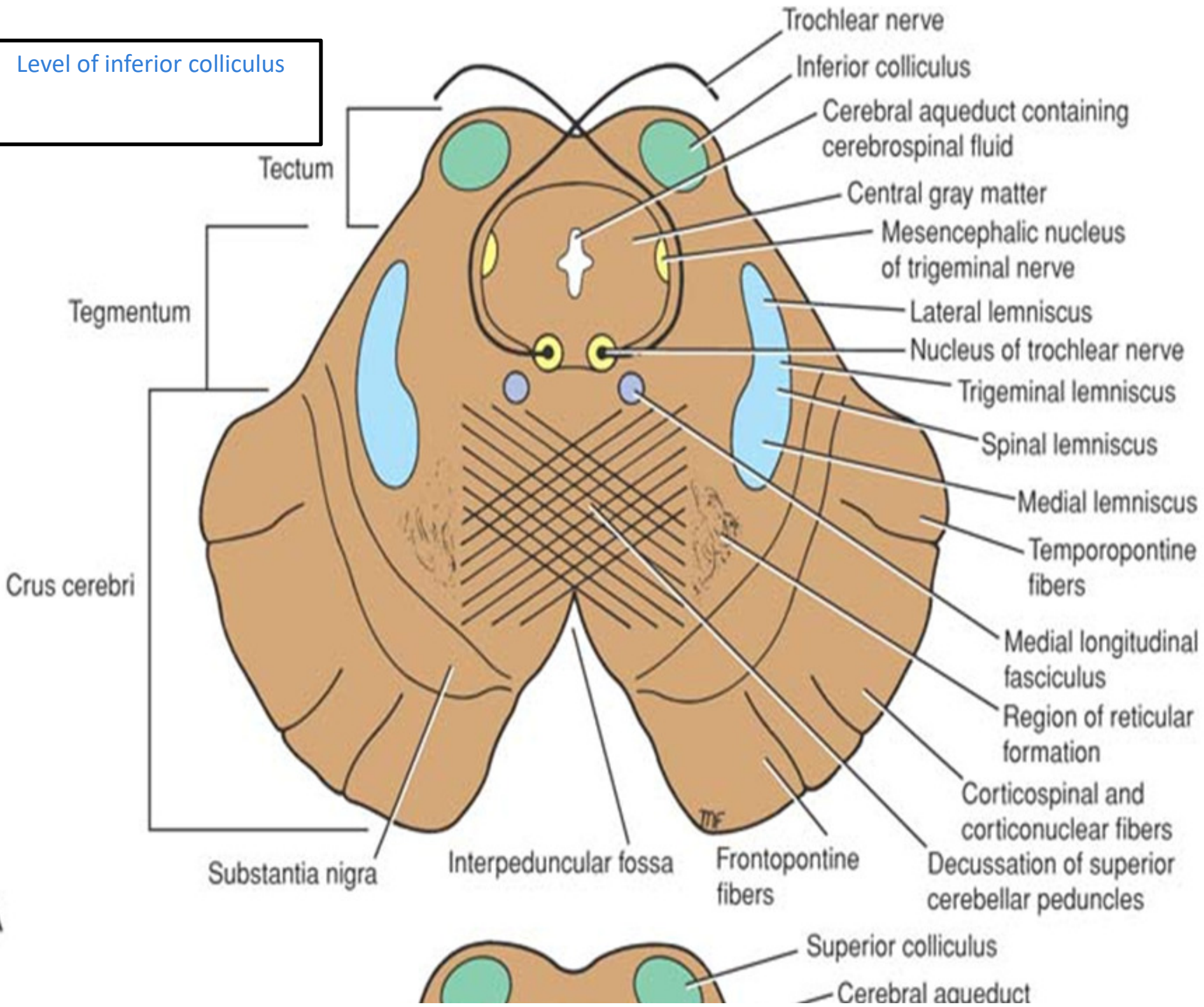
Level of inf. colliculus

- Trochlear nucleus lies close to midline in the central gray matter (posterior to MLF)
- Trochlear nerves decussate in the superior medullary velum
- Decussation of sup. cerebellar peduncles (central part of the tegmentum anterior to the cerebral aqueduct)
- RF is lateral to decussation
- Medial, spinal, trigeminal & lateral lemnisci (Posterior to Substantia nigra)



- Substantia nigra
- Crus cerebri
- Mesencephalic nucleus of trigeminal (*lateral to cerebral aqueduct*)
- MLF

Level of inferior colliculus

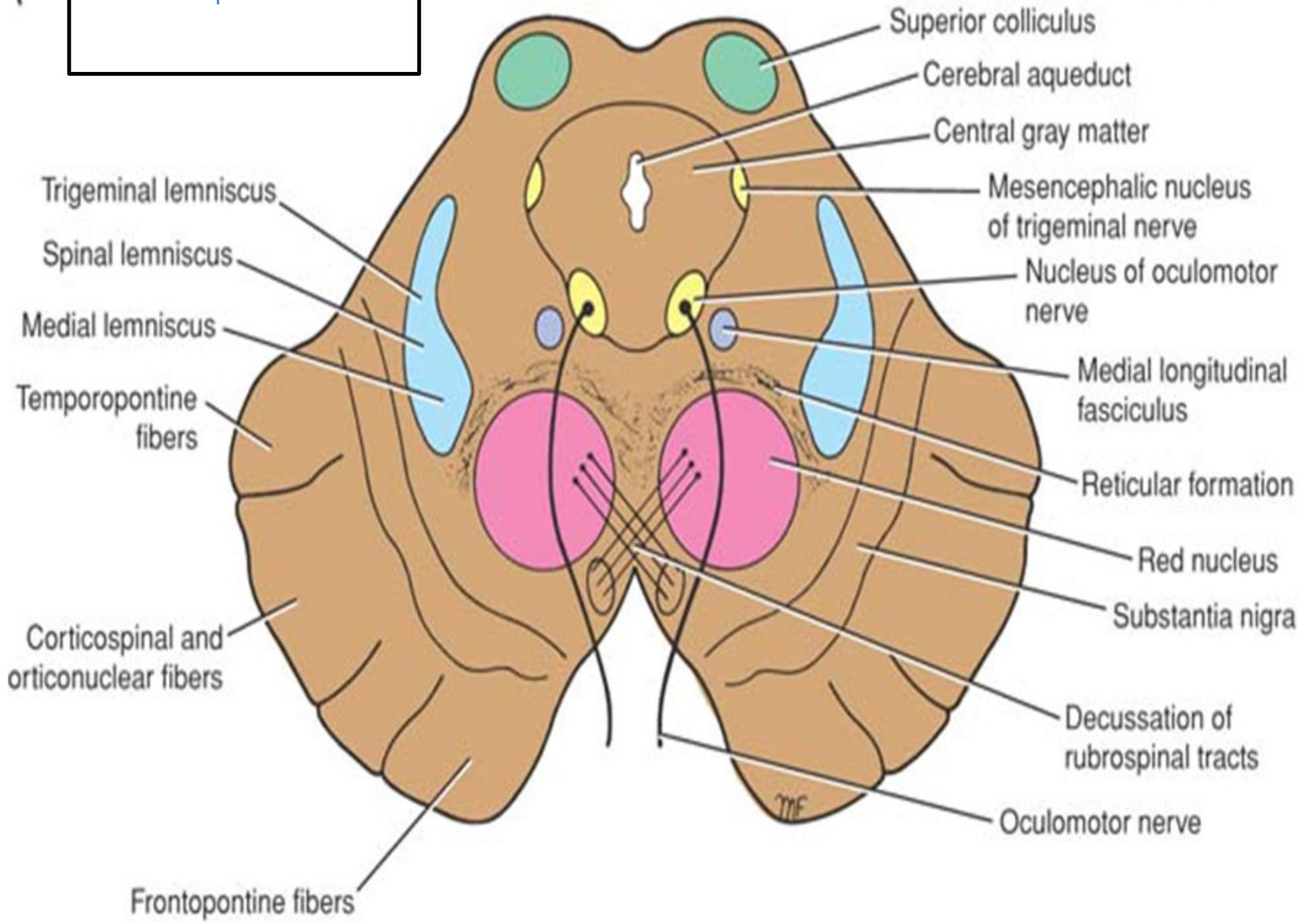


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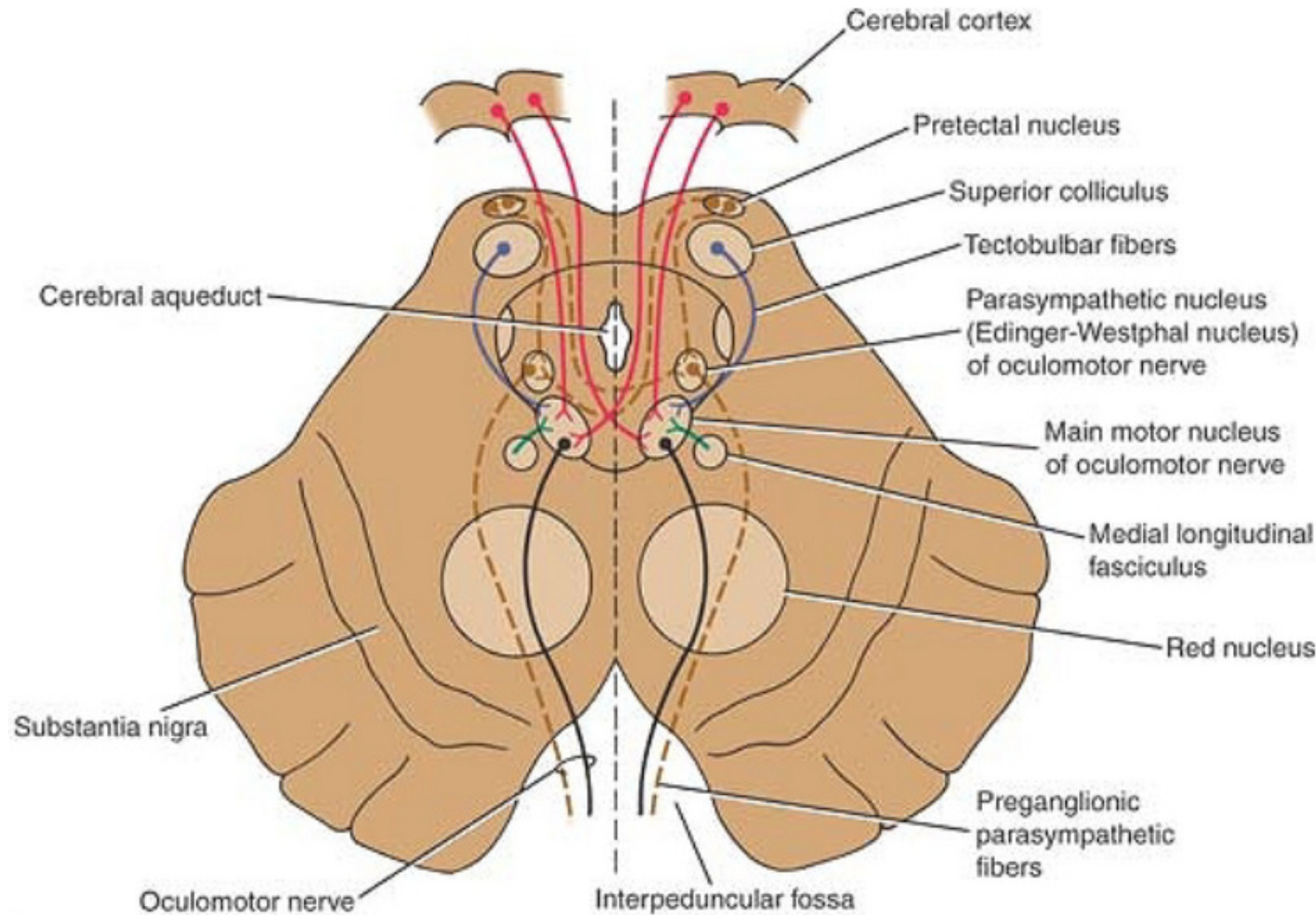
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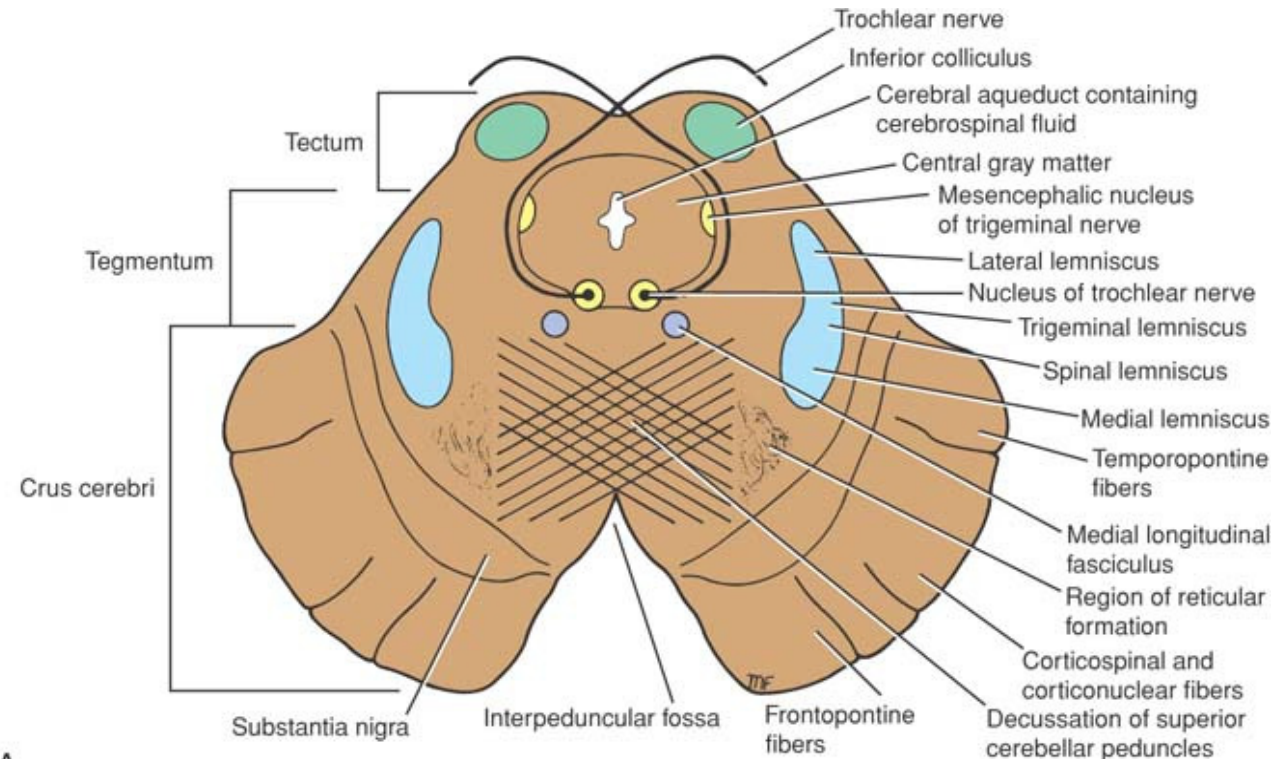
Level of superior colliculus

trigeminal cerebellar peduncles

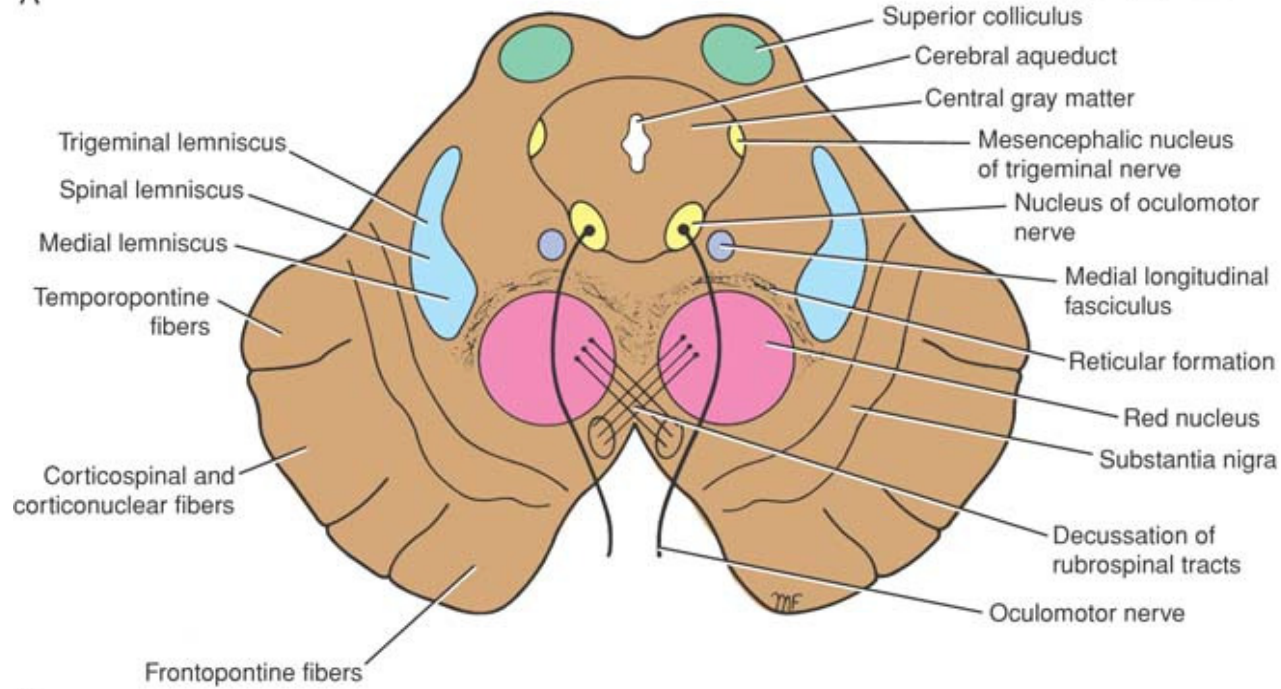


- Edinger-Westphal nucleus
- **pretectal nucleus:** close to the lateral part of the superior colliculus.





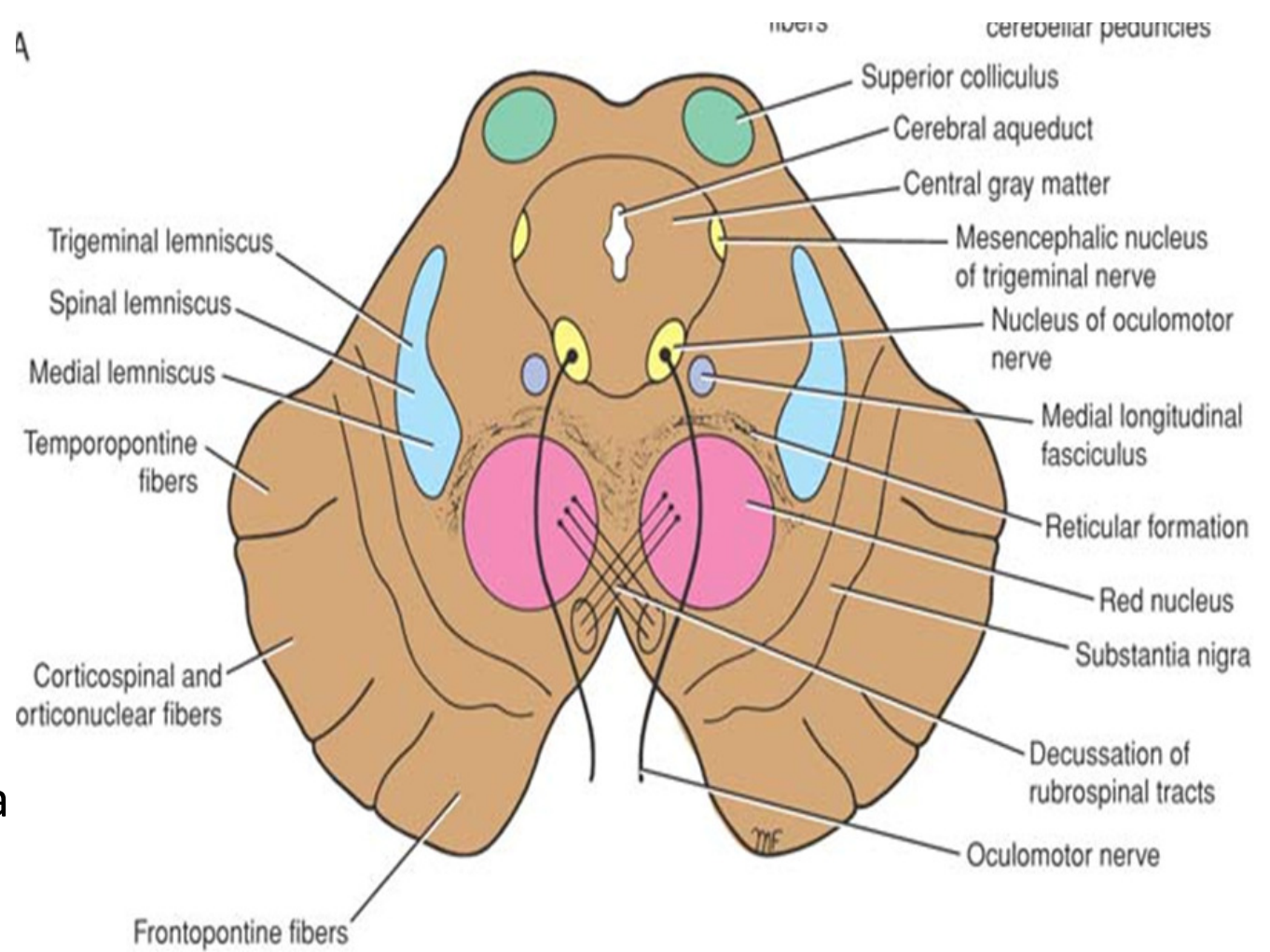
A



B

Red nucleus

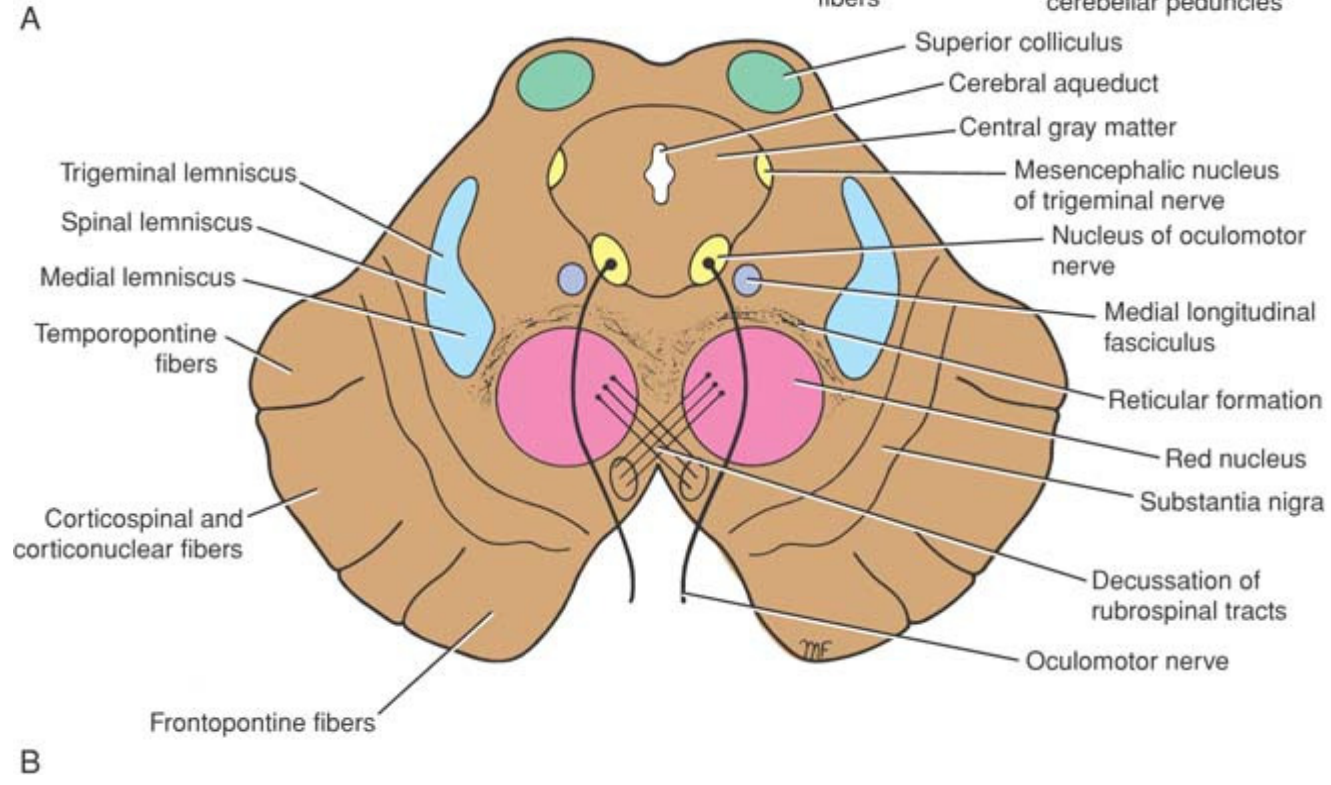
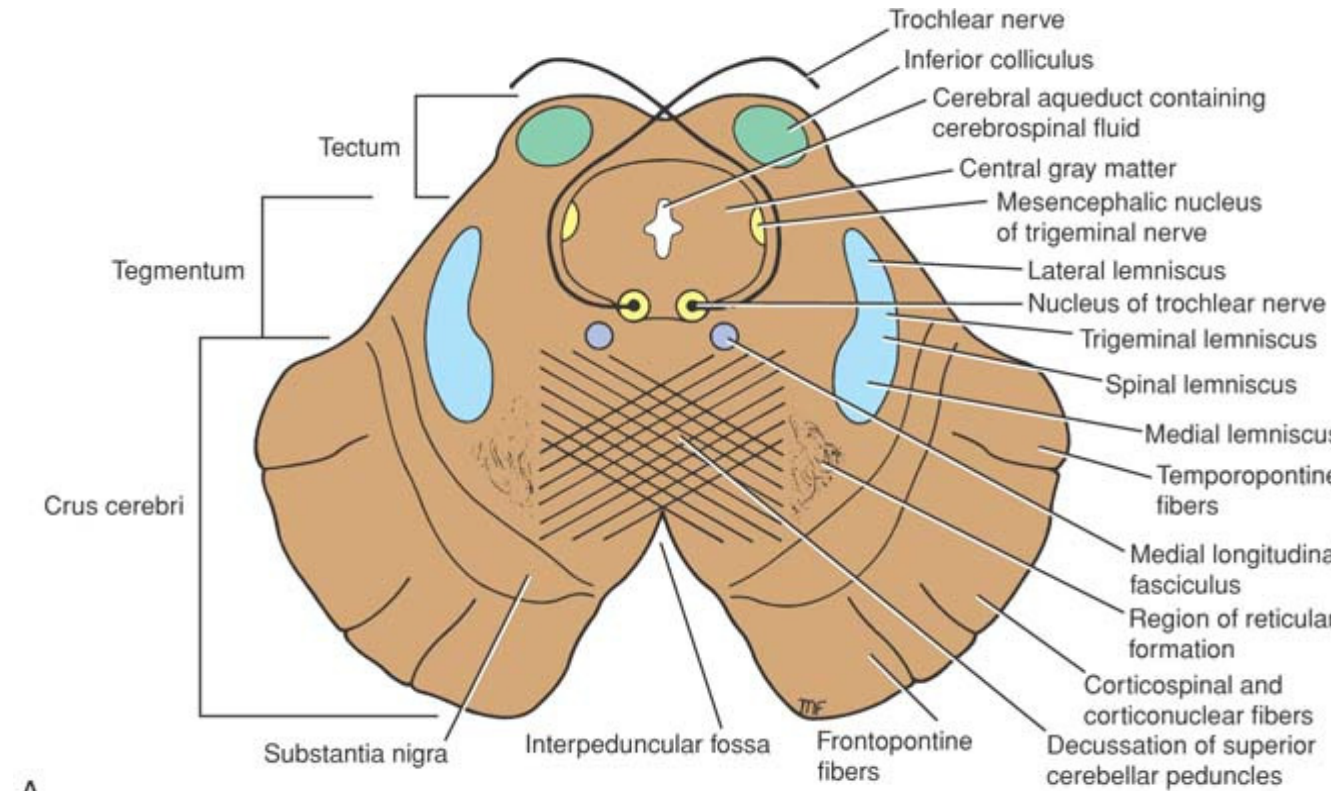
- Rounded mass of gray matter
- Situated bt cerebral aqueduct and substantia nigra
- Reddish blue(vascularity & iron containing pigment)
- Afferents from: cerebral cortex, cerebellum, substantia nigra, thalamic nuclei, spinal cord
- Efferent to: spinal cord, reticular formation, thalamus and substantia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



Crus cerebri

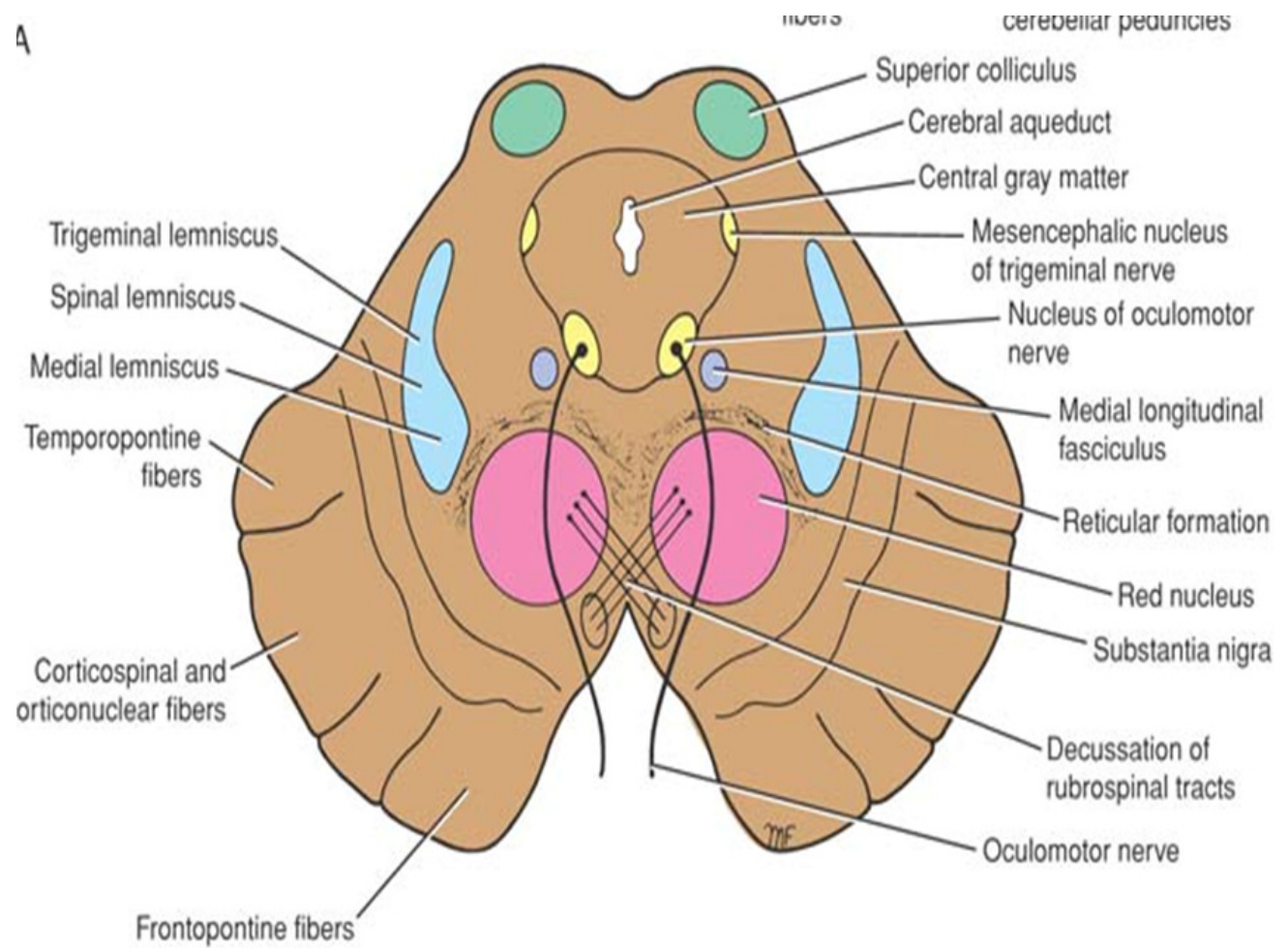
- Corticospinal & corticonuclear fibers (middle)
- Frontopontine fibers (medial)
- Temporopontine fibers (lateral)

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



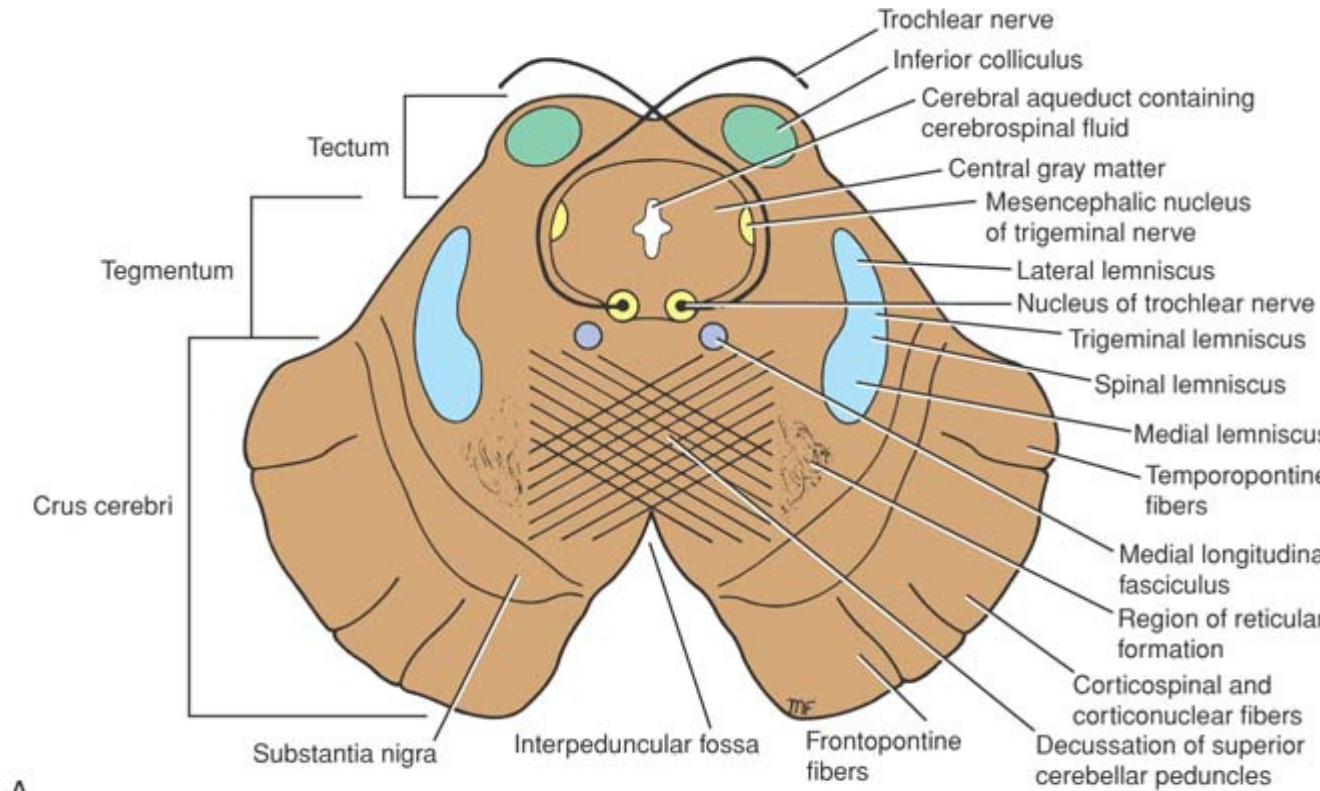
Level at superior colliculus

- 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

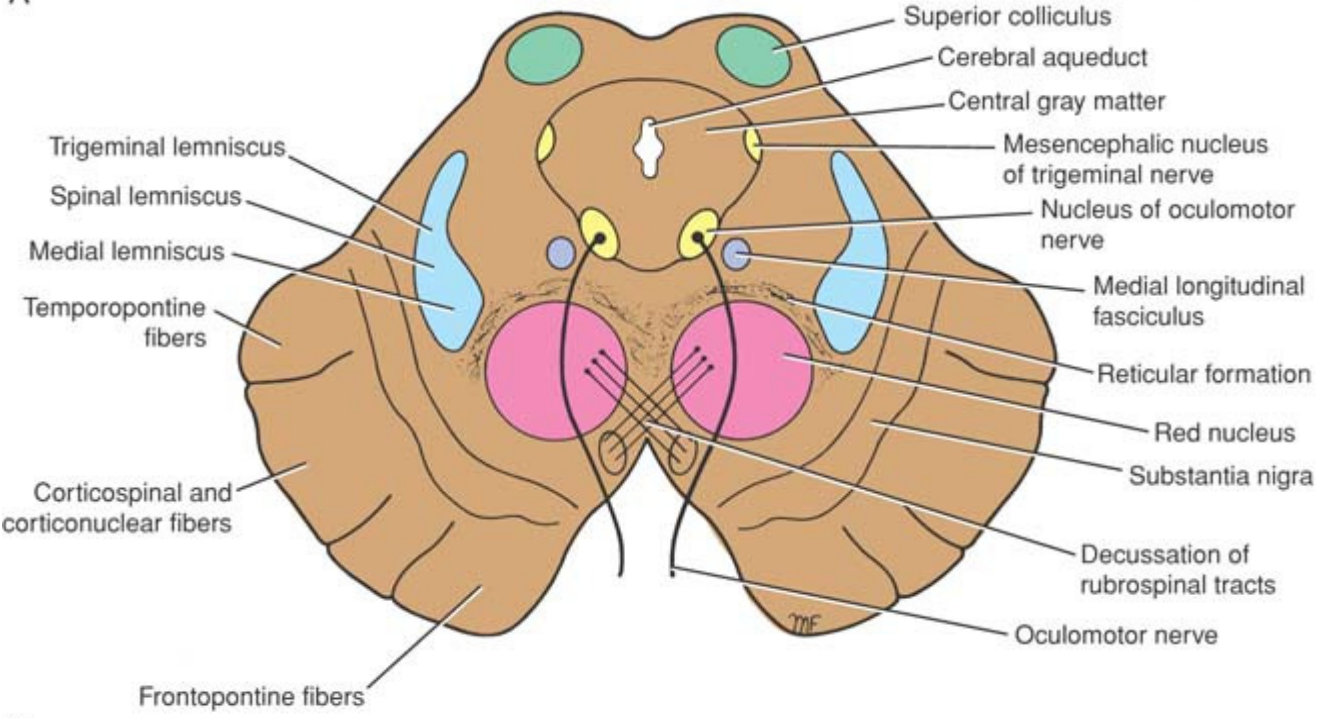


Substantia nigra

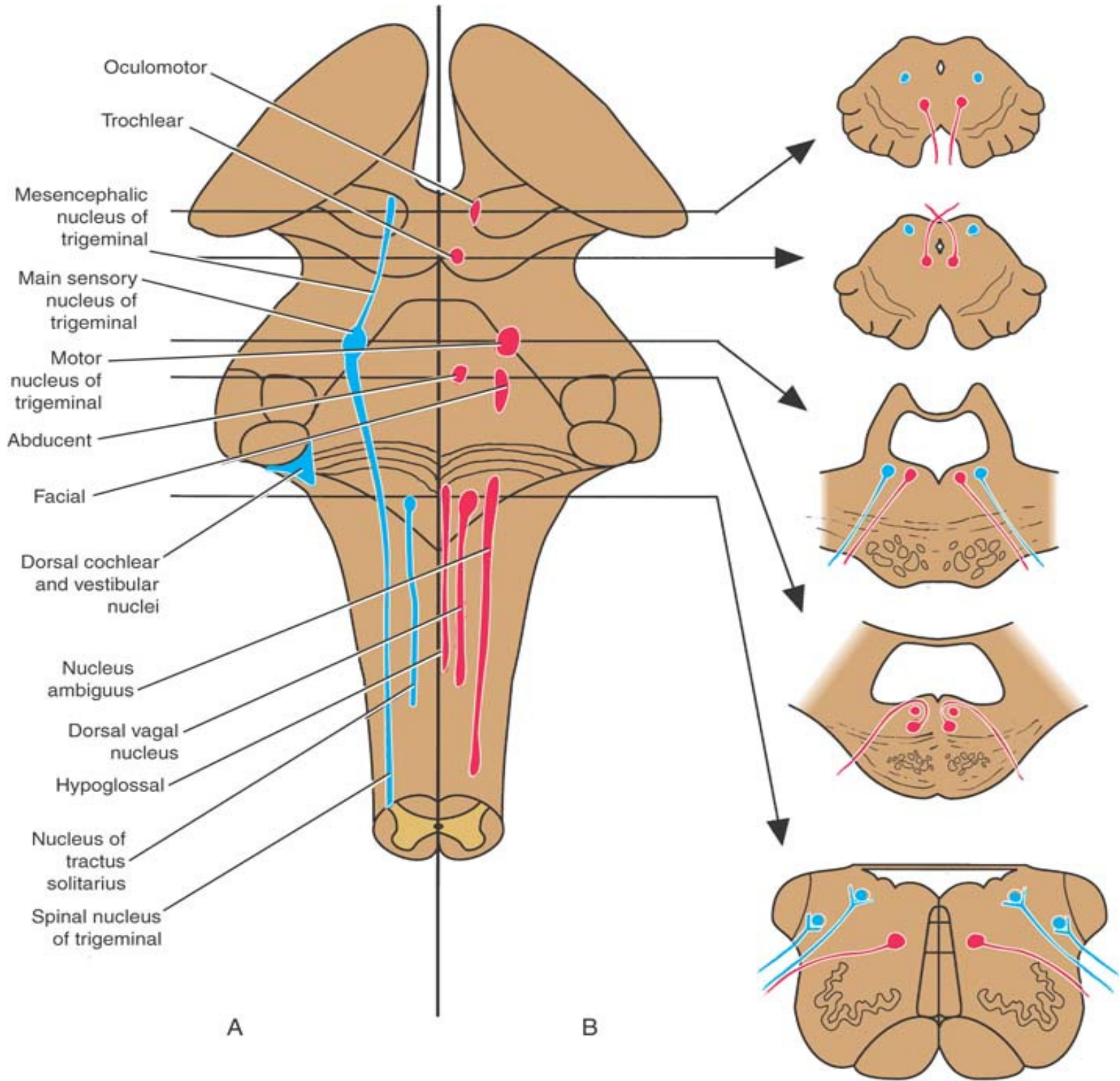
- Large motor nucleus
- is a brain structure located in the midbrain
- plays an important role in reward, addiction, and movement.
- *Substantia nigra* is Latin for "black substance" due to high levels of melanin
- has connections with basal ganglia ,cerebral cortex
- Concerned with muscle tone
- Parkinson's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



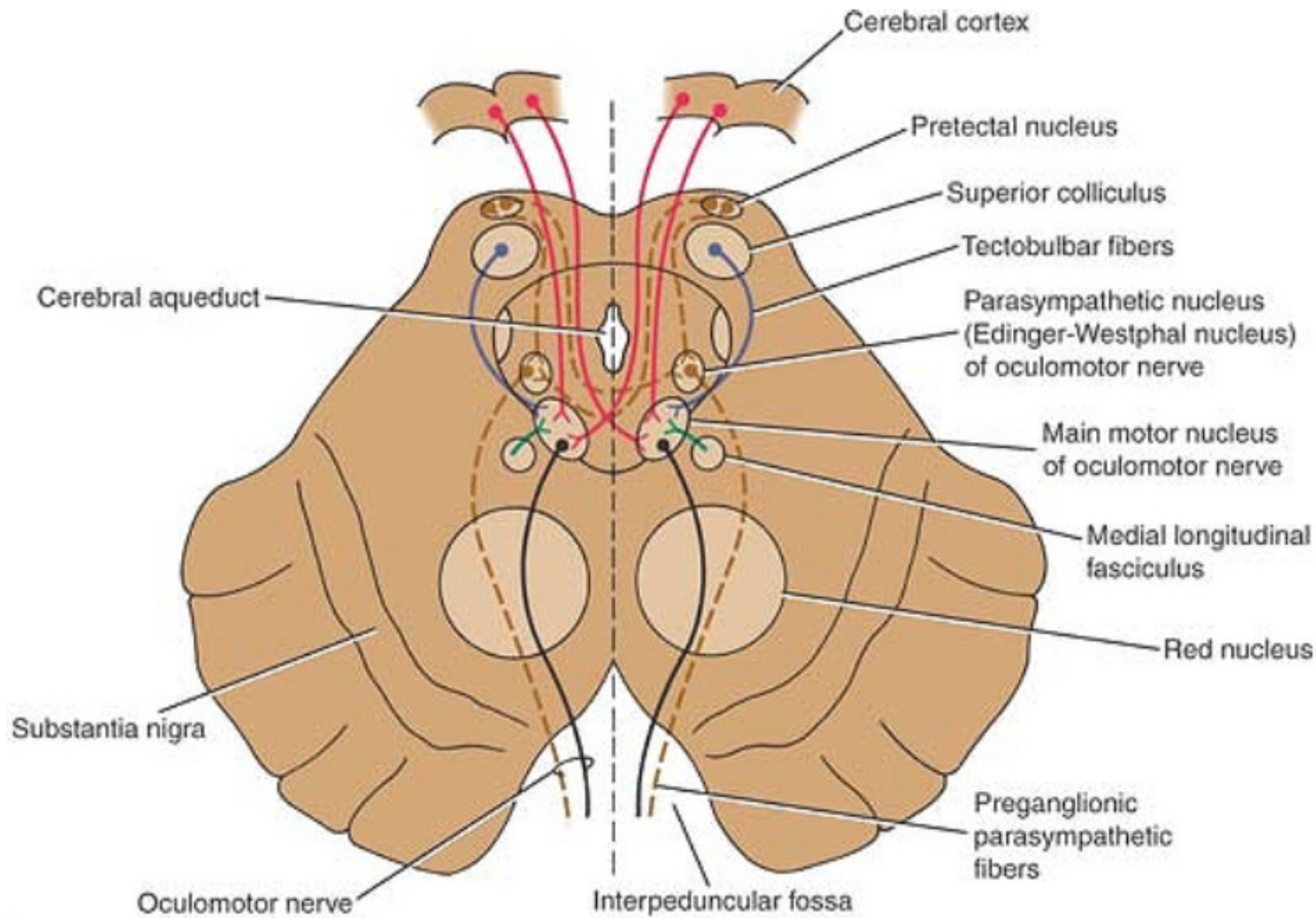
A



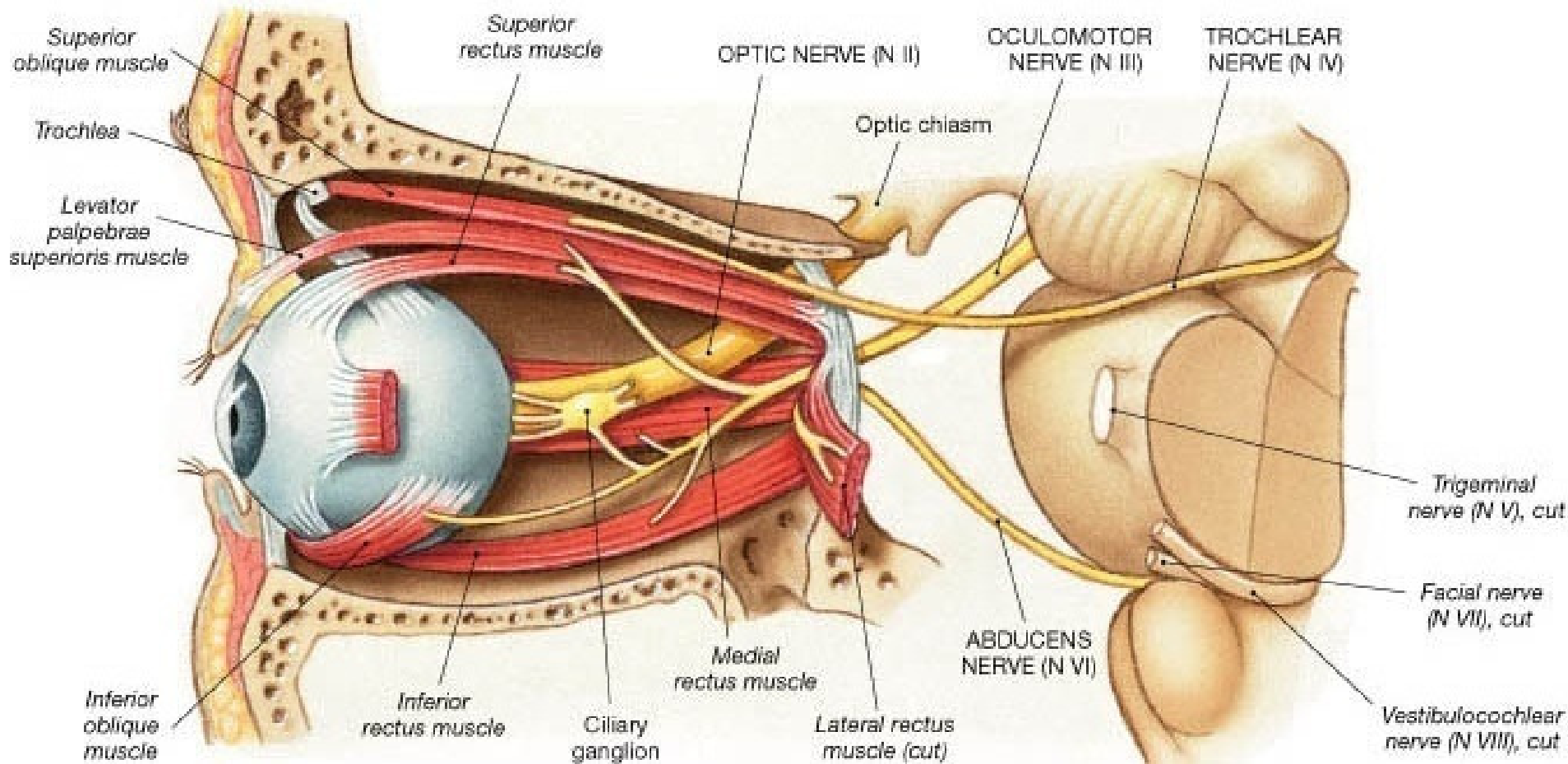
B



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

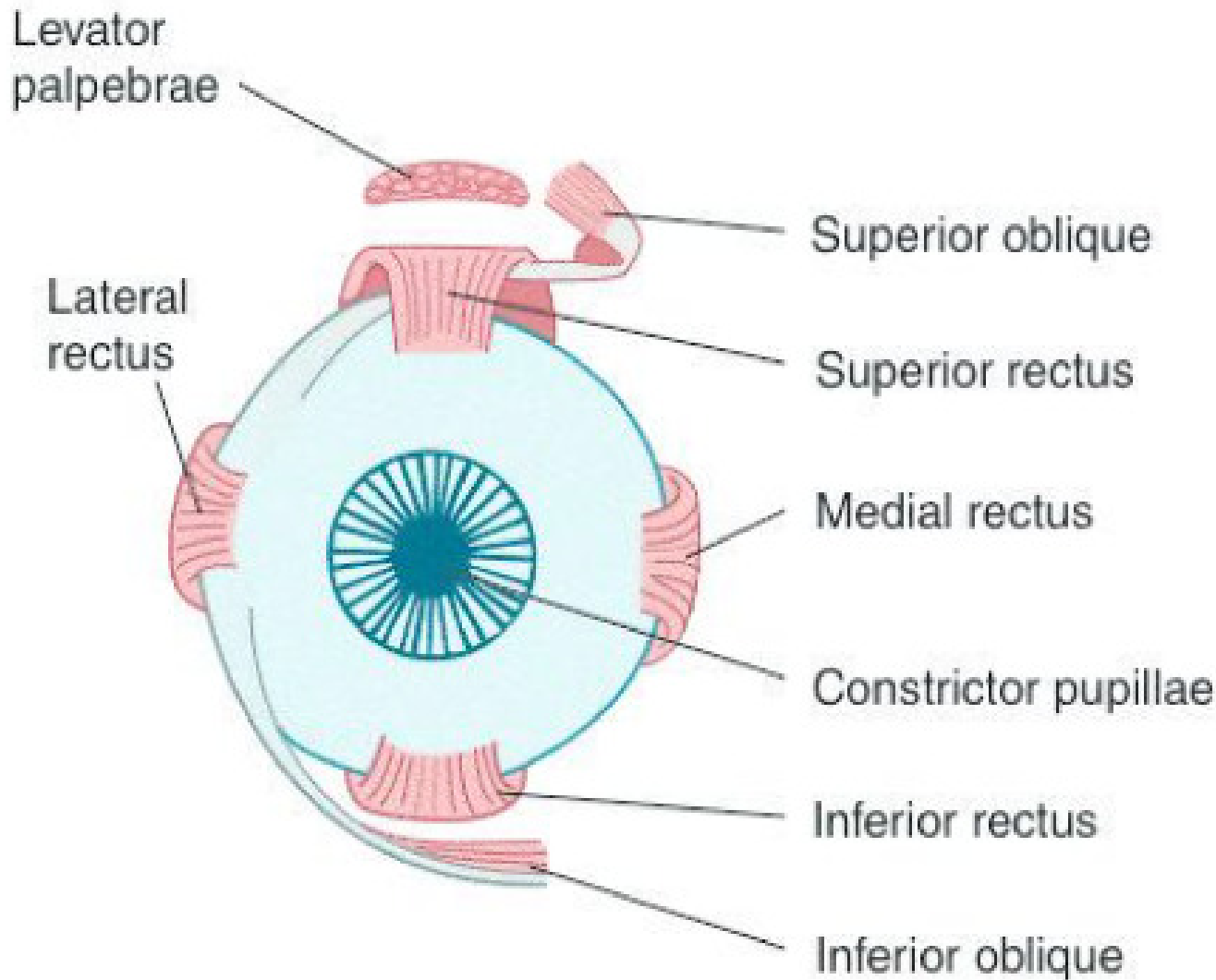
Oculomotor Nerve (III)

- **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



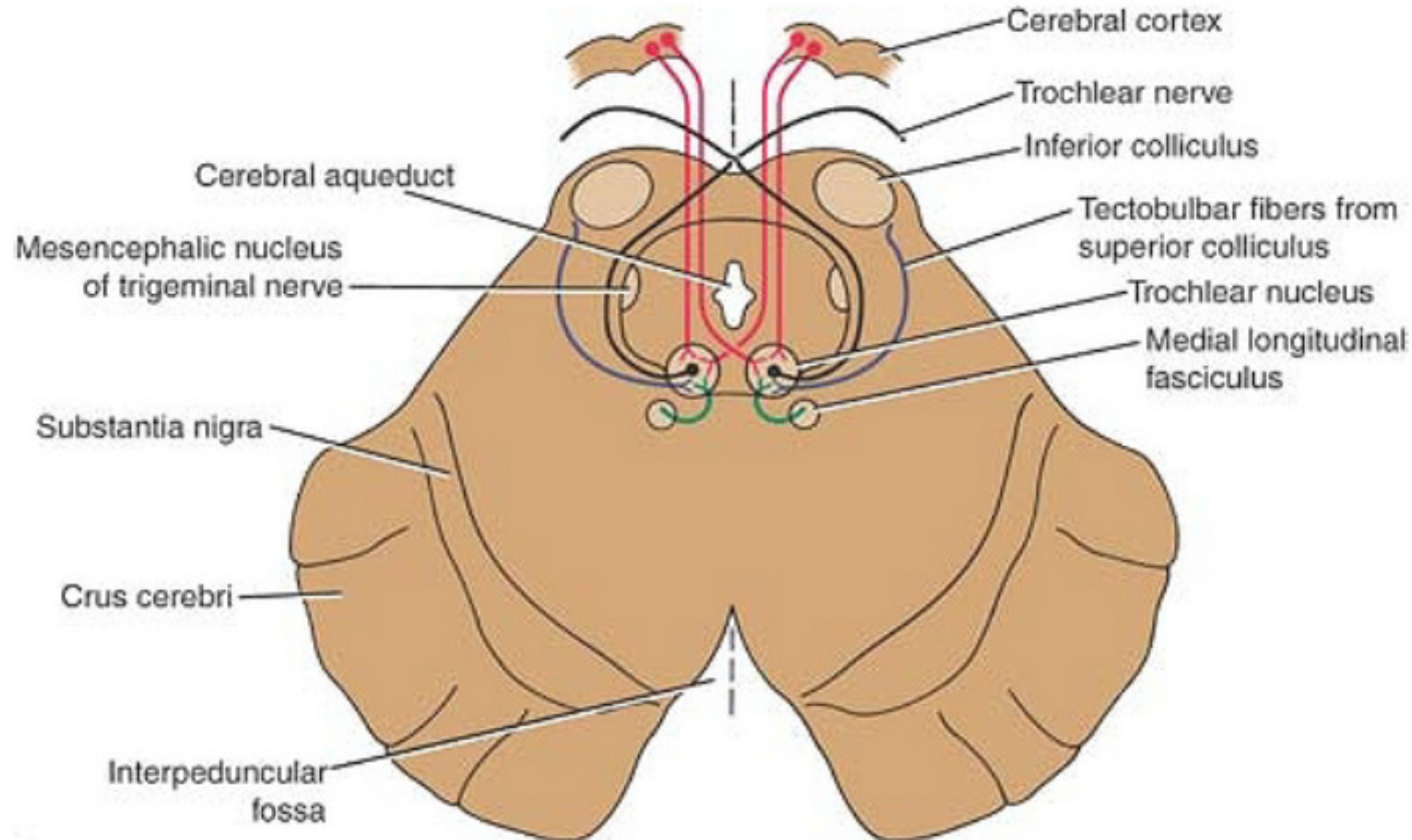
Double Vision

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

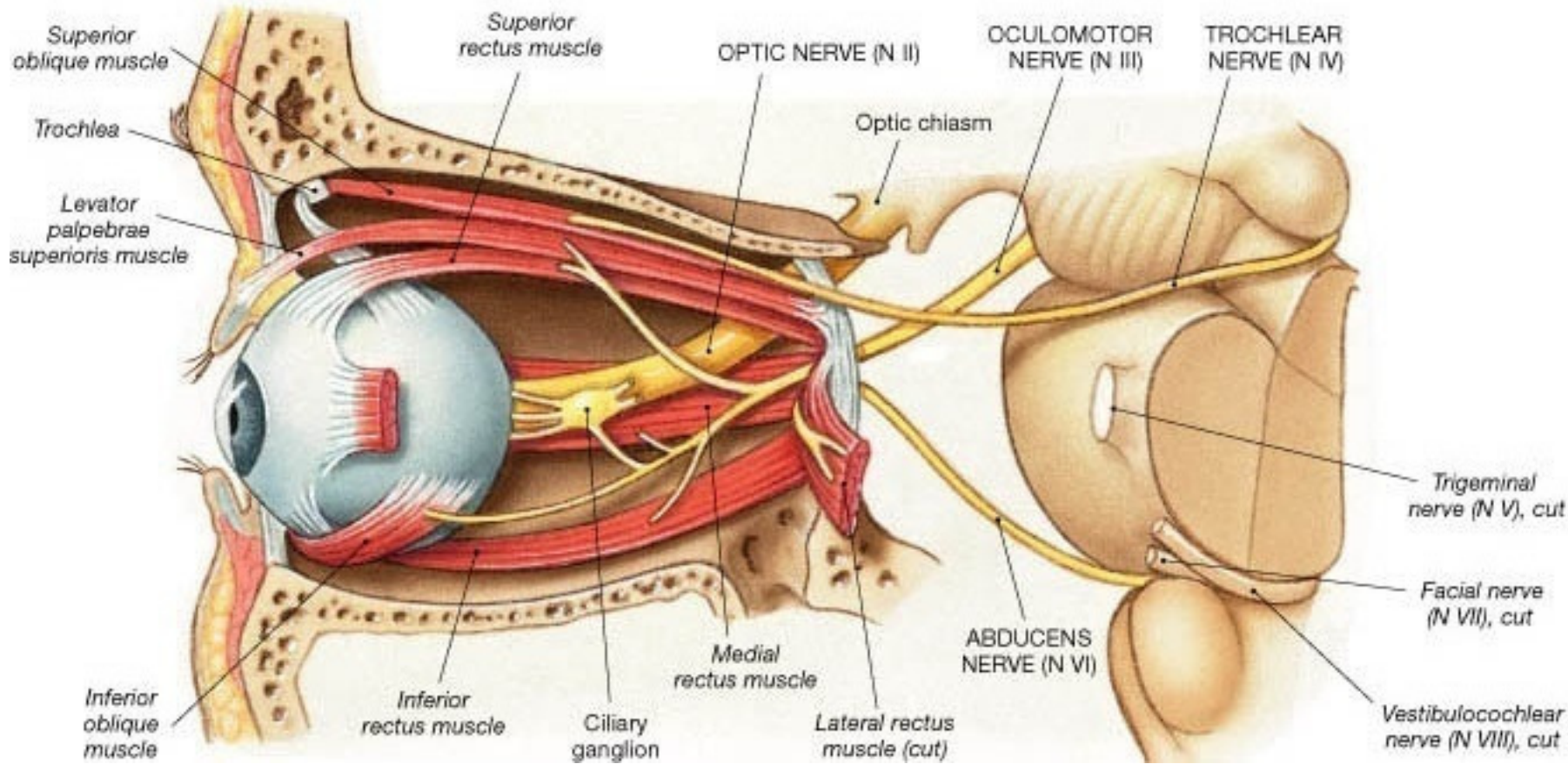
Trochlear Nerve

Nucleus

- **Location**

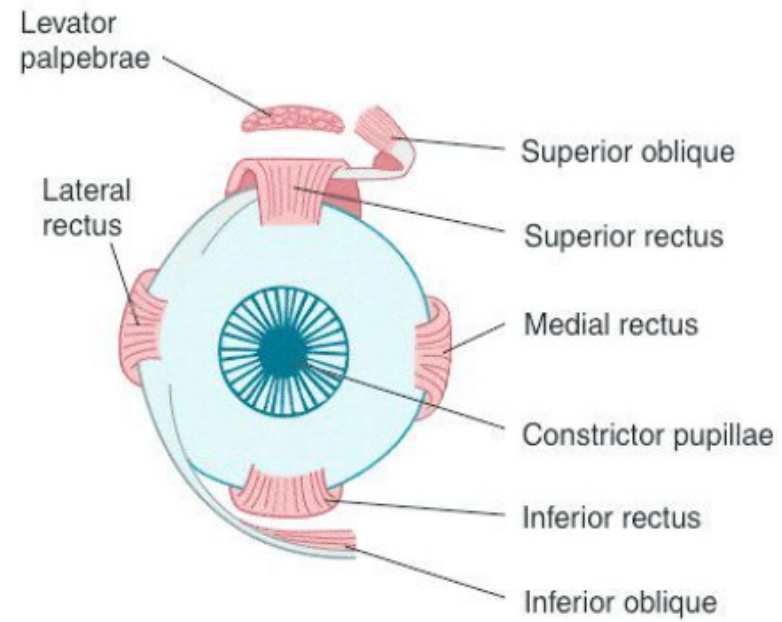


- Pass **posteriorly** around the central gray matter
- Immediately decussates



Trochlear Nerve

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



Trochlear Nerve injury

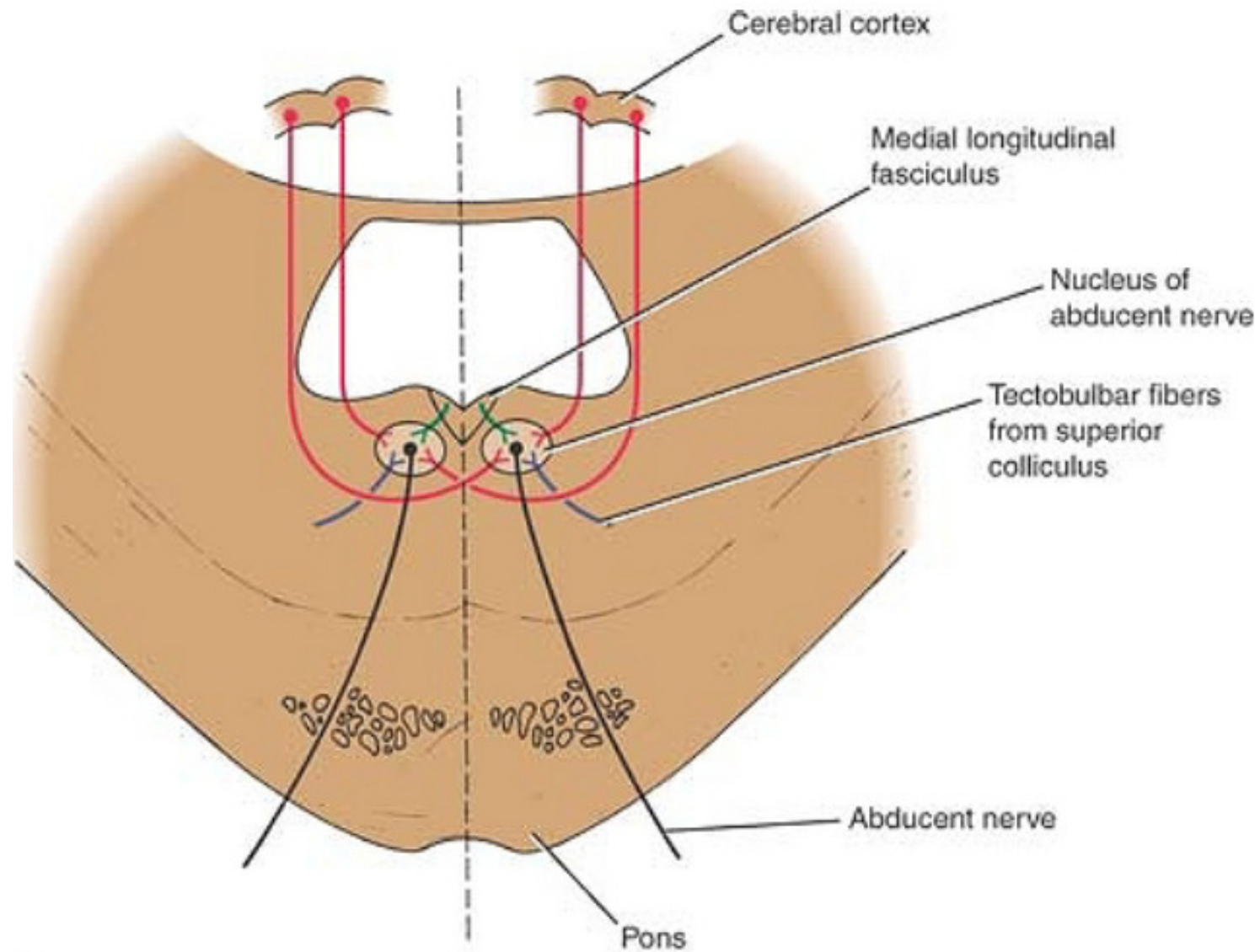
- Symptoms:
 - Diplopia
 - Difficulty in turning the eye downward and laterally.
 - Difficulty in descending stairs
 - Head tilt to the side opposite the paralysed eye (compensatory adjustment)

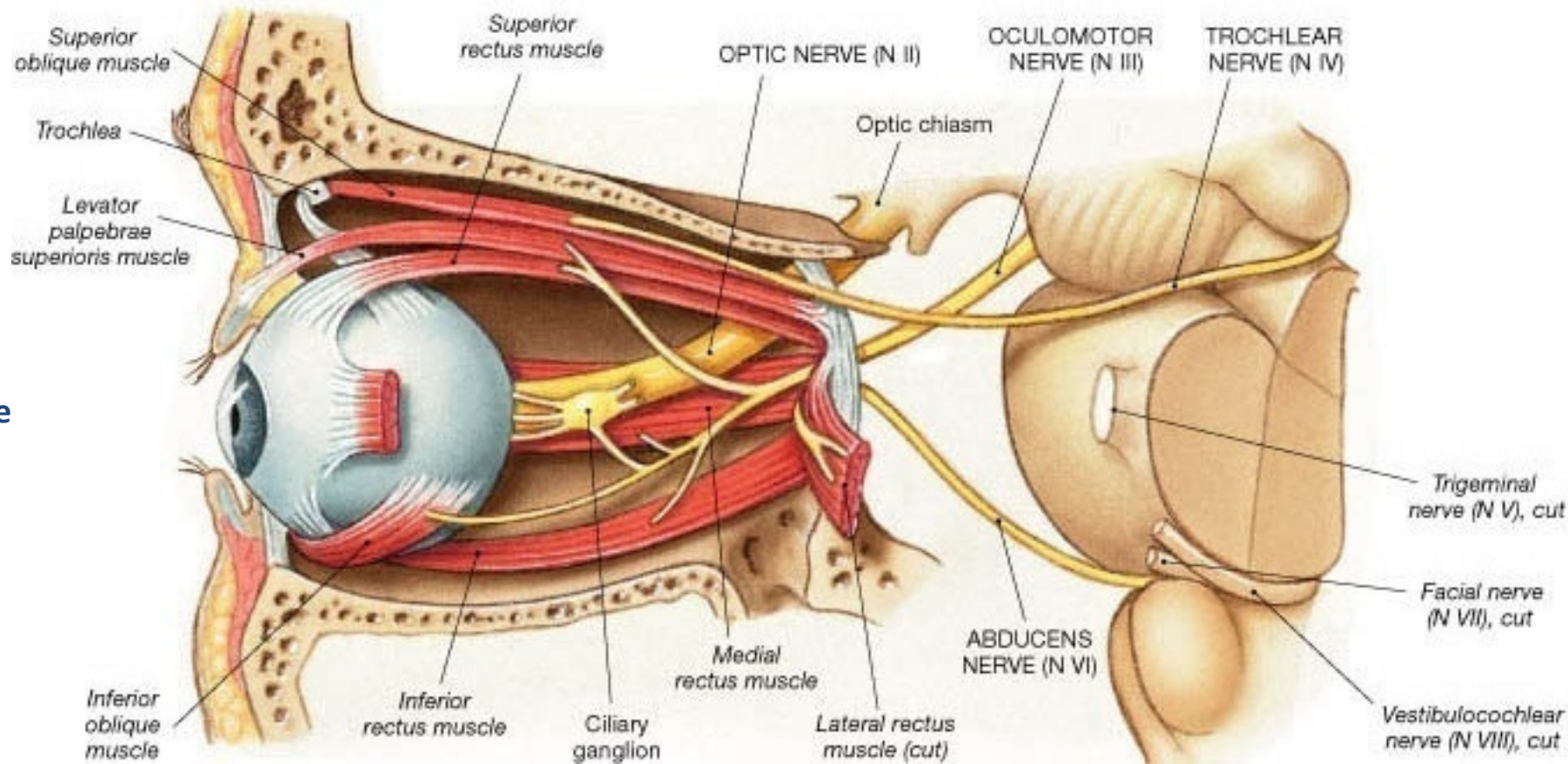


Abducent Nerve

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

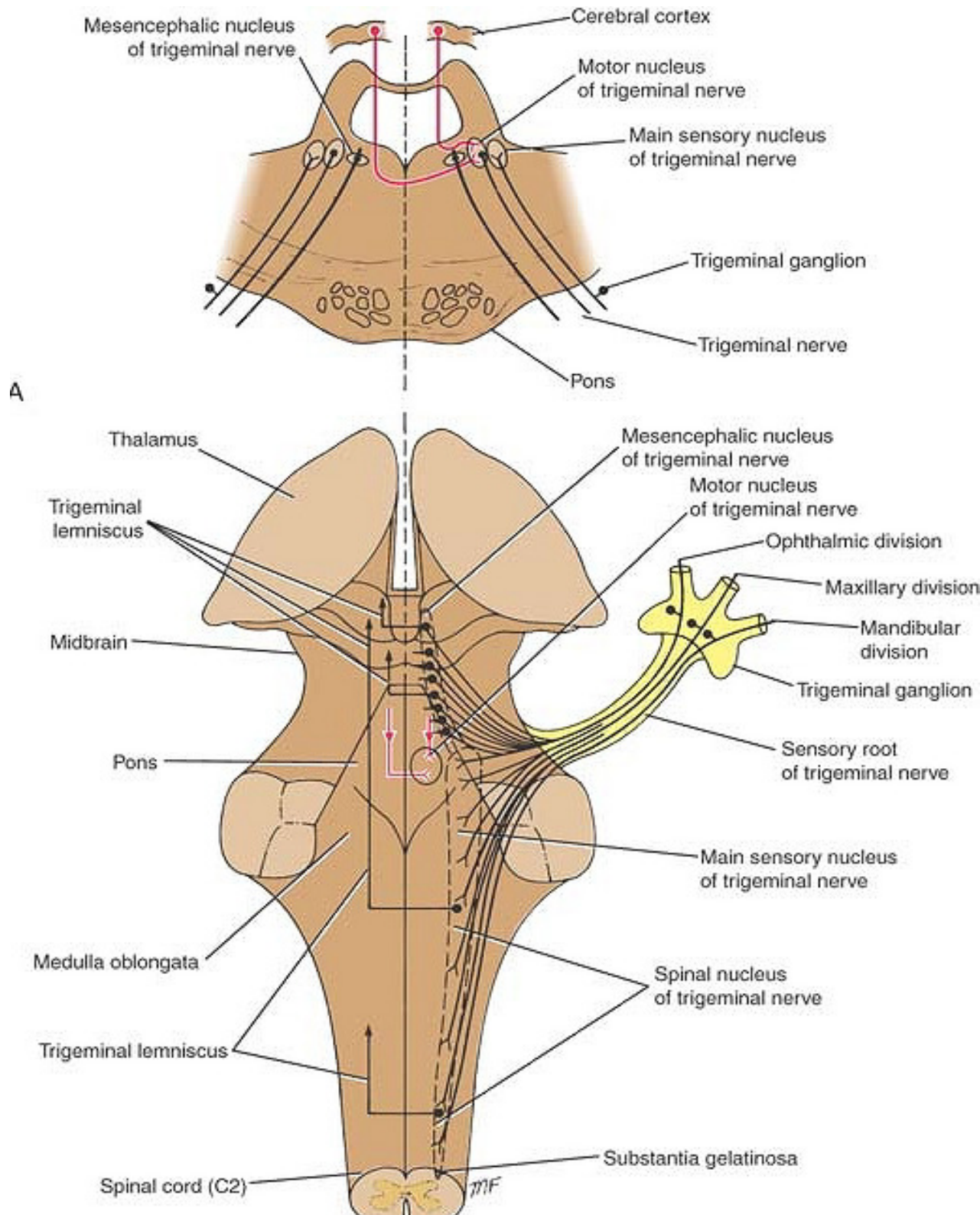
Abducent Nerve injury

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



Trigeminal Nerve Nuclei

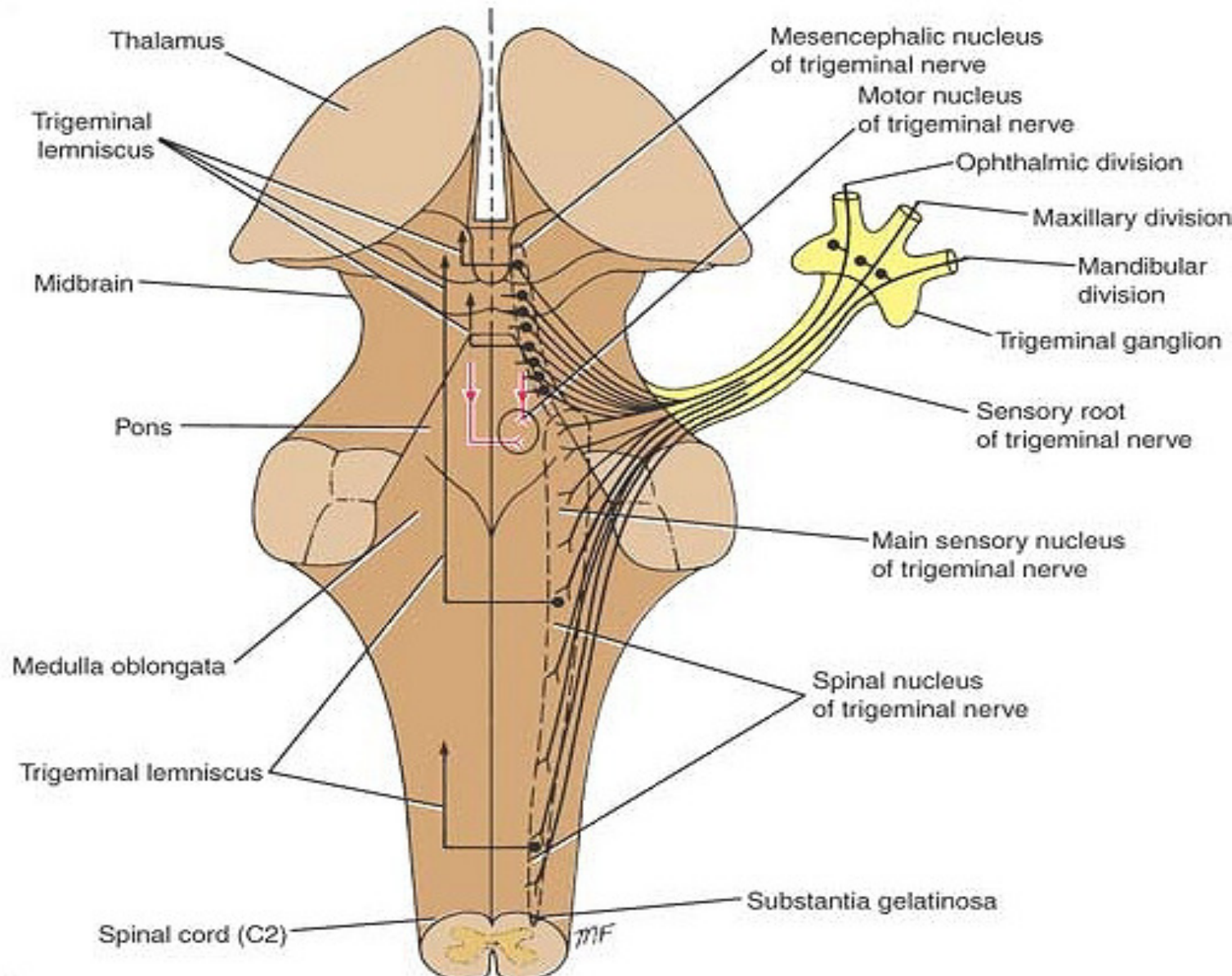
- **Main sensory nucleus**
 - Posterior part of the pons (lateral)
- **Motor nucleus**
 - Posterior part of the pons (Medial)
- **Spinal nucleus**
 - Superiorly: main sensory nucleus
 - Inferiorly: C2 segment
- **Mesencephalic nucleus**
 - Lateral part of the gray matter around the cerebral aqueduct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

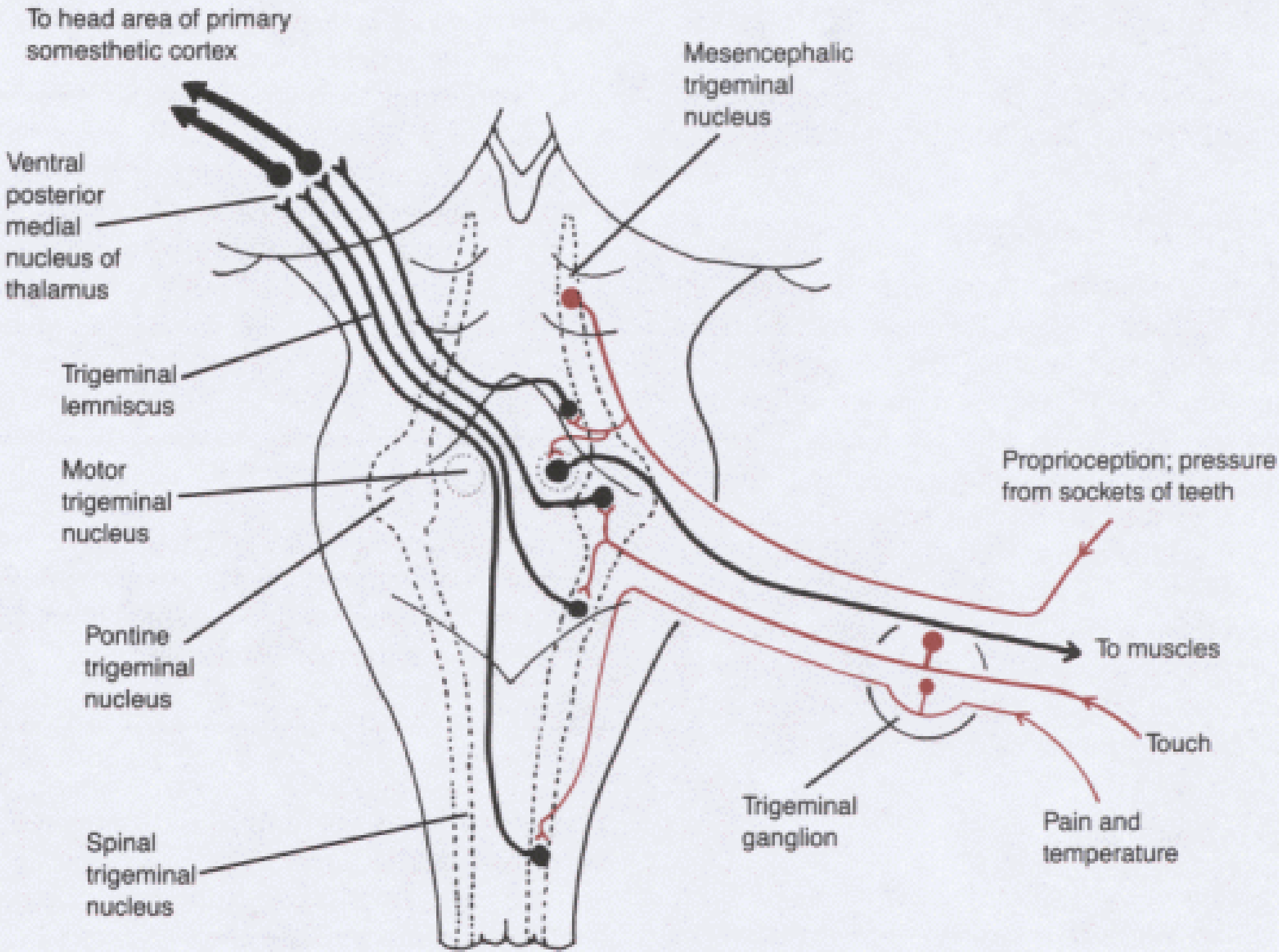


Sensory

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
- Main sensory nucleus: discriminative and light touch of the face as well as conscious proprioception, (similar to PCML)
- Spinal nucleus: crude touch, pain, and temperature (similar to ALS)
- Mesencephalic nucleus: reflex proprioception of the periodontal ligament and of the muscles of mastication in the jaw





Motor

Components

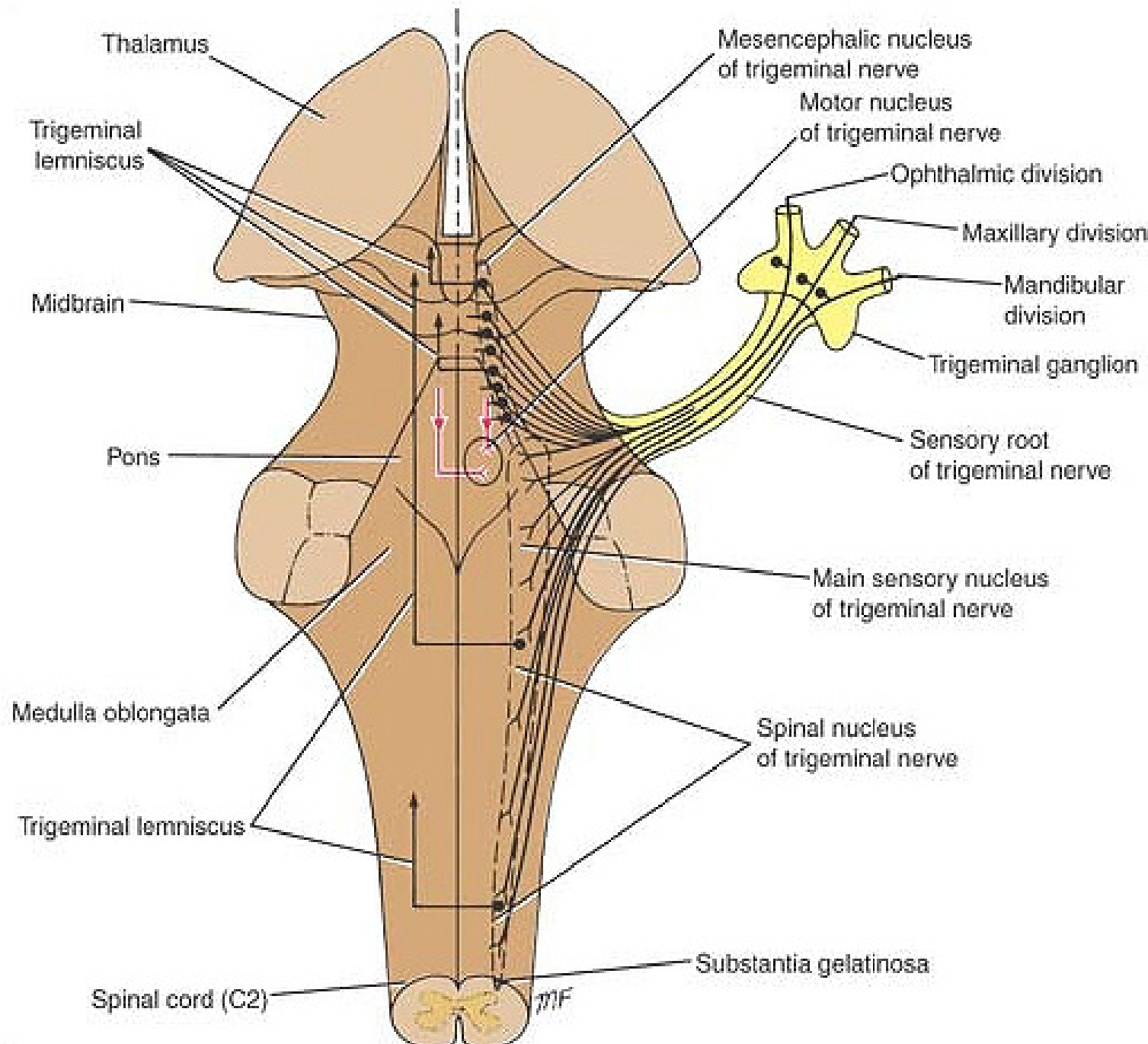
- Motor nucleus receives

- Corticonuclear fibers
- Red nucleus
- Reticular formation
- Tectum

Supplies

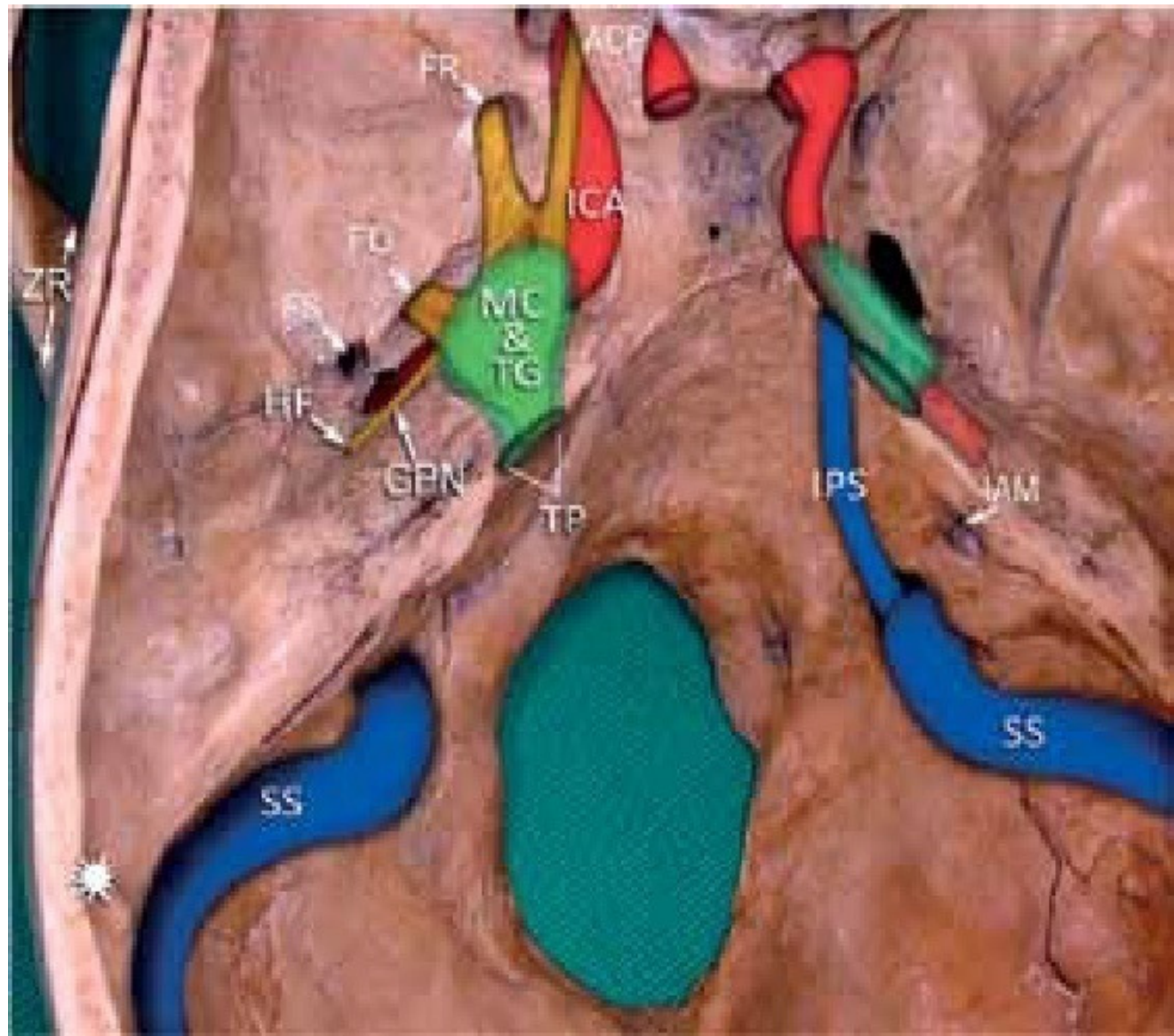
- Muscles of mastication
- Tensor tympani

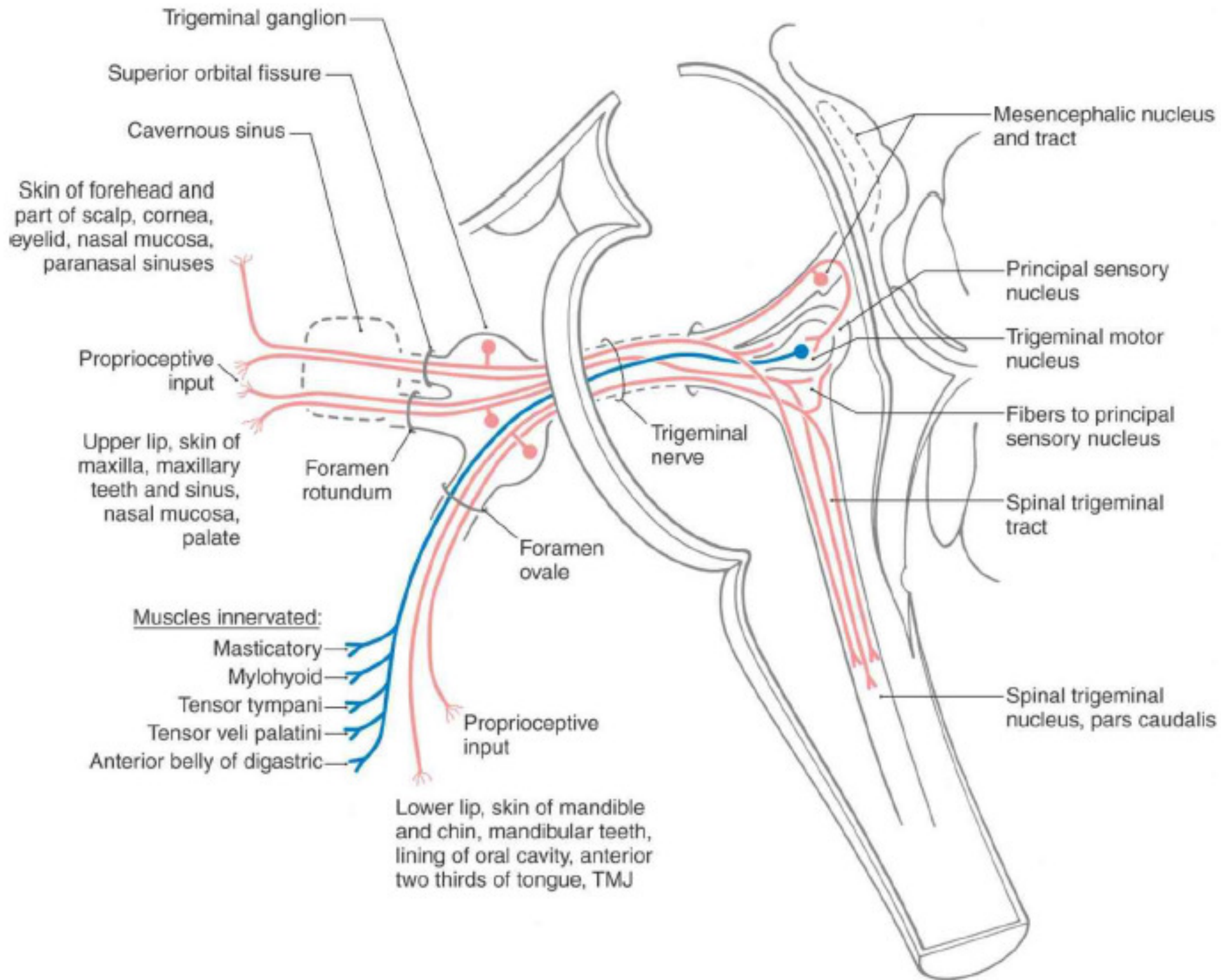
- Tensor veli palatini
- Mylohyoid
- Anterior belly of the digastric muscle

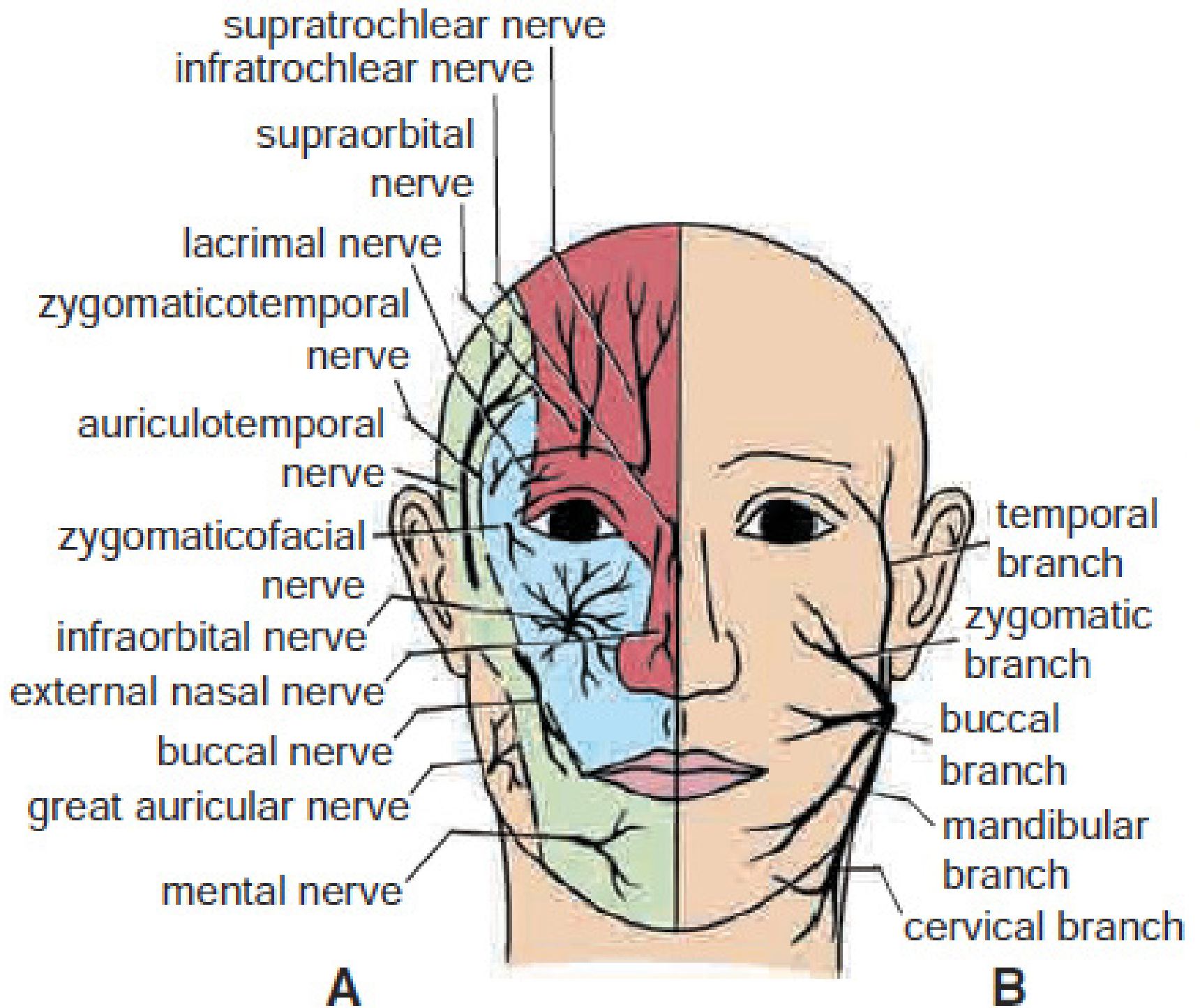


Course of V

- 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

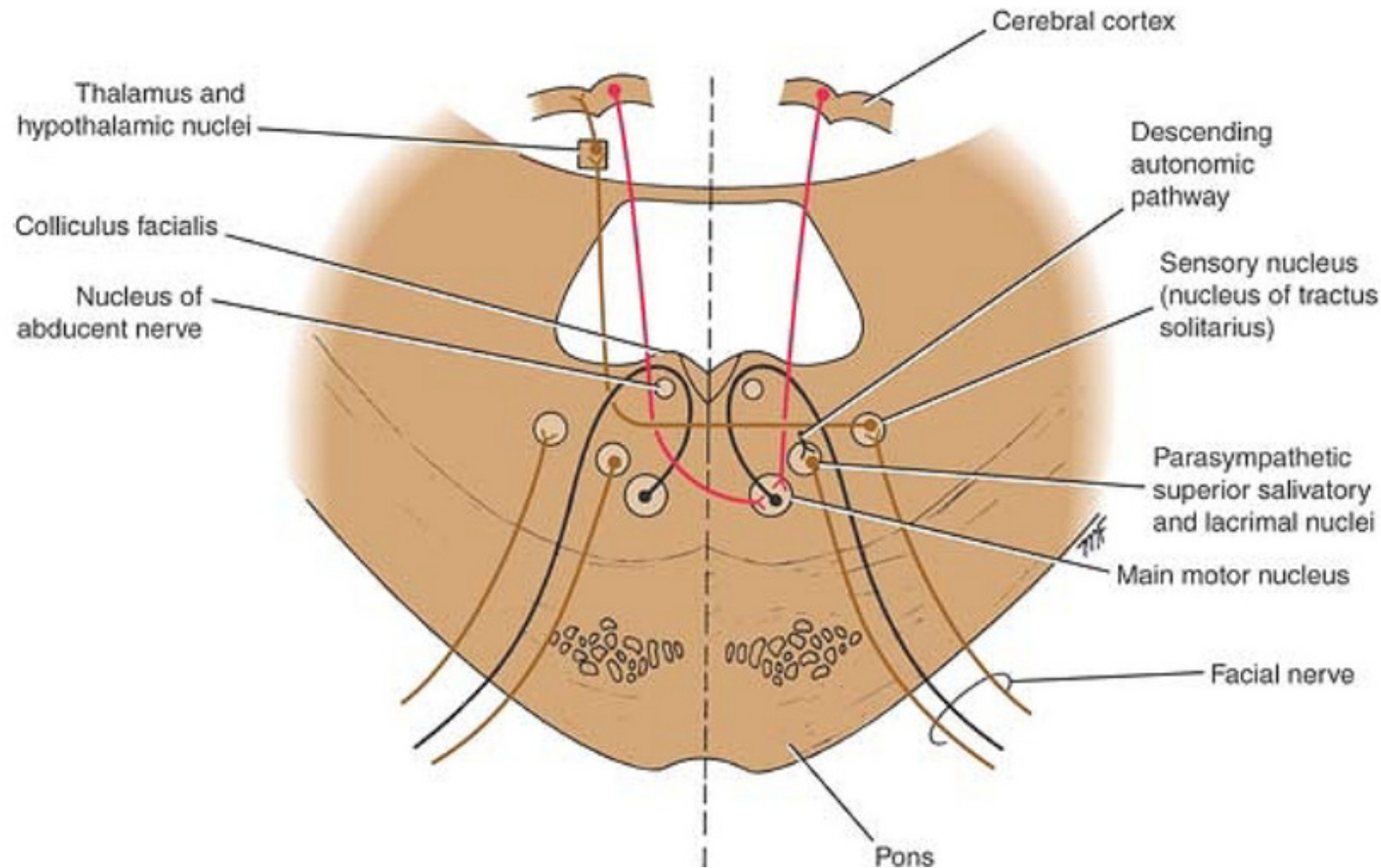






Facial Nerve Nuclei

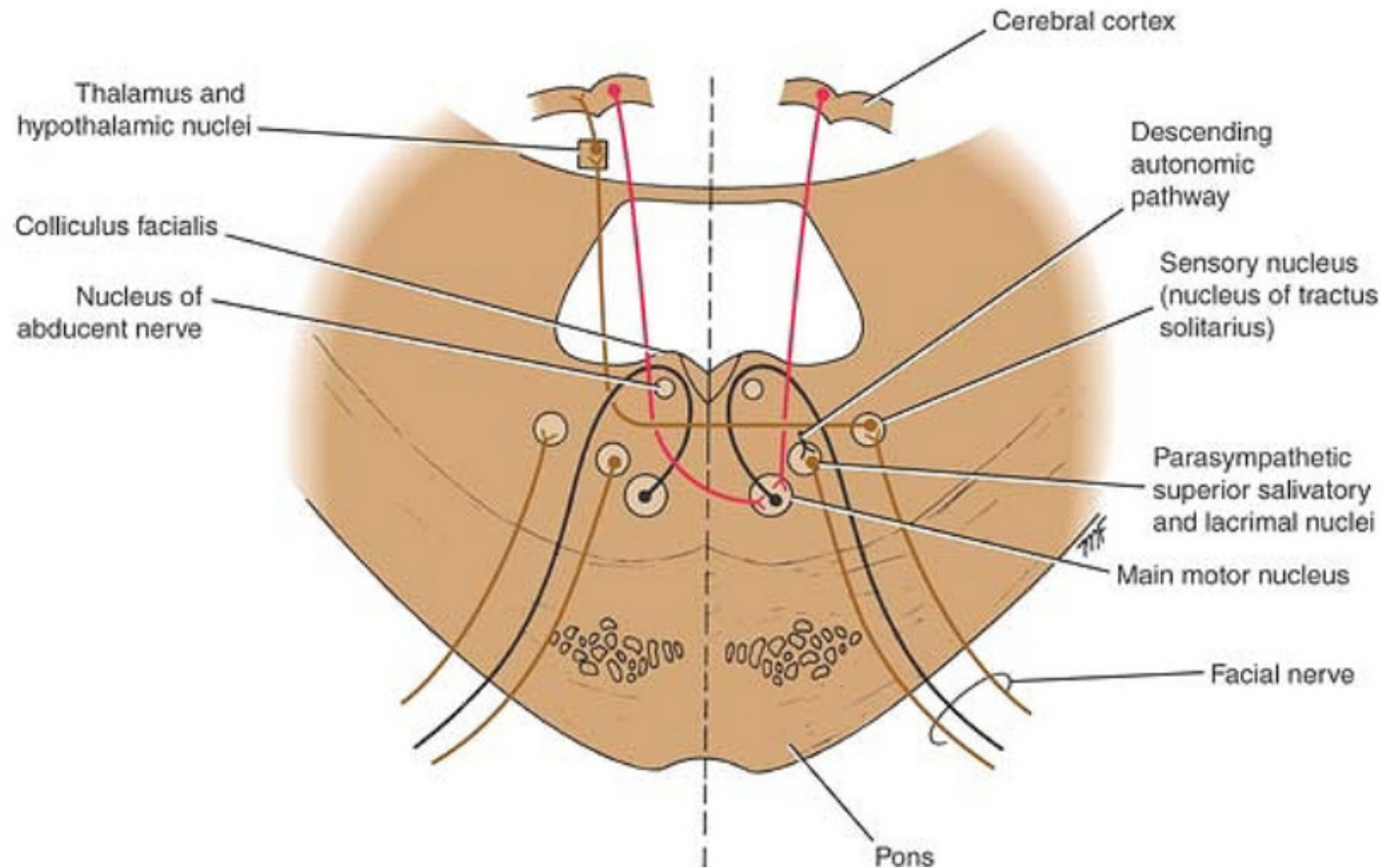
- **Main Motor Nucleus**
- Deep in the reticular formation of the lower part of the pons
- The part of the nucleus that supplies
 - **Upper part** of the face receives corticonuclear fibers from **both** hemispheres.
 - **lower part** of the face receives only corticonuclear fibers from the **opposite**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

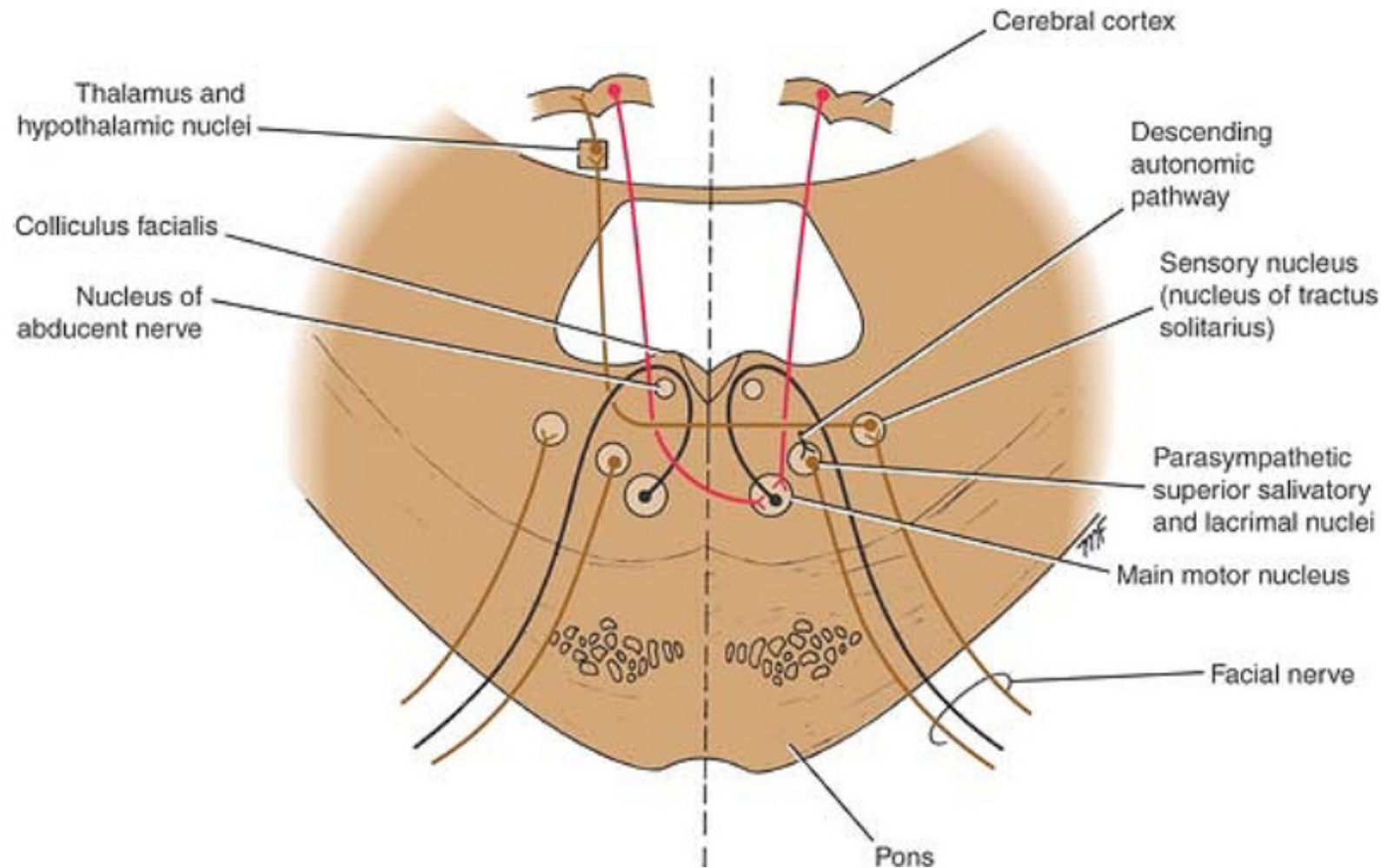


Facial Nerve Nuclei

Sensory Nucleus: Taste

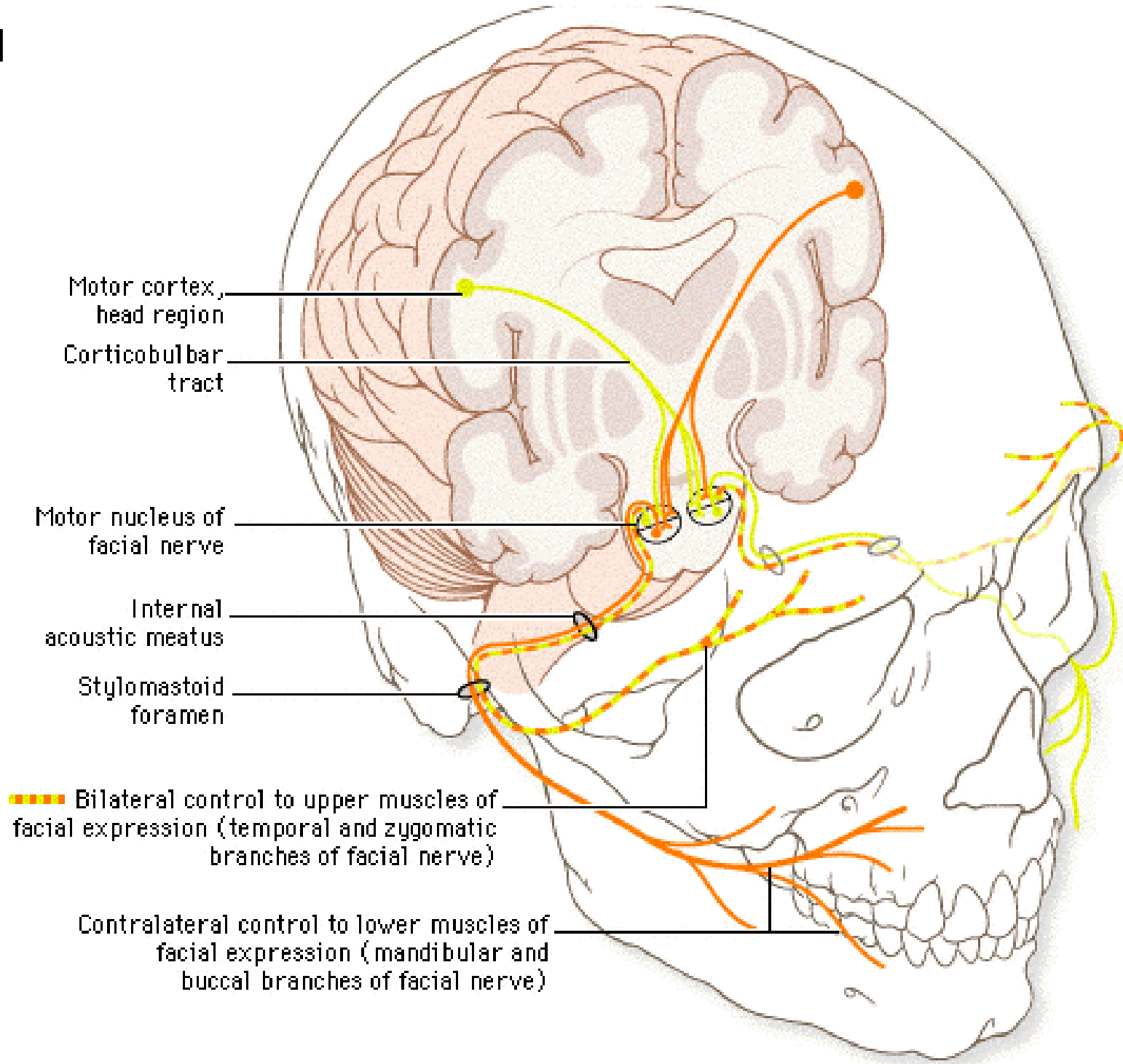
- **Location:** upper part of the nucleus of the tractus solitarius
- Sensations of taste

- Cell bodies in geniculate ganglion
- Sensory Nucleus
- VPM
- Primary gustatory cortex (area 43)



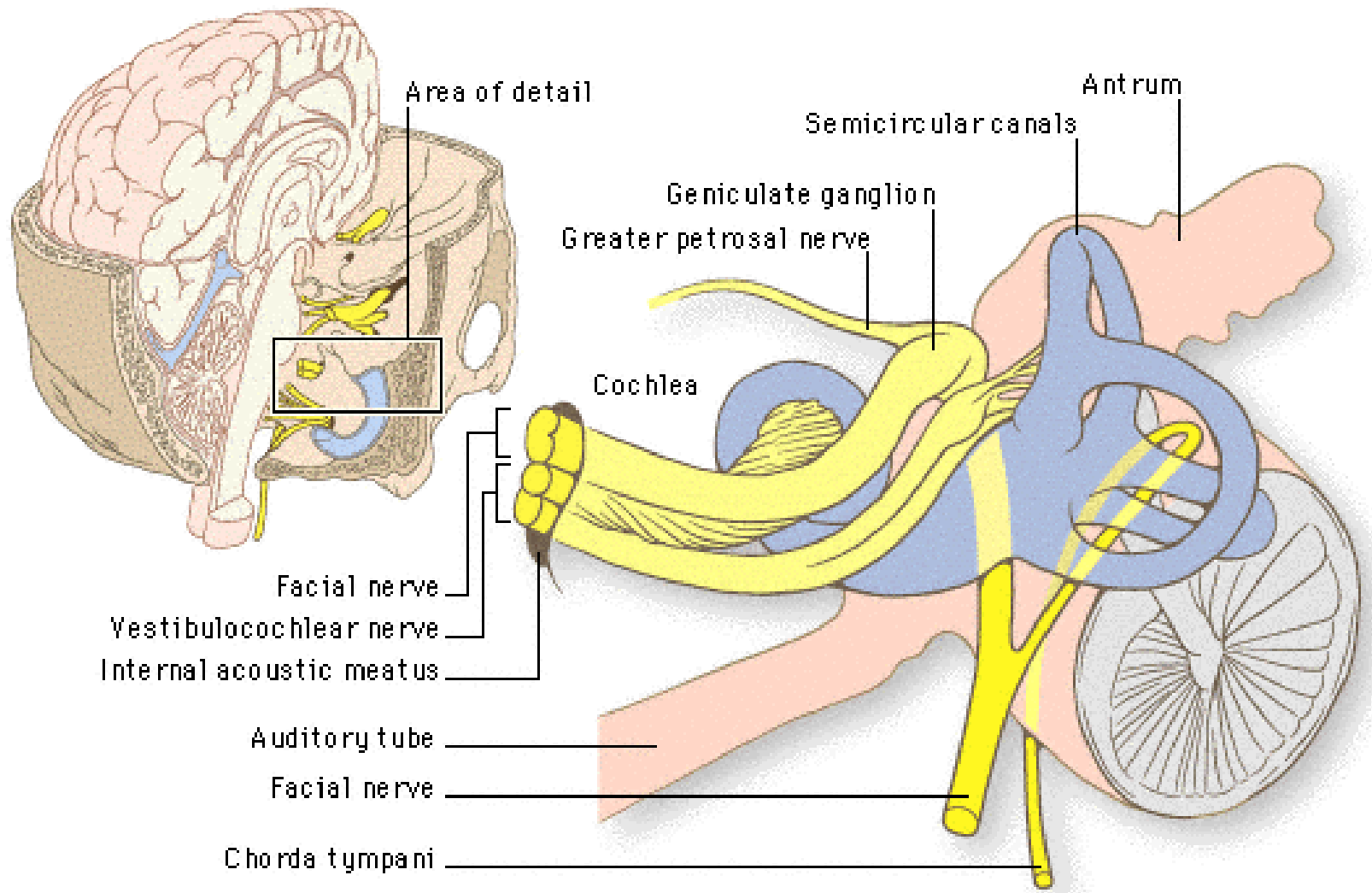
Course of VII

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



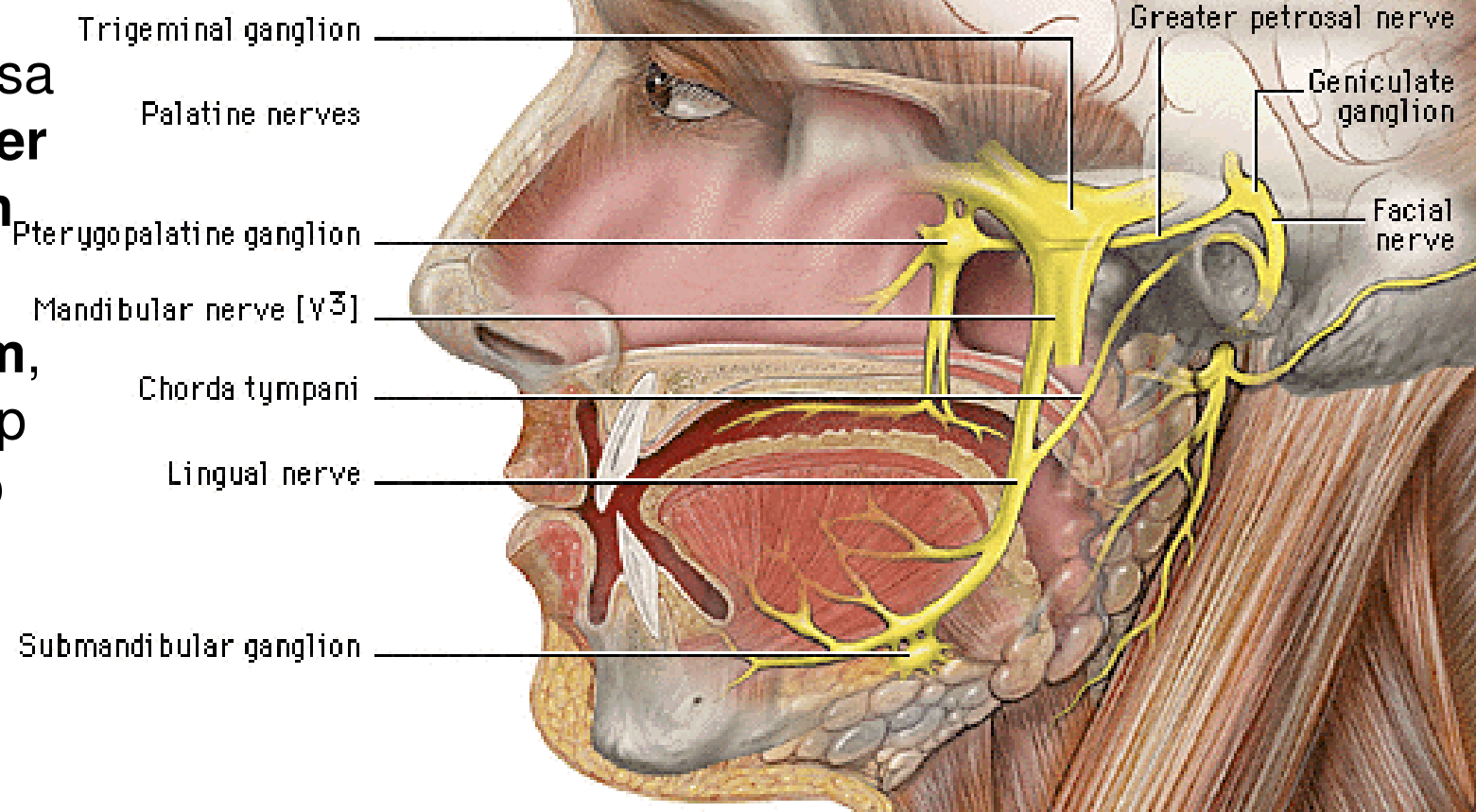
Course of VII

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



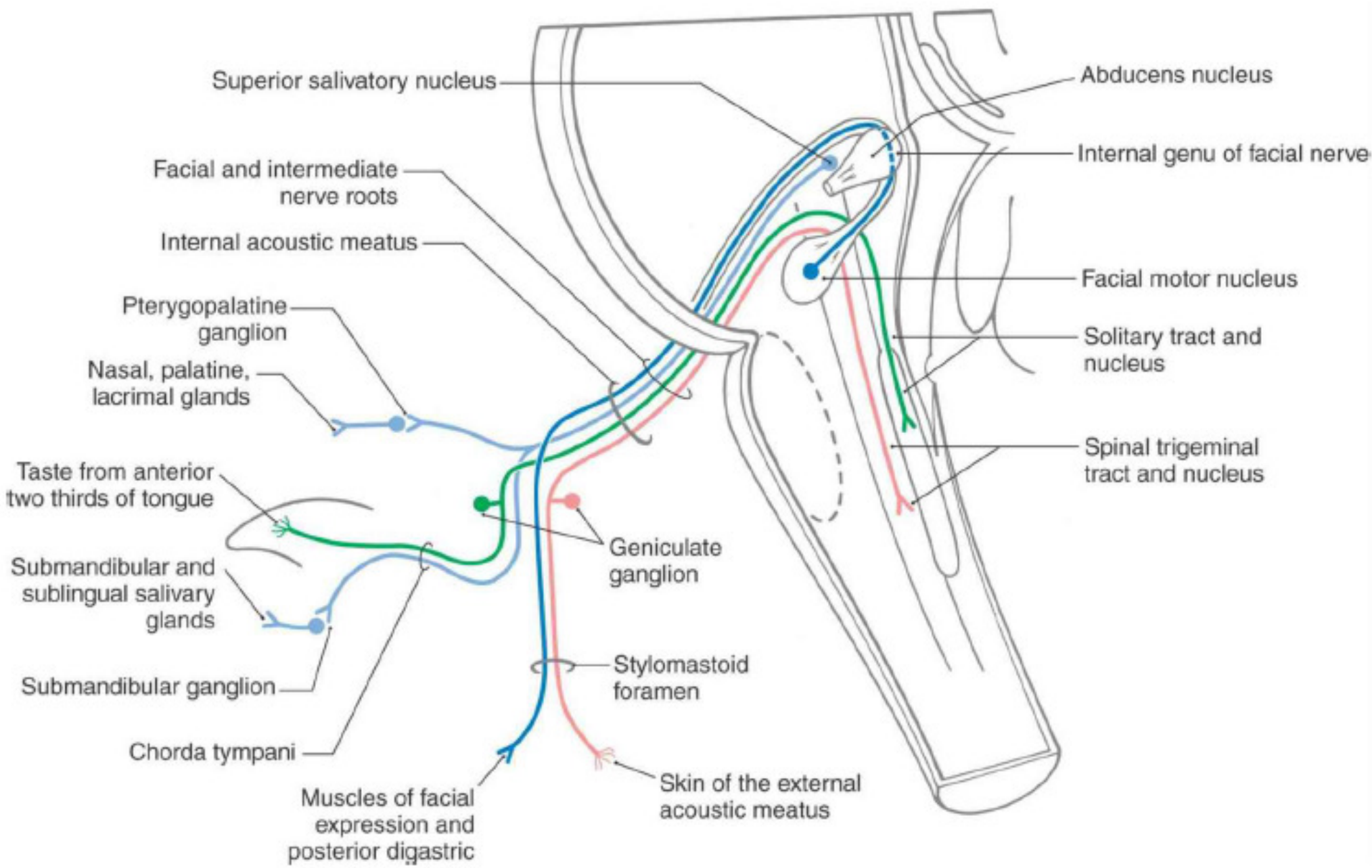
greater petrosal nerve

- 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



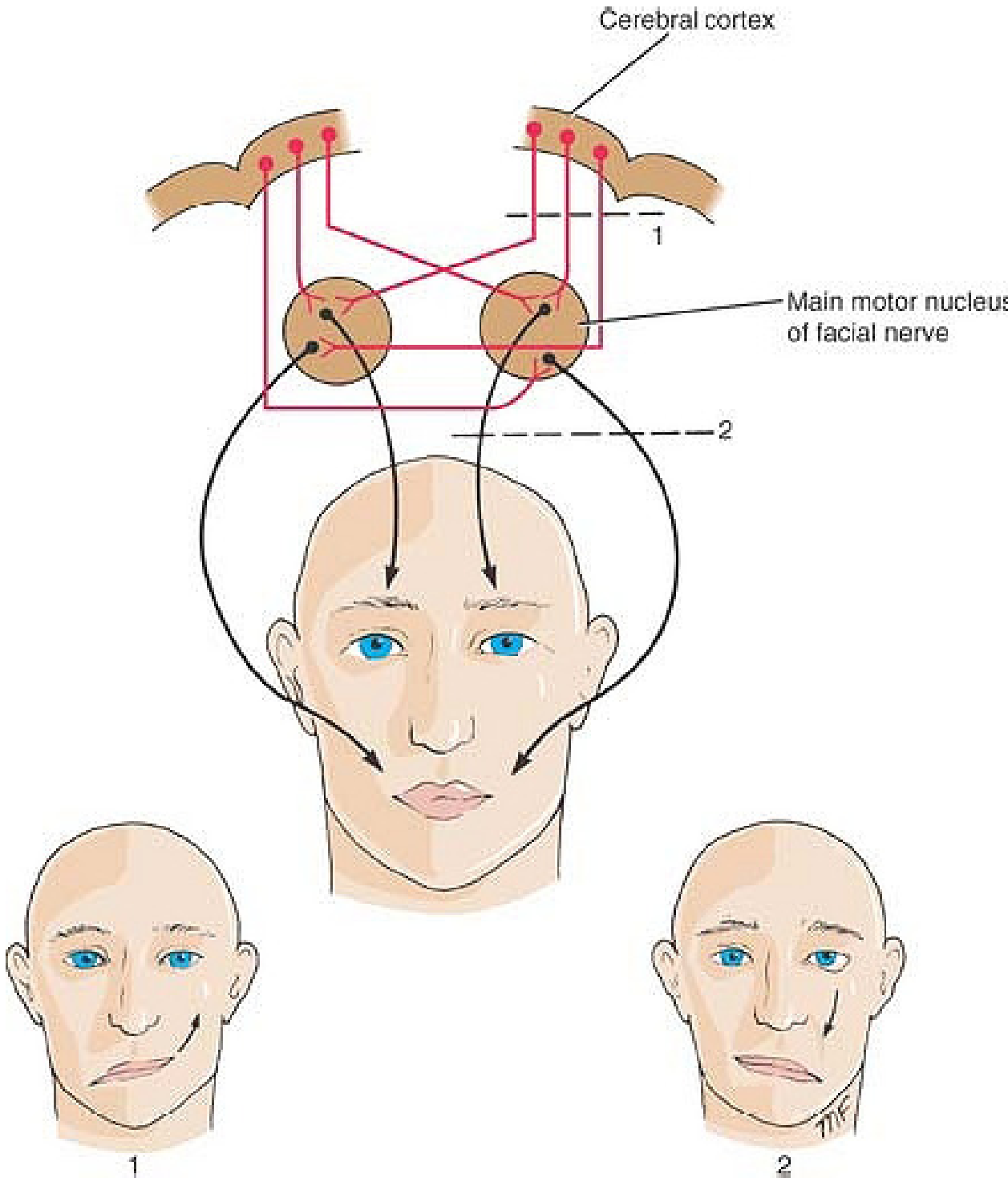
The chorda tympani nerve

- 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



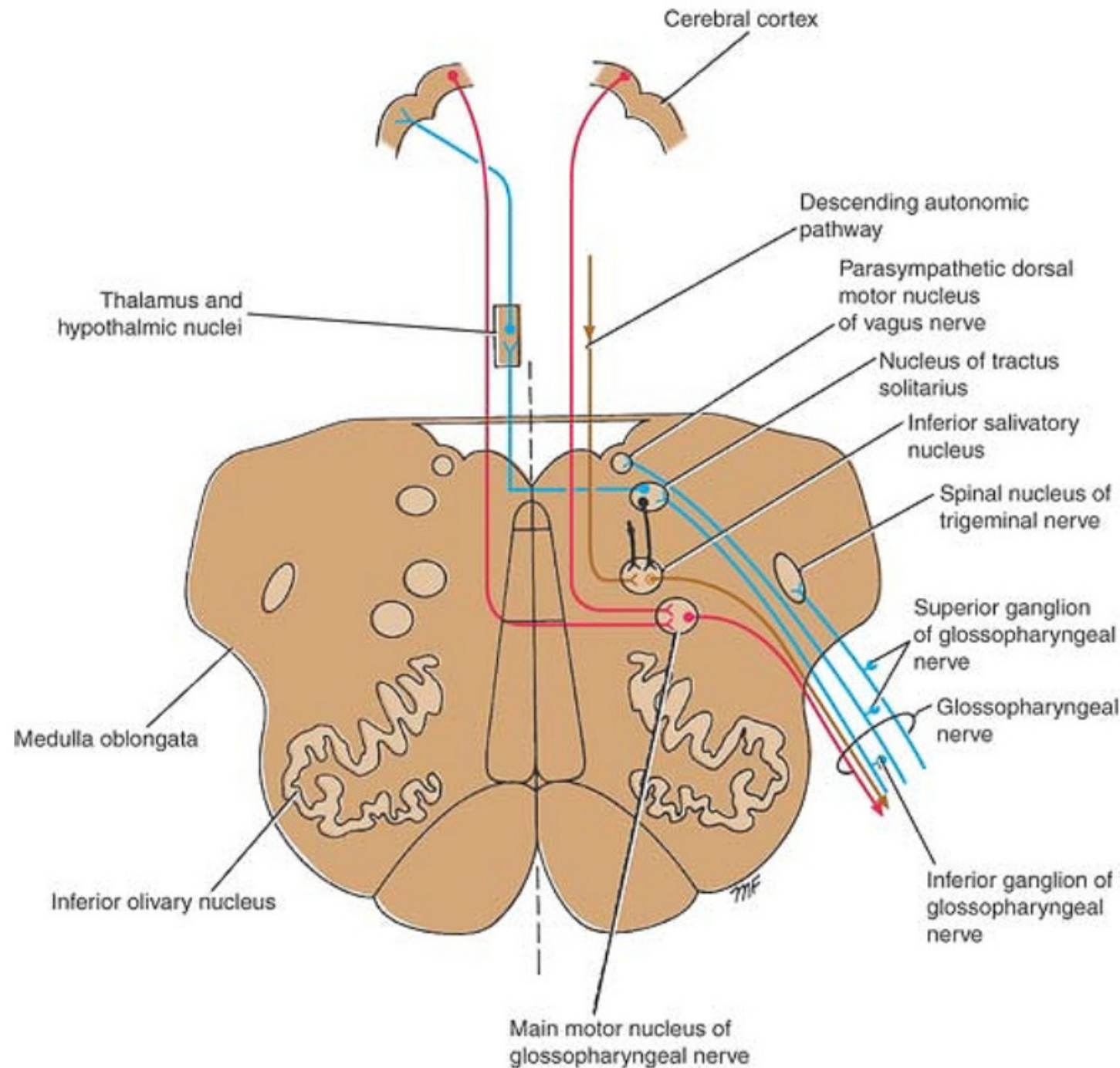
Bell's Palsy

- 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?



Glossopharyngeal Nerve Nuclei

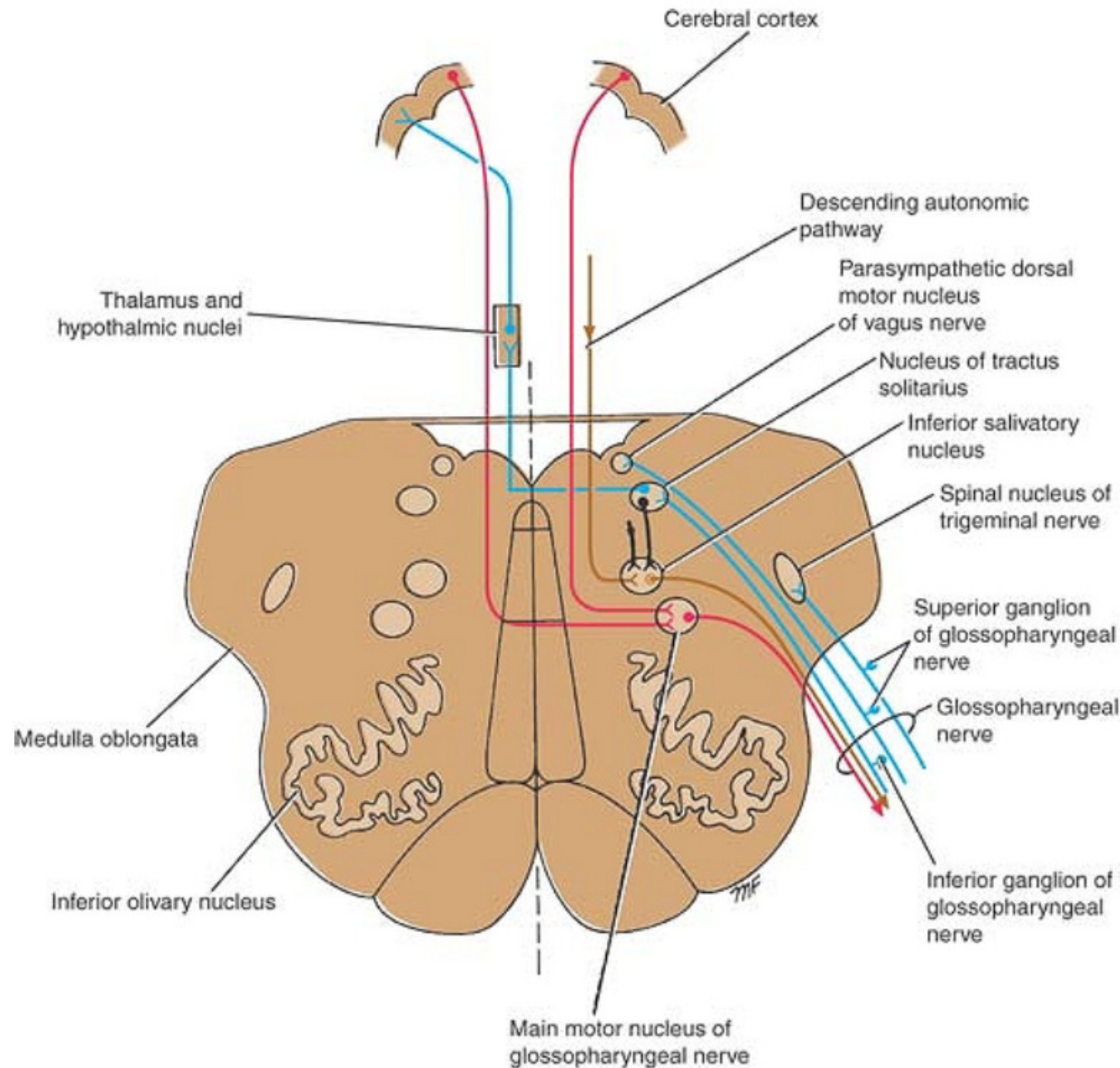
- **Main Motor Nucleus**
- Deep in the reticular formation of the medulla oblongata
- superior end of the nucleus ambiguus
- receives corticonuclear fibers from **both** cerebral hemispheres.
- supply the **stylopharyngeus muscle**



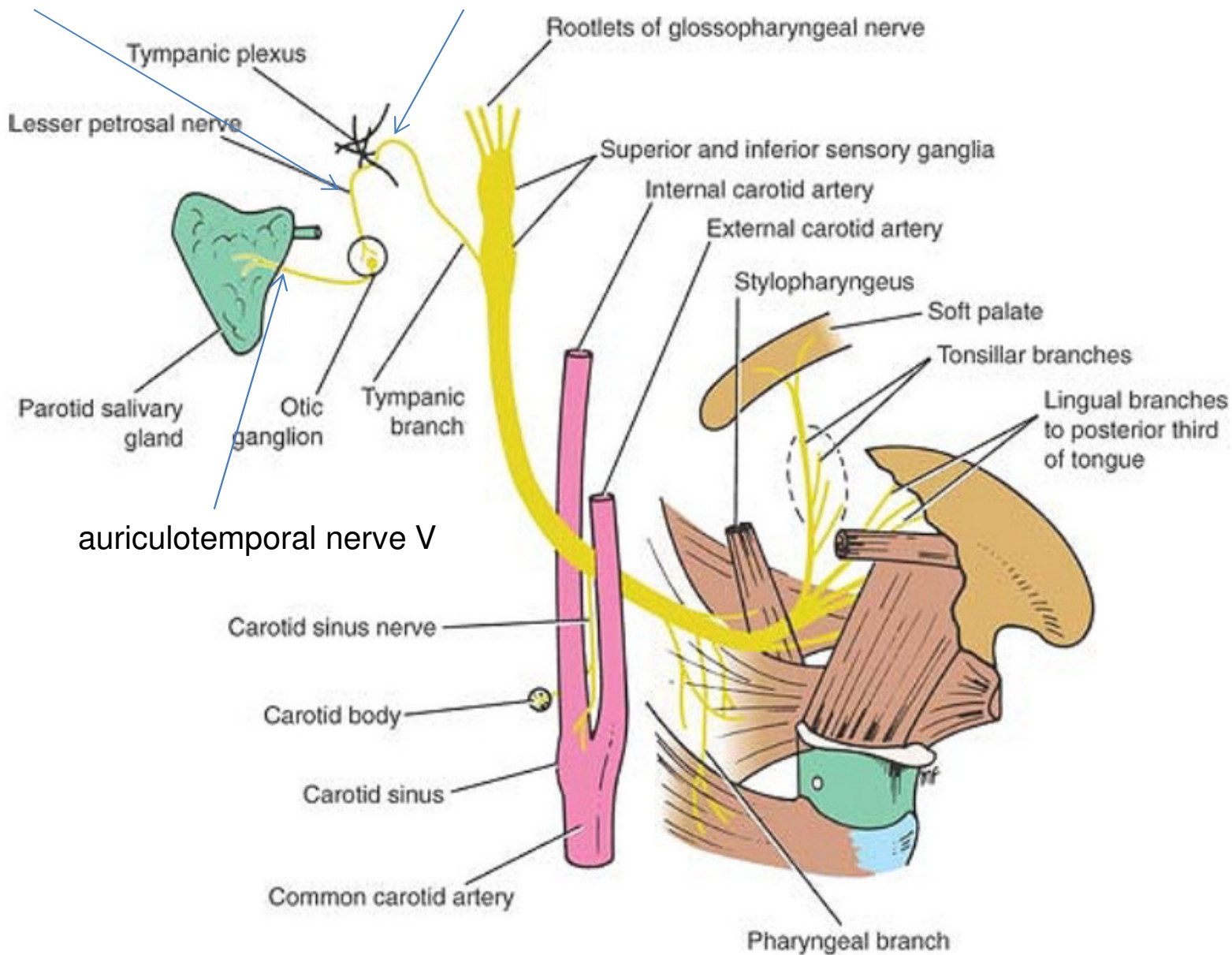
Glossopharyngeal Nerve Nuclei

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



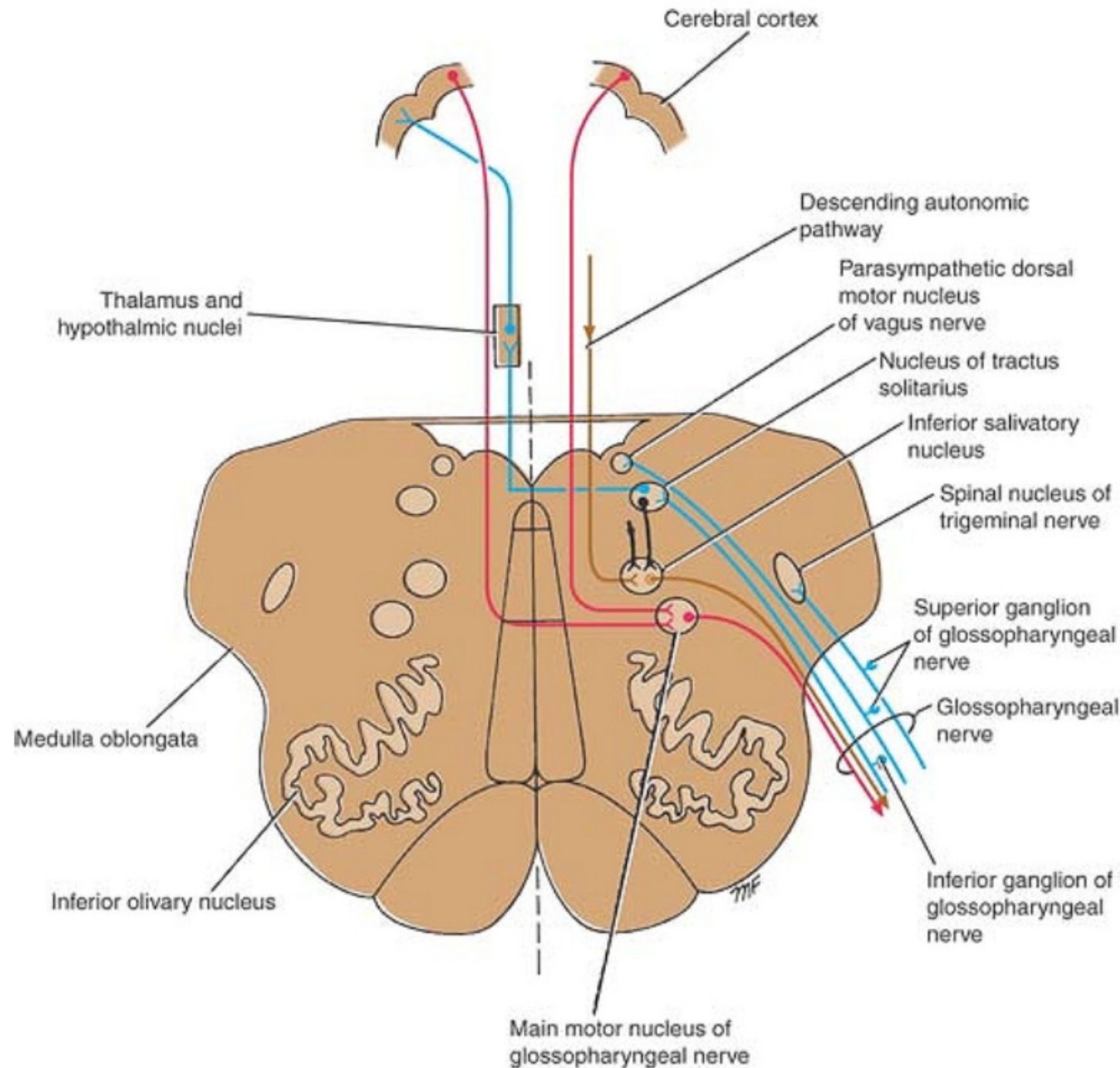
Hiatus for Lesser petrosal nerve Tympanic canaliculus



- 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.

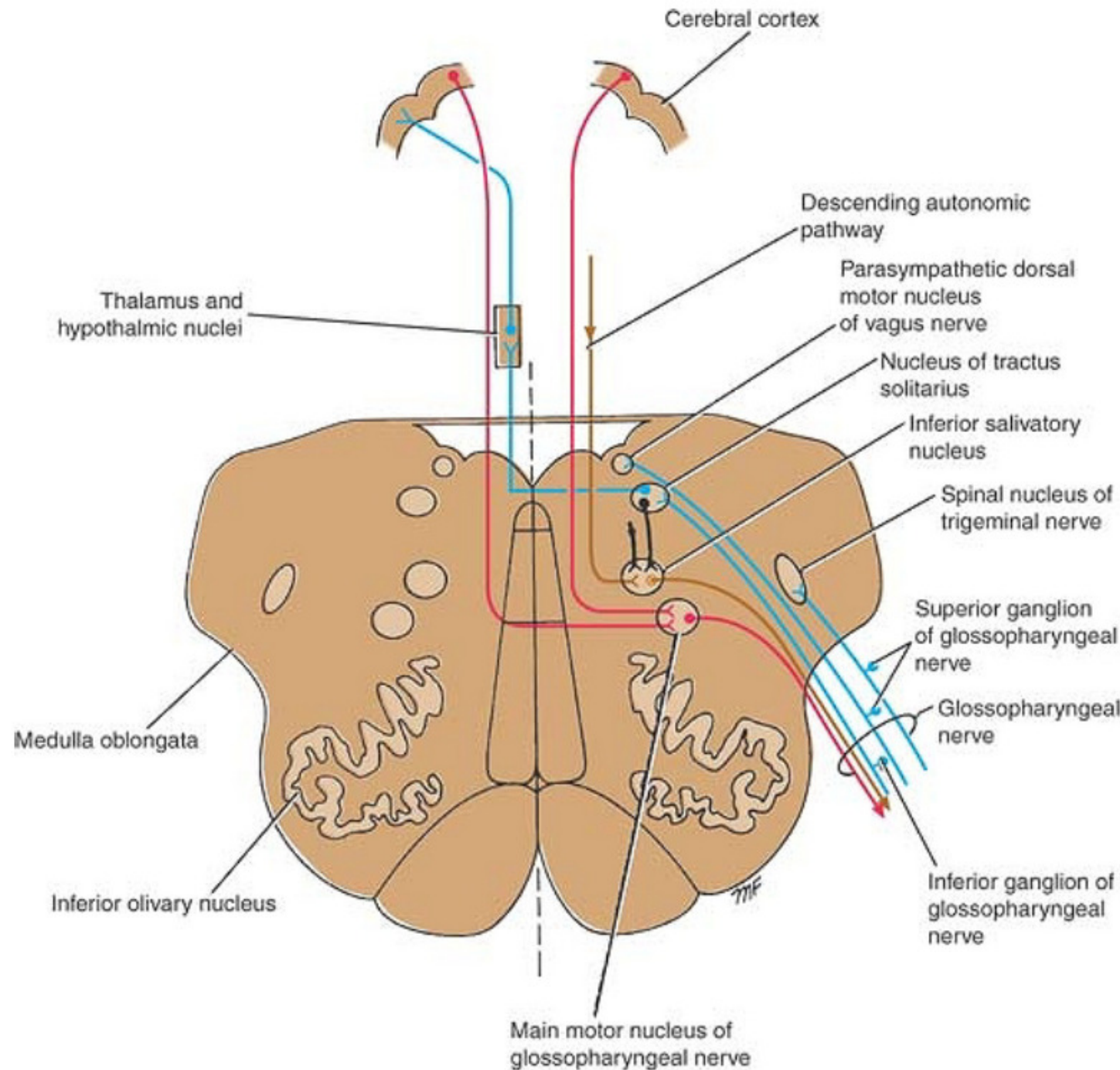
Glossopharyngeal Nerve Nuclei

- **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

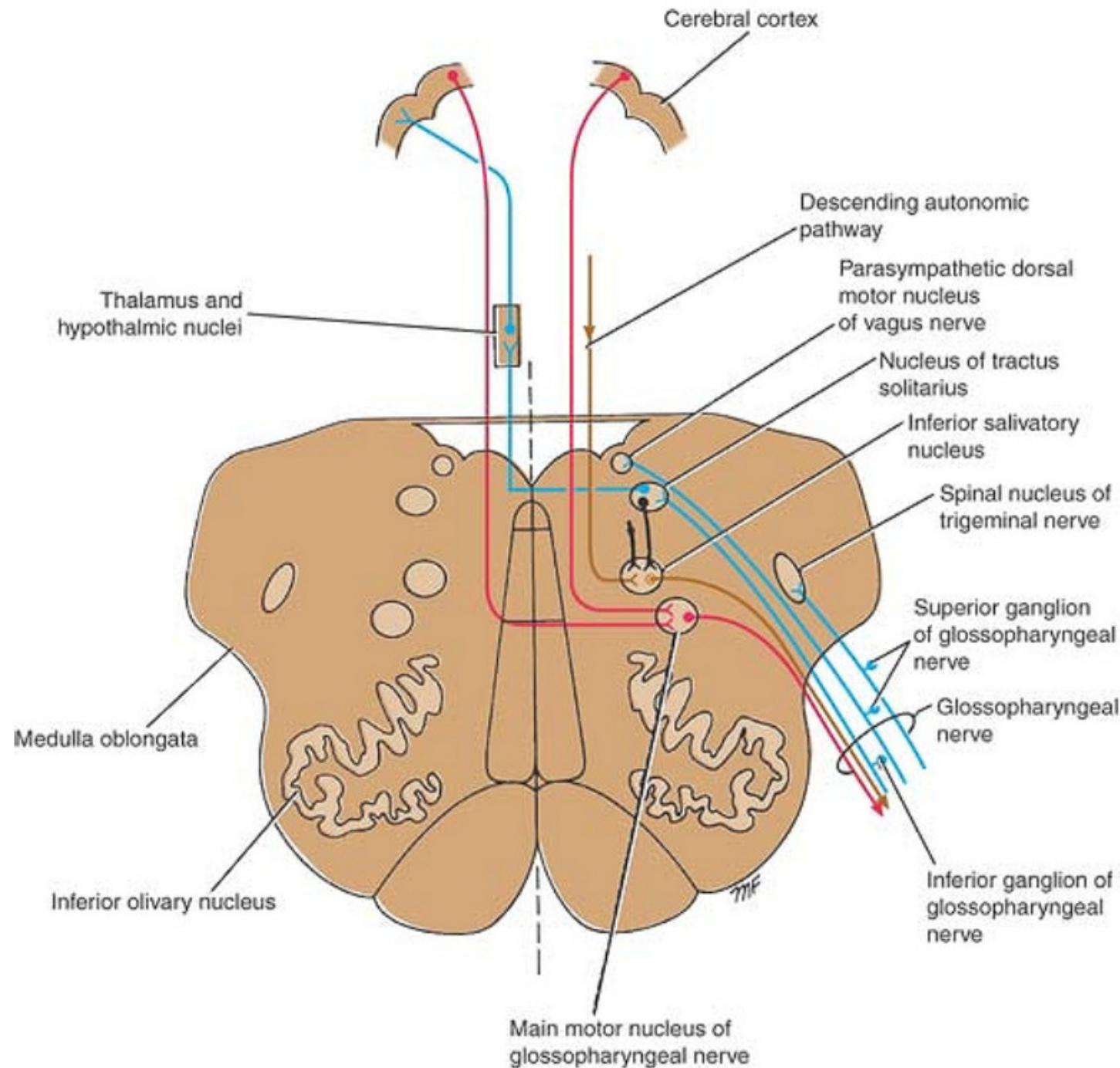
- **Sensory Nucleus** part of the nucleus of the tractus solitarius
- Afferent impulses from the **carotid sinus** (baroreceptor)
- Cell body in inferior glossopharyngeal ganglion
- Sensory nucleus
- connected to dorsal nucleus of the vagus nerve (carotid sinus reflex)



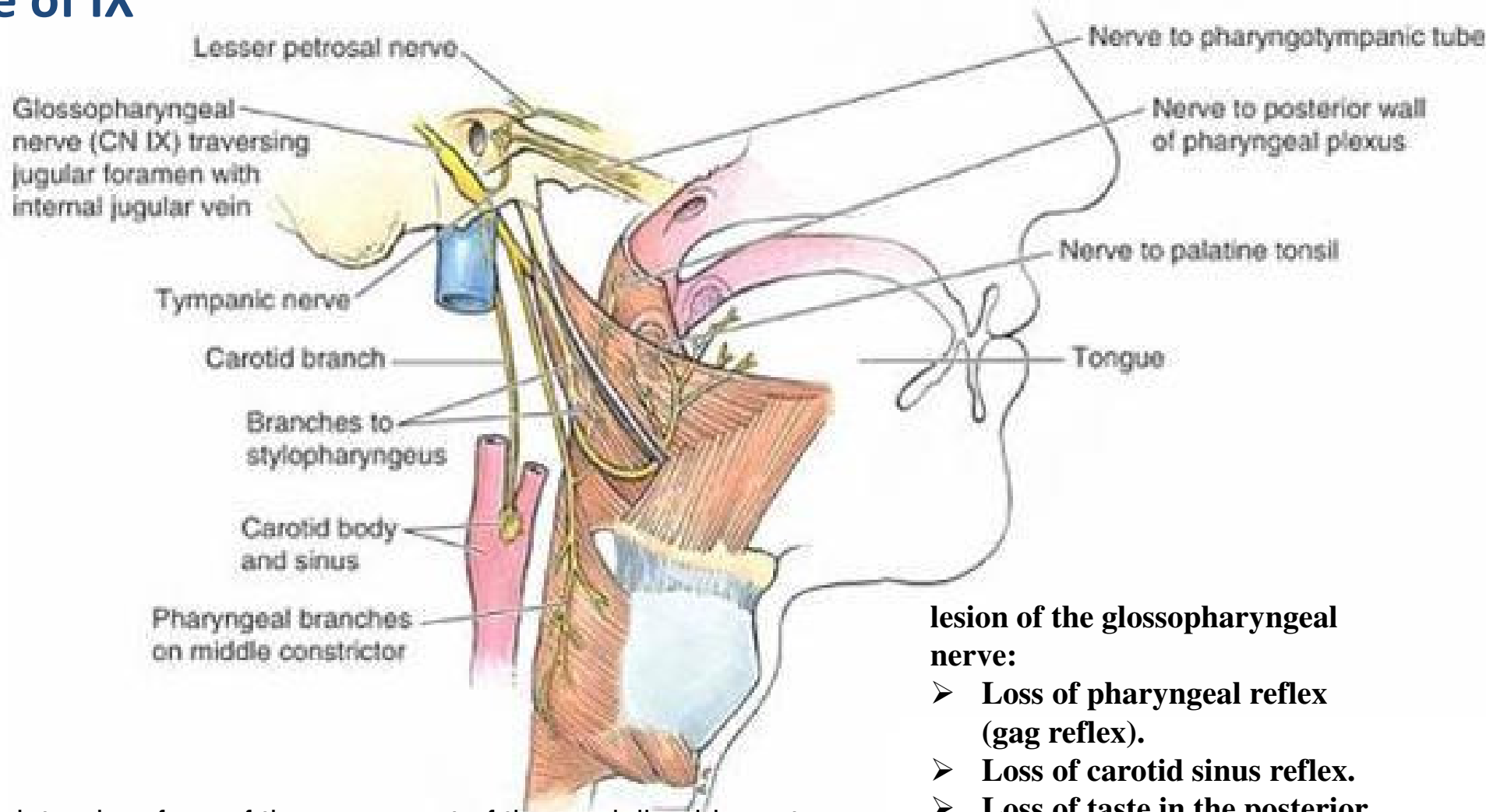
Glossopharyngeal Nerve Nuclei

- **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



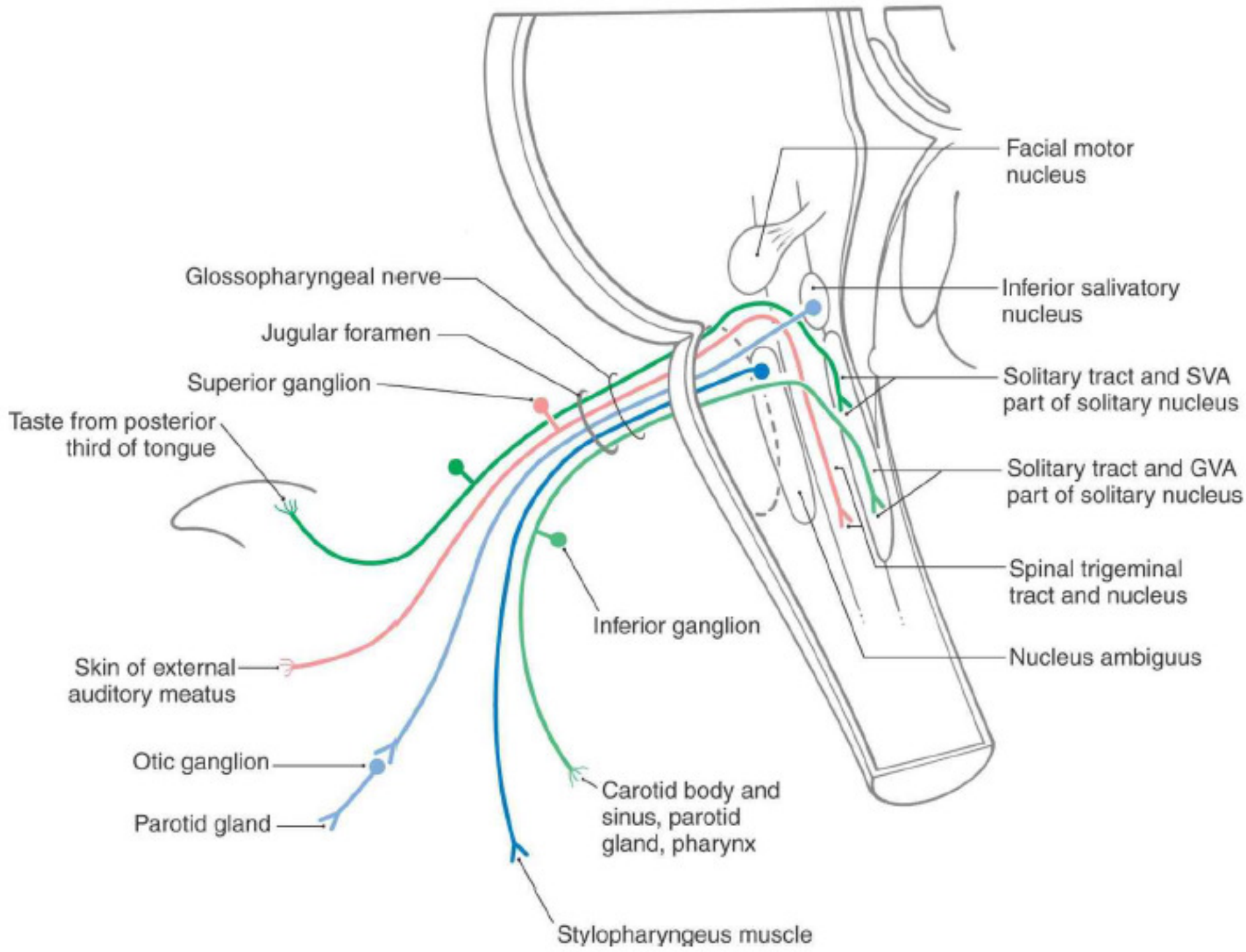
Course of IX



lesion of the glossopharyngeal nerve:

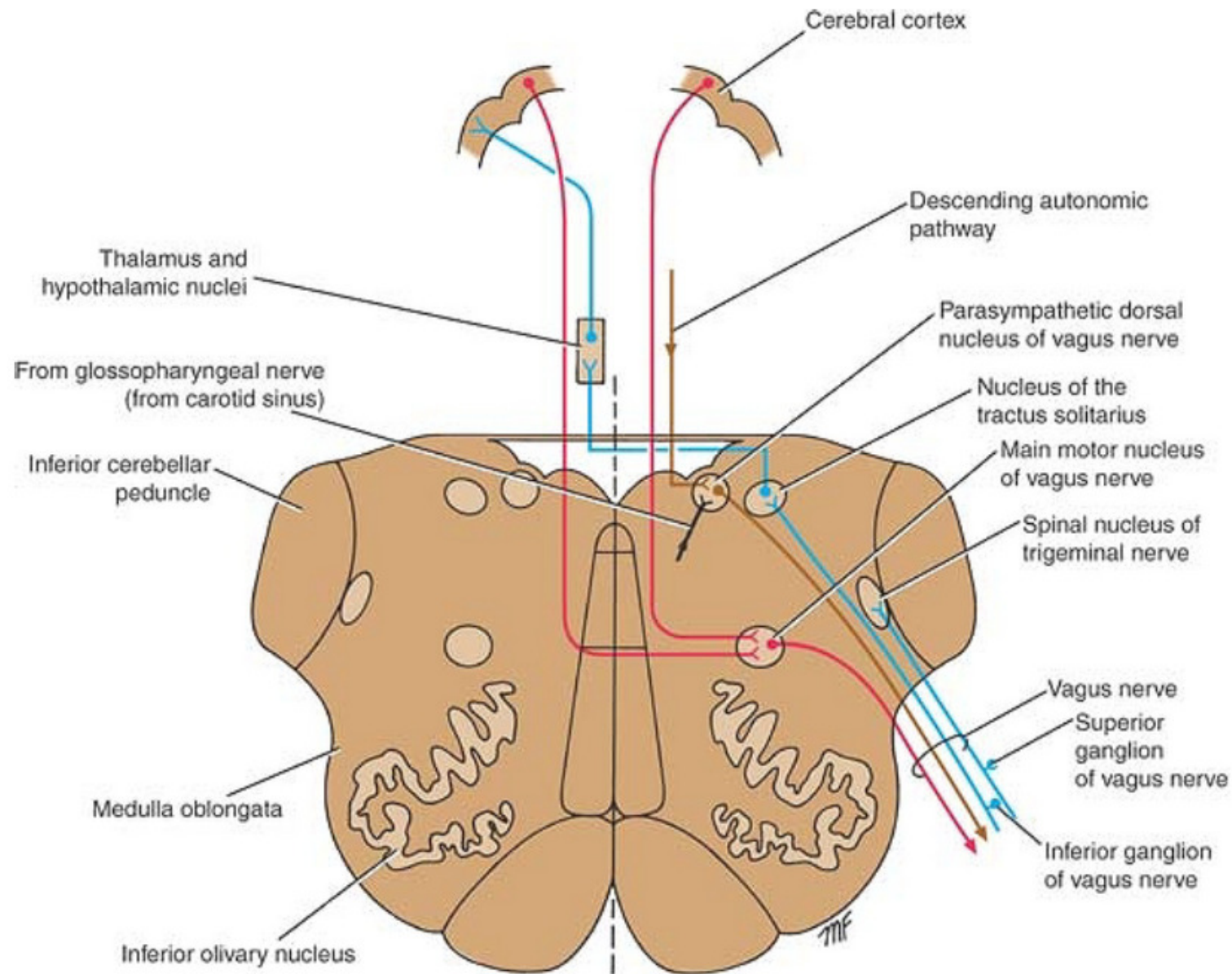
- **Loss of pharyngeal reflex (gag reflex).**
- **Loss of carotid sinus reflex.**
- **Loss of taste in the posterior third of tongue (Vallate papillae).**

- 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



Vagus Nerve Nuclei

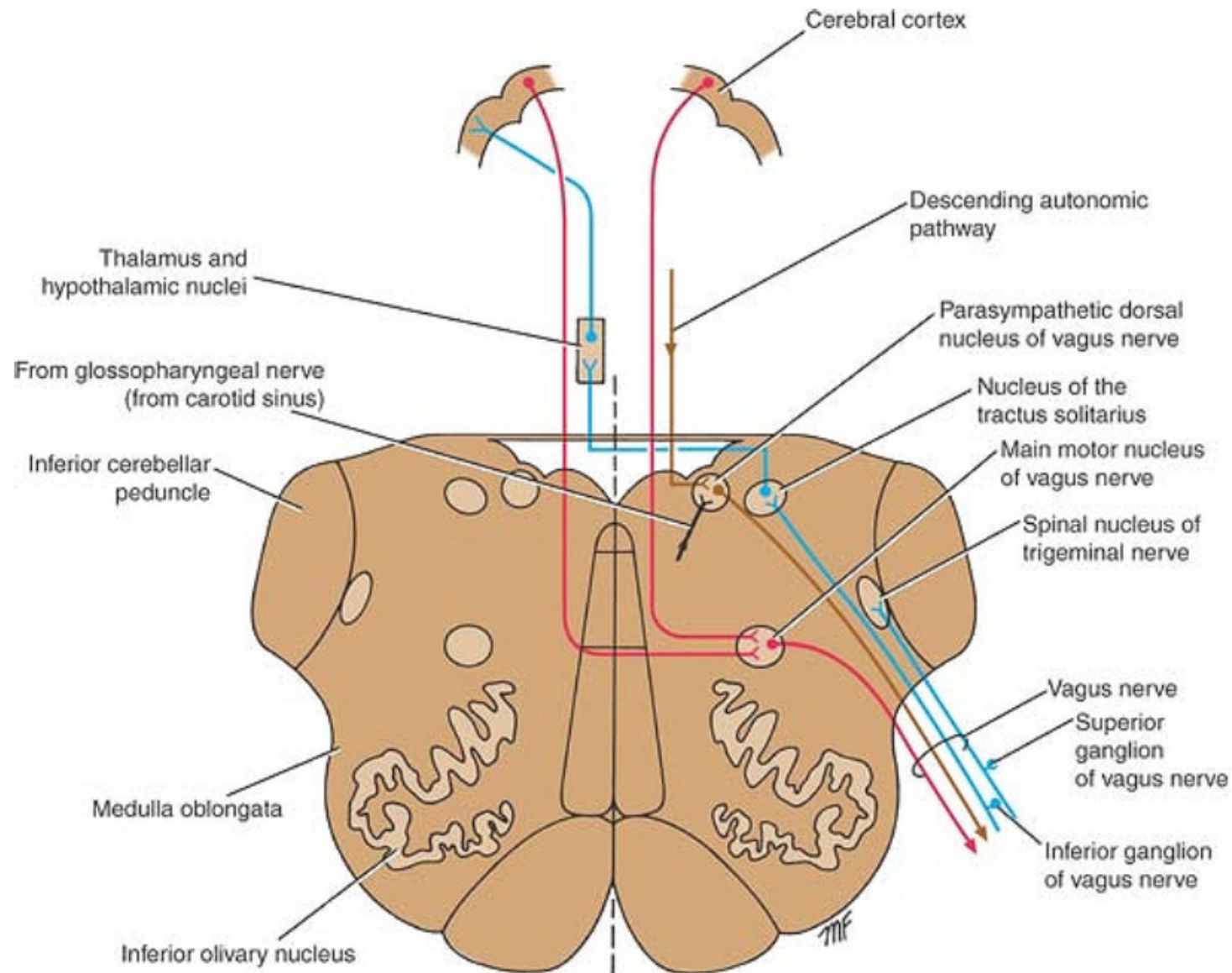
- **Main Motor Nucleus**
- Deep in the reticular formation of the medulla oblongata
- Lower part of nucleus ambiguus
- Receives corticonuclear fibers from **both** cerebral hemispheres.
- Supply the constrictor muscles of the pharynx and the intrinsic muscles of the larynx



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

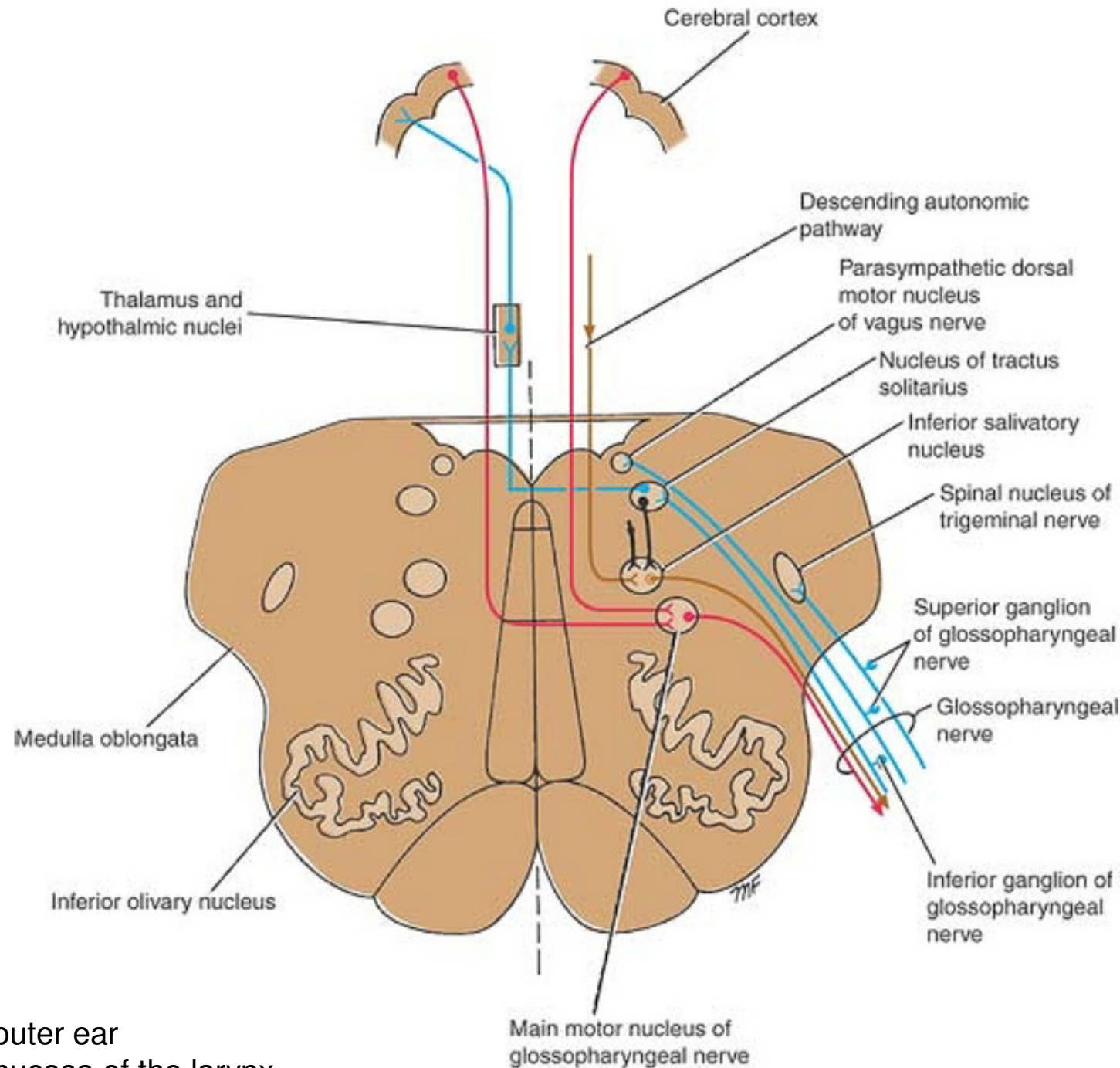
• Postcentral gyrus

-- common sensation

• superior ganglion of vagus

• Spinal nucleus of the trigeminal nerve.

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

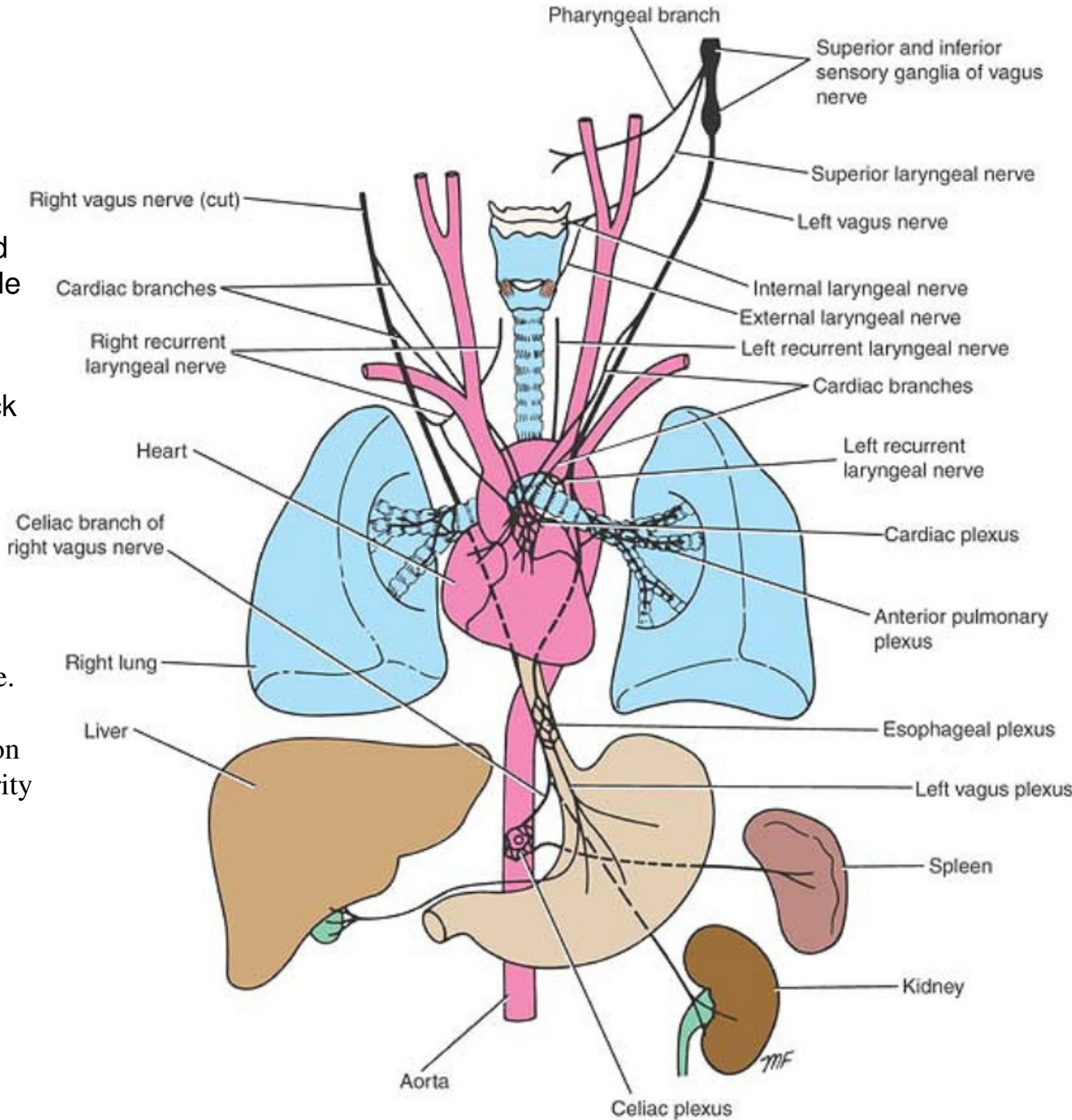


Course of X

- 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:

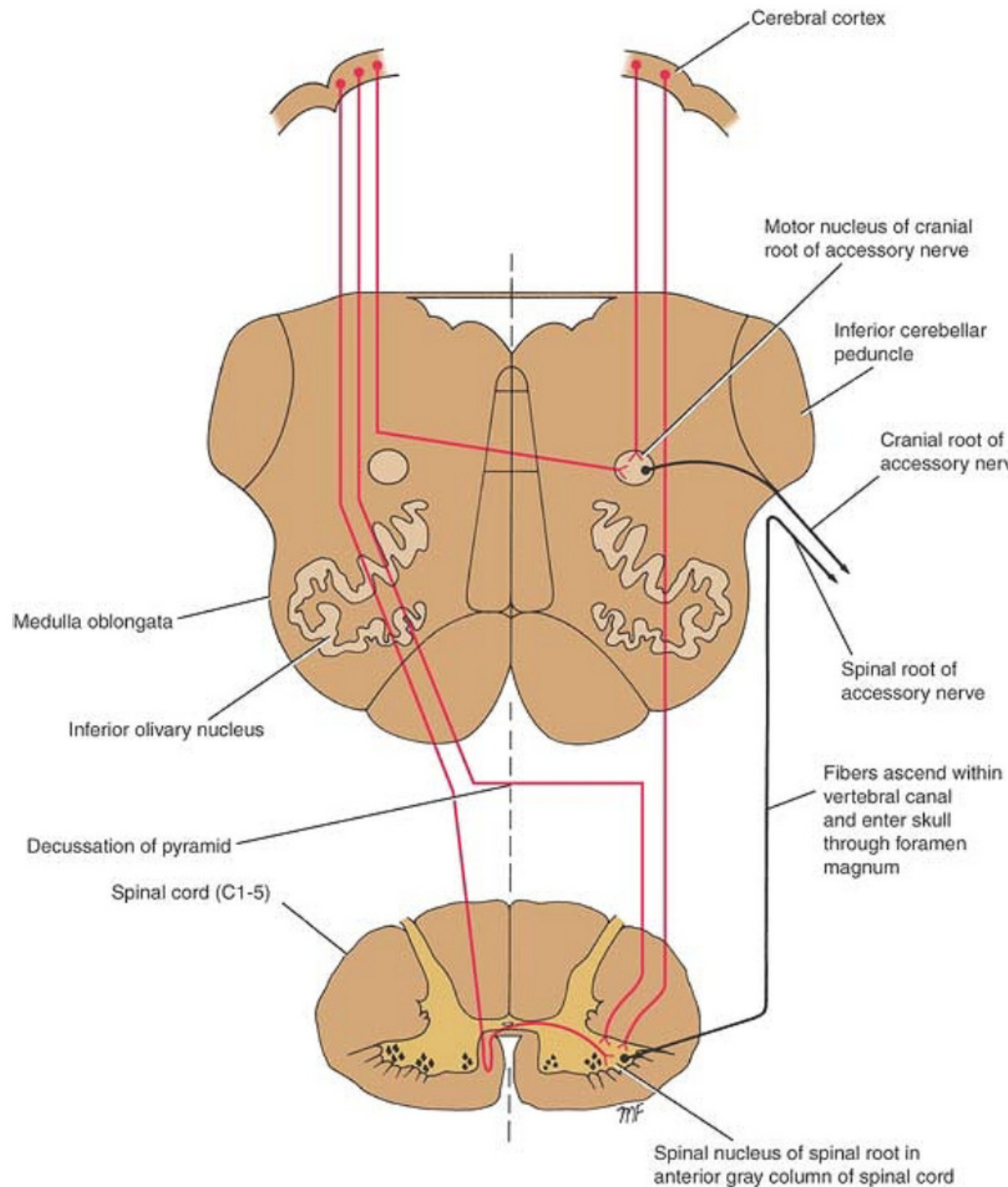
- Uvula deviates to the healthy side.
- Hoarseness of voice
- Dysphagia and nasal regurgitation
- Arrhythmia in heart and irregularity in GI tract because



Accessory Nerve

cranial root

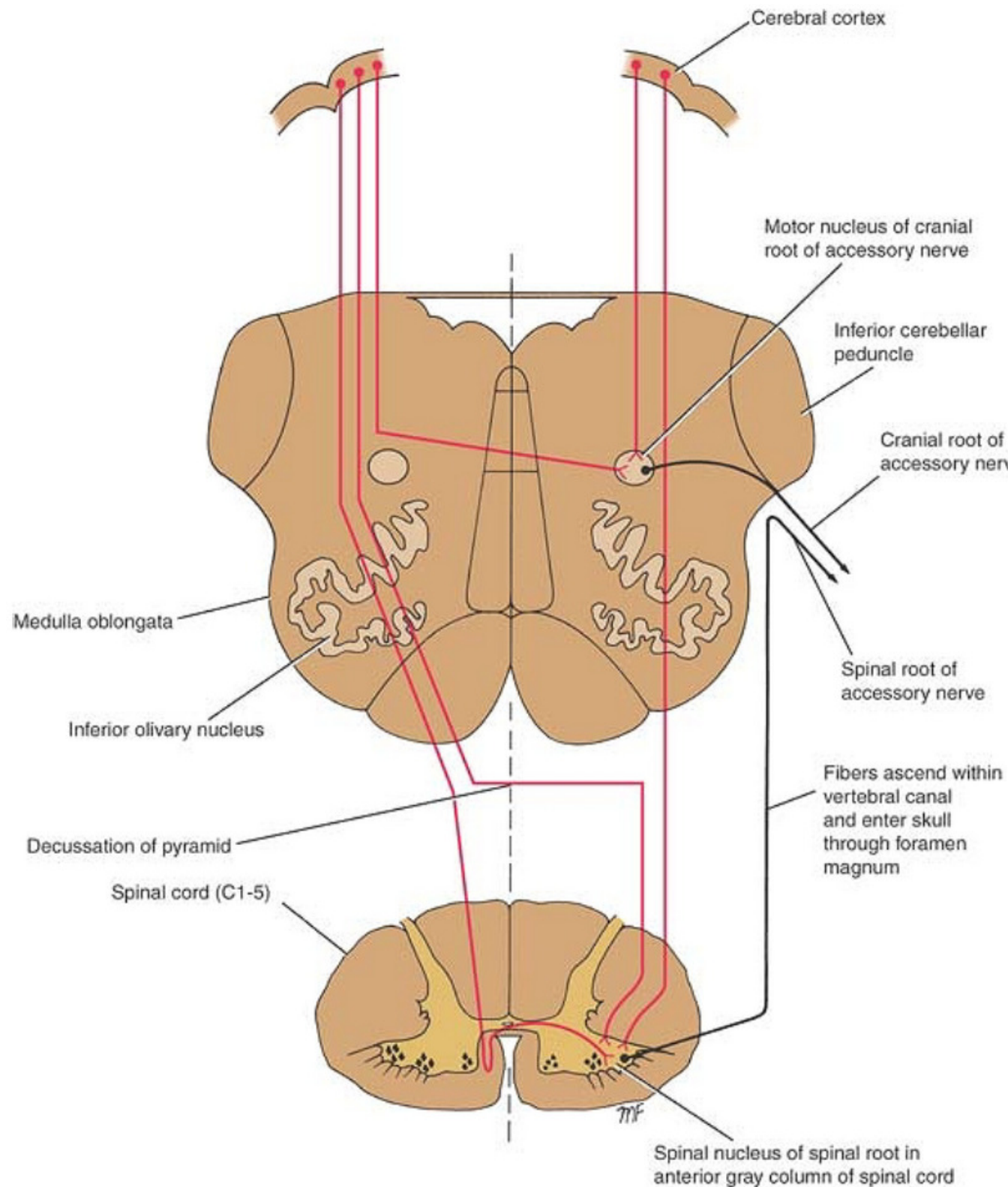
- nucleus ambiguus
- Receives corticonuclear fibers from **both** cerebral hemispheres.
- anterior surface of the medulla oblongata between the olive and the inferior cerebellar peduncle
- joins the vagus nerve



Accessory Nerve

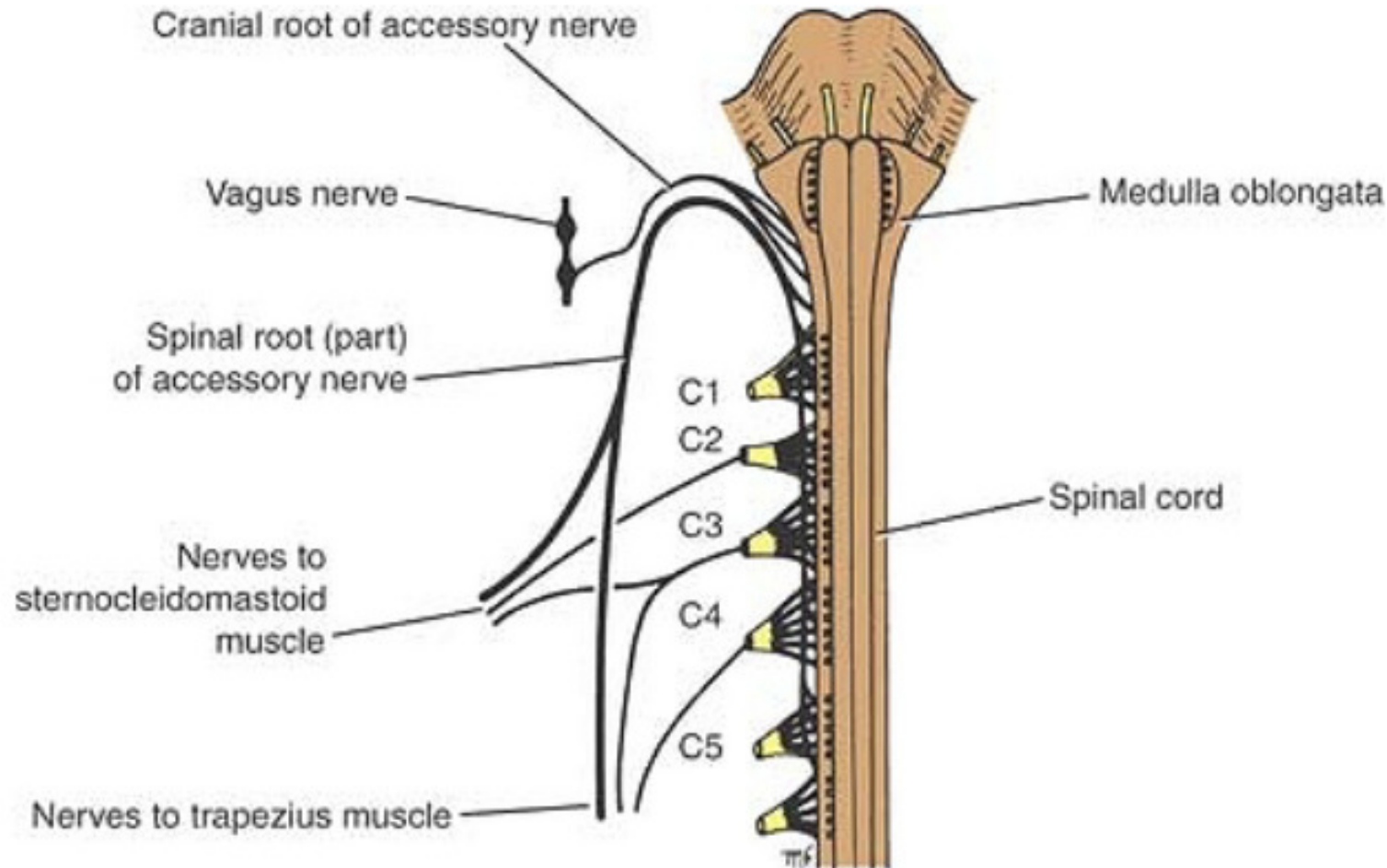
Spinal root

- **spinal nucleus**
(anterior gray column of upper five cervical segments)



Accessory Nerve Course

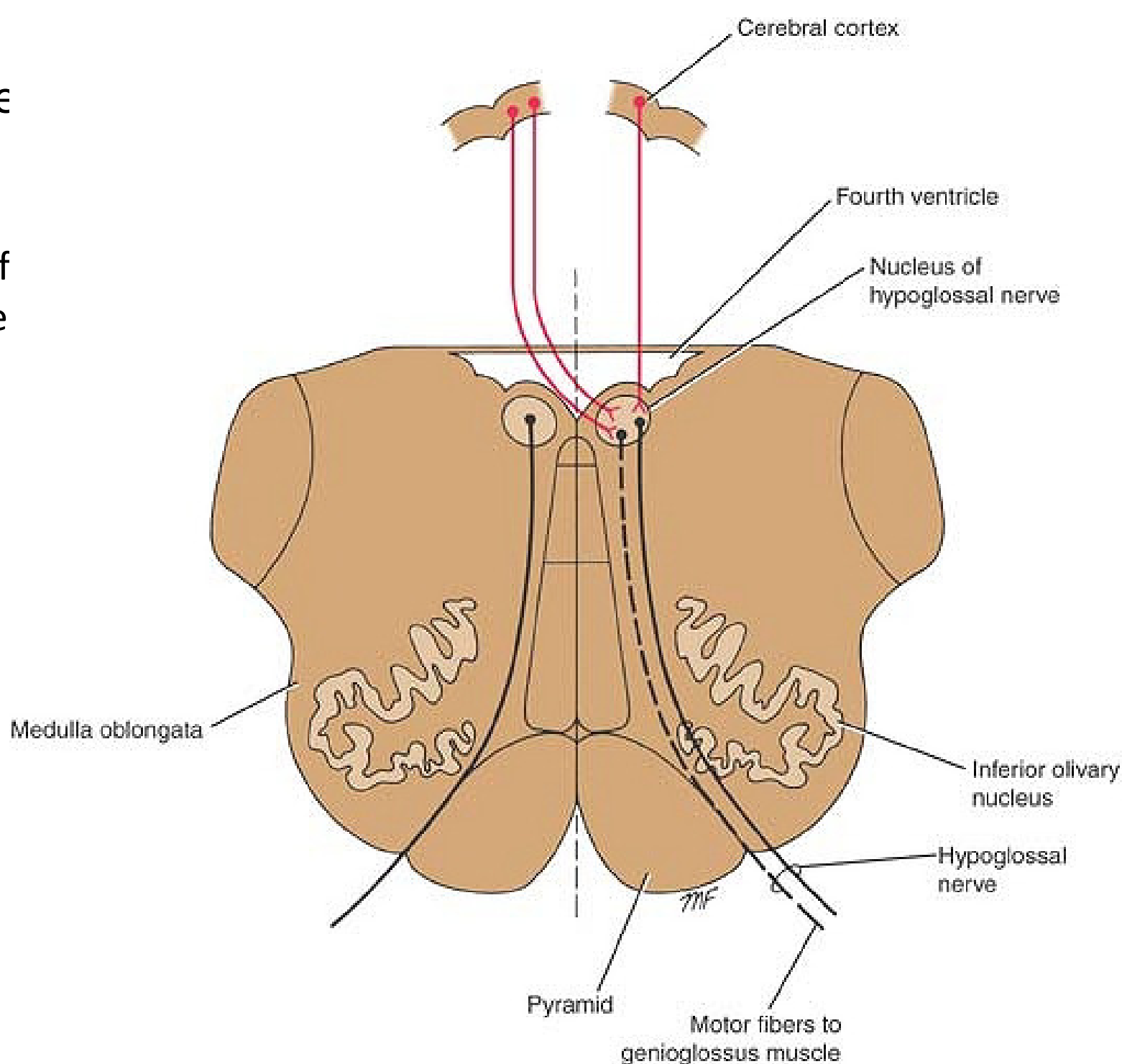
- spinal root emerge from the spinal cord between the anterior and posterior nerve roots of the cervical spinal nerves
- Enters the skull through the foramen magnum
- joins the cranial root



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

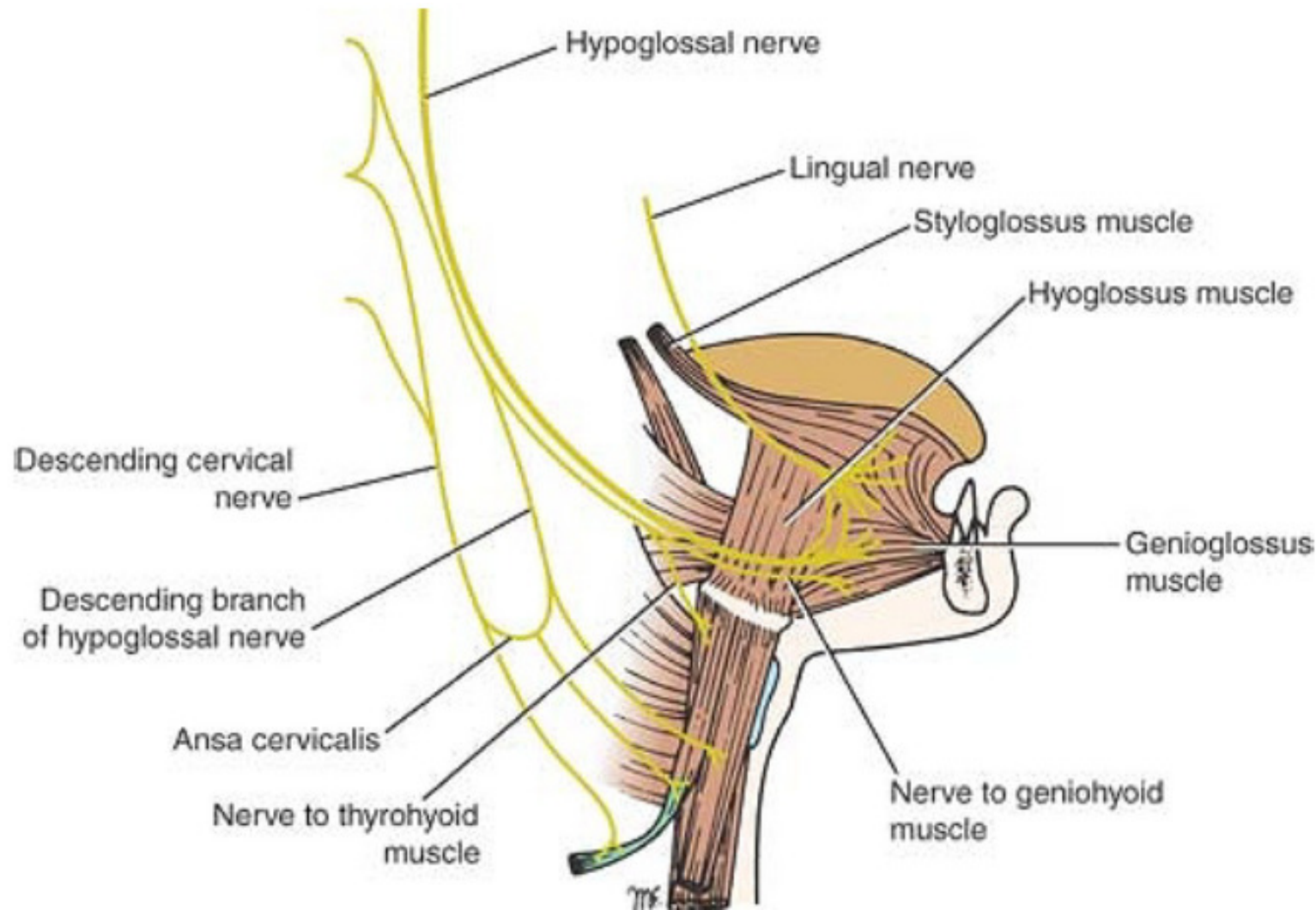
Hypoglossal nucle

- 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



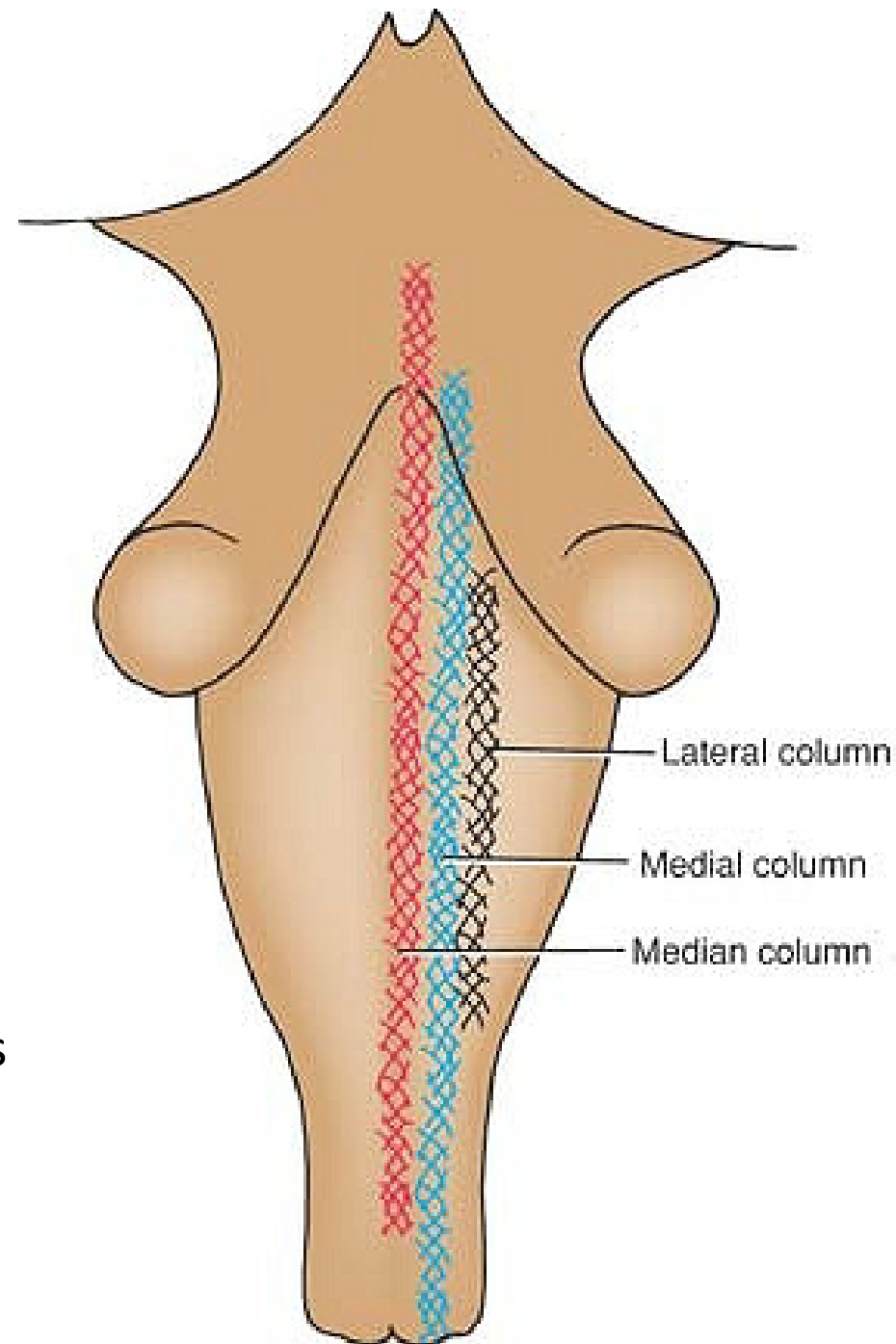
Hypoglossal Nerve injury

- 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



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.

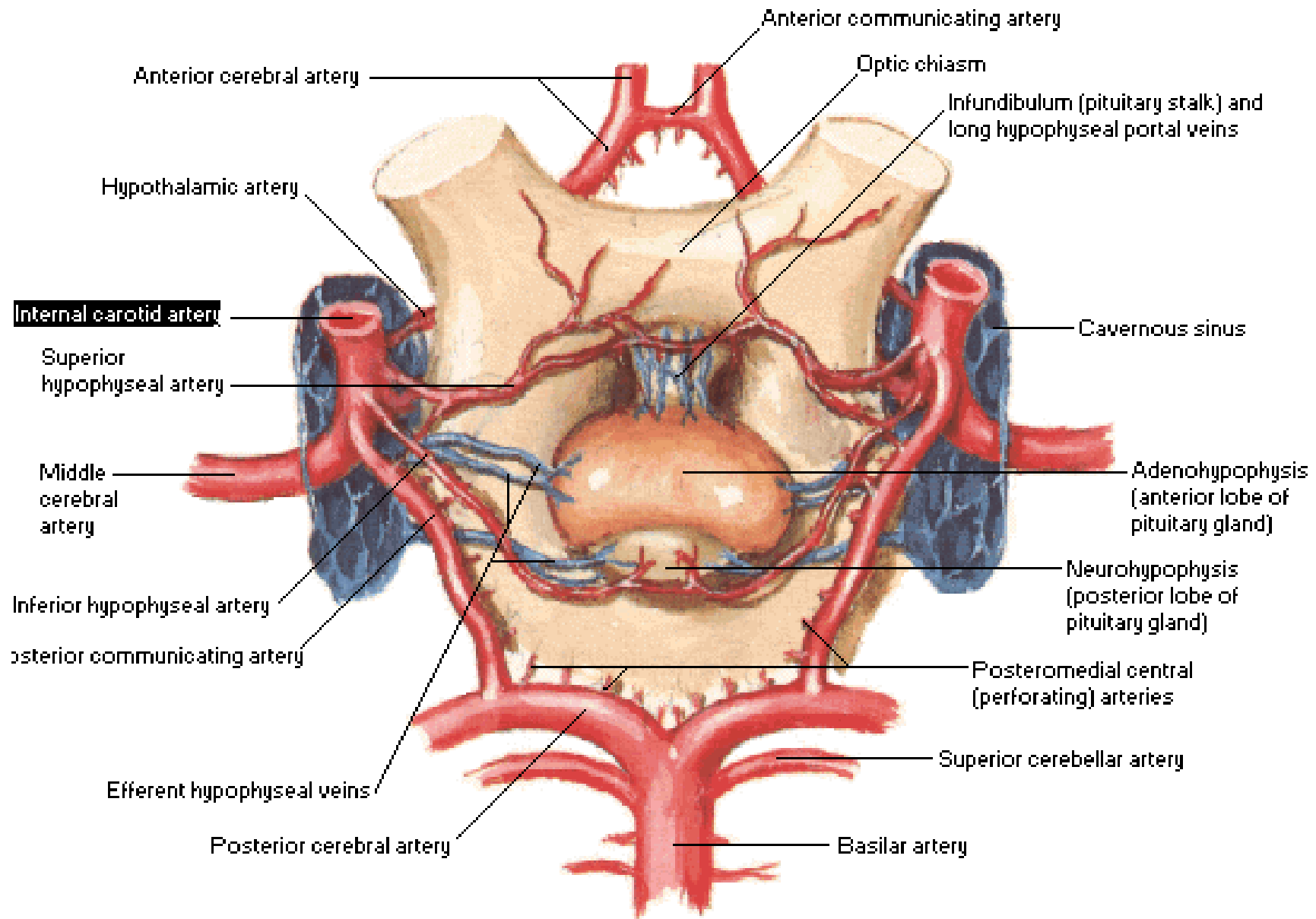


Basilar artery

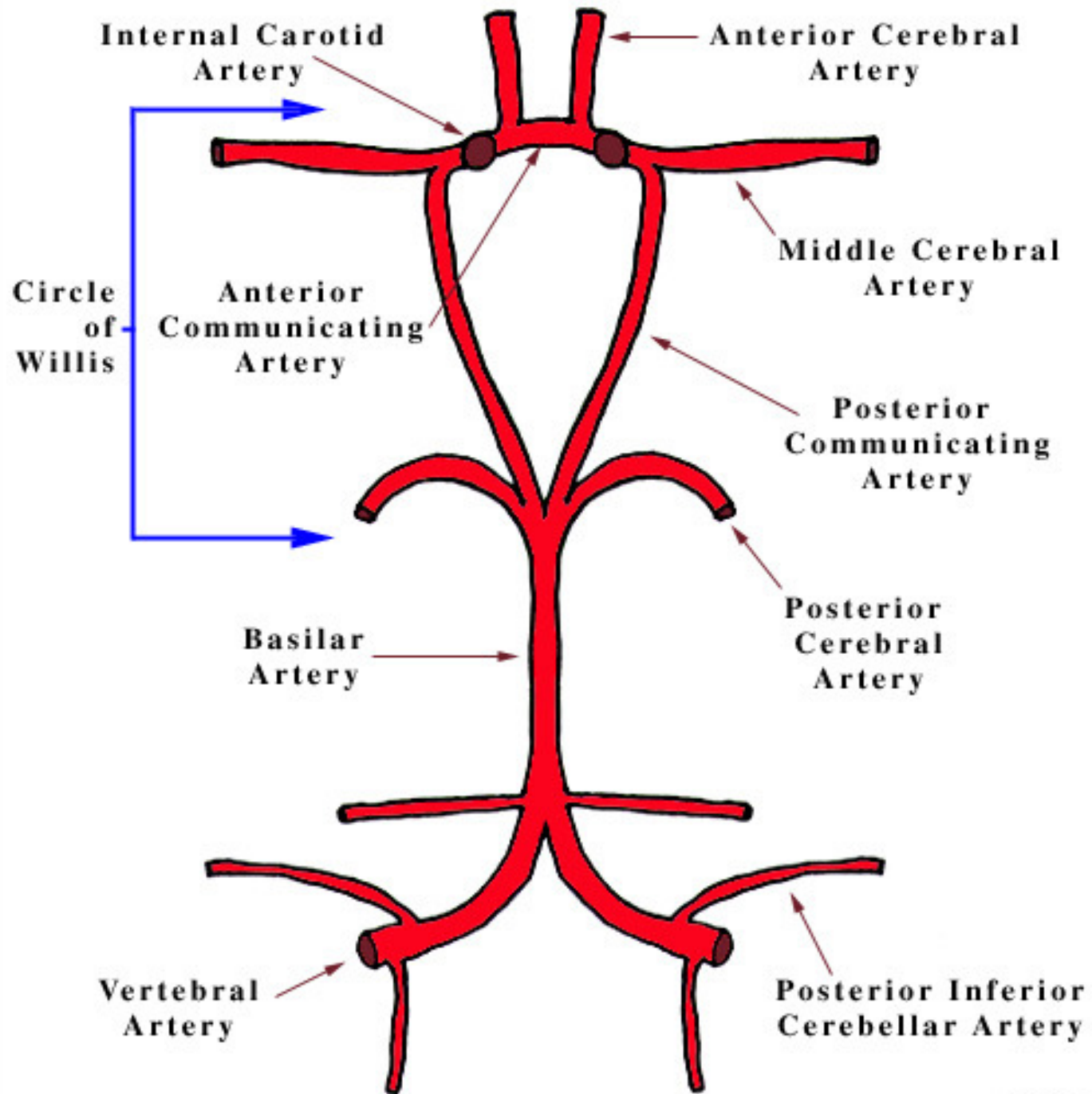
- Formed by the **union** of the two vertebral arteries at the **lower border** of the **pons**
- Ascends on the front of the pons lodged in the **basilar groove**
- Ends at the **upper border** of the pons by dividing into 2 **Posterior cerebral arteries (PCA)**

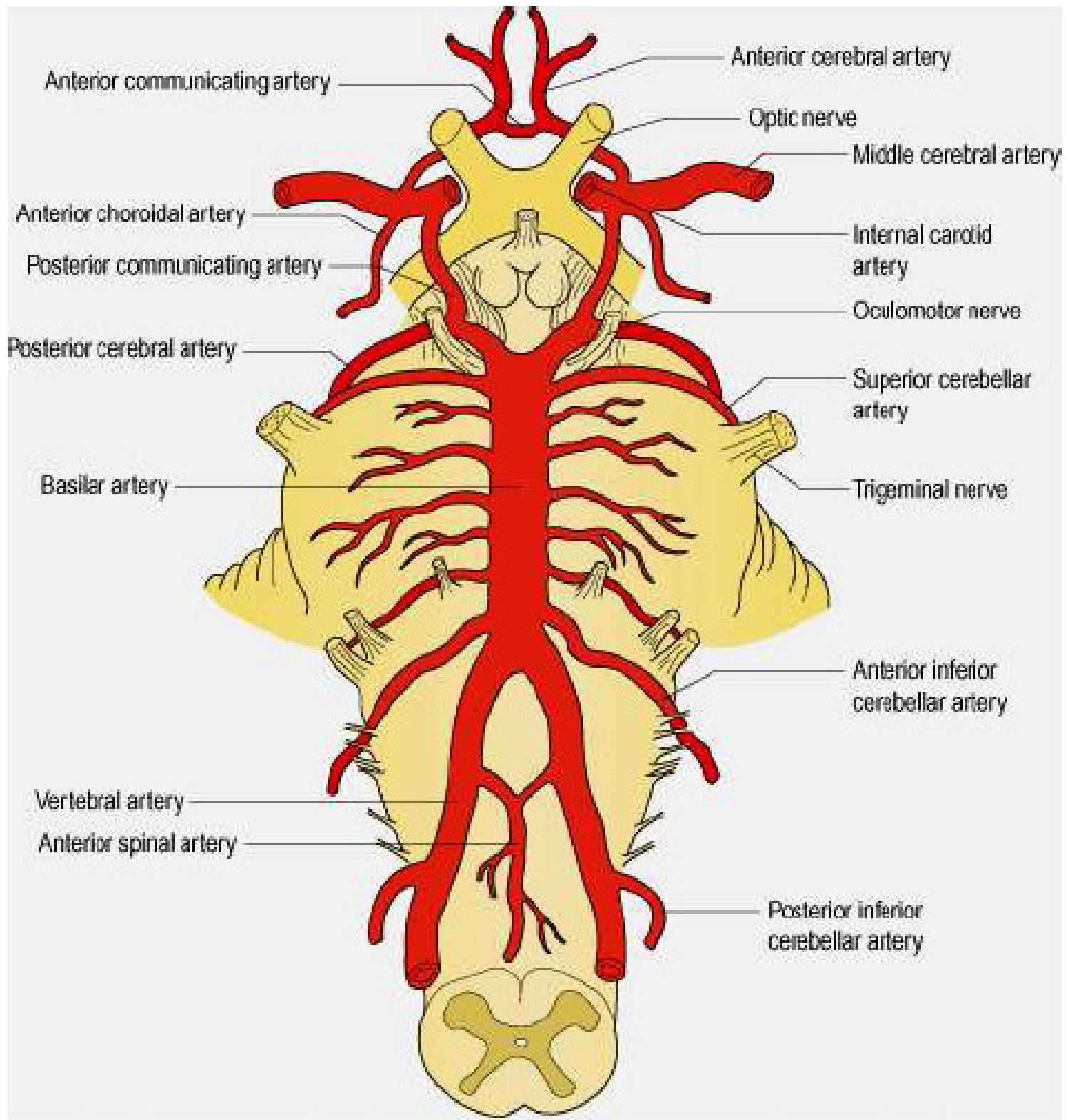
Cerebral Arterial Circle [Willis] - Vessels in Situ

Inferior View



CIRCLE OF WILLIS

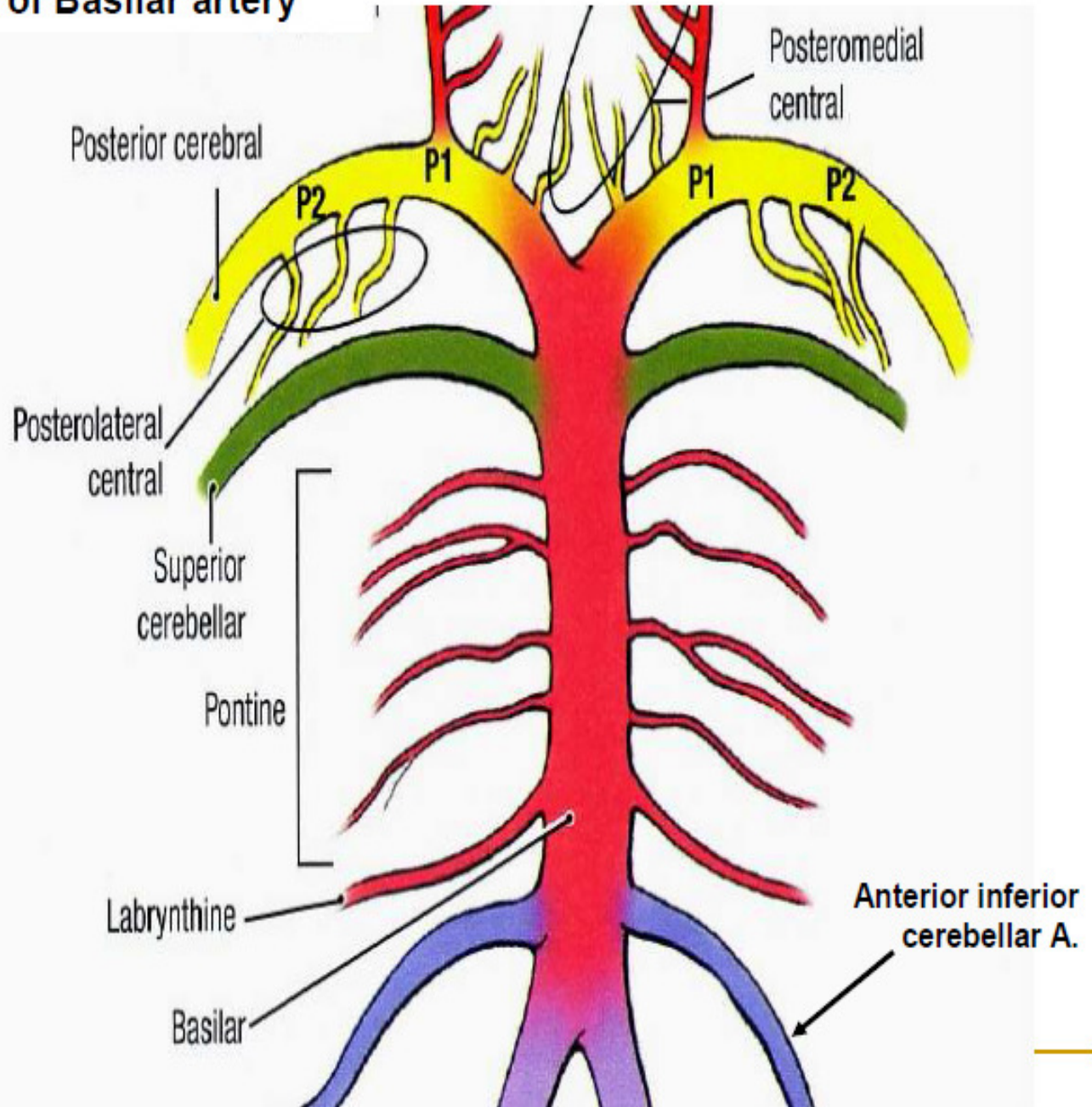




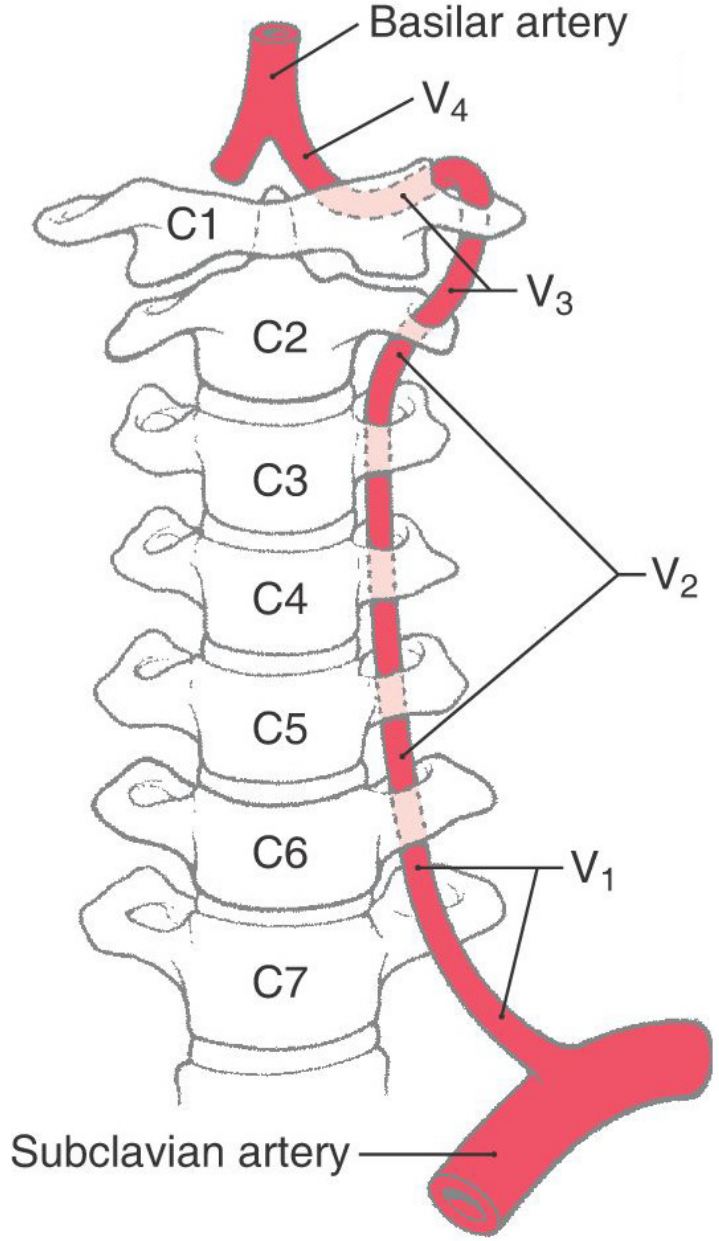
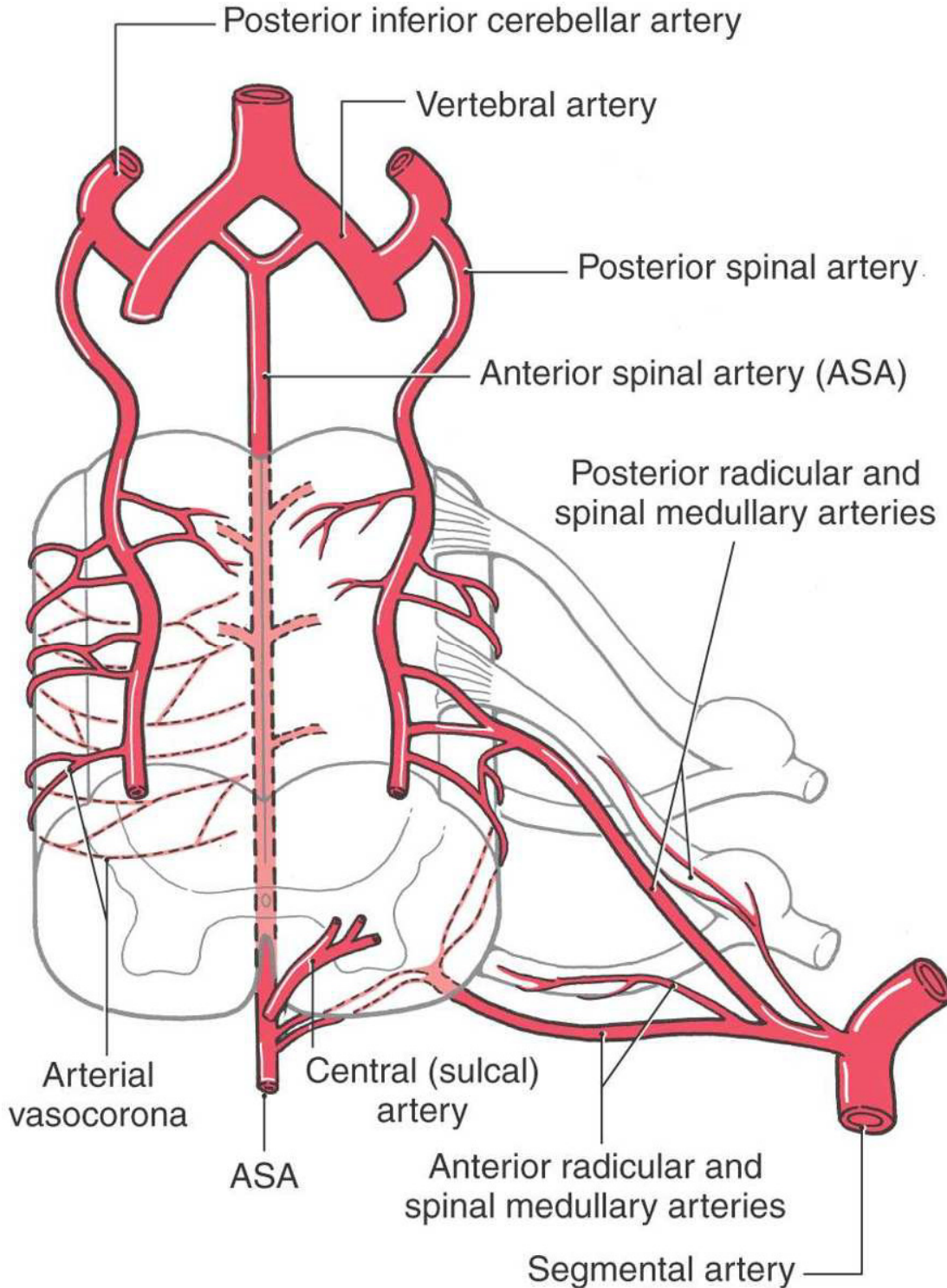
Basilar artery

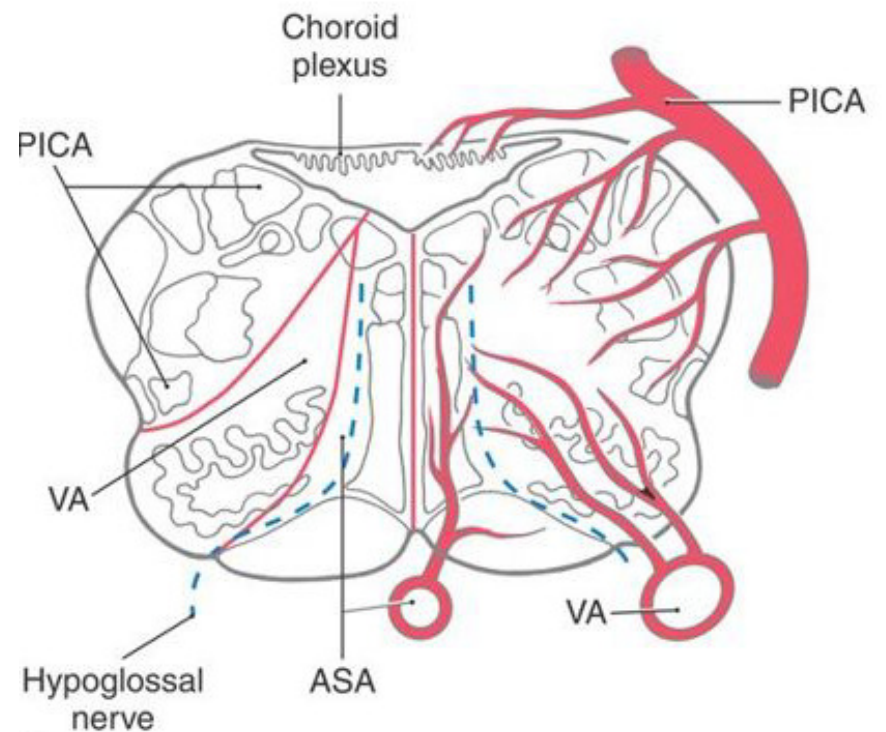
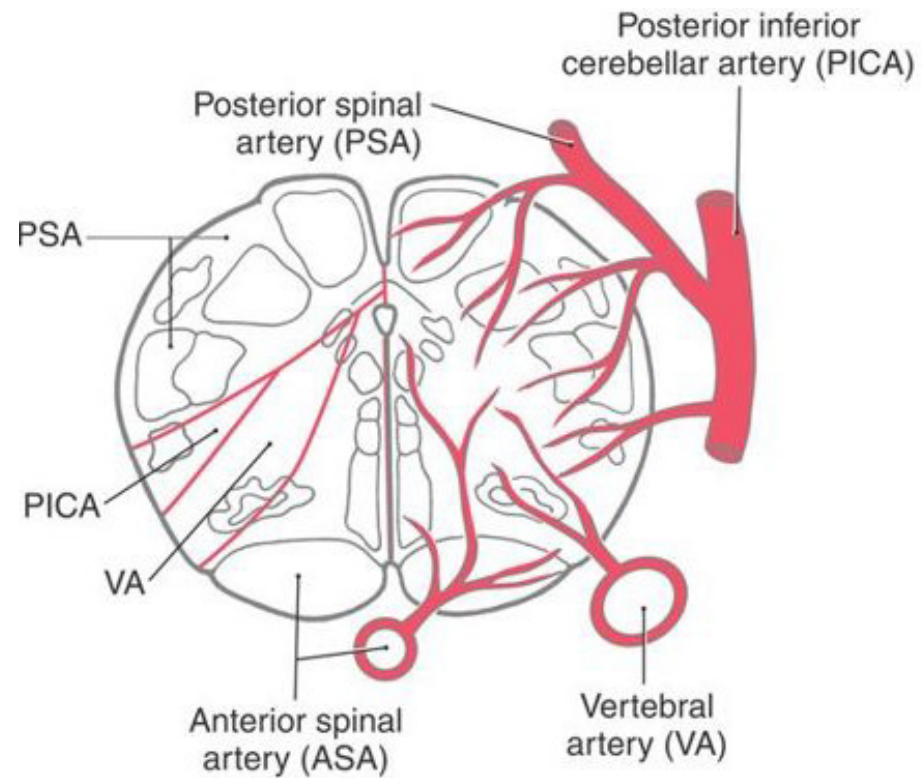
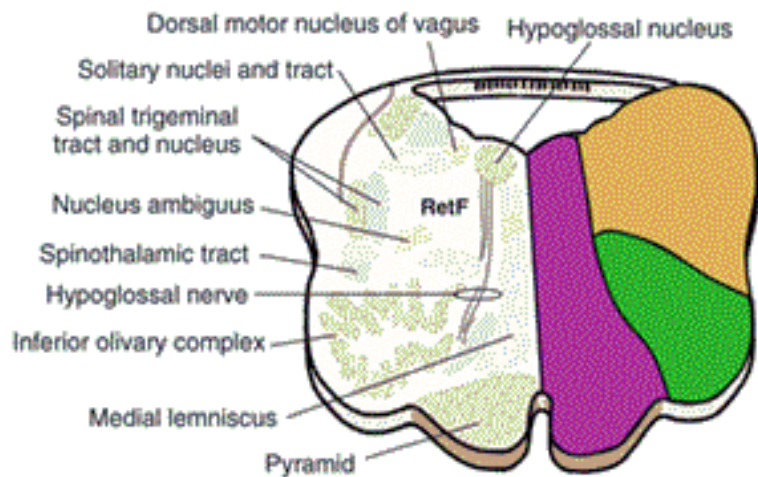
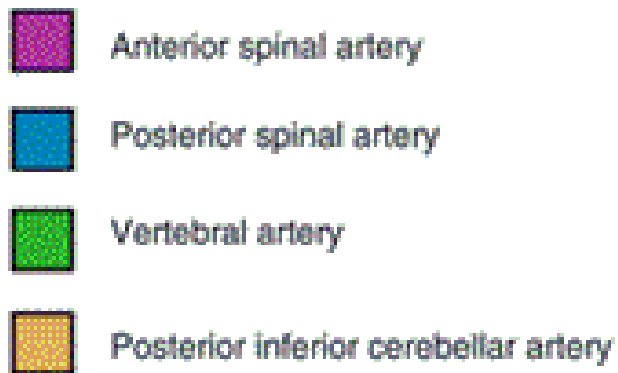
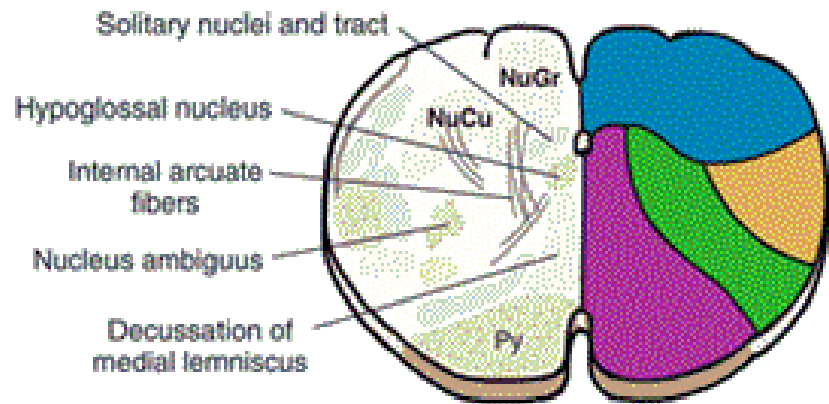
Branches of Basilar artery

- Branches of basilar artery
 - anterior inferior cerebellar artery (AICA) supplies inferior surface of the cerebellum
 - Pontine arteries supply pons
 - superior cerebellar artery supplies superior surface of cerebellum and pons



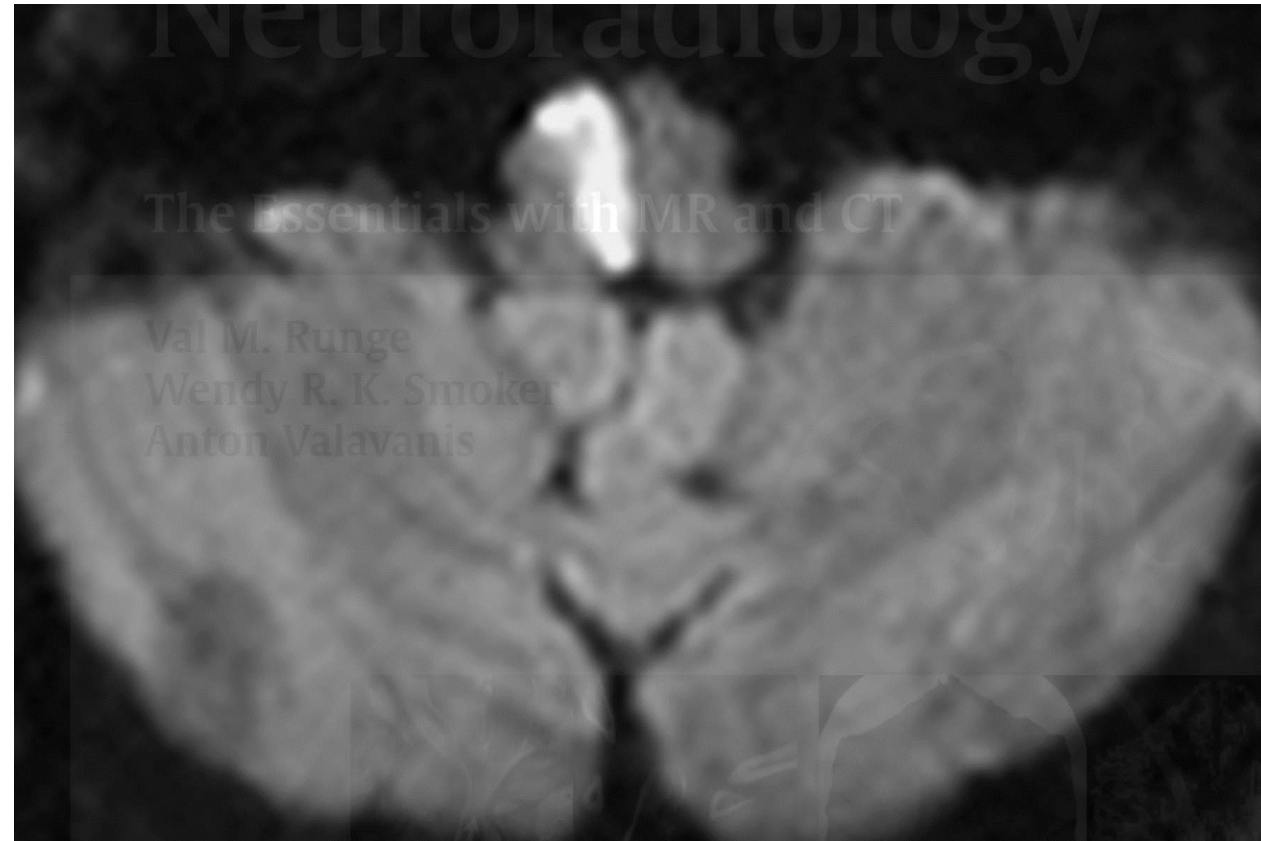
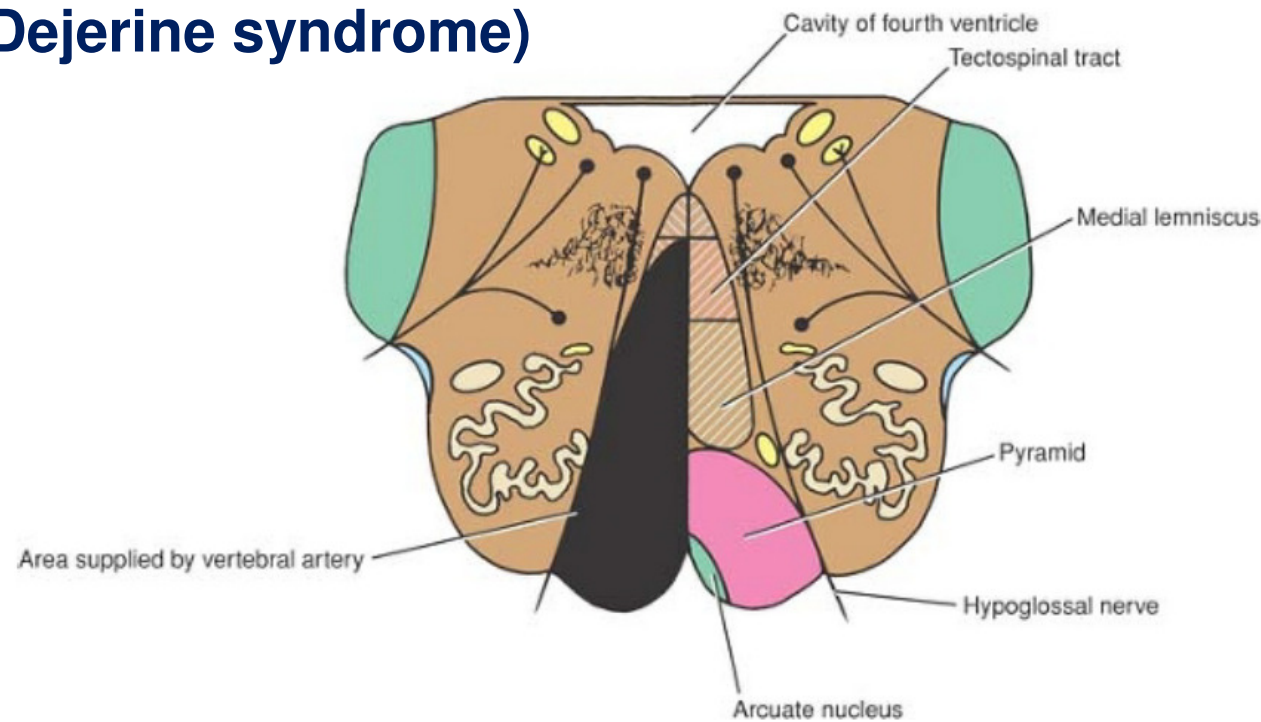
Blood supply of spinal cord





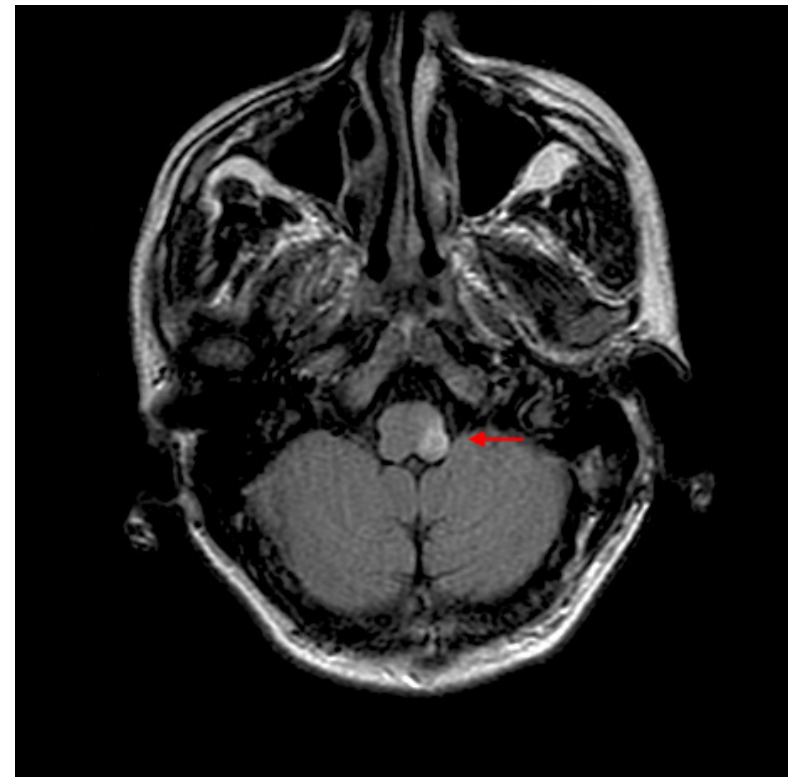
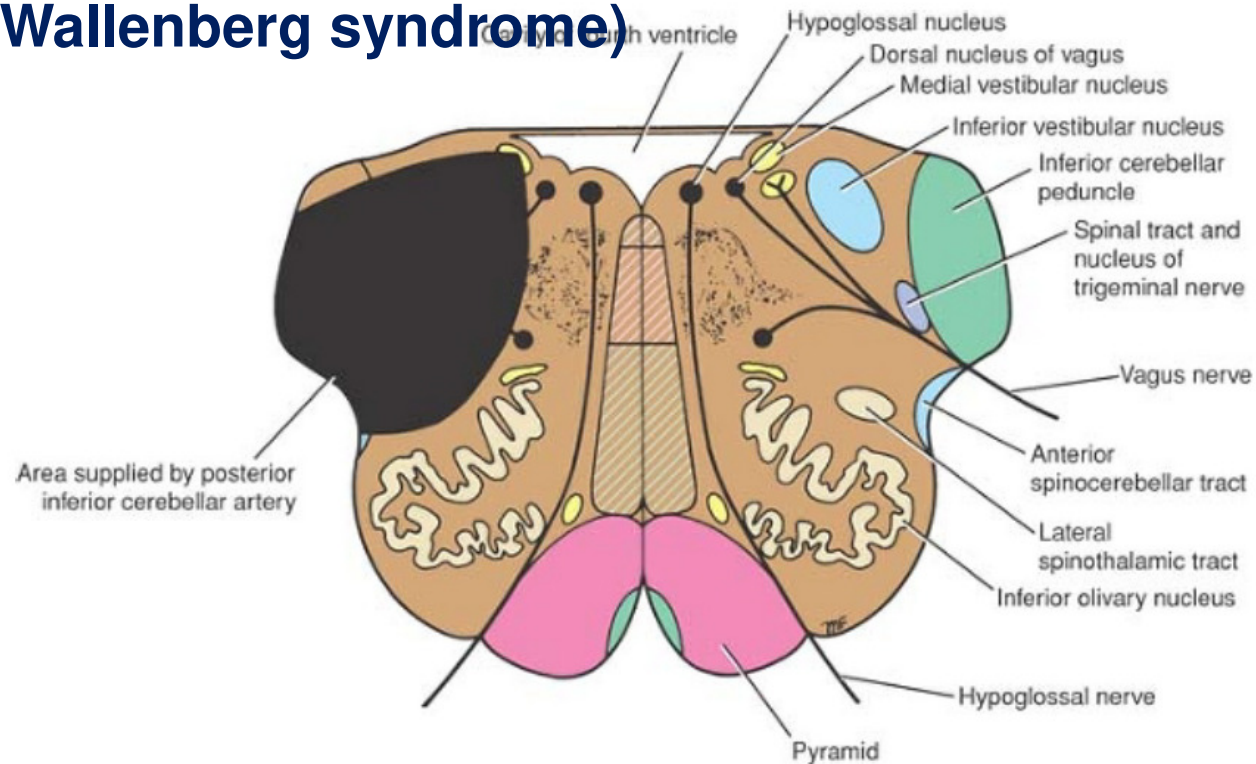
Medial medullary syndrome (Dejerine syndrome)

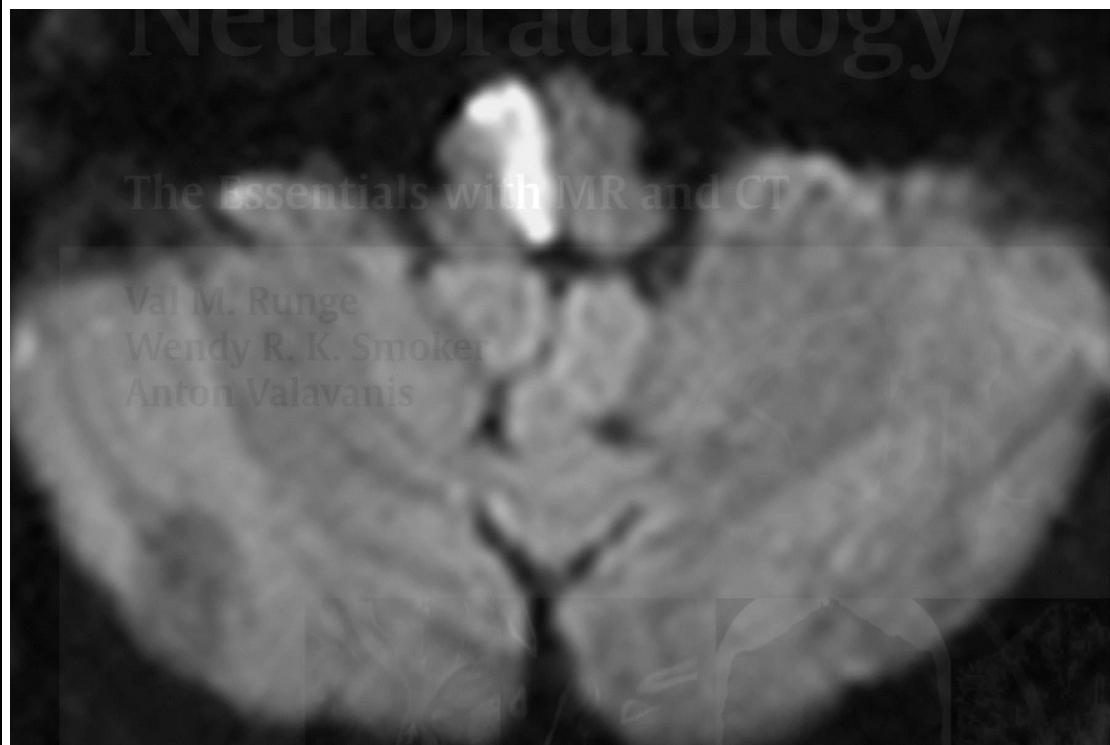
- Symptoms
 - Contralateral hemiparesis (pyramidal and corticospinal damage)
 - Contralateral loss of proprioception and vibratory sense (medial lemniscus)
 - Deviation of the tongue to the ipsilateral side when it is protruded (hypoglossal root or nucleus injury)



Lateral medullary syndrome (Wallenberg syndrome)

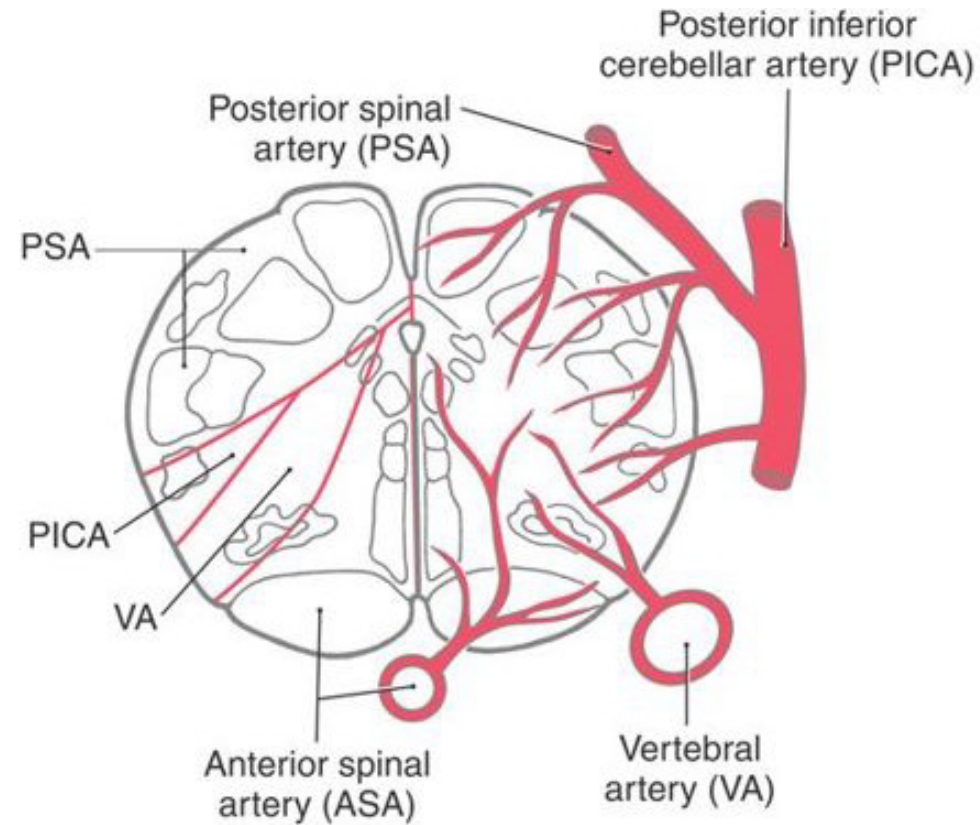
- Symptoms
- contralateral loss of pain and temperature sensation from the body (anterolateral system)
- ipsilateral loss of pain and temperature sensation from the face (spinal trigeminal tract and nucleus),
- vertigo and nystagmus (vestibular nuclei),
- loss of taste from the ipsilateral half of the tongue (solitary tract and nucleus),
- hoarseness and dysphagia (nucleus ambiguus or roots of cranial nerves IX and X)
- **Ipsilateral Horner syndrome:**
hypothalamospinal fibers

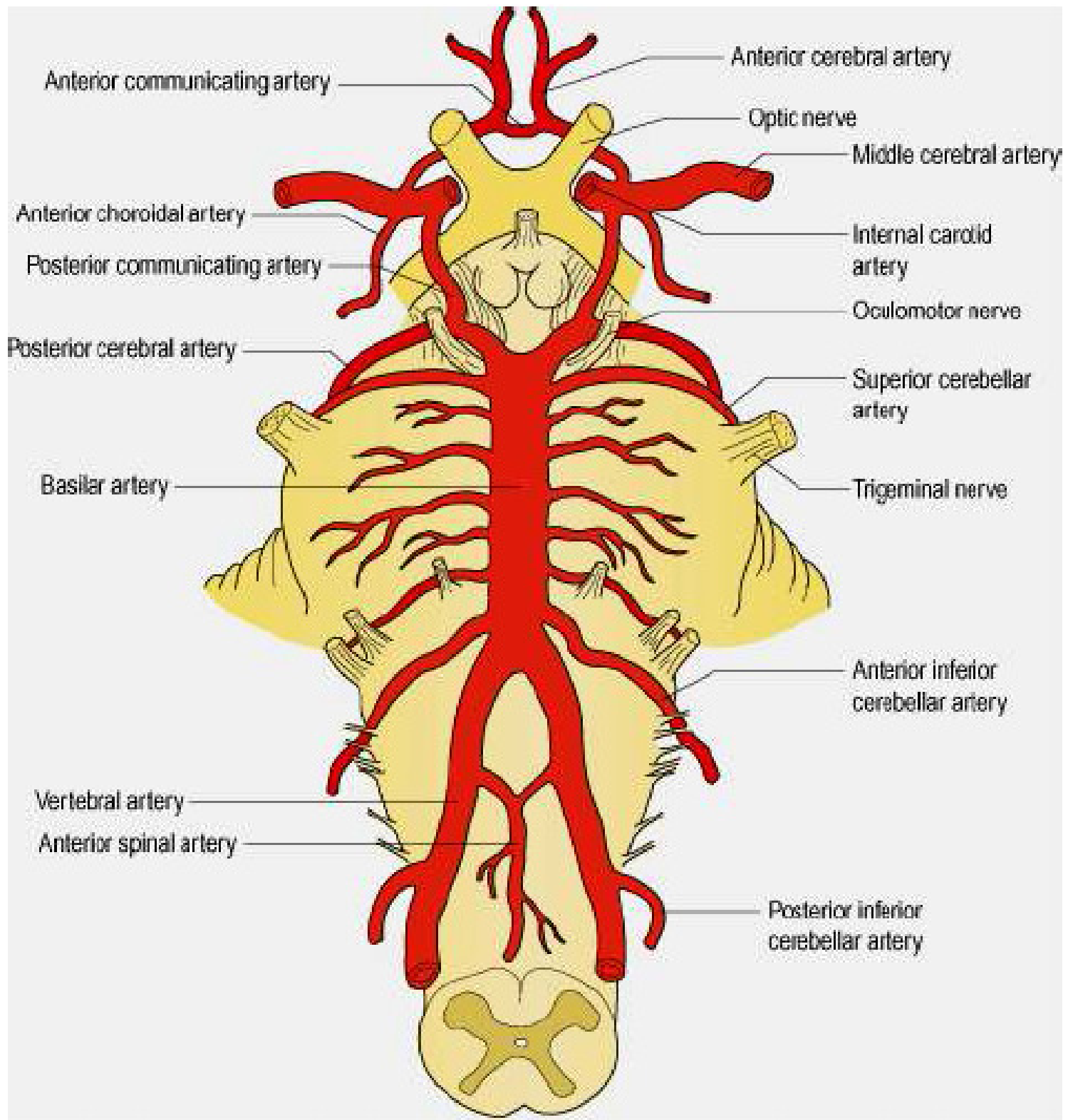


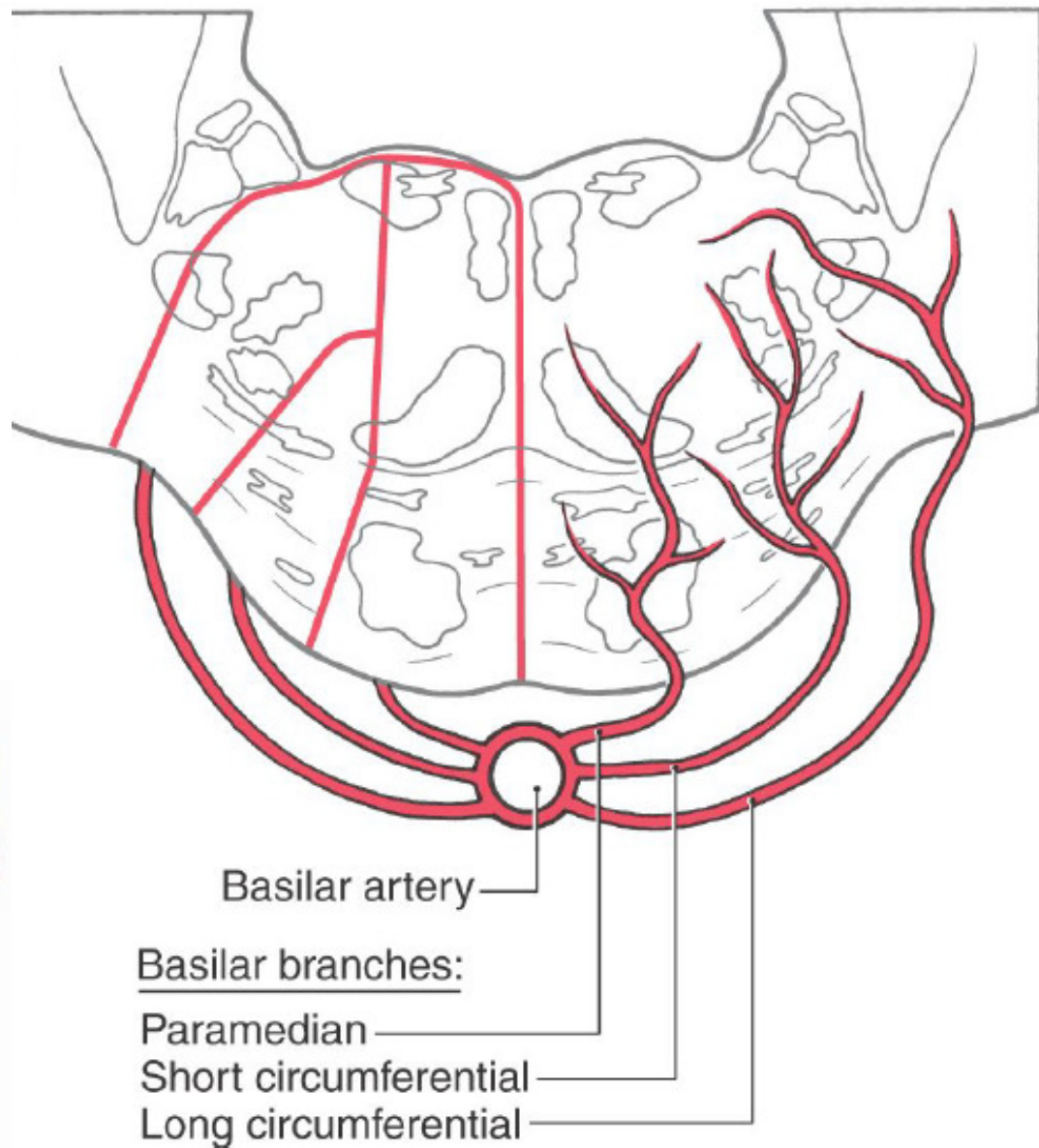
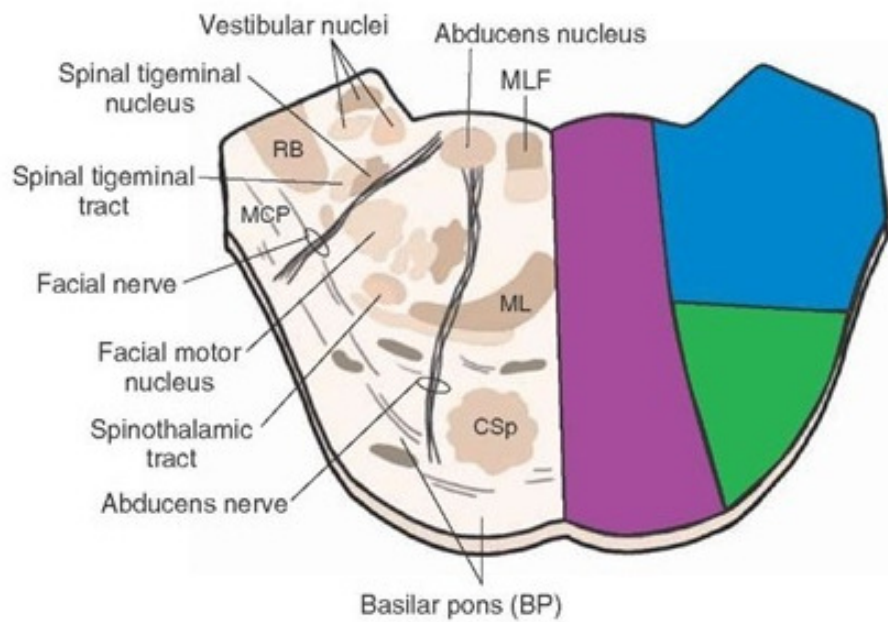
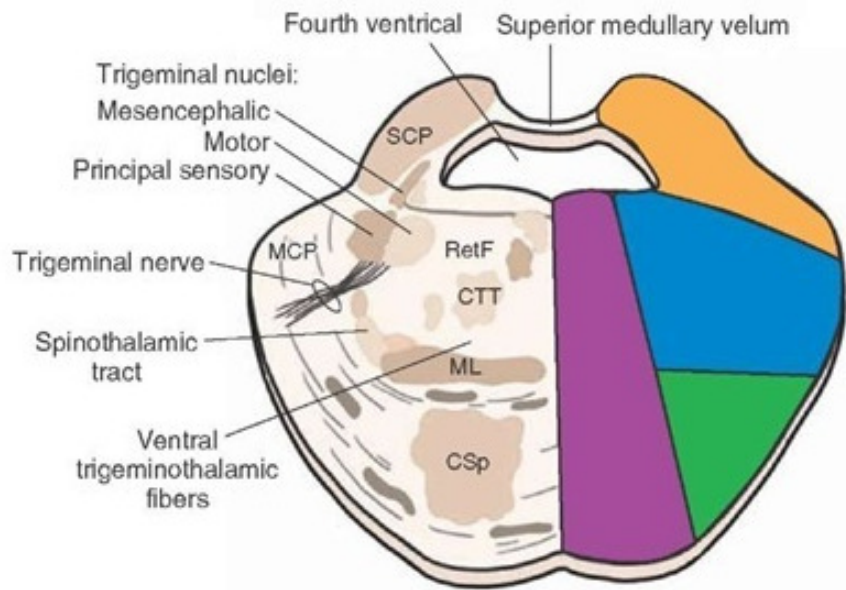


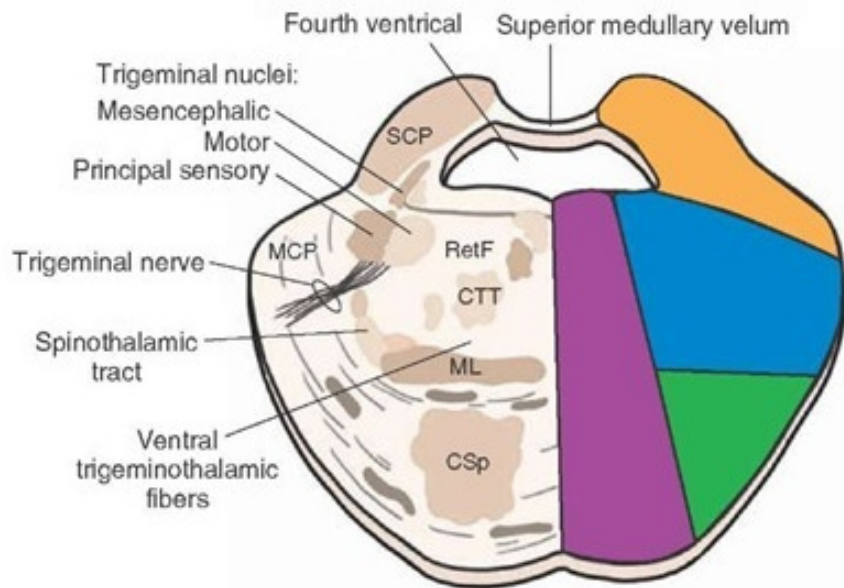
Vascular lesions of the posterior spinal artery

- Symptoms
 - ipsilateral loss of proprioception and vibratory sense
 - ipsilateral loss of pain and temperature sensation from the face









Paramedian branches of basilar artery



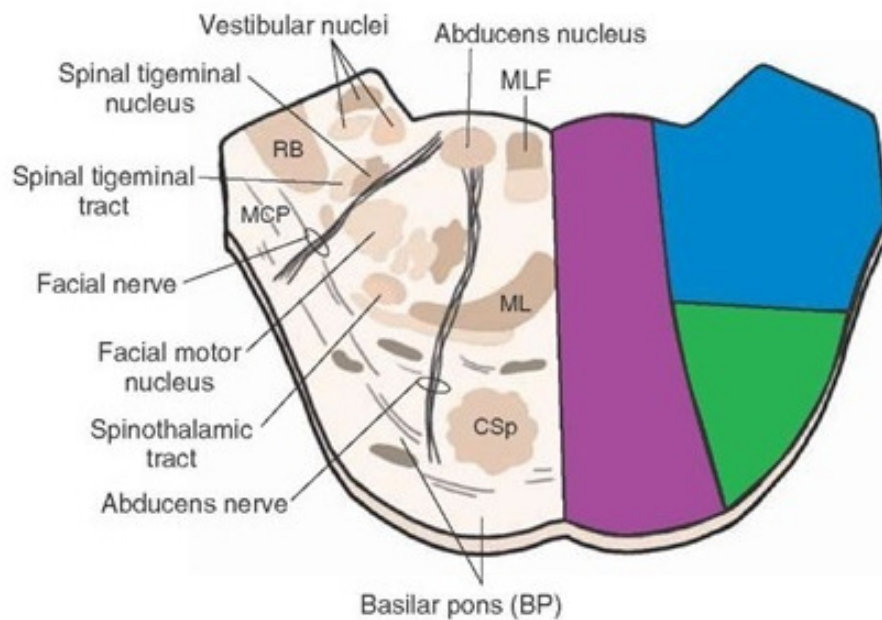
Long circumferential branches of basilar artery and branches of anterior inferior cerebellar artery (AICA)



Long circumferential branches of basilar artery

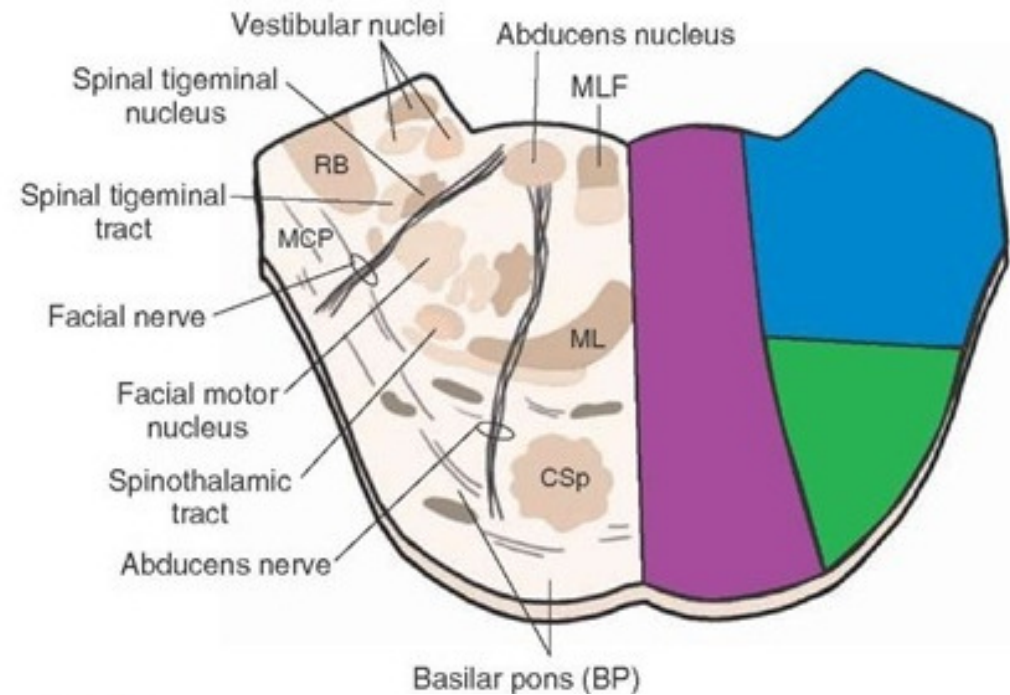


Long circumferential branches of basilar artery and branches of superior cerebellar artery (SCA)



Foville syndrome

- Due to: Occlusion of the paramedian branches
- ipsilateral abducens nerve paralysis
- contralateral hemiparesis
- variable contralateral sensory loss reflecting various degrees of damage to the medial lemniscus



- Paramedian branches of basilar artery
- Long circumferential branches of basilar artery and branches of anterior inferior cerebellar artery (AICA)
- Long circumferential branches of basilar artery

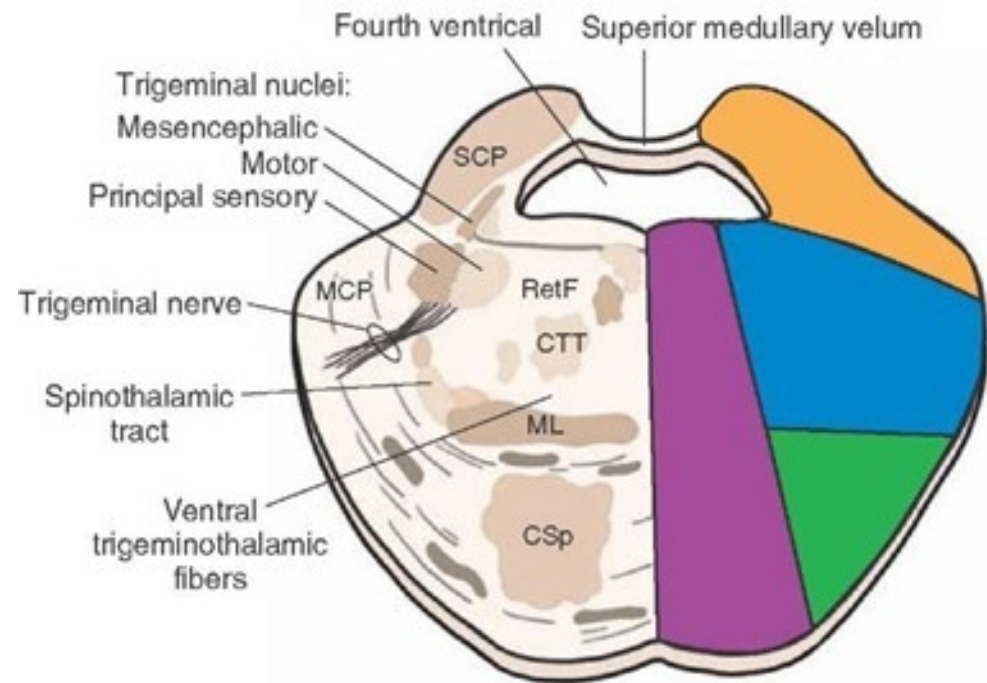
Millard-Gubler syndrome

- If the area of damage is shifted somewhat laterally to include the root of the **facial nerve along with corticospinal fibers**, the patient has a **contralateral** hemiparesis and an ipsilateral paralysis of the facial muscles

Syndrome of the midpontine base

- Due to: Occlusion of the paramedian branches and short circumferential branches
- Corticospinal fibers (contralateral hemiparesis)
- Sensory and motor trigeminal roots (ipsilateral loss of pain and thermal sense and paralysis of the masticatory muscles),
- Fibers of the middle cerebellar peduncle (ataxia).

hallmark of brainstem vascular lesions, **ipsilateral cranial nerve sign coupled with a contralateral long tract sign**



Paramedian branches of basilar artery



Long circumferential branches of basilar artery and branches of anterior inferior cerebellar artery (AICA)

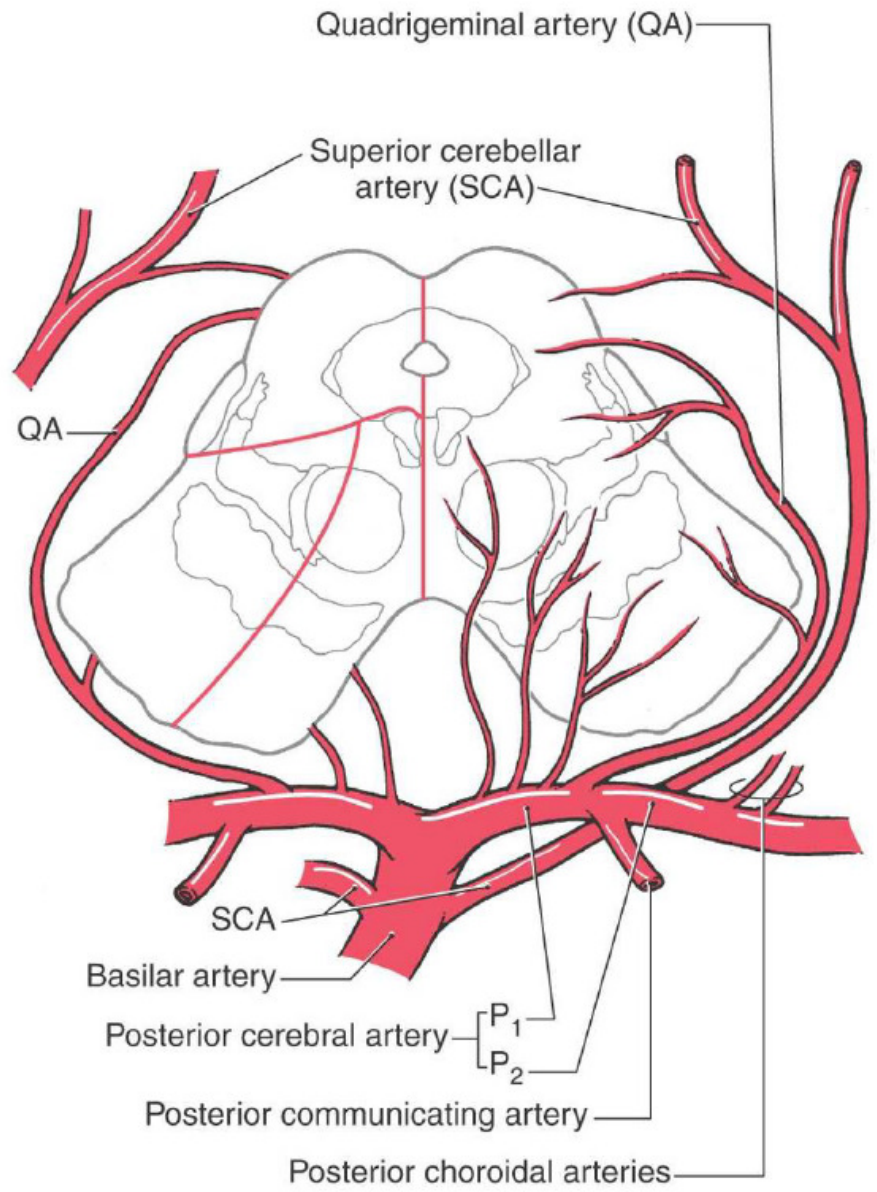


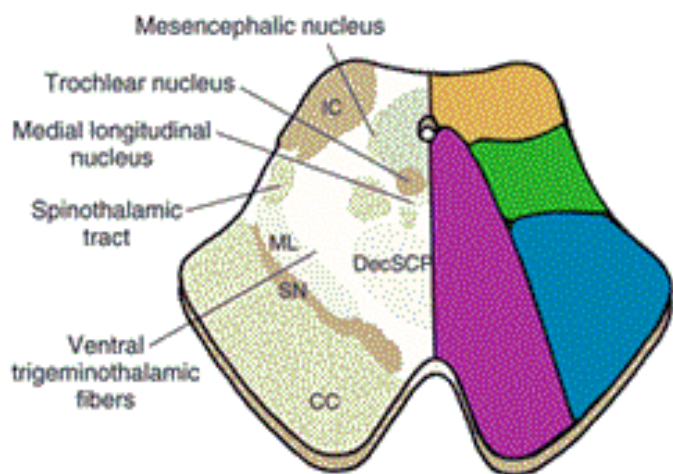
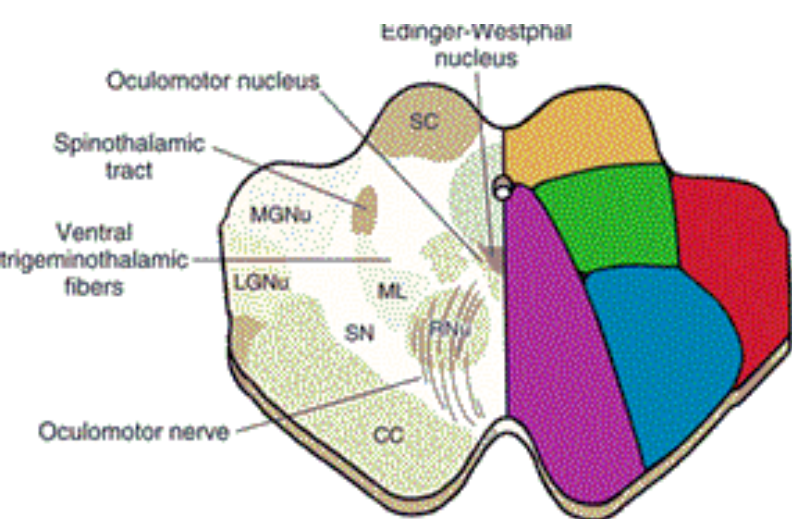
Long circumferential branches of basilar artery



Long circumferential branches of basilar artery and branches of superior cerebellar artery (SCA)

- **Basilar artery**
 - **quadrigeminal**
 - **superior cerebellar arteries**
- **Internal carotid: anterior choroidal artery**
- **Posterior cerebral artery: medial posterior choroidal artery**










paramedian branches

are the oculomotor, trochlear, and Einger-Westphal nuclei; the exiting oculomotor fibers; the red nucleus; and medial aspects of the substantia nigra and crus cerebri

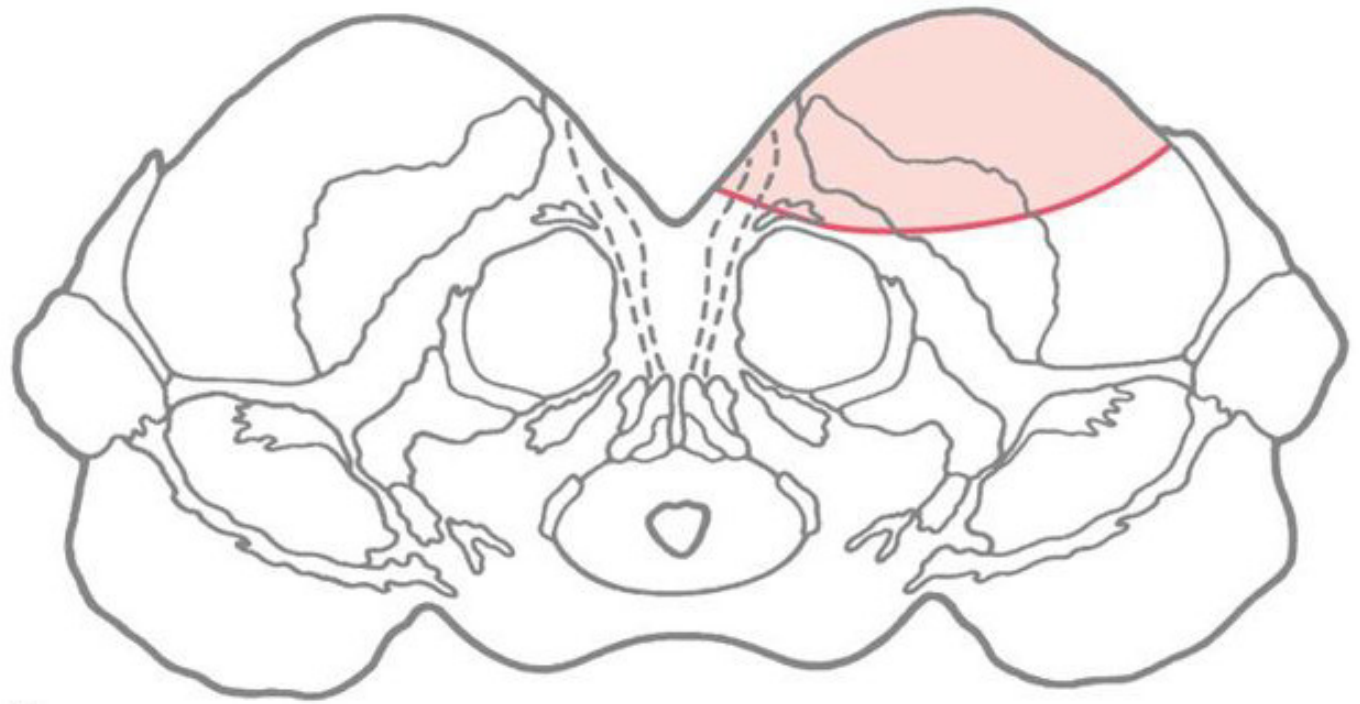
Medial regions of the midbrain receive numerous small branches from posterior cerebral artery and from the posterior communicating artery

Ventrolateral regions of the midbrain are served by penetrating branches of the **quadrigeminal artery the anterior choroidal artery, and the medial posterior choroidal artery**. The region served by these branches includes the lateral parts of the crus and substantia nigra and the medial lemniscus

The posterior midbrain is served primarily by the **quadrigeminal artery** which typically arises from posterior cerebral artery Much of the periaqueductal gray, the nuclei of the superior and inferior colliculi, the anterolateral system, and the brachium of the inferior colliculus are served by quadrigeminal branches. Additional blood supply medial branches of the superior cerebellar artery

-  Anteromedial (paramedian) branches of basilar bifurcation and posterior cerebellar artery (paramedian branches)
-  Anterolateral (short circumferential) branches of the quadrigeminal and medial posterior choroidal arteries
-  Lateral branches of quadrigeminal (level of inferior colliculus) and posterior medial choroidal arteries (level of superior colliculus)
-  Quadrigeminal and superior cerebellar arteries (level of inferior colliculus), quadrigeminal and posterior medial choroidal arteries (level of superior colliculus)
-  Thalamogeniculate artery posterior cerebral artery

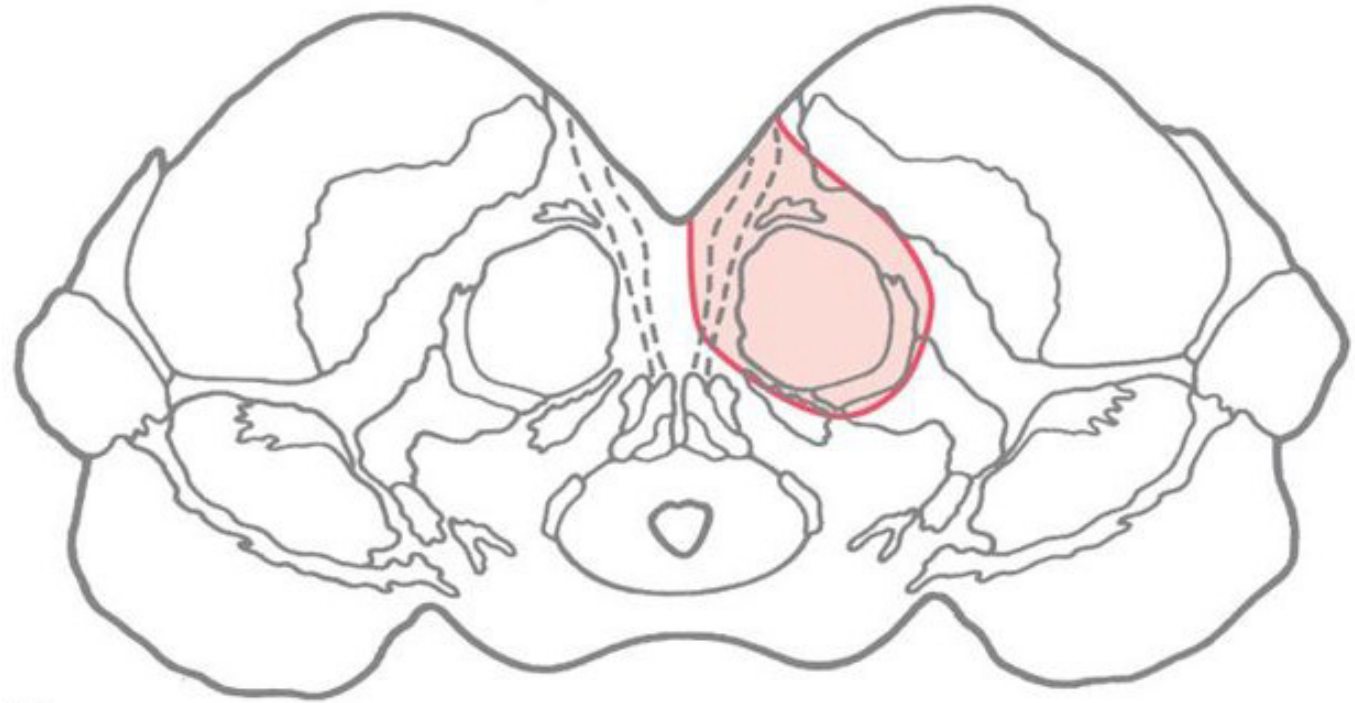
Weber syndrome



- Due to: Occlusion of vessels serving the medial portions of the midbrain involving the oculomotor nerve and the crus cerebri.
- Ipsilateral paralysis of all extraocular muscles except the lateral rectus and superior oblique
- Paralysis of the contralateral extremities
- Ipsilateral dilatation of pupil
- Contralateral weakness of the facial muscles of the lower half of the face
- Contralateral deviation of the tongue when it is protruded

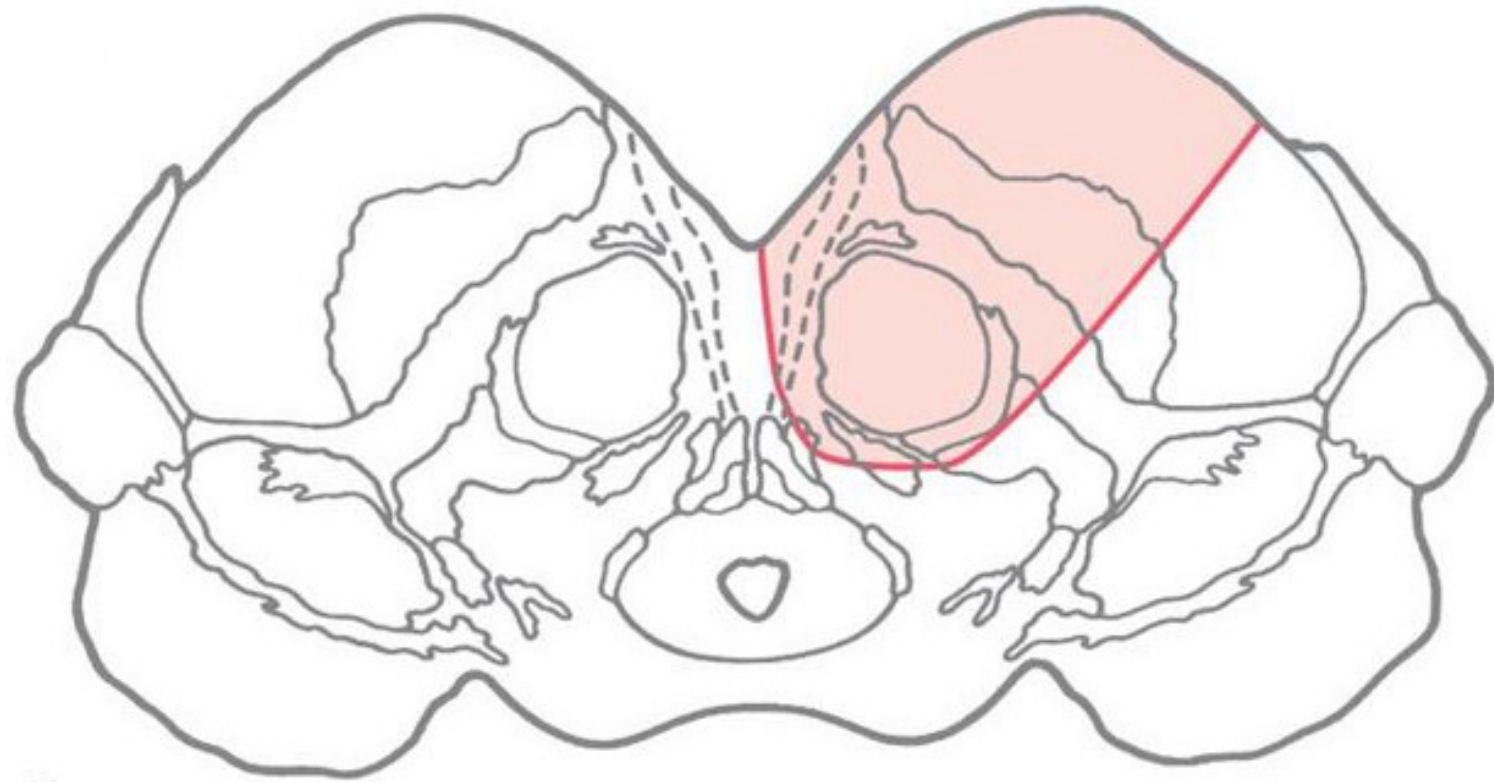
hallmark of brainstem vascular lesions, **ipsilateral cranial nerve sign coupled with a contralateral long tract sign**

Claude syndrome



- Due to: Occlusion of vessels serving the central area of the midbrain
- ipsilateral paralysis of most eye movements; the eye is directed down and out
- Ipsilateral dilatation of pupil
- contralateral ataxia, tremor, and incoordination

Benedikt syndrome



- Large lesion that includes the territories of both the Weber and Claude syndromes

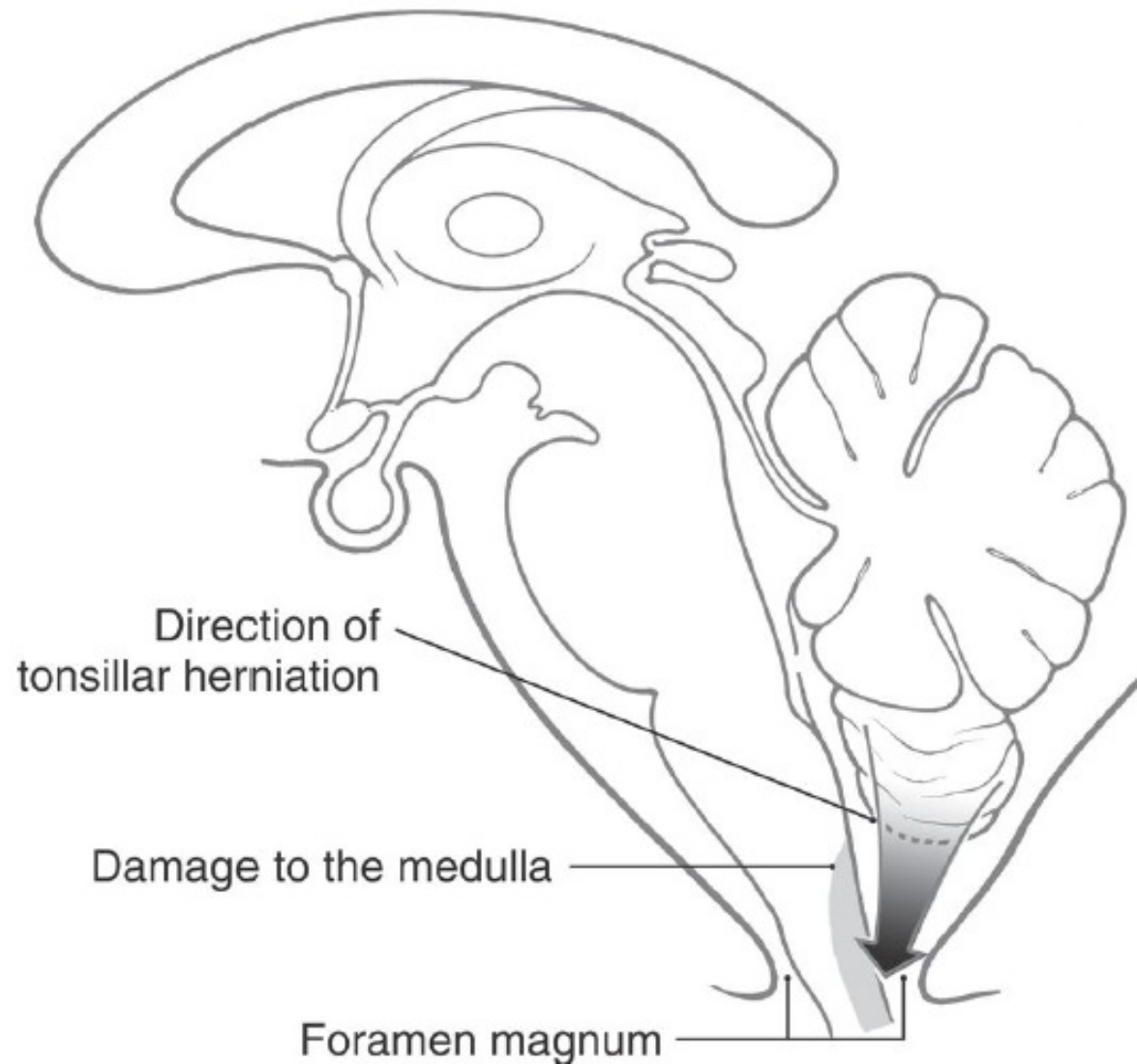
TONSILLAR HERNIATION

❑ Causes:

- mass in the posterior fossa (tumor, hemorrhage)
- **increase in intracranial pressure**
- The major concern in acute herniation is damage to the **ventrolateral reticular area** (heart rate and respiration)

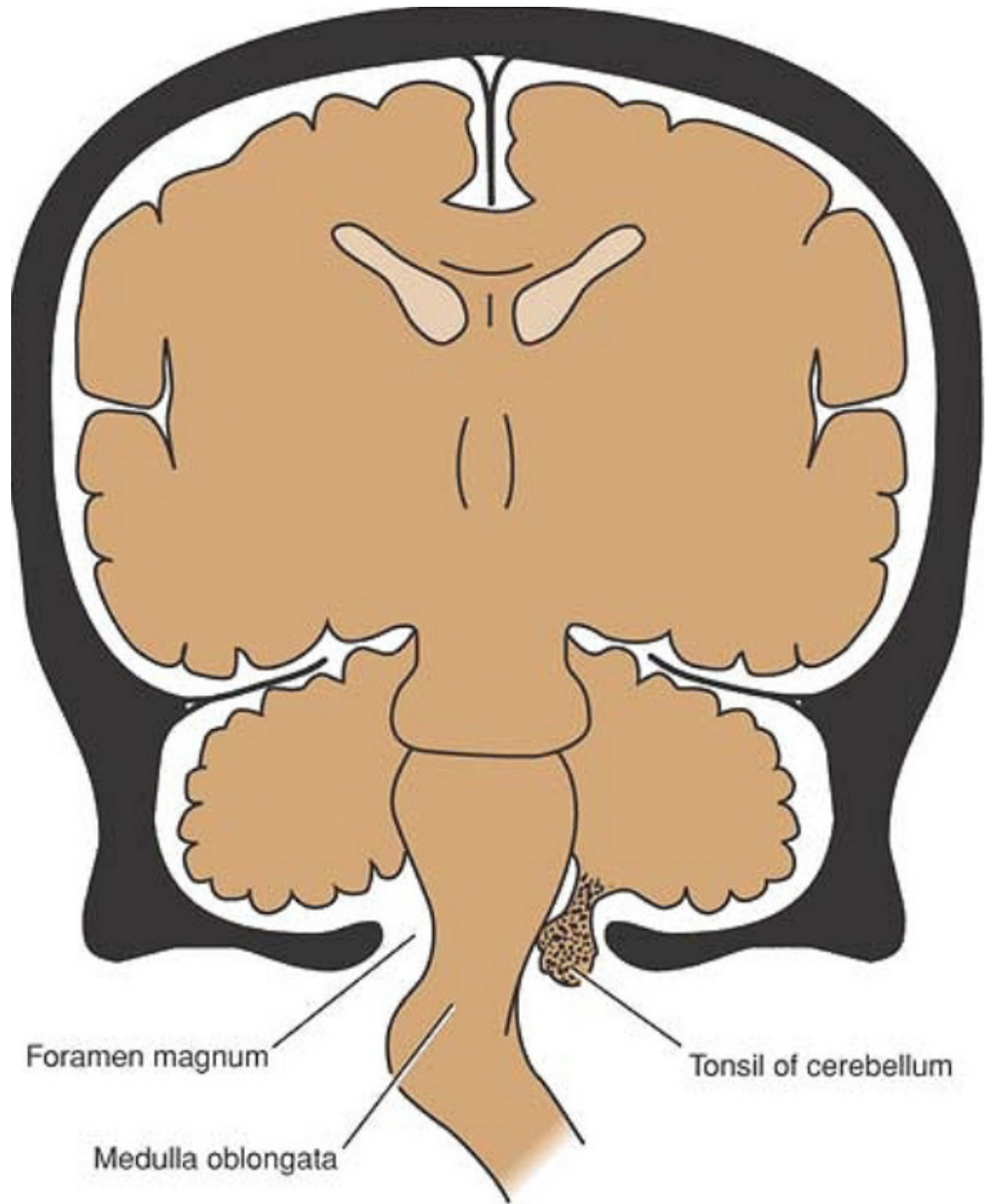
❑ Symptoms

- sudden change in heart rate and respiration
- **hypertension**
- **hyperventilation**
- rapidly decreasing levels of consciousness
- If severe death



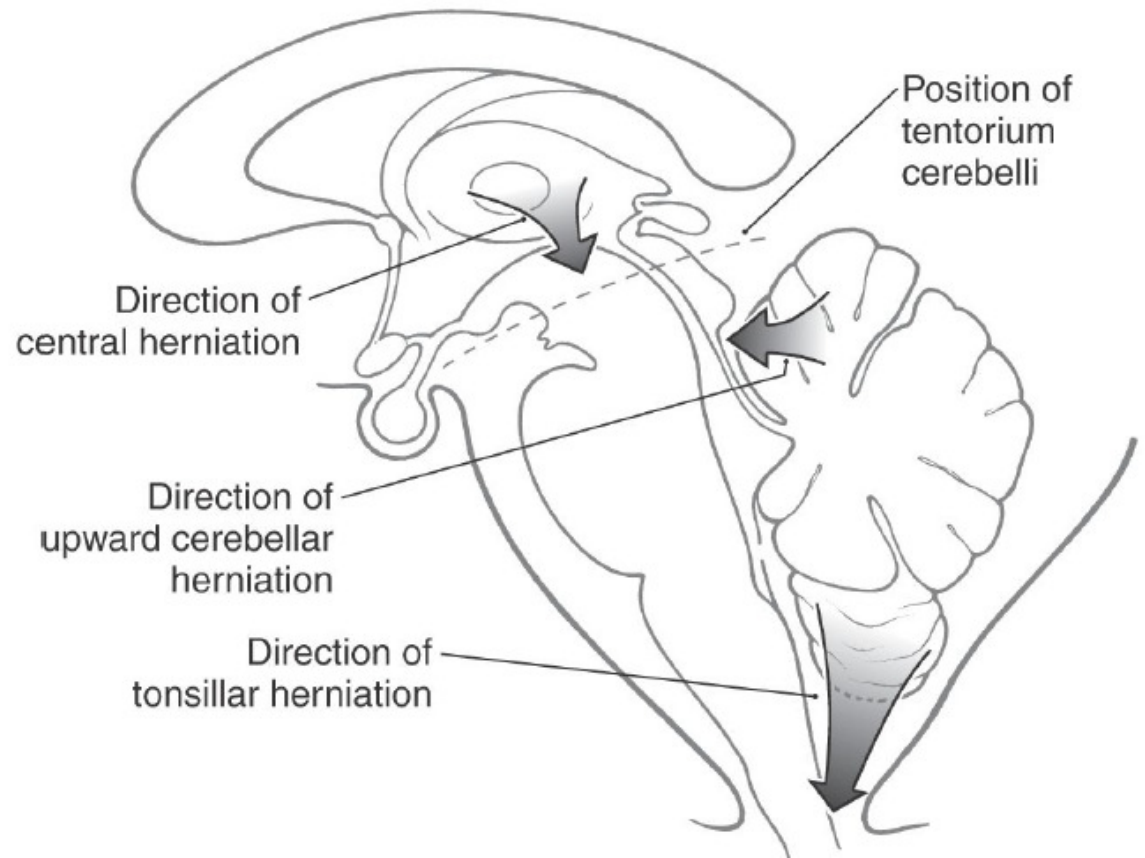
Arnold-Chiari Phenomenon

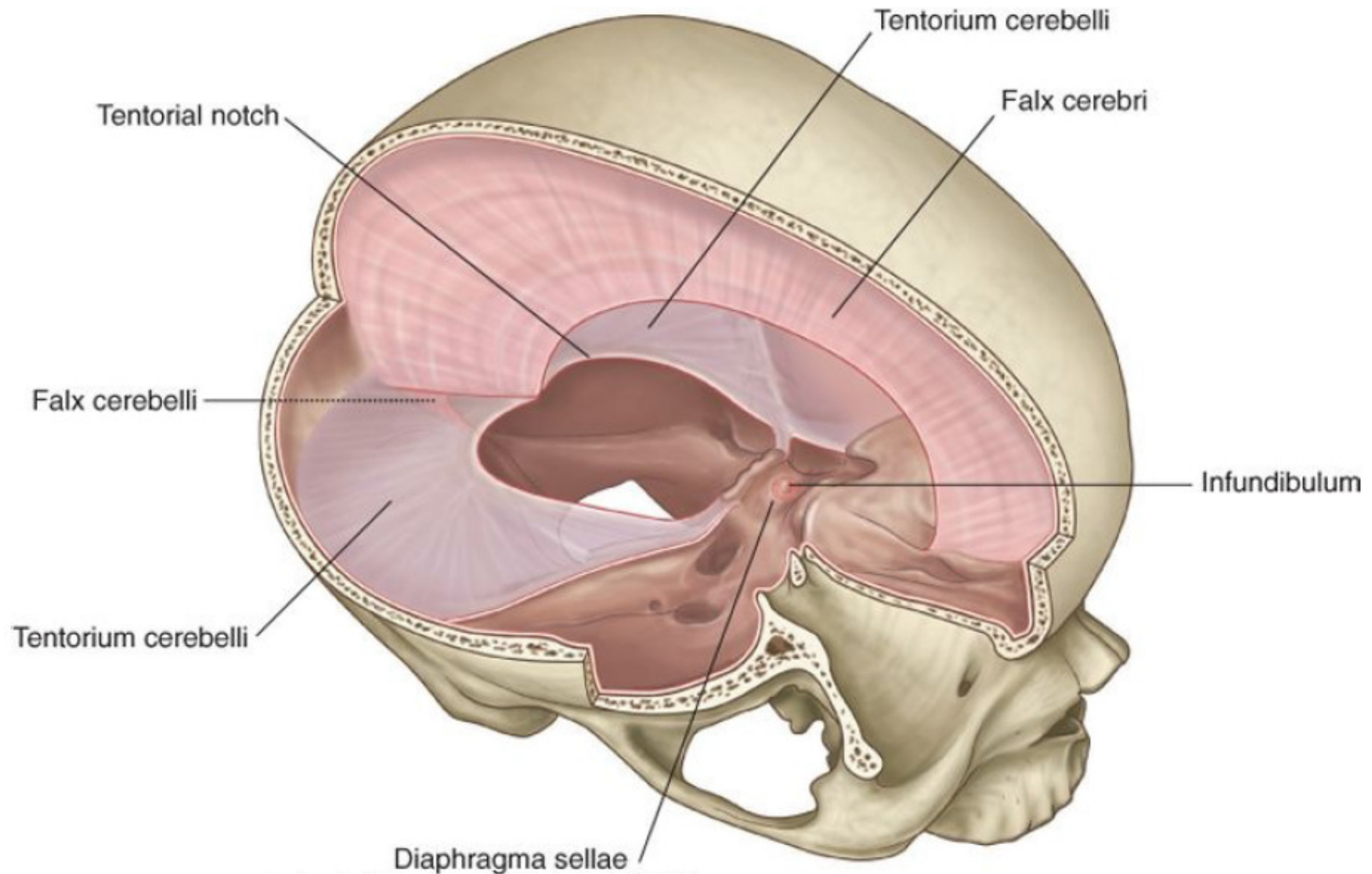
- Congenital anomaly in which there is a herniation of the tonsils of the cerebellum and the medulla oblongata through the foramen magnum into the vertebral canal



Central herniation

- ❑ space occupying lesion in the hemisphere (supratentorial compartment) elevates intracranial pressure and forces the diencephalon downward through the tentorial notch and into the brainstem
- ❑ Symptoms: change in respiration, eye movements are irregular,
 - As the damage progresses downward into the brainstem, there is significant change in respiration
 - Tachypnea and apnea
 - profound loss of motor and sensory functions,
 - probable loss of consciousness.

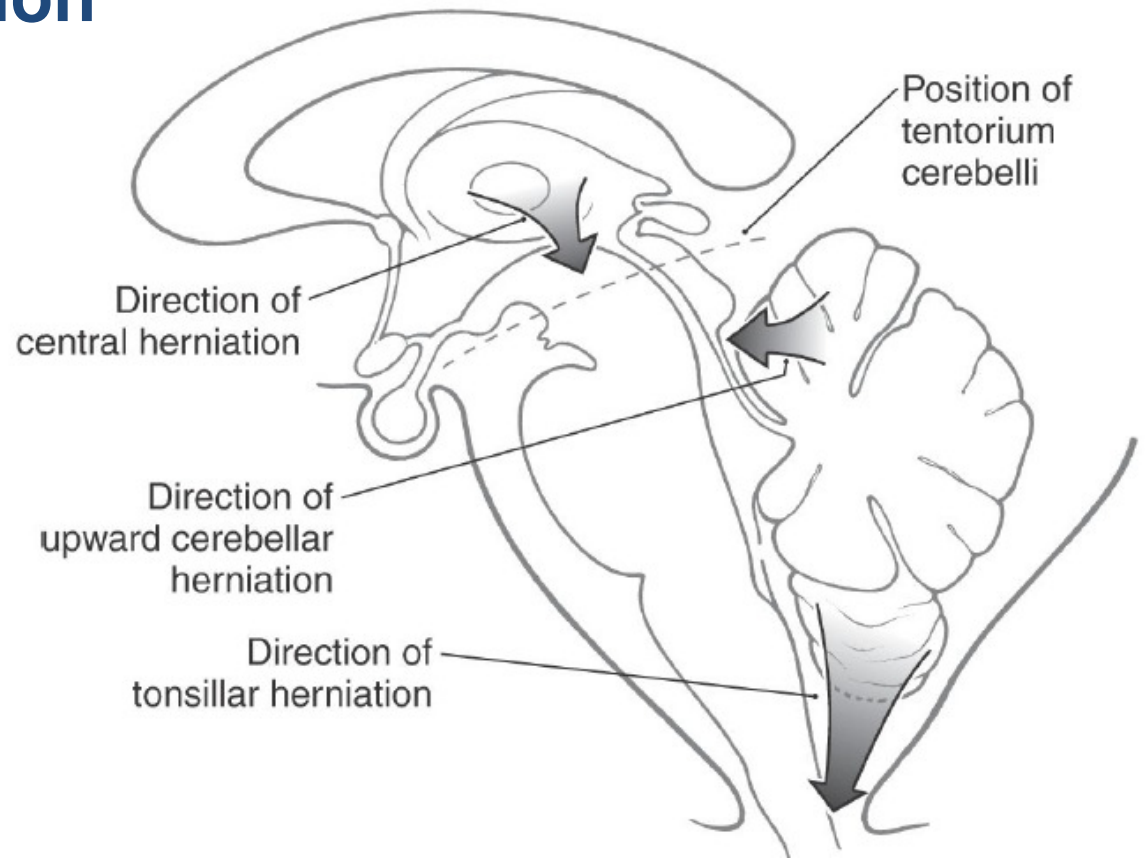




- Falx cerebri: crescent-shaped, Attachments:
 - Anterior: crista galli, Posterior: tentorium cerebelli
- Tentorium cerebelli: horizontal, Attachments:
 - Anteriolateral: superior border of the petrous. Posterior: occipital bone, Anteriolmedial: free, tentorial notch

Upward Cerebellar Herniation

- A mass in the posterior fossa may force portions of the cerebellum upward through the tentorial notch (upward cerebellar herniation) and compress the midbrain
- The result may be occlusion of branches of the superior cerebellar artery with resultant infarction of cerebellar structures or obstruction of the cerebral aqueduct and hydrocephalus.
- The latter is seen as signs characteristic of an increase in intracranial pressure
- vomiting, headache, lethargy, decreased levels of consciousness).



Uncal Herniation

➤ movement the uncus) downward over the edge of the tentorium cerebelli

➤ **Early signs:**

❖ dilated pupil ipsilateral to the herniation

❖ abnormal eye movements ipsilateral to the herniation

❖ double vision

❖ Weakness of the extremities (corticospinal fiber involvement) opposite to the dilated pupil.

➤ **Later:**

❖ respiration is affected

