

Anatomy for Dentistry



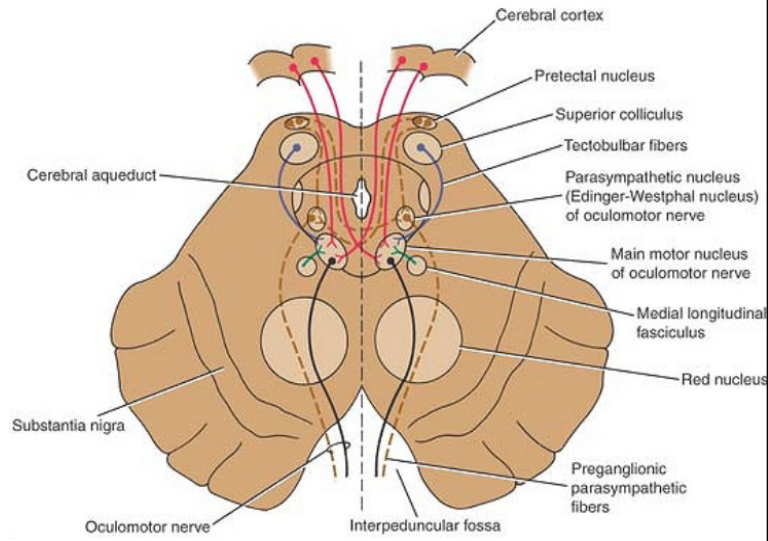
Dr. Mohammad Alsalem, PhD

Cranial nerves



- **Olfactory** (I) nerve; sensory for smell
- **Optic** (II) nerve; sensory for vision
- **Oculomotor** (III) nerve; motor for eye muscles
- **Trochlear** (IV) nerve; motor for an eye muscle
- **Trigeminal** (V) nerve; mixed (sensory) and motor for muscles of mastication
- **Abducens** (VI) nerve; motor for an eye muscle
- **Facial** (VII) nerve; mixed (sensory) motor for muscles of facial expression
- **Vestibulocochlear** (VIII) nerve; sensory for hearing and equilibrium.
- **Glossopharyngeal** (IX) nerve; mixed
- **Vagus** (X) nerve; mixed
- **Accessory** (XI) nerve; motor
- **Hypoglossal** (XII) nerve; motor for tongue muscles

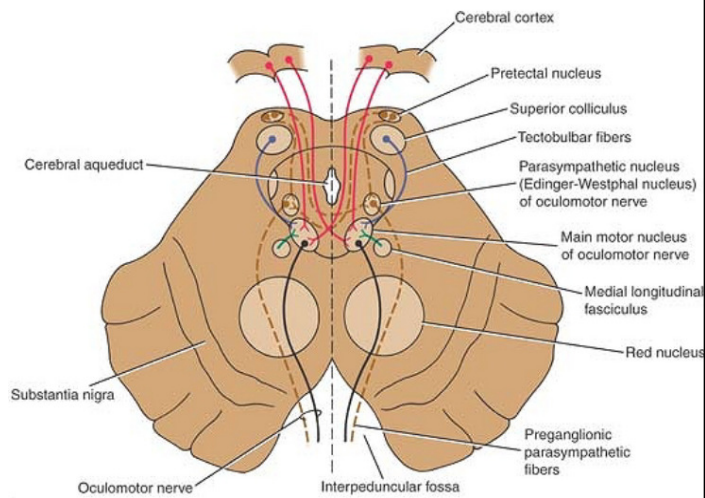
Oculomotor Nerve (III)



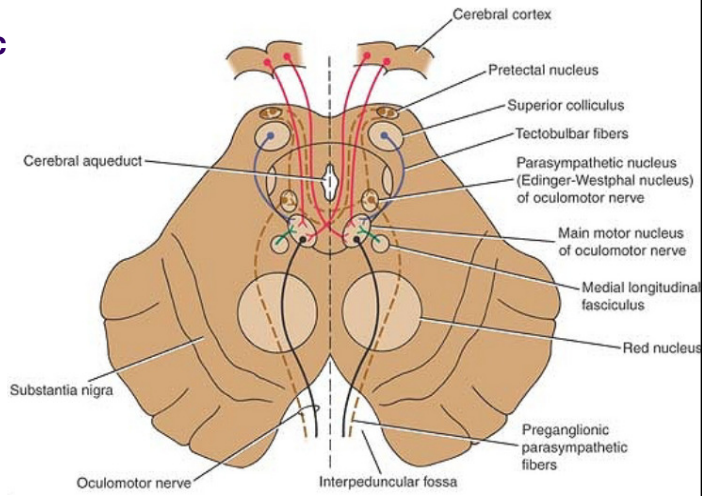
- **Main oculomotor nucleus**
- **Accessory parasympathetic nucleus (Edinger-Westphal nucleus)**

Main oculomotor nucleus

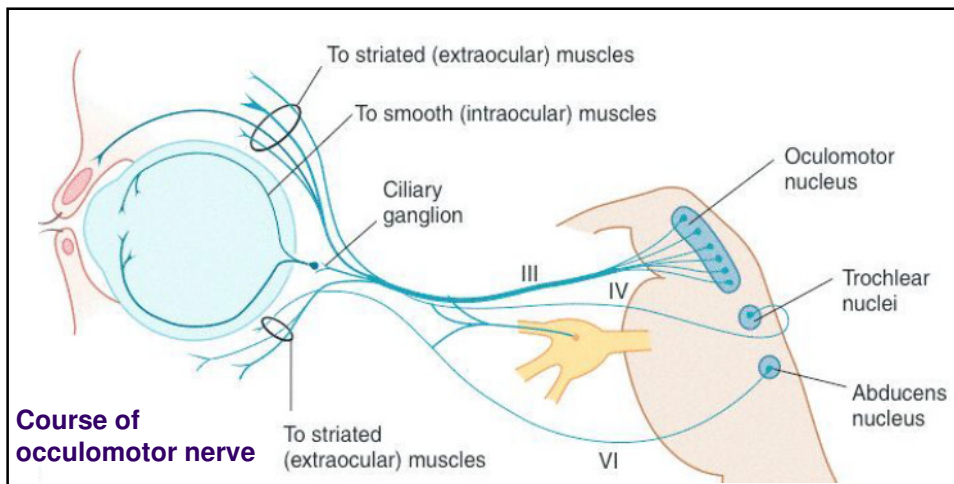
- **Location**
- **Receives from:**
 - Corticonuclear fibers
 - Tectobulbar fibers: Info from visual cortex
 - Medial longitudinal fasciculus: connected to the nuclei of the IV, VI, VIII cranial nerves.



Accessory parasympathetic nucleus



- **Location**
- **Receives from:**
 - Corticonuclear fibers: (accommodation reflex)
 - Pretectal nucleus: direct and consensual light reflexes.

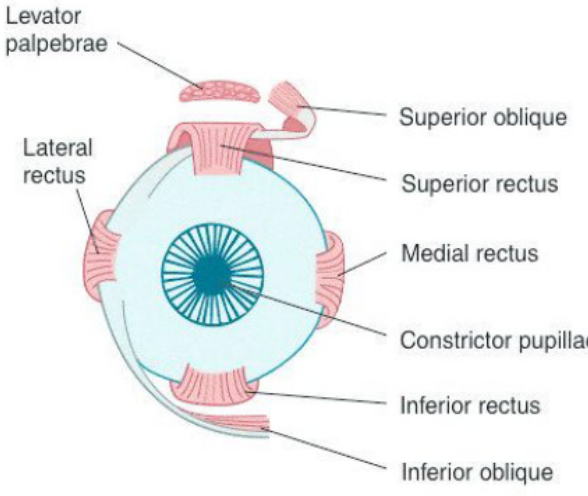


Course of oculomotor nerve

- 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

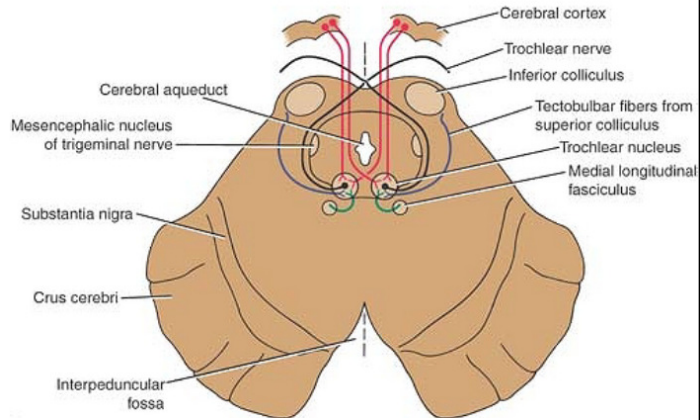
- Complete lesion**
 - All of the muscles are paralyzed except lateral rectus and superior oblique
 - Symptoms:
 - External strabismus
 - Diplopia
 - Ptosis: drooping of the upper eyelid.
 - The pupil is widely dilated and nonreactive to light
 - Accommodation of the eye is paralyzed.
- Incomplete lesions:**
 - Internal ophthalmoplegia:** loss of the autonomic innervation of the sphincter pupillae and ciliary muscle
 - External ophthalmoplegia.:** paralysis of the extraocular muscles

Trochlear Nerve

Nucleus

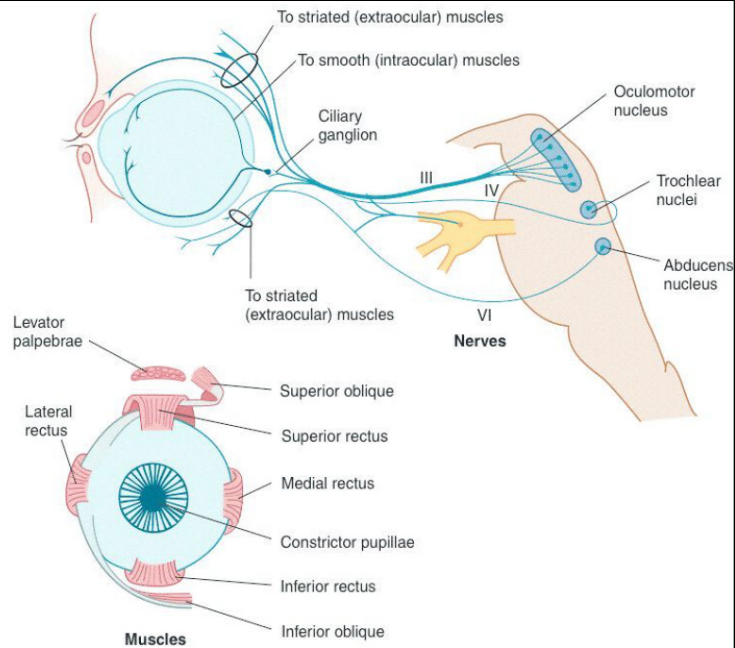
- **Location**
- **Receives from:**
 - Corticonuclear fibers
 - Tectobulbar fibers: Info from visual cortex
 - Medial longitudinal fasciculus: connected to the nuclei of the III, VI, VIII cranial nerves.



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

Trochlear Nerve

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



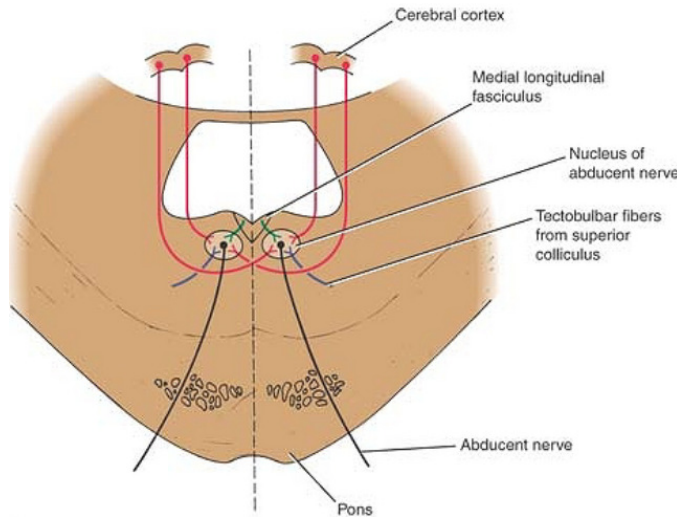
Trochlear Nerve injury

- 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

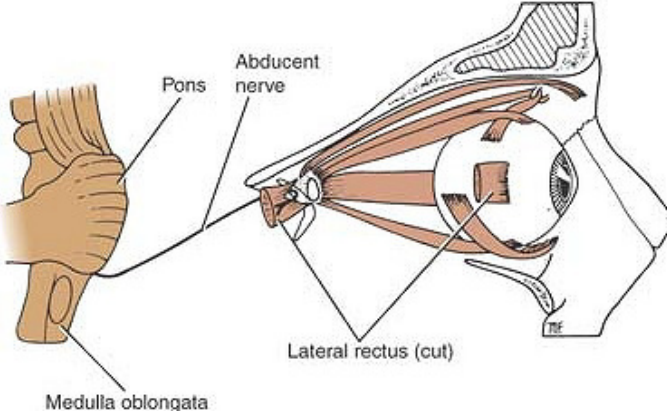
- Receives from:
 - Corticonuclear fibers
 - Tectobulbar fibers: Info from visual cortex
 - Medial longitudinal fasciculus: connected to the nuclei of the III, IV, VIII cranial nerves.



- **Location**

beneath the floor of the upper part of the fourth ventricle, close to the midline

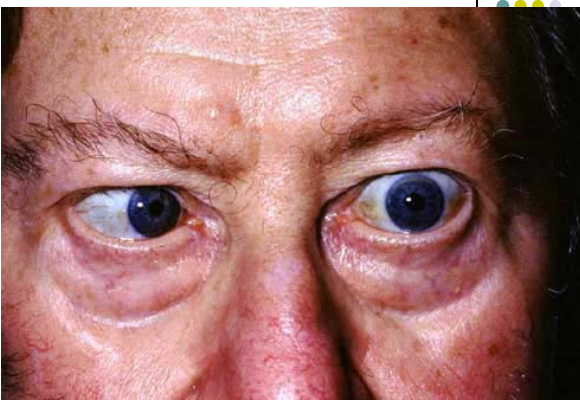

Course of Abducent nerve



The diagram illustrates the anatomical path of the abducent nerve. On the left, the brainstem is shown with the pons and medulla oblongata. The abducent nerve is shown exiting the pons and passing anteriorly in a groove between the pons and the medulla oblongata. It then travels through the cavernous sinus, below and lateral to the internal carotid artery, and through the superior orbital fissure. Finally, it innervates the lateral rectus muscle of the eye, which is shown in a cut state to reveal the nerve's path.

- 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



The photograph shows a patient's eyes with a significant medial deviation of the right eye, characteristic of internal strabismus. The patient is looking straight ahead, but the right eye is turned inward. This is a classic sign of an abducent nerve injury, where the unopposed medial rectus muscle pulls the eyeball medially.

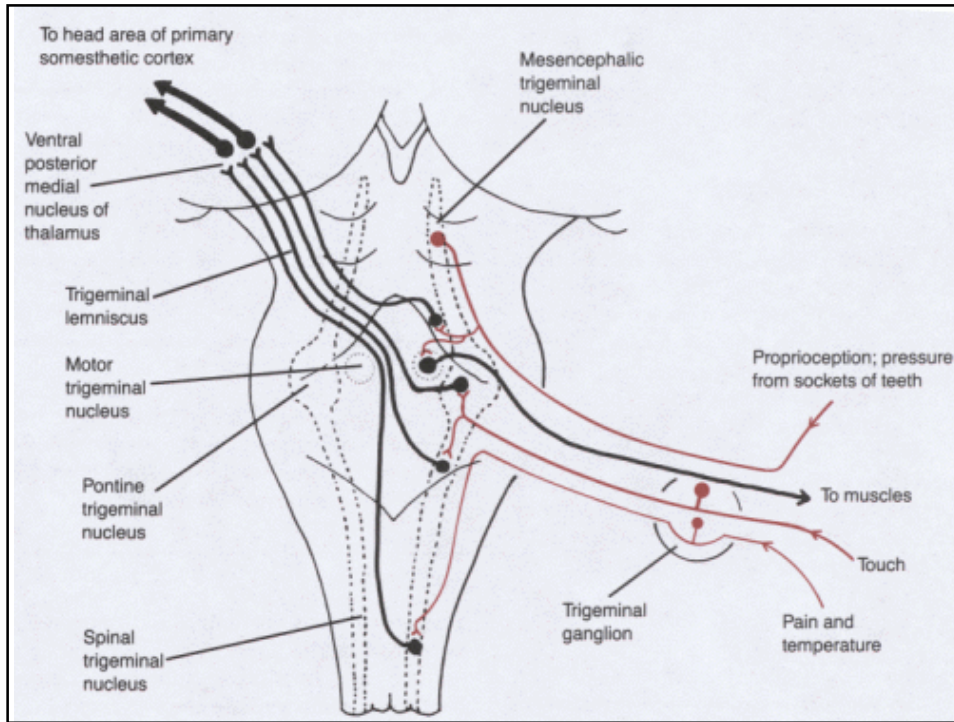
- Symptoms:
 - Diplopia
 - Difficulty in turning the eye laterally.
 - **internal strabismus.** unopposed medial rectus pulls the eyeball medially

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
 - Medial longitudinal fasciculus
 - Reticular formation
 - Tectum
- Supplies
 - Muscles of mastication
 - Tensor tympani
 - Tensor veli palatini
 - Mylohyoid
 - Anterior belly of the digastric muscle

Thalamus

Mesencephalic nucleus of trigeminal nerve

Motor nucleus of trigeminal nerve

Ophthalmic division

Maxillary division

Mandibular division

Trigeminal ganglion

Sensory root of trigeminal nerve

Main sensory nucleus of trigeminal nerve

Spinal nucleus of trigeminal nerve

Substantia gelatinosa

Trigeminal lemniscus

Trigeminal lemniscus

Spinal cord (C2)

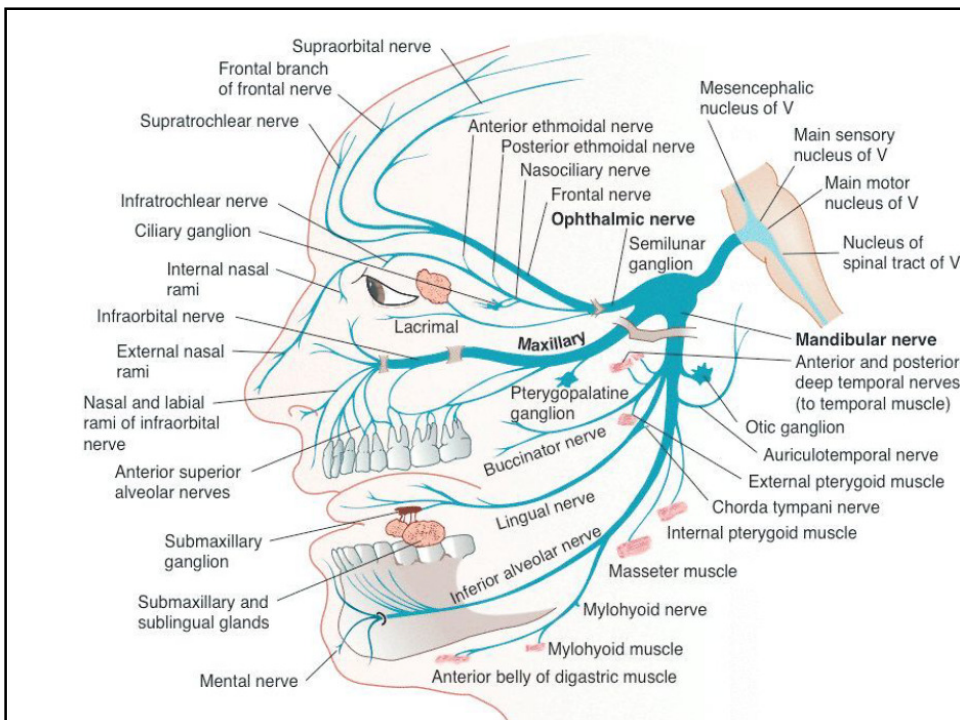
Midbrain

Pons

Medulla oblongata

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:

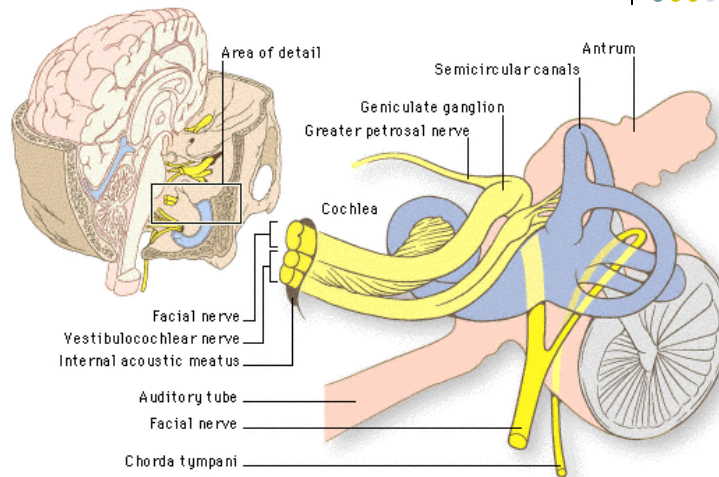
- **Location:** upper part of the nucleus of the tractus solitarius
- **Sensations of taste**
 - Cell bodies in geniculate ganglion
 - Sensory Nucleus
 - VPM
 - Primary gustatory cortex (area 43)

Course of VII

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

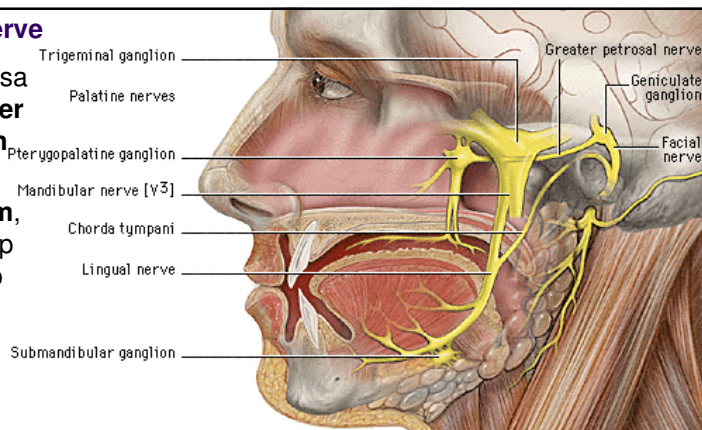
Course of VII

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



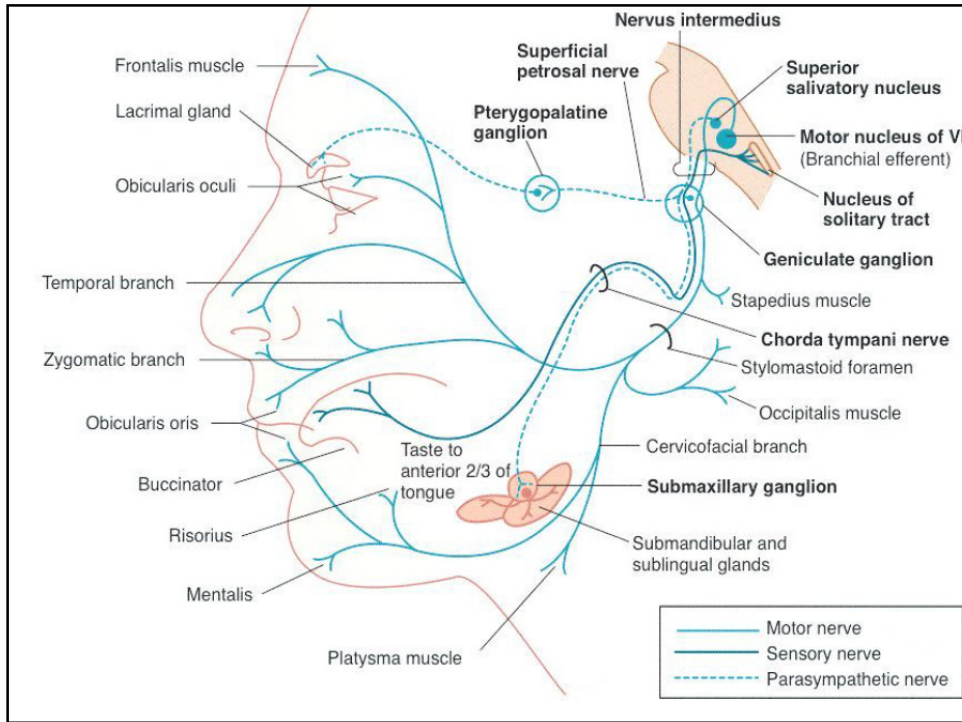
greater petrosal nerve

- 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

The diagram shows the neural pathways from the **Cerebral cortex** to the **Main motor nucleus of facial nerve** in the brainstem. It illustrates how different lesions affect the face:

- 1 (Upper Motor Neuron Injury):** Shows a face with a normal smile, indicating that the lower motor neurons are intact.
- 2 (Lower Motor Neuron Injury):** Shows a face with a normal smile but a drooping mouth on the left side, indicating a lesion in the lower motor neuron (the facial nerve).

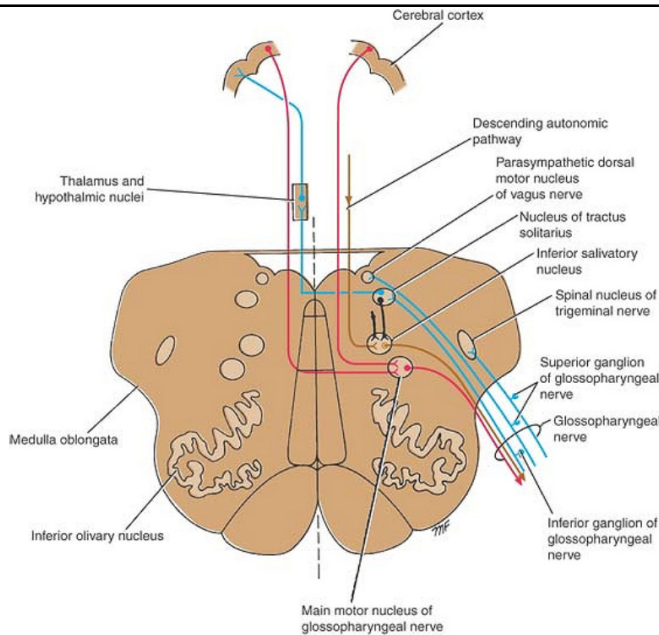
Bell's Palsy

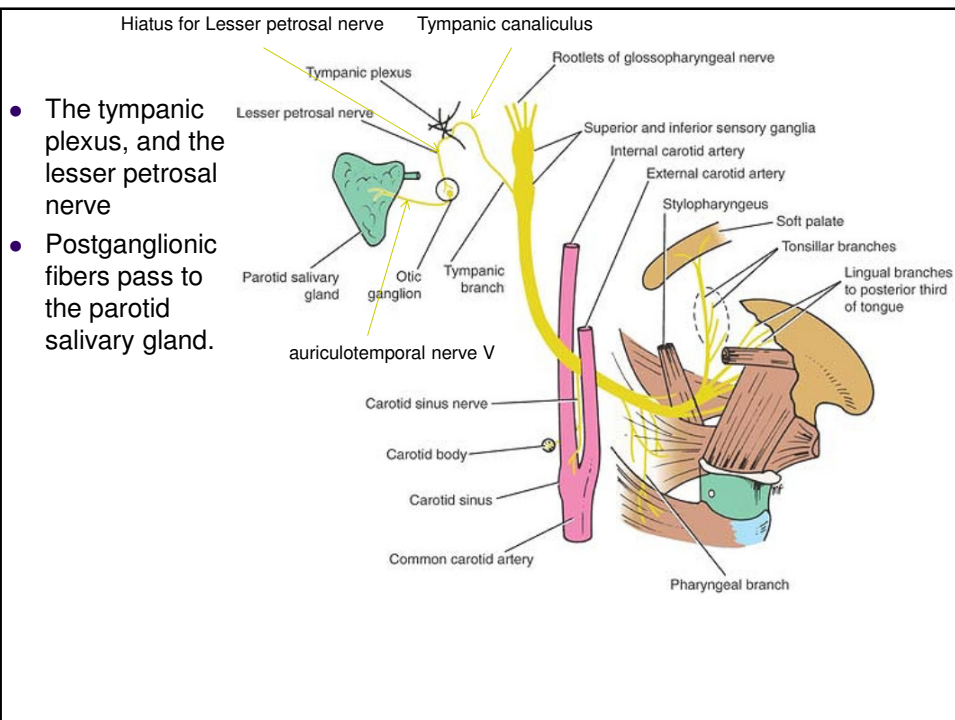
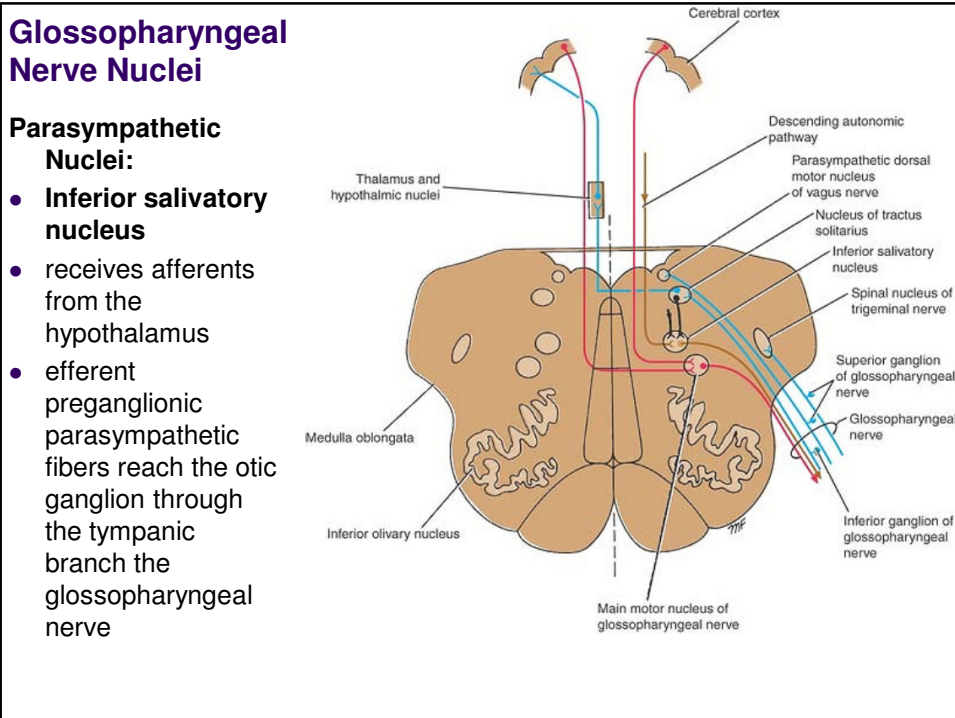
- Usually unilateral
- Lower motor neuron type of facial paralysis.
- Cause is not known,
 - Exposure of the face to a cold draft?
 - Complication of diabetes?
 - Can occur as a result of tumors or AIDS?



Glossopharyngeal Nerve Nuclei

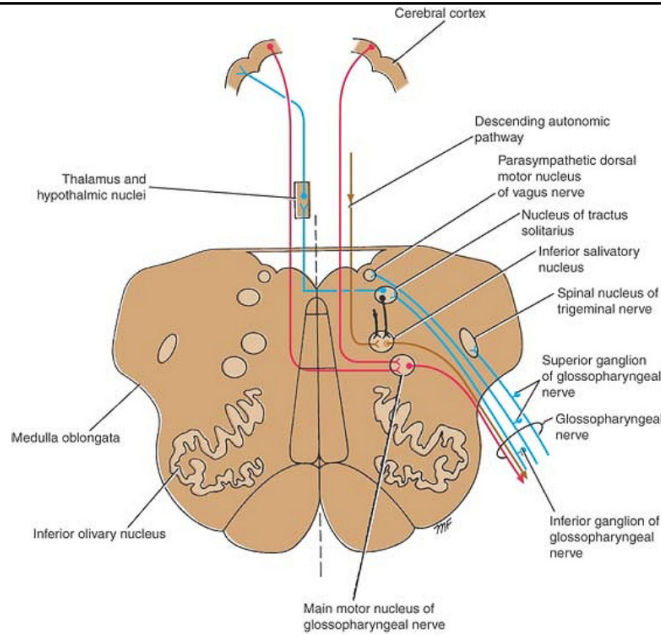
- **Main Motor Nucleus**
- Deep in the reticular formation of the medulla oblongata
- superior end of the nucleus ambiguus
- receives corticonuclear fibers from **both** cerebral hemispheres.
- supply the **stylopharyngeus muscle**





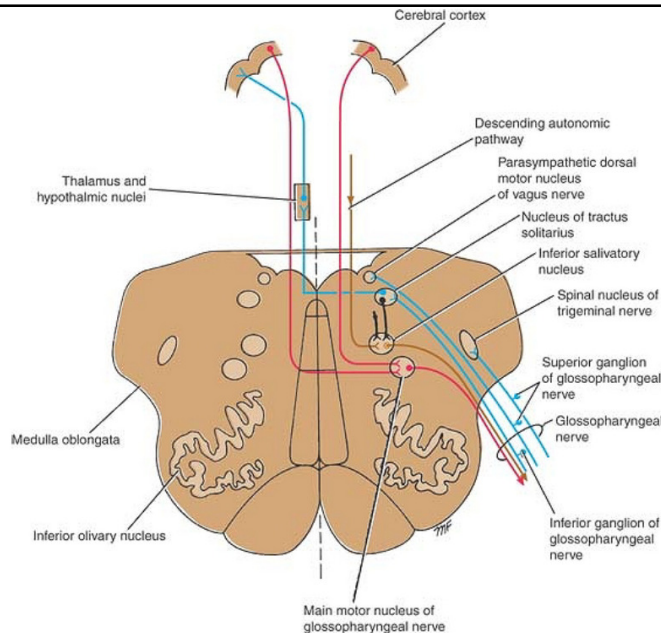
Glossopharyngeal Nerve Nuclei

- **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
- 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 pharynx 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**

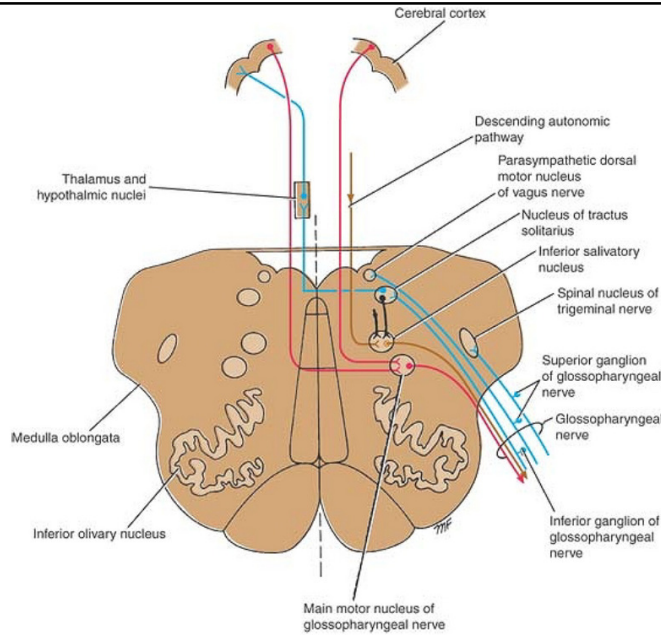
Lower part of the nucleus of the tractus solitarius

---**Taste** from epiglottis.

- Cell body in inferior ganglion of vagus
- Sensory nucleus
- Thalamus
- Postcentral gyrus

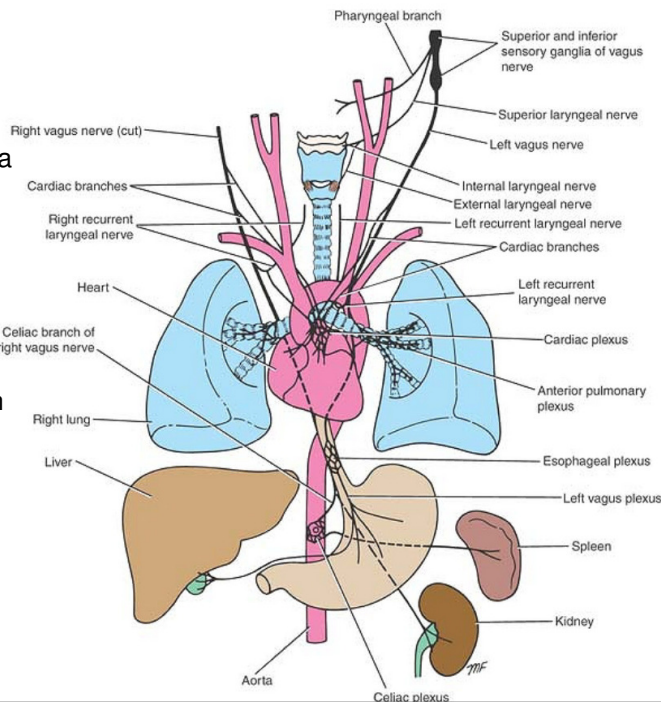
-- **common sensation**

- superior ganglion of vagus
- Spinal nucleus of the trigeminal nerve.



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



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

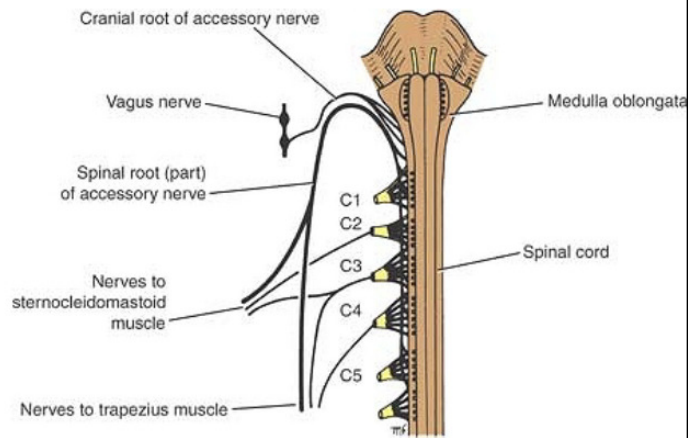
Accessory Nerve

Spinal root

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

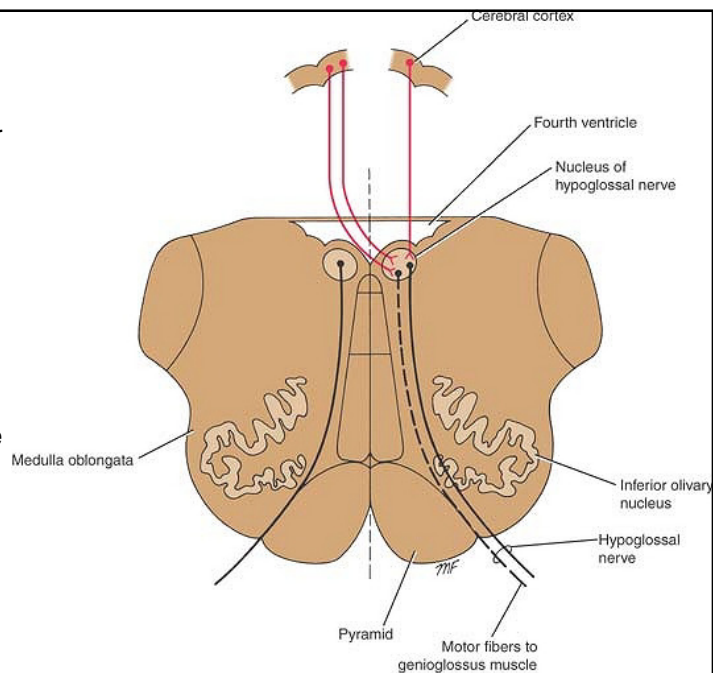
Accessory Nerve Course

- 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 nucleus

- 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

