

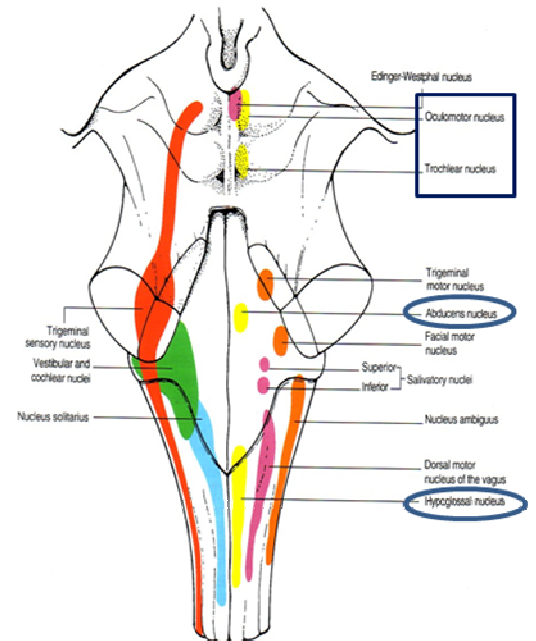
DEEP ORIGIN OF THE CRANIAL NERVES

- The first **two** cranial nerves are attached directly to the forebrain.
- The last **10** cranial nerves (from the 3rd to the 12th) are attached to the brain stem.
- The olfactory system is closely associated functionally and structurally to the limbic system.
- The nuclei of the last 10 cranial nerves are arranged in **7 columns** in each side of the middle line in the brain stem.
- In the brain stem, in each side of the middle line, there are **medial 3 column contain motor nuclei** and the **lateral 4 column contain sensory nuclei**.

MOTOR NUCLEI COLUMN :

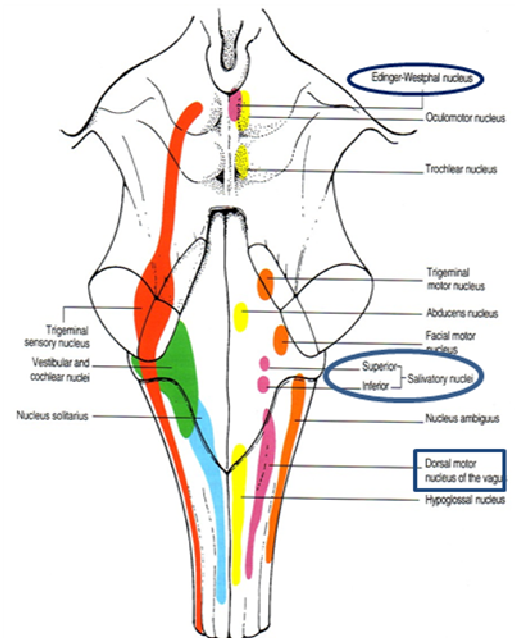
1. General Somatic Efferent (GSE) column :

- Motor nuclei which are in line with the anterior horn cells of the spinal cord.
- It give rise to motor fibers which supply striated muscles developed from the **myotomes** (3,4,6 ,12), (eye & tongue).
- These are :
 1. **Hypoglossal nucleus** in the medulla oblongata.
 2. **Abducent nucleus** in the caudal Pons.
 3. **Oculomotor** and **Trochlear nuclei** in the midbrain.



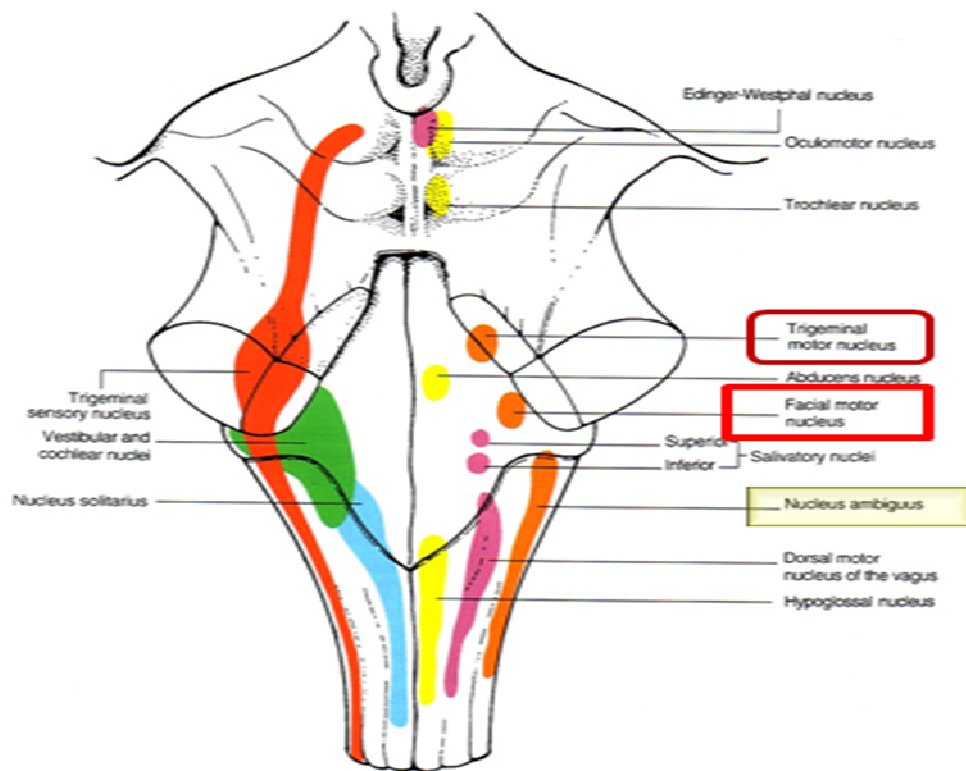
2. General Visceral Efferent (GVE) column :

- Motor nuclei which give **parasympathetic** fibers to supply smooth muscles of the organs, blood vessels and glands (**3,7,9,10**).
- It is homologues to the **lateral horn** cells in the spinal cord.
- These are :
 1. **Dorsal motor nucleus of vagus.**
 2. **Inferior salivatory nucleus.**
 3. **Superior salivatory nucleus.**
 4. **Edinger-Westphal nucleus.**



3. Special Visceral Efferent (SVE) Column :

- Motor nuclei which supply muscles developed from the **pharyngeal arches**, (**Branchiomotor cell column**).
- These are : (**5,7,9 &10**)
 1. **Ambiguus nucleus**, in medulla (9, 10 & cranial part of accessory nerve).
 2. **Motor nucleus of the trigeminal nerve**, in the **mid Pons**.
 3. **Motor nucleus of the facial, nerve** in the **caudal Pons**.



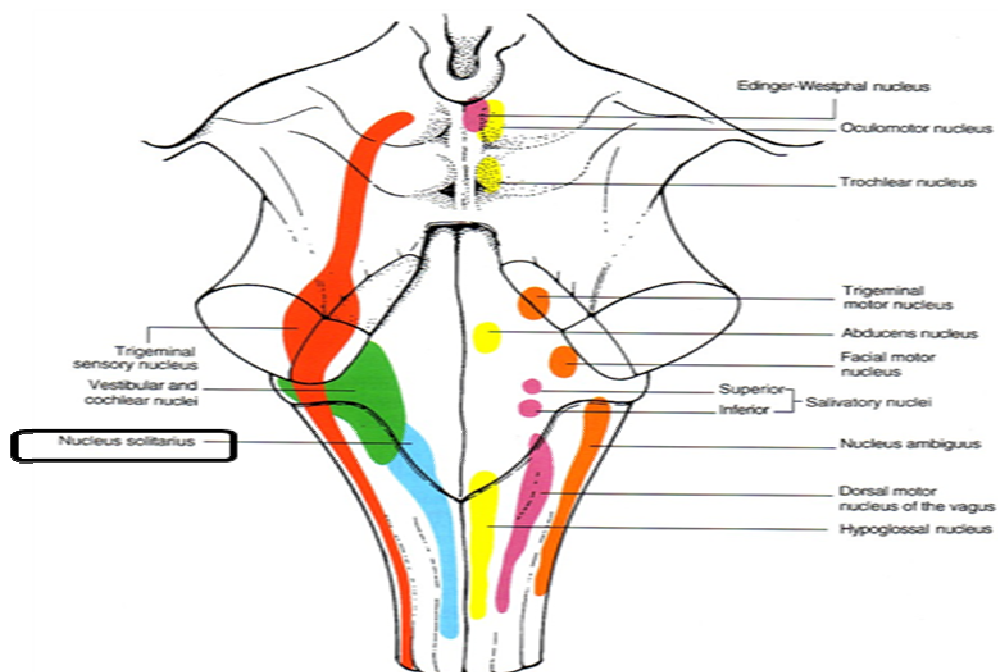
SENSORY NUCLEI COLUMN :

1. General Visceral Afferent (GVA) column :

- Sensory nucleus which receive, visceral afferent from pharynx, larynx, esophagus ,thoracic and abdominal viscera : **Nucleus solitarius.**

2. Special Visceral Afferent (SVA) column :

- Sensory nucleus which receives taste sensation : **Nucleus solitarius.**



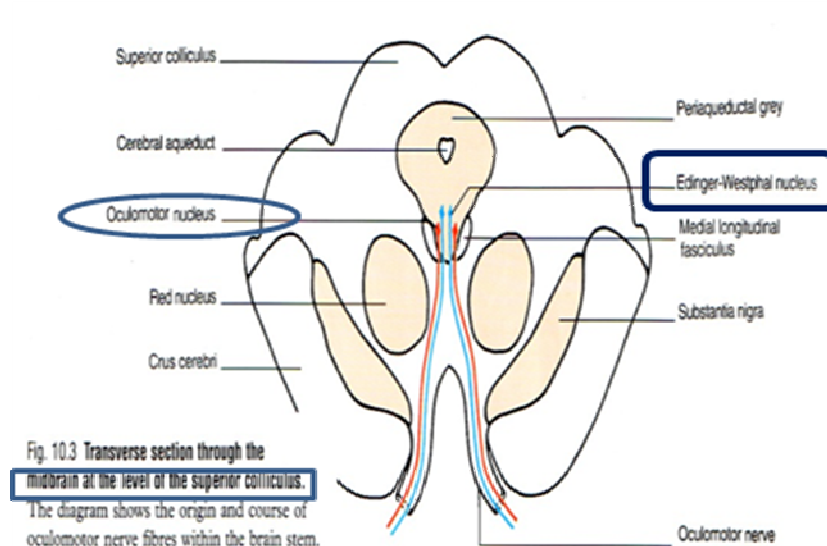
3. General Somatic Afferent (GSA) column : Sensory nuclei which receive :

- General sensation : (pain, **temperature**, pressure and touch) from the head :
 - **Trigeminal sensory nucleus (Spinal and main sensory nuclei of trigeminal nerve.**
- Deep (proprioceptive) sensation : from muscles of mastication and tendons & ligaments of TMJ :
 - **Mesencephalic nucleus of the trigeminal nerve.**

4. Special Somatic Afferent (SSA) column : It receive special sensation from the ear, **Vestibulocochlear nuclei.**

OCULOMOTOR NUCLEUS :

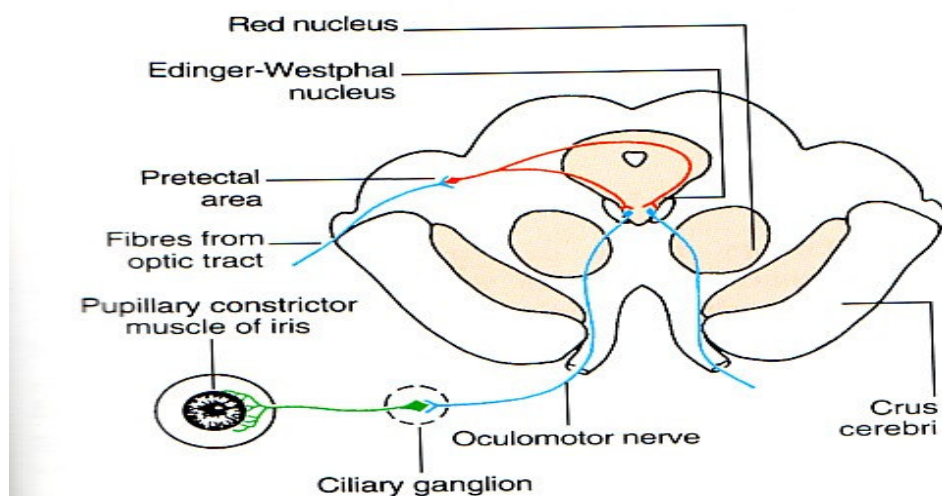
- Lies close to the apex of the periaqueductal grey of the midbrain.
- It lies at the level of the **superior colliculus**.
- Its efferent fibers run in the 3rd CN to **LPS** (Levator palpebrae superioris) and all extraocular muscles except LR6 & SO4. (lateral rectus by abducent nerve ,and superior oblique by trochlear nerve)
- It emerges in the interpeduncular fossa medial to the crus cerebri between the **posterior cerebral and superior cerebellar arteries**.



- Then it passes in the lateral wall of the cavernous sinus then through the **SOF** (sup. orbital fissure), to the orbit.

EDINGER-WESTPHAL NUCLEUS :

- Lies close to the oculomotor nucleus.
- Gives preganglionic fibers to the ciliary ganglion.
- Many of the preganglionic fibers traverse the **Red Nucleus**.
- Postganglionic fibers run in the short ciliary nerve.
- It supply the constrictor pupillae and ciliary muscles.



TROCHLEAR NUCLEUS :

- Lies in the periaqueductal grey of the midbrain at the level of the inferior colliculus.
- Axons pass dorsally and cross the midline (the only nerve from the back of the brain stem).
- It courses around crus cerebri between posterior cerebral and superior cerebellar arteries.
- It runs in the lateral wall of the cavernous sinus then to **SOF**.
- It supplies **SO4**.
- It moves the eye downwards and medially.

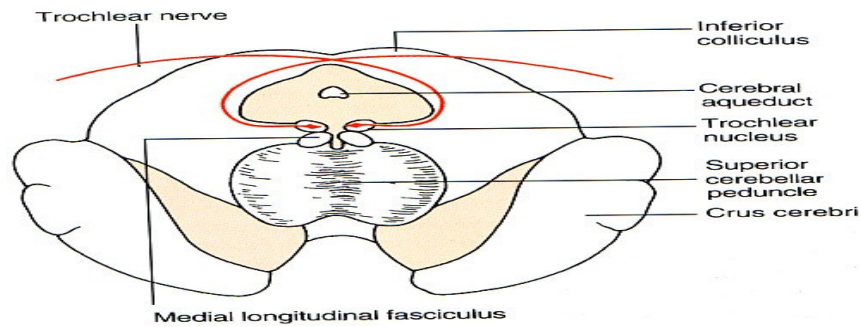


Fig. 10.6 Transverse section through the midbrain at the level of the inferior colliculus. The diagram shows the location of the trochlear nucleus and the course of trochlear nerve fibres.

ABDUCENS NUCLEUS :

- Lies in caudal Pons beneath the floor of the 4th ventricle.
- Fibres pass ventrally and emerge from the **Ponto-medullary** junction between the pyramid and the Pons.
- Abducent nerve passes in the lateral wall of the cavernous sinus then through the **SOF** to supply the lateral rectus which abduct the eye.

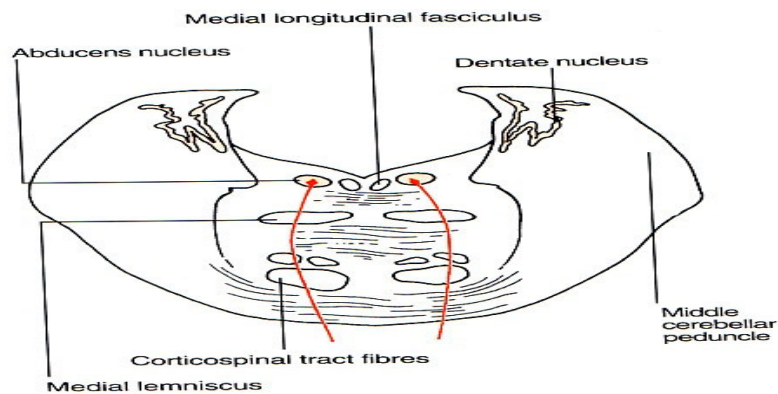


Fig. 10.7 Transverse section through the caudal pons. The diagram shows the location of the abducens nucleus and the course of abducens nerve fibres.

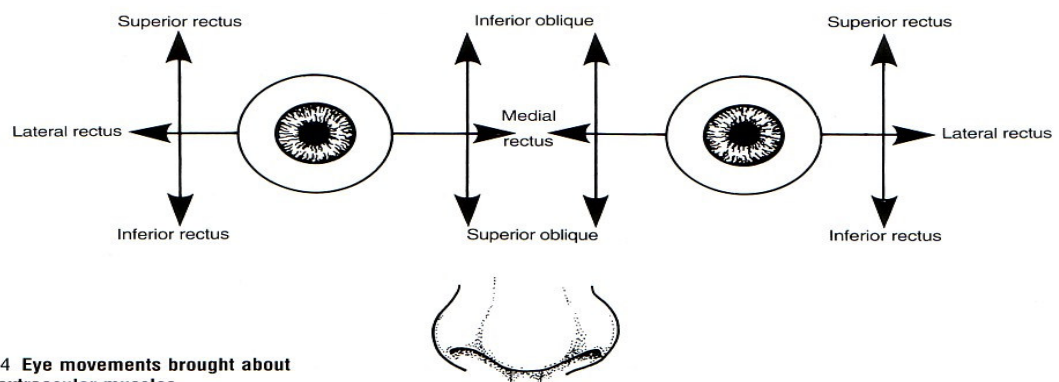


Fig. 10.4 Eye movements brought about by the extraocular muscles.

B

Muscle tested		Direction to move eye when testing muscle
Superior rectus		Look laterally and upward
Inferior rectus		Look laterally and downward
Lateral rectus		Look laterally
Medial rectus		Look medially
Inferior oblique		Look medially and upward
Superior oblique		Look medially and downward

© Elsevier. Drake et al: Gray's Anatomy for Students - www.studentconsult.com

Fig. 10.8 Right oculomotor (III) nerve palsy.

The upper part of the diagram shows ptosis on the right. The lower part shows that, with elevation of the eyelid, the eyeball can be seen to be abducted and the pupil dilated.

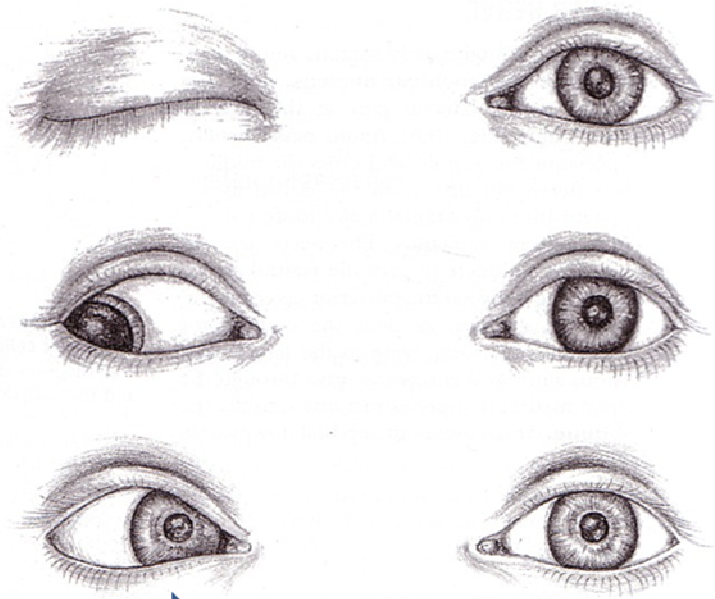


Fig. 10.9 Left abducens (VI) nerve palsy.

On looking in the direction of the arrow, the left eye fails to abduct.



TRIGEMINAL NERVE (MIXED) :

- Sensory fibers of the 5th cranial nerve are carried via the ophthalmic, maxillary and mandibular divisions.
- It emerges from the ventro-lateral aspect of the Pons at the junction with the **MCP** (middle cerebellar peduncle) by **L**arge **L**ateral **S**ensory root & **S**mall **M**otor **M**edial root.
- It carries pain, temperature, touch & pressure sensations from face, ant. scalp, cornea, dura mater, nasal & oral cavities, teeth and gums.

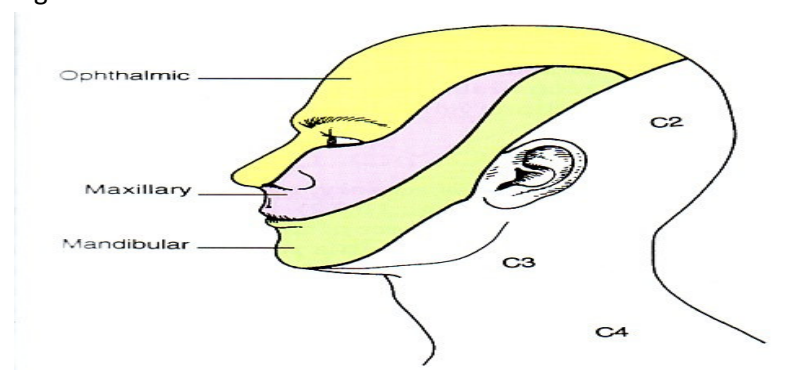


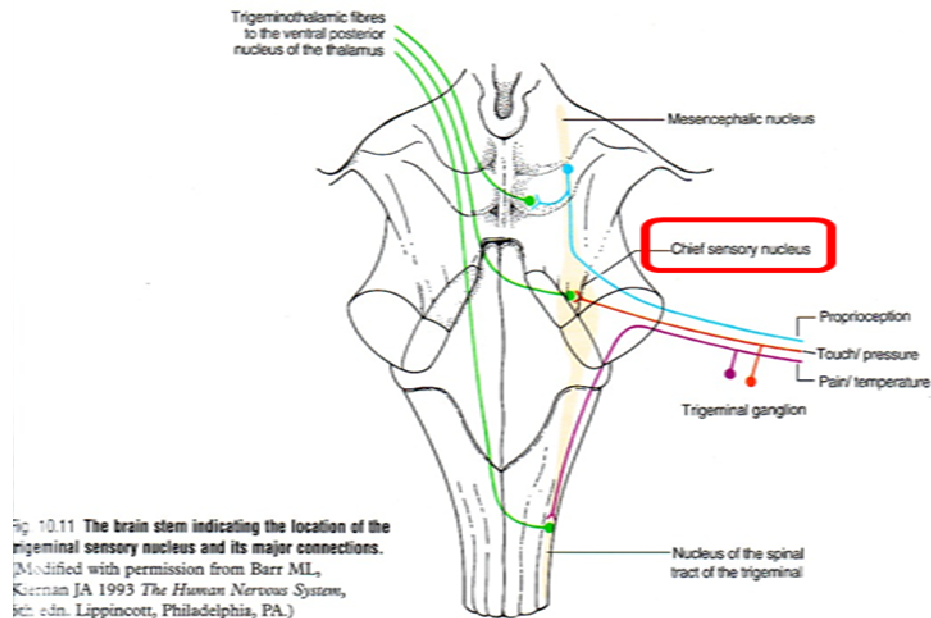
Fig. 10.10 Superficial distribution of sensory fibres in the three divisions of the trigeminal nerve.

TRIGEMINAL NUCLEI :

- One large sensory ganglion located in the middle cranial fossa, at the apex of petrous temporal bone, its central process go to : **Trigeminal Sensory Nucleus.**
- It extends all through the brain stem & upper cervical segments.
- It is formed of 3 subdivisions :

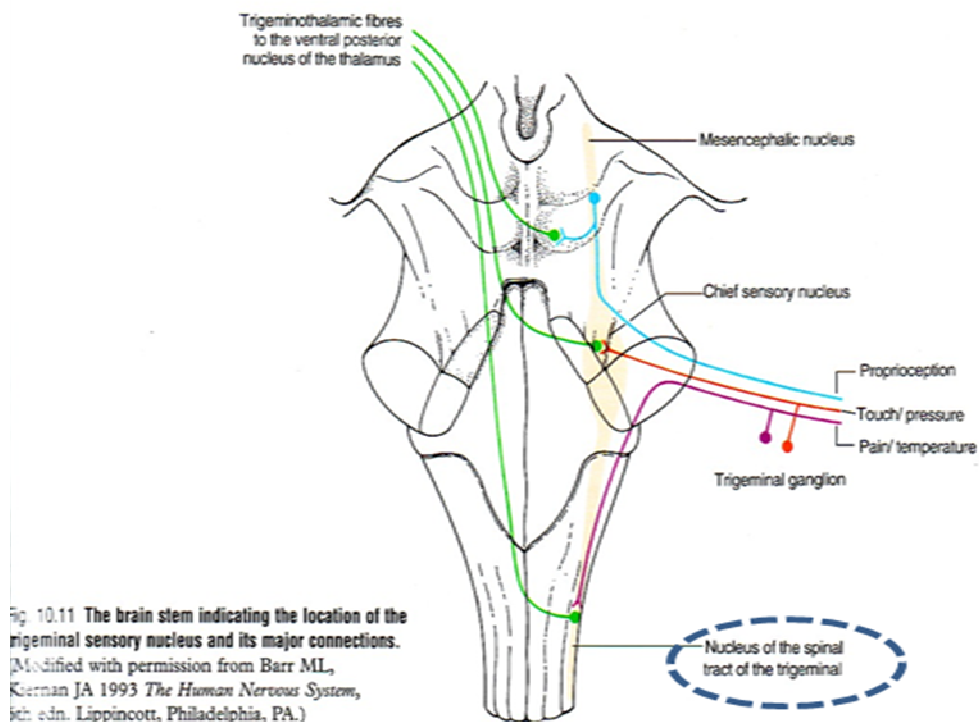
1. Chief or Main or principal sensory nucleus :

- Lies in pontine tegmentum close to the entry of 5th CN.
- It receives touch and pressure.



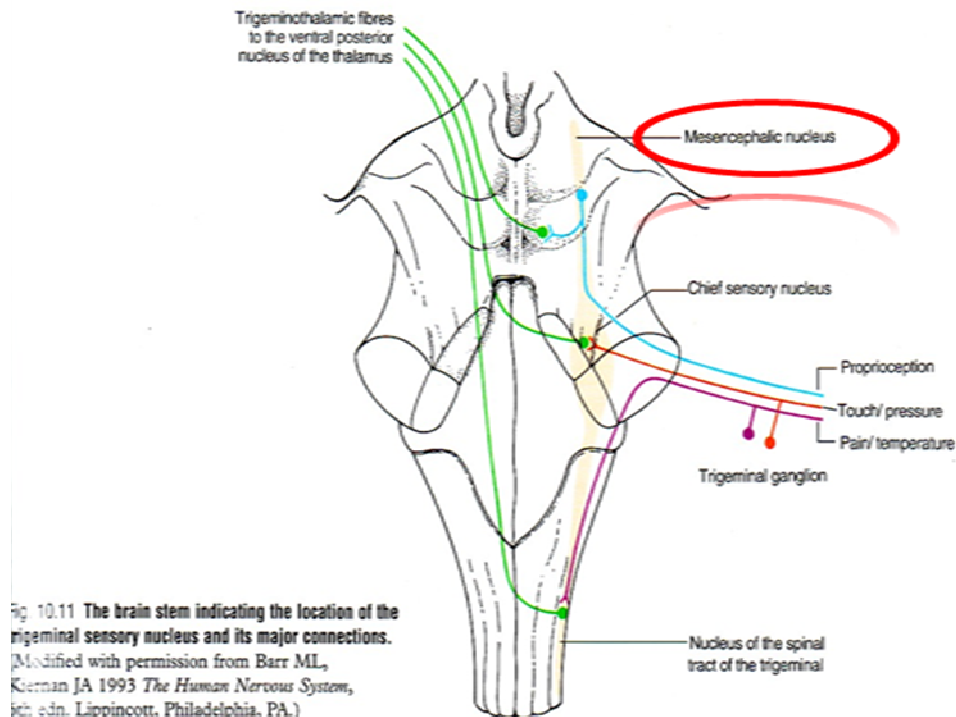
2. Spinal nucleus & tract of the trigeminal nerve :

- Extends caudally in the medulla and upper cervical segments.
- It is continuous below the with substantia gelatinosa of **Rolando**.
- It receives pain & temperature sensations.
- From the face, scalp, orbit, nasal and oral cavities, and anterior 2/3 of the tongue.



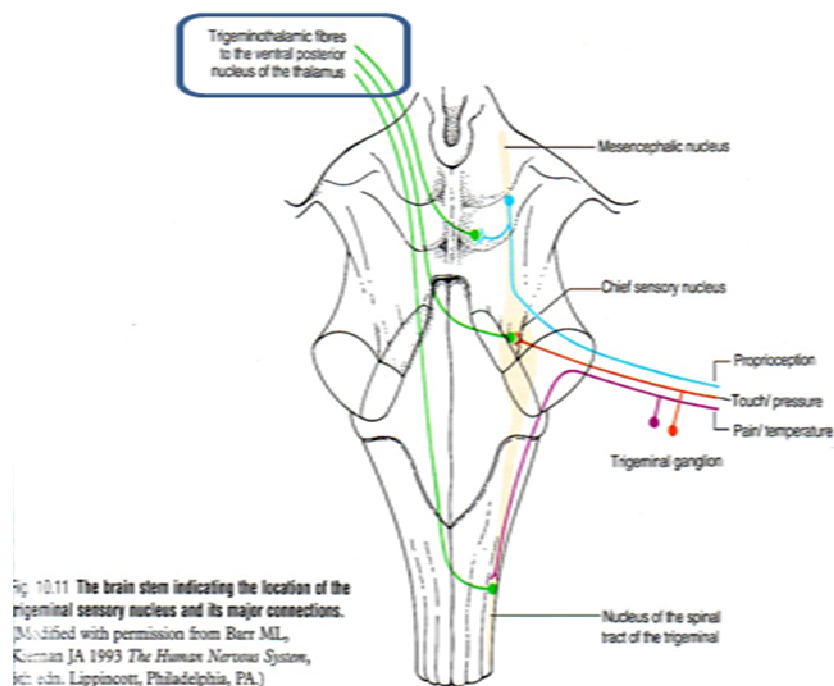
3. Mesencephalic Nucleus :

- Extends rostrally into the midbrain.
- It carries **proprioceptive** afferent fibers from the muscles of mastication and from the **TMJ**.
- The cell bodies of all sensations are present in the **trigeminal ganglion**, *Except proprioceptive* sensation which lies in the CNS.



• Trigeminal lemniscus :

- Axons arising from the trigeminal nucleus decussate to form the contralateral trigeminal tract, or lemniscus (**2nd order neuron**).
- This terminates in the contralateral **PMVN** (post. medial ventral nucleus) of thalamus, then to parietal sensory cortex.
- The trigeminal nucleus sends fibers to the cerebellum from which, the cerebellum send fibers to the **facial nucleus** which mediate facial grimacing and eye closure (corneal reflex).



- **Motor nucleus of trigeminal nerve :**

- It lies in pontine tegmentum medial to the main sensory nucleus.
- Fibers runs in the motor root of the trigeminal, then they join the mandibular nerve.
- It supply **8 (4+4)** muscles which developed from the 1st pharyngeal arch.

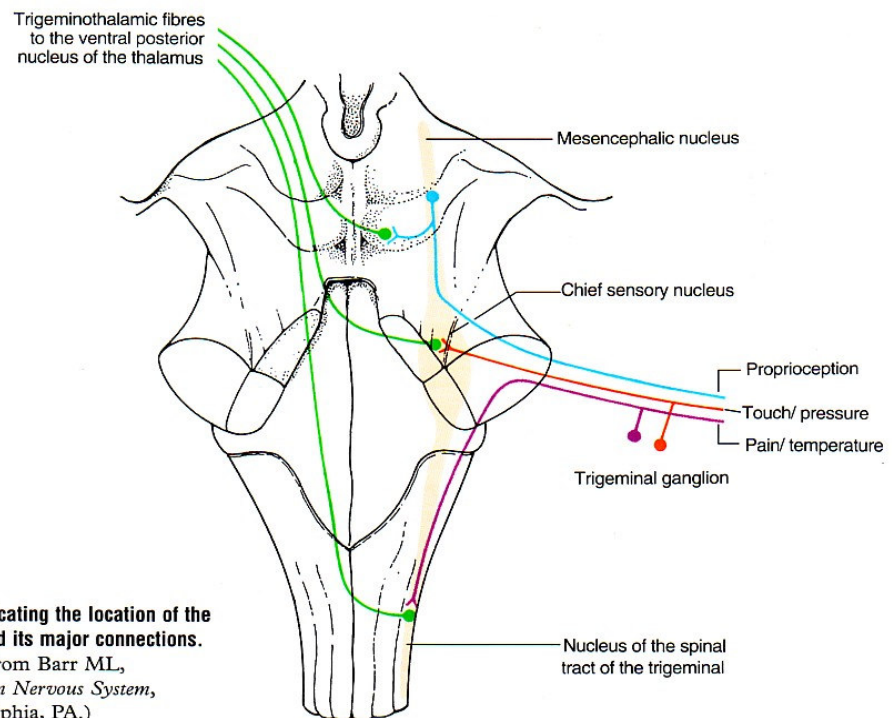


Fig. 10.11 The brain stem indicating the location of the trigeminal sensory nucleus and its major connections. (Modified with permission from Barr ML, Kiernan JA 1993 *The Human Nervous System*, 5th edn. Lippincott, Philadelphia, PA.)

FACIAL NUCLEI :

- The facial nerve contains, sensory, **motor** & parasympathetic fibers.
- It joins the brain stem in the cerebellopontine angle.
- **It consists of two roots :**
 1. **Lateral root** (nervous intermedius), contains sensory & parasympathetic fibers.
 2. **Medial root** contains motor fibers.
- Sensory fibers, carry taste from the anterior 2/3rd of tongue, floor of mouth and palate, which end in rostral part of **solitary nucleus**.
- It also carry cutaneous sensation from part of external ear, which end in the **spinal nucleus of 5th CN**.

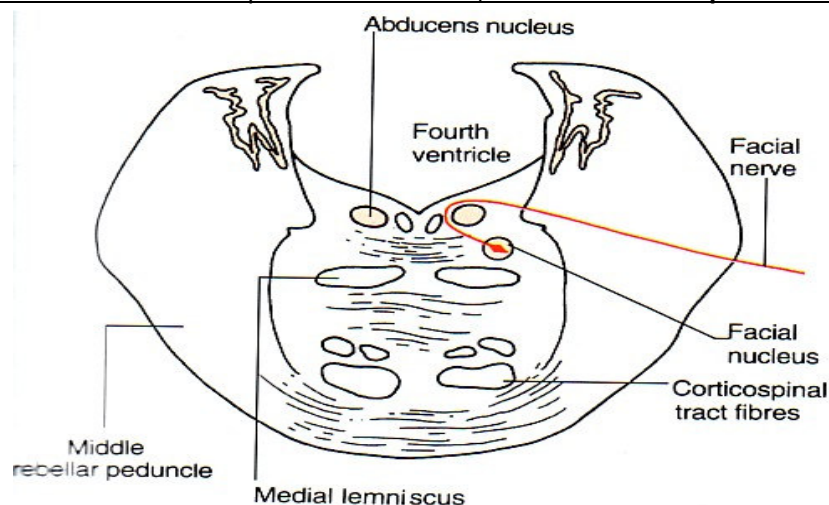


Fig. 10.13 Transverse section through the pons. The diagram shows the origin and course of the motor fibres of the facial nerve.

- **Motor nucleus of facial nerve :**

- It lies in the **caudal Pons**.
- The axons pass dorsally, looping around abducens nucleus beneath the floor of 4th ventricle.
- Axons pass in the motor root 7th CN.
- It supply muscles of 2nd pharyngeal arch.
- **N.B. Corticobulbar fibers project bilaterally to the upper part of the motor 7th nucleus, and project to the lower part of the nucleus from the opposite side only.**

- **Superior salivatory nucleus :**

- Lies in the Pons.
- Axons run in the nervous intermedius, to the parasympathetic ganglia :
 1. **Submandibular ganglion** : Postganglionic fibers pass to submandibular & sublingual salivary gland.
 2. **Pterygopalatine ganglion** : Postganglionic fibers pass to Lacrimal gland, nasal and oral mucous membrane.

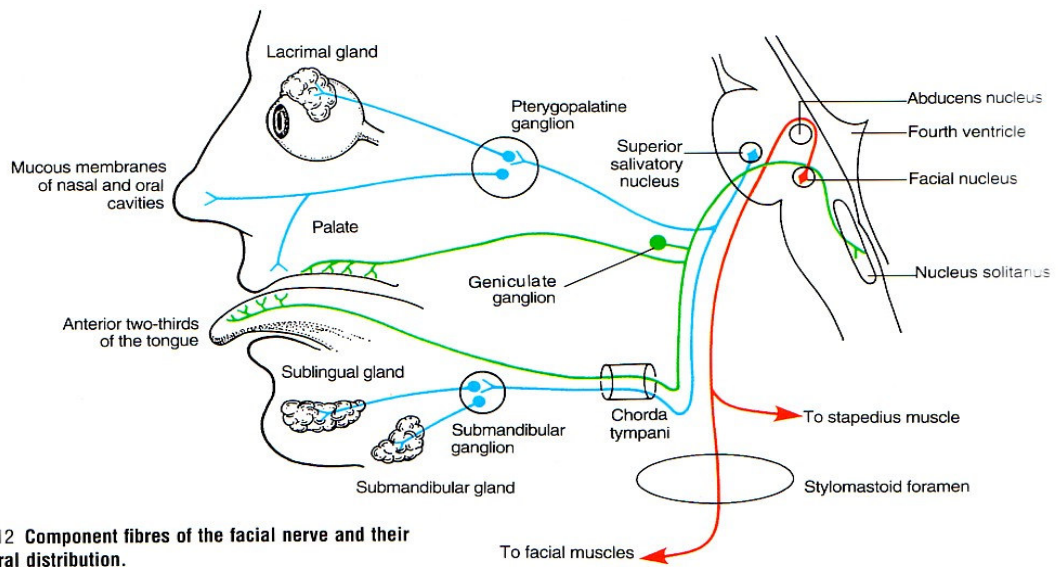
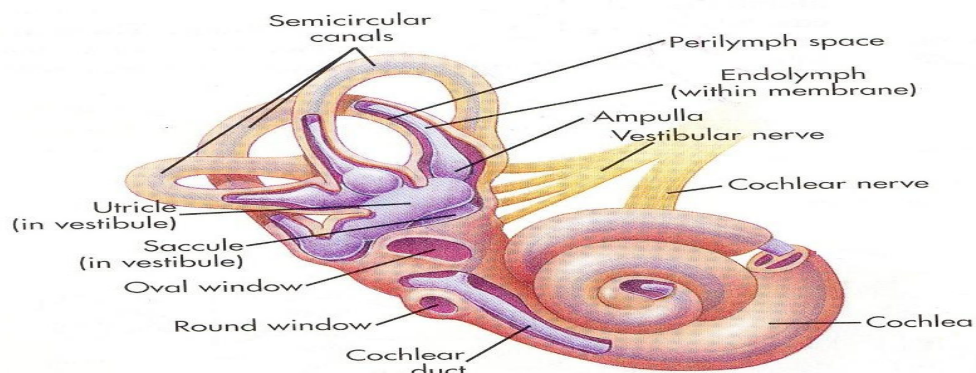


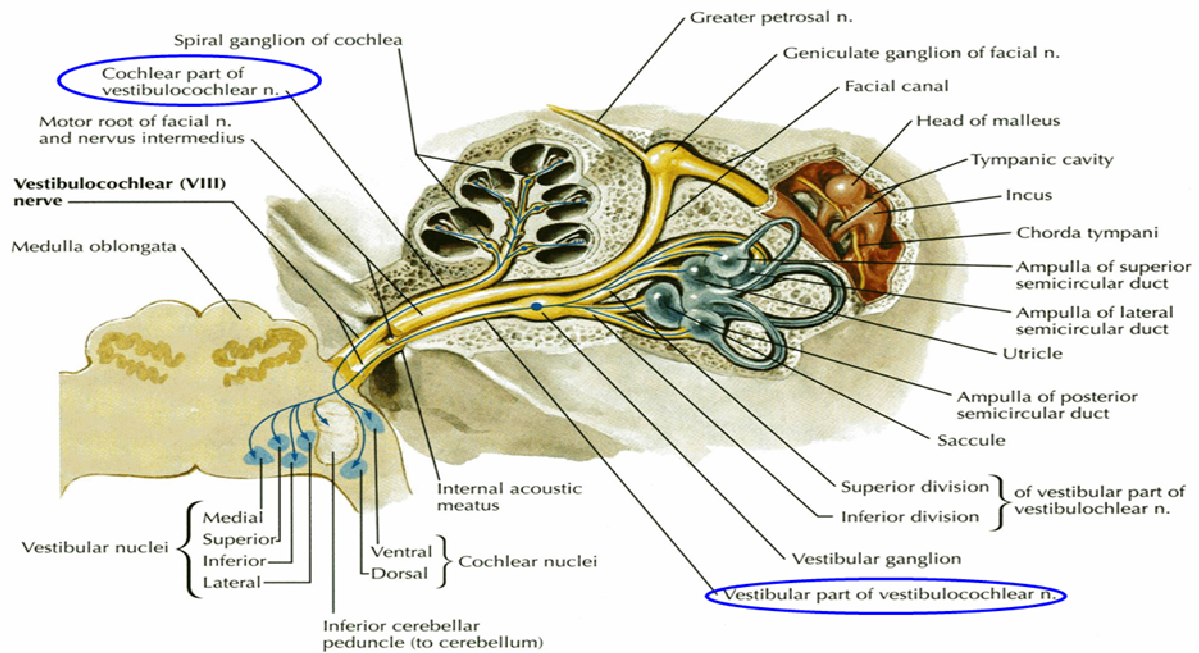
Fig. 10.12 Component fibres of the facial nerve and their peripheral distribution.
(Red, motors; green, sensory; blue, parasympathetic.)

VESTIBULO-COCHLEAR NERVE :

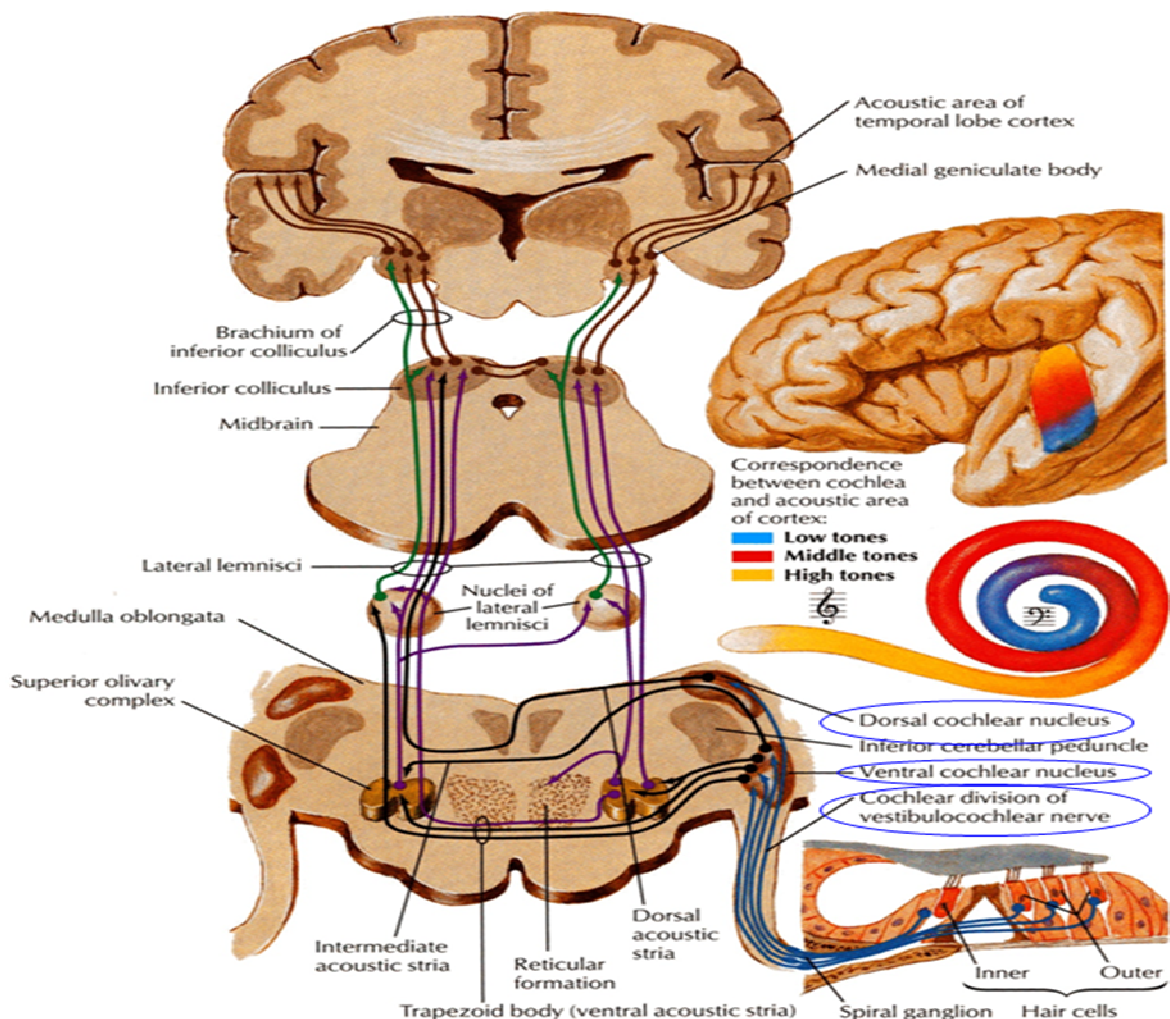
- **Type :** special sensory.
- **Two sensory ganglia :** located in the internal ear (vestibular & spiral ganglia).
- **Function :**
 - **Vestibular** nuclei in rostral medulla (4 nuclei, superior inferior medial & lateral) : conveys impulses associated with balance of body
 - **Cochlear** nuclei (dorsal & ventral), lie close to the **ICP** (inferior cerebellar peduncle) : conveys impulses associated with hearing
- **Lesion results into :** loss of hearing, tinnitus, vertigo, dizziness, ataxia.



- The vestibulocochlear nerve has two parts: the **vestibular nerve**, which carries *information related to position and movement of the head*, and the **cochlear nerve**, which carries *auditory information*.

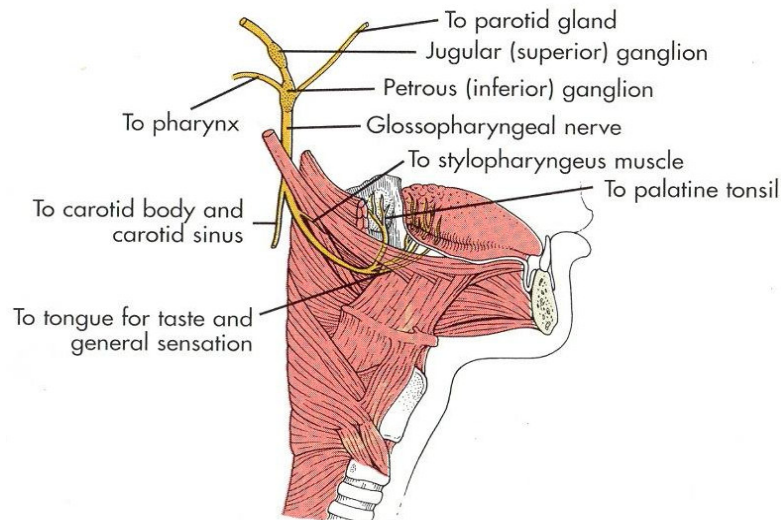


- The cochlear nerve joins the brain stem at the level of the rostral medulla.
- Its fibres bifurcate and end in the **dorsal & ventral cochlear nuclei**, which lie close to the inferior cerebellar peduncle.
- From here, **the ascending auditory pathway** to the thalamus and cerebral cortex.



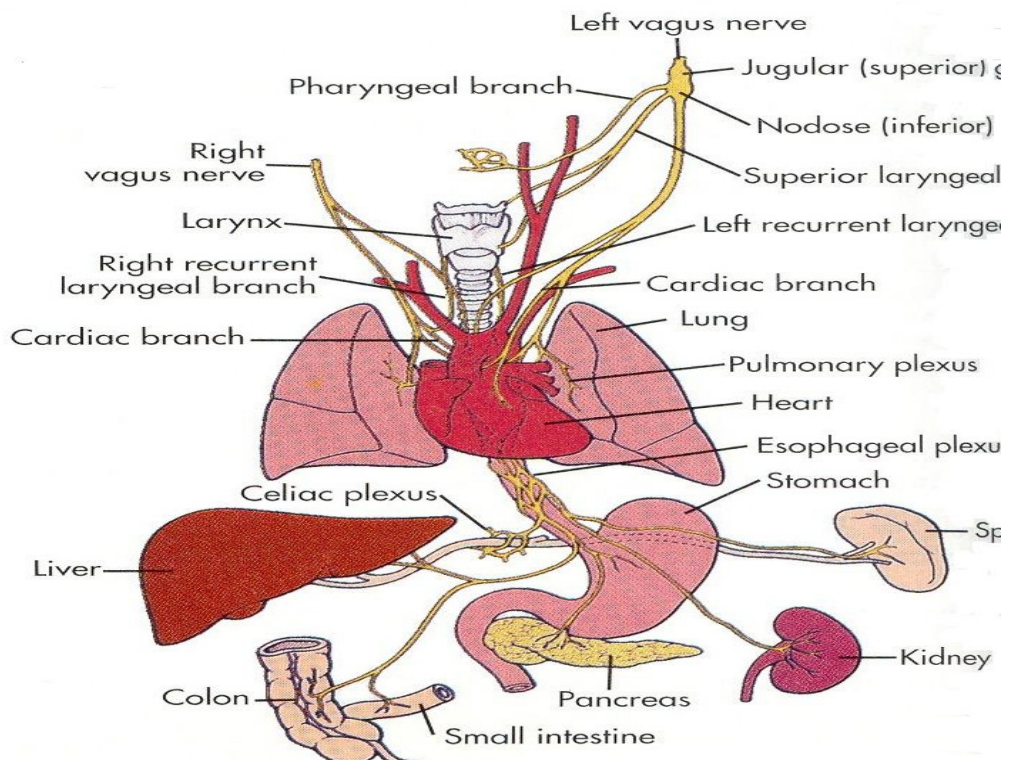
GLOSSOPHARYNGEAL NERVE :

- **Type** : motor, sensory (general & special), parasympathetic.
- **Two sensory ganglia** : superior & inferior, located at the level of jugular foramen.
- **Function** : supplies Stylopharyngeus parotid gland, carries taste fibers from post. 1/3 of tongue, general sensations from pharynx & palate
- **Lesion results into** : Dysphagia , loss of sensation from throat, loss of parotid secretion and loss of taste from the post. 1/3rd of the tongue.



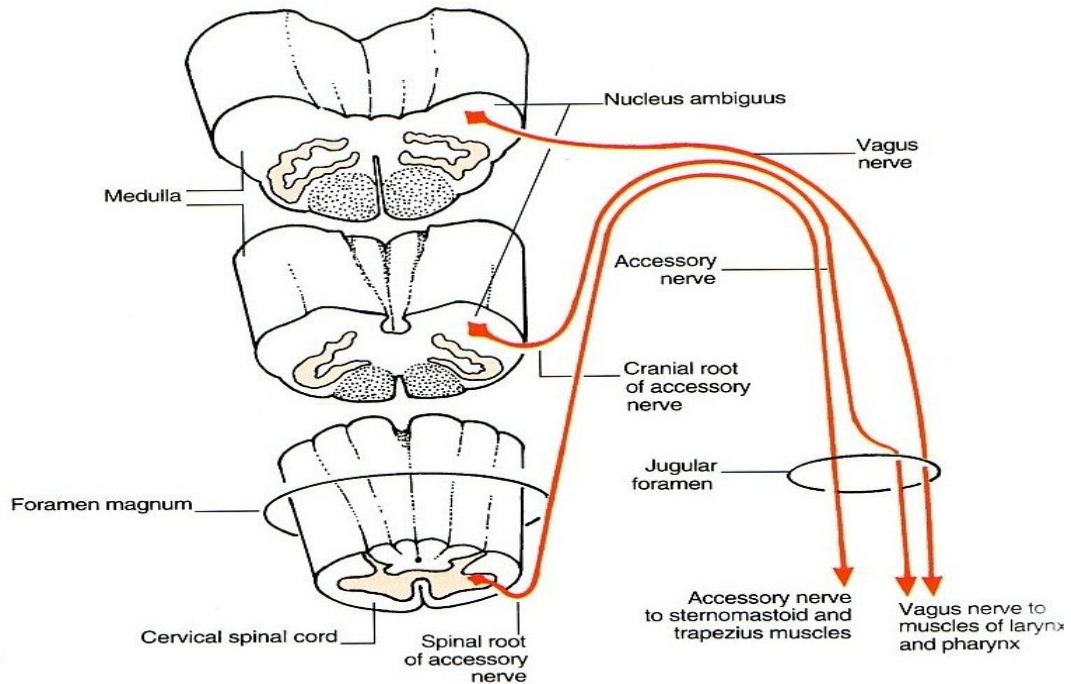
VAGUS NERVE :

- **Type** : motor (cranial part of accessory nerve), sensory (general & special), parasympathetic.
- **Two sensory ganglia** : superior & inferior, located at the level of jugular foramen.
- **Function** : supplies visceral muscles, glands of GIT, muscles of the larynx and pharynx, taste buds of tongue root, sensations from the viscera.
- **Lesion results into** : Dysphagia, dysphonia, dysarthria.
 - Loss of sensations from the organs & Loss of taste from the root of the tongue & epiglottis.

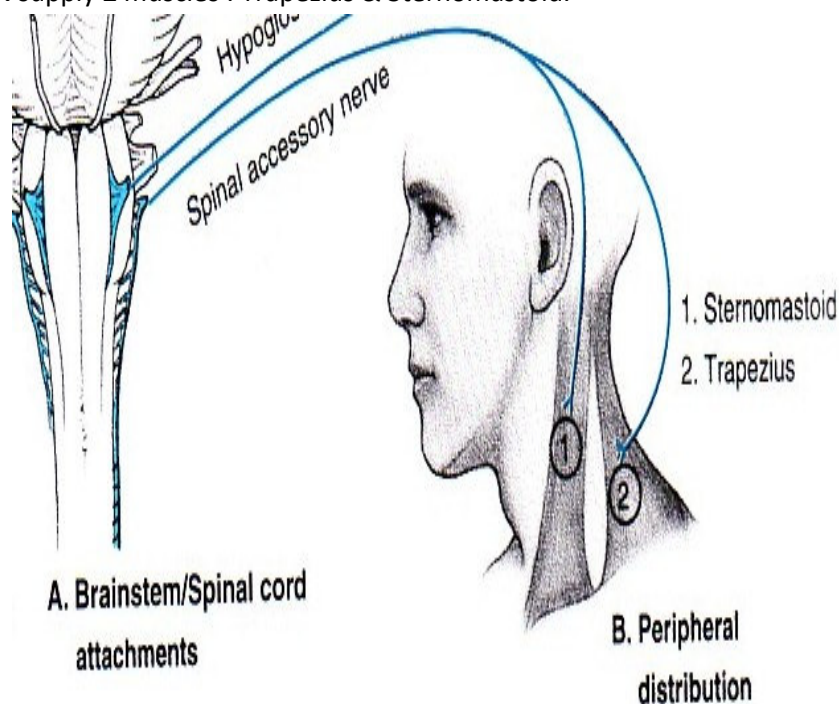


ACCESSORY NERVE :

- **Function :** Pure motor,
- **Formed of 2 roots :**
 1. **Cranial :** from caudal part of nucleus ambiguus in medulla.
 - It emerges from lateral aspect of medulla below the vagus.
 2. **Spinal :** from anterior horn of the upper 5 or 6 cervical segments.
 - It emerges midway between the ventral and dorsal roots
 - It ascends through foramen magnum to the cranial cavity.

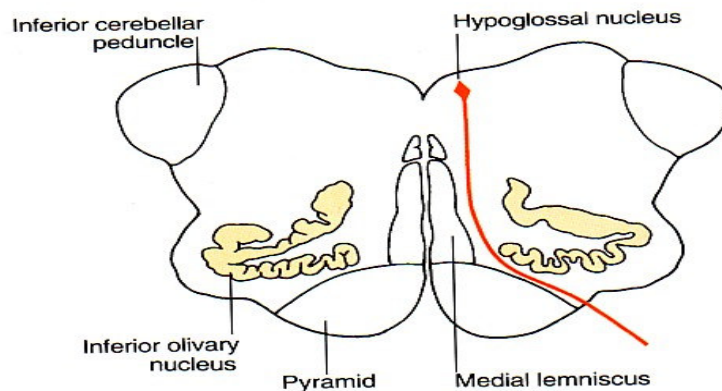


- The 2 roots join in the jugular foramen.
- Once they pass exit the jugular foramen they separate again.
 - **Cranial root :** joins the vagus and distributed to muscles of soft palate, pharynx and larynx.
 - **Spinal root :** supply 2 muscles : Trapezius & Sternomastoid.

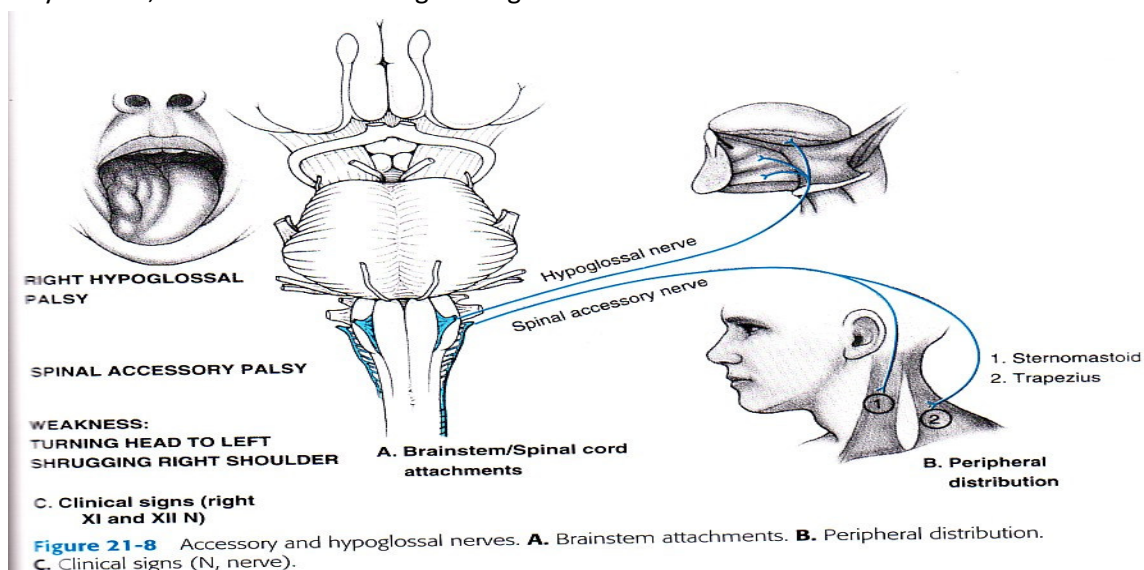


HYPOGLOSSAL NUCLEUS :

- Lies close to the middle line in both open & closed medulla.
- Its upper part lies deep to the hypoglossal triangle in the floor of the 4th ventricle.
- Its axons pass ventrally and emerge between pyramid & olive.
- The nucleus receives afferents from solitary & trigeminal sensory nuclei.
- These are involved in reflex movement of chewing, sucking and swallowing.



- It also, receives corticobulbar tracts from the contralateral motor cortex.
- **Motor neurone disease** is a chronic degenerative disorder.
 - **Pseudobulbar Palsy** : Degeneration of corticobulbar fibers projecting to the nucleus ambiguus & hypoglossal nucleus leading to dysphonia, dysphagia, dysarthria, weakness & spasticity of the tongue.
 - **Bulbar palsy** : Degeneration of hypoglossal and ambiguus nuclei leads to dysphonia, dysphagia, dysarthria, weakness and wasting of tongue.



THE END

LoveTomy Team 426

Team leader : Dr. hams

Dr. S Dr. noop Omar H

ابننسم همي بروحي

M.A.M Abo Slo7 Cute Killer



SELF QUIZ

1- Regarding the general organization of the cranial nerves, all are true EXCEPT :

- a. The olfactory system is closely associated functionally and structurally to the limbic system.
- b. The last 10 cranial nerves are attached to the brain stem.
- c. The first two cranial nerves are attached directly to the midbrain (forebrain).
- d. There are 3 medial (motor) columns and 4 lateral (sensory) columns In each side of the middle line of the brain stem.
- e. The nuclei of the last 10 cranial nerves are arranged in 7 columns in each side of the middle line in the brain stem.

2- Regarding the motor nuclei columns, all are true EXCEPT :

- a. Special visceral efferent column are motor nuclei which supply muscles developed from the pharyngeal arches.
- b. General somatic efferent column contain the hypoglossal, abducent, oculomotor and trigeminal nuclei (trochlear).
- c. General visceral efferent column contain motor nuclei giving parasympathetic fibers supplying smooth muscles of the organs, blood vessels and glands.
- d. Edinger-Westphal nucleus is located in the general visceral efferent column.
- e. Ambiguus nucleus is located in the medulla.

3- Regarding the sensory nuclei columns, all are true EXCEPT :

- a. Mesencephalic nucleus of the trigeminal nerve receives deep sensations from muscles of mastication, tendons and ligaments of the temporomandibular joint.
- b. Special somatic afferent column receives special sensations from the ear via the vestibulechoclear nuclei.
- c. General visceral afferent column receive visceral sensations from the pharynx, larynx, esophagus, thoracic and abdominal viscera via nucleus solitarius.
- d. Pain, temperature, pressure and touch sensations from the head are received by the trigeminal sensory nucleus.
- e. Smell sensations are received by the nuclei in the special visceral afferent column (taste).

1. c	2. b	3. e
------	------	------