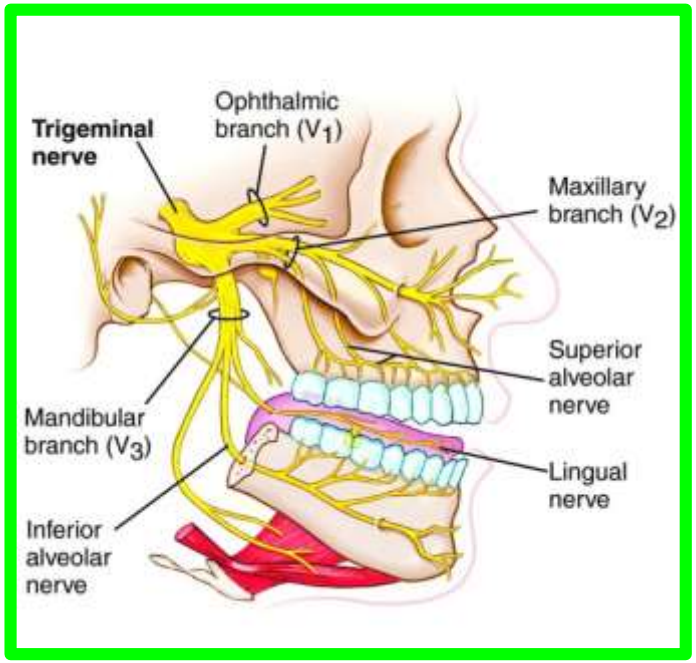
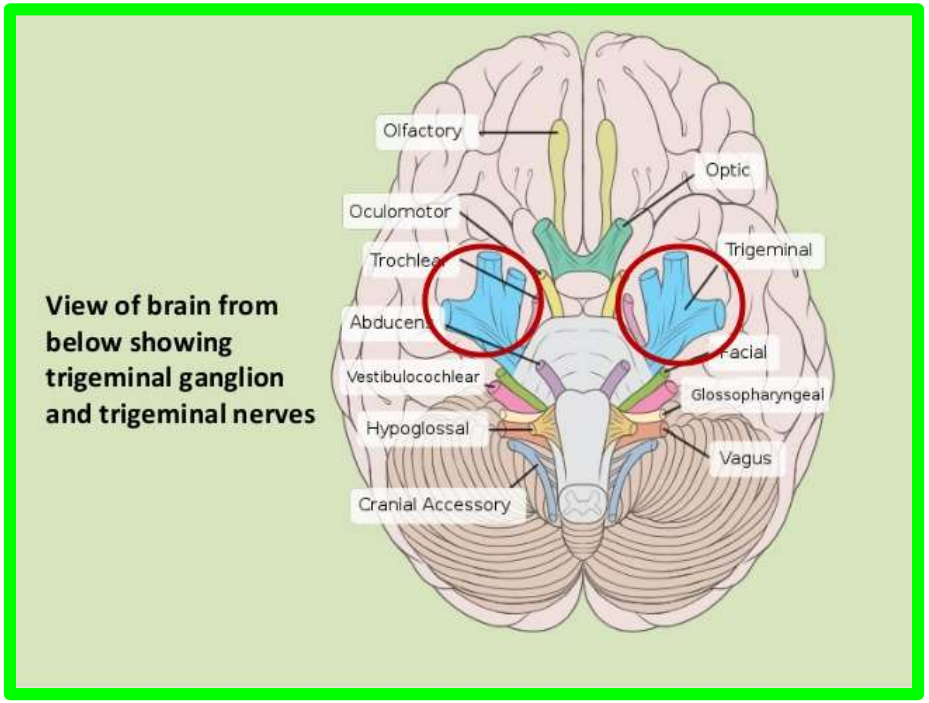
Dr.Ayman lab

Trigeminal Nerve

❖*The trigeminal nerve is the largest cranial nerve.*

❖*It leaves the anterior aspect of the pons as a small motor root and a large sensory root*





❖ *it passes forward, out of the posterior cranial fossa, to reach the apex of the petrous part of the temporal bone in the middle cranial fossa.*

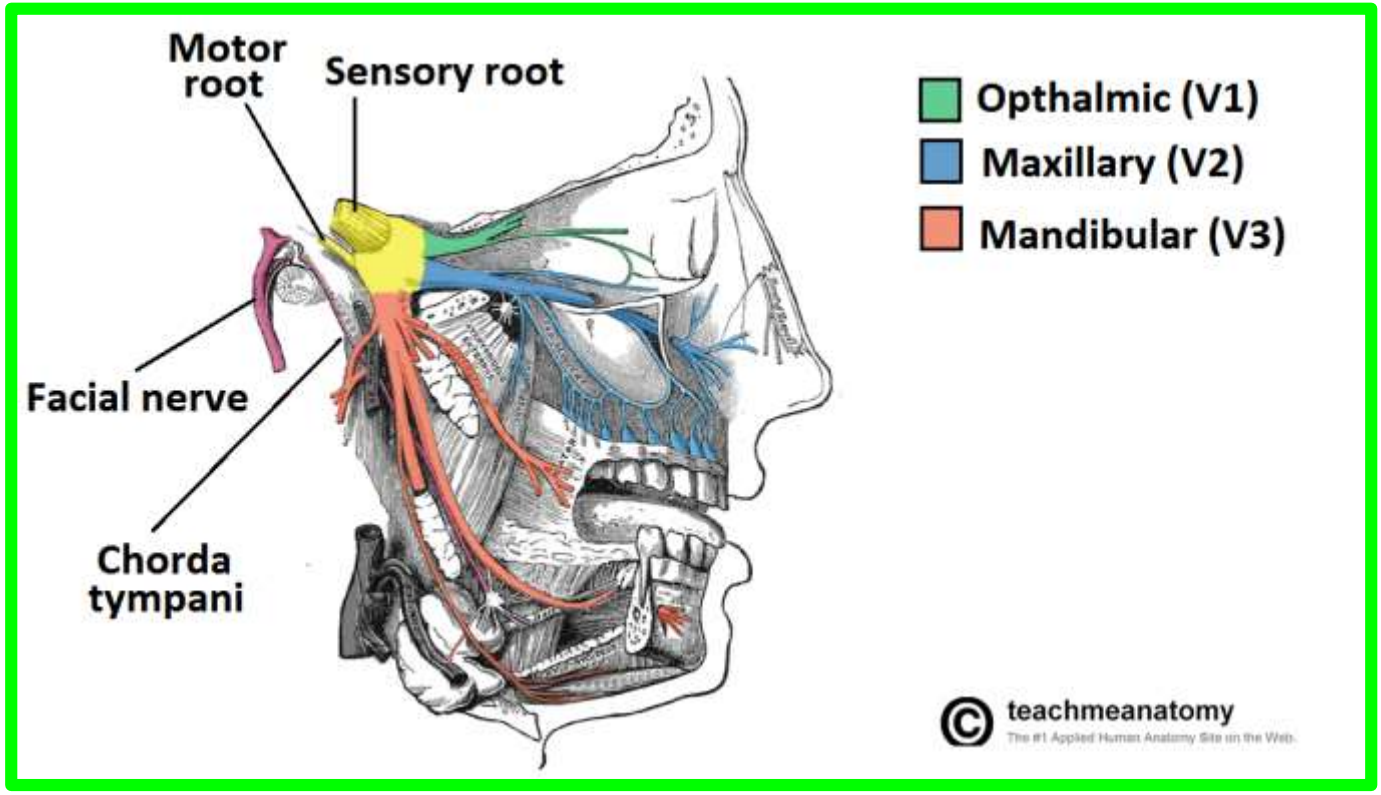
❖*Here, the large sensory root expands to form the trigeminal ganglion*

Trigeminal Nerve

❖*The trigeminal ganglion* ***lies within a pouch of dura mater called the*** *trigeminal cave. (Meckel cave)*

❖***The motor root of the trigeminal nerve is situated below the sensory ganglion and is completely separate from it.***

❖ *The ophthalmic (V1), maxillary (V2), and mandibular (V3) nerves* ***arise from the anterior border of the ganglion***



Trigeminal Nerve

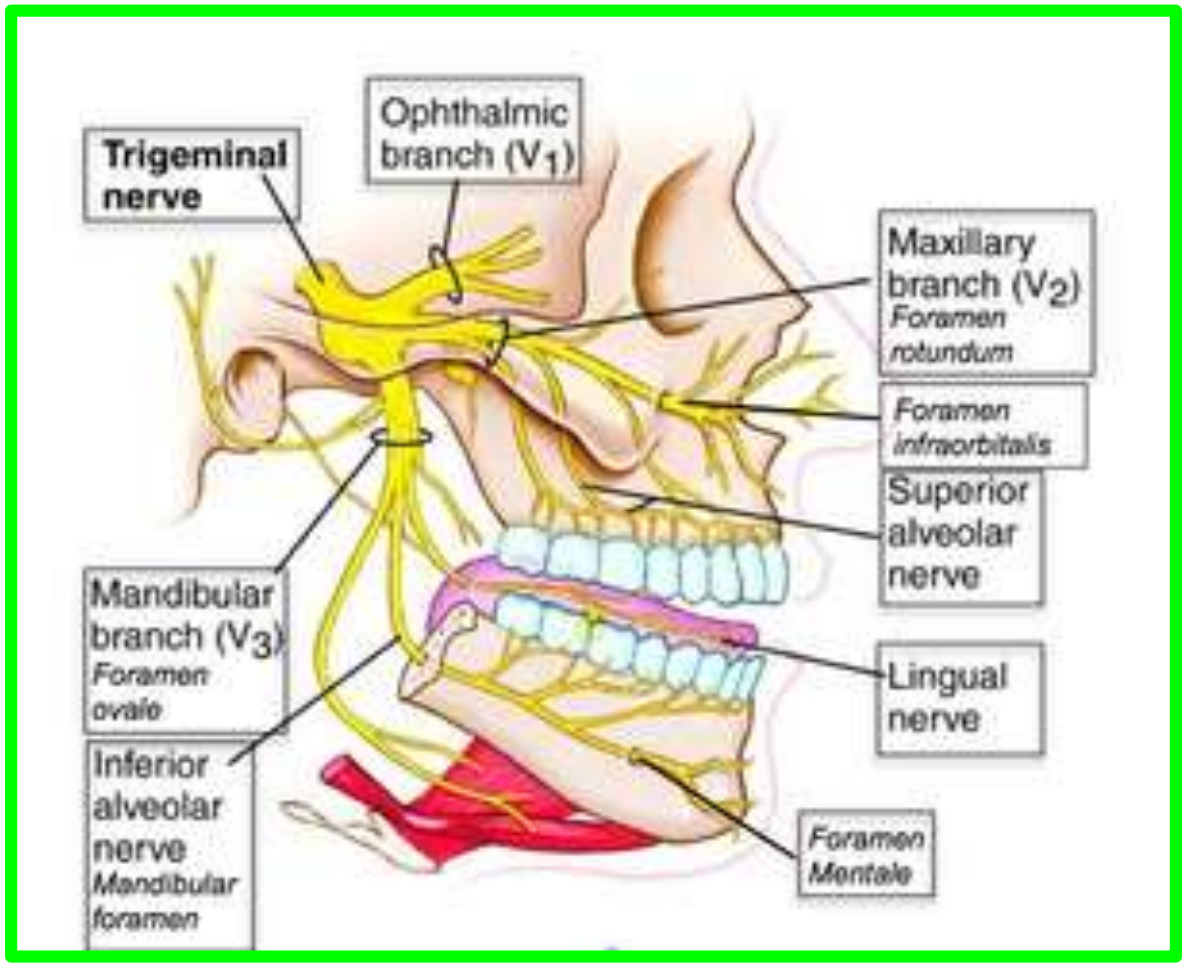
Ophthalmic Nerve (V1)

✓ Is purely sensory.

✓ It runs forward in the lateral wall of the cavernous sinus in the middle cranial fossa and divides into three branches:

- ❖ The Lacrimal,
- ❖ Frontal,
- ❖ Nasociliary nerves,

which enter the orbital cavity through the superior orbital fissure



Trigeminal Nerve

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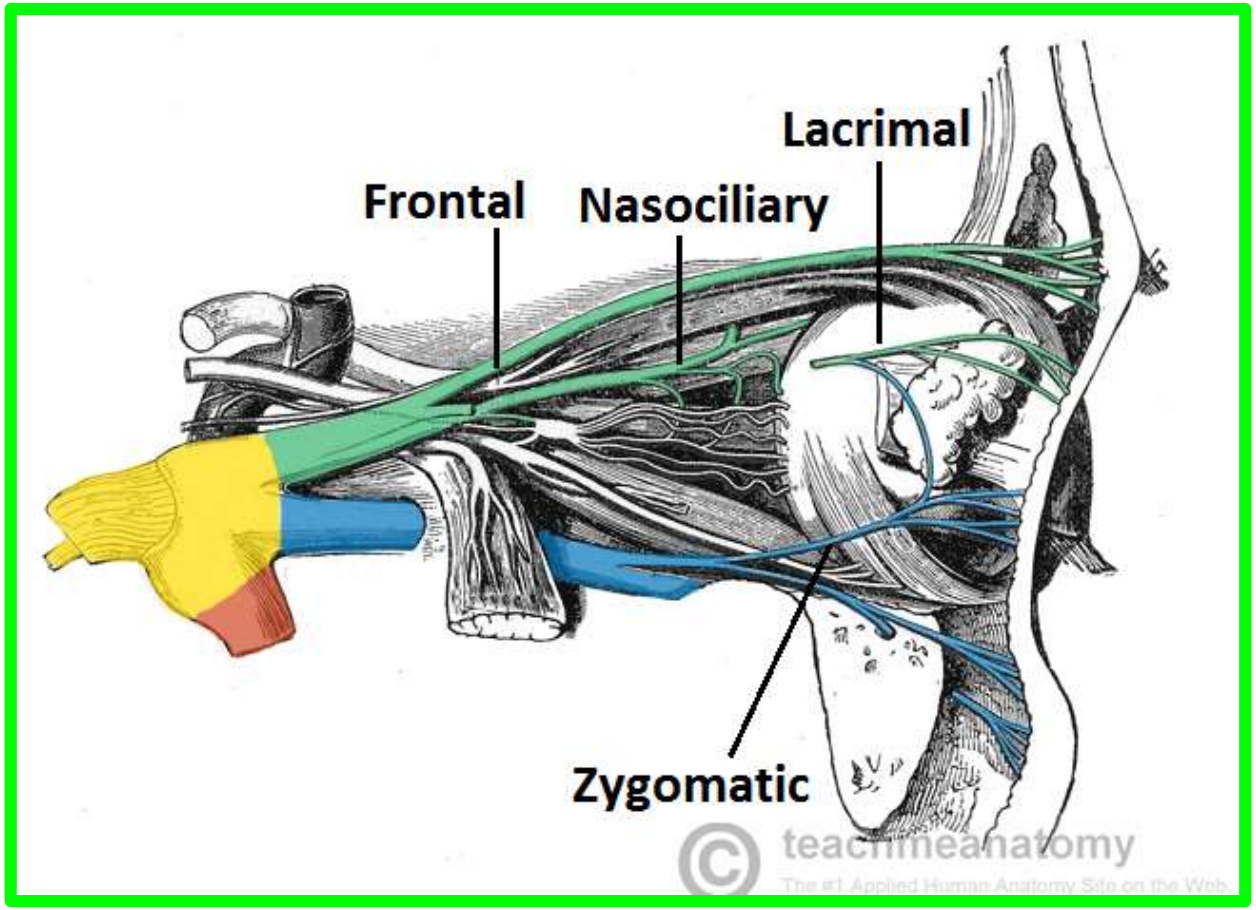
Wednesday 2 March 2022

Ophthalmic Nerve (V1)

1...The Lacrimal nerve

✓It is joined by the *zygomaticotemporal branch* of the *maxillary nerve*, which contains the parasympathetic secretomotor fibers to *the lacrimal gland*

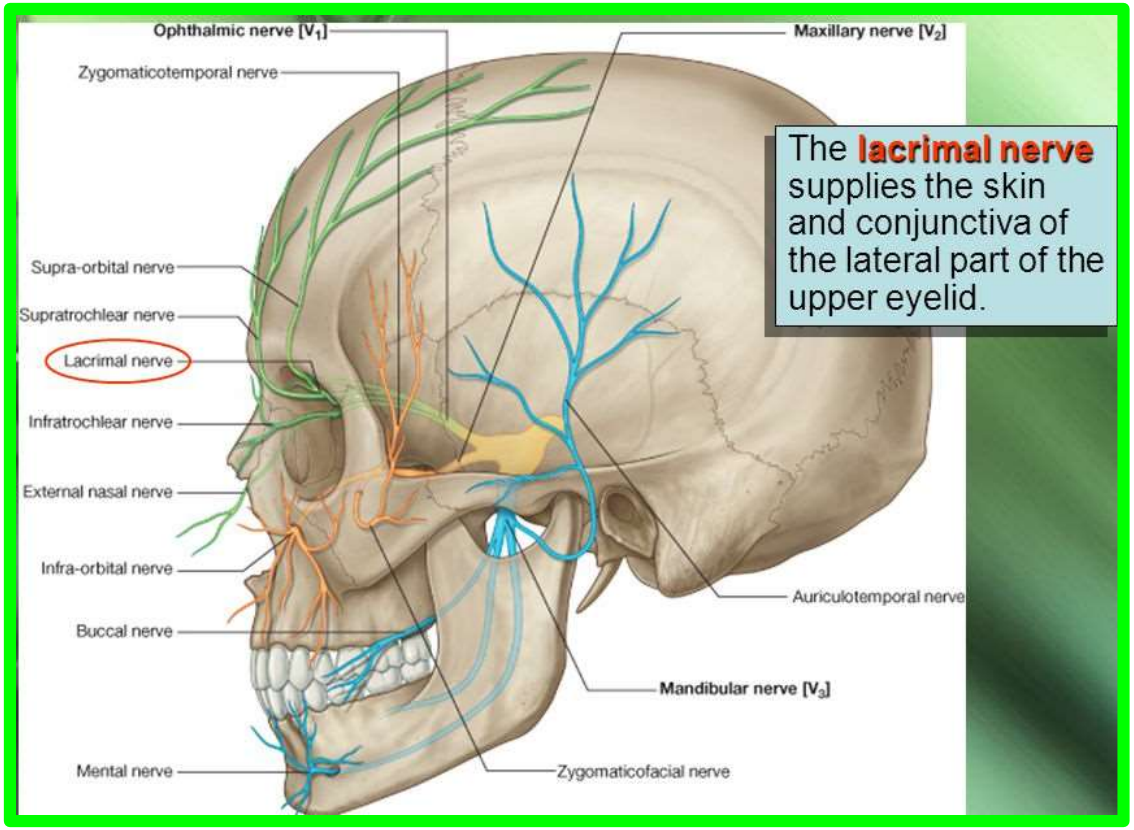


✓*The lacrimal nerve* then enters *the lacrimal gland* and gives branches to the conjunctiva and the skin of the upper eyelid.

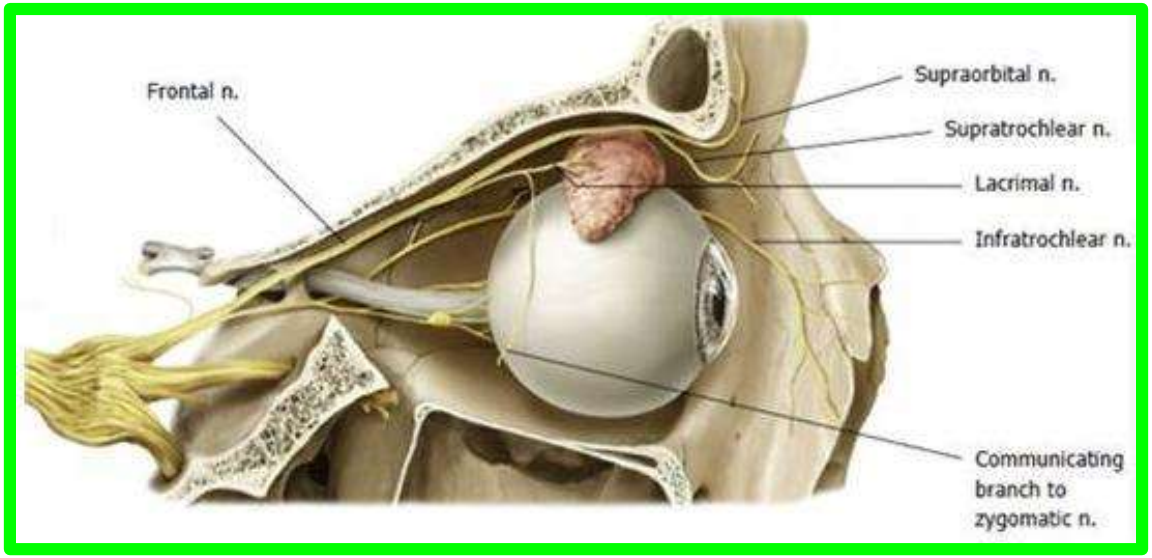
Ophthalmic Nerve (V1)

2...The frontal nerve

✓Runs forward on the upper surface of the levator palpebrae superioris muscle and divides into the supraorbital and supratrochlear nerves



✓These nerves leave the orbital cavity and supply the frontal air sinus and the skin of the forehead and the scalp



Ophthalmic Nerve (V1)

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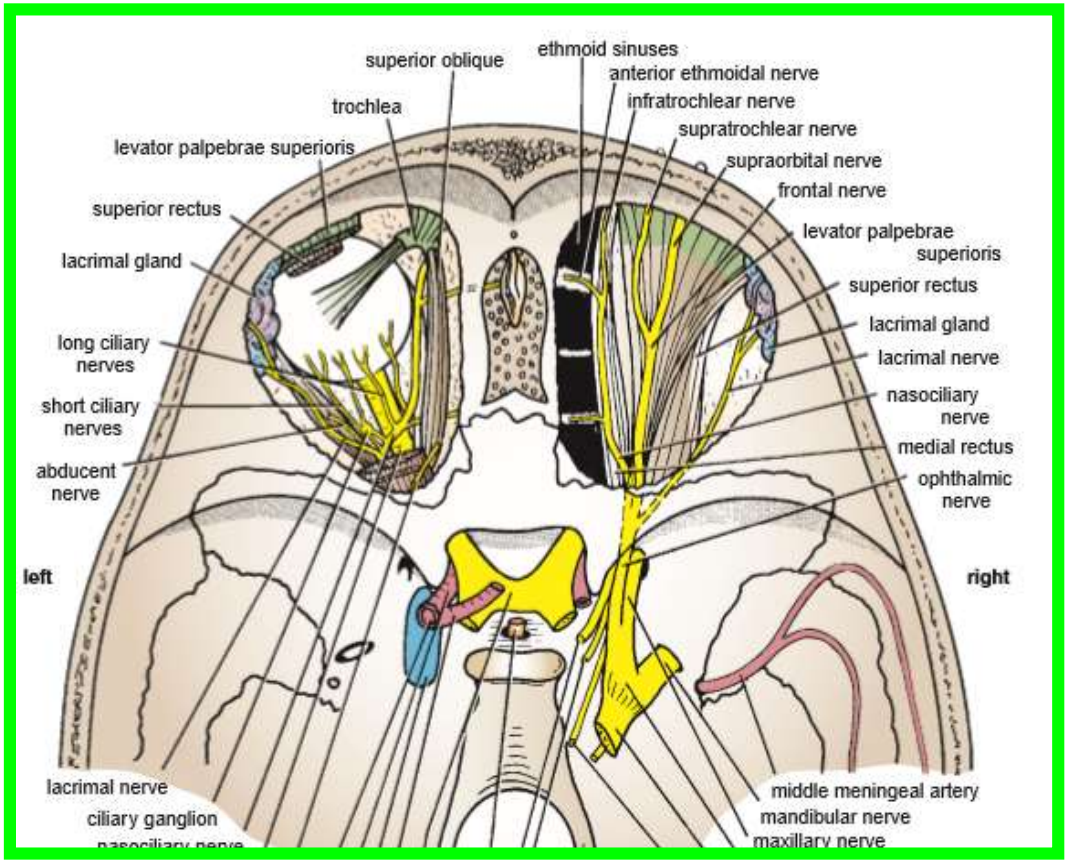
3...The nasociliary nerve

✓Crosses the optic nerve

✓Runs forward on the upper border of the medial rectus m.

✓Continues as the anterior ethmoid nerve

✓It then descends at the side of the crista galli to enter the nasal cavity.



✓It gives off two internal nasal branches and it then supplies the skin of the tip of the nose with the external nasal nerve.

Ophthalmic Nerve (V1)

3...The nasociliary nerve

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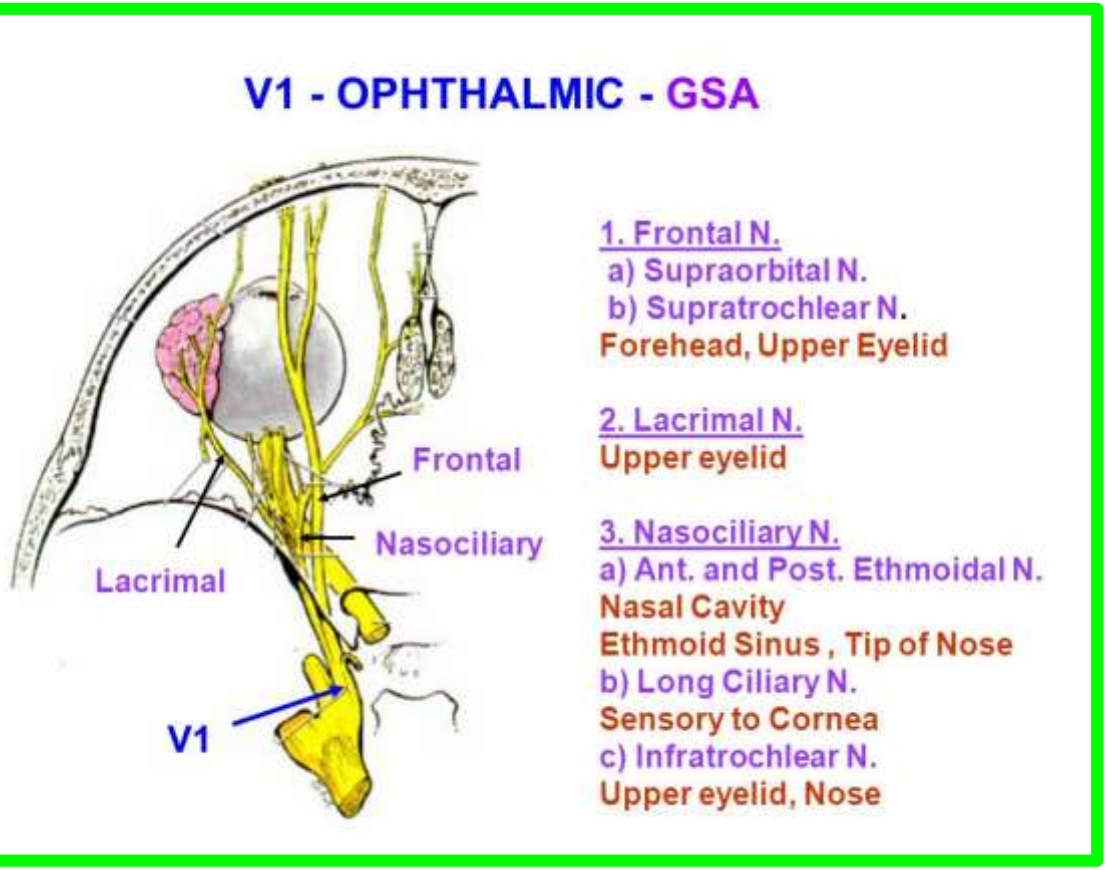
Its branches include the following:

❖■ Sensory fibers to the ciliary ganglion

❖■Long ciliary nerves that contain sympathetic fibers to the dilator pupillae muscle and sensory fibers to the cornea.



❖■Infratrochlear nerve that supplies the skin of the eyelids

❖■Posterior ethmoidal nerve that is sensory to the ethmoid and sphenoid sinuses

Maxillary Nerve (V2)

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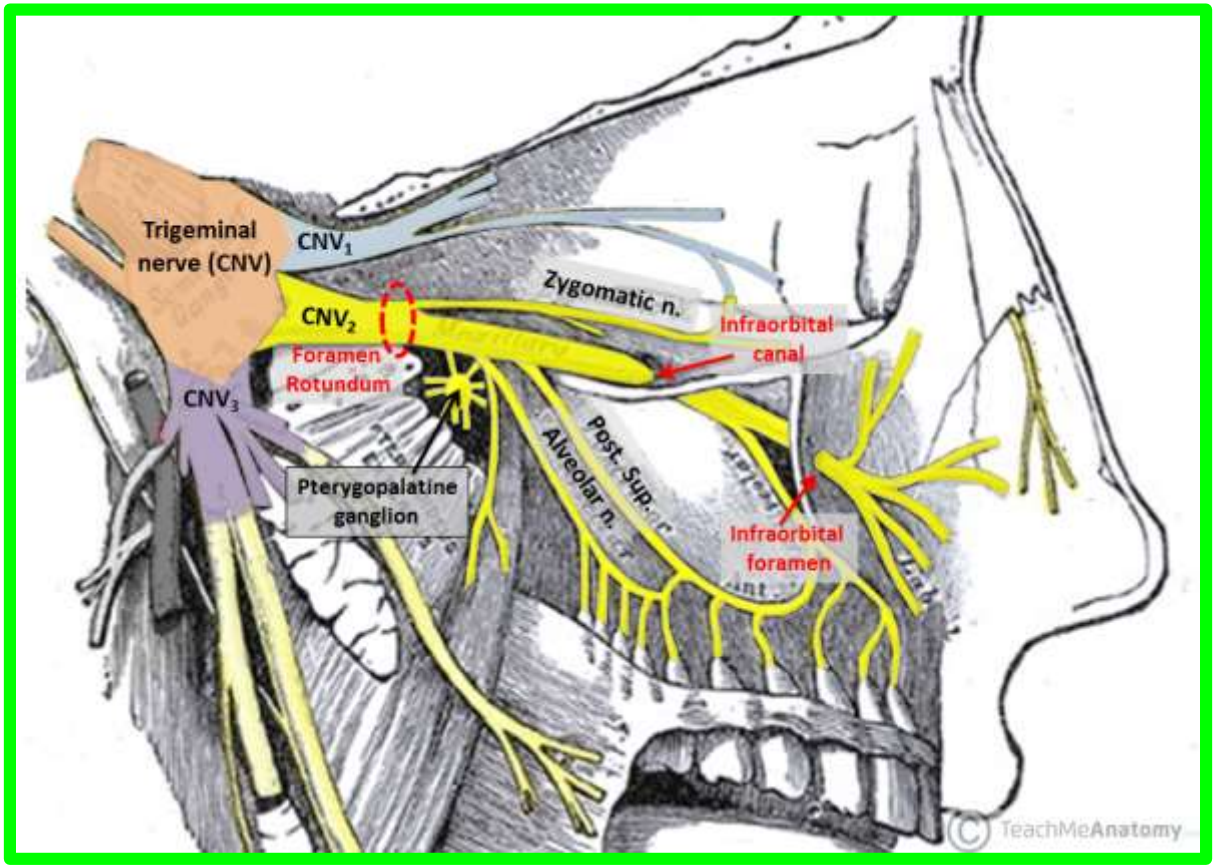
✓The maxillary nerve arises from the trigeminal ganglion in the middle cranial fossa

✓It passes forward in the lateral wall of the cavernous sinus and leaves the skull through the foramen rotundum

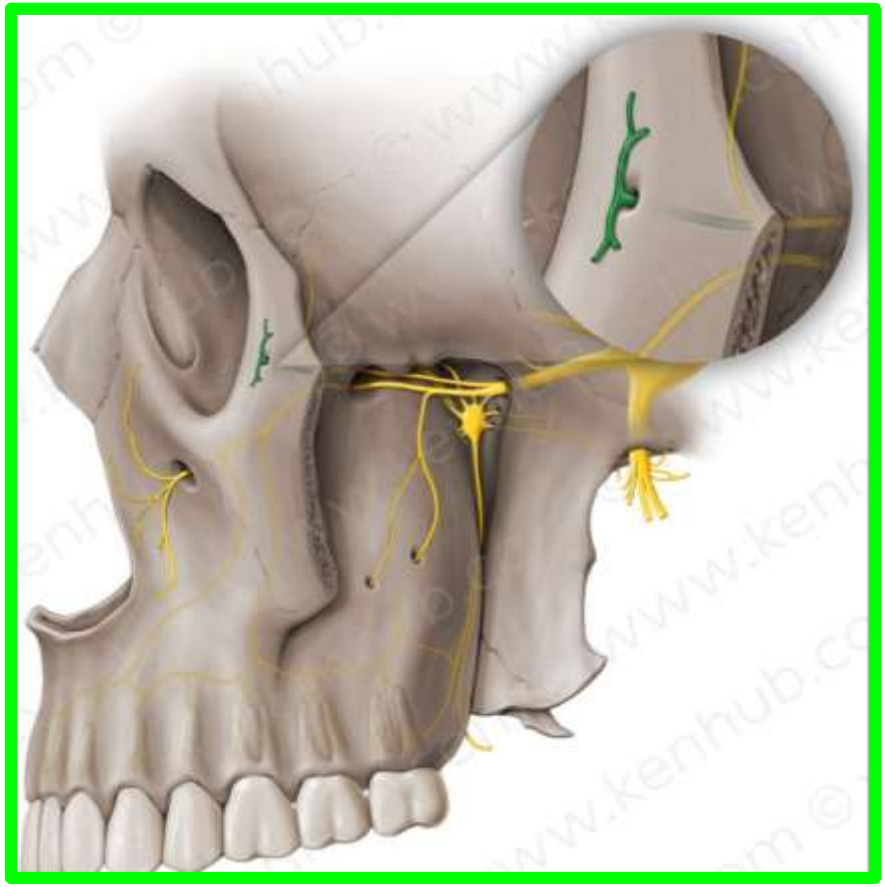


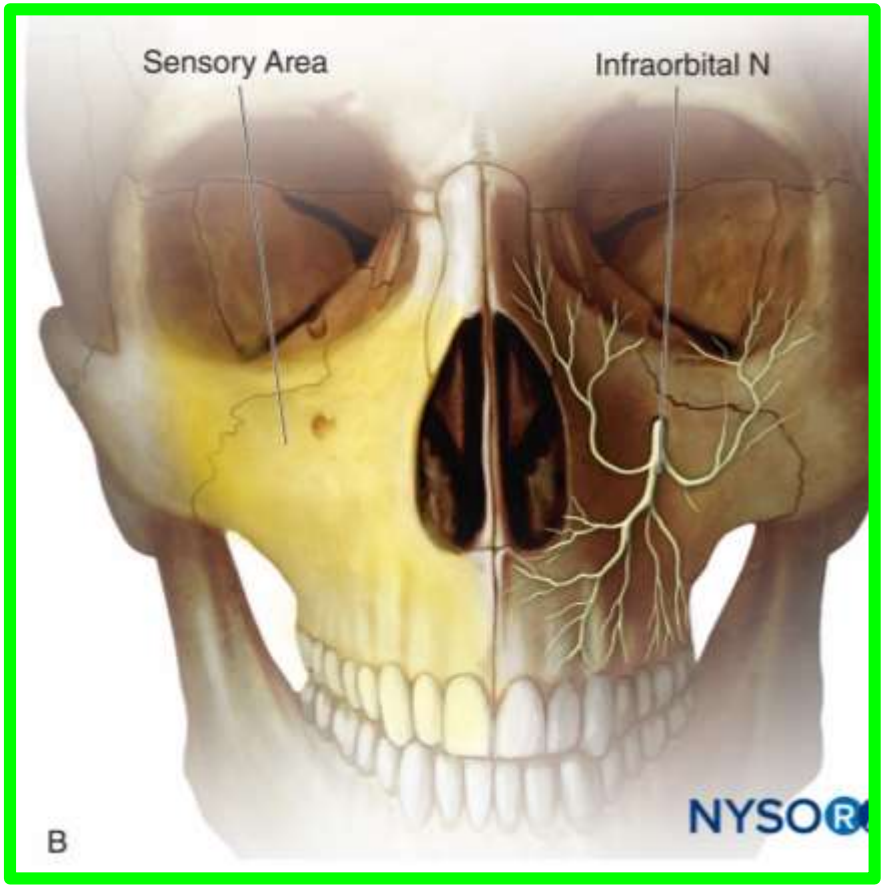
✓It crosses the pterygopalatine fossa to enter the orbit through the inferior orbital fissure.

Maxillary Nerve (V2)

✓*It then continues as the infraorbital nerve in the infraorbital groove, and it emerges on the face through the infraorbital foramen.*

✓*It gives sensory fibers to the skin of the face and the side of the nose.*





Maxillary Nerve (V2)

Branches

- **Meningeal branches**
- **Zygomatic branch which divides into the zygomaticotemporal and the zygomaticofacial nerves that supply the skin of the face**

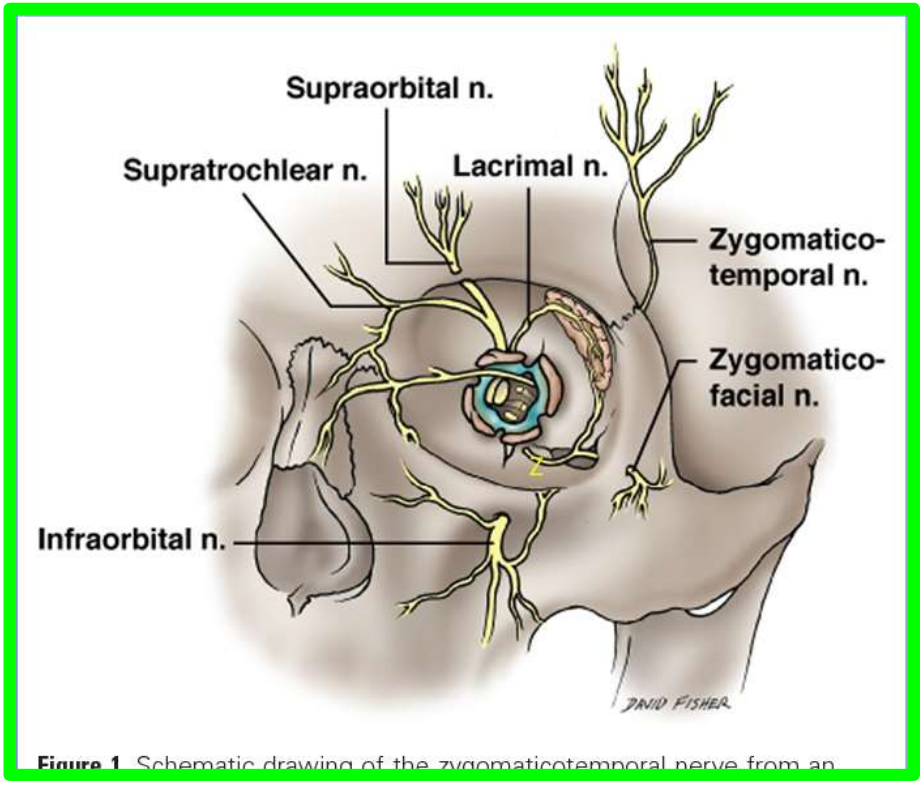
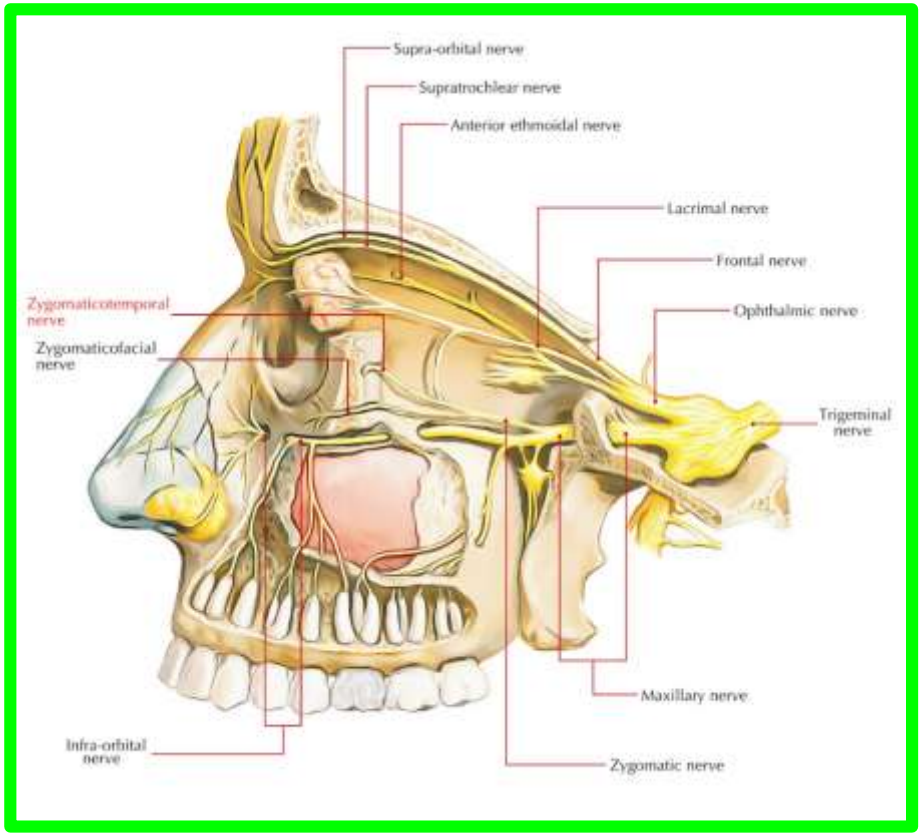


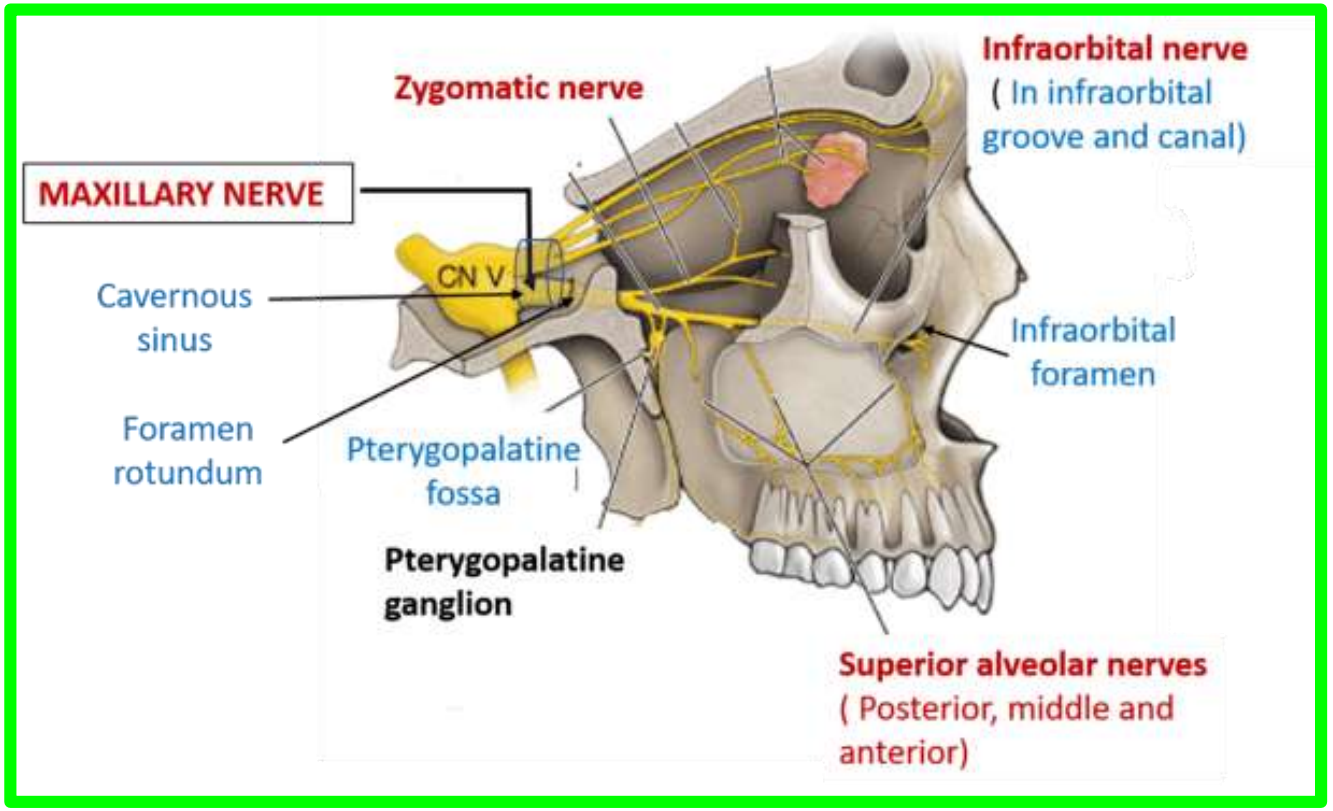
Figure 1 Schematic drawing of the zygomaticotemporal nerve from an



The zygomaticotemporal branch gives parasympathetic secretomotor fibers to the lacrimal gland via the lacrimal nerve.

Maxillary Nerve (V2)

■■ ***Ganglionic branches***, *which are* ***two short nerves*** *that suspend* ***the pterygopalatine ganglion*** *in the* ***pterygopalatine fossa.***

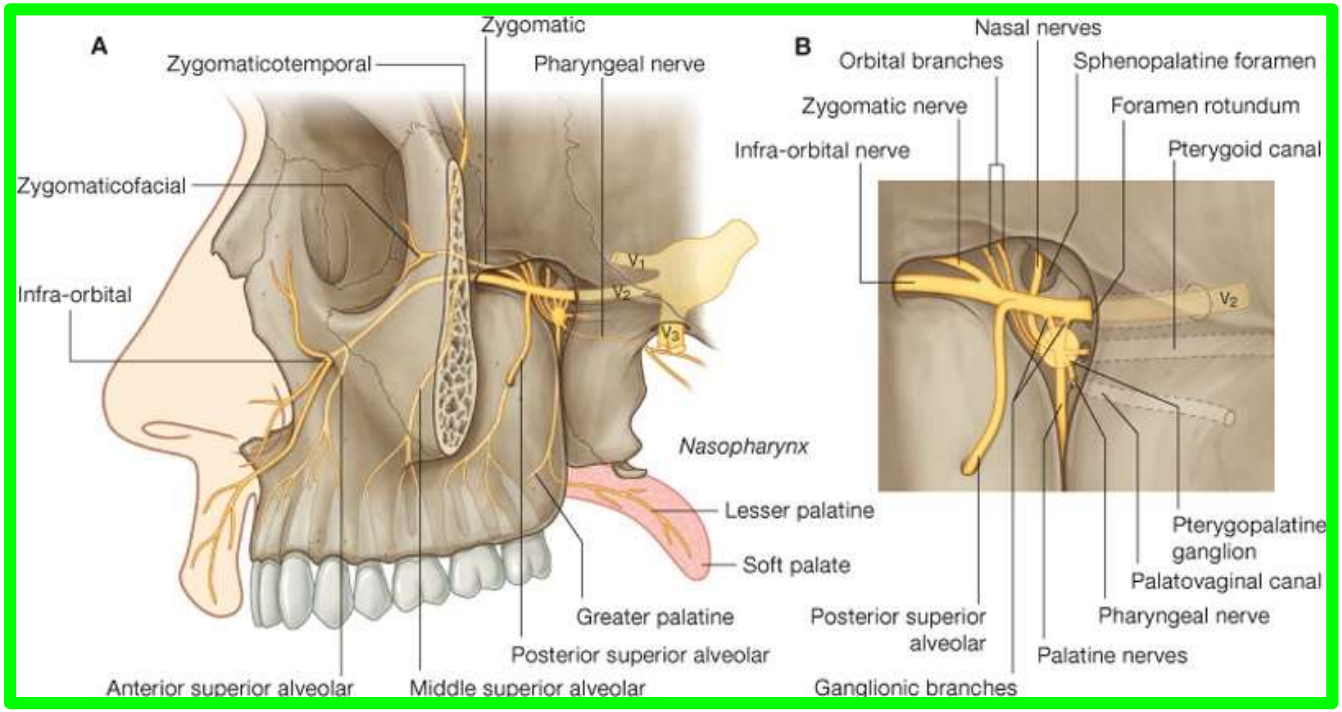


They contain sensory fibers that have passed through the ganglion from the nose, the palate, and the pharynx. They also contain postganglionic parasympathetic fibers that are going to the lacrimal gland

Maxillary Nerve (V2)

■■ Posterior superior alveolar nerve which supplies the maxillary sinus as well as the upper molar teeth and adjoining parts of the gum and the cheek

■■ Middle superior alveolar nerve which supplies the maxillary sinus as well as the upper premolar teeth, the gums, and the cheek

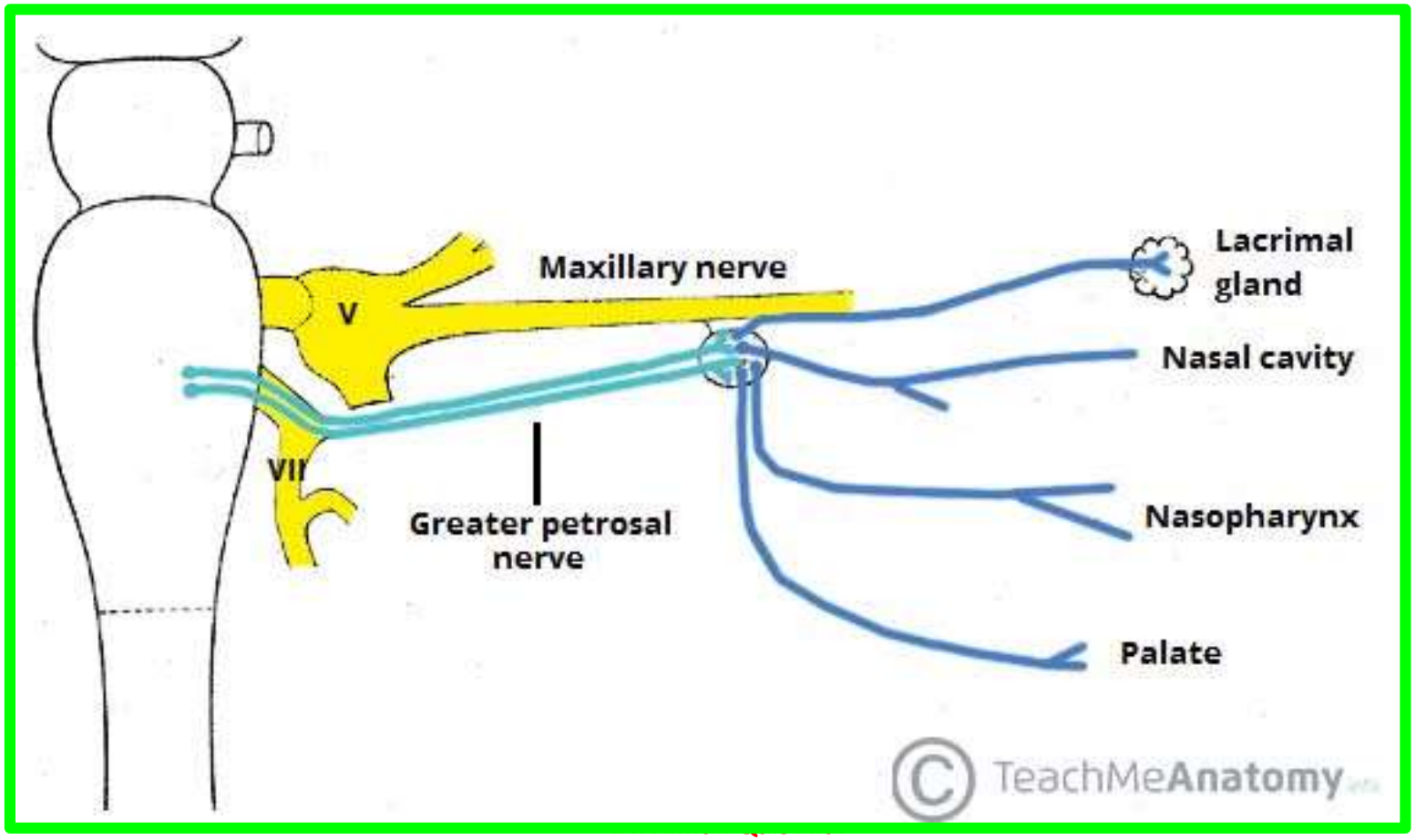


■■ Anterior superior alveolar nerve, which supplies the maxillary sinus as well as the upper canine and the incisor teeth

Pterygopalatine Ganglion

is a parasympathetic ganglion, which is suspended from the maxillary nerve in the pterygopalatine fossa.

It is secretomotor to the lacrimal and nasal glands



Pterygopalatine Ganglion

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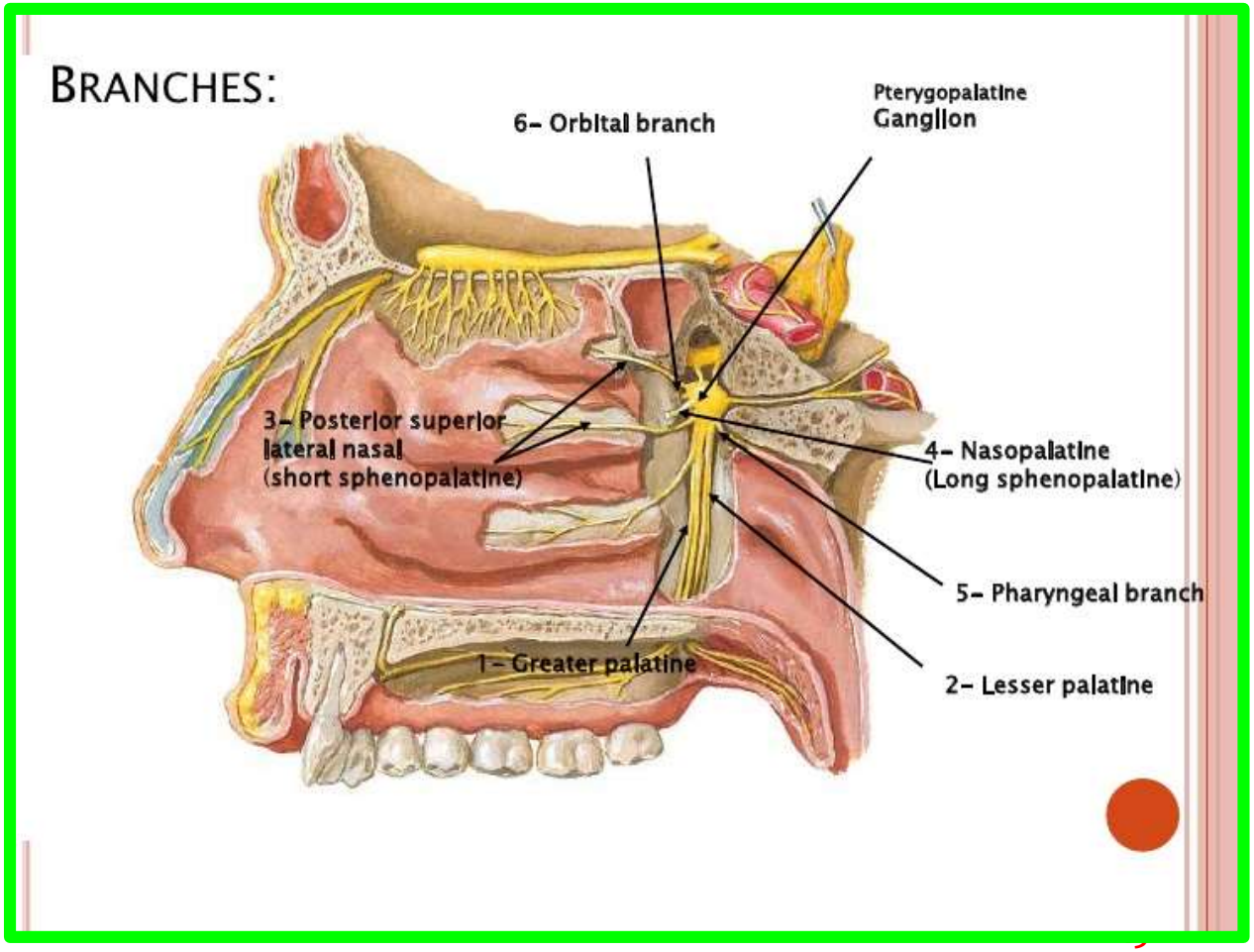
Branches

■■ **Orbital branches**, which enter the orbit through the inferior orbital fissure

■■ **Greater and lesser palatine nerves** which supply the palate, the tonsil, and the nasal cavity

■■ **Pharyngeal branch**, which supplies the roof of the nasopharynx



Mandibular Nerve (V3)

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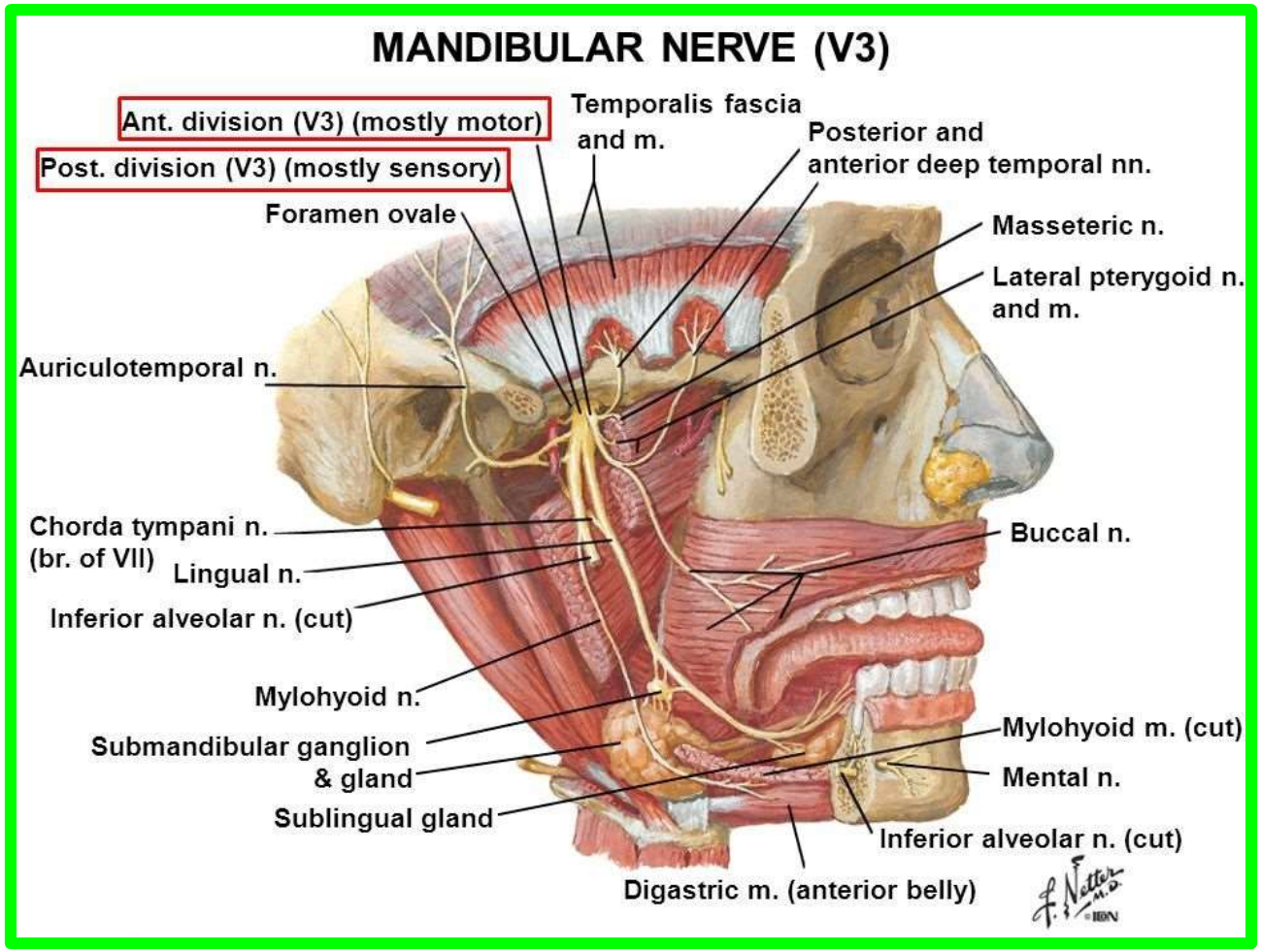
✓ Is both motor and sensory

✓ The sensory root leaves the trigeminal ganglion and passes out of the skull through the foramen ovale to enter the infratemporal fossa.

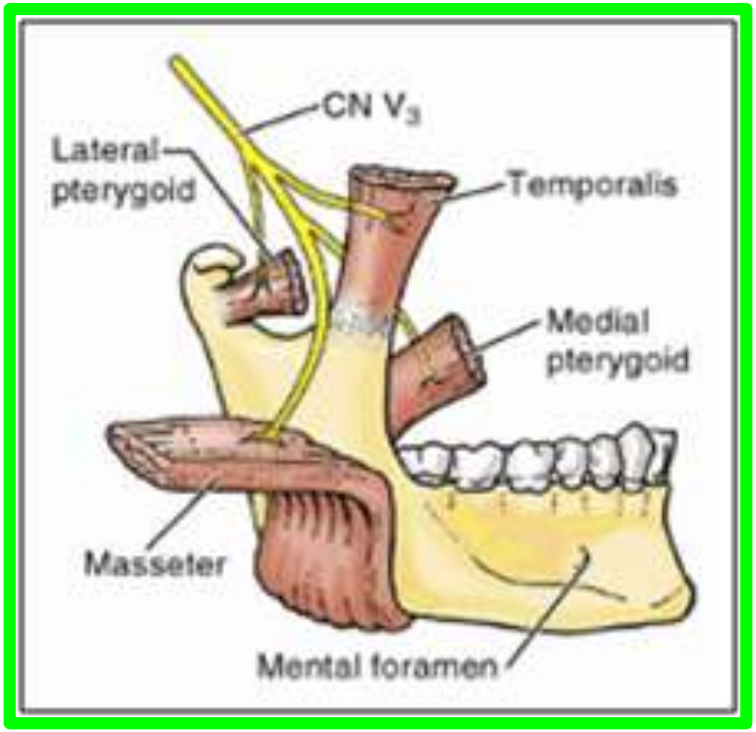


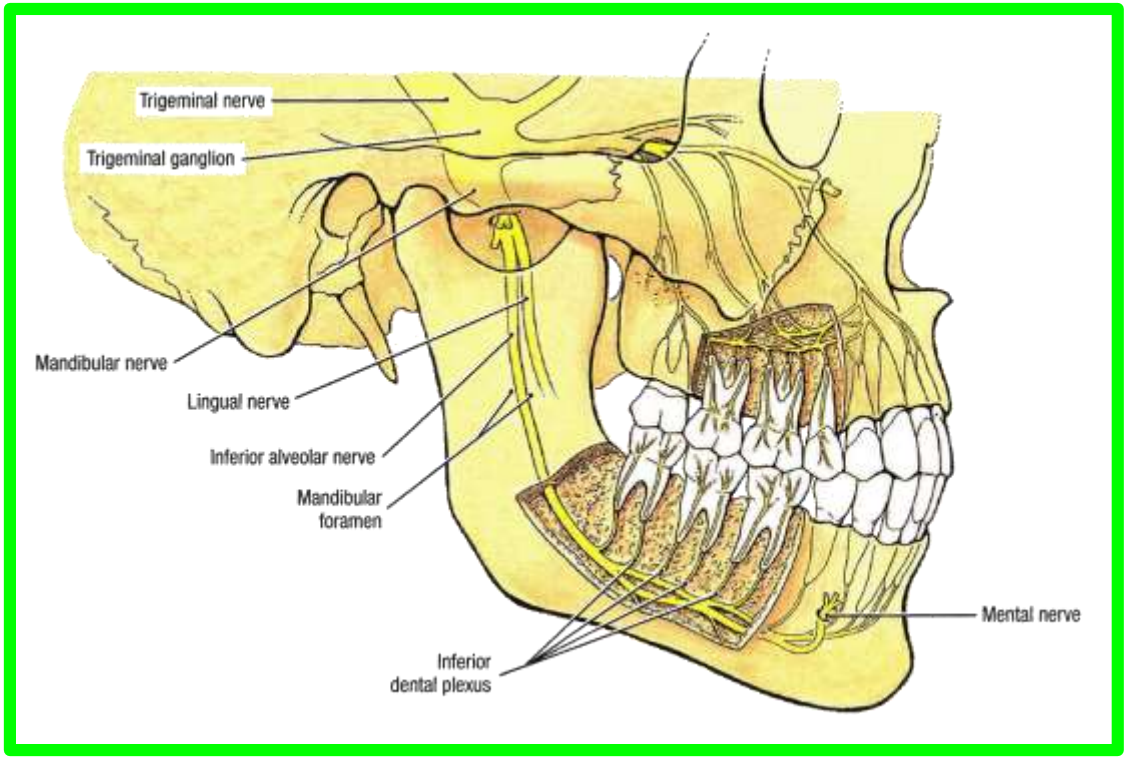
✓ The motor root of the trigeminal nerve also leaves the skull through the foramen ovale and joins the sensory root to form the trunk of the mandibular nerve, and then divides into a small anterior and a large posterior division

Mandibular Nerve (V3)

Branches from the Main Trunk of the Mandibular Nerve

- **Meningeal branch**
- **Nerve to the medial pterygoid muscle, which supplies not only the medial pterygoid, but also the tensor veli palatini muscle**



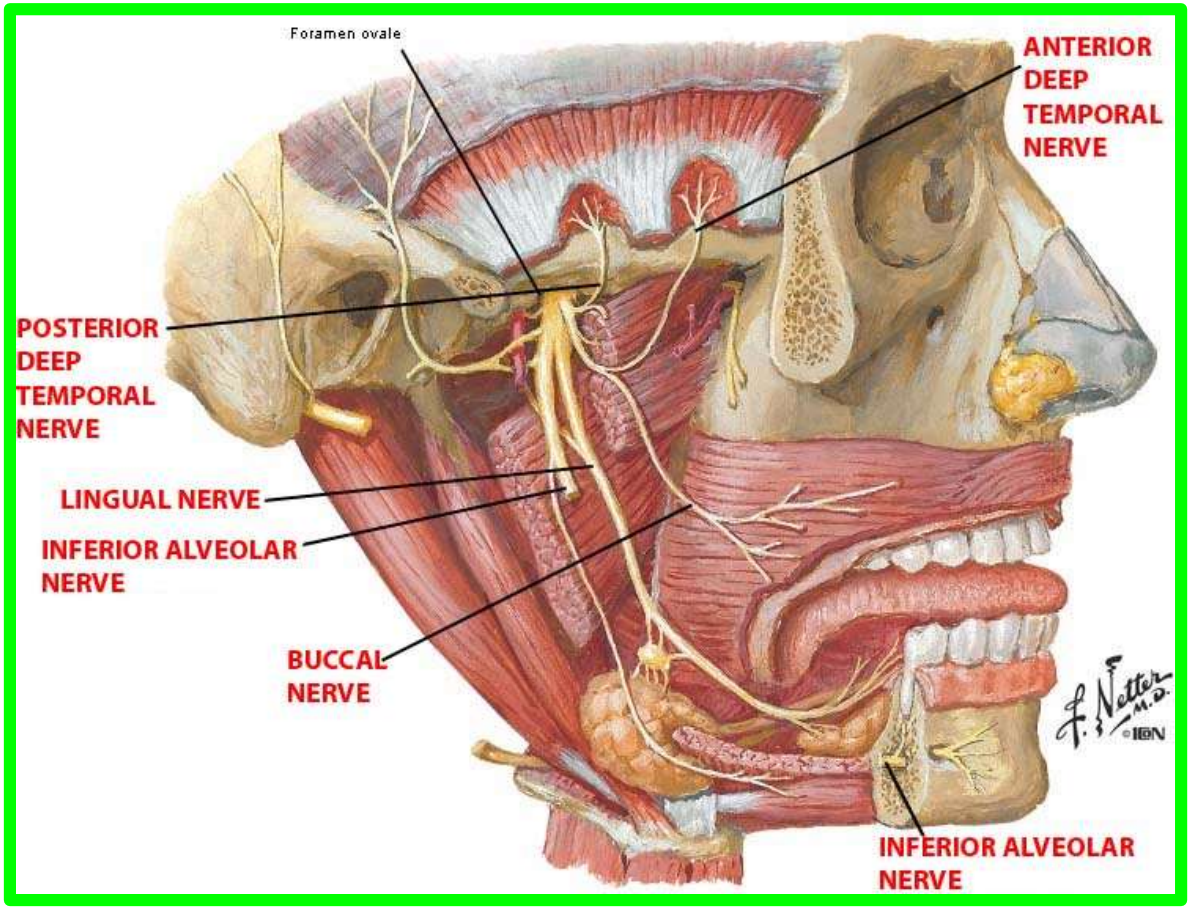


Mandibular Nerve (V3)

Branches from the Anterior Division of the Mandibular Nerve

- **Masseteric nerve** to the masseter muscle
- **Deep temporal nerves** to the temporalis muscle
- **Nerve to the lateral pterygoid muscle**
- **Buccal nerve** to the **skin and the mucous membrane of the cheek**

The buccal nerve does not supply the buccinator muscle (which is supplied by the facial nerve), and it is the only sensory branch of the anterior division of the mandibular nerve



Mandibular Nerve (V3)

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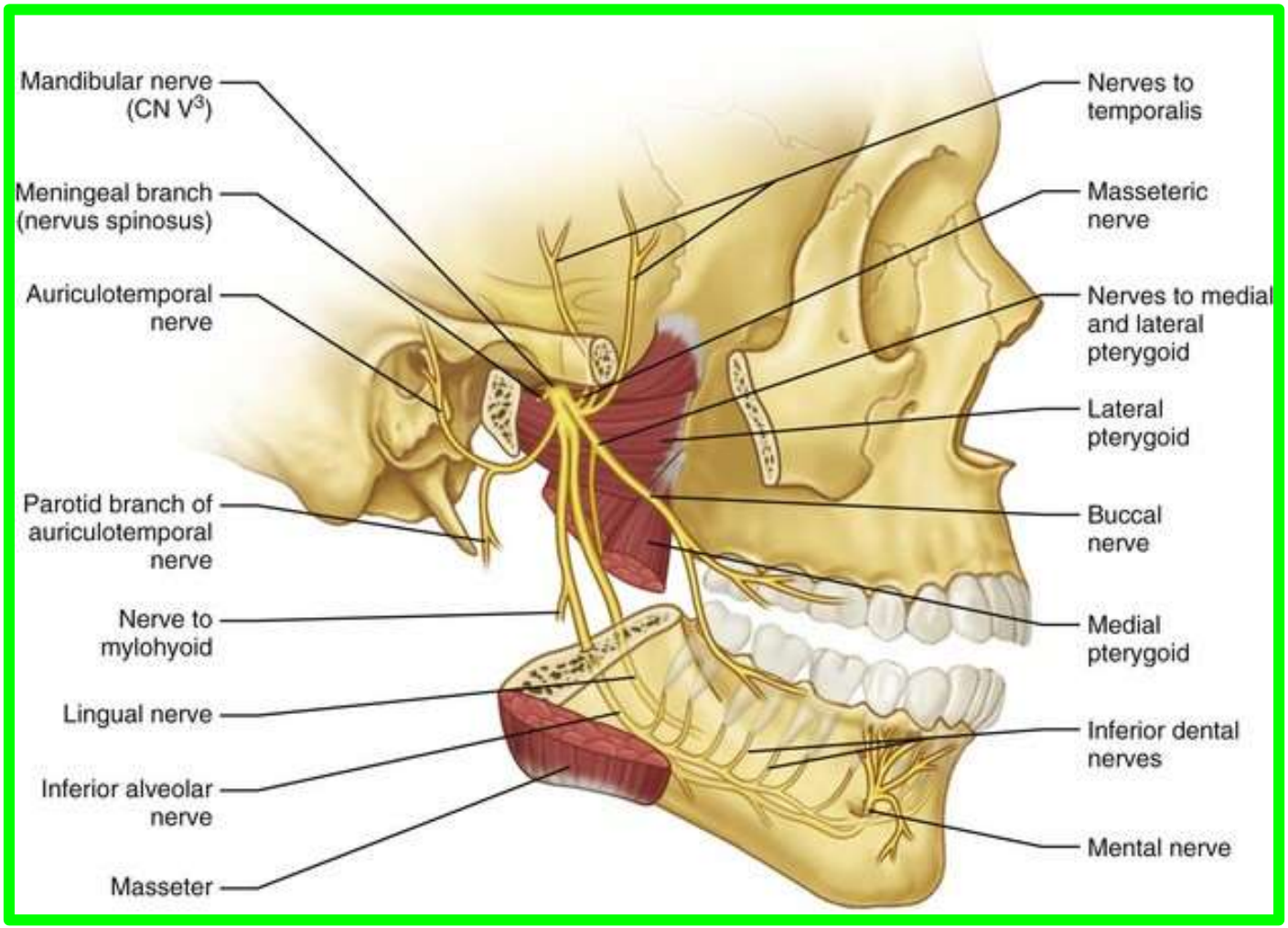
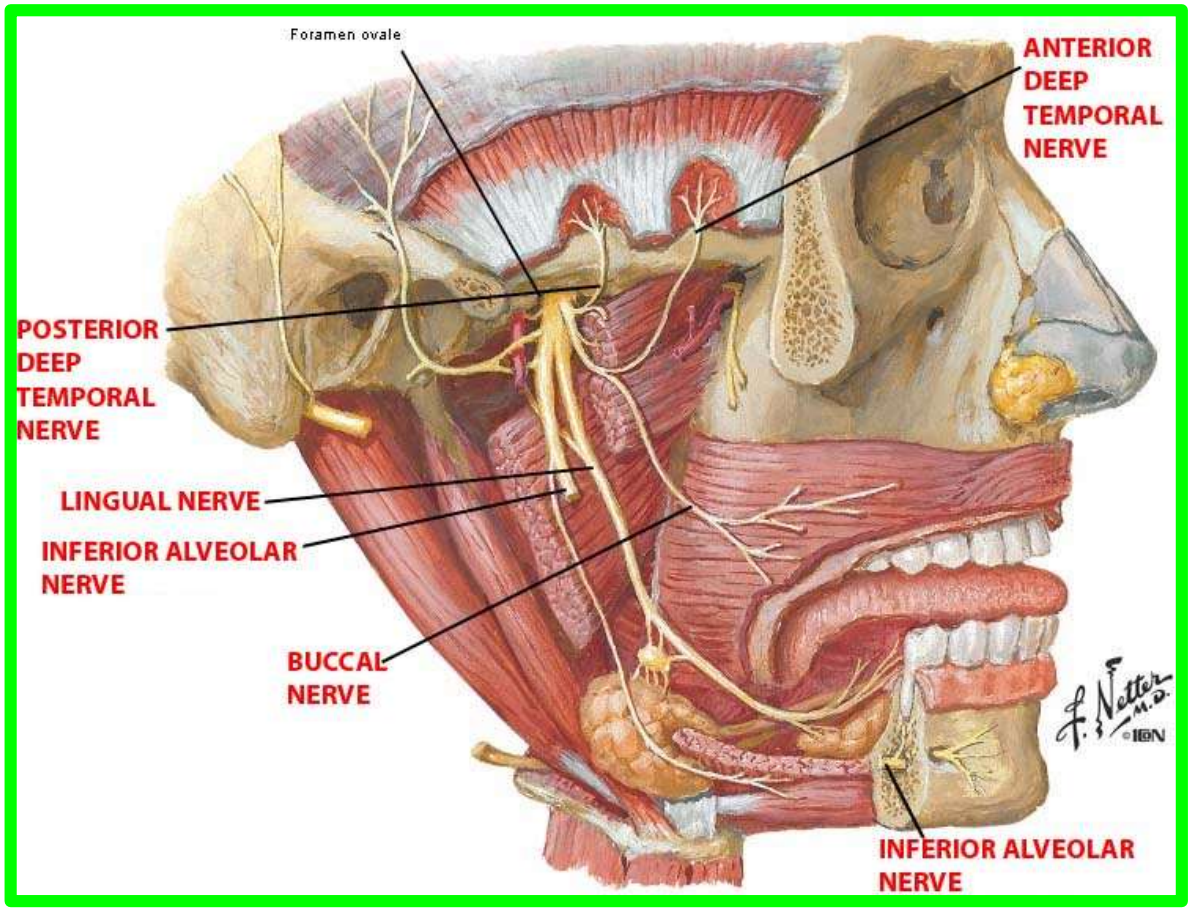
Branches from the Posterior Division of the Mandibular Nerve

■ **Auriculotemporal nerve, which supplies the skin of the auricle, the external auditory meatus, the temporomandibular joint, and the scalp.**



Branches from the Posterior Division of the Mandibular Nerve

■■ **Lingual nerve**, It runs forward **on the side of the tongue** and **crosses the submandibular duct.** In its course, it is joined by **the chorda tympani nerve**, and it **supplies the mucous membrane of the anterior two thirds of the tongue** and **the floor of the mouth**.

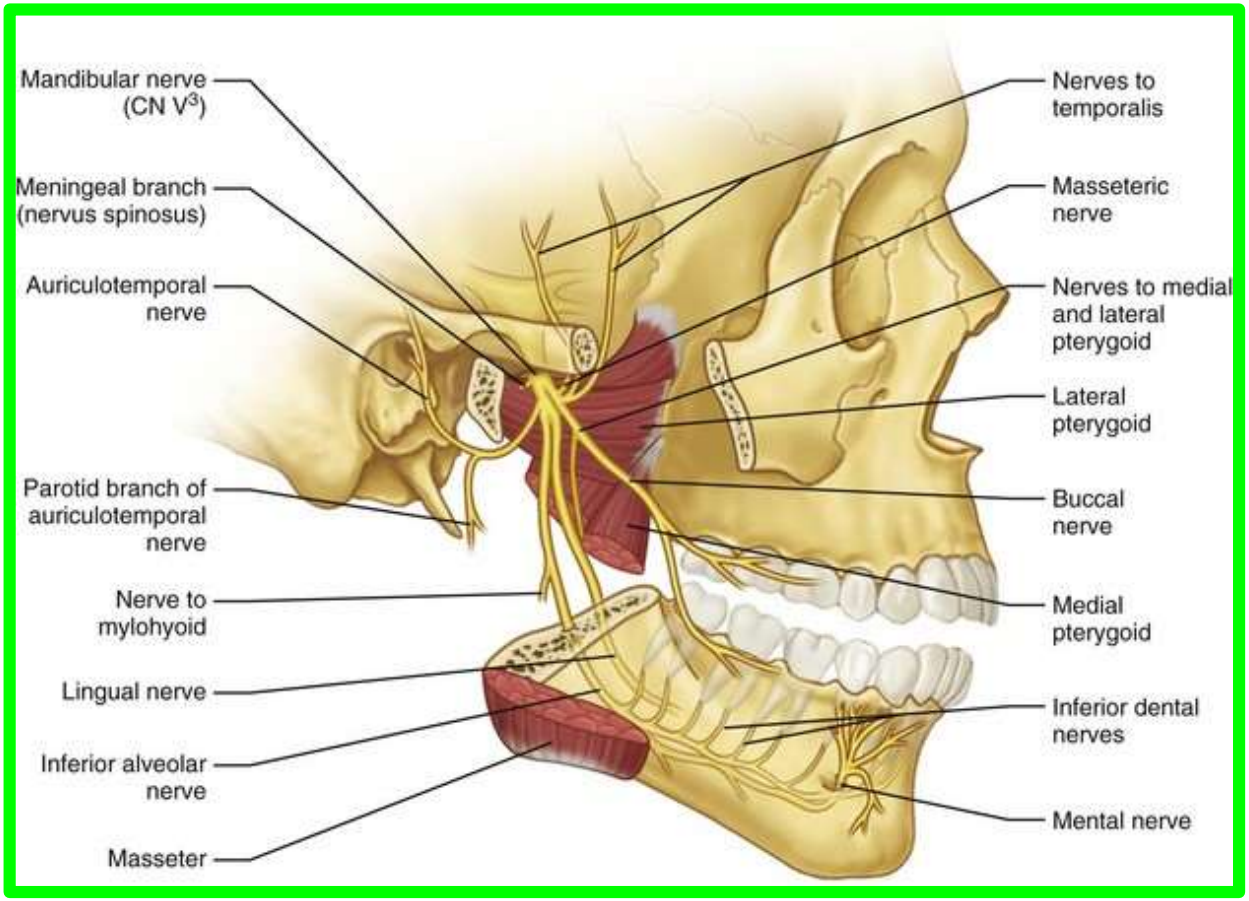


It also gives off preganglionic parasympathetic secretomotor fibers to the submandibular ganglion.

Branches from the Posterior Division of the Mandibular Nerve

■■*Inferior alveolar nerve* which enters *the mandibular canal* to supply the teeth of the lower jaw and emerges through the *mental foramen (mental nerve)* to supply the skin of the chin

Before entering the canal, it gives off the *mylohyoid nerve* which supplies the *mylohyoid muscle* and the *anterior belly of the digastric muscle*.



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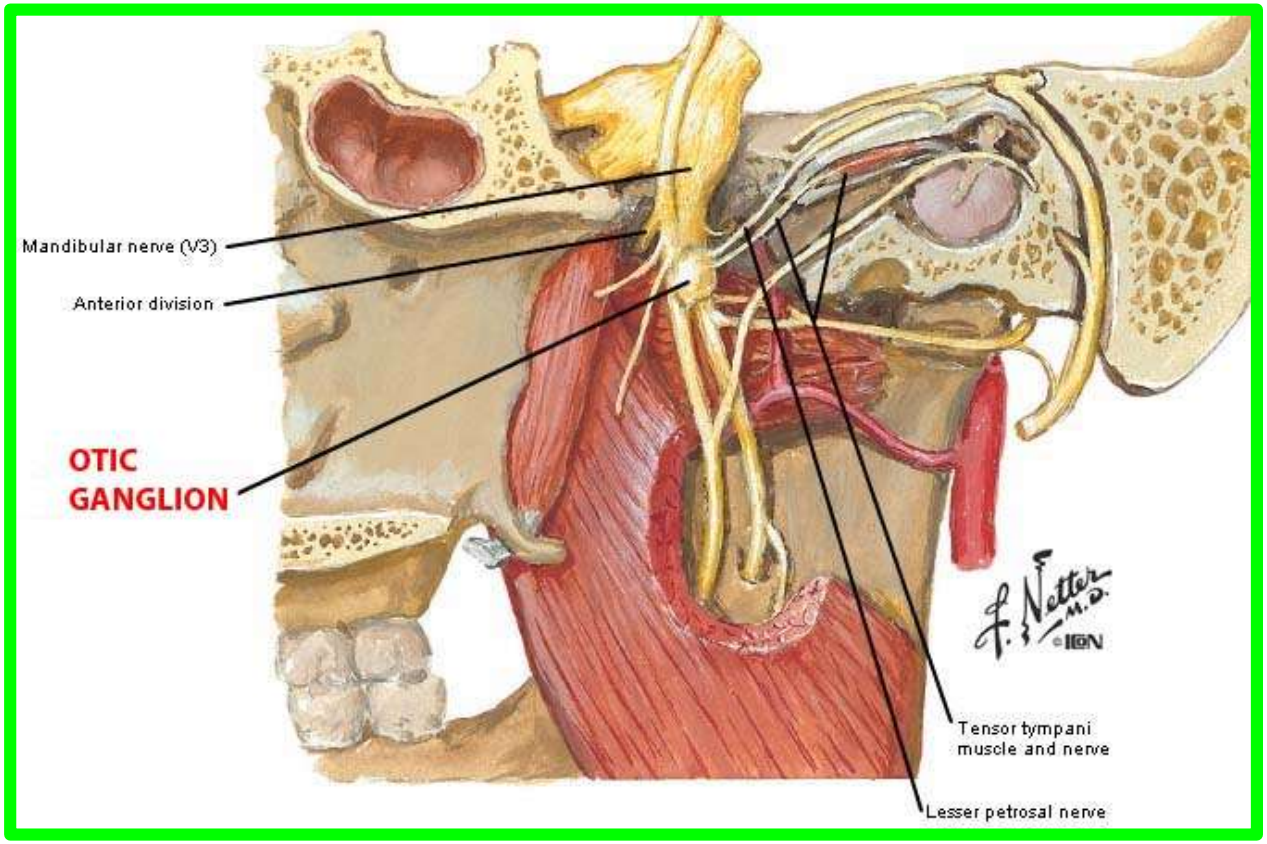
✓*The branches of the posterior division of the mandibular nerve are sensory (except the nerve to the mylohyoid muscle).*

The otic ganglion

is a parasympathetic ganglion that is located medial to the mandibular nerve just below the skull, and it is adherent to the nerve to the medial pterygoid muscle.



✓*The preganglionic fibers* originate in the glossopharyngeal nerve, and they reach the ganglion via *the lesser petrosal nerve*

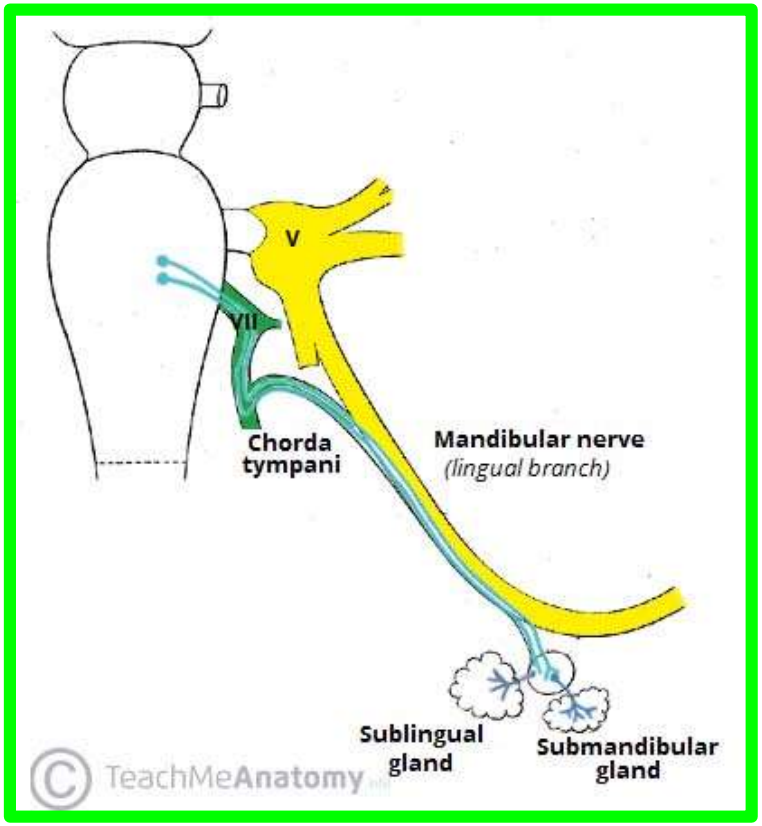
✓*The postganglionic secretomotor* fibers reach the parotid salivary gland via *the auriculotemporal nerve.*

Submandibular Ganglion

✓ *is a parasympathetic ganglion that lies deep to the submandibular salivary gland and is attached to the lingual nerve by small nerves*

✓ *Preganglionic parasympathetic fibers reach the ganglion from the facial nerve via the chorda tympani and the lingual nerves.*

✓ *Postganglionic secretomotor fibers pass to the submandibular and the sublingual salivary glands..*

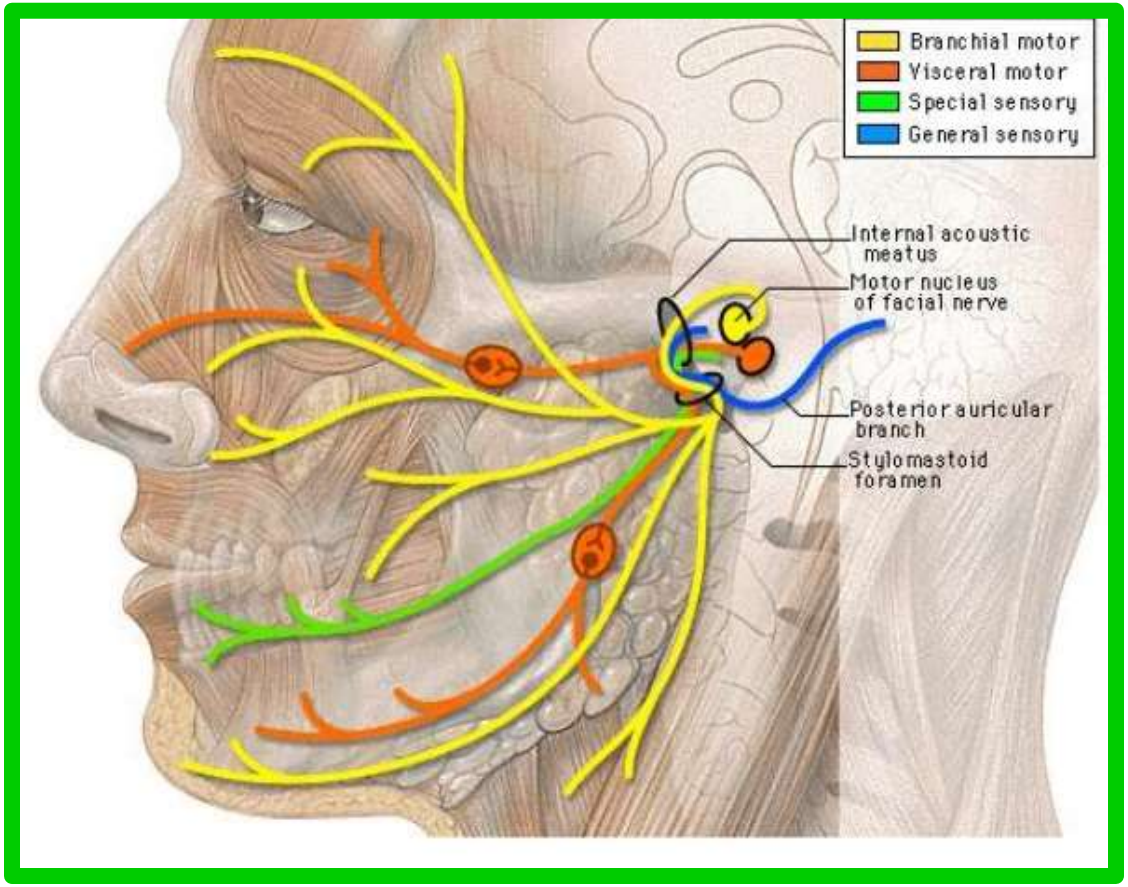


The trigeminal nerve is thus the main sensory nerve of the head and innervates the muscles of mastication. It also tenses the soft palate and the tympanic membrane

FACIAL NERVE (CN VII)

Functions:

- ❖ Sensory— Somatic sensory (general) and special sensory (taste)
- ❖ Motor— Somatic motor and visceral motor (parasympathetic)
- ❖ It also carries proprioceptive fibers from the muscles it innervates.



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FACIAL NERVE (CN VII)

1. Main Motor Nucleus

✓The main motor nucleus lies deep in the reticular formation of the lower part of the pons

✓The part of the nucleus that supplies the muscles of the upper part of the face receives corticonuclear fibers from both cerebral hemispheres

✓ The part of the nucleus that supplies the muscles of the lower part of the face receives only corticonuclear fibers from the opposite cerebral hemisphere.

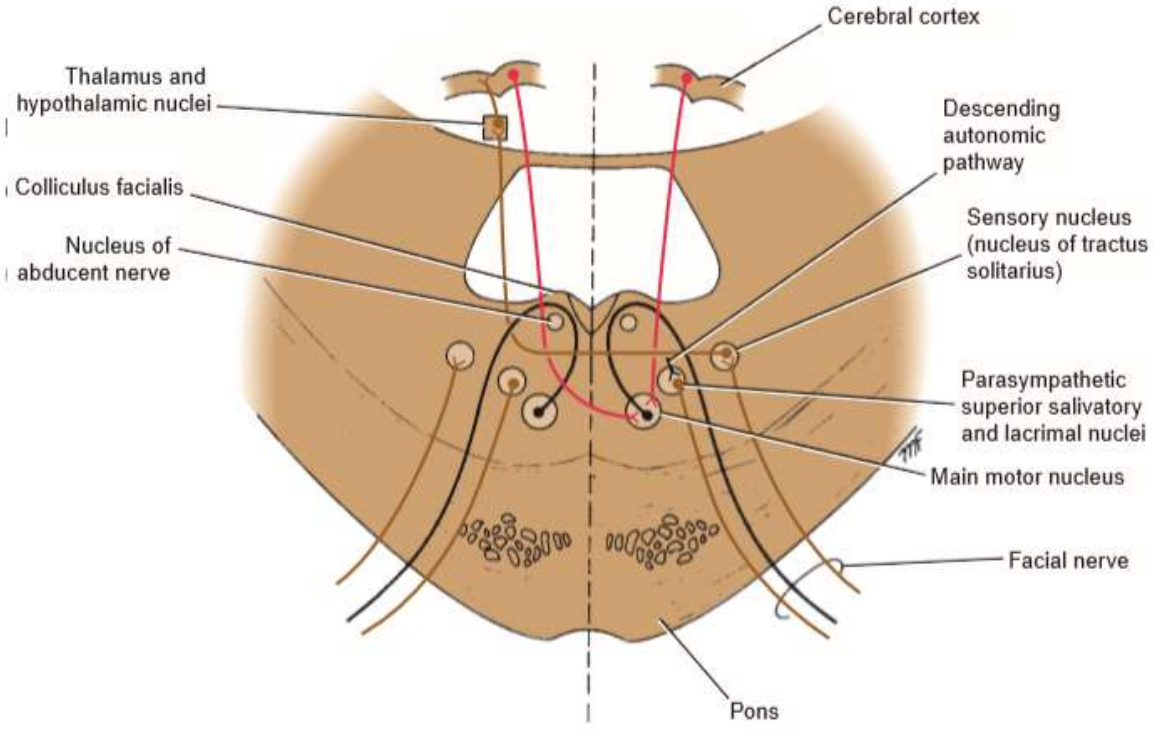

Figure 11-11 Facial nerve nuclei and their central connections.

FACIAL NERVE (CN VII)

2. Parasympathetic Nuclei

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Parasympathetic nuclei lie posterolateral to the main motor nucleus. They are the: A. superior salivatory and B. lacrimal nuclei

✓***A. The superior salivatory nucleus receives afferent fibers from the hypothalamus through the descending autonomic pathways.***

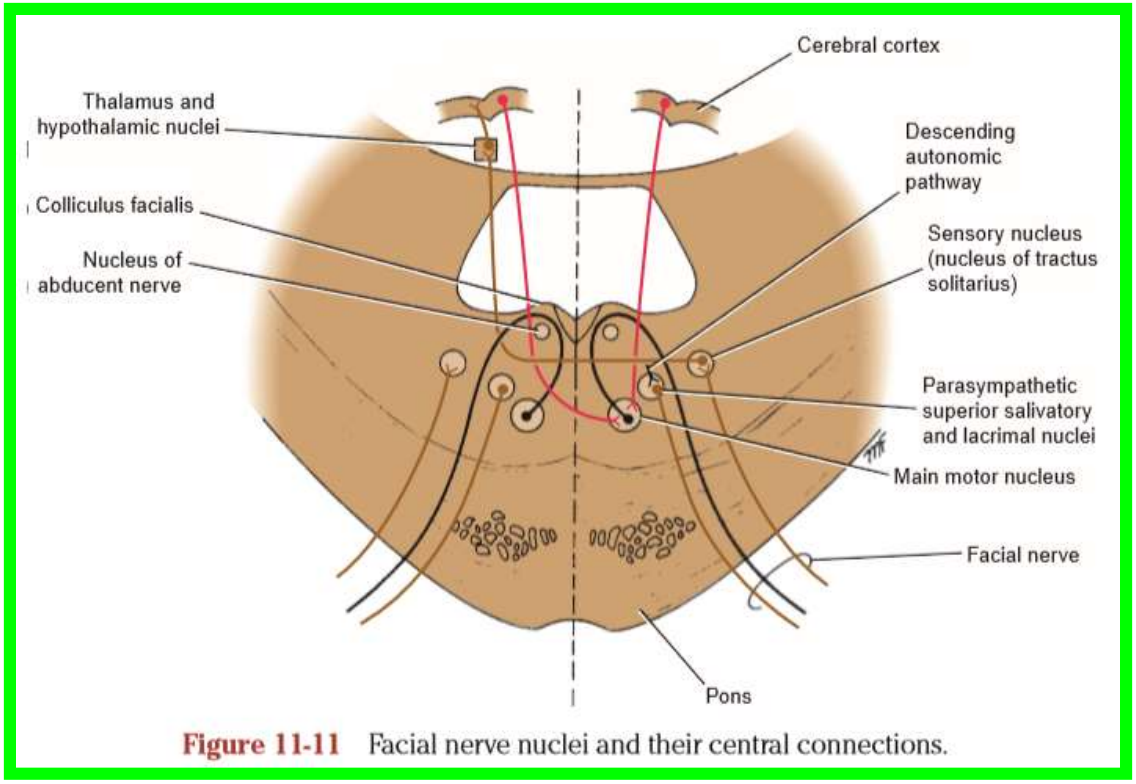

Figure 11-11 Facial nerve nuclei and their central connections.

✓***Information concerning taste also is received from the nucleus of the solitary tract from the mouth cavity.***

FACIAL NERVE (CN VII)

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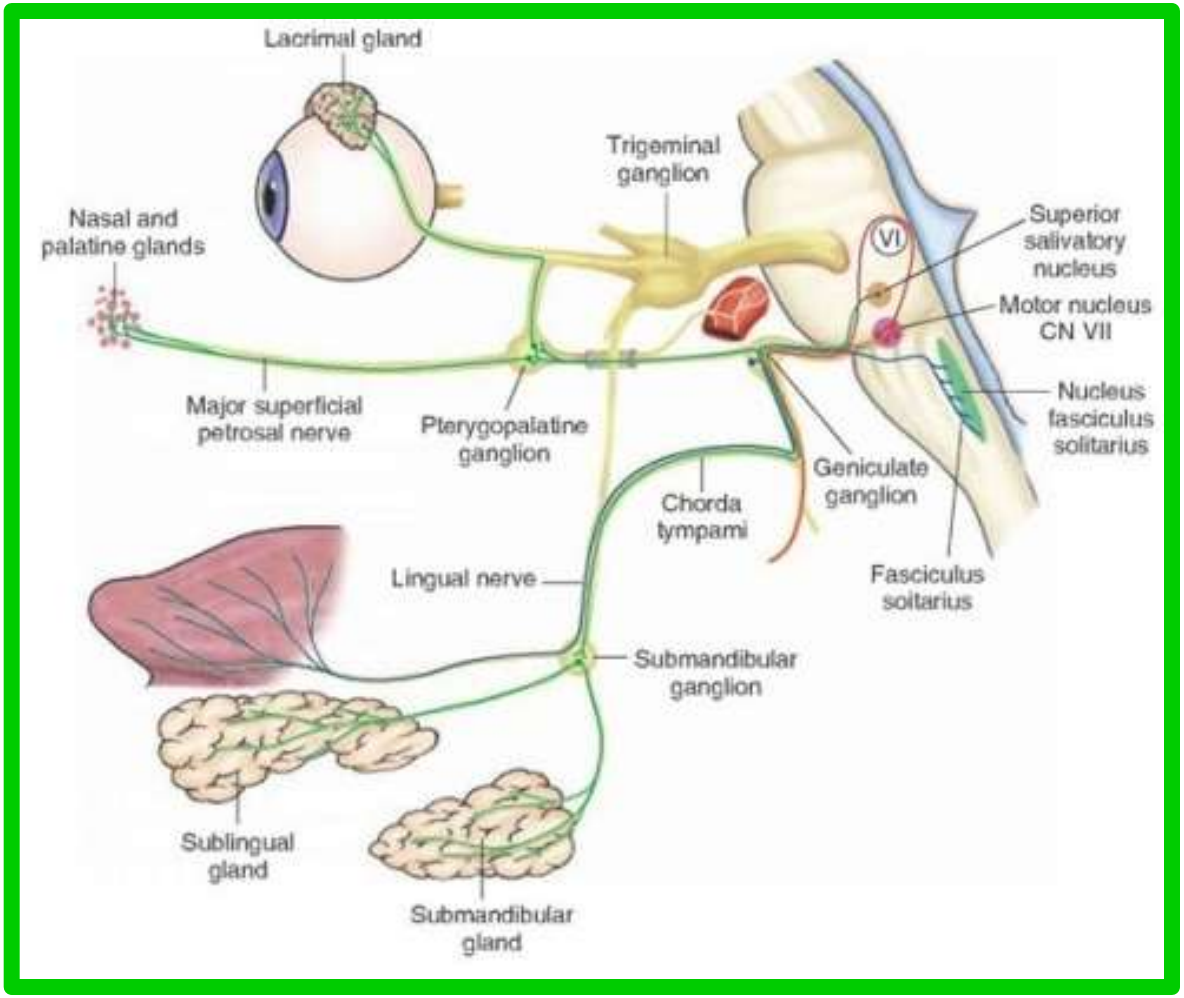
2. Parasympathetic Nuclei

B. The lacrimal nucleus ***receives afferent fibers from the hypothalamus for emotional responses and from the sensory nuclei of the trigeminal nerve for reflex lacrimation secondary to irritation of the cornea or conjunctiva.***



FACIAL NERVE (CN VII)

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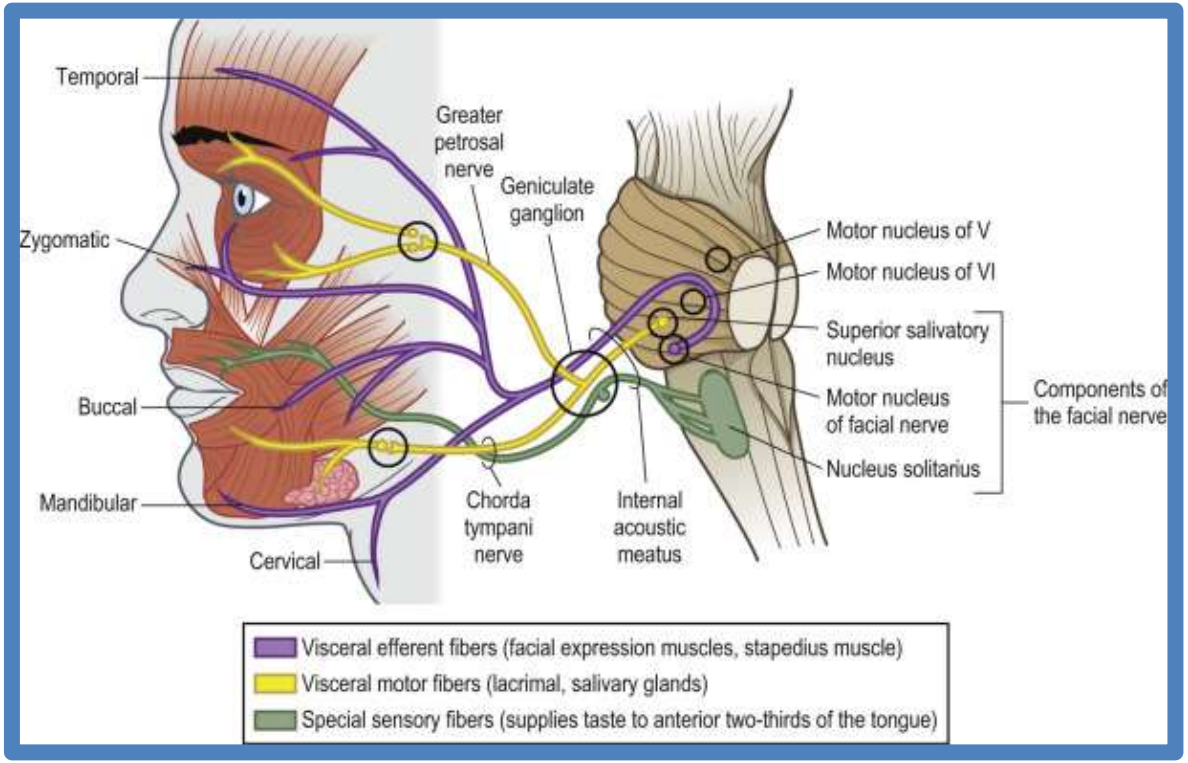
3. Sensory Nucleus

The sensory nucleus is the upper part of the nucleus of the tractus solitarius and lies close to the motor nucleus



Sensations of taste travel through the peripheral axons of nerve cells situated in the geniculate ganglion on the seventh cranial nerve

FACIAL NERVE (CN VII)

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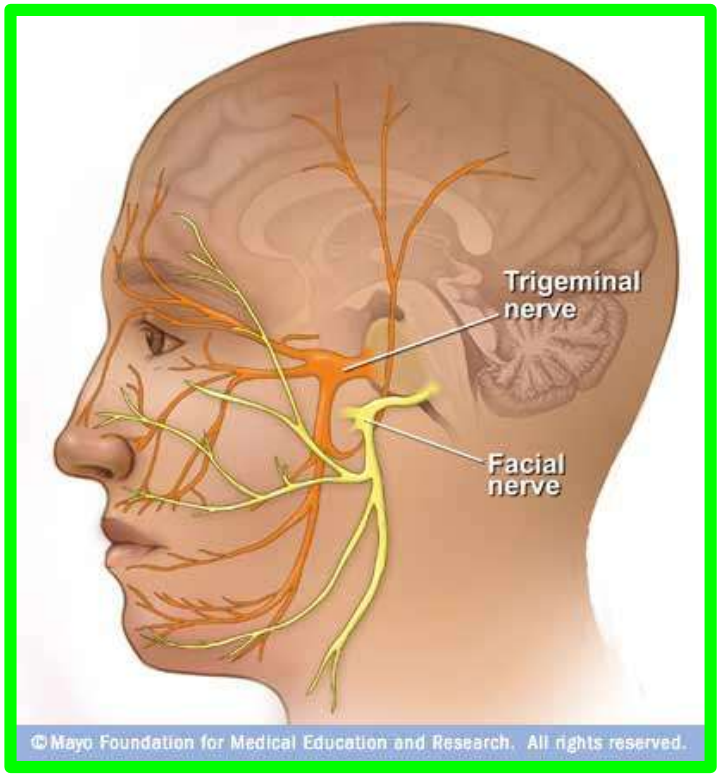
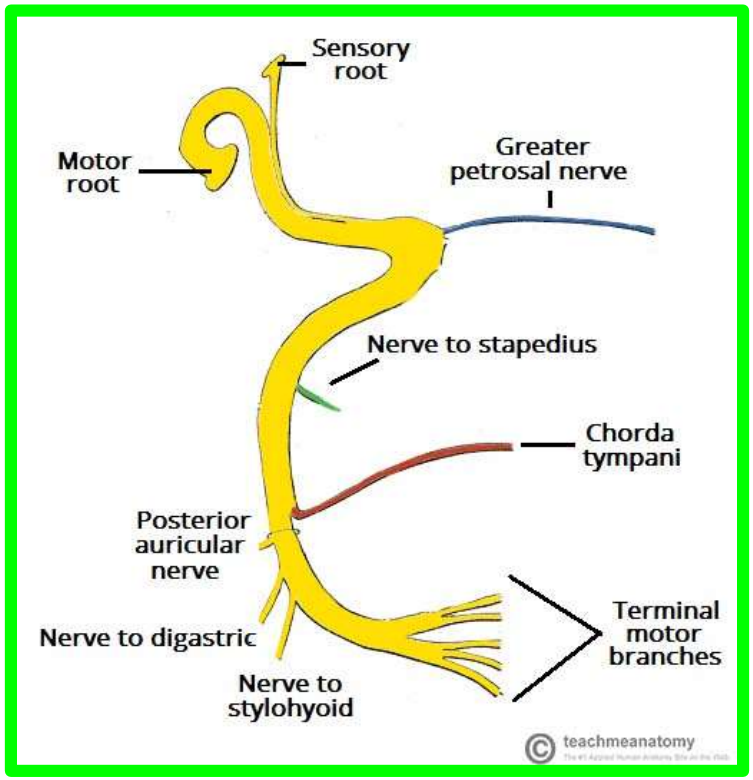
❖*The facial nerve (CN VII) emerges from the junction of the pons and medulla as two divisions: the motor root and the intermediate nerve.*

❖*The larger motor root (facial nerve proper) innervates the muscles of facial expression, and the smaller intermediate nerve carries taste, parasympathetic, and somatic sensory fibers.*

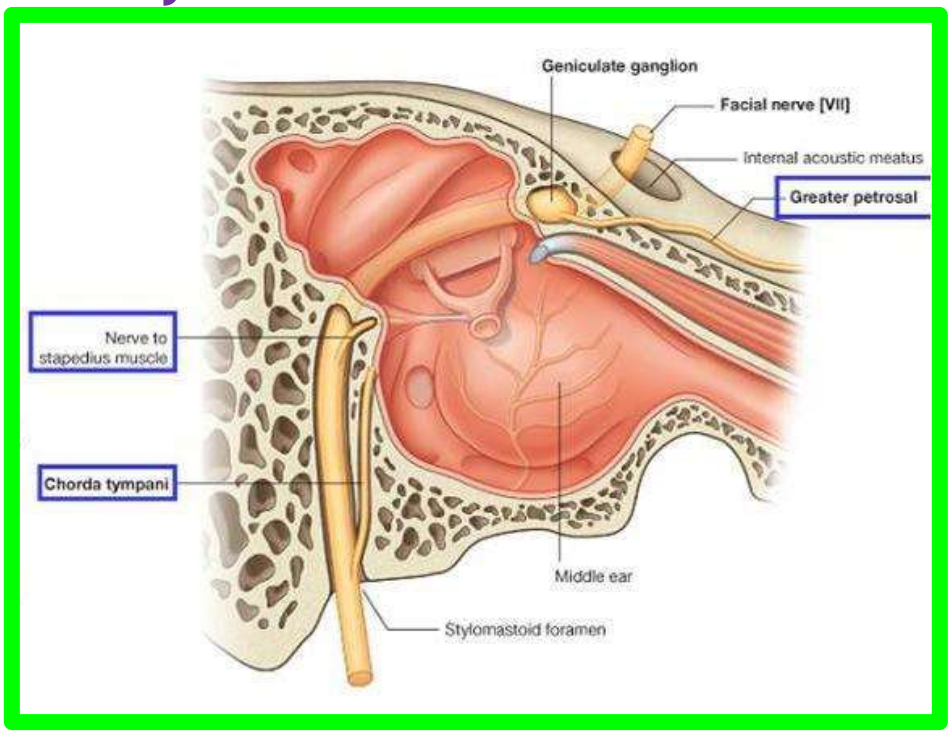




FACIAL NERVE (CN VII)

During its course,* CN VII traverses the *posterior cranial fossa, internal acoustic meatus, facial canal, stylomastoid foramen of the temporal bone,* and *parotid gland.

After traversing the internal acoustic meatus, the nerve proceeds a short distance anteriorly within the temporal bone and then turns abruptly posteriorly to course along the medial wall of the tympanic cavity.



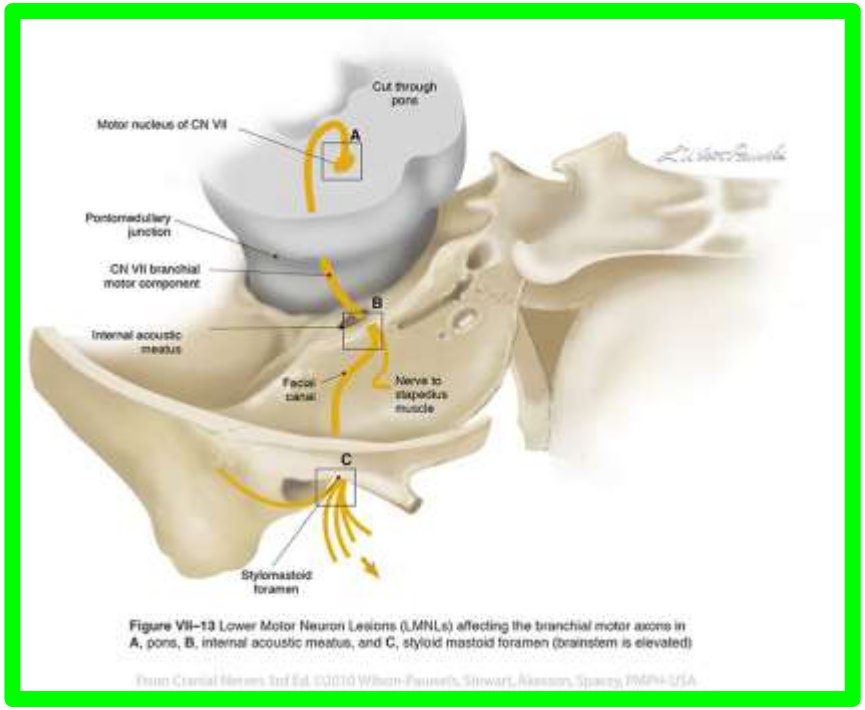


Figure VII–13 Lower Motor Neuron Lesions (LMNLs) affecting the branchial motor axons in A, pons, B, internal acoustic meatus, and C, styloid mastoid foramen (brainstem is elevated)

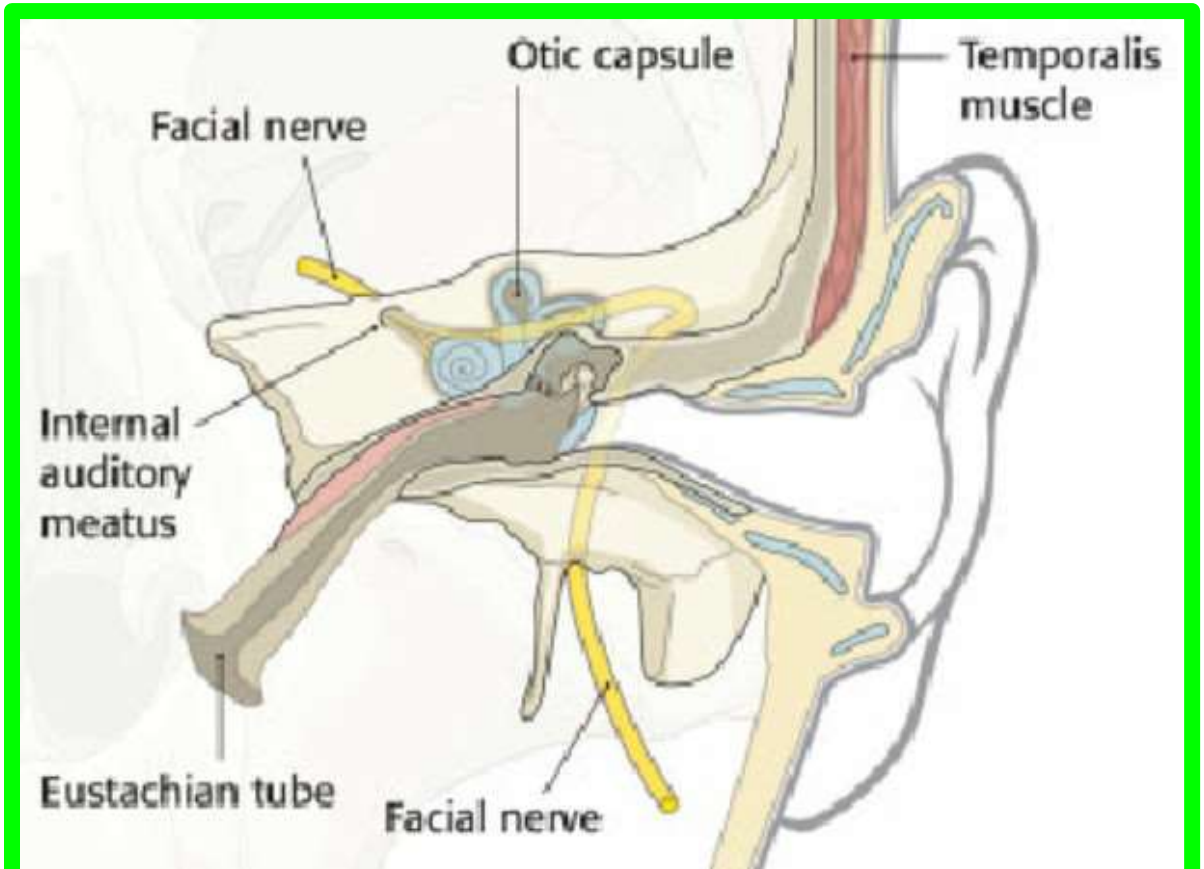
FACIAL NERVE (CN VII)

- ***Course and relations;***

A- Intracranial course of the facial nerve

(1) It leaves the cranial cavity by entering the internal auditory meatus. it runs through a bony canal (facial canal) inside petrous part of temporal bone as follows:

(a) It runs first laterally above the vestibule of the inner ear.



FACIAL NERVE (CN VII)

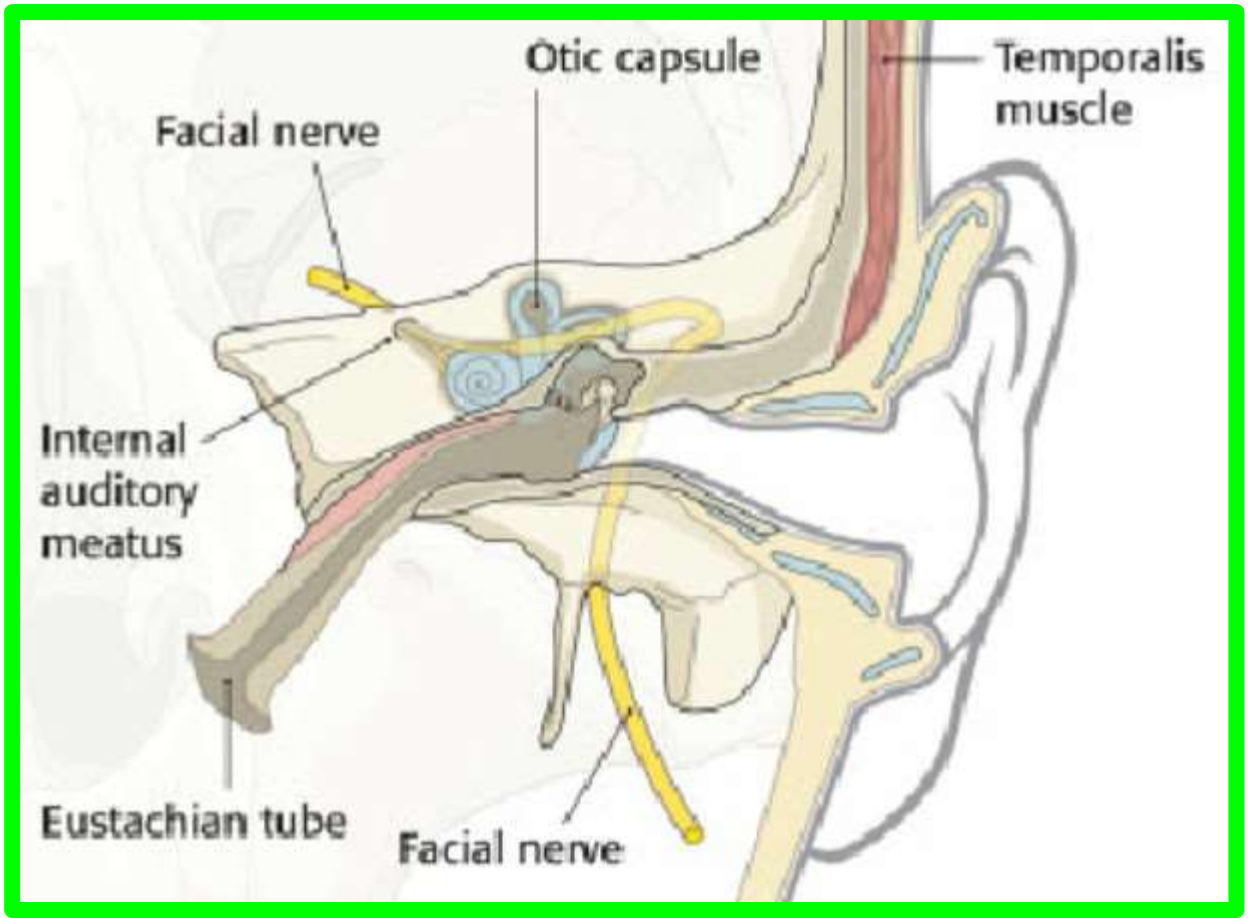
Course and relations;

(b) Then, it bends sharply backwards above the promontory in the medial wall of middle ear cavity.

- This sharp bend is called geniculum and carries the geniculate ganglion.

(c) Finally, it passes downwards behind the middle ear.

(d) It exits from the stylomastoid foramen.



Course and relations;

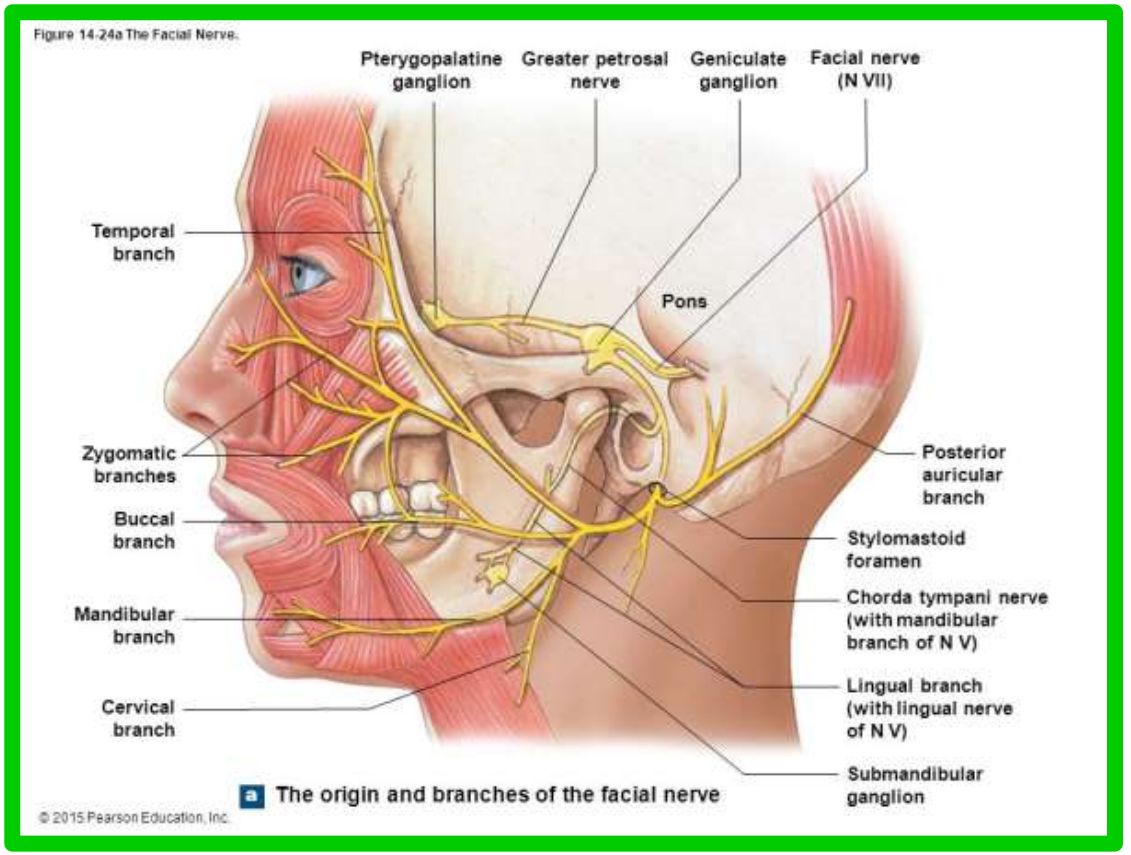
B – Extracranial course of facial nerve:

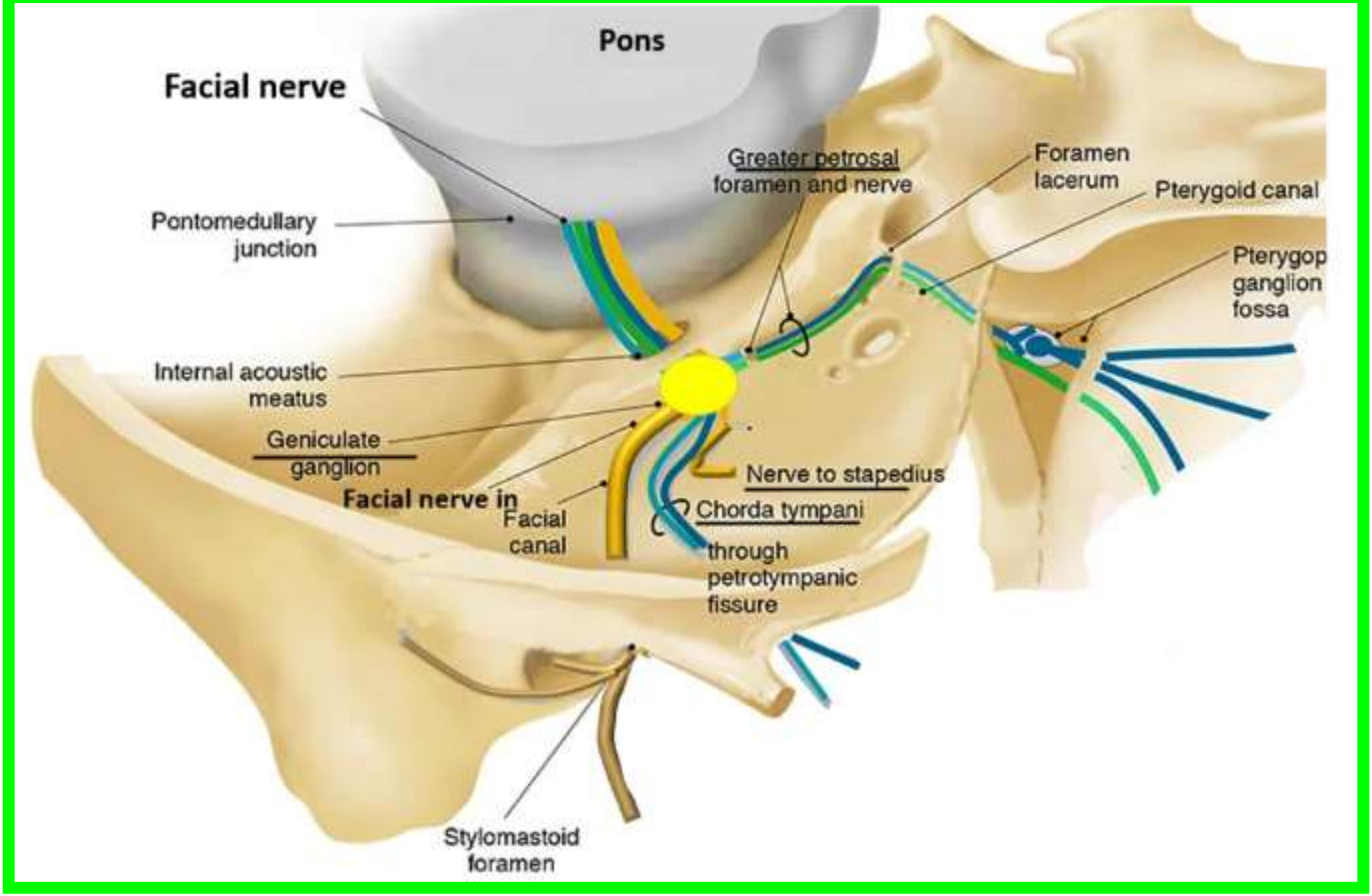
(1) It leaves the facial canal through the stylomastoid foramen.

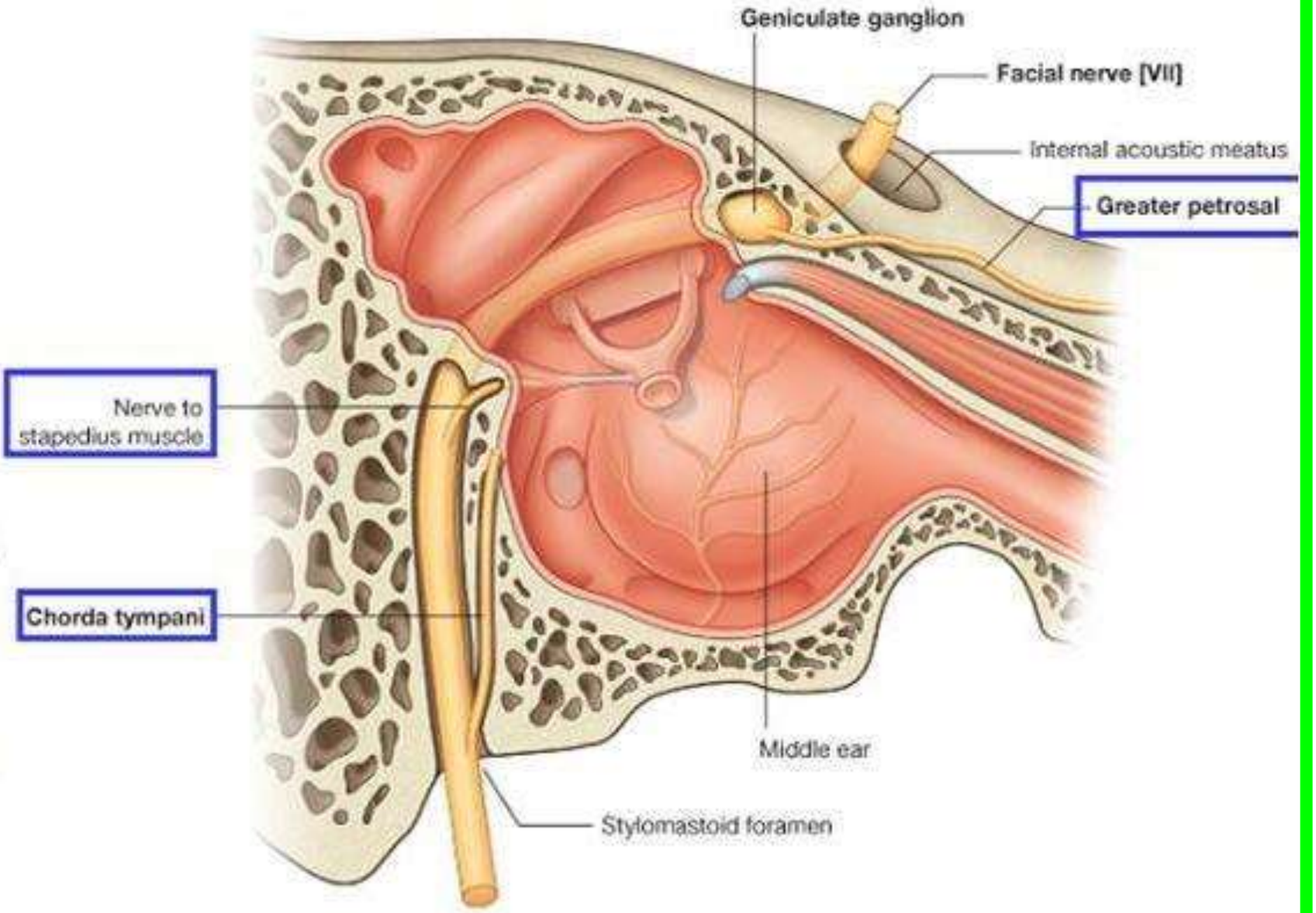
(2) It turns forwards making a curve around the lateral side of the styloid process.

(3)It enters the posteromedial surface of parotid gland (lying superficial to external carotid artery and retromandibular vein)VAN

(4) It ends inside the substance of the gland by dividing into 5 terminal branches




Pons
Facial nerve
Greater petrosal foramen and nerve
Foramen lacerum
Pterygoid canal
Pontomedullary junction
Pterygop ganglion fossa
Internal acoustic meatus
Geniculate ganglion
Facial nerve in
Facial canal
Nerve to stapedius
Chorda tympani
through petrotympanic fissure
Stylomastoid foramen

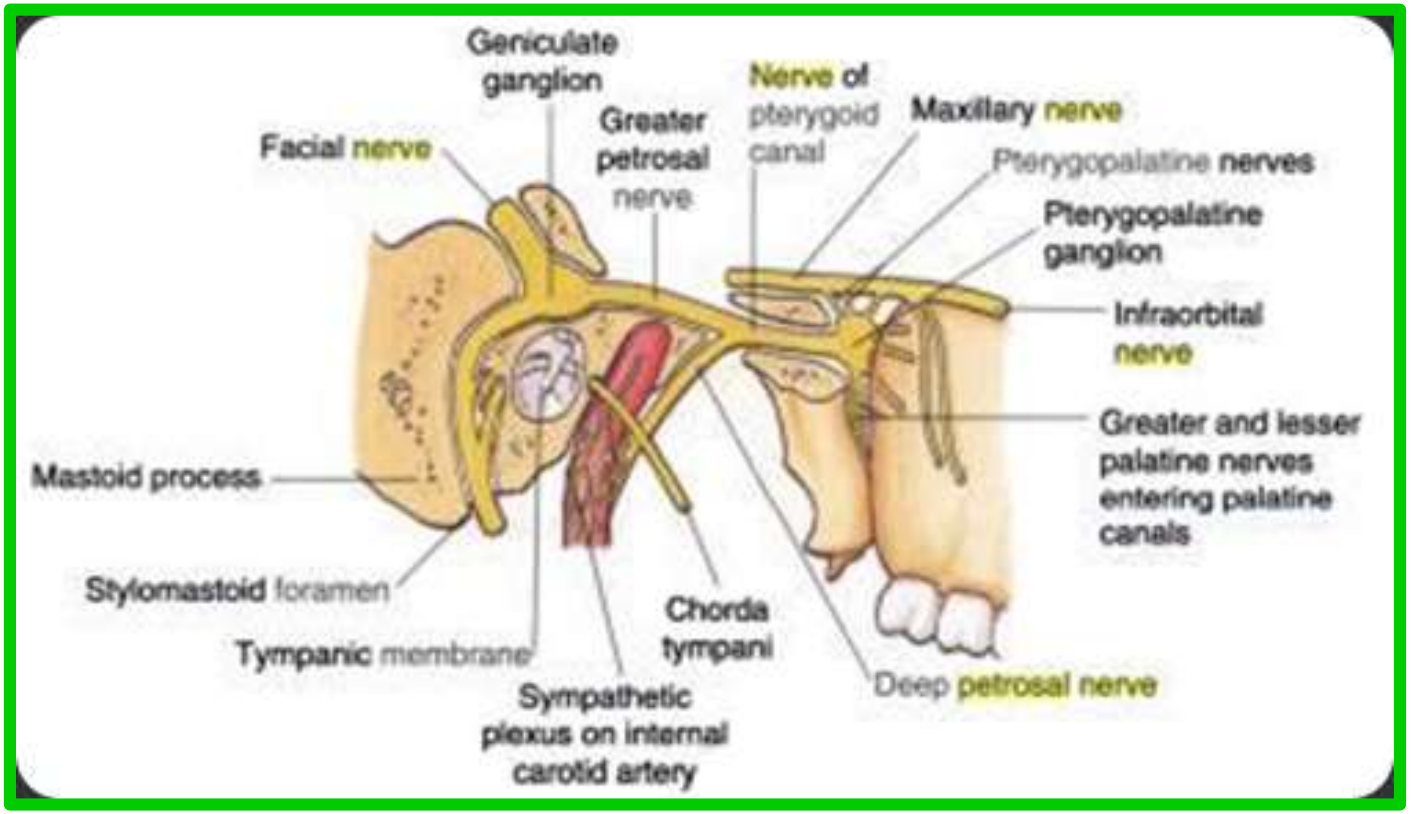

Geniculate ganglion
Facial nerve [VII]
Internal acoustic meatus
Greater petrosal
Nerve to stapedius muscle
Chorda tympani
Middle ear
Stylomastoid foramen

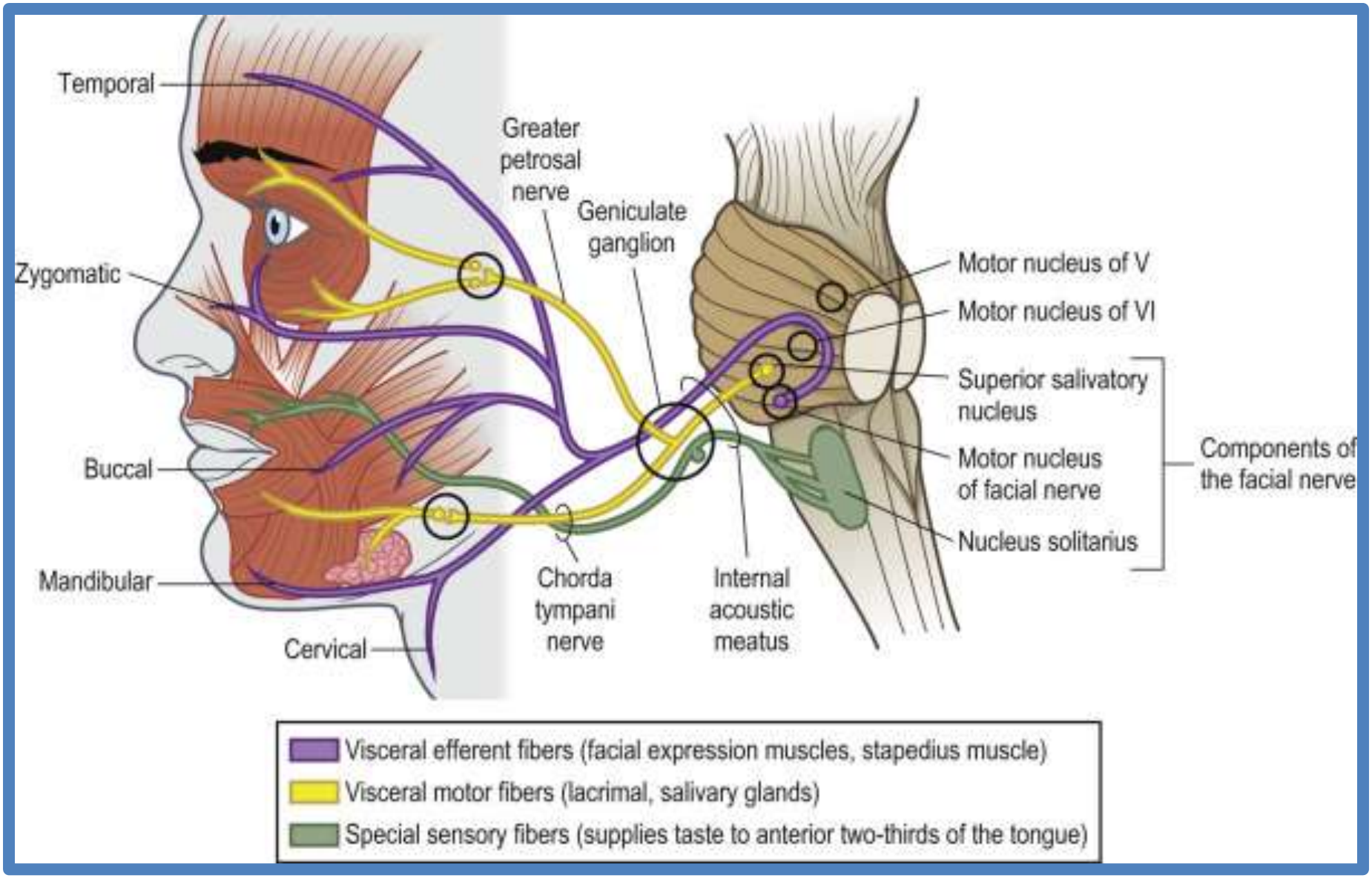
FACIAL NERVE (CN VII)

The sharp bend, the geniculum of the facial nerve is the site of the geniculate ganglion, the sensory ganglion of CN VII

While traversing the temporal bone within the facial canal, CN VII gives rise to the:

- ✓***Greater petrosal nerve.***
- ✓***Nerve to the stapedius.***
- ✓***Chorda tympani nerve.***




Temporal
Zygomatic
Buccal
Mandibular
Cervical
Greater petrosal nerve
Geniculate ganglion
Chorda tympani nerve
Internal acoustic meatus
Motor nucleus of V
Motor nucleus of VI
Superior salivatory nucleus
Motor nucleus of facial nerve
Nucleus solitarius
Components of the facial nerve
Visceral efferent fibers (facial expression muscles, stapedius muscle)
Visceral motor fibers (lacrimal, salivary glands)
Special sensory fibers (supplies taste to anterior two-thirds of the tongue)

FACIAL NERVE (CN VII)

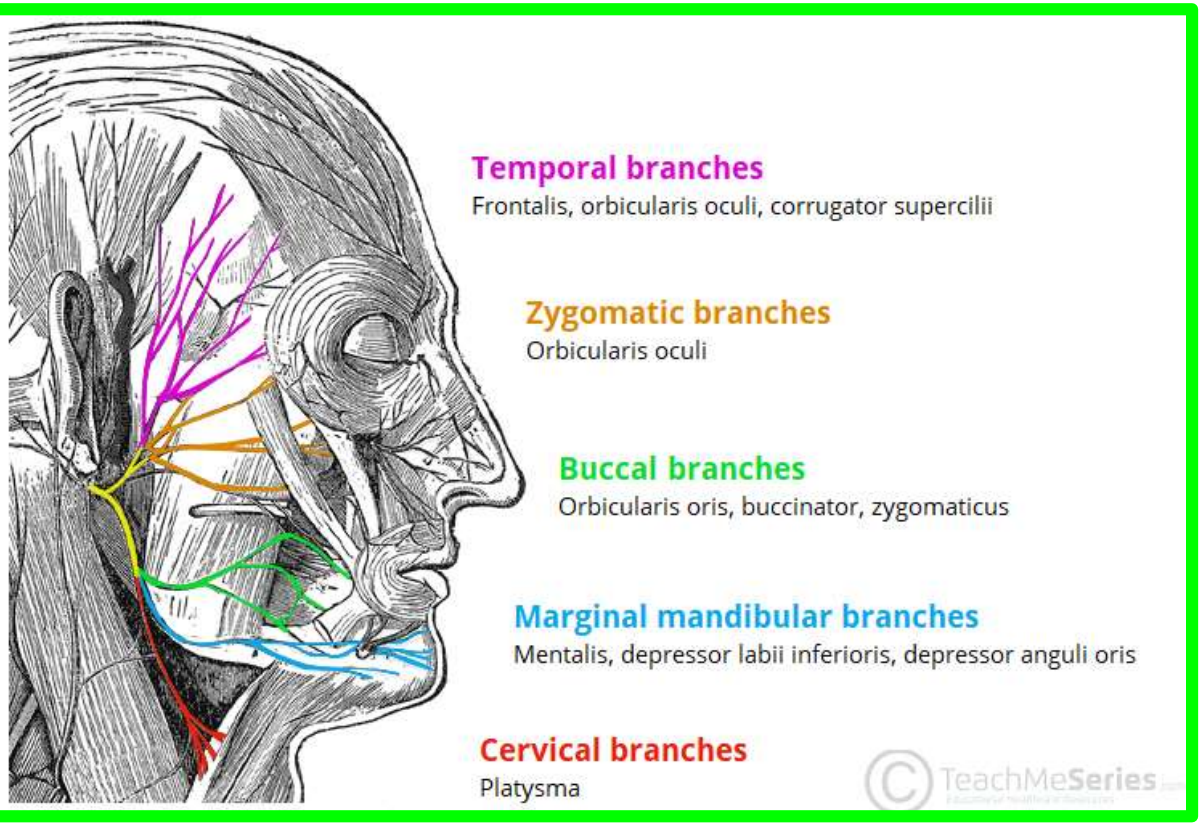
✓CN VII emerges from the cranium via the stylomastoid foramen;

✓Gives off the posterior auricular branch;

✓ Enters the parotid gland; and forms the parotid plexus,

which gives rise to the following five terminal motor branches:

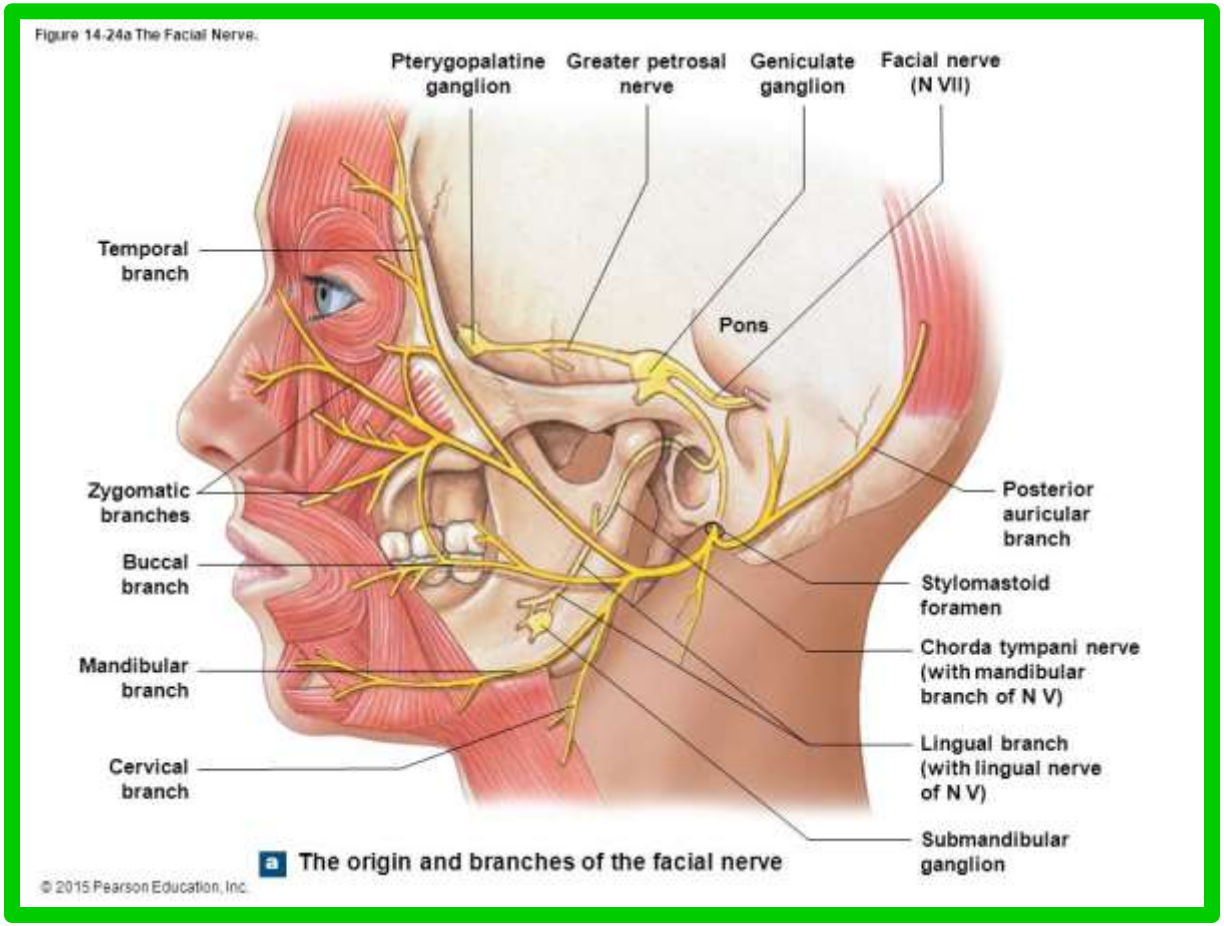
- Temporal,
- Zygomatic,
- Buccal,
- Marginal mandibular,
- Cervical.



FACIAL NERVE (CN VII)

❑Somatic Motor

The facial nerve supplies the muscles of facial expression and auricular muscles. It also supplies the posterior bellies of the digastric, stylohyoid, and stapedius muscles.



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FACIAL NERVE (CN VII)

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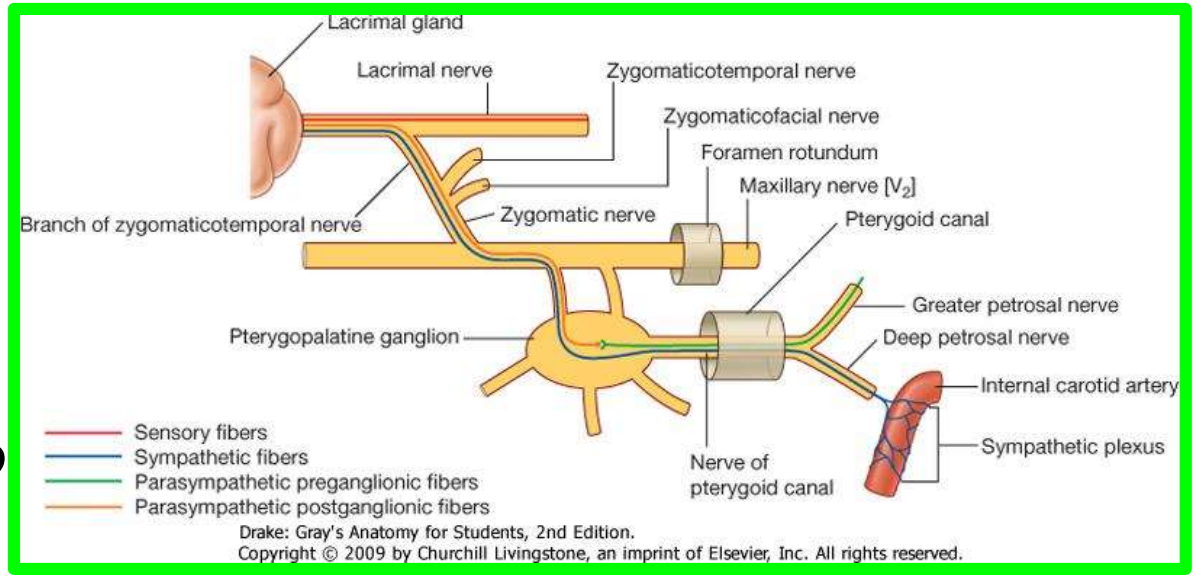
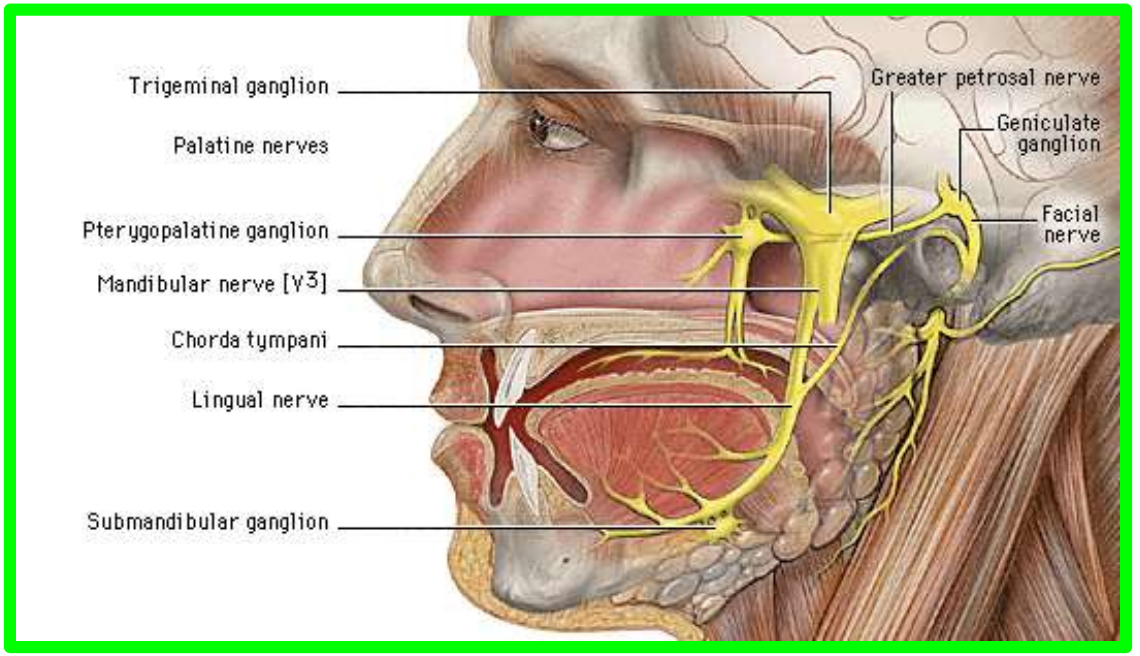
❑Visceral (Parasympathetic) Motor

CN VII provides presynaptic parasympathetic fibers to the **pterygopalatine ganglion** for innervation of **the lacrimal glands** and to **the submandibular ganglion** for innervation of **the sublingual and submandibular salivary glands.**





FACIAL NERVE (CN VII)

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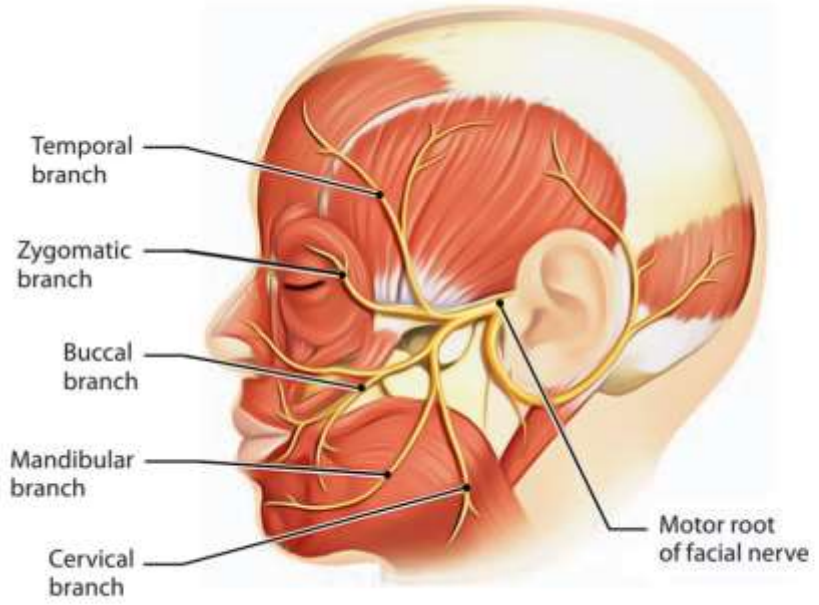
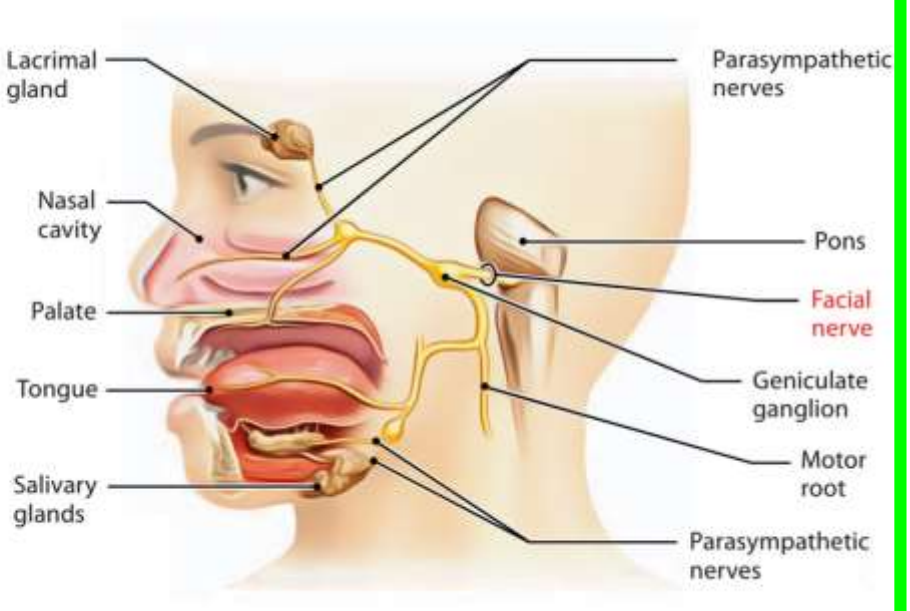
- *The pterygopalatine ganglion is associated with the maxillary nerve (CN V_2), which distributes its postsynaptic fibers, whereas the submandibular ganglion is associated with the mandibular nerve (CN V_3).*
- *Parasympathetic fibers synapse in these ganglia, whereas sympathetic and other fibers pass through them.*





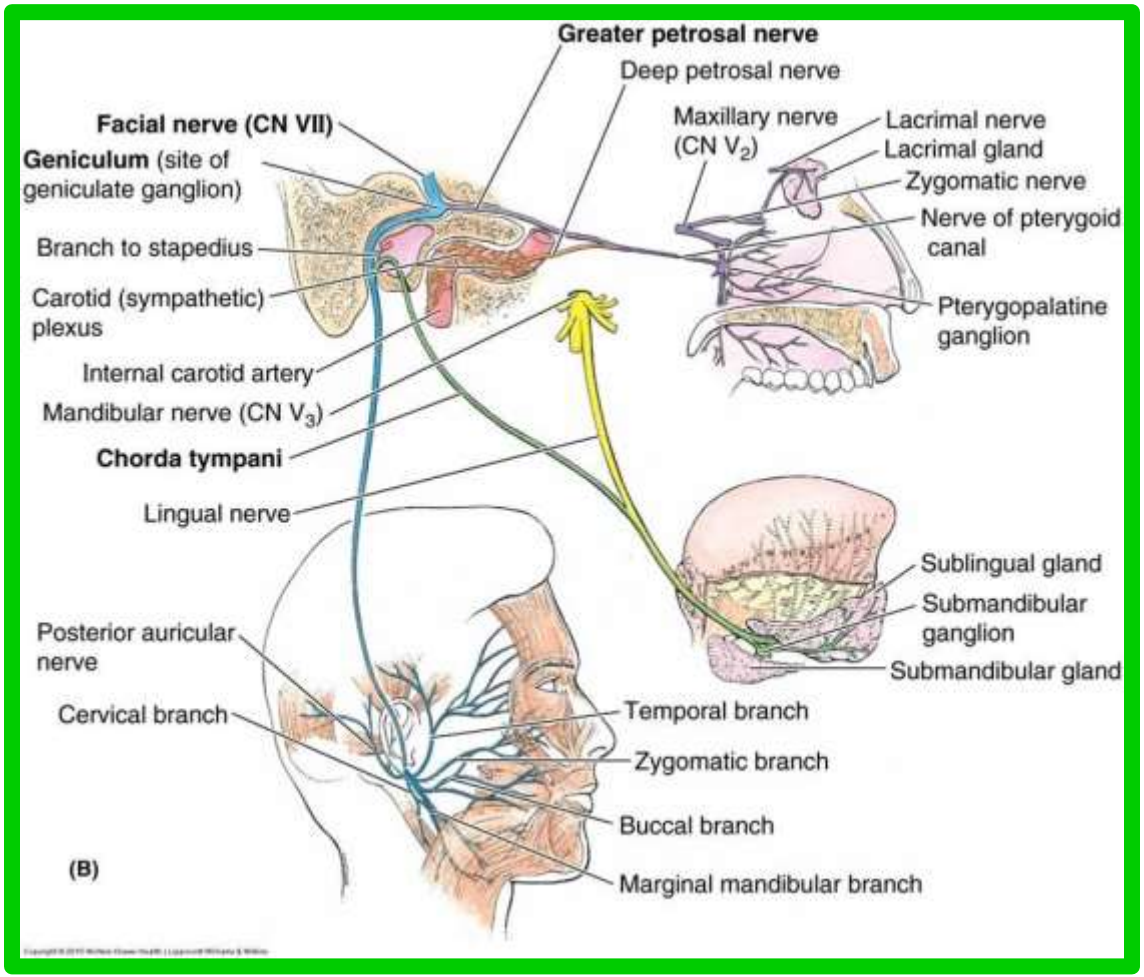
FACIAL NERVE (CN VII)

❑General Sensory (Somatic)

Some fibers from the geniculate ganglion supply a small area of the skin of the concha of the auricle, close to external acoustic meatus.

❑Special Sensory (Taste)

Fibers carried by the chorda tympani join the lingual nerve to convey taste sensation from the anterior two thirds of the tongue and soft palate.

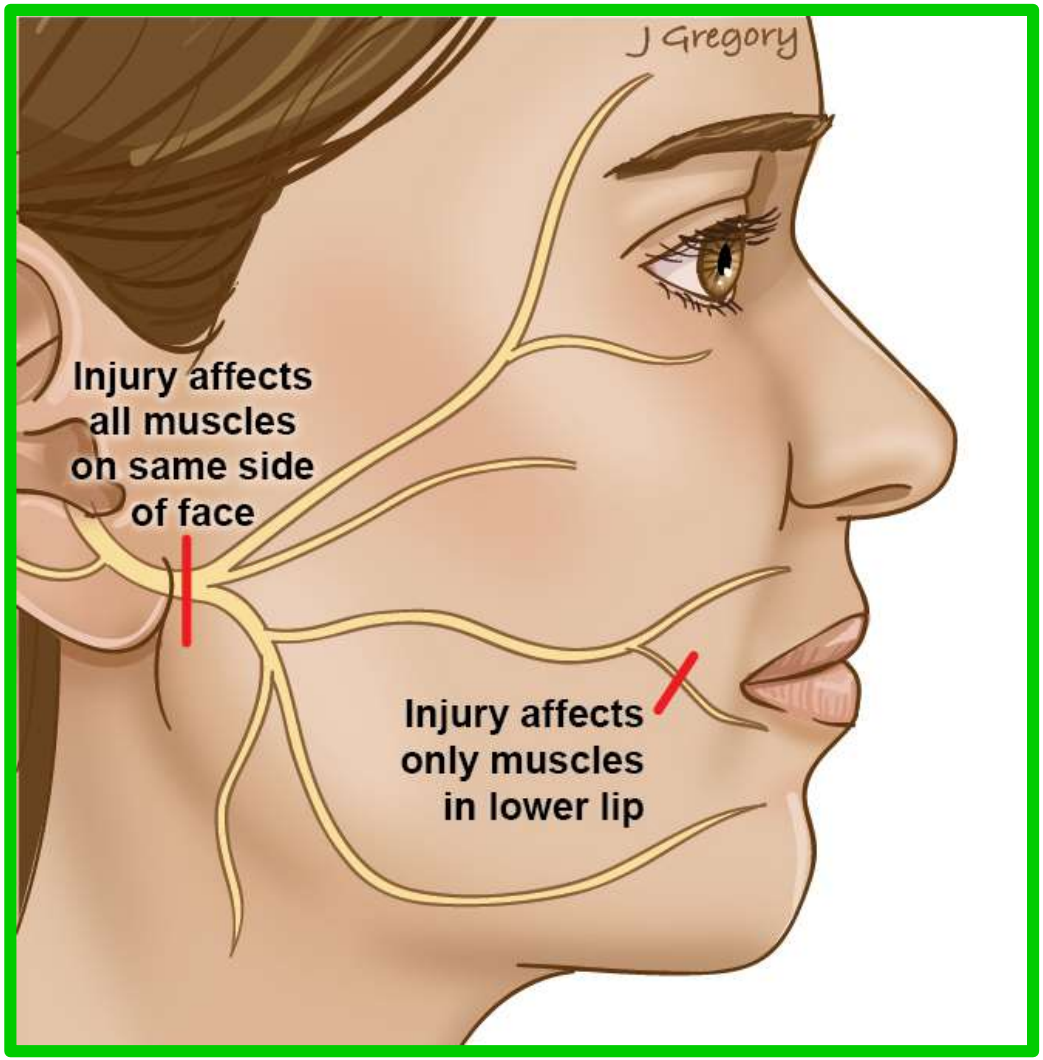


Facial Injury

Because the branches of CN VII are superficial, they are subject to injury from knife and gunshot wounds, cuts, and birth injury.

Damage to CN VII is common with fracture of the temporal bone and is usually detectable immediately after the injury.

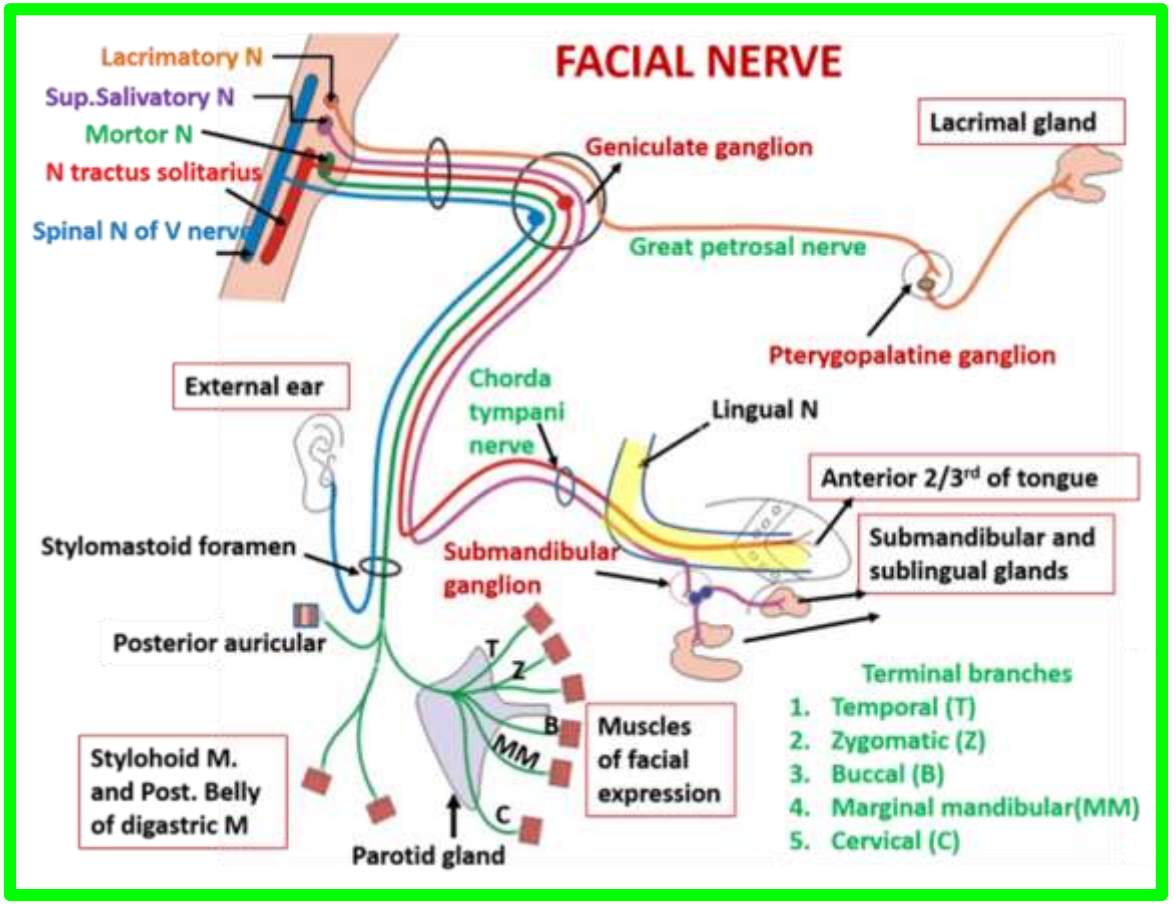
CN VII may also be affected by tumors of the brain and cranium, aneurysms, meningeal infections, and herpes viruses.



A lesion of CN VII near its origin or near the geniculate ganglion is accompanied by loss of motor, gustatory (taste), and autonomic functions.

The motor paralysis of facial muscles involves superior and inferior parts of the face on the ipsilateral side

- ***ipsilateral facial plegia,***
- ***decreased secretion of saliva and tears,***
- ***hyperacusis and***
- ***ageusia to anterior two-thirds of the ipsilateral part of the tongue***



The part of the facial nucleus that controls the muscles of the upper part of the face receives corticonuclear fibers from both cerebral hemispheres. Therefore, it follows that with a lesion involving the upper motor neurons, only the muscles of the lower part of the face will be paralyzed

in patients with a lesion of the facial nerve motor nucleus or the facial nerve itself–– that is, a lower motor neuron lesion––all the muscles on the affected side of the face will be paralyzed

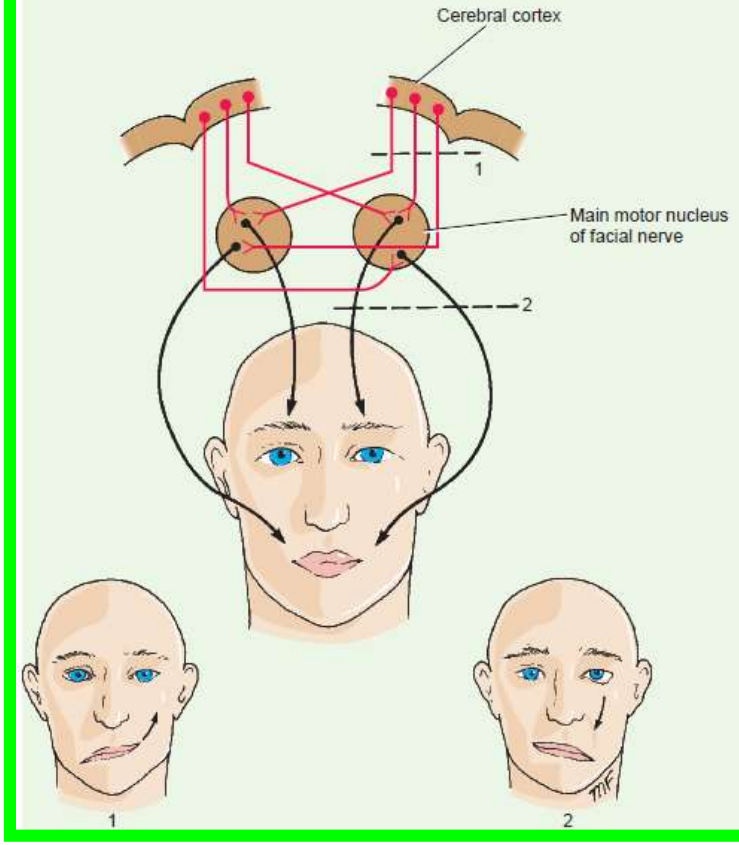
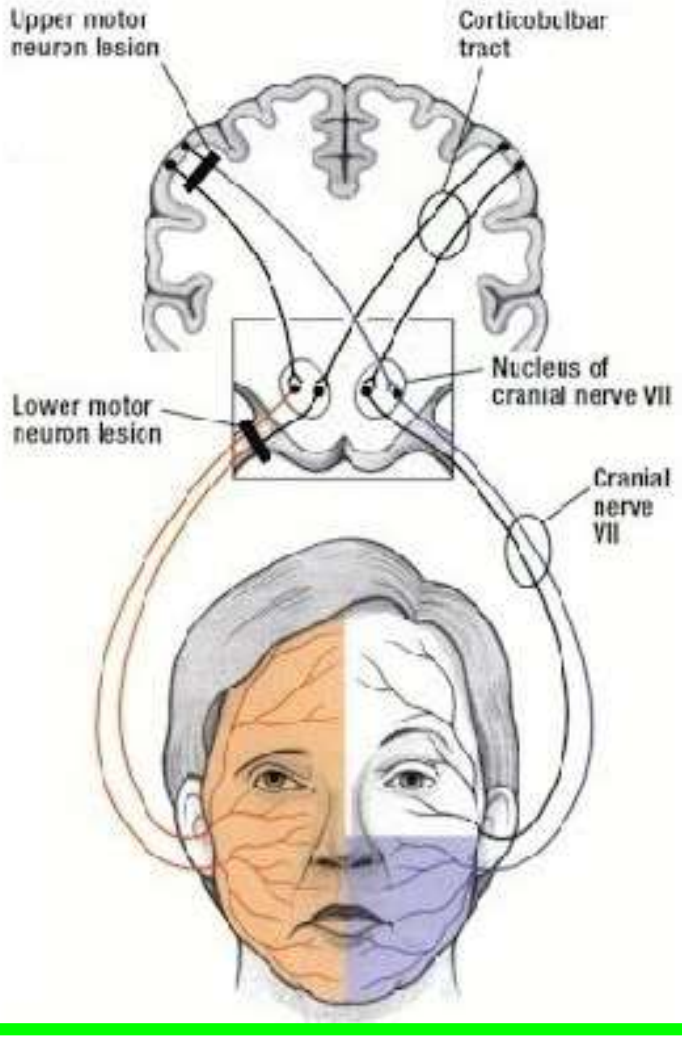


Figure 11-25 Facial expression defects associated with lesions of the upper motor neurons **(1)** and lower motor neurons **(2)**.

- Upper motor lesions spare the upper facial muscles and affect the contralateral lower face

- Lower motor lesions affect all the ipsilateral facial muscles



Bell's palsy

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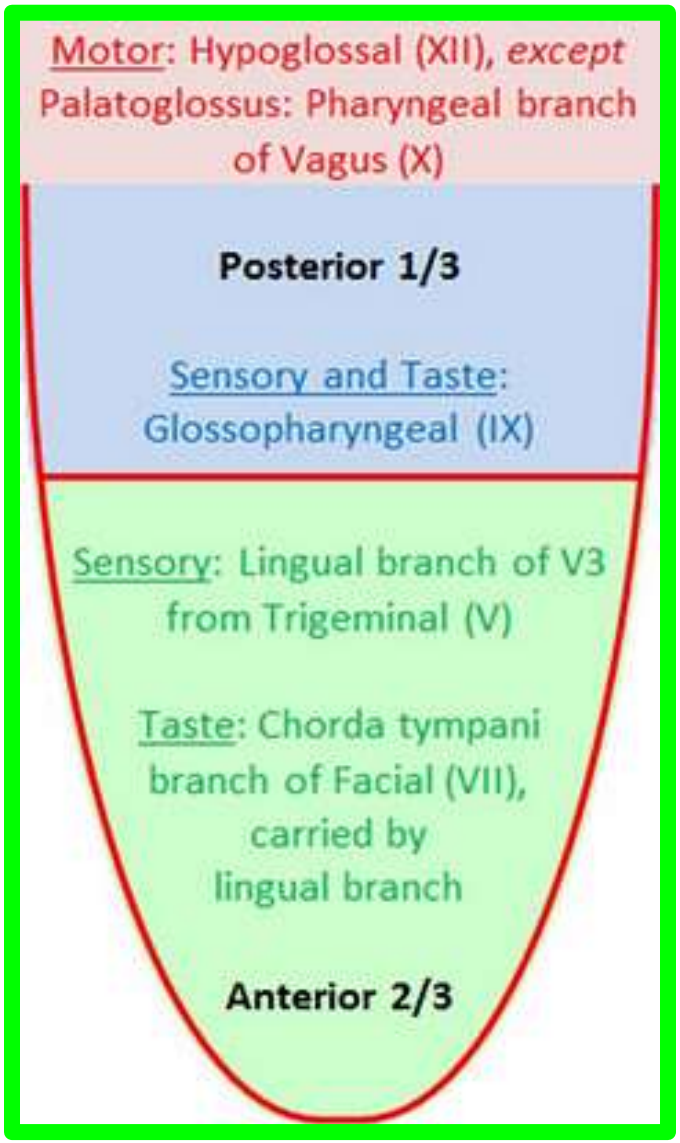
Bell's palsy is a temporary facial paralysis that affects movements like smiling and blinking, resulting in a droopy effect. It is caused by nerve damage that interrupts the relay of messages from the brain to the face – usually on just one side of the face.

- ✓Sudden weakness or paralysis on one side of the face
- ✓Difficulty smiling or closing the eyelid on the affected side
- ✓Jaw or ear pain on the affected side
- ✓Drooling
- ✓Dryness in the eye and mouth
- ✓Ringing in the ear or sensitivity to sound (hyperacusis)
- ✓Impaired speech or taste
- ✓Difficulty eating and drinking
- ✓Reduced tear production.

Sense of the taste

For general sensation (touch and temperature), the mucosa of the anterior two thirds of the tongue is supplied by the lingual nerve, a branch of CN V_3

For special sensation (taste), this part of the tongue, except for the vallate papillae, is supplied through the chorda tympani nerve, a branch of CN VII



Sense of the taste

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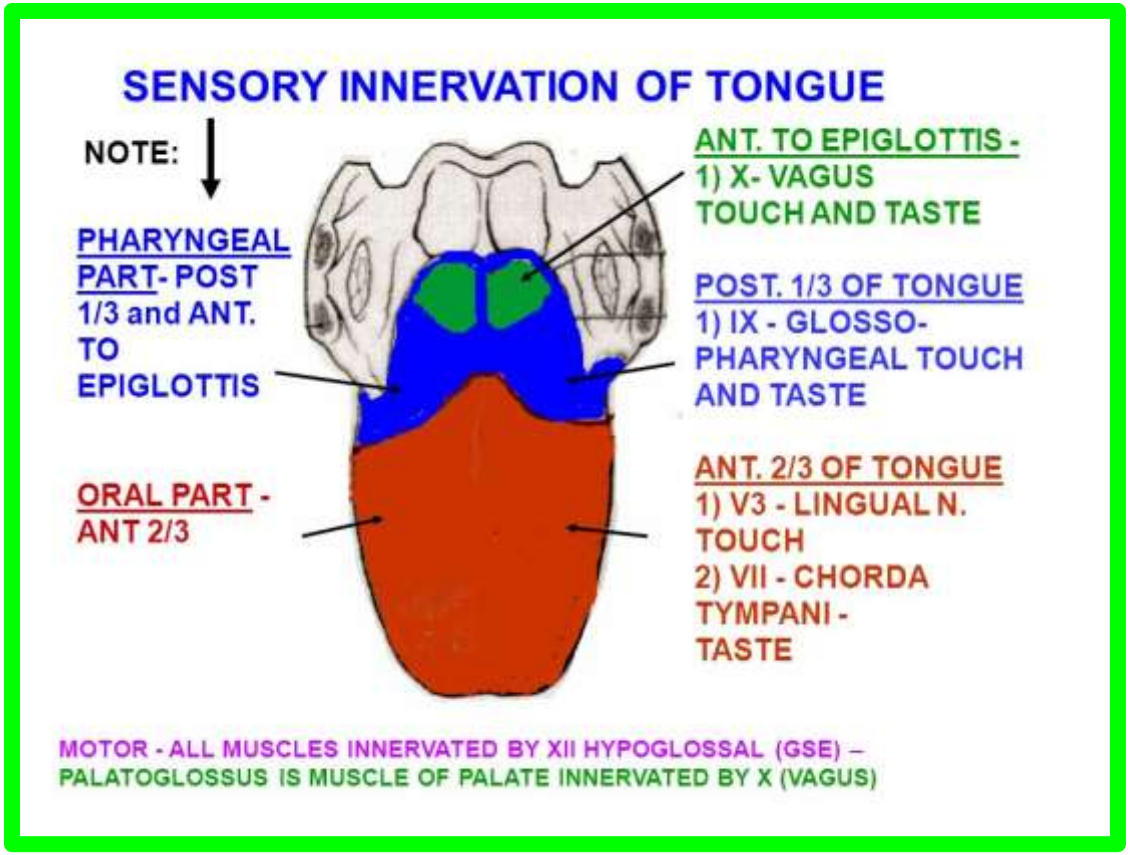
The chorda tympani joins the lingual nerve and runs anteriorly in its sheath.

The mucous membrane of the posterior third of the tongue and the vallate papillae are supplied by the lingual branch of the glossopharyngeal nerve (CN IX) for both general and special sensation.



Sense of the taste

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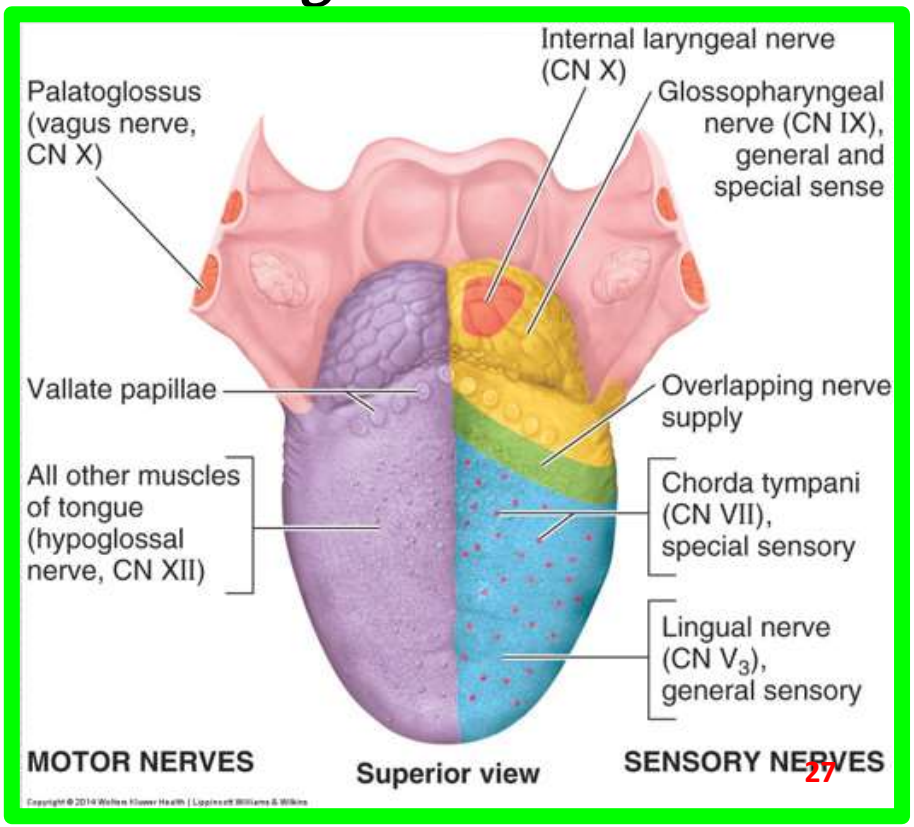
❖Twigs of the internal laryngeal nerve, a branch of the vagus nerve (CN X), supply mostly general but some special sensation to a small area of the tongue just anterior to the epiglottis.

❖These mostly sensory nerves also carry parasympathetic secretomotor fibers to serous glands in the tongue.

❖Parasympathetic fibers from the chorda tympani nerve travel with the lingual nerve to the submandibular and sublingual salivary glands. These nerve fibers synapse in the submandibular ganglion, which hangs from the lingual nerve

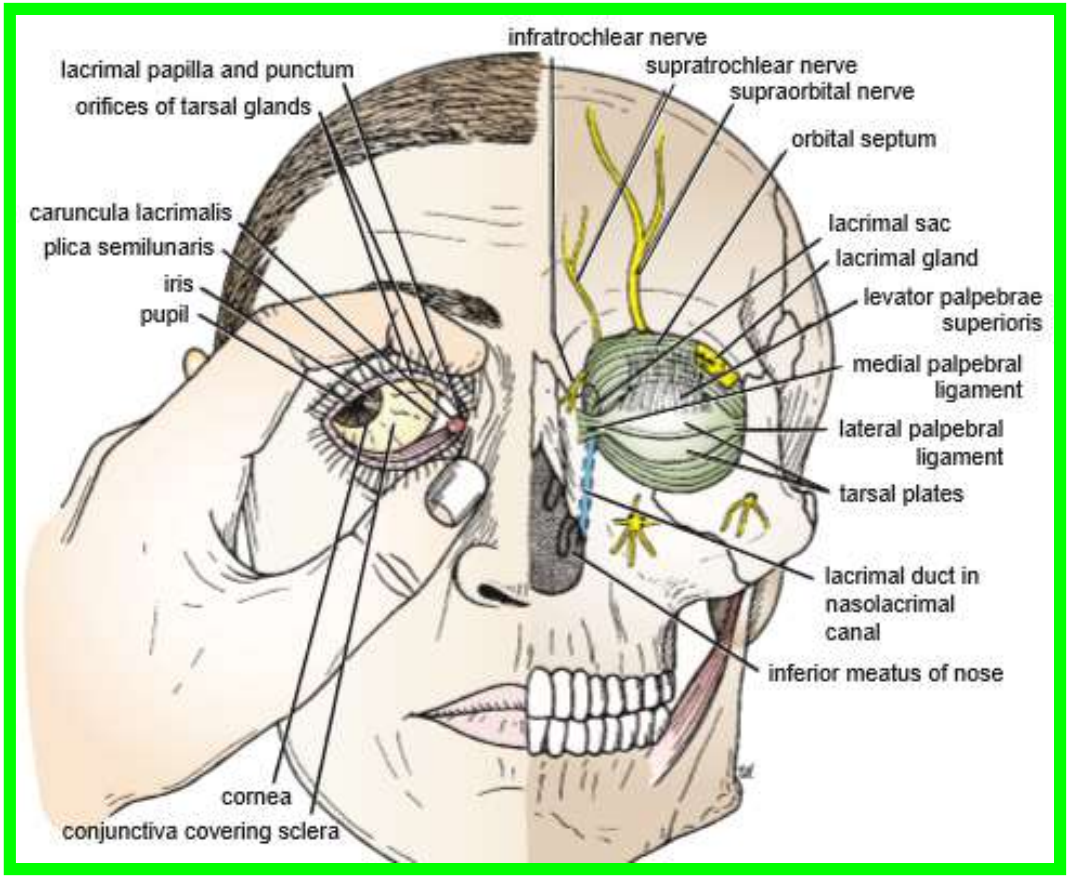


The Orbital Region

✓***The orbital region*** *is the area of the face overlying* ***the orbit*** *and* ***eyeball*** *and includes* ***the upper and lower eyelids*** *and* ***lacrimal apparatus***

✓***The orbits*** *are a pair* ***of bony cavities*** *that contain the* ***eyeballs****; their* ***associated muscles****,* ***nerves, vessels****, and* ***fat****; and most of* ***the lacrimal apparatus****.*

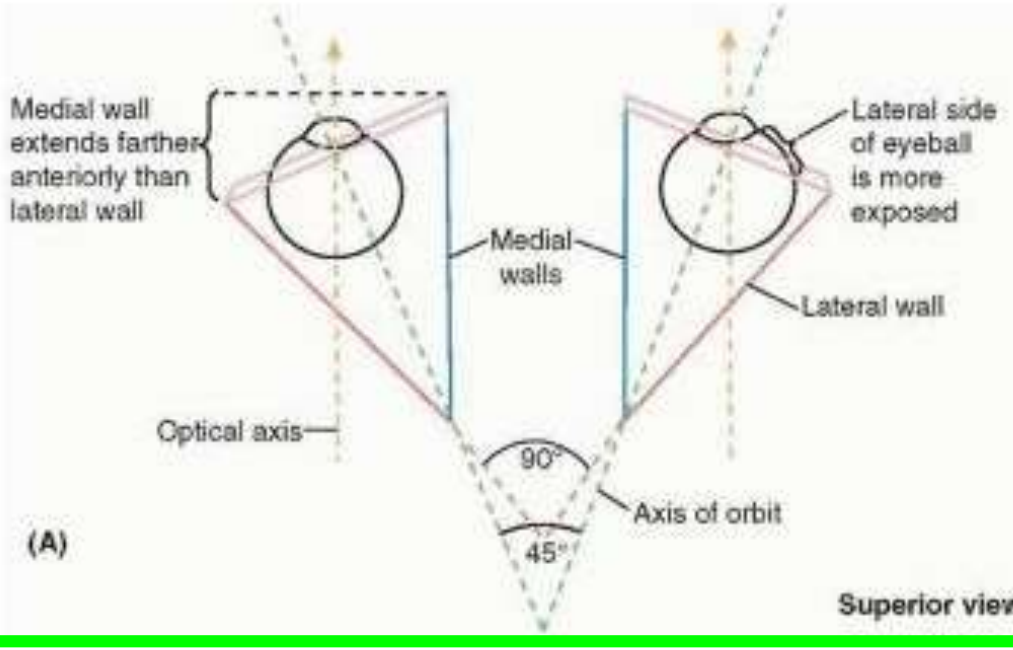
✓***The orbital opening*** *is guarded by two thin, movable folds,* ***the eyelids***

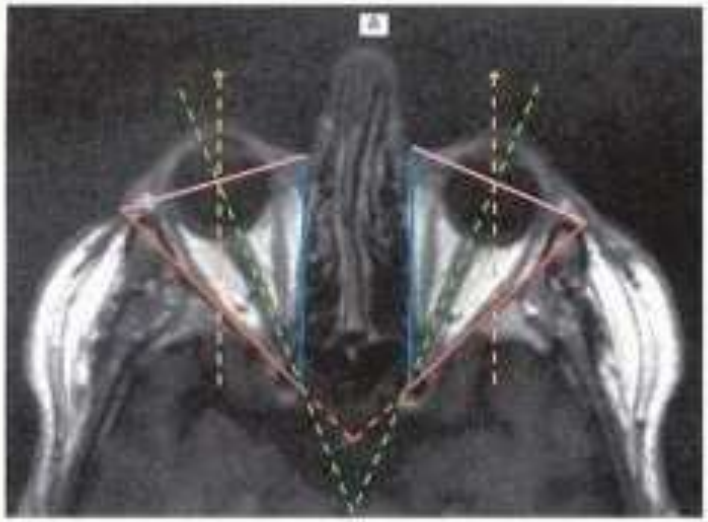


Orbits

❖*The orbits are **bilateral bony cavities** in the facial skeleton that resemble hollow quadrangular pyramids with **their bases** directed **anterolaterally** **and their apices, posteromedially***

❖*The **medial walls** of the two orbits, separated by **the ethmoidal sinuses** and the **upper parts of the nasal cavity**, are nearly parallel, **whereas their lateral walls are approximately at a right (90°) angle.***





Superior views

Orbits

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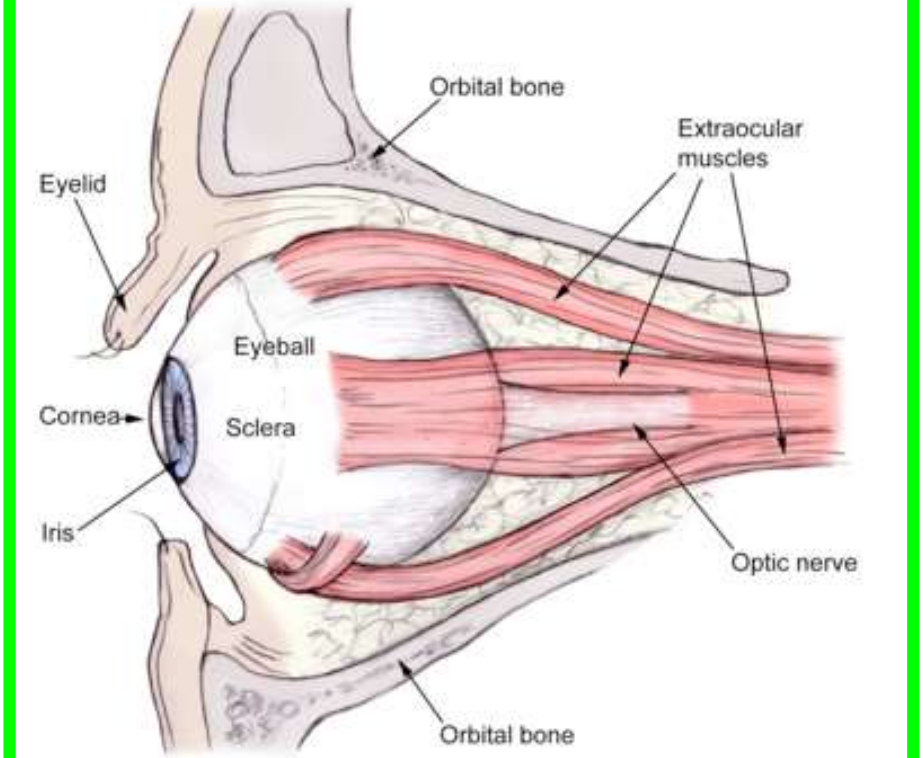
✓Consequently, ***(orbital axes)*** ***diverge*** *at approximately* ***45°.***

✓ *The* ***optical axes*** *(the direction or line of sight) for the two eyeballs, are* ***parallel, ("looking straight ahead"),***

✓***The orbits*** *anterior to them contain and protect the eyeballs which include the:*

- ***Eyelids,*** *..controlling exposure of the anterior eyeball.*
- ***Extraocular muscles,*** *which position the eyeballs and raise the superior eyelids.*
- ***Nerves and vessels***
- ***Orbital fascia.***
- ***Mucous membrane (conjunctiva)*** *lining the eyelids*



All space within the orbits not occupied by these structures is filled with orbital fat

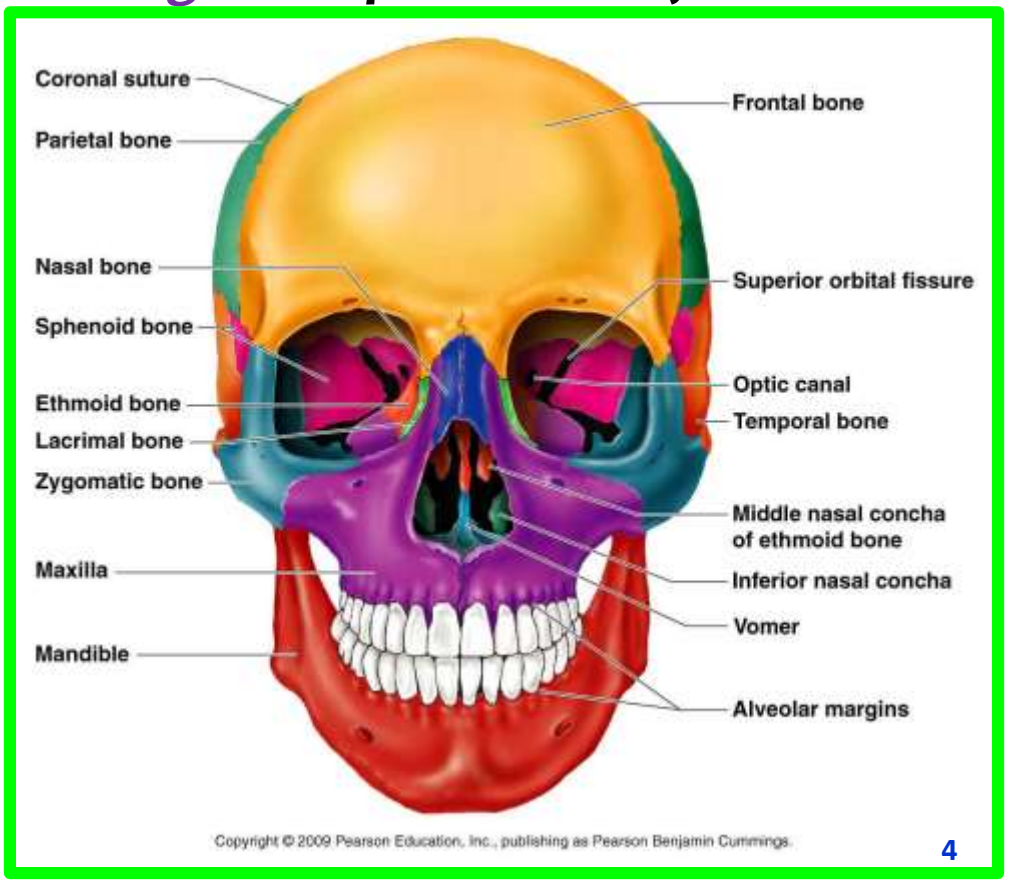
Orbits

The quadrangular pyramidal orbit has a base, four walls, and an apex

❖The base

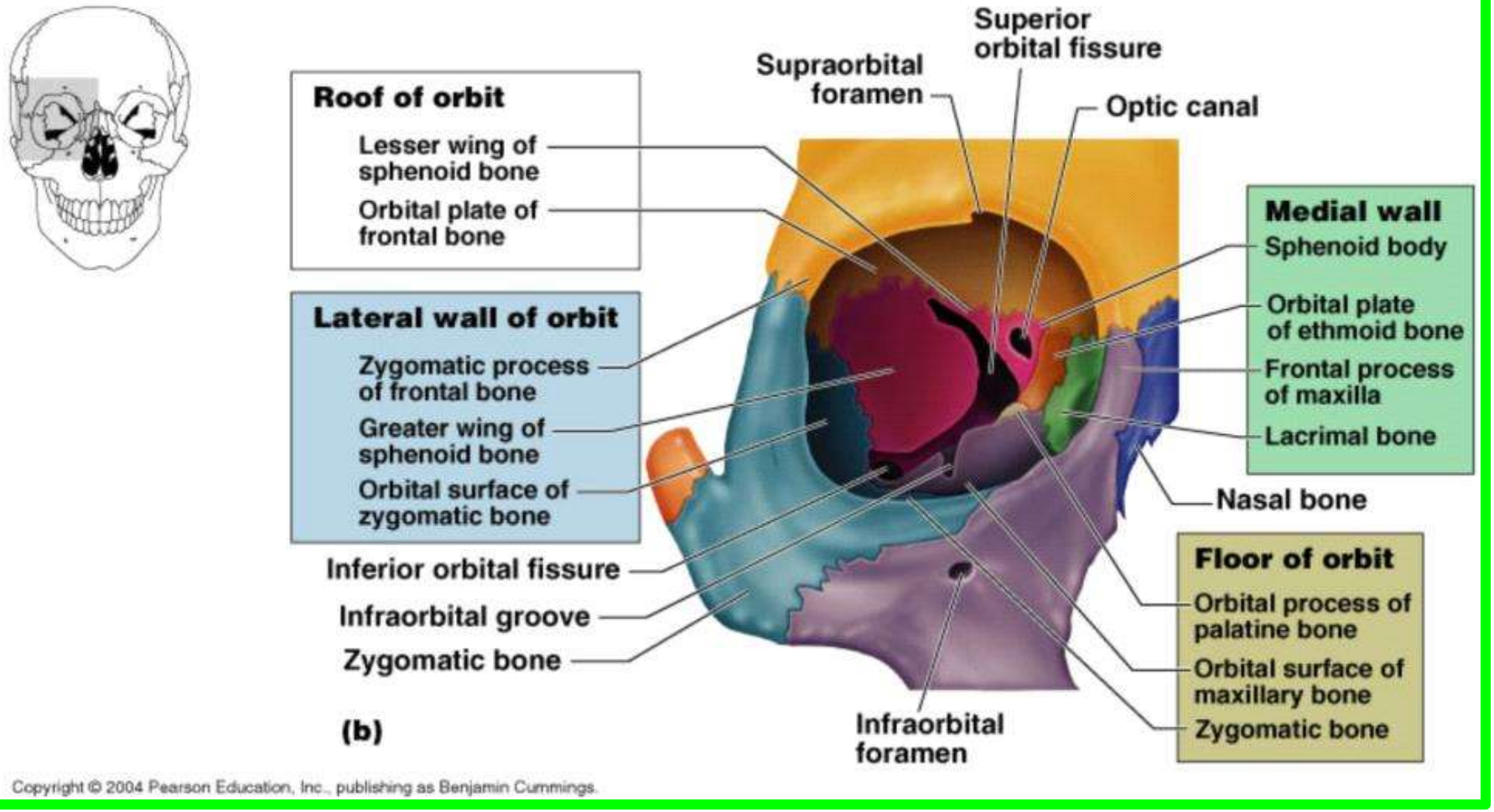
above by the frontal bone, the lateral margin the processes of the frontal and zygomatic bones, the inferior margin is the zygomatic bone and the maxilla, the medial margin the processes of the maxilla and the frontal bone.

❖The apex is at the optic canal in the lesser wing of the sphenoid just medial to the superior orbital fissure.



Orbits

- The superior wall (roof)
- The medial walls
- The inferior wall (orbital floor)
- The lateral wall



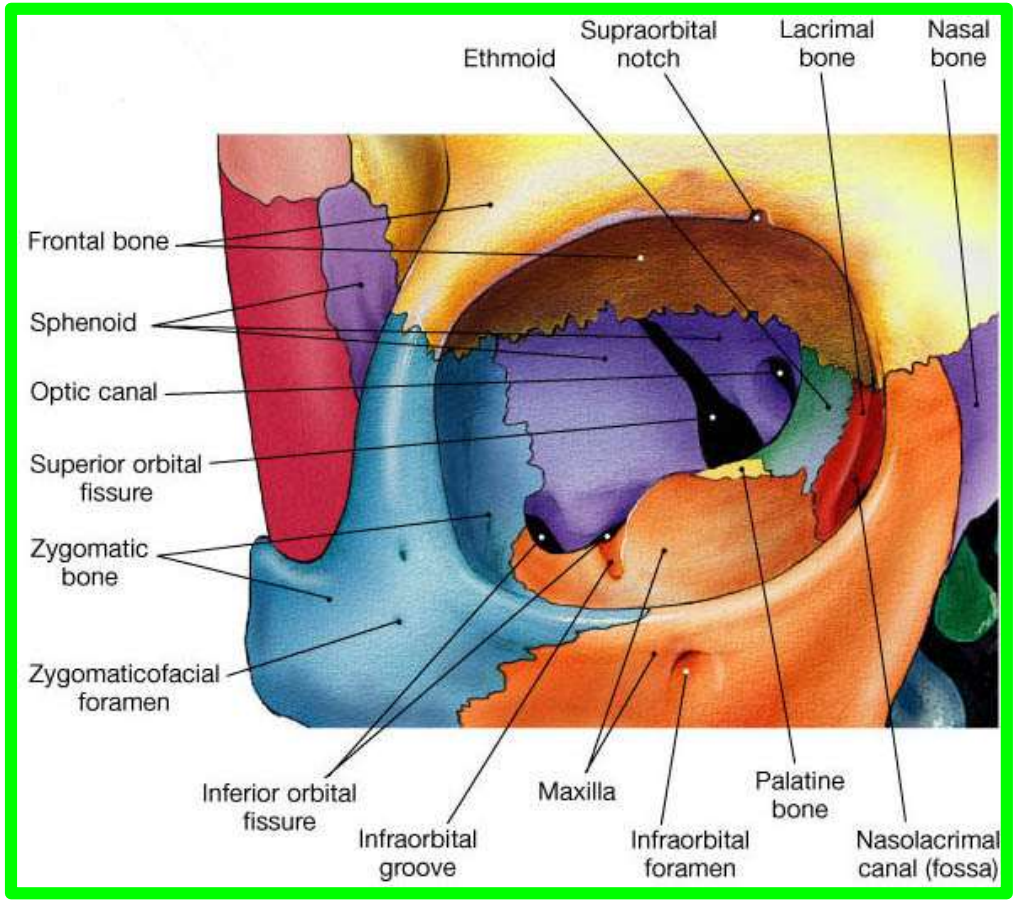
Openings into the Orbital Cavity

❑***Orbital opening:*** *About* ***one sixth of the eye*** *is exposed; the remainder is protected by the walls of the orbit.*

❑***Supraorbital notch (Foramen):*** *It transmits the* ***supraorbital nerve*** *and* ***blood vessels***

❑***Infraorbital groove and canal:*** *in the orbital plate of the maxilla, they transmit the* ***infraorbital nerve*** *and* ***blood vessels.***

❑***Nasolacrimal canal:*** *Located anteriorly on the medial wall; it communicates with the* ***inferior meatus*** *of the nose* ***It transmits the nasolacrimal duct.***



Openings into the Orbital Cavity

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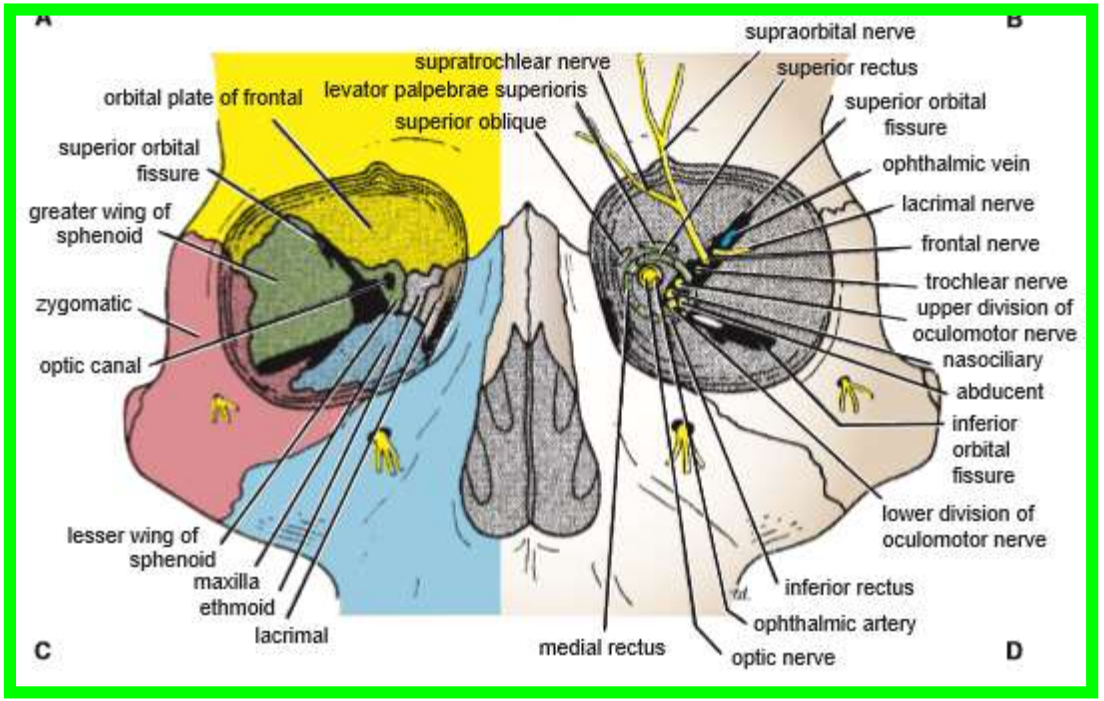
❑***Inferior orbital fissure:*** *it* ***communicates with the pterygopalatine fossa.*** *It transmits* ***the maxillary nerve*** *and its zygomatic branch,* ***the inferior ophthalmic vein,*** *and* ***sympathetic nerves.***

❑***Superior orbital fissure:*** *it* ***communicates with the middle cranial fossa.*** *It transmits* ***the lacrimal nerve, the frontal nerve, the trochlear nerve, the oculomotor nerve the abducent nerve, the nasociliary nerve, and the superior ophthalmic vein.***



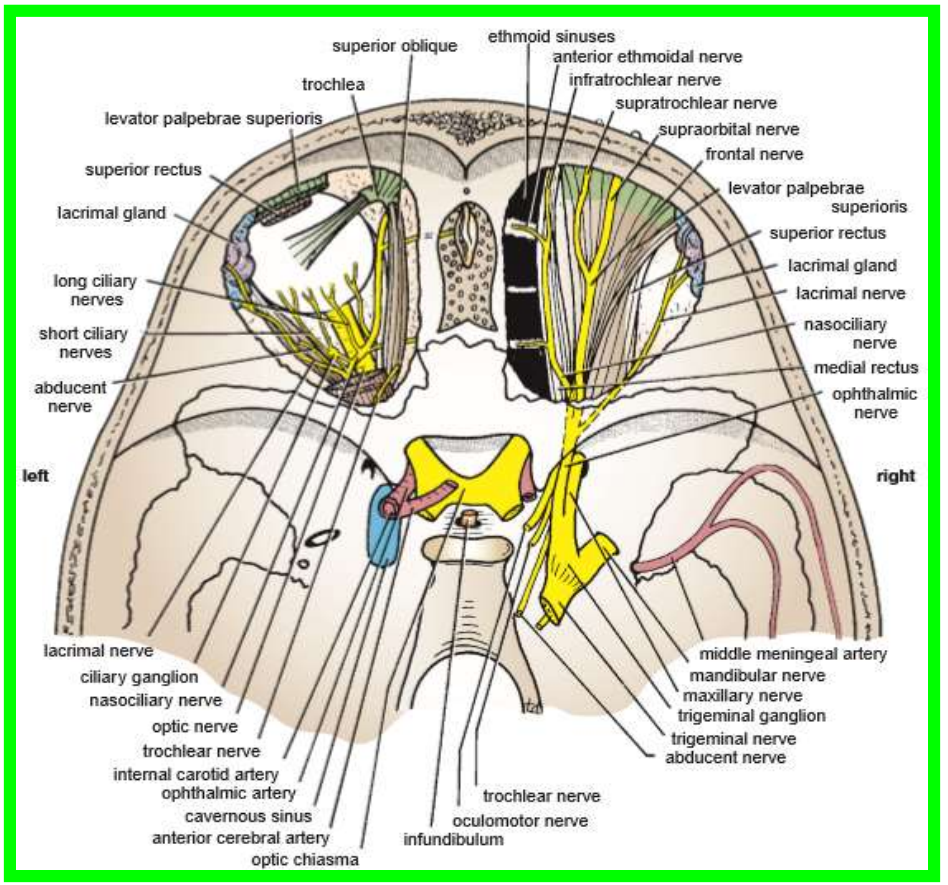
❑***Optic canal:*** ***it communicates with the middle cranial fossa. It transmits the optic nerve and the ophthalmic artery.***

Nerves of the Orbit

❖**Optic Nerve :** enters the orbit from the middle cranial fossa by passing through the optic canal . It is accompanied by the ophthalmic artery

❖**Lacrimal Nerve:** arises from the ophthalmic division of CN V. It enters the orbit through the upper part of the superior orbital fissure

❖**Frontal Nerve :** from the ophthalmic division of CN V . It enters the orbit through the upper part of the superior orbital fissure. It divides into the supratrochlear and supraorbital nerves



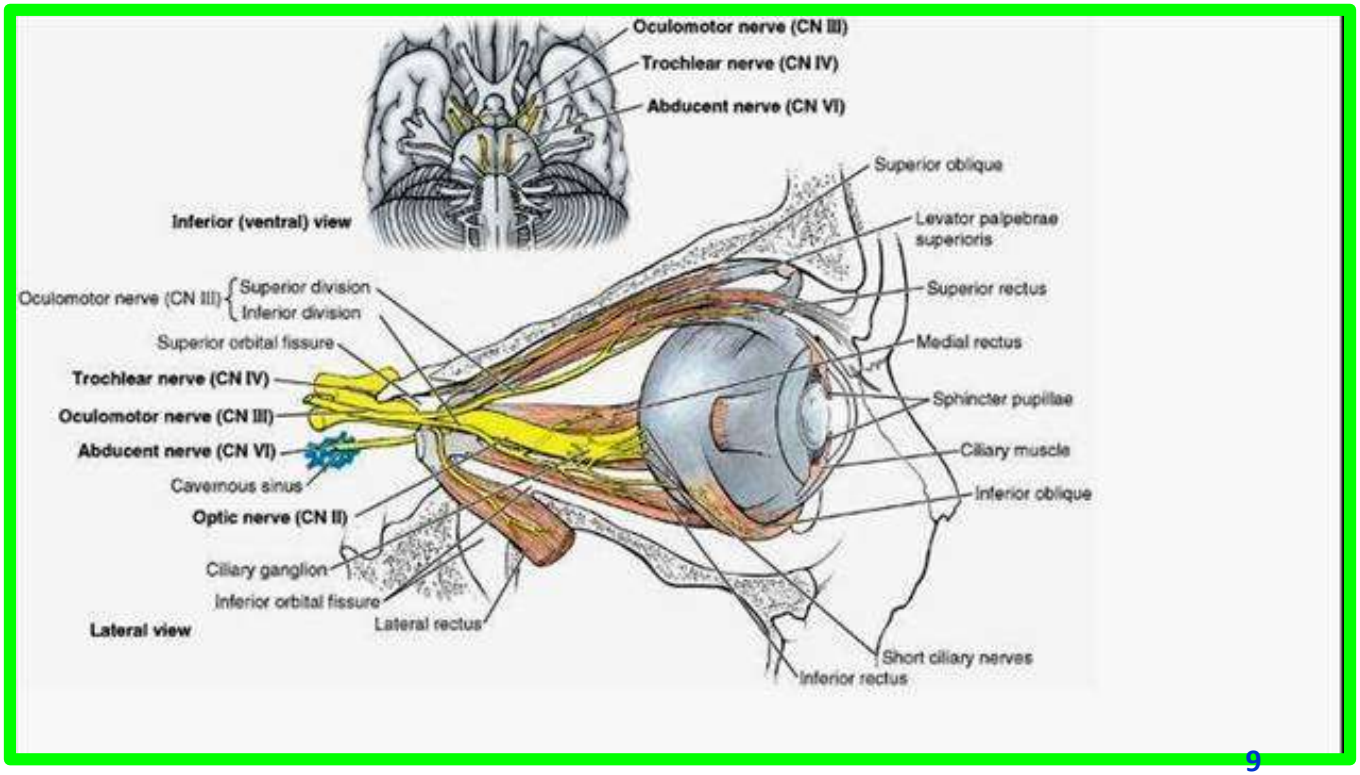
Nerves of the Orbit

❖*Trochlear Nerve* ***enters the orbit through the upper part of the superior orbital fissure. It runs forward and supplies*** *the superior oblique muscle*

❖*Oculomotor Nerve* ***enters the orbit through the lower part of the superior orbital fissure***

❖*Nasociliary Nerve* ***arises from the*** *ophthalmic division CN V.* ***It enters the orbit through the lower part of the superior orbital fissure***

❖*Abducent Nerve* ***enters the orbit through the lower part of the superior orbital fissure. It supplies*** *the lateral rectus muscle*



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Nerves of the Orbit

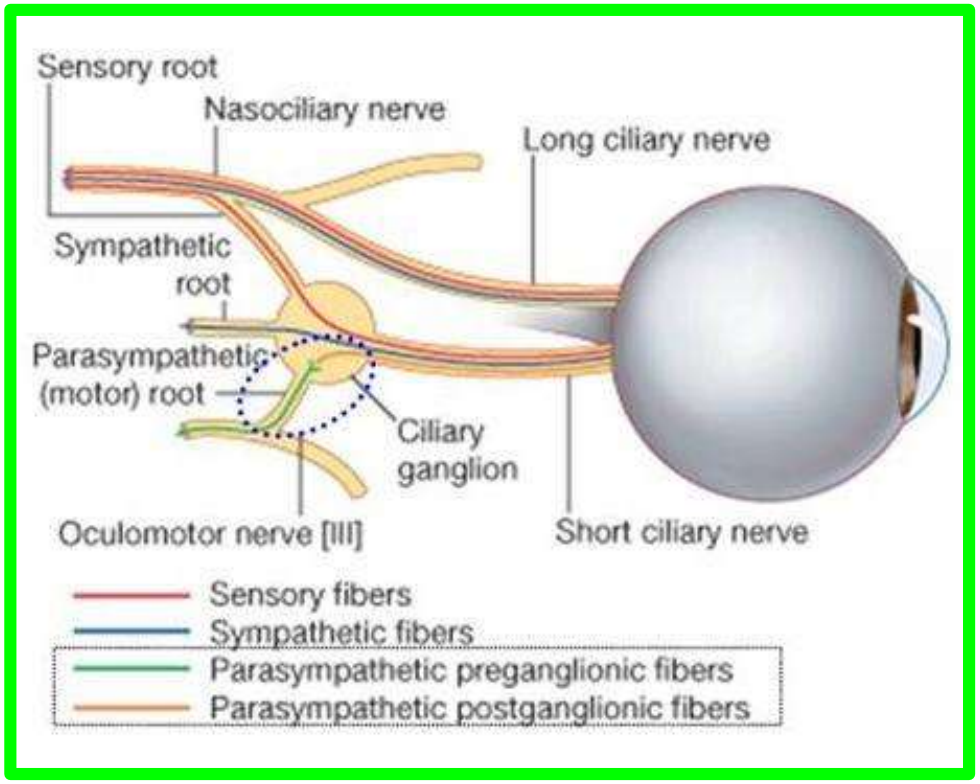
Ciliary Ganglion

✓*is a parasympathetic ganglion about the size of a pinhead*
✓ *situated in the posterior part of the orbit*

✓*It receives its preganglionic parasympathetic fibers from the oculomotor nerve via the nerve to the inferior oblique.*

✓ *The postganglionic fibers leave the ganglion in the short ciliary nerves, which enter the back of the eyeball and supply the sphincter pupillae and the ciliary muscle.*

✓ *A number of sympathetic fibers pass from the internal carotid plexus into the orbit and run through the ganglion without interruption*



Blood Vessels of the Orbit

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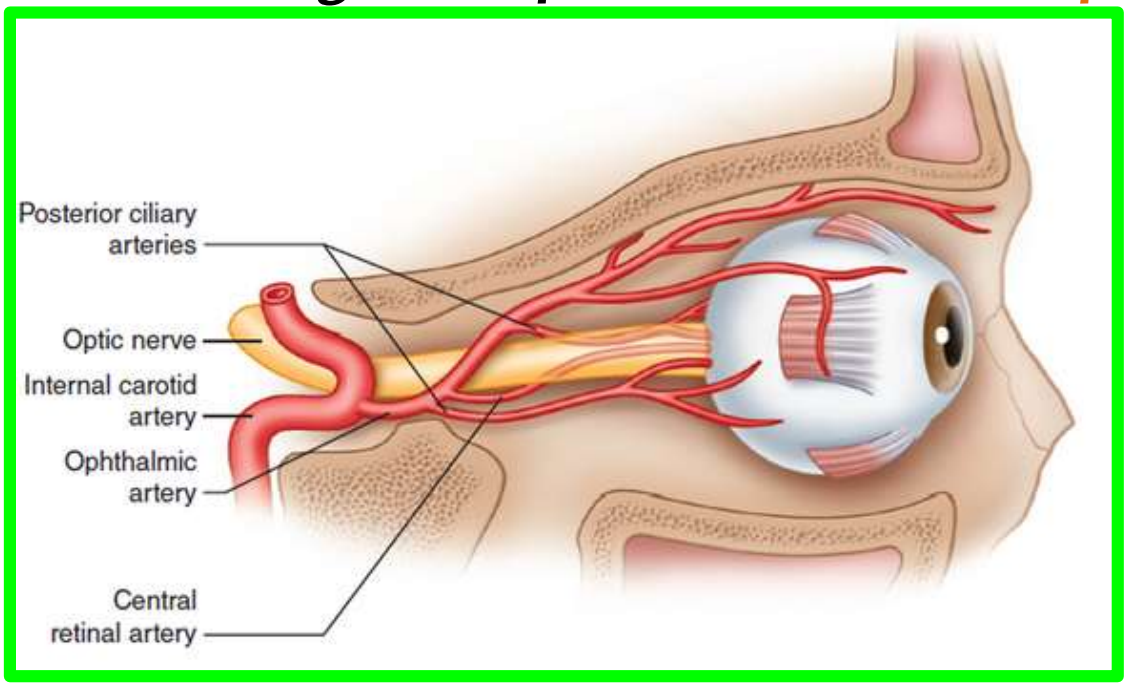
Ophthalmic Artery

- *is a branch of the internal carotid artery after that vessel emerges from the cavernous sinus.*
- *It enters the orbit through the optic canal with the optic nerve.*



- *It runs forward and crosses the optic nerve to reach the medial wall of the orbit.*
- *It gives off numerous branches, which accompany the nerves in the orbital cavity.*

Branches of the Ophthalmic Artery

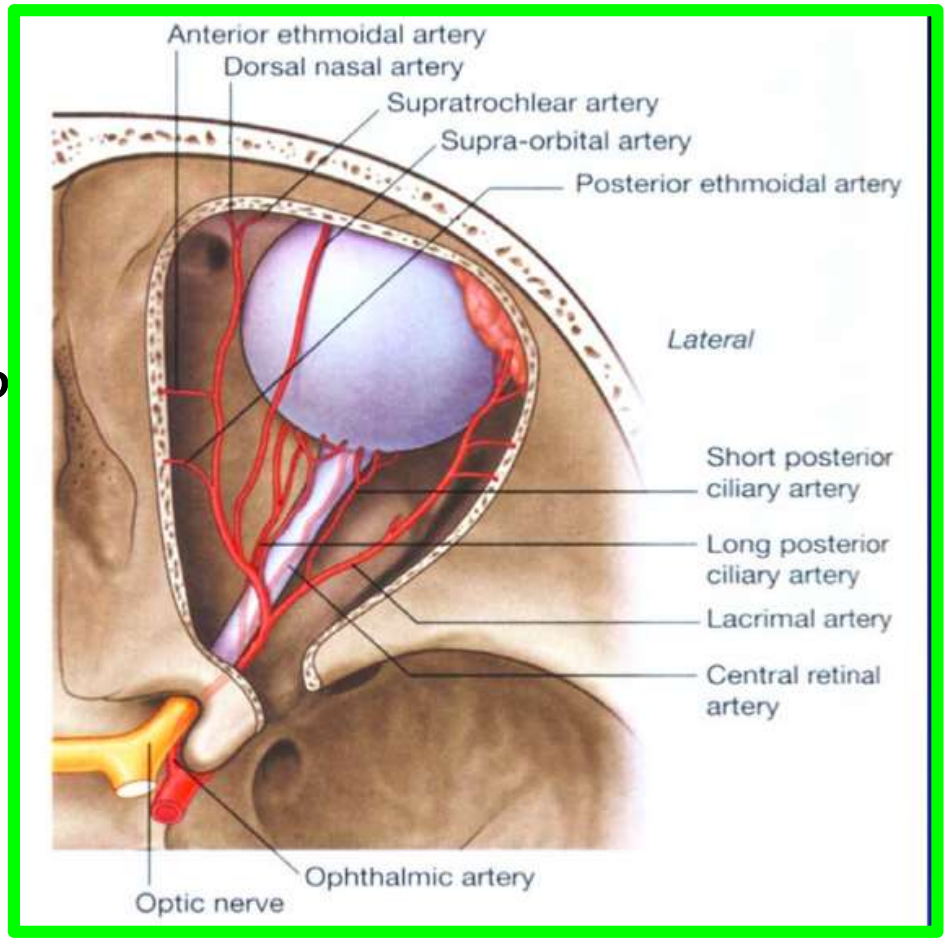
■■ *The central artery of the retina* is a small branch that pierces the meningeal sheaths of *the optic nerve* to gain entrance to the nerve and enters the eyeball at the center of *the optic disc.*

■■ *The muscular branches*

■■ *The ciliary arteries* can be divided into *anterior* and *posterior groups*. The former group enters the eyeball near the corneoscleral junction; the latter group enters near the optic nerve.

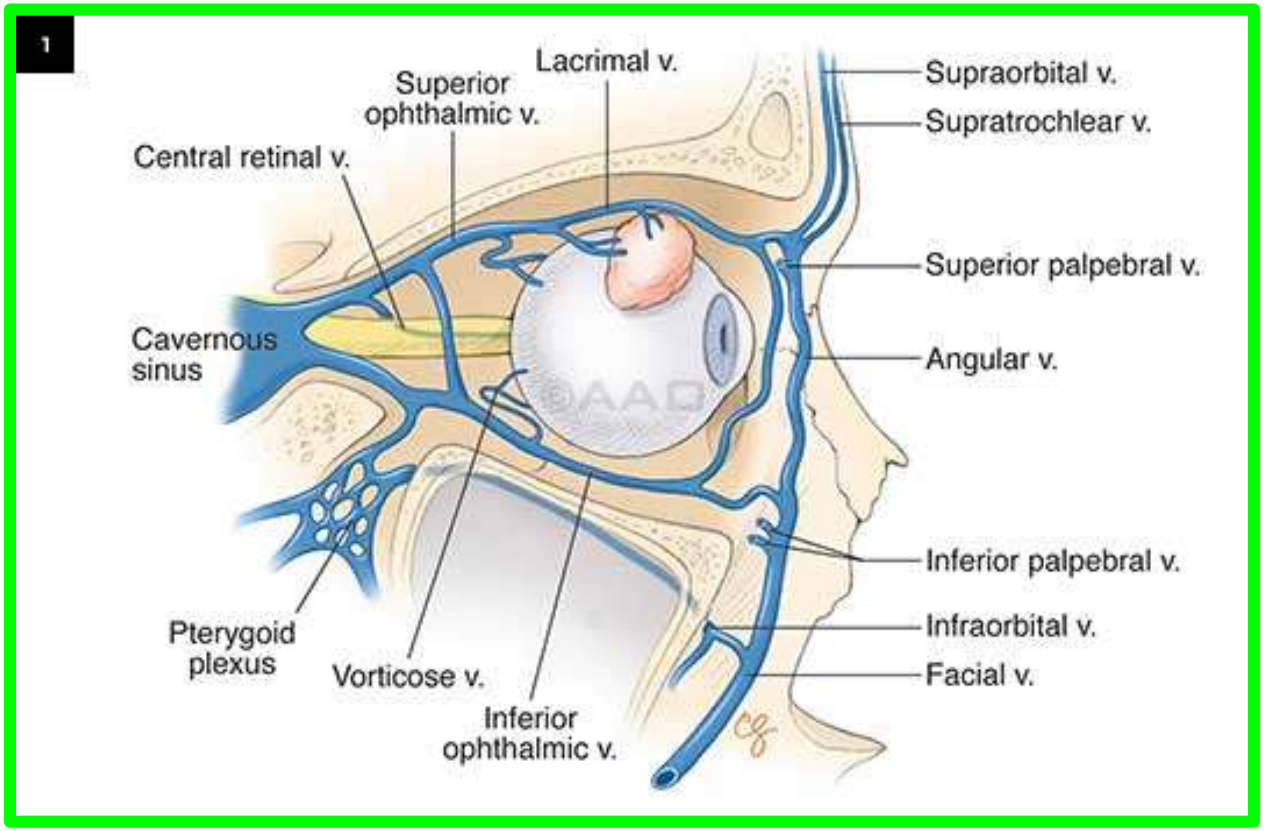
■■ *The lacrimal artery* to the *lacrimal gland*

■■ *The supratrochlear and supraorbital arteries* are distributed to the skin of the forehead



Ophthalmic Veins

- ***The superior ophthalmic vein*** ***communicates in front with*** ***the facial vein***
- ***The inferior ophthalmic vein*** ***communicates through the inferior orbital fissure with the*** ***pterygoid venous plexus*****.**
- ***Both veins pass backward through the superior orbital fissure and drain into*** ***the cavernous sinus***



Eyelids

✓*The superficial surface of the eyelids is covered by skin, and the deep surface is covered by a mucous membrane called the conjunctiva.*

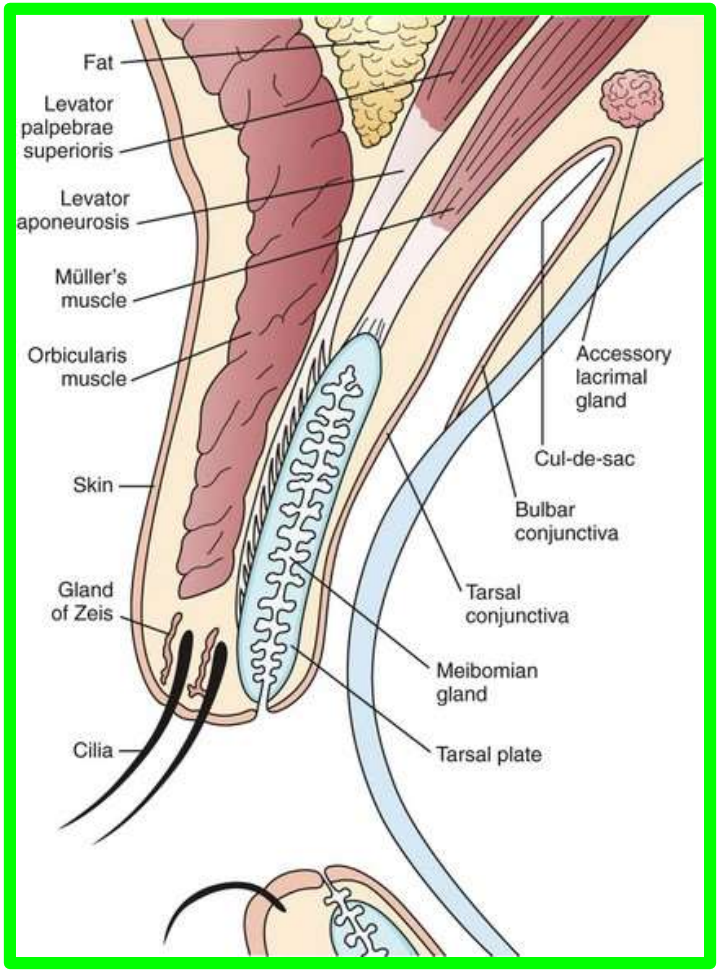
✓*The eyelashes are short, curved hairs on the free edges of the eyelids*

✓*They are arranged in double or triple rows at the mucocutaneous junction.*

✓*The sebaceous glands (glands of Zeis) open directly into the eyelash follicles.*

✓*The ciliary glands (glands of Moll) are modified sweat glands that open separately between adjacent lashes*

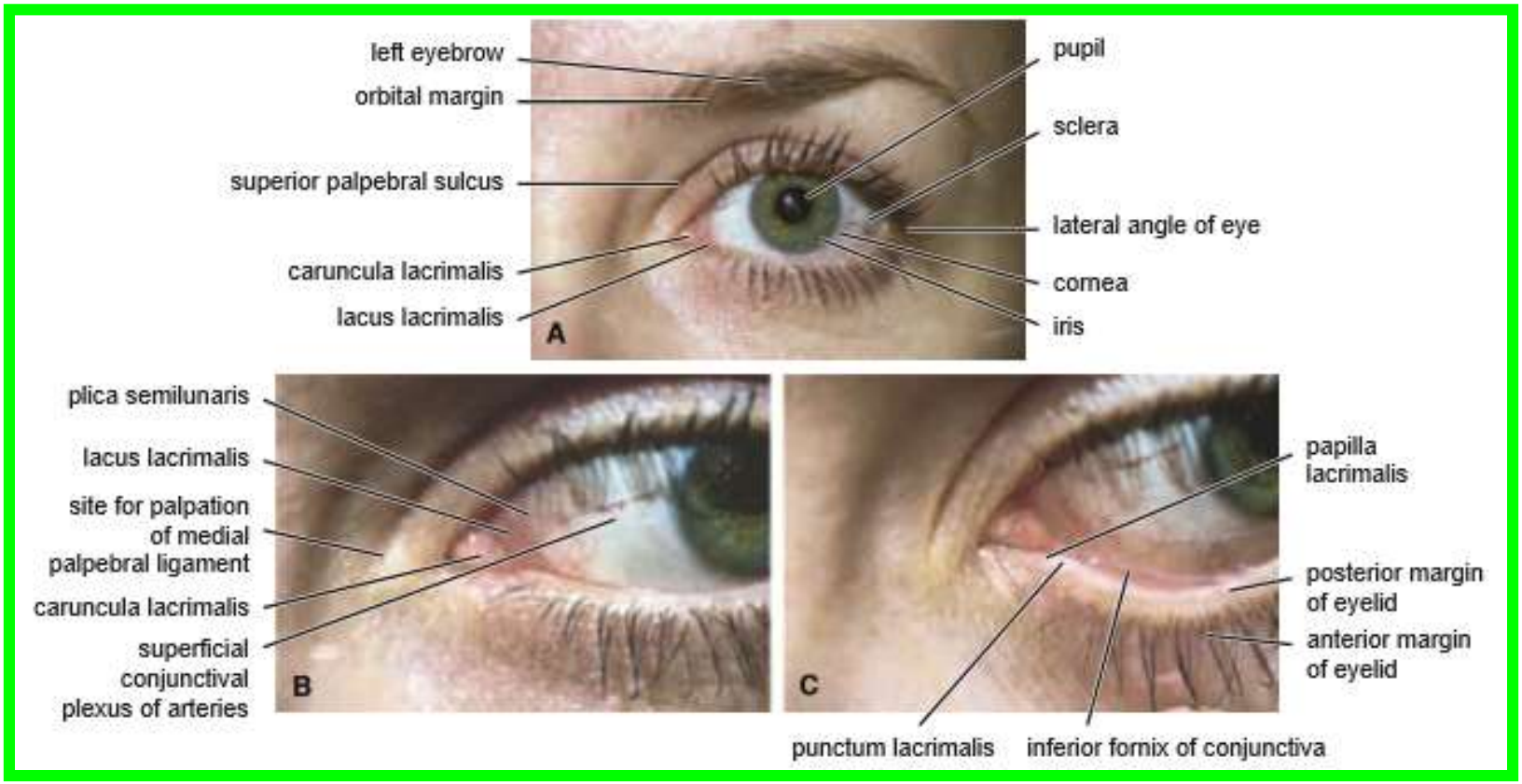
✓*The tarsal glands are long, modified sebaceous glands that pour their oily secretion onto the margin of the lid; their openings lie behind the eyelashes*



Eyelids

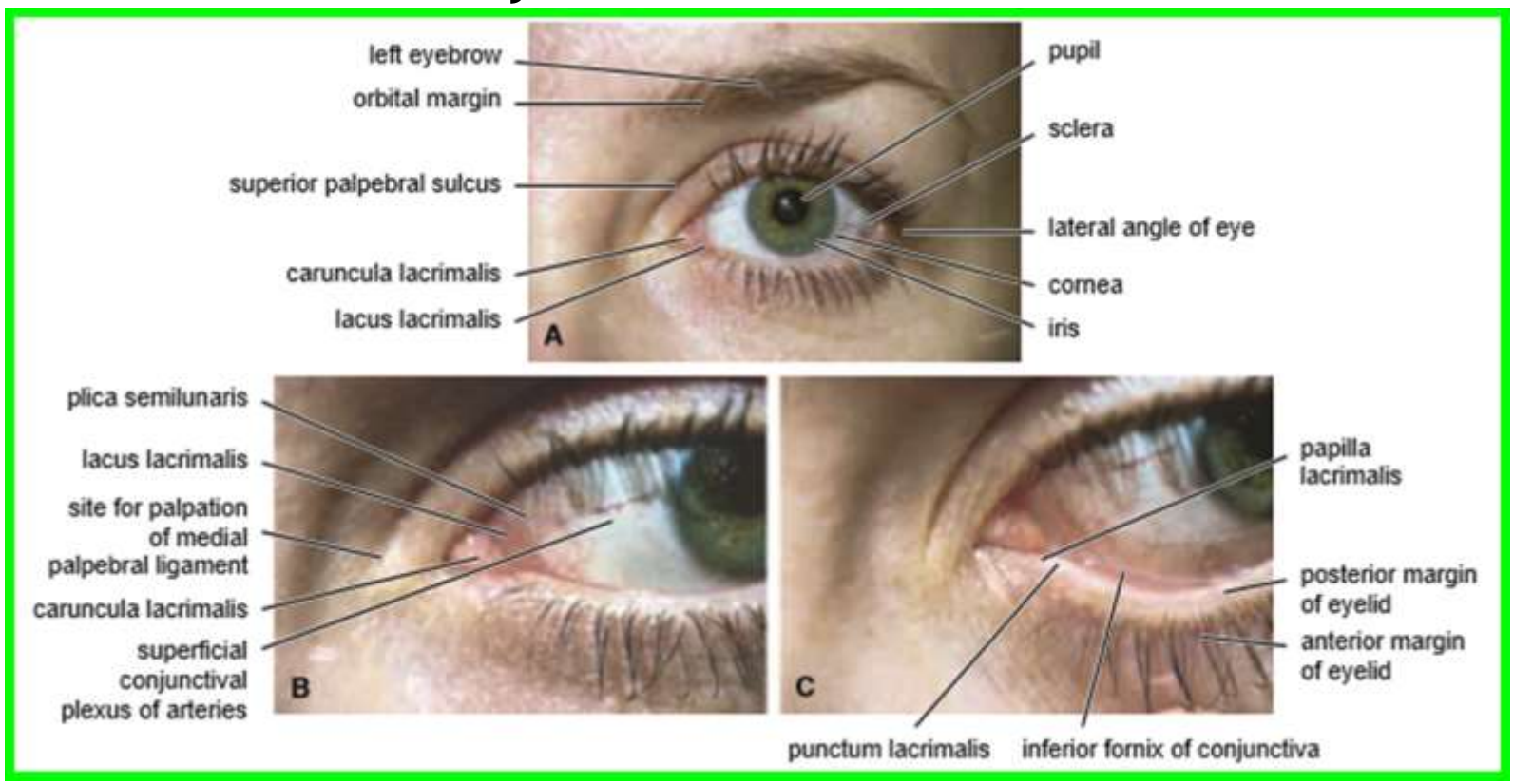
✓*The more rounded medial angle is separated from the eyeball by a small space, the lacus lacrimalis, in the center of which is a small, reddish yellow elevation, the caruncula lacrimalis*

✓*A reddish semilunar fold, called the plica semilunaris, lies on the lateral side of the caruncle.*



Eyelids

- ✓Near the medial angle of the eye a small elevation, the papilla lacrimalis, is present.
- ✓On the summit of the papilla is a small hole, the punctum lacrimale, which leads into the canaliculus lacrimalis
- ✓The papilla lacrimalis projects into the lacus, and the punctum and canaliculus carry tears down into the nose



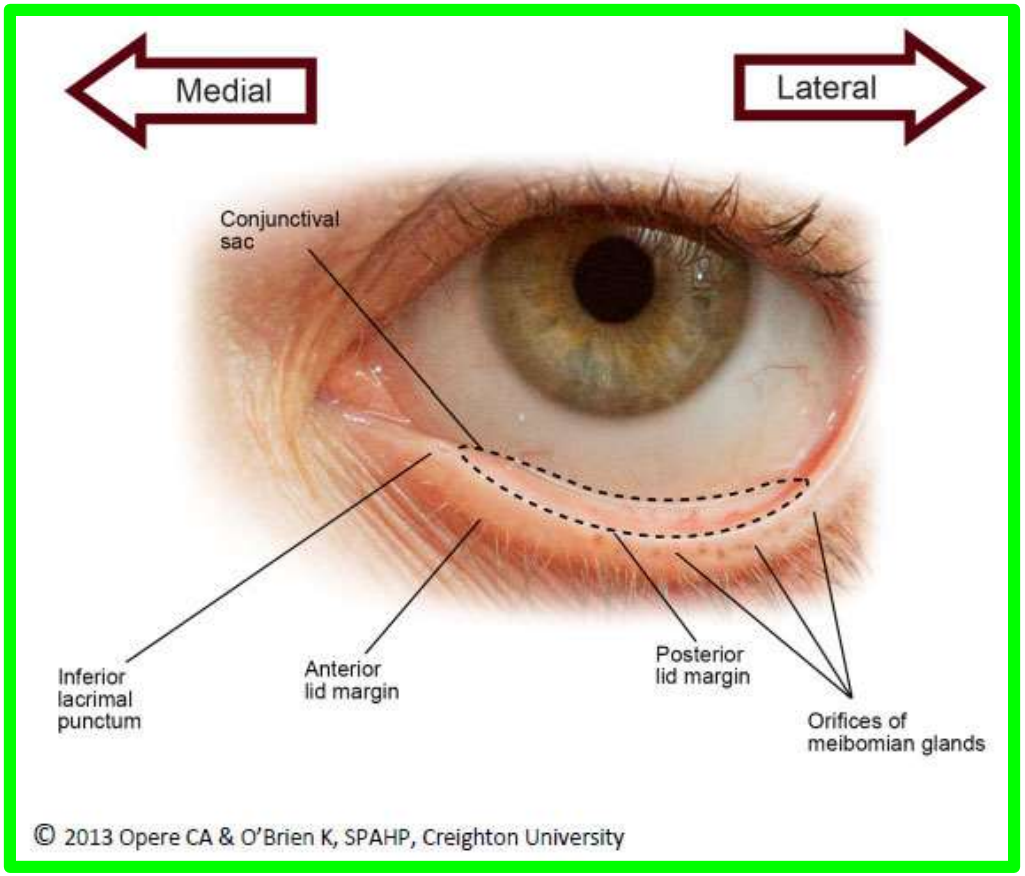
Eyelids

The conjunctiva

✓*is a thin mucous membrane that lines the eyelids and is reflected at the superior and inferior fornices onto the anterior surface of the eyeball*

✓*Its epithelium is continuous with that of the cornea.*

✓*The upper lateral part of the superior fornix is pierced by the ducts of the lacrimal gland*

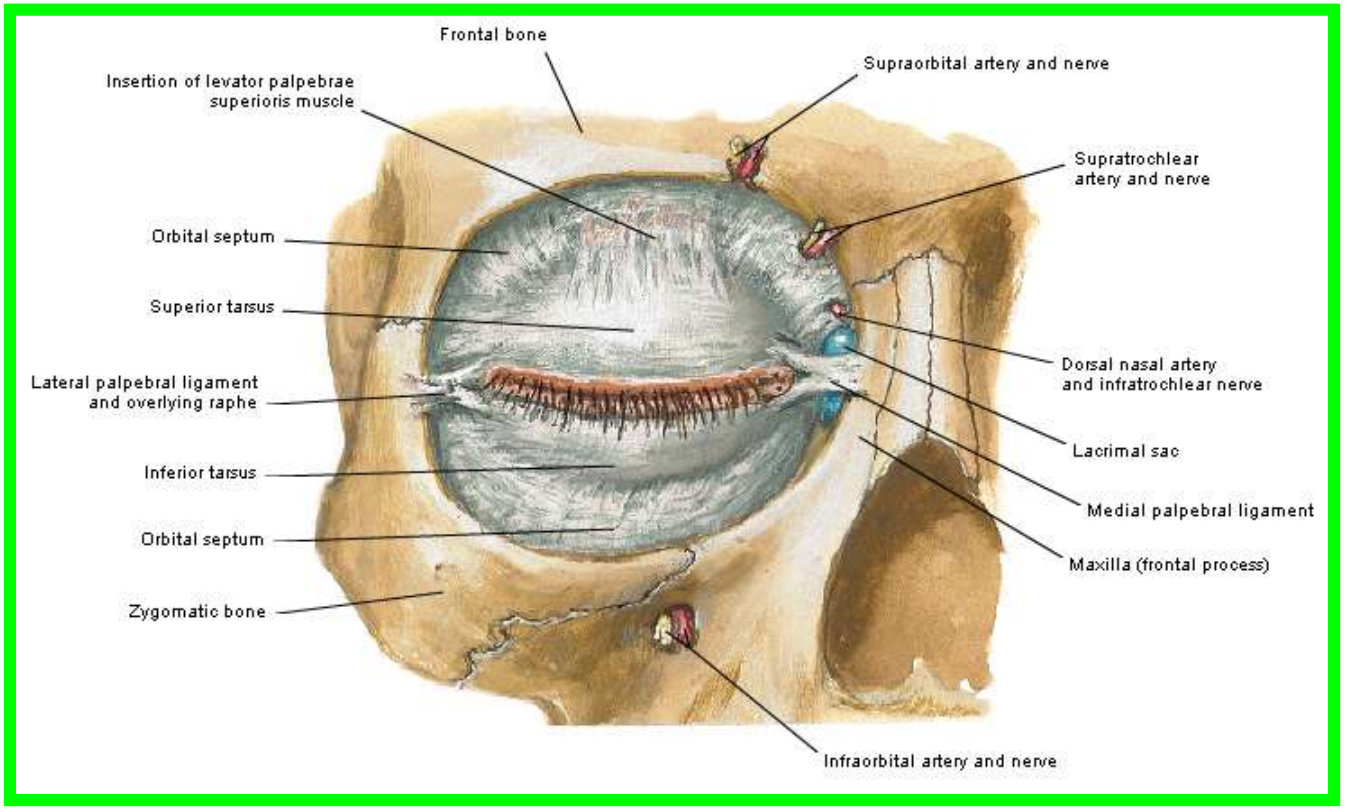


✓*The conjunctiva thus forms a potential space, the conjunctival sac, which is open at the palpebral fissure.*

Eyelids

- ✓The framework of the eyelids is formed by a fibrous sheet, the orbital septum
- ✓This is attached to the periosteum at the orbital margins.
- ✓The orbital septum is thickened at the margins of the lids to form the superior and inferior tarsal plates.

- ✓The tarsal glands are embedded in the posterior surface of the tarsal plates.



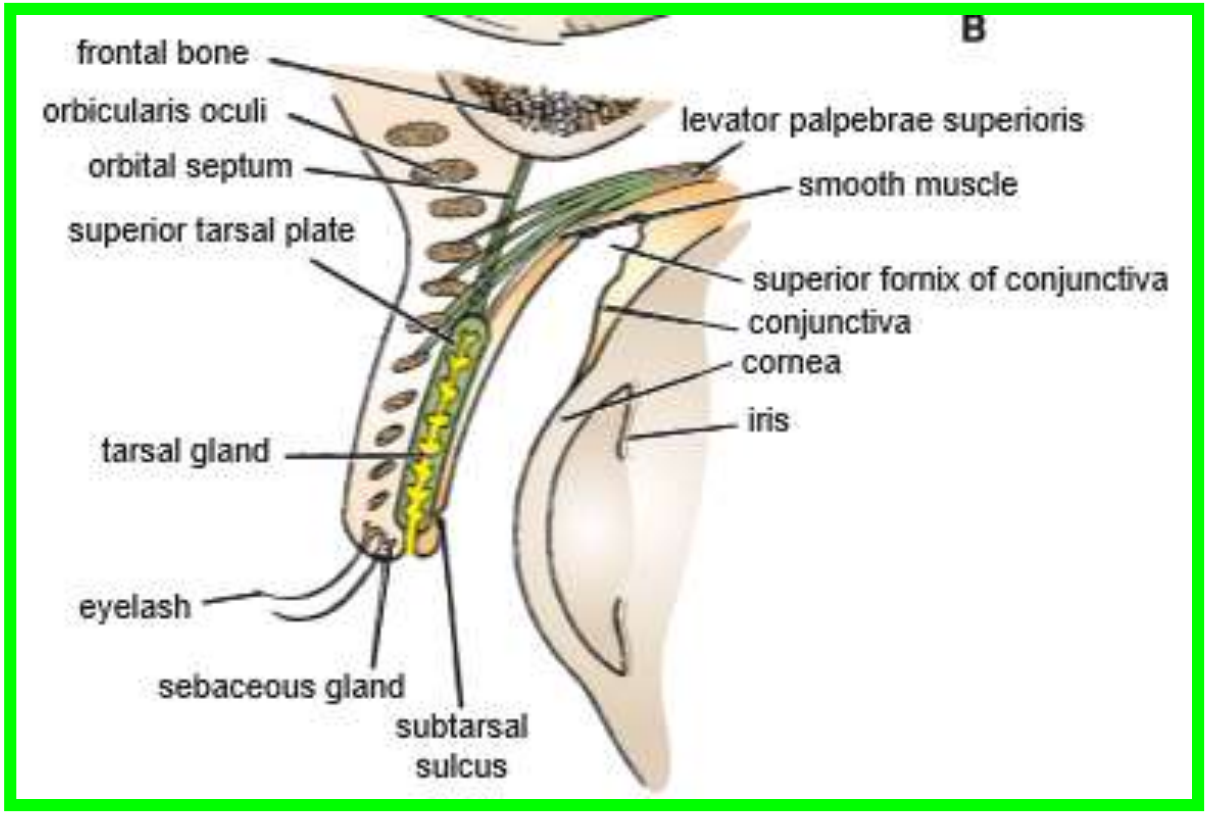
Eyelids

✓*Beneath the eyelid is a groove, the subtarsal sulcus, which runs close to and parallel with the margin of the lid.*

✓*The sulcus tends to trap small foreign particles introduced into the conjunctival sac and is thus clinically important.*

✓*The superficial surface of the tarsal plates and the orbital septum are covered by the palpebral fibers of the orbicularis oculi muscle*

✓ *The aponeurosis of insertion of the levator palpebrae superioris muscle pierces the orbital septum to reach the anterior surface of the superior tarsal plate and the skin*



Lacrimal Apparatus

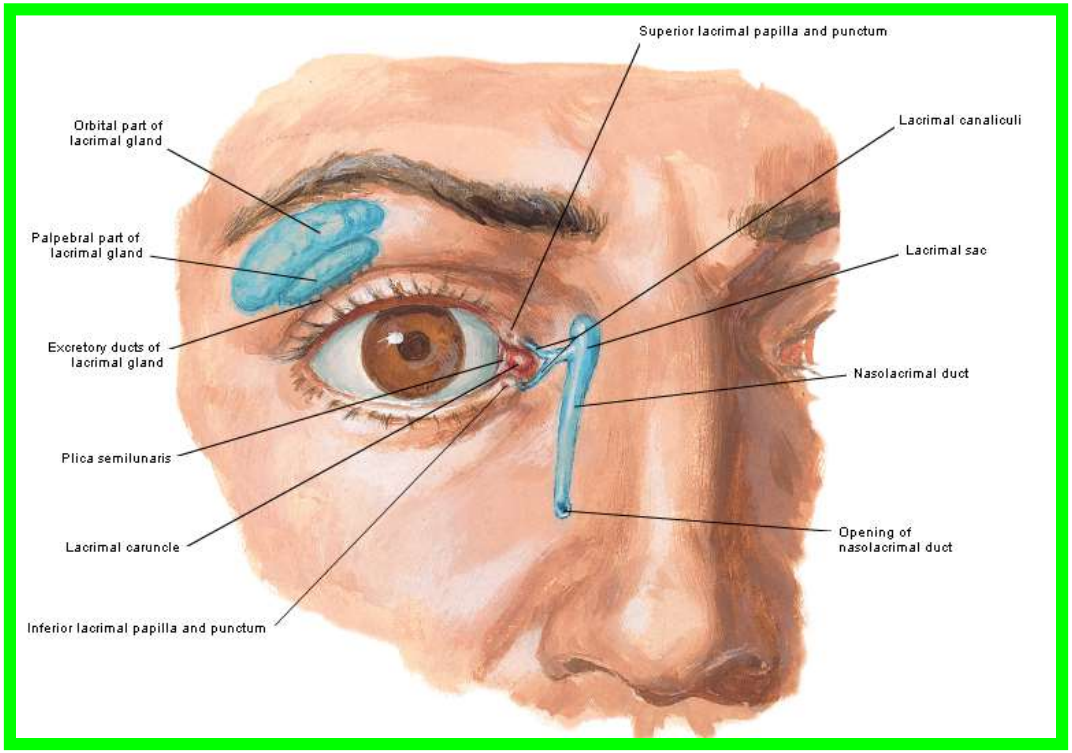
Lacrimal Gland

The gland is consist of

- ❑ Large orbital part
- ❑ Small palpebral part

✓ It is situated above the eyeball in the anterior and upper part of the orbit posterior to the orbital septum

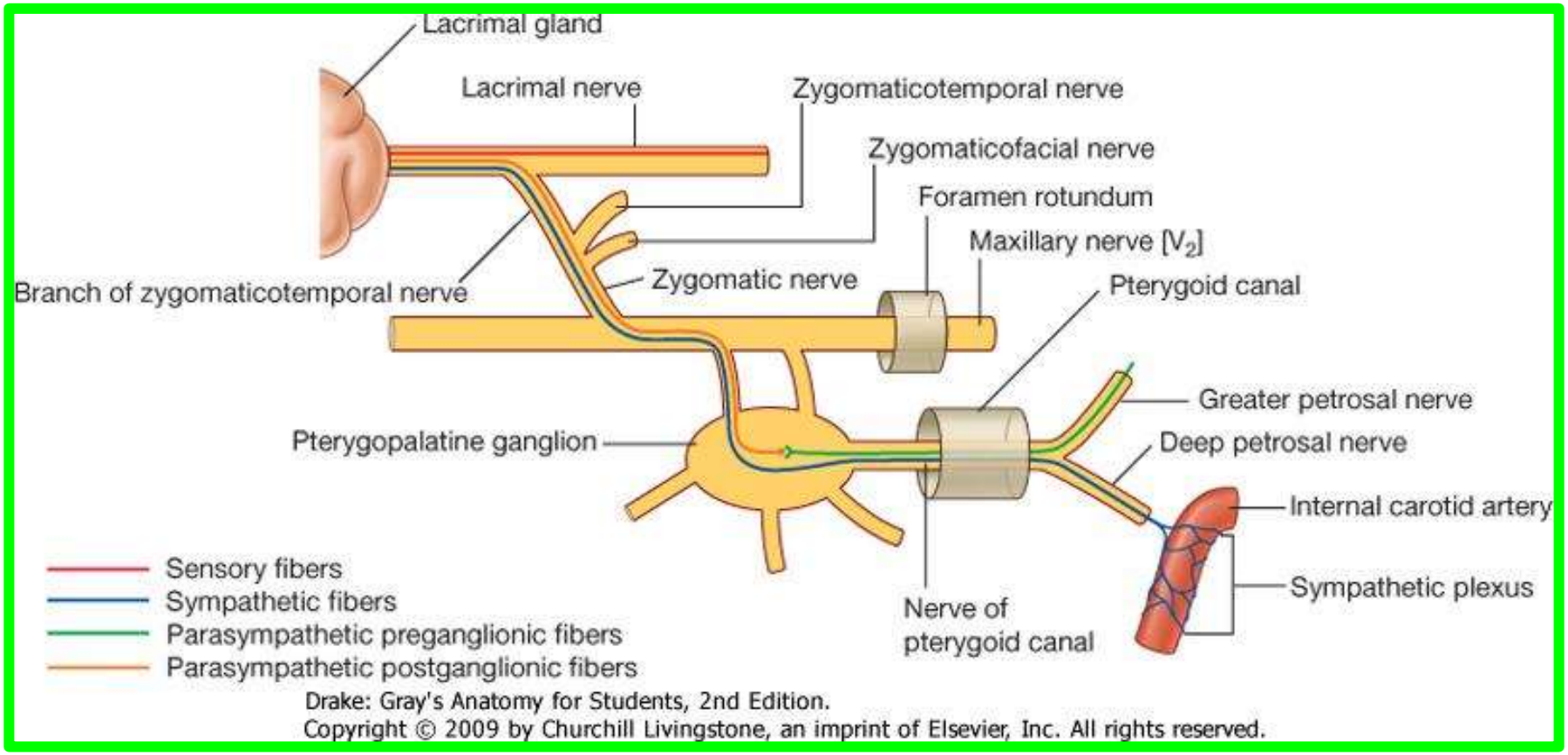
✓ The gland opens into the lateral part of the superior fornix of the conjunctiva by 12 ducts.



Lacrimal Gland

The parasympathetic secretomotor nerve supply is derived from the lacrimal nucleus of the facial nerve

The sympathetic postganglionic nerve supply is from the internal carotid plexus and travels in the deep petrosal nerve,

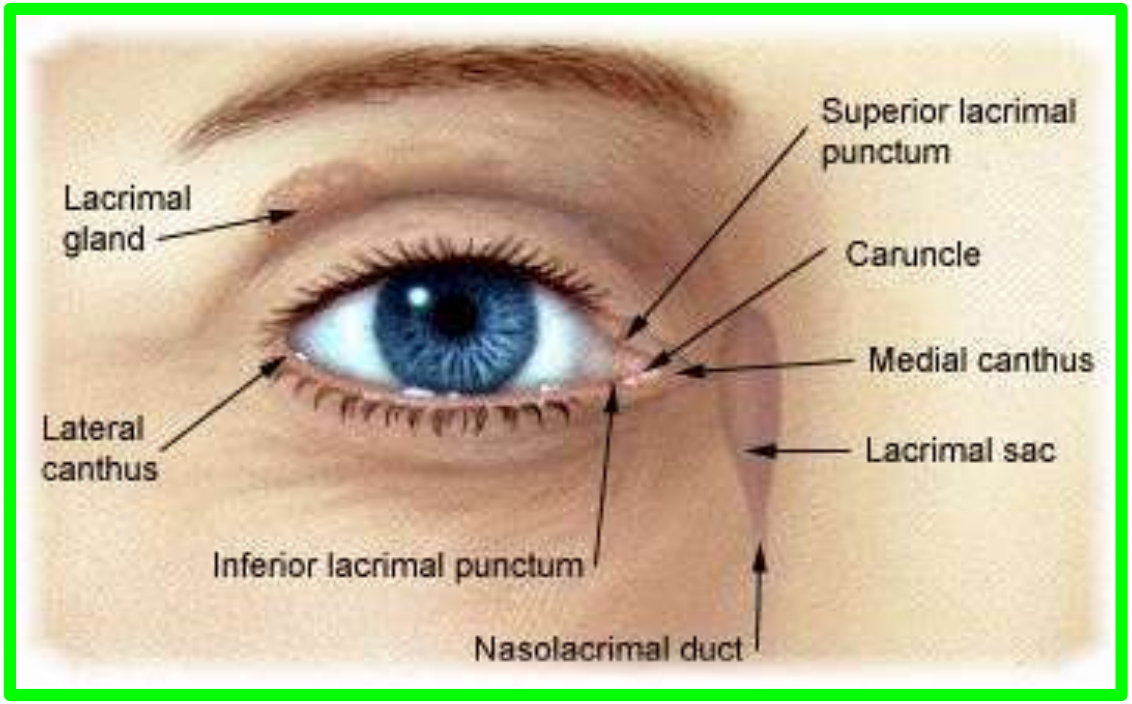


Drake: Gray's Anatomy for Students, 2nd Edition.

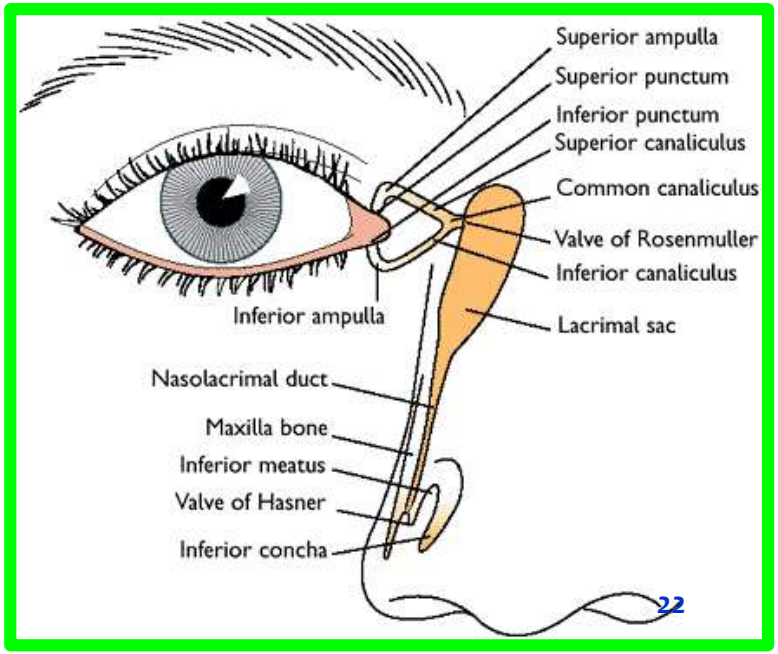
Lacrimal Ducts

- The tears circulate across the cornea and accumulate in the lacus lacrimalis.

then enter the canaliculi lacrimales through the puncta lacrimalis.



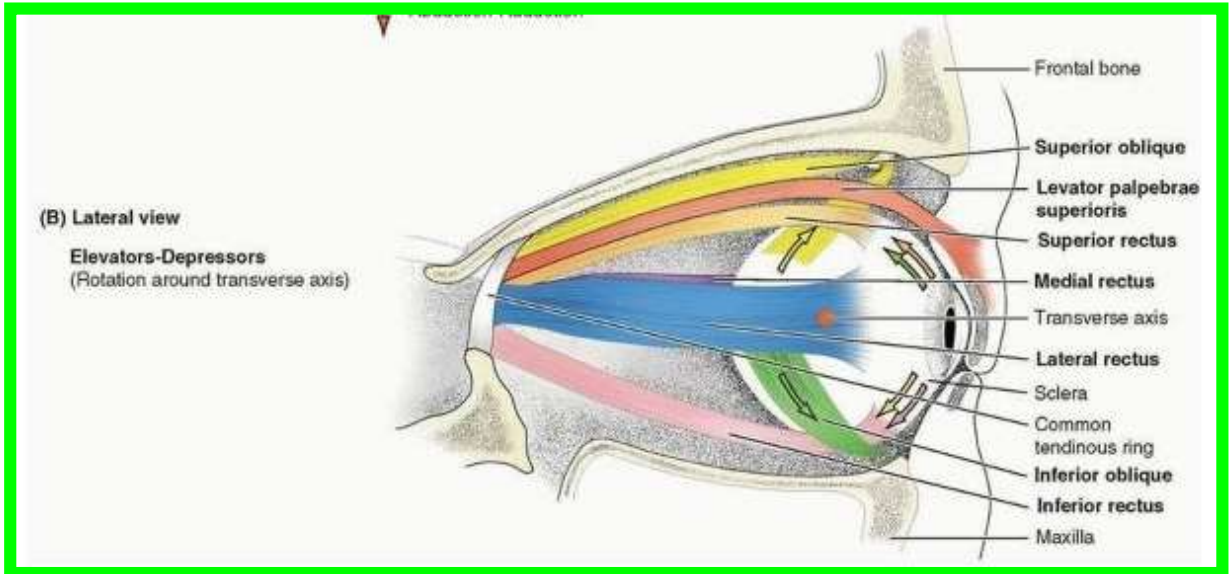
- The canaliculi lacrimales open into the lacrimal sac Then to the nasolacrimal duct.
- The nasolacrimal duct is about 0.5 in. (1.3 cm) long descends and opens into the inferior meatus of the nose.



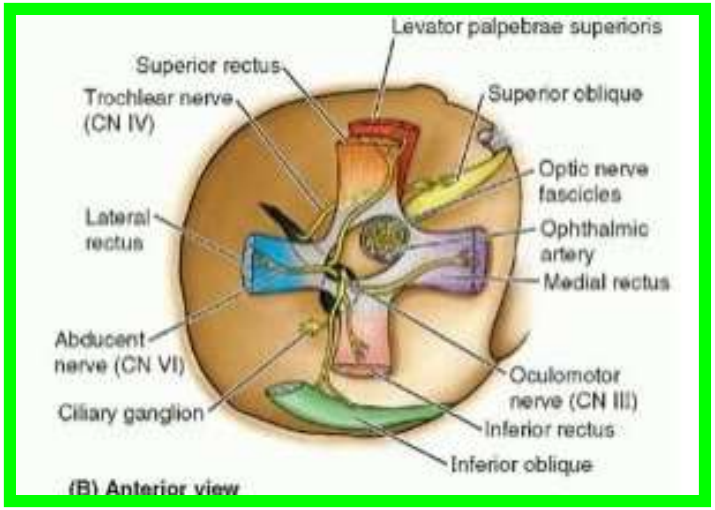
EXTRAOCULAR MUSCLES OF ORBIT

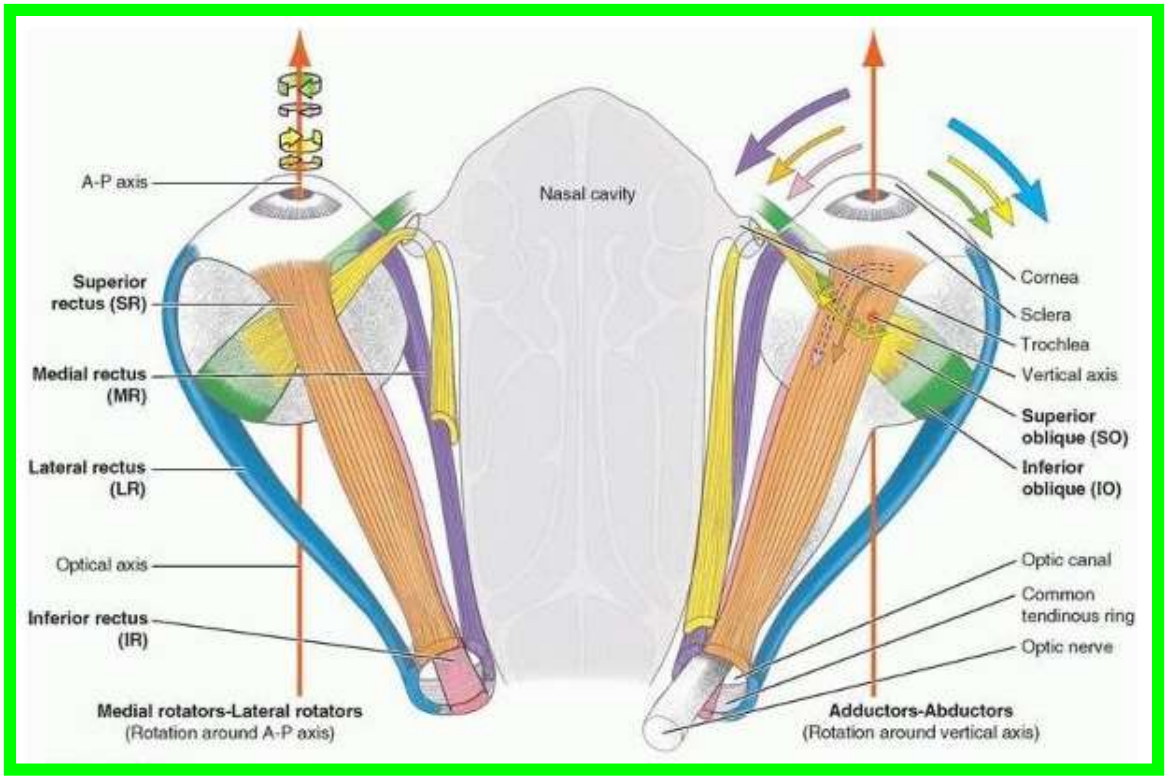
Muscle: Superior rectus
Origin: common tendinous ring
Insertion: Superior surface of eyeball just posterior to corneoscleral junction
N. Supply: Oculomotor nerve
Action: Raises cornea upward and medially

Muscle: Inferior rectus
Origin: common tendinous ring
Insertion: Inferior surface of eyeball just posterior to corneoscleral junction
N Supply: Oculomotor nerve (3rd cranial nerve)
Action: Depresses cornea downward and medially



Muscle: Medial rectus
Origin: Common tendinous ring
Insertion: Medial surface of eyeball just posterior to corneoscleral junction
N. Supply: Oculomotor nerve (3rd cranial nerve)
Action: Rotates eyeball so that cornea looks medially





Muscle: Lateral rectus
Origin: Common tendinous ring
Insertion: Lateral surface of eyeball just posterior to corneoscleral junction
N. Supply: Abducent nerve (6th cranial nerve)
Action: Rotates eyeball so that cornea looks laterally

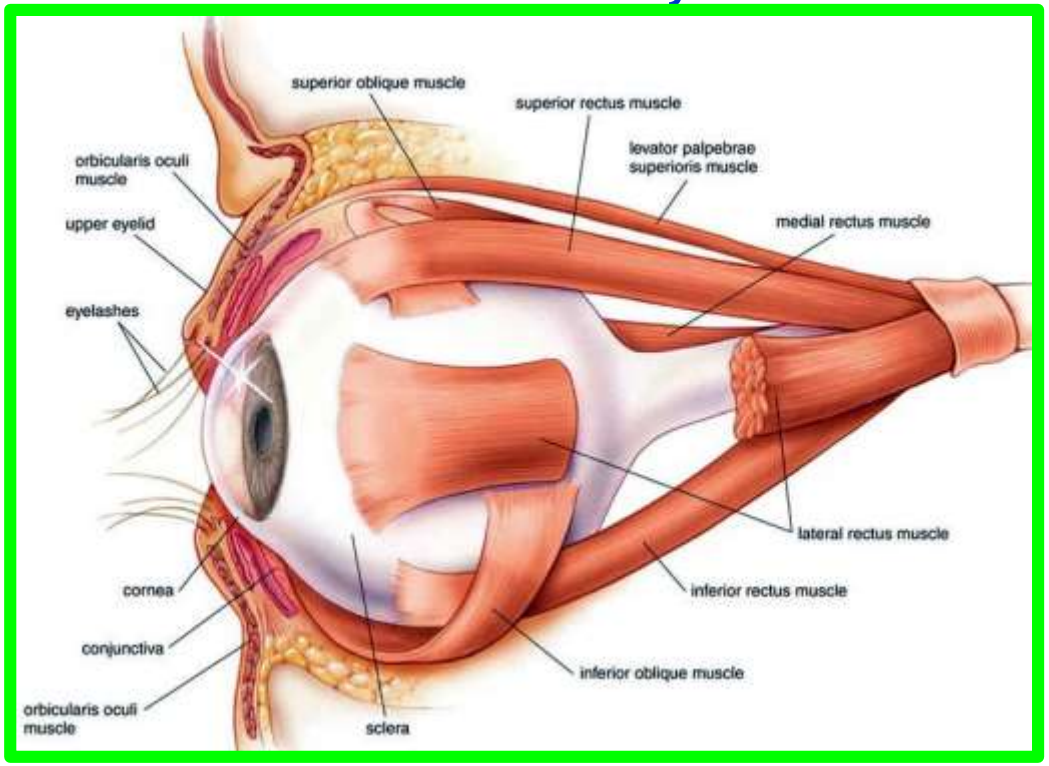
Muscle: ***Superior oblique***

Origin: ***Posterior wall of orbital cavity***

Insertion: ***Passes through pulley and is attached to superior surface of eyeball beneath superior rectus***

N. Supply: ***Trochlear nerve (4th cranial nerve)***

Action: ***Rotates eyeball so that cornea looks downward and laterally***



Muscle: ***Inferior oblique***

Origin: ***Floor of orbital cavity***

Insertion: ***Lateral surface of eyeball deep to lateral rectus***

N. Supply: ***Oculomotor nerve (3rd cranial nerve)***

Action: ***Rotates eyeball so that cornea looks upward and laterally***

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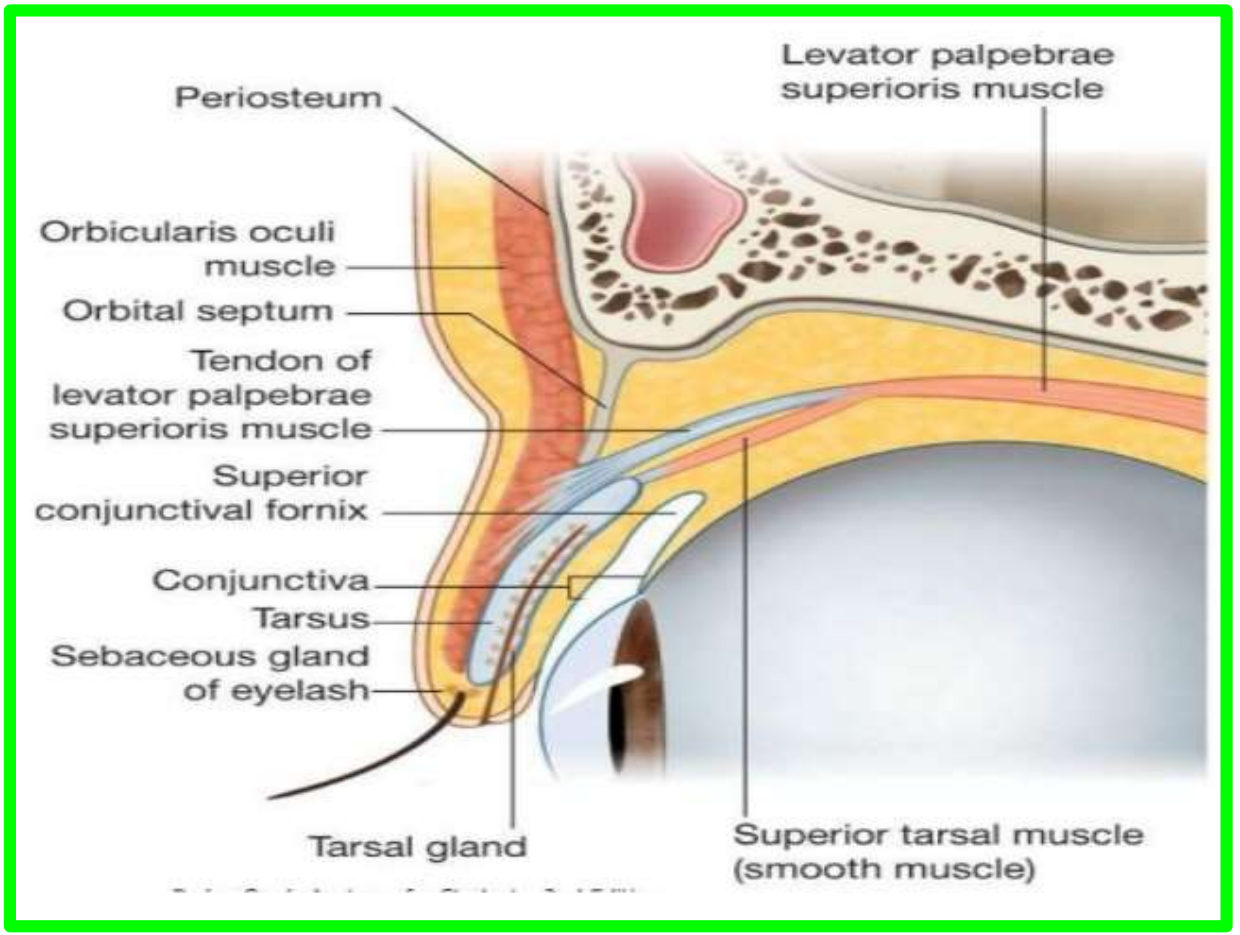
Muscle: *Levator palpebrae superioris*

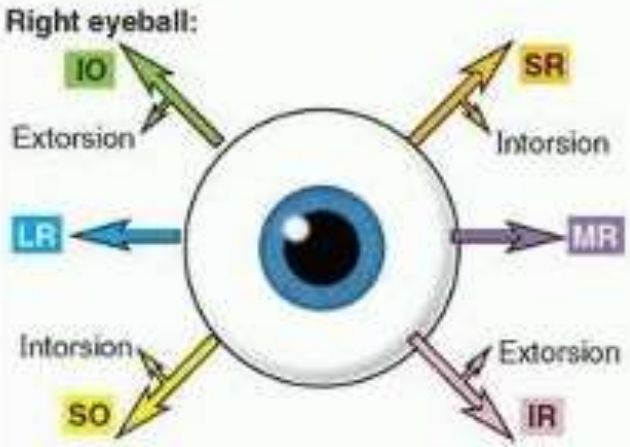
Origin: *Back of orbital cavity*

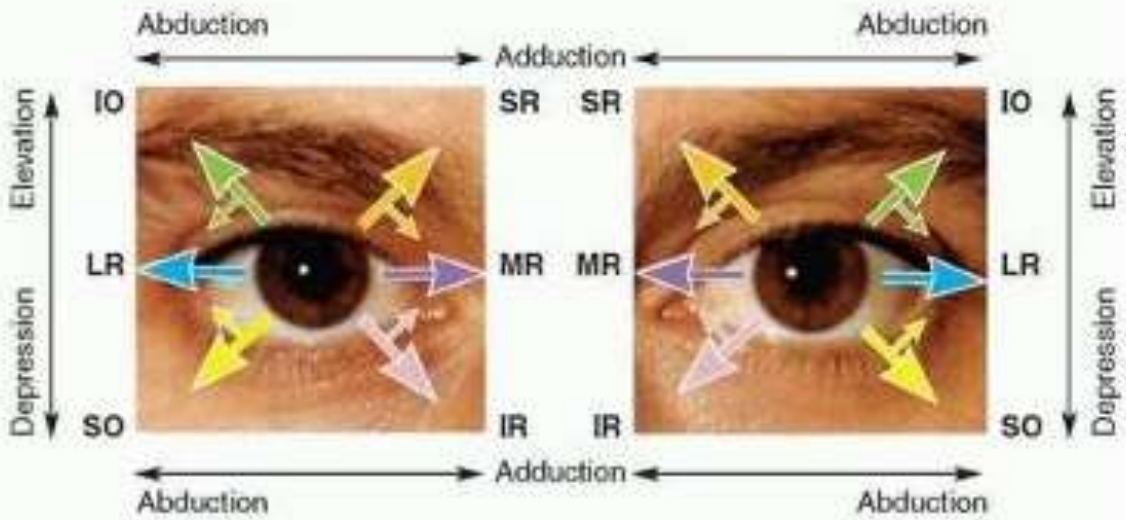
Insertion: *Anterior surface and upper margin of superior tarsal plate*

N. Supply: *Striated muscle oculomotor nerve, smooth muscle sympathetic*

Action: *Raises upper lid*




Right eyeball:
IO
Extorsion
SR
Intorsion
LR
MR
Intorsion
SO
Extorsion
IR

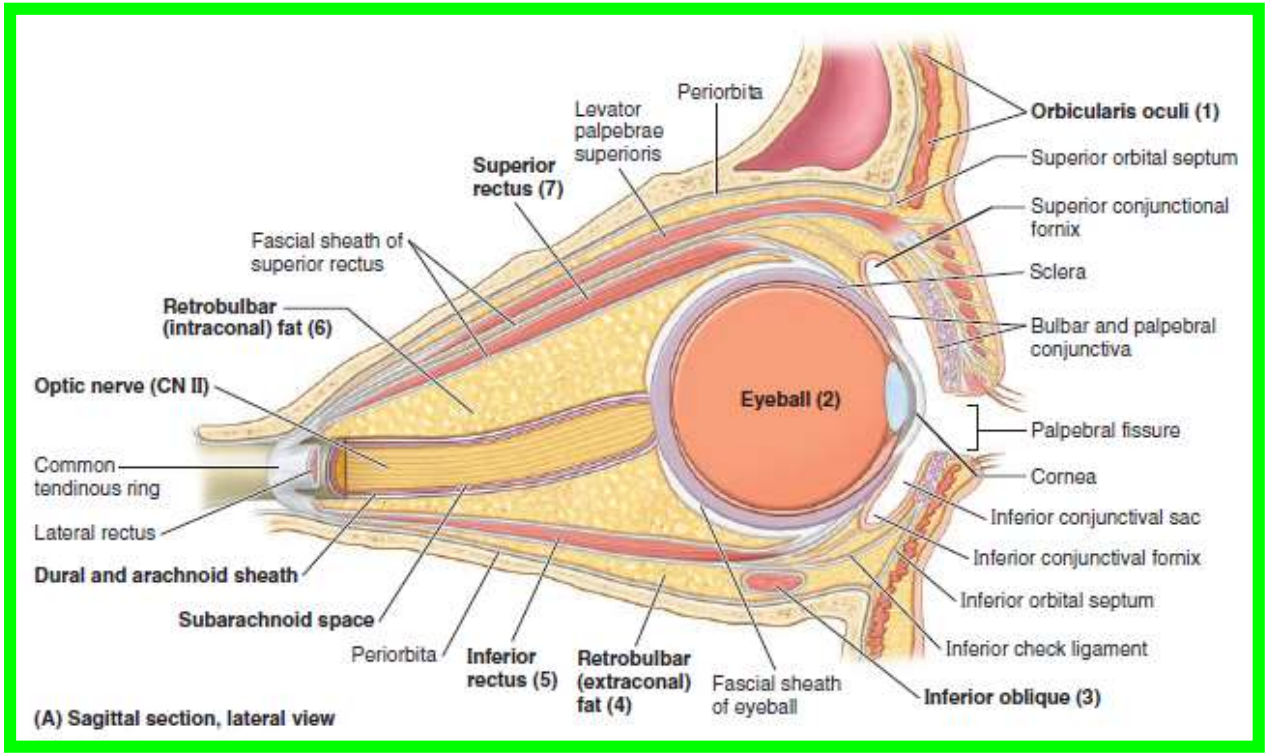

Abduction
Adduction
Abduction
Elevation
Depression
IO
SR
SR
IO
LR
MR
MR
LR
SO
IR
IR
SO
Adduction
Abduction
Abduction

Eyeball

The eyeball contains the optical apparatus of the visual system. It occupies most of the anterior portion of the orbit, suspended by six extrinsic muscles that control its movements, and a fascial suspensory apparatus

It measures approximately 25 mm in diameter.

All anatomical structures within the eyeball have a circular or spherical arrangement



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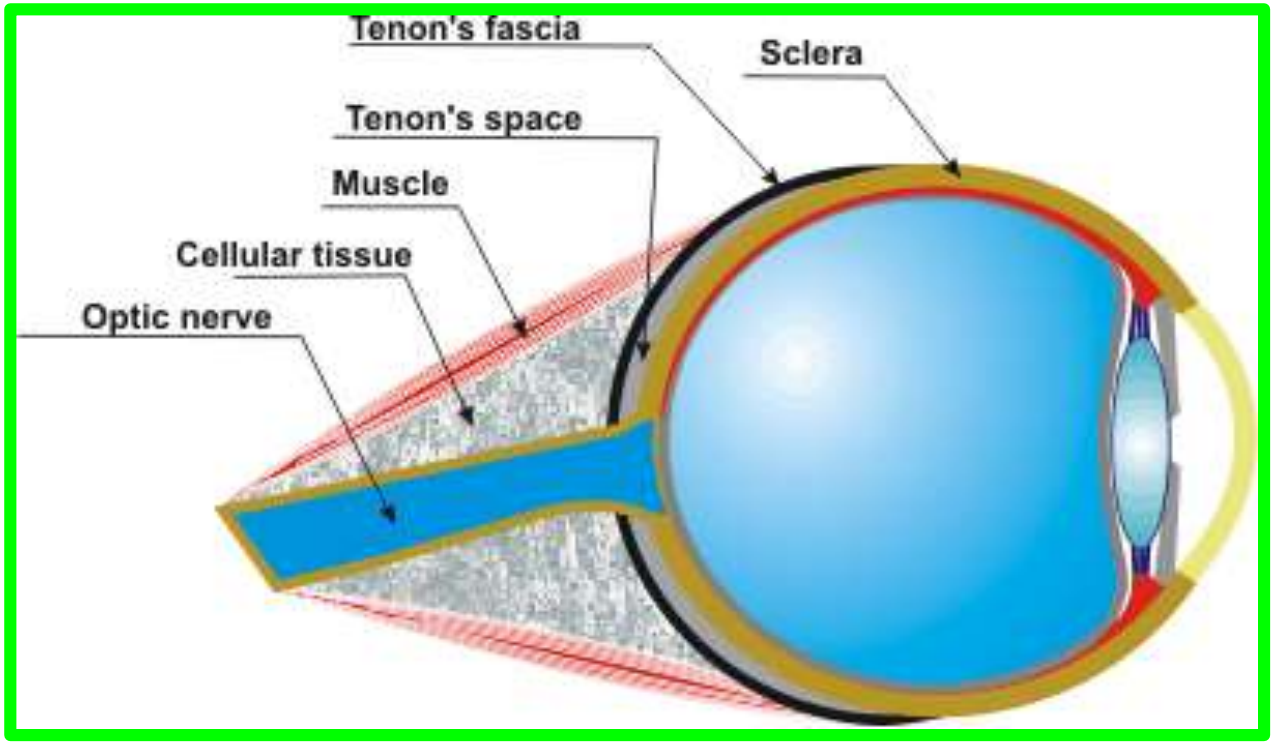
Eyeball

The eyeball proper has three layers; however, there is an additional connective tissue layer that surrounds the eyeball, supporting it within the orbit.

The connective tissue layer is composed posteriorly of the fascial sheath of the eyeball (bulbar fascia or Tenon capsule), which forms the actual socket for the eyeball, and anteriorly of bulbar conjunctiva



- ***the episcleral space (a potential space), lies between the fascial sheath and the outer layer of the eyeball***

Eyeball

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The three layers of the eyeball are the:

1. *Fibrous layer (outer coat), consisting of the sclera and cornea*
2. *Vascular layer (middle coat), consisting of the choroid, ciliary body, and iris*
3. *Inner layer (inner coat), consisting of the retina, which has both optic and nonvisual parts*

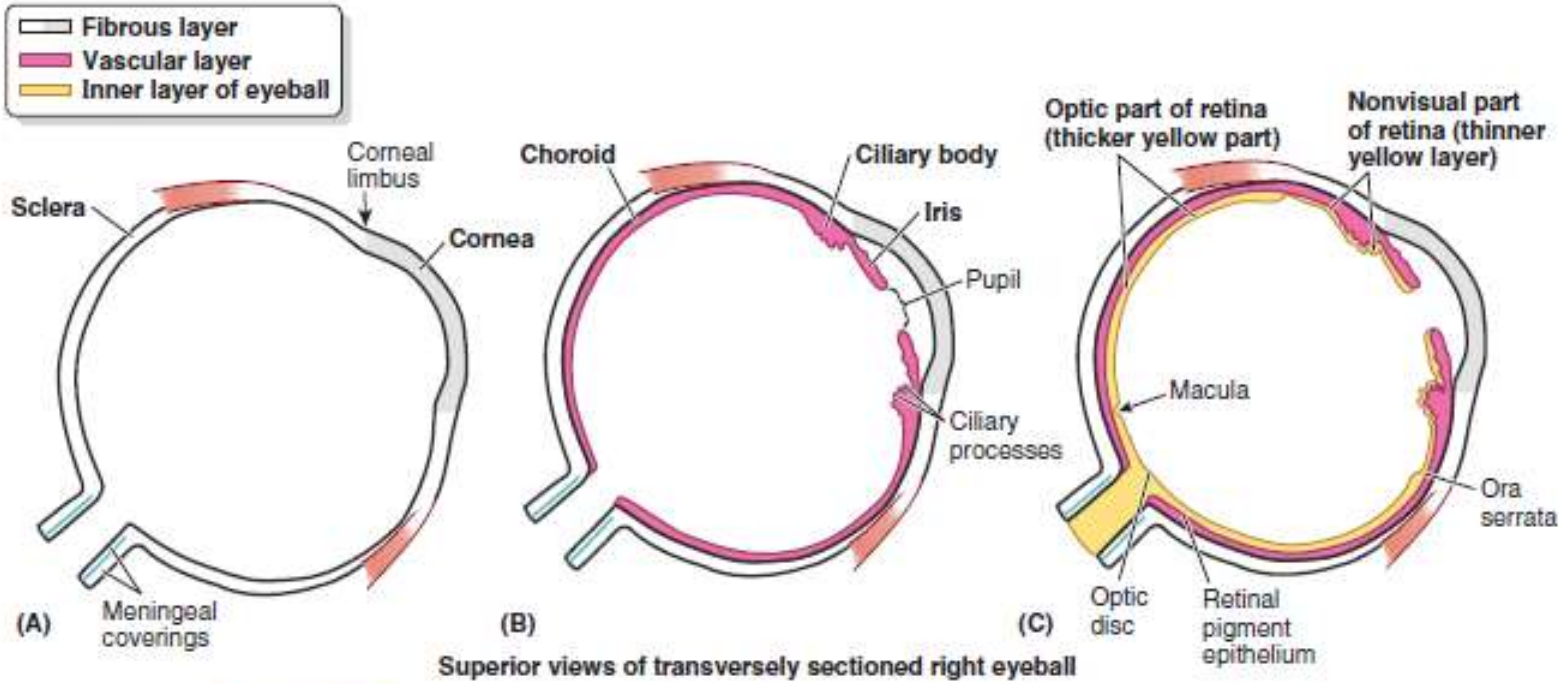


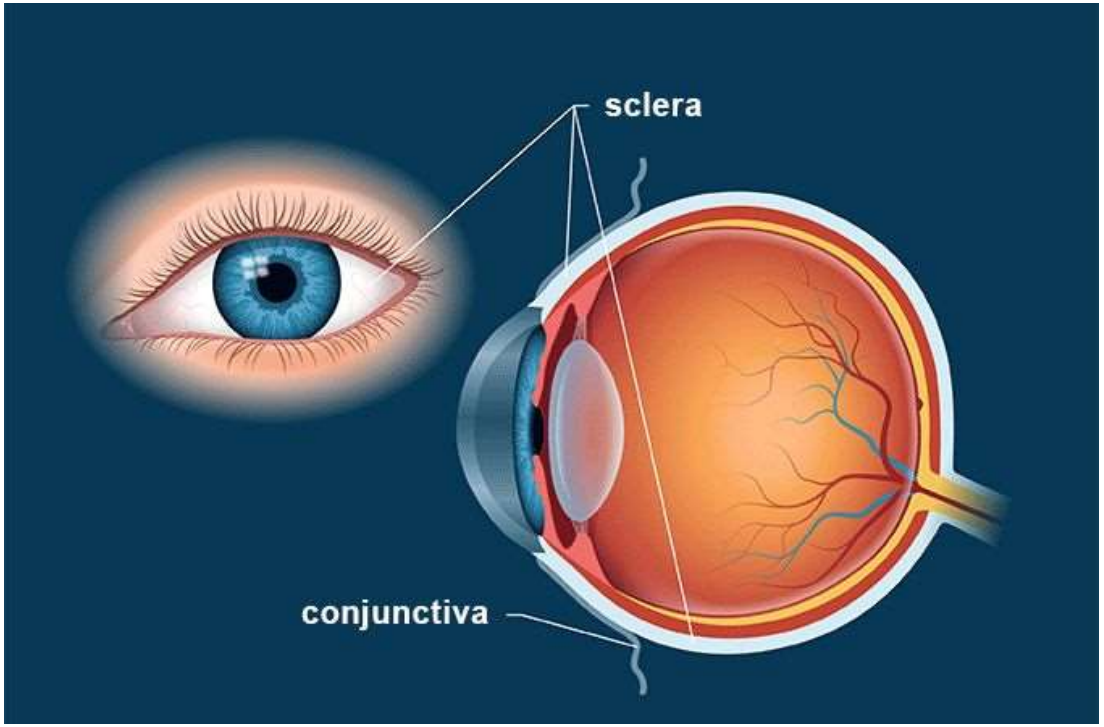
FIGURE 7.26. Layers of eyeball. A. Outer fibrous layer. B. Middle vascular layer. C. Inner layer (retina).

1. FIBROUS LAYER OF EYEBALL

Dr. Aiman Qais Afar

The fibrous layer of the eyeball is the external fibrous skeleton of the eyeball, providing shape and resistance.

- ✓ *The sclera is the tough opaque part of the fibrous layer (coat) of the eyeball*
- ✓ *covering the posterior five sixths of the eyeball and*
- ✓ *providing attachment for both the extrinsic (extra-ocular) and the intrinsic muscles of the eye*

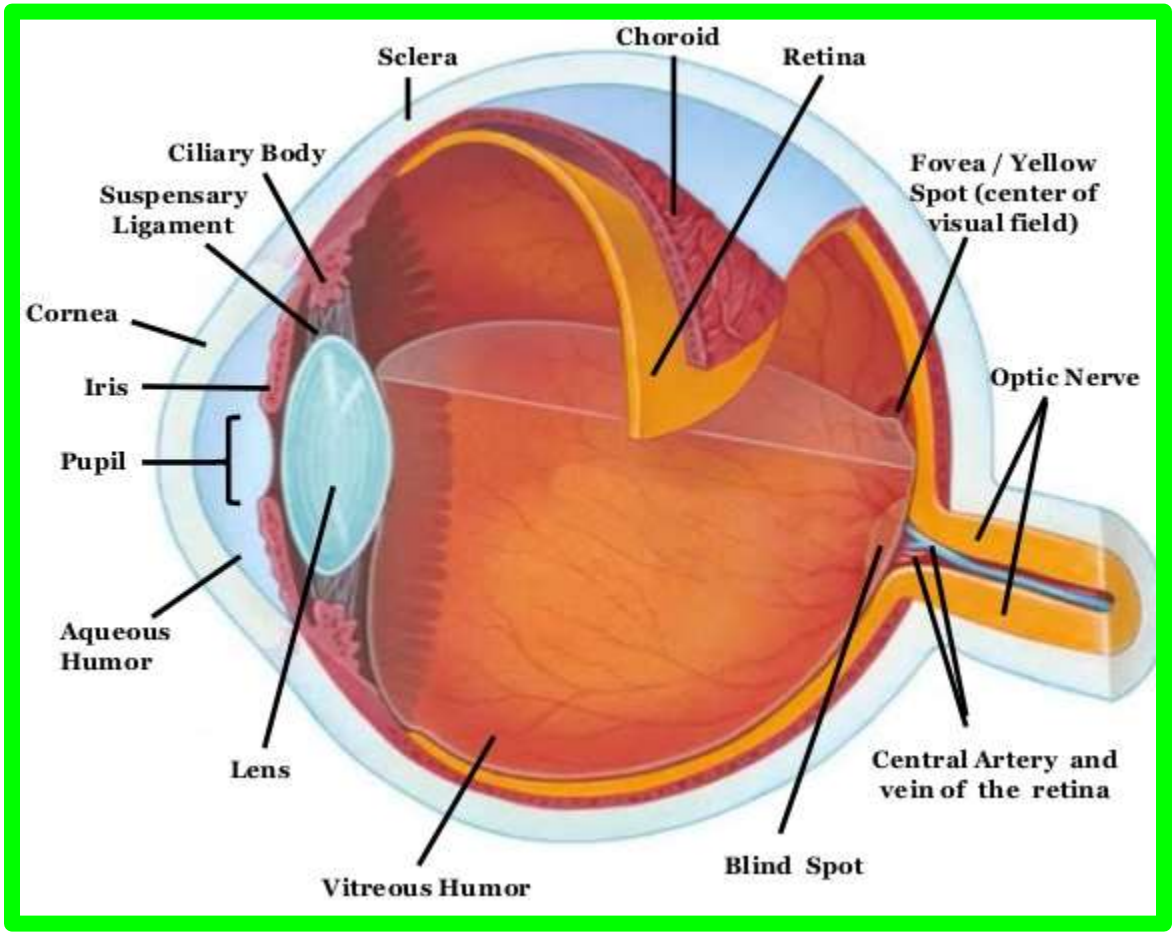


- ✓ *The anterior part of the sclera is visible through the transparent bulbar conjunctiva as "the white of the eye" .*

1. FIBROUS LAYER OF EYEBALL

- ✓ *The cornea is the transparent part of the fibrous layer covering the anterior one sixth of the eyeball.*

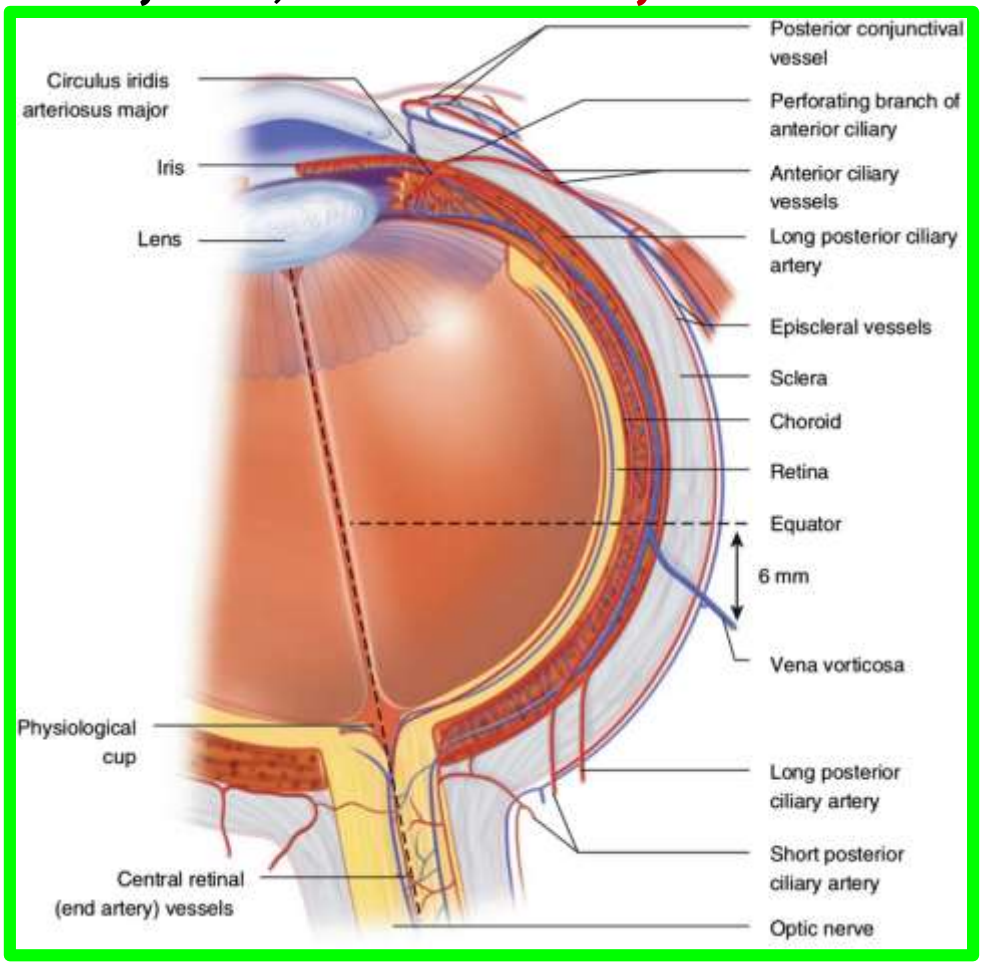
The convexity of the cornea is greater than that of the sclera and so it appears to protrude from the eyeball when viewed laterally.



1. FIBROUS LAYER OF EYEBALL

Whereas the sclera is relatively avascular, the cornea is completely avascular, receiving its nourishment from capillary beds around its periphery and
fluids on its external and internal surfaces, the lacrimal fluid and aqueous humor, respectively .

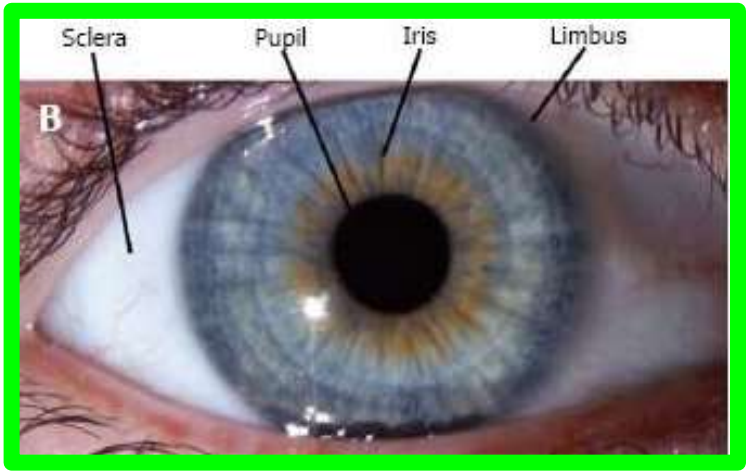
Lacrimal fluid also provides oxygen absorbed from the air

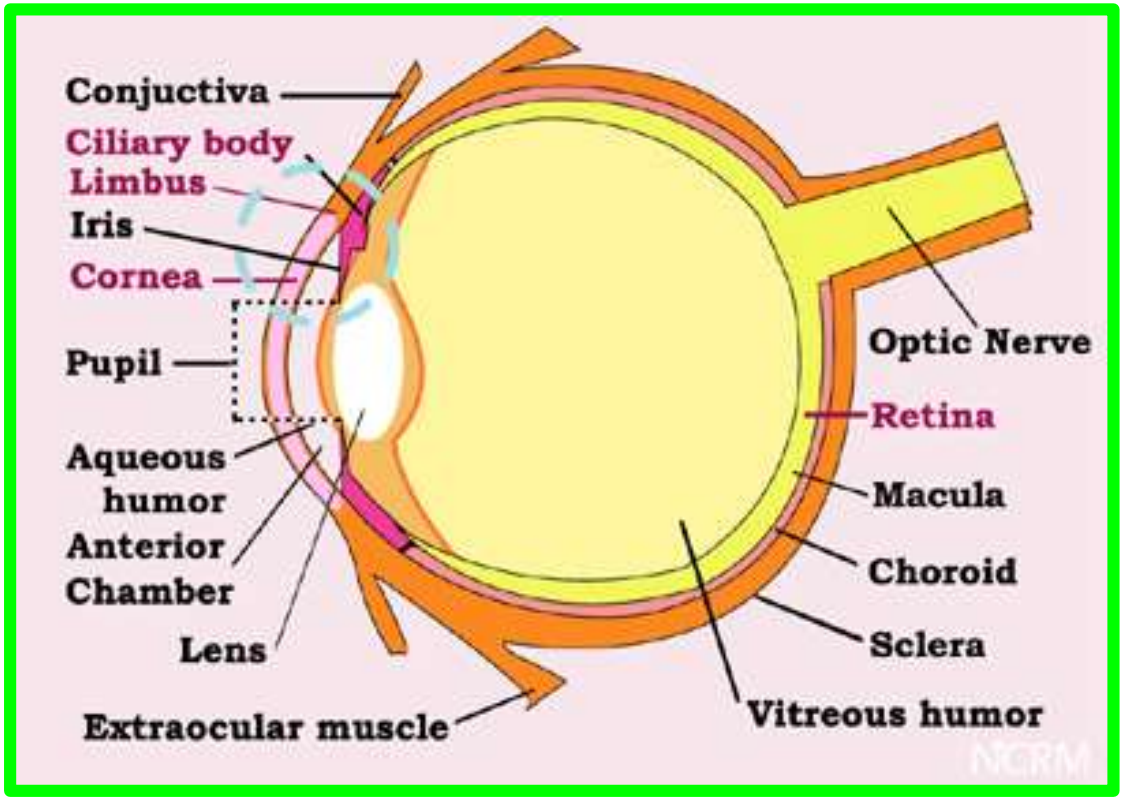


1. FIBROUS LAYER OF EYEBALL

The cornea is highly sensitive to touch; its innervation is provided by the ophthalmic nerve (CN V1). Even very small foreign bodies (e.g., dust particles) elicit blinking, flow of tears, and sometimes severe pain. Drying of the corneal surface may cause ulceration

The limbus of the cornea is the angle formed by the intersecting curvatures of sclera and cornea at the corneoscleral Junction.



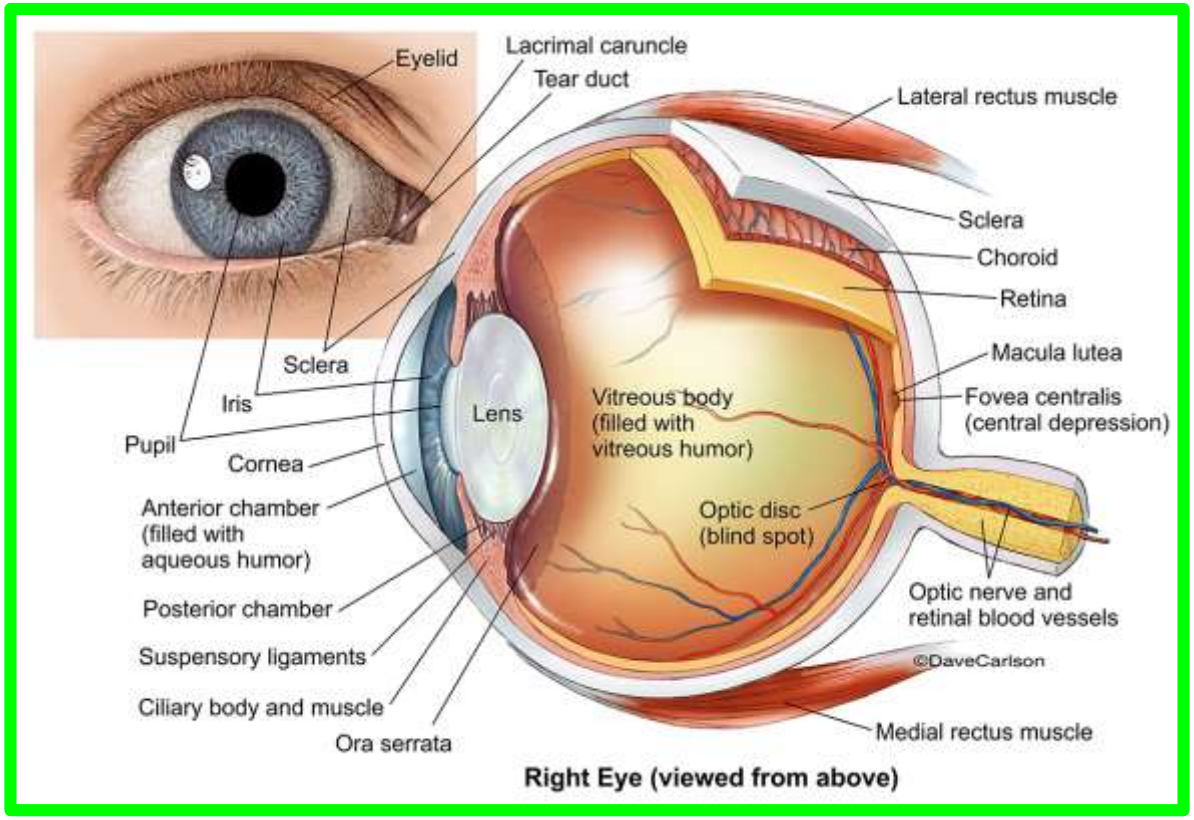


The junction is a 1-mm wide, gray, and translucent circle including numerous capillary loops involved in nourishing the avascular cornea.

2. VASCULAR LAYER OF EYEBALL

The vascular layer of the eyeball (also called the uvea or uveal tract) consists of the choroid, ciliary body, and iris.

The choroid, a dark reddish-brown layer between the sclera and the retina, forms the largest part of the vascular layer of the eyeball and lines most of the sclera.



Within this pigmented and dense vascular bed, larger vessels are located externally (near the sclera).

2. VASCULAR LAYER OF EYEBALL

The finest vessels *(the capillary lamina of the choroid or* ***choriocapillaris,*** *an extensive capillary bed) are innermost, adjacent to* ***the avascular light-sensitive layer of the retina,*** *which it supplies with oxygen and nutrients. Engorged with blood in life (it has the highest perfusion rate per gram of tissue of all vascular beds of the body),*

this layer is responsible for the "red eye" reflection that occurs in flash photography

2. VASCULAR LAYER OF EYEBALL

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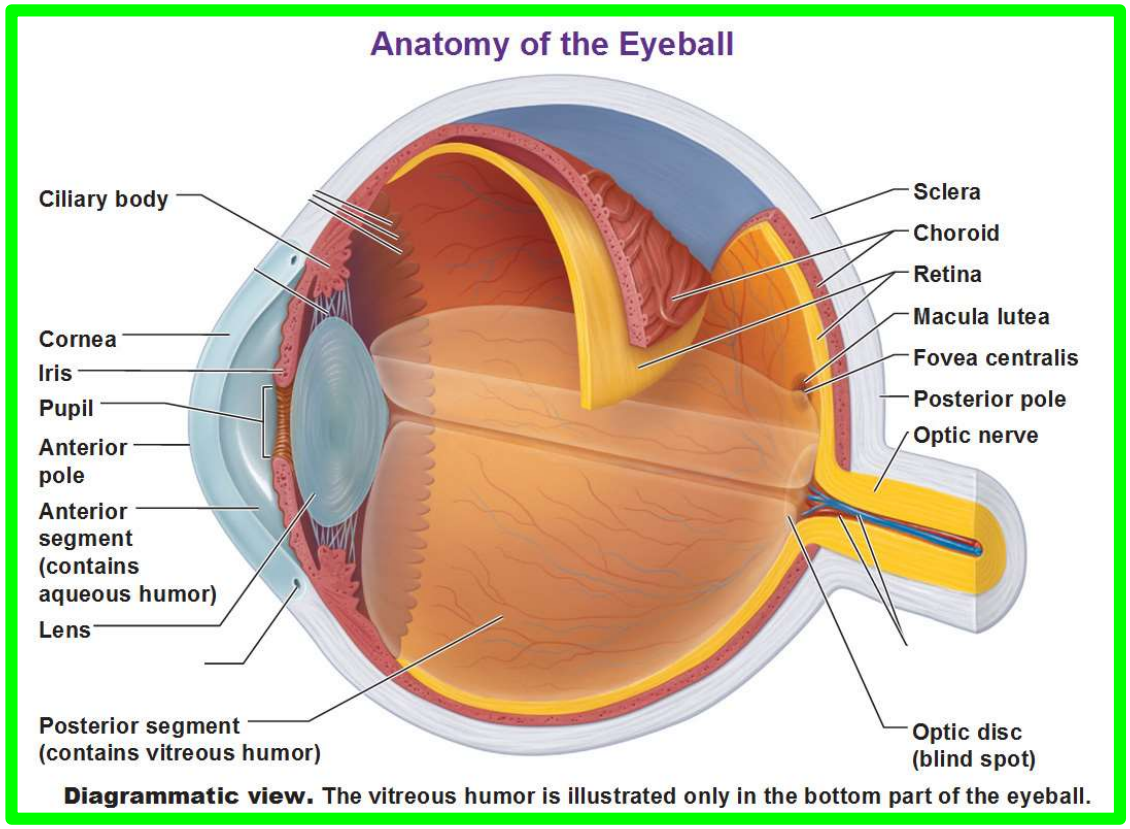
✓*The ciliary body is a ring-like thickening of the layer posterior to the corneoscleral junction that is muscular as well as vascular.*

✓*It connects the choroid with the circumference of the iris.*

✓*The ciliary body provides attachment for the lens.*

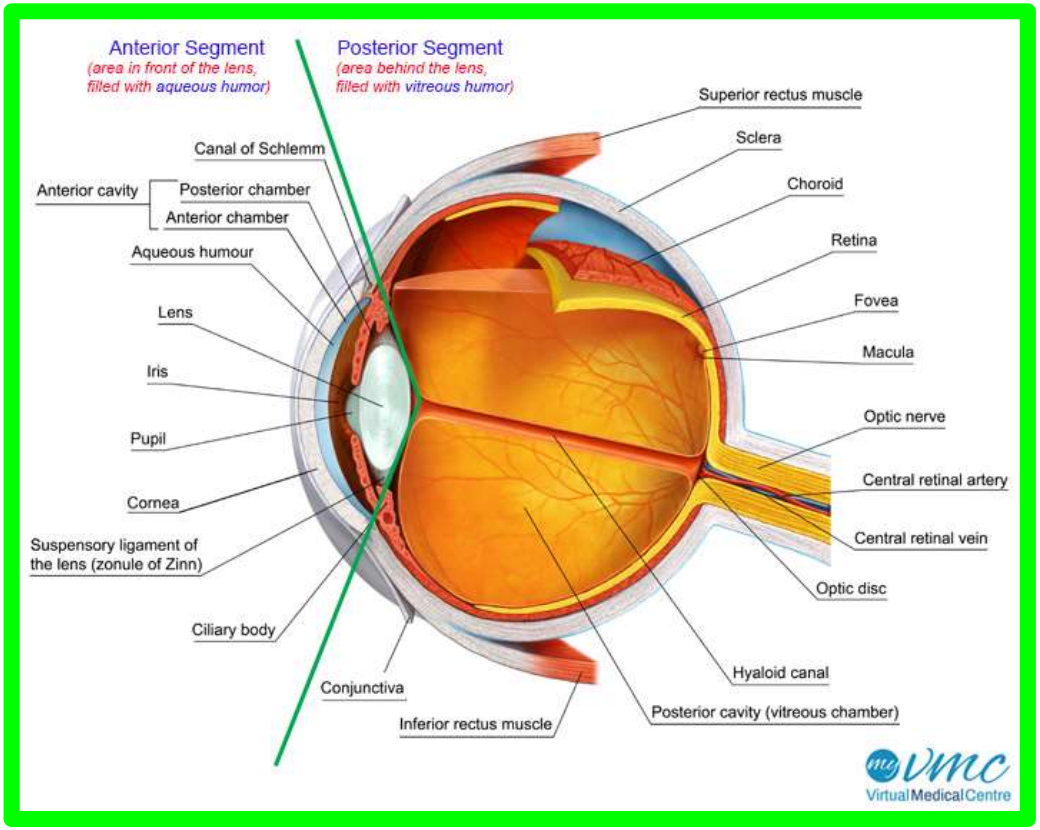


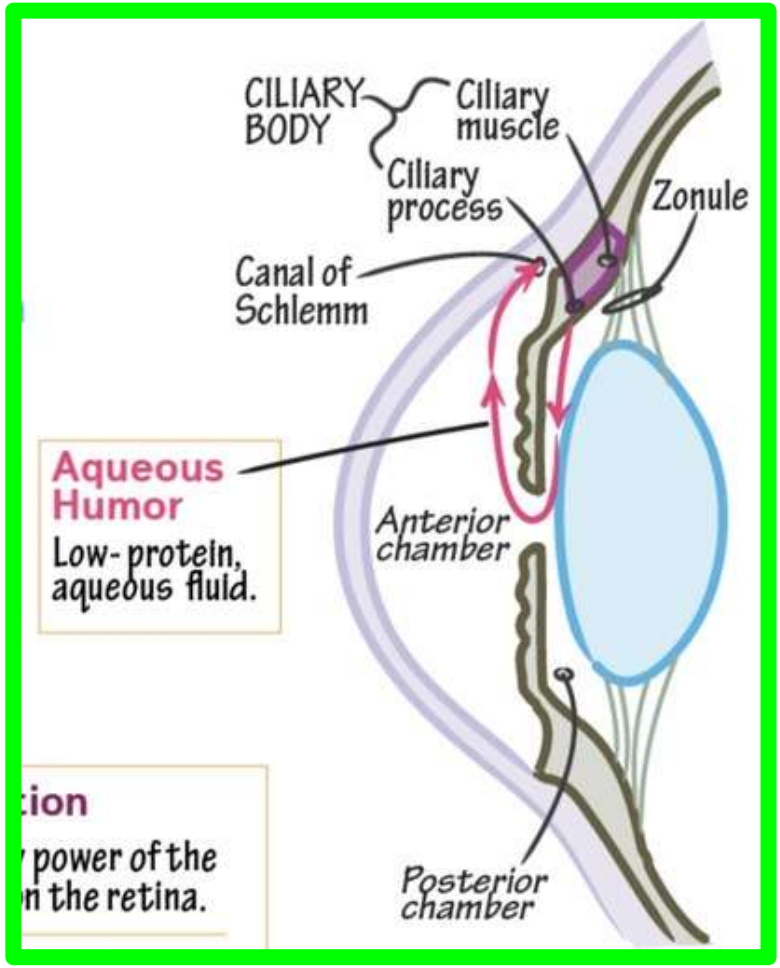
✓*The contraction and relaxation of the circularly arranged smooth muscle of the ciliary body controls thickness, and therefore the focus, of the lens.*

2. VASCULAR LAYER OF EYEBALL

✓Folds on the internal surface of the ciliary body, the ciliary processes, secrete aqueous humor.

✓Aqueous humor fills the anterior segment of the eyeball, the interior of the eyeball anterior to the lens, suspensory ligament, and ciliary body .

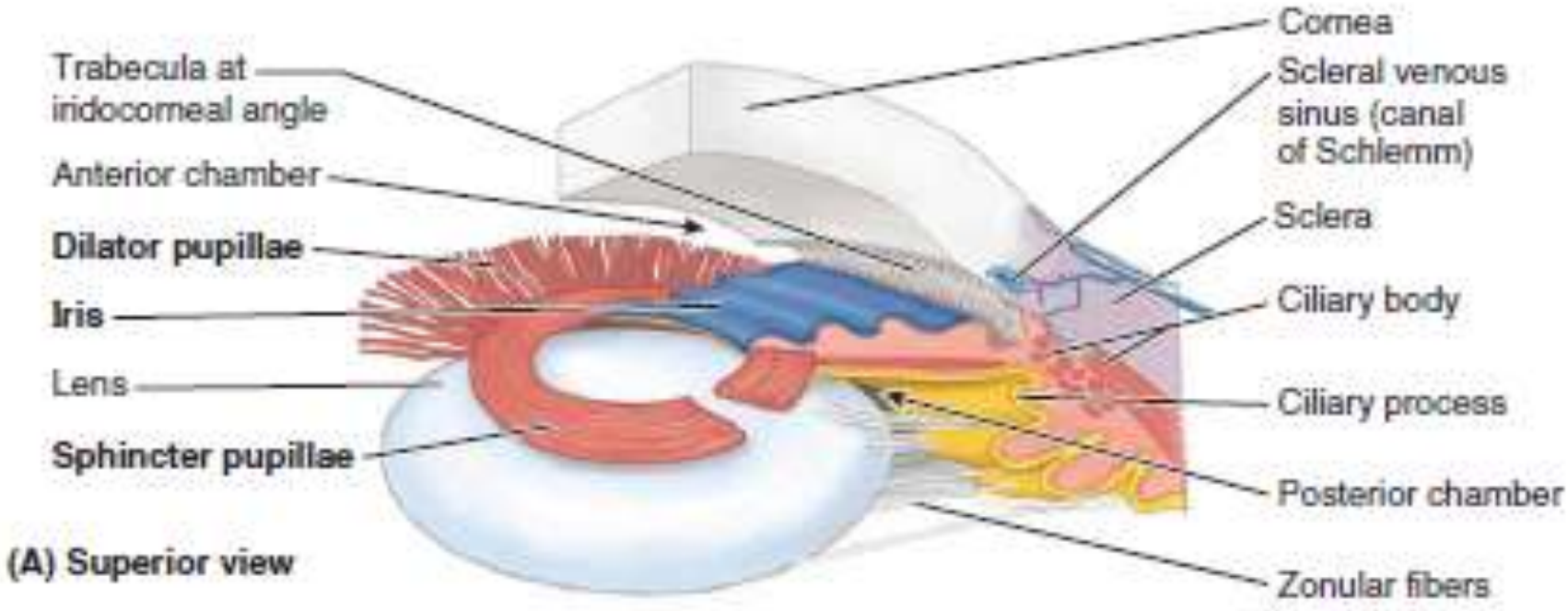




2. VASCULAR LAYER OF EYEBALL

***The iris**, which literally lies on the anterior surface of the lens, is a **thin contractile diaphragm** with a central aperture, **the pupil**, for transmitting light .*

When awake, the size of the pupil varies continually to regulate the amount of light entering the eye



2. VASCULAR LAYER OF EYEBALL

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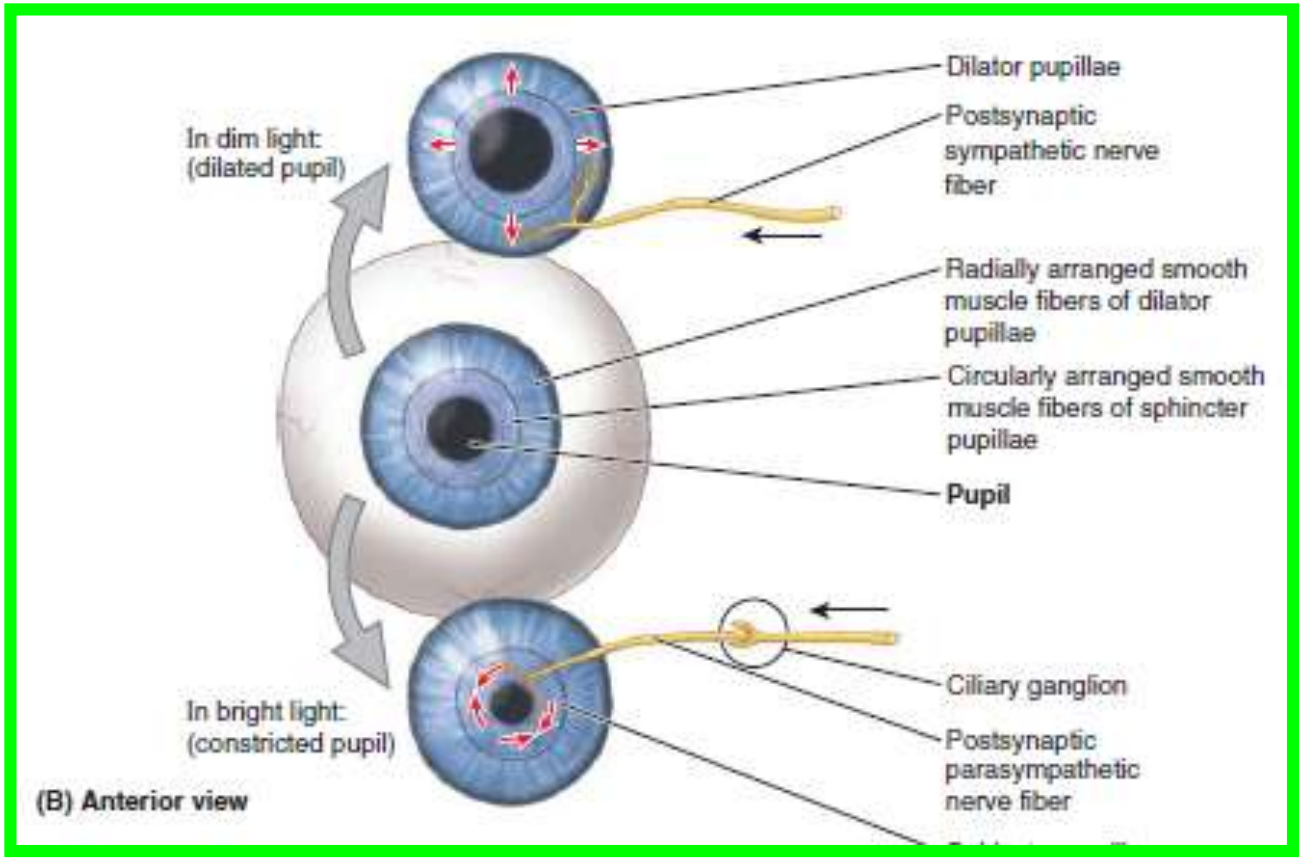
Two involuntary muscles control the size of the pupil:

- the parasympathetically stimulated, circularly arranged sphincter pupillae decreases its diameter (constrict or contracts the pupil, pupillary miosis)
- and the sympathetically stimulated, radially arranged dilator pupillae increases its diameter (dilates the pupil).

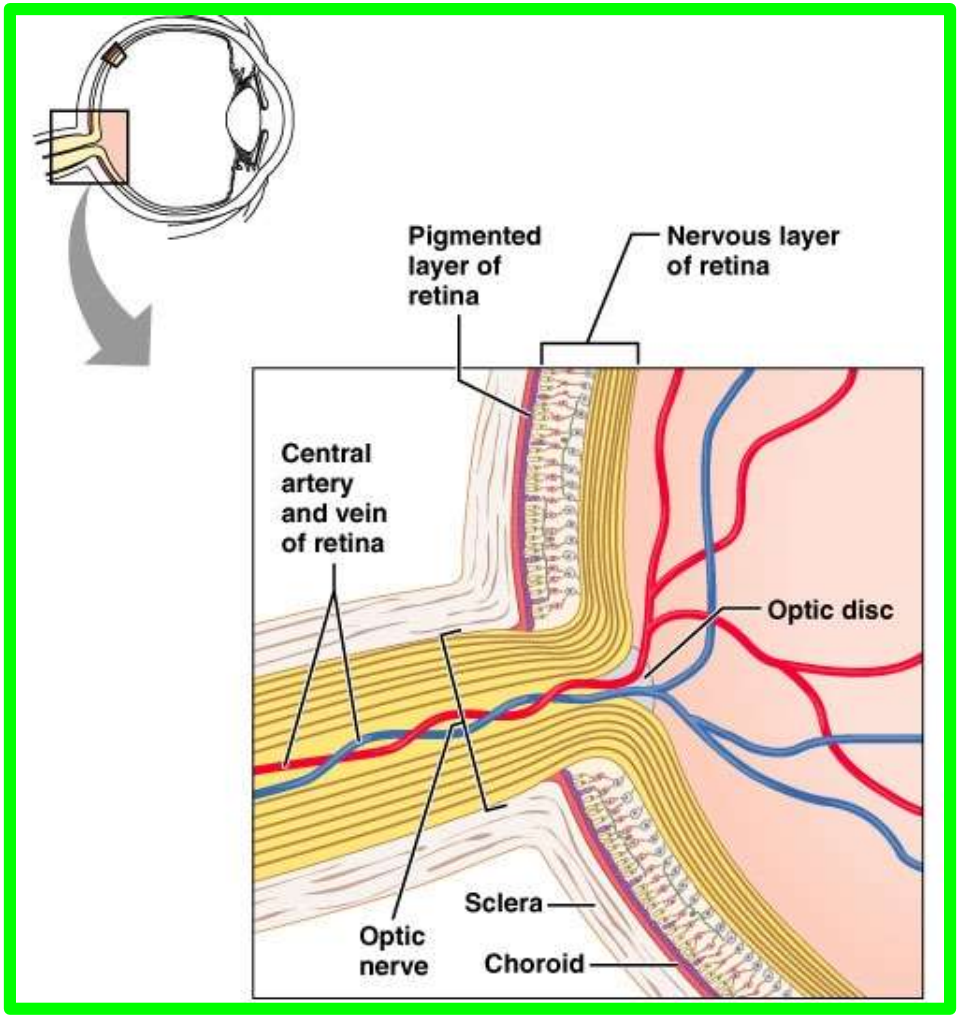


3. INNER LAYER OF EYEBALL

- ***The inner layer of the eyeball is the retina.***
- ***It consists grossly of two functional parts with distinct locations: the optic and nonvisual parts.***

✓ ***A. The optic part of the retina;***
is sensitive to visual light rays and has two layers:

a neural layer and pigmented layer.



3. INNER LAYER OF EYEBALL

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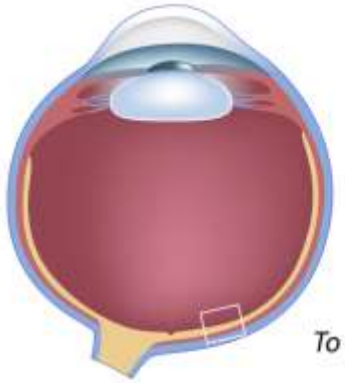
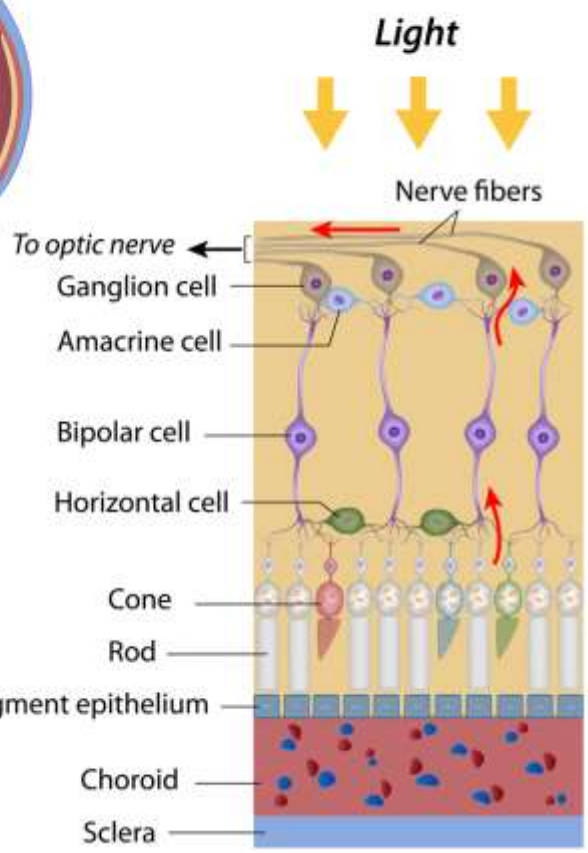
The neural layer *is light receptive.*

The pigmented layer *consists of a single layer of cells that reinforces the light-absorbing property of the choroid in reducing the scattering of light in the eyeball*



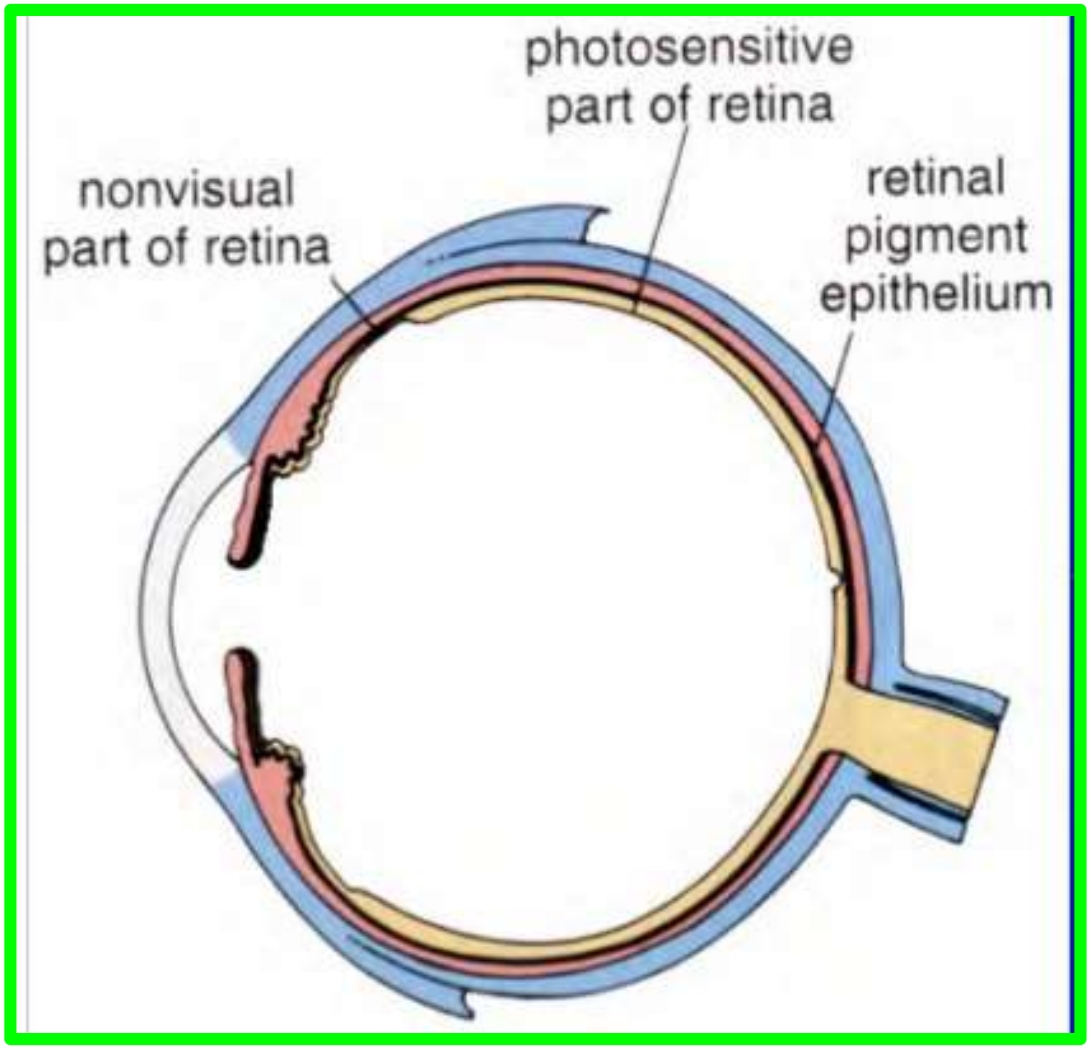
Structure of the Retina



3. INNER LAYER OF EYEBALL

- ✓ ***B. The nonvisual retina** is an anterior continuation of the pigmented layer and a layer of supporting cells.*

***The nonvisual retina** extends over **the ciliary body** (ciliary part of the retina) and the posterior surface of **the iris** (iridial part of the retina) to the pupillary margin*



3. INNER LAYER OF EYEBALL

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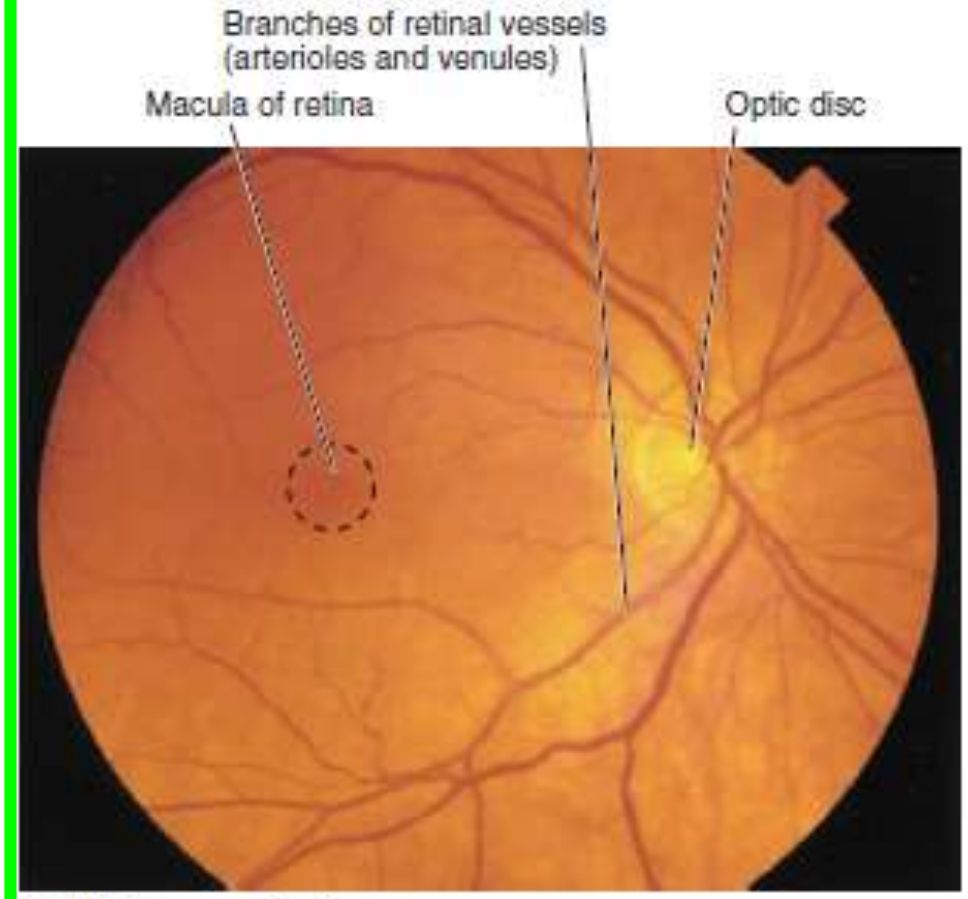
Clinically, the internal aspect of the posterior part of the eyeball, where light entering the eyeball is focused, is referred to as the fundus of the eyeball (ocular fundus).

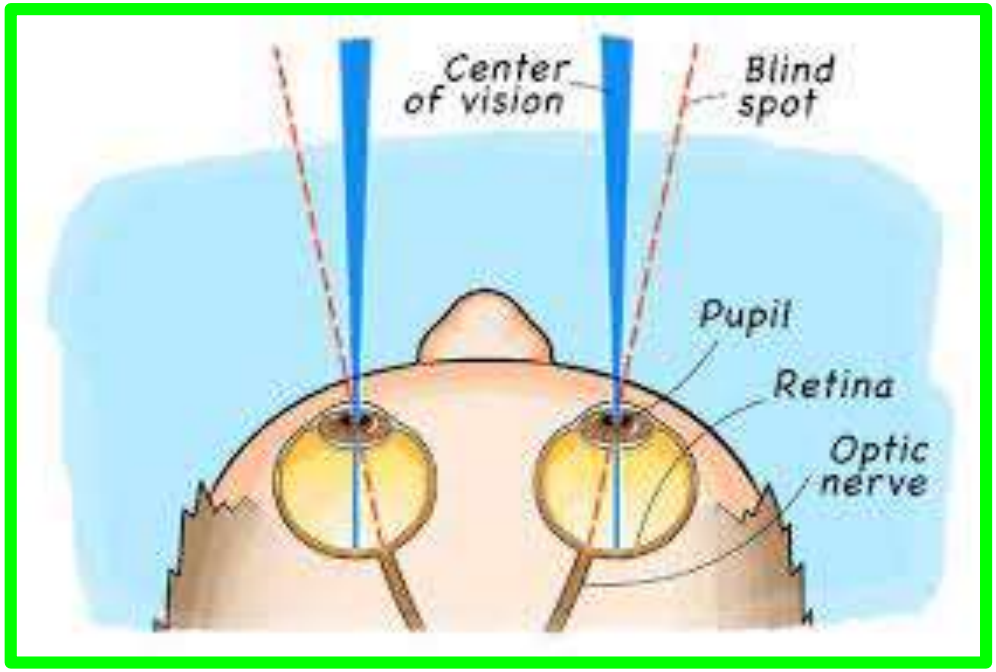
The retina of the fundus includes a distinctive circular area, the optic disc (optic papilla), where the sensory fibers and vessels conveyed by the optic nerve (CN II) enter and radiate to the eyeball.

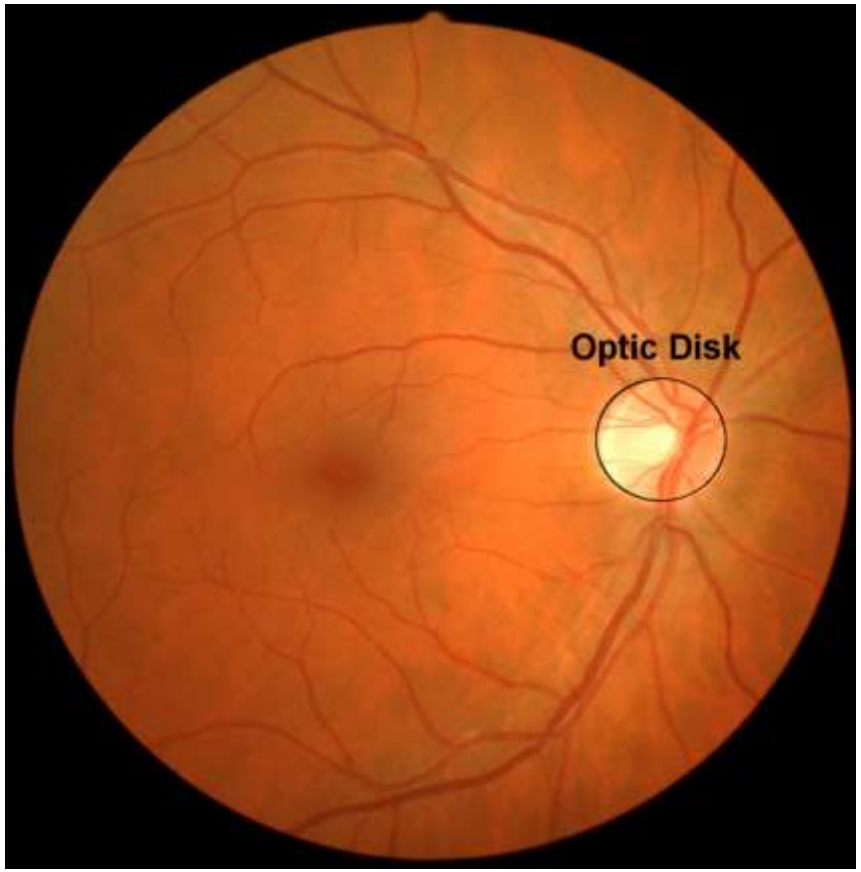


Ophthalmoscopic view

3. INNER LAYER OF EYEBALL

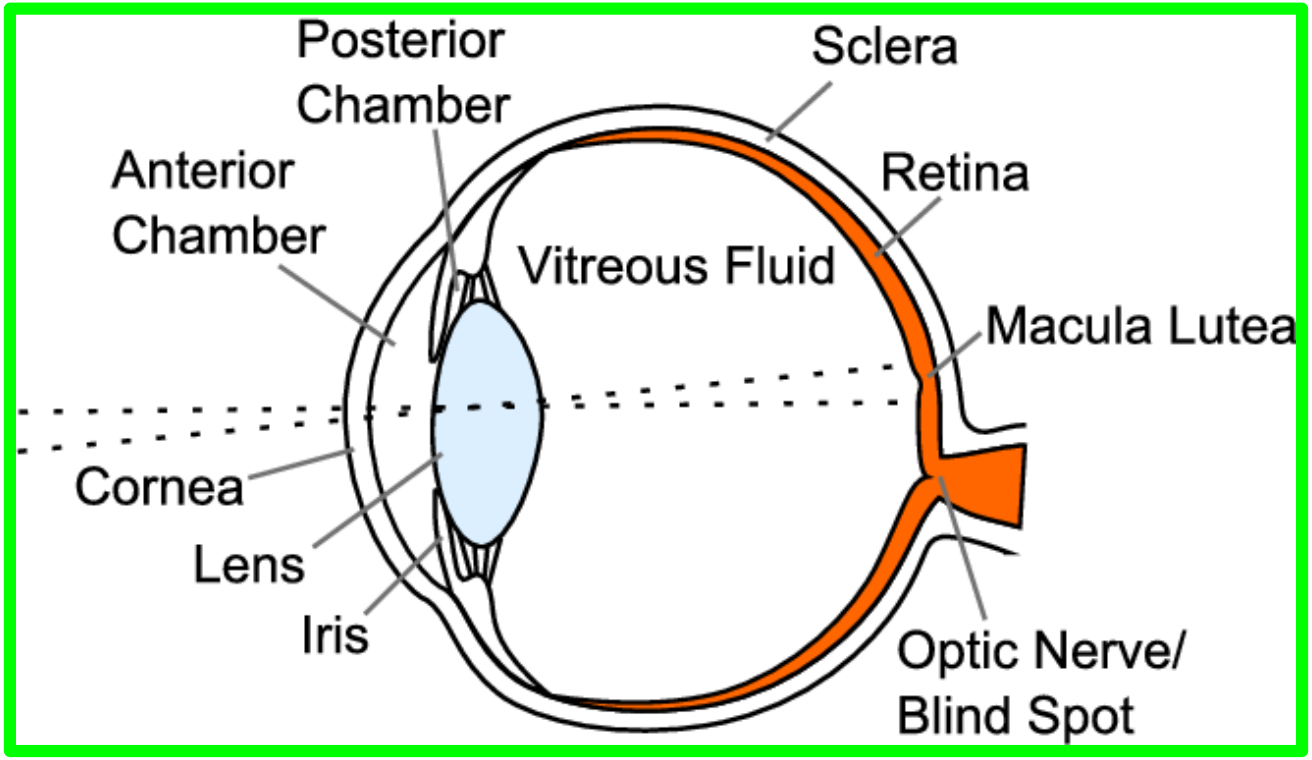
Because it contains no photoreceptors, the optic disc is insensitive to light. Hence, it is commonly called the blind spot.





3. INNER LAYER OF EYEBALL

- *Just lateral to the optic disc is the macula of the retina or macula lutea (L. yellow spot). The yellow color of the macula is apparent only when the retina is examined with red-free light.*



- *The macula lutea is a small oval area of the retina with special photoreceptor cones that is specialized for acuity of vision.*
- *It is not normally observed with an ophthalmoscope*

3. INNER LAYER OF EYEBALL

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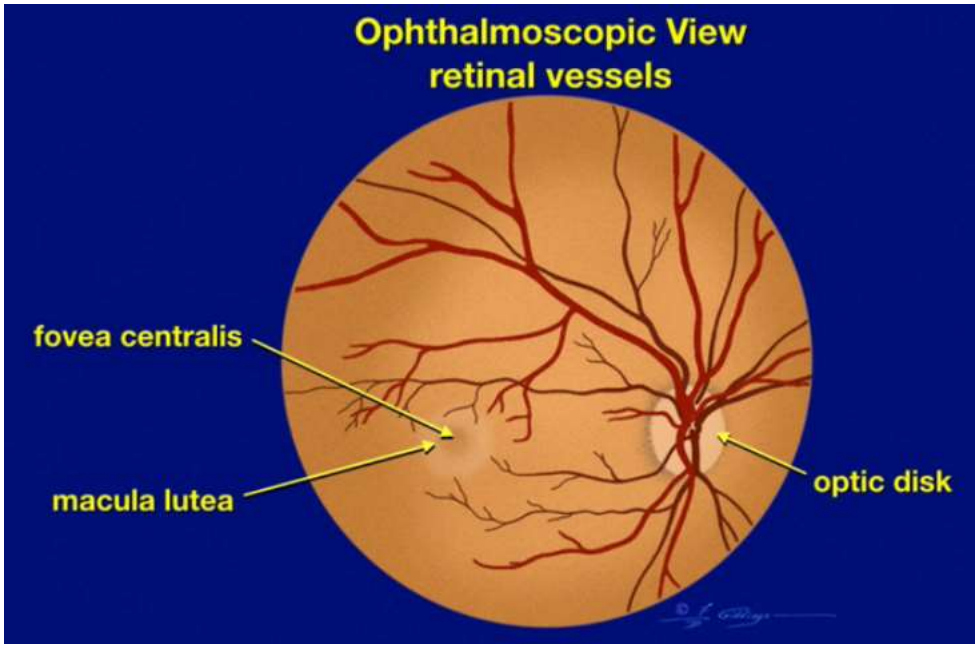
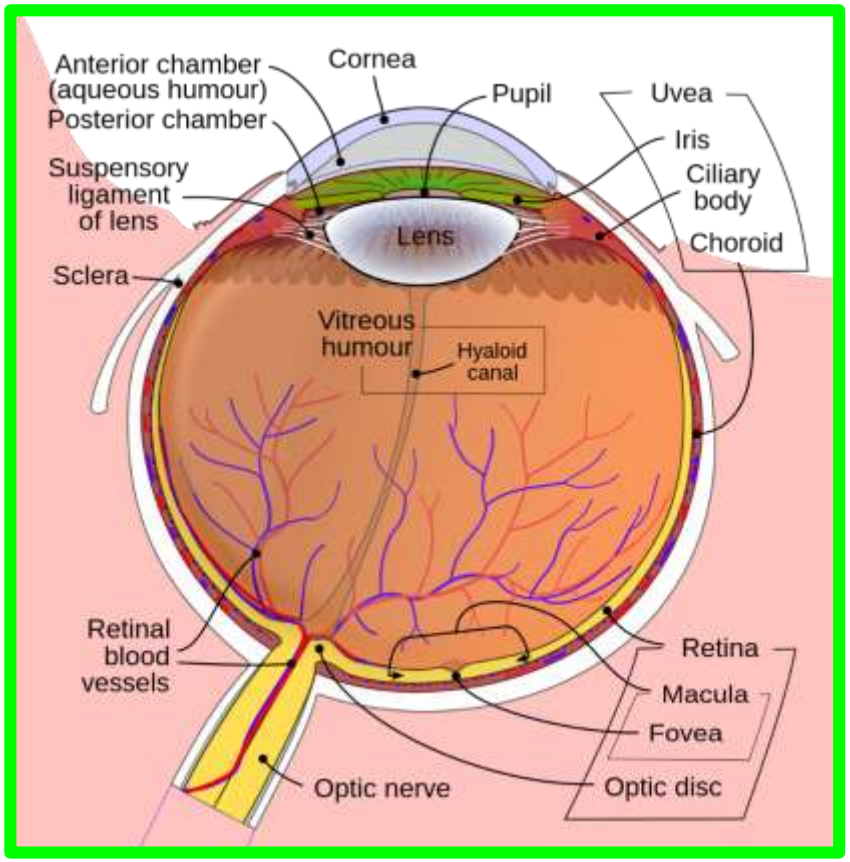
At the center of the macula lutea is a depression, the fovea centralis (L. central pit), the area of most acute vision.



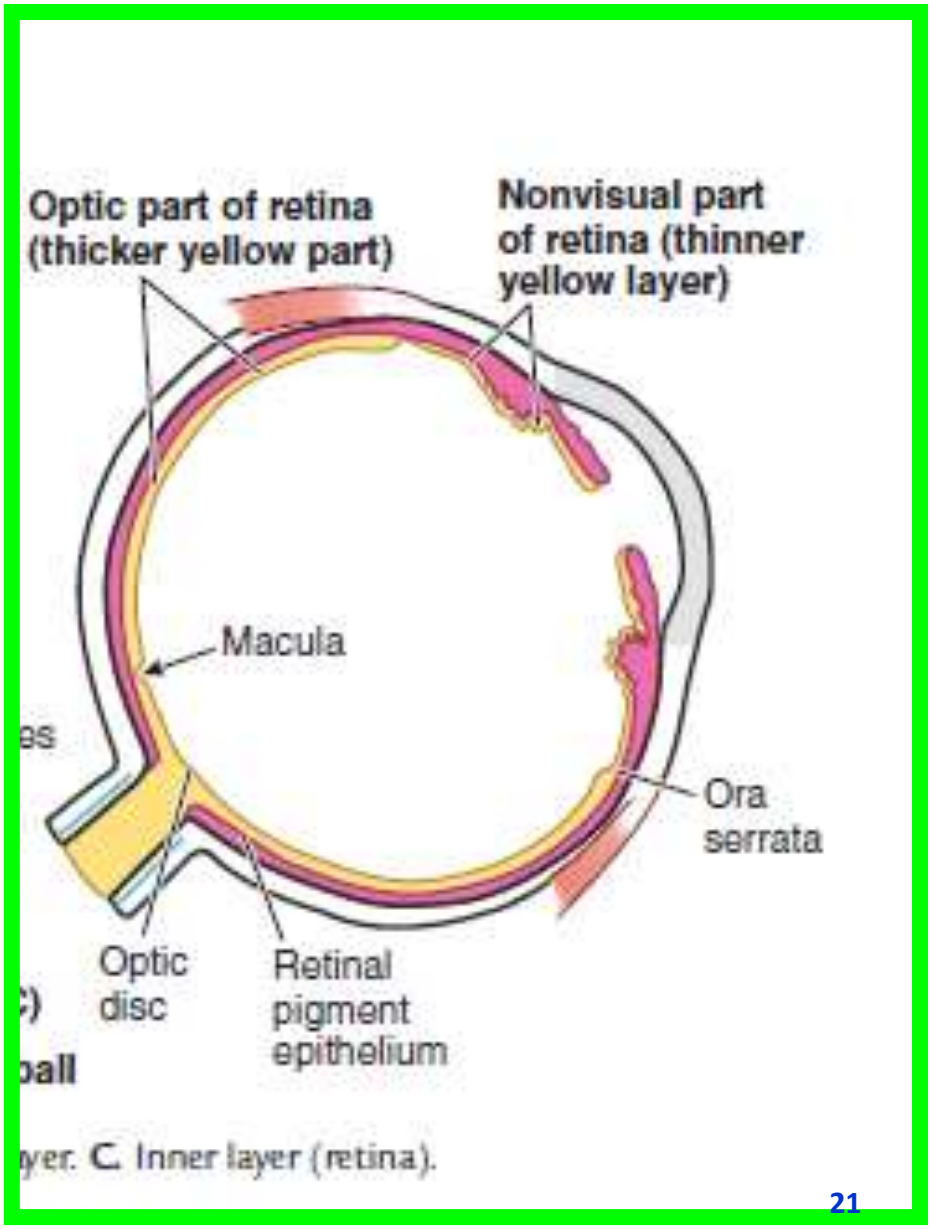


The fovea is approximately 1.5 mm in diameter; its center, the foveola, does not have the capillary network visible elsewhere deep to the retina.

3. INNER LAYER OF EYEBALL

The optic part of the retina *terminates anteriorly along* ***the ora serrata*** *(L. serrated edge), the irregular posterior border of the ciliary body*

Except for the cones and rods of its neural layer, the retina is supplied by ***the central retinal artery****, a branch of* ***the ophthalmic artery.***



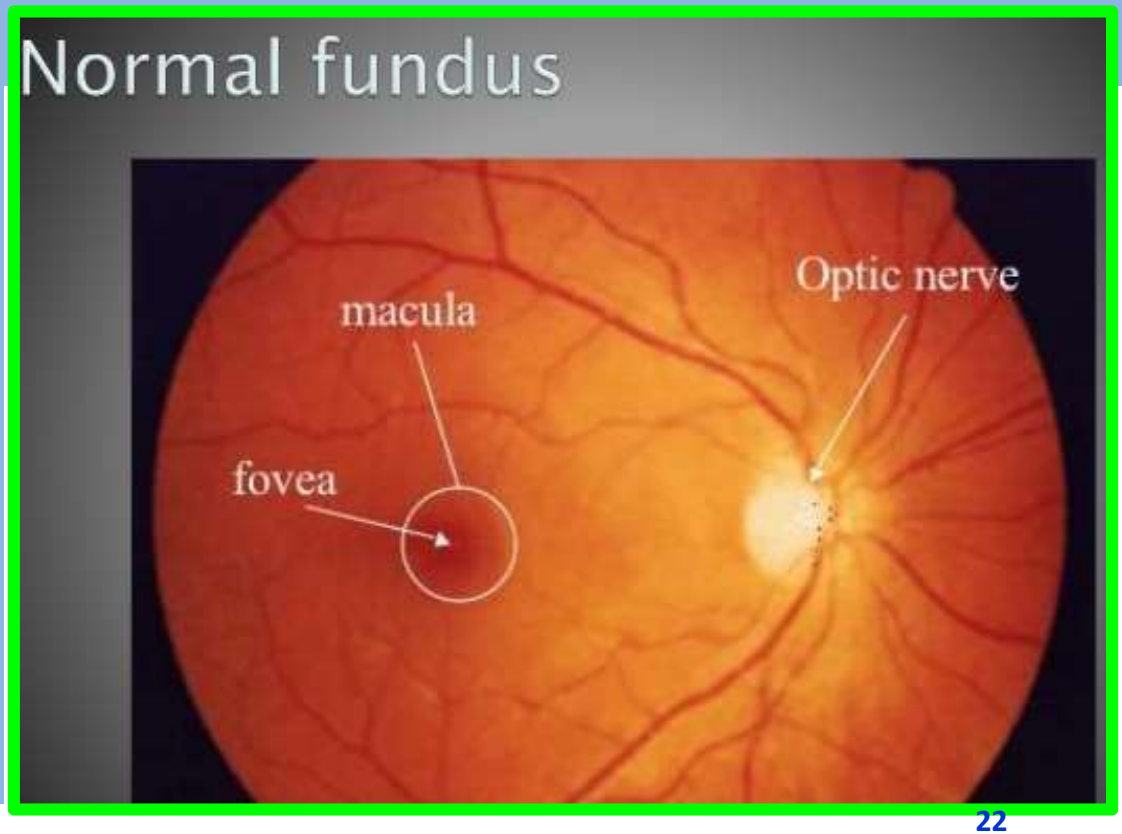
Ophthalmoscopy

Physicians view the fundus (inner surface of the posterior part) of the eye with an ophthalmoscope.

The retinal arteries and veins radiate over the fundus from the optic disc. The pale, oval optic disc appears on the medial side, with retinal vessels radiating from its center in the ophthalmoscopic view of the retina

Pulsation of the retinal arteries is usually visible.

Centrally, at the posterior pole of the eyeball, the macula lutea appears darker than the reddish hue of surrounding areas of the retina.



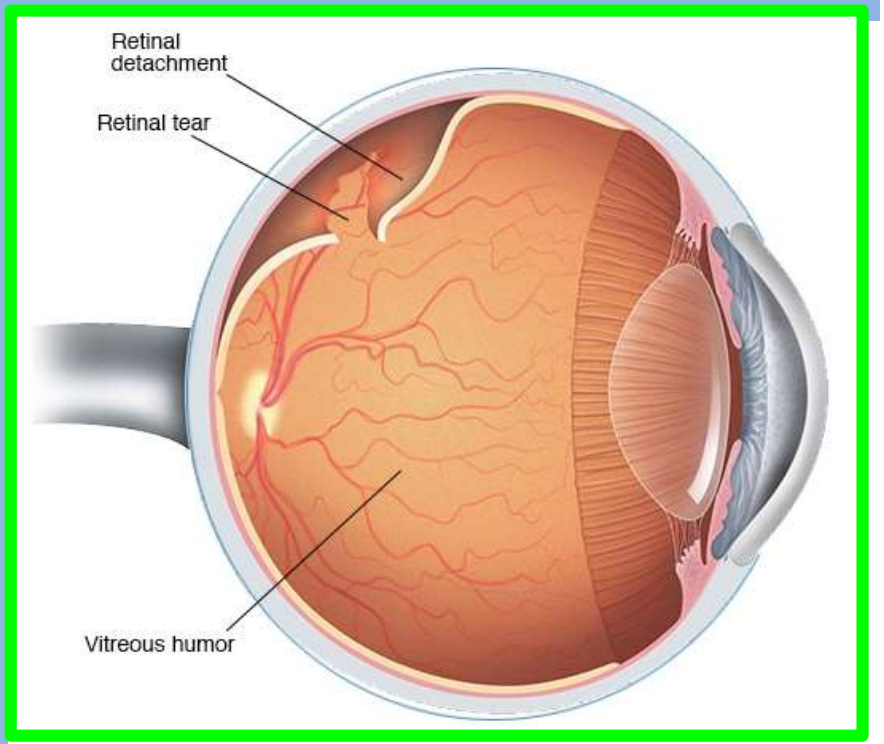
Detachment of Retina

The layers of the developing retina are separated in the embryo by an intraretinal space. During the early fetal period, the embryonic layers fuse, obliterating this space. Although the pigment cell layer becomes firmly fixed to the choroid, its attachment to the neural layer is not firm.

Consequently, detachment of the retina may follow a blow to the eye.

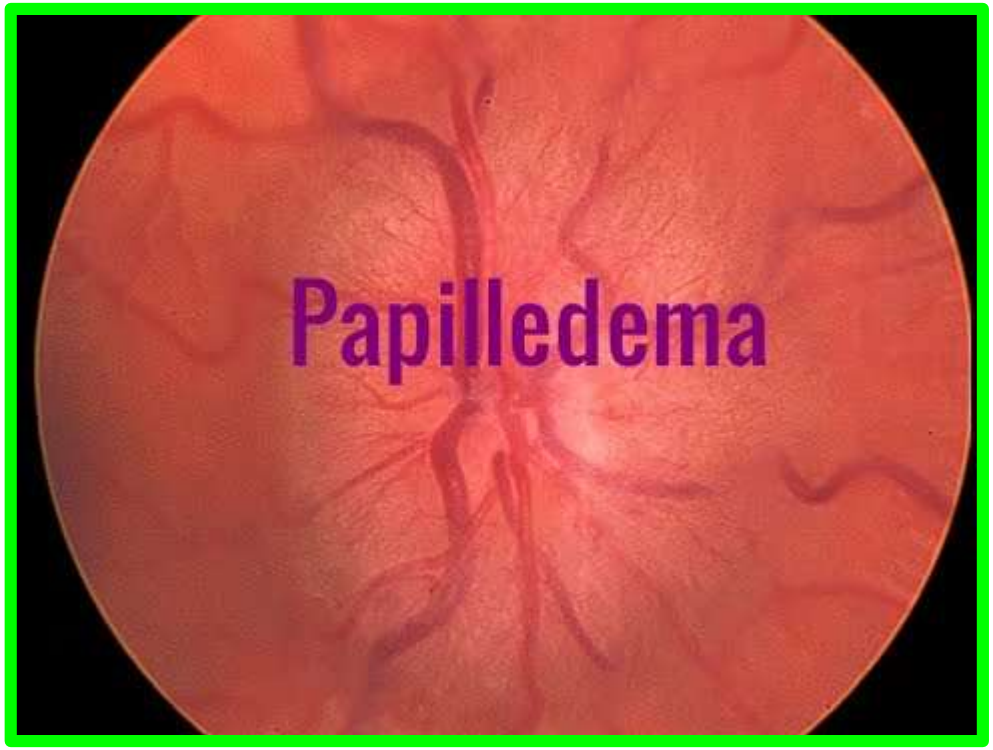
A detached retina usually results from seepage of fluid between the neural and pigmented layers of the retina, perhaps days or even weeks after trauma to the eye.

People with a retinal detachment may complain of flashes of light or specks floating in front of their eye.



Papilledema

An increase in CSF pressure slows venous return from the retina, causing edema of the retina (fluid accumulation). The edema is viewed during ophthalmoscopy as swelling of the optic disc, a condition called papilledema.



Eyeball

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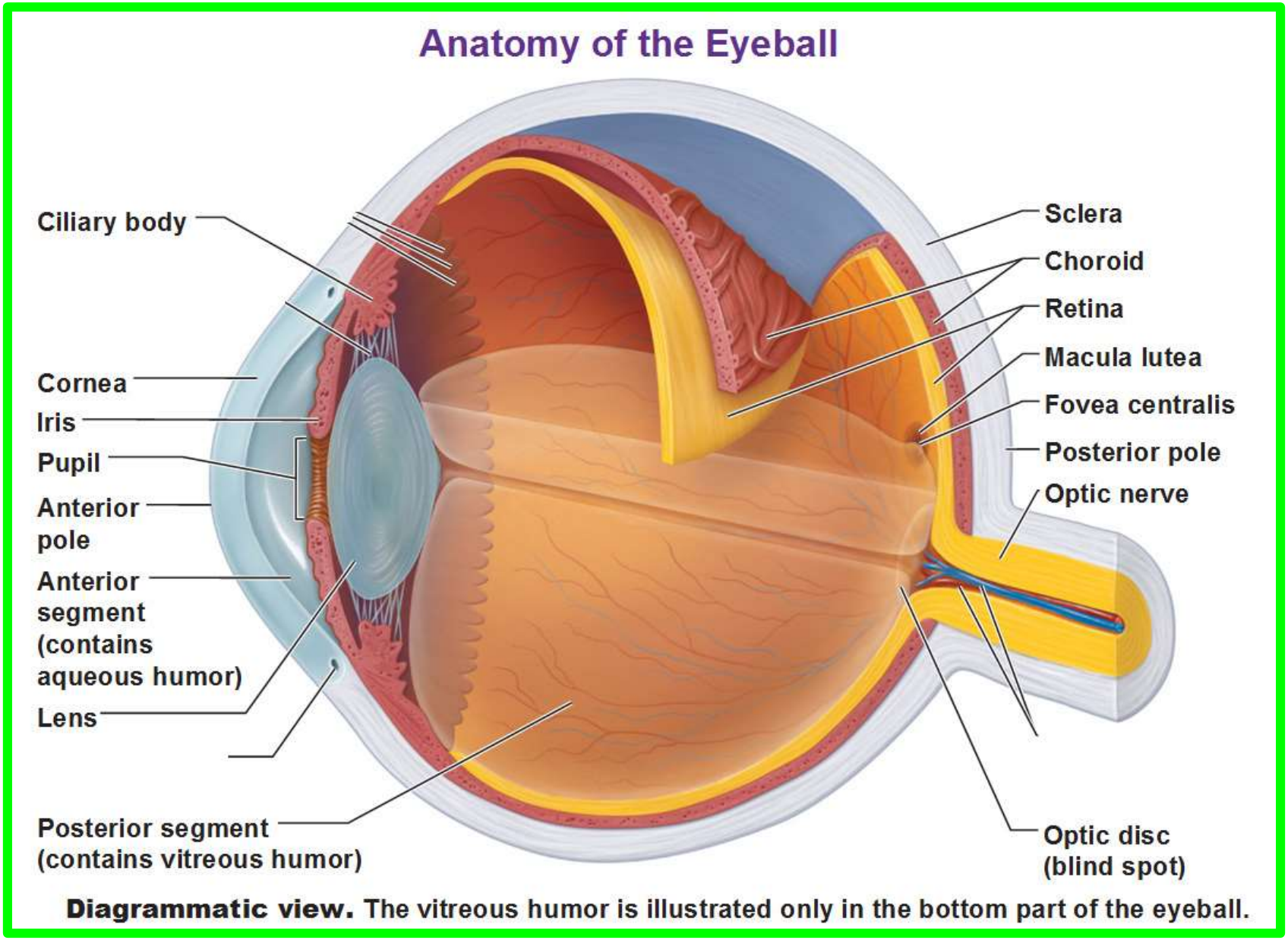

OPTIC NERVE (CRANIAL NERVE II)

Dr. Aiman Qais Afar

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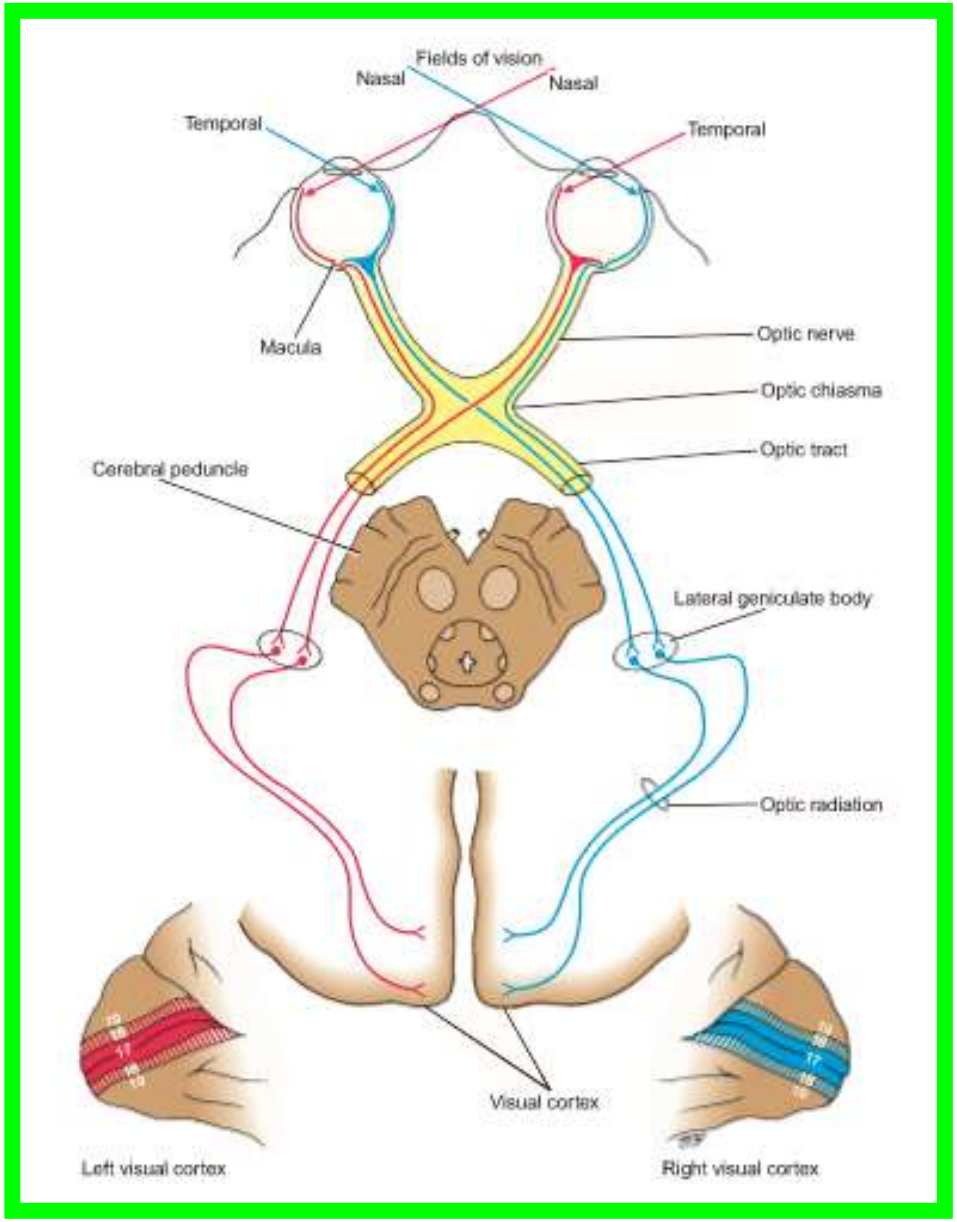
Origin of the Optic Nerve

✓The fibers of the optic nerve are the axons of the cells in the ganglionic layer of the retina.

✓They converge on the optic disc and exit from the eye, about 3 or 4 mm to the nasal side of its center, as the optic nerve

✓The optic nerve leaves the orbital cavity through the optic canal and unites with the optic nerve of the opposite side to form the optic chiasma.



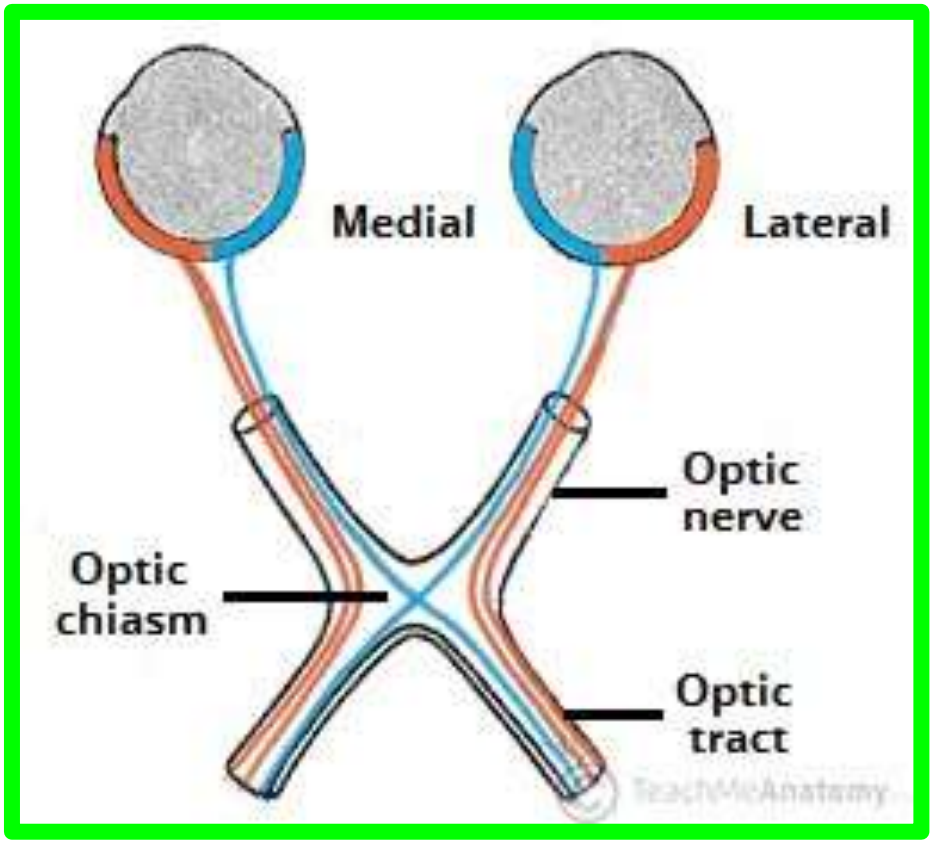
OPTIC NERVE (CRANIAL NERVE II)

Dr. Aiman Qais Afar

Optic Chiasma

❖*The optic chiasma is situated at the junction of the anterior wall and floor of the third ventricle.*

❖*Its anterolateral angles are continuous with the optic nerves, and the posterolateral angles are continuous with the optic tracts*



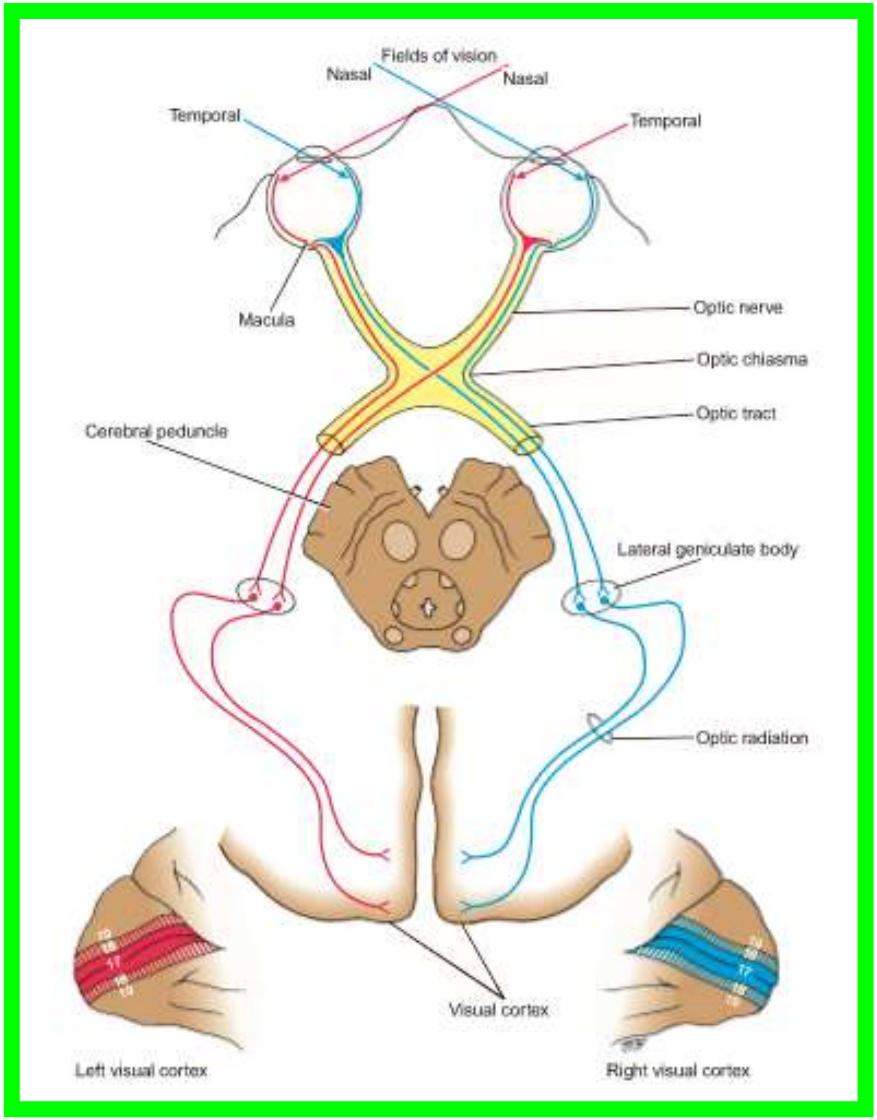
❖ *In the chiasma, the fibers from the nasal (medial) half of each retina, including the nasal half of the macula, cross the midline and enter the optic tract of the opposite side, while the fibers from the temporal (lateral) half of each retina, including the temporal half of the macula, pass posteriorly in the optic tract of the same side.*

OPTIC NERVE (CRANIAL NERVE II)

Optic Tract

✓The optic tract emerges from the optic chiasma and passes Posterolaterally around the cerebral peduncle.

✓Most of the fibers now terminate by synapsing with nerve cells in the lateral geniculate body, which is a small projection from the posterior part of the thalamus.(pulvinar)



✓A few of the fibers pass to the pretectal nucleus and the superior colliculus of the midbrain and are concerned with light reflexes

OPTIC NERVE (CRANIAL NERVE II)

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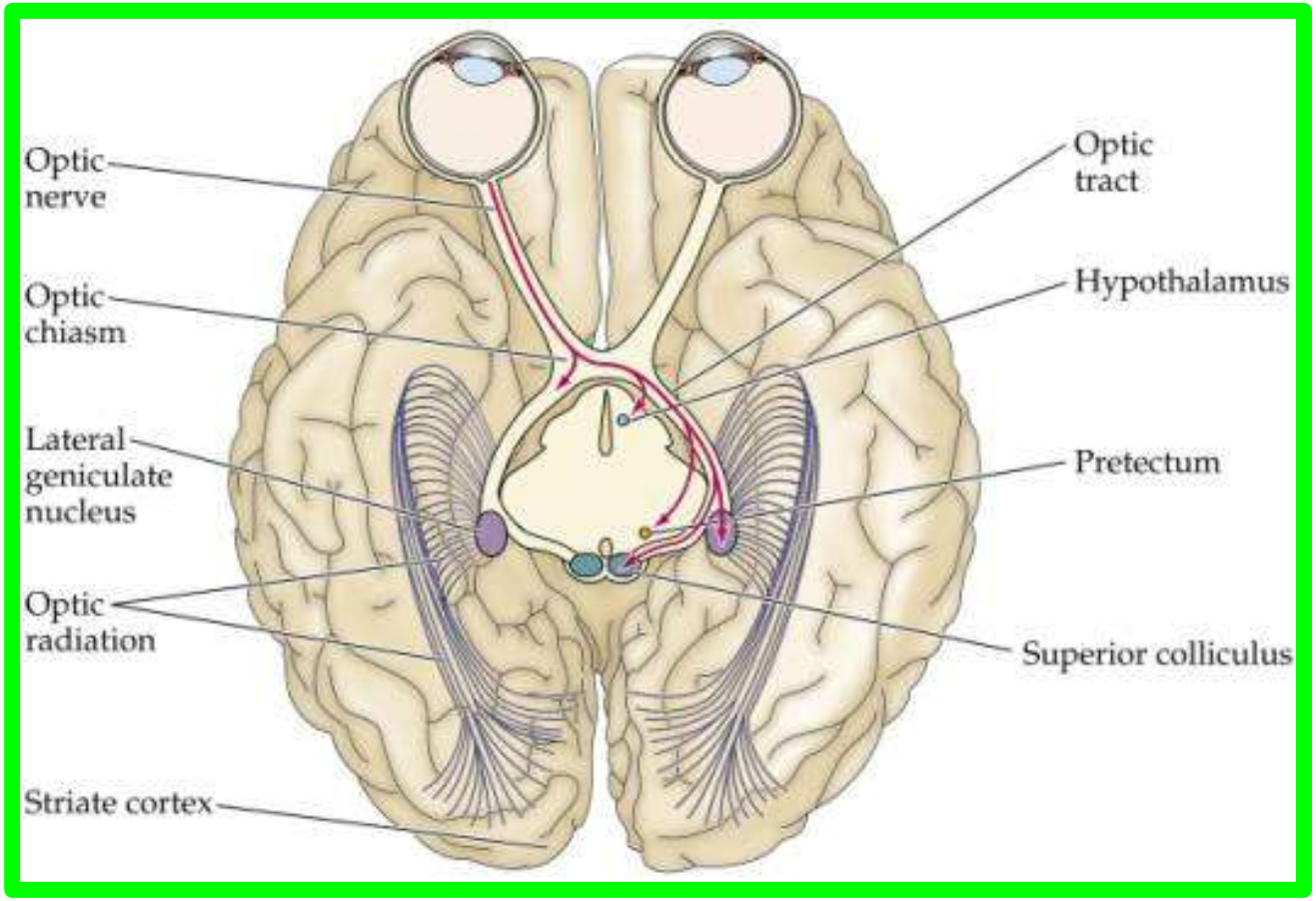
Lateral Geniculate Body

✓*The lateral geniculate body is a small, oval swelling projecting from the pulvinar of the thalamus.*



✓*It consists of six layers of cells, on which synapse the axons of the optic tract.*

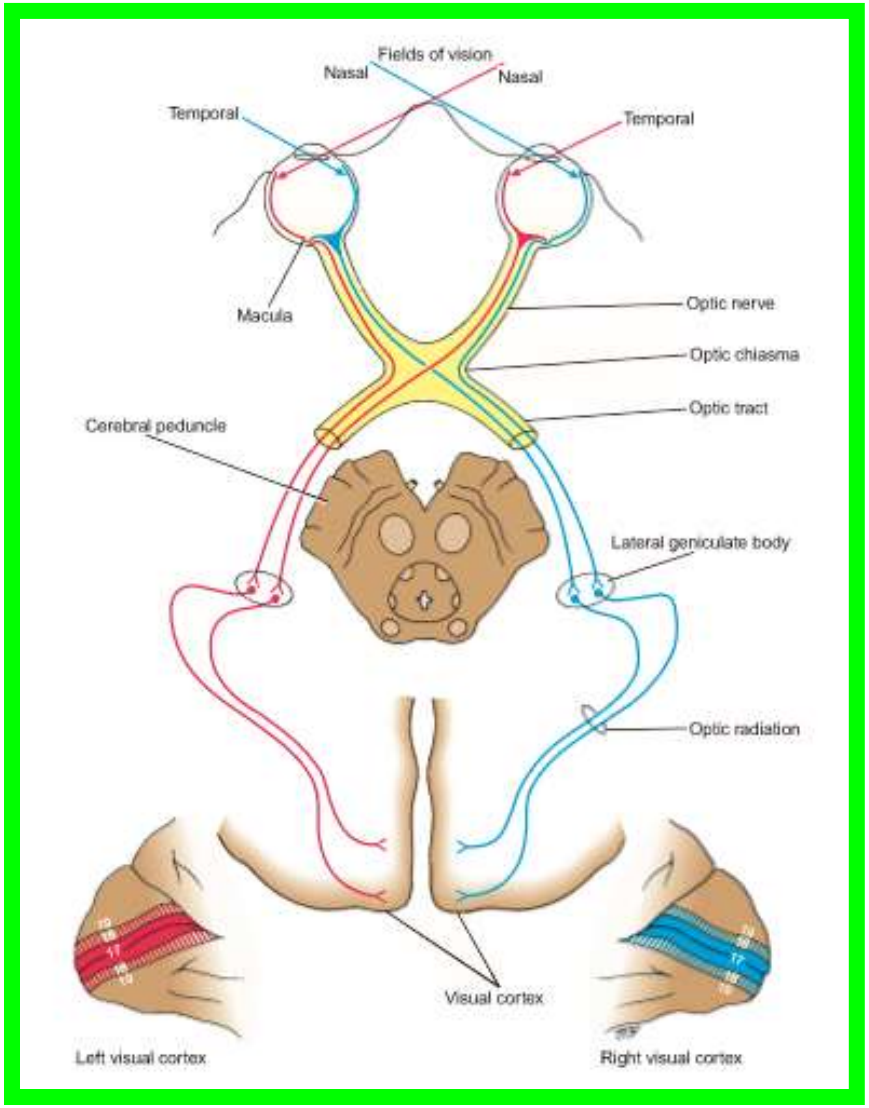
✓*The axons of the nerve cells within the geniculate body leave it to form the optic radiation*

OPTIC NERVE (CRANIAL NERVE II)

Optic Radiation

❑*The fibers of the optic radiation are the axons of the nerve cells of the lateral geniculate body.*

❑*The tract passes posteriorly through the retrolenticular part of the internal capsule and terminates in the visual cortex (area 17), which occupies the upper and lower lips of the calcarine sulcus on the medial surface of the cerebral hemisphere*



❑*The visual association cortex (areas 18 and 19) is responsible for recognition of objects and perception of color.*

Neurons of the Visual Pathway and Binocular Vision

Four neurons conduct visual impulses to the visual cortex:

(1) rods and cones, which are specialized receptor neurons in the retina;

(2) bipolar neurons, which connect the rods and cones to the ganglion cells;

(3) ganglion cells, whose axons pass to the lateral geniculate body; and

(4) neurons of the lateral geniculate body, whose axons pass to the cerebral cortex.

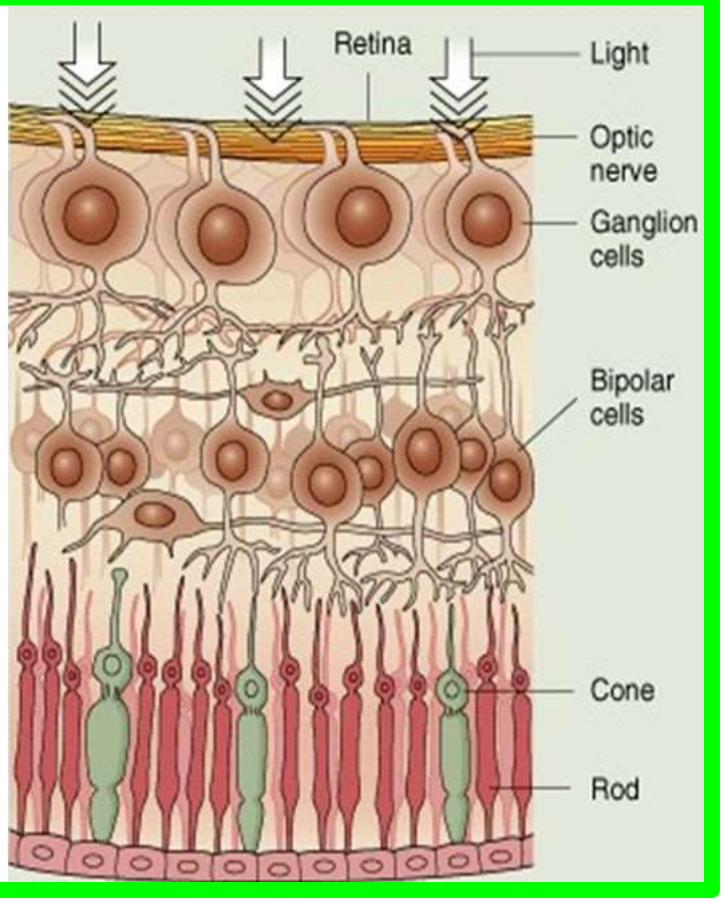
Visual Pathway

Photoreceptors:

Rods & Cones of retina

3 neuron pathway

- **1st order neurons:**
  Bipolar cells of retina.
- **2nd order neurons:**
  Ganglion cells of retina. Their axons form the **optic nerve**
- **3rd order neurons:**
  Neurons in the lateral geniculate body. Their axons terminate in **primary visual cortex.**

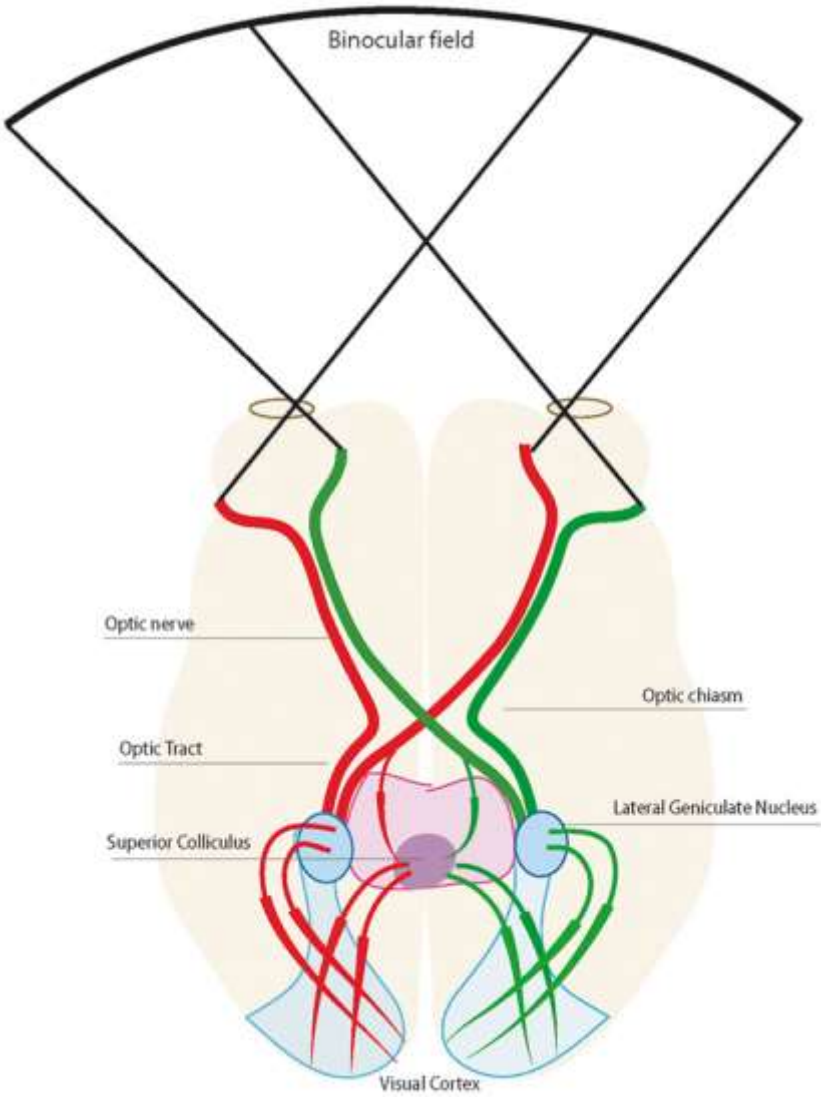


Neurons of the Visual Pathway and Binocular Vision

- ***In binocular vision**, the right and left fields of vision are projected on portions of both retinae*

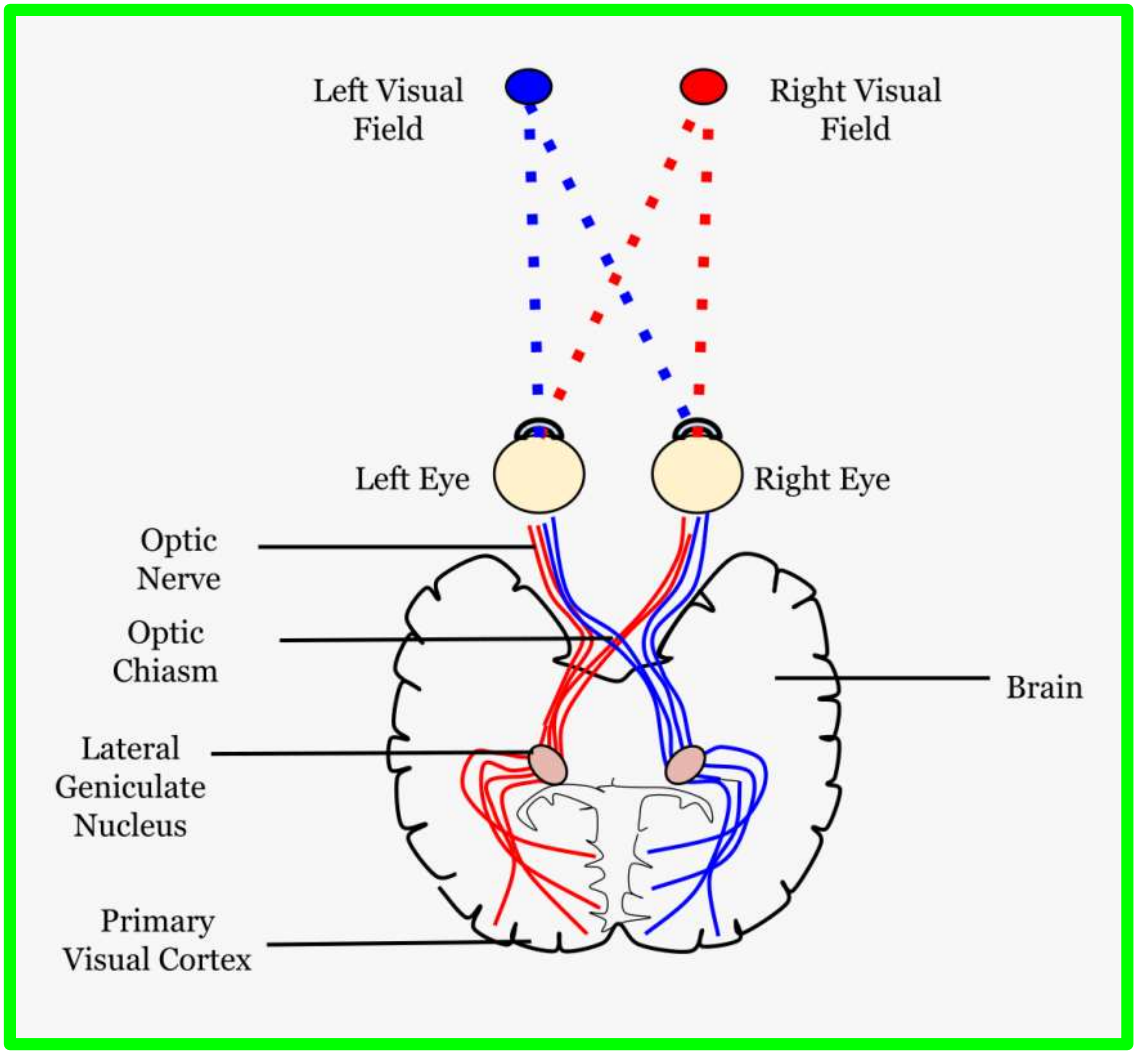
- ***The image of an object in the right field of vision is projected on the nasal half of the right retina and the temporal half of the left retina.***

- ***In the optic chiasma, the axons from these two retinal halves are combined to form the left optic tract***



Neurons of the Visual Pathway and Binocular Vision

- *The lateral geniculate body neurons* now project the complete *right field of vision* on the *visual cortex of the left hemisphere* and the *left visual field* on the *visual cortex of the right hemisphere*



Neurons of the Visual Pathway and Binocular Vision

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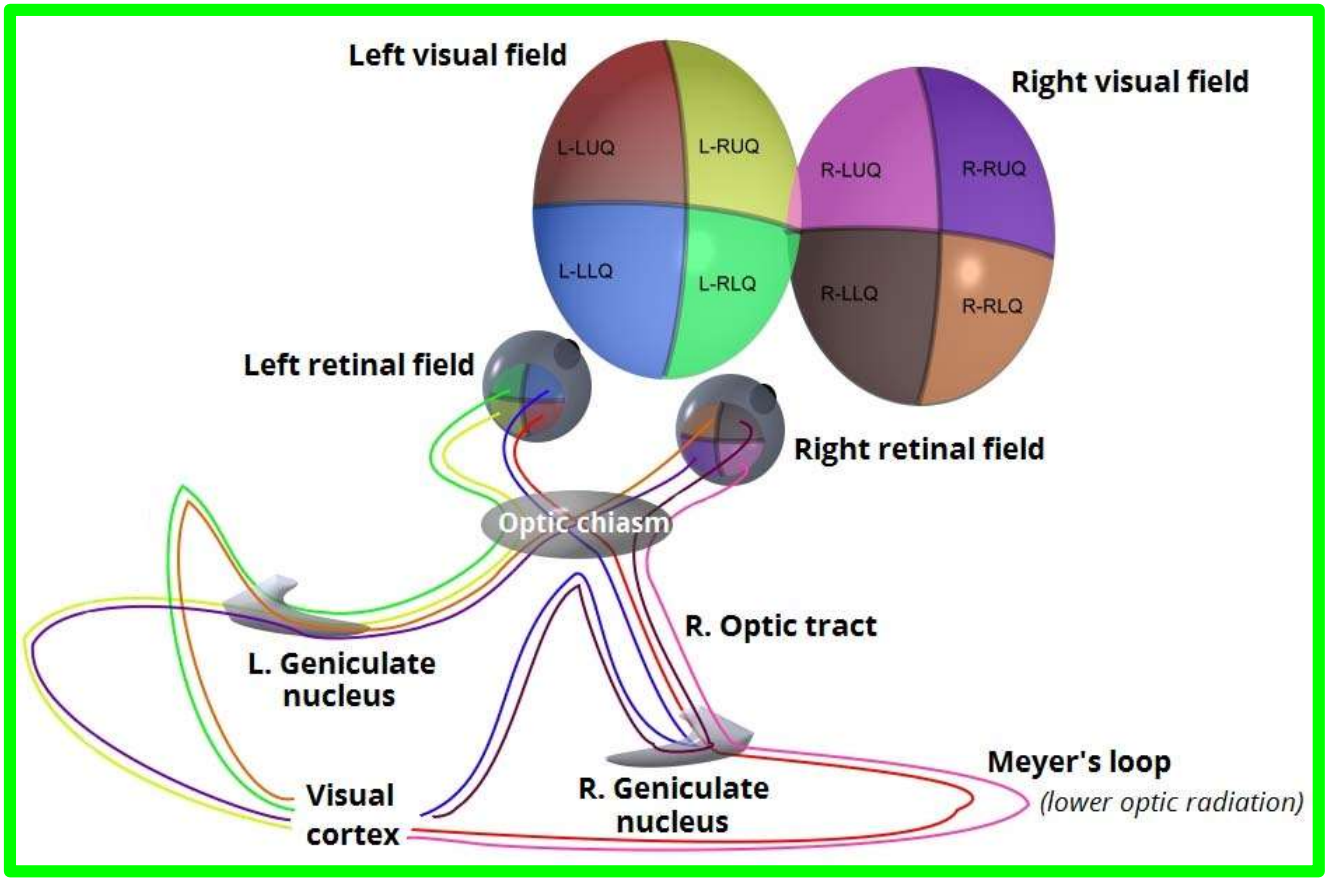
❑*The lower retinal quadrants (upper field of vision) project on the lower wall of the calcarine sulcus, while the upper retinal quadrants (lower field of vision) project on the upper wall of the sulcus.*



❑*Note also that the macula lutea is represented on the posterior part of area 17,and the periphery of the retina is represented anteriorly.*

1. Visual Reflexes

Dr. Aiman Qais Afar

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Direct and Consensual Light Reflexes

✓*If a light is shone into one eye, the pupils of both eyes normally constrict.*

✓*The constriction of the pupil on which the light is shone is called the direct light reflex; the constriction of the opposite pupil, even though no light fell on that eye, is called the consensual light reflex*

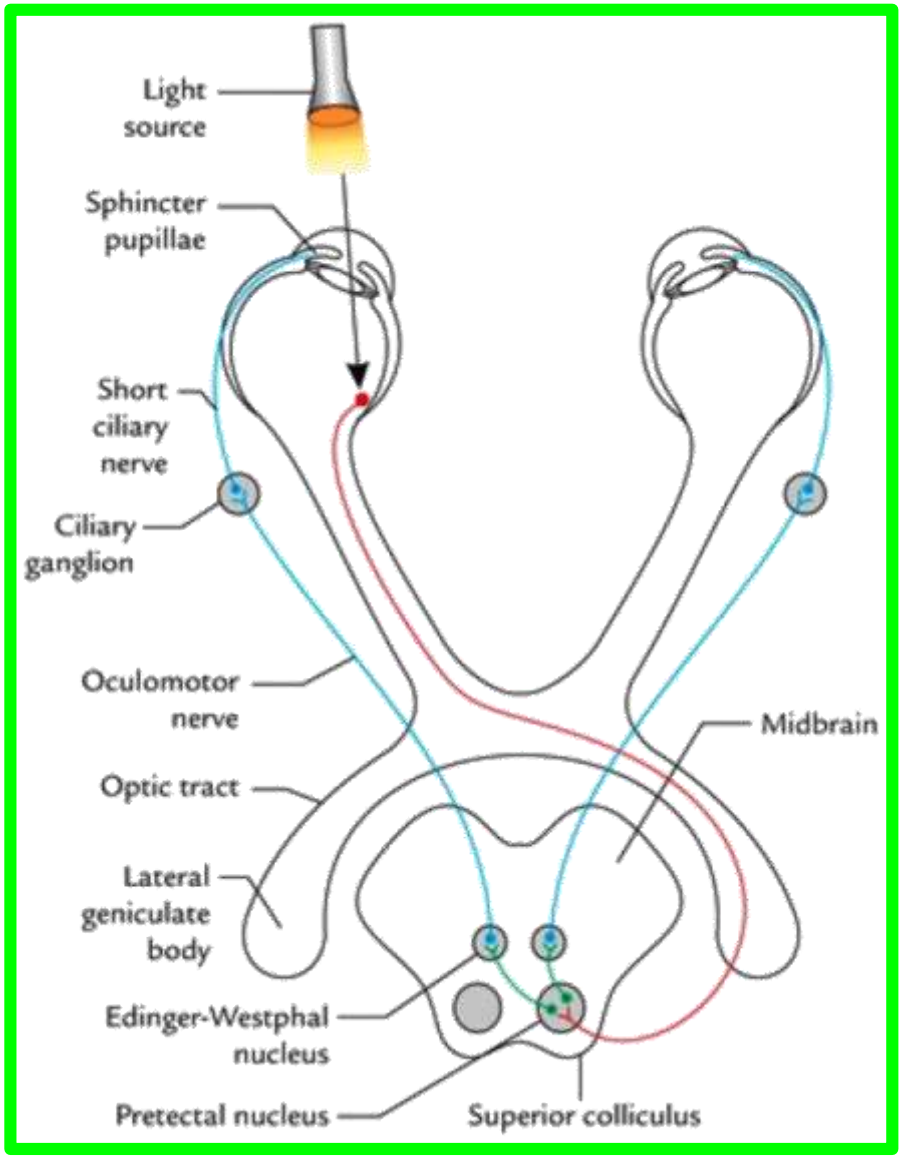
1. Visual Reflexes

Direct and Consensual Light Reflexes

✓*The afferent impulses travel through the optic nerve, optic chiasma, and optic tract*

✓*Here, a small number of fibers leave the optic tract and synapse on nerve cells in the pretectal nucleus, which lies close to the superior colliculus.*

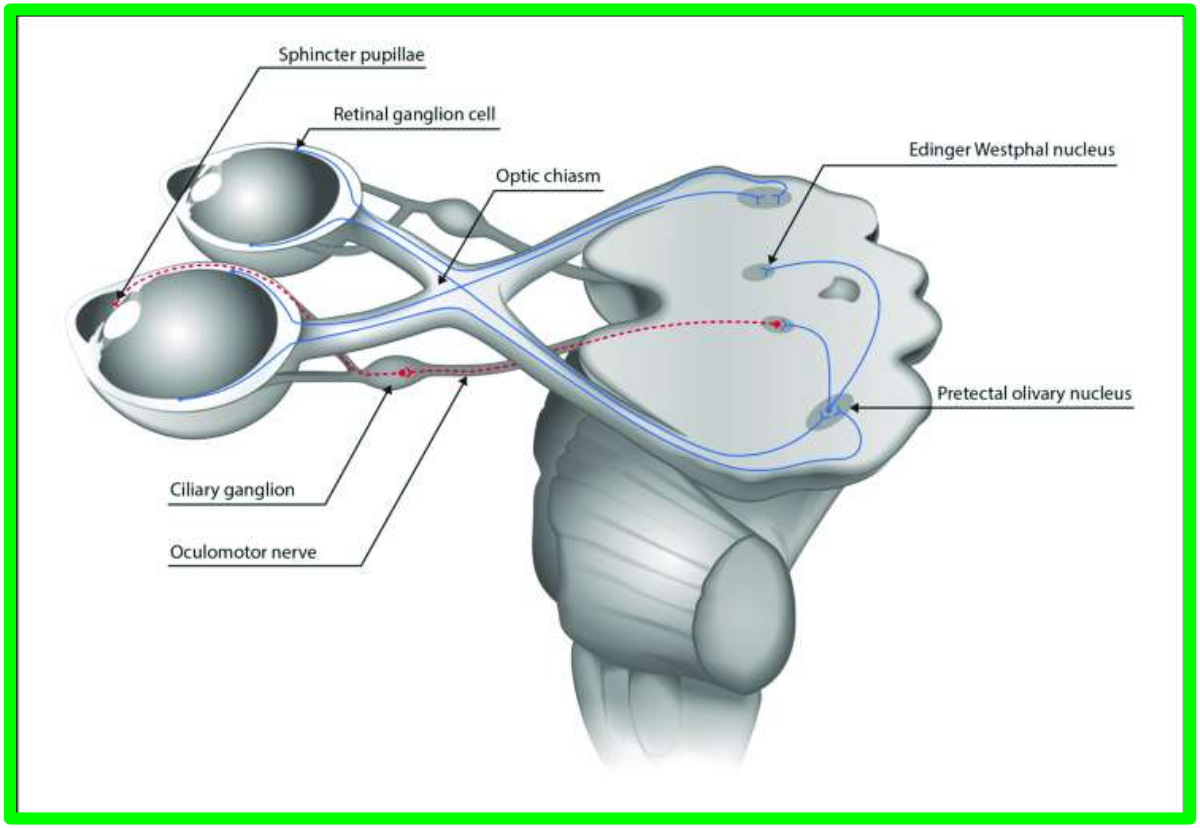
The impulses are passed by axons of the pretectal nerve cells to the parasympathetic nuclei (EdingerWestphal nuclei) of the third cranial nerve on both sides.



1. Visual Reflexes

Direct and Consensual Light Reflexes

Here, the fibers synapse and the parasympathetic nerves travel through the third cranial nerve to the ciliary ganglion in the orbit



Dr. Aiman Qais Afar

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✓Finally, postganglionic parasympathetic fibers pass through the short ciliary nerves to the eyeball and the constrictor pupillae muscle of the iris.

1. Visual Reflexes

Direct and Consensual Light Reflexes

✓*Both pupils constrict* in *the consensual light reflex* because the pretectal nucleus sends fibers *to the parasympathetic nuclei on both sides* of the midbrain

✓*The fibers that cross the median plane do so close to the cerebral aqueduct in the posterior commissure*

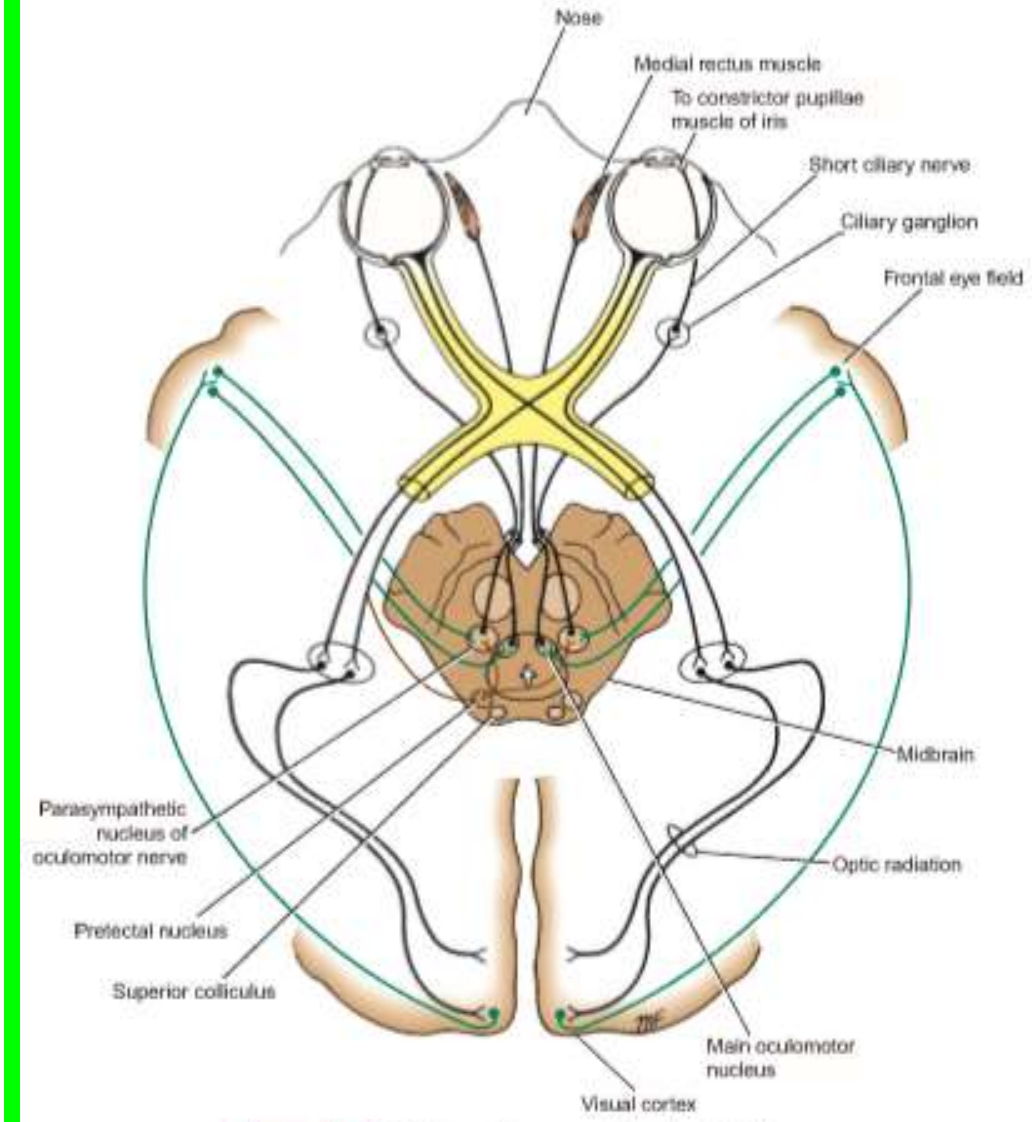

Figure 11-3 Optic pathway and the visual reflexes.

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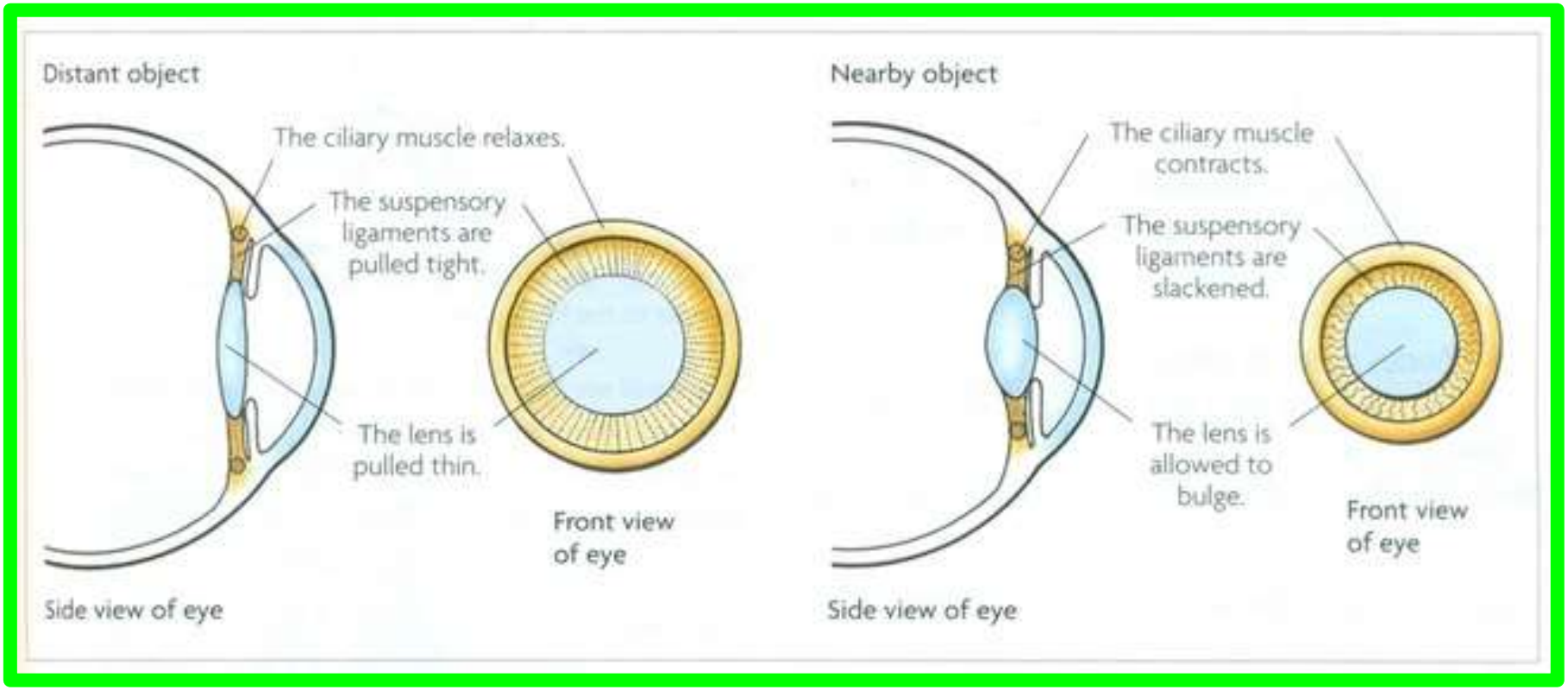
2. Accommodation Reflex

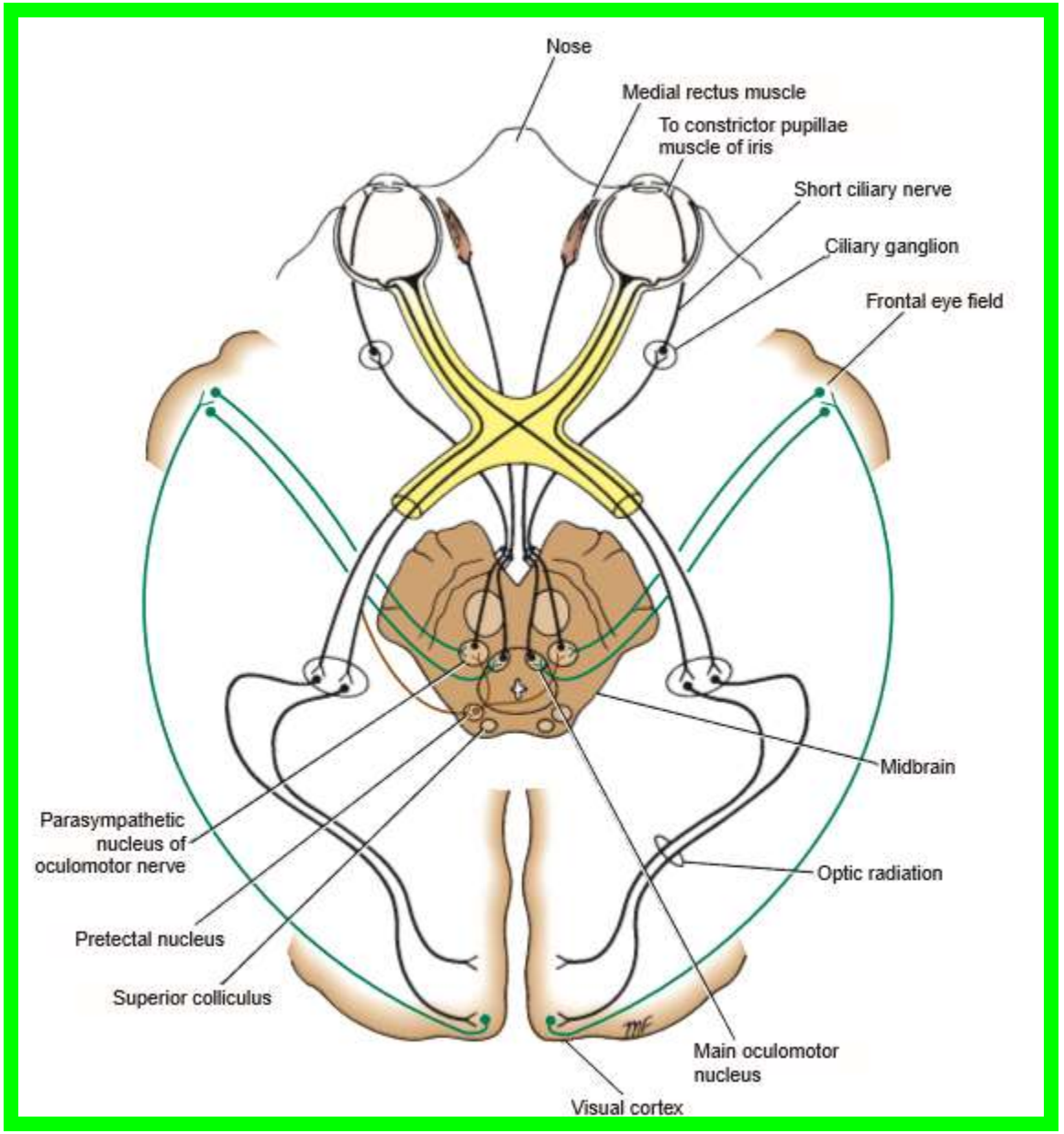
When the eyes are directed from a distant to a near object, contraction of the medial recti brings about convergence of the ocular axes; the lens thickens to increase its refractive power by contraction of the ciliary muscle; and the pupils constrict to restrict the light waves to the thickest central part of the lens.



2. Accommodation Reflex

The afferent impulses travel through the optic nerve, the optic chiasma, the optic tract, the lateral geniculate body, and the optic radiation to the visual cortex.

The visual cortex is connected to the eye field of the frontal cortex



2. Accommodation Reflex

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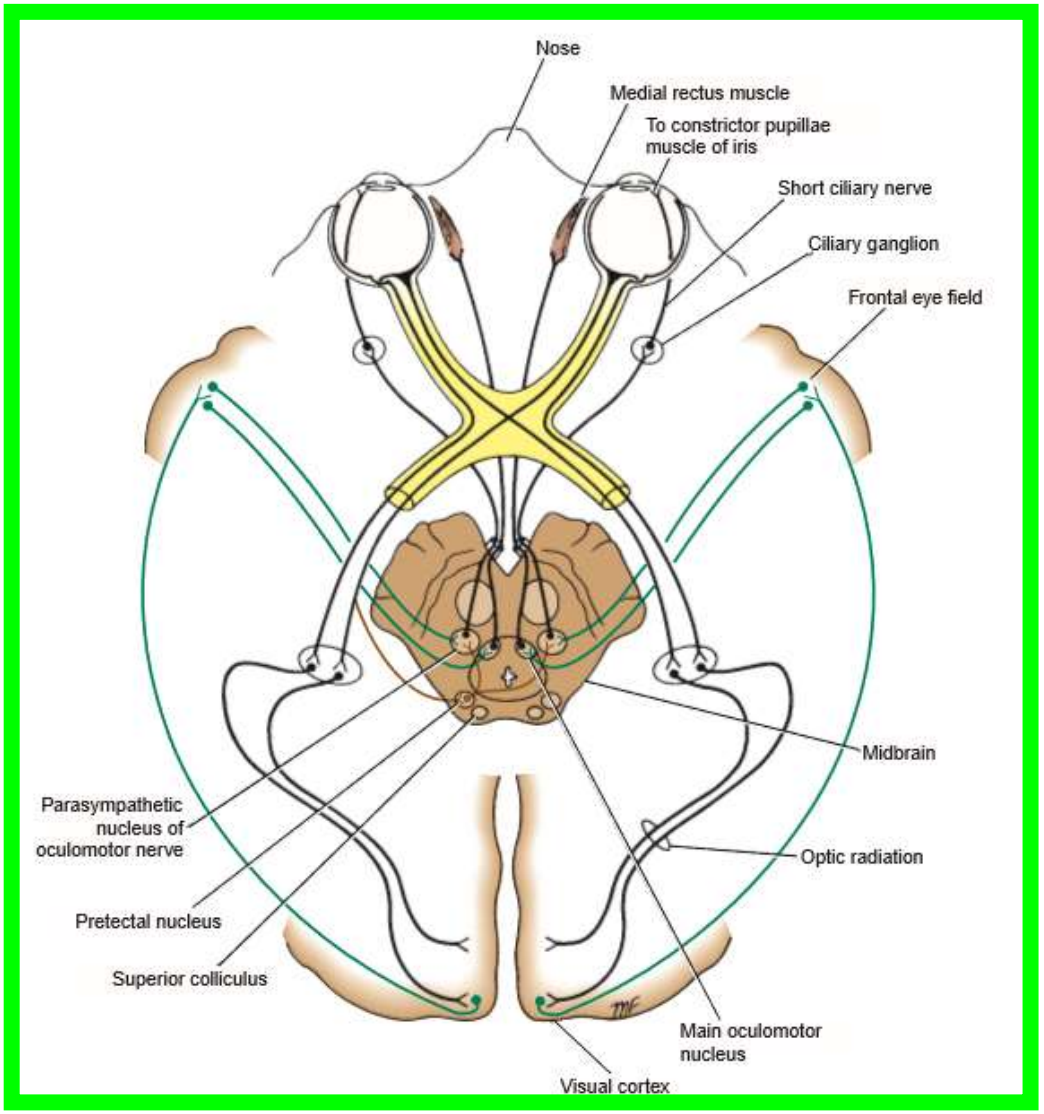
❑From here, cortical fibers descend through the internal capsule to the oculomotor nuclei in the midbrain.

❑ The oculomotor nerve travels to the medial recti muscles.

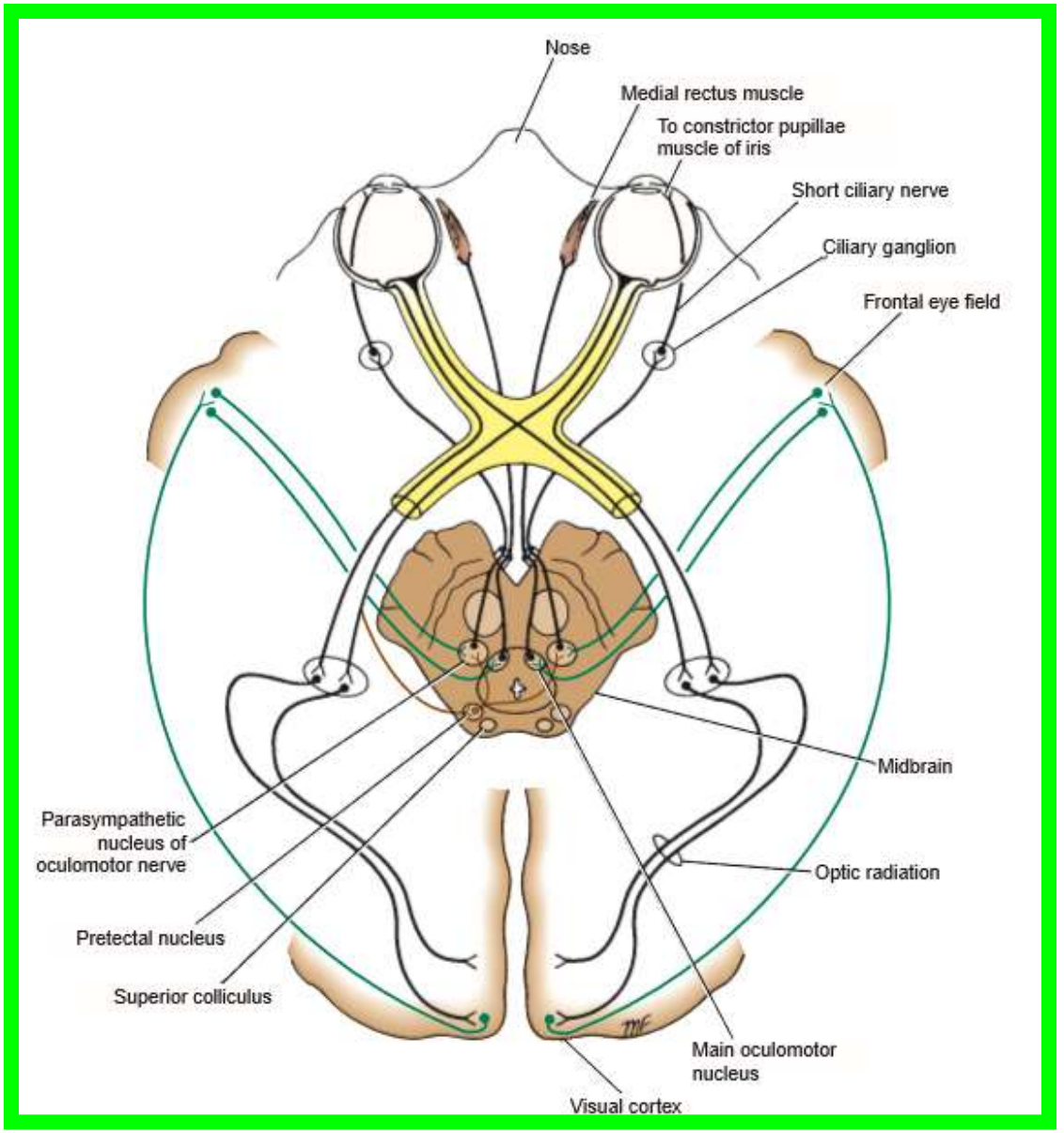
❑ Some of the descending cortical fibers synapse with the parasympathetic nuclei (Edinger-Westphal nuclei) of the third cranial nerve on both sides



2. Accommodation Reflex

❑ *Here, the fibers synapse, and the parasympathetic nerves travel through the third cranial nerve to the ciliary ganglion in the orbit.*

❑ *Finally, postganglionic parasympathetic fibers pass through the short ciliary nerves to the ciliary muscle and the constrictor pupillae muscle of the iris*



3. Corneal Reflex

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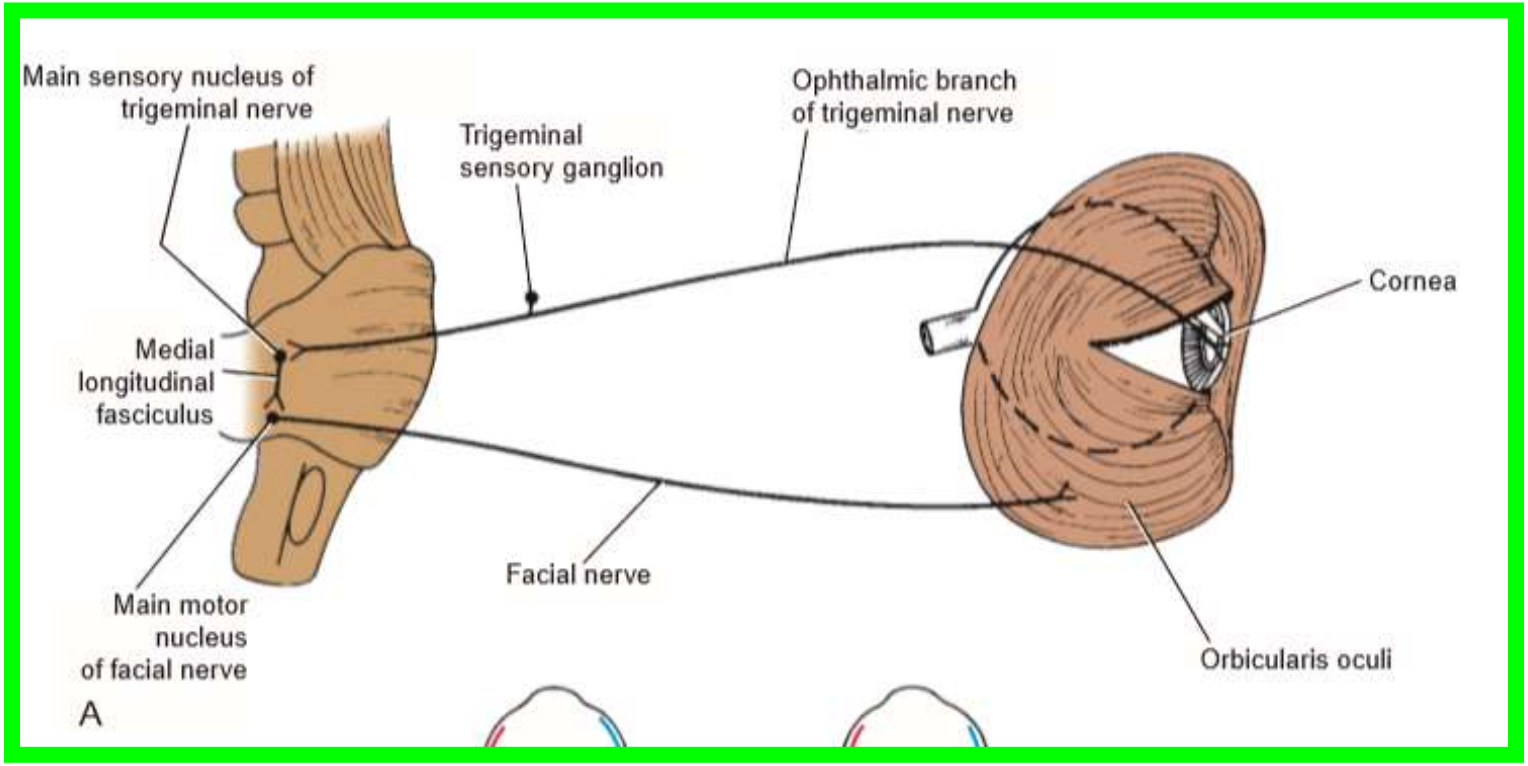
❖*Light touching of the cornea or conjunctiva results in blinking of the eyelids.*

❖*Afferent impulses from the cornea or conjunctiva travel through the ophthalmic division of the trigeminal nerve to the sensory nucleus of the trigeminal nerve*

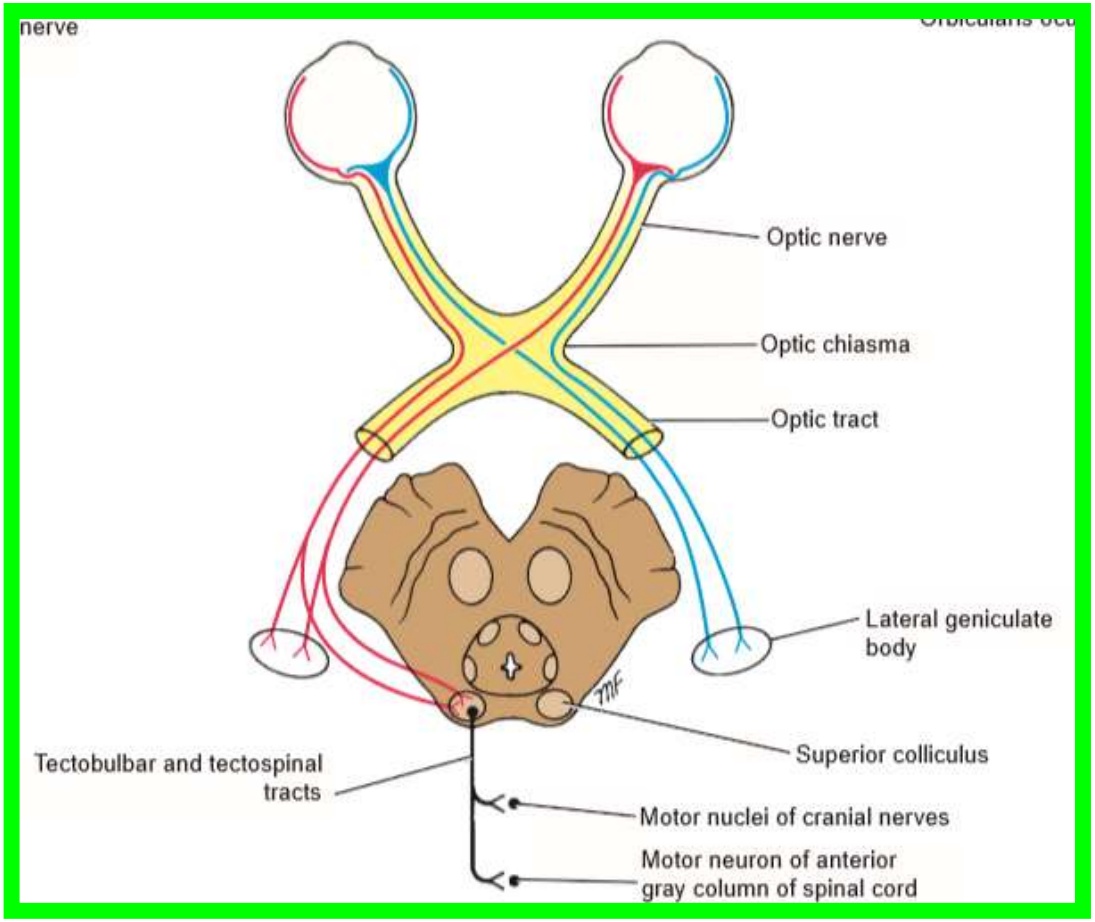


❖*Internuncial neurons connect with the motor nucleus of the facial nerve on both sides through the medial longitudinal fasciculus.*

❖*The facial nerve and its branches supply the orbicularis oculi muscle, which causes closure of the eyelids.*

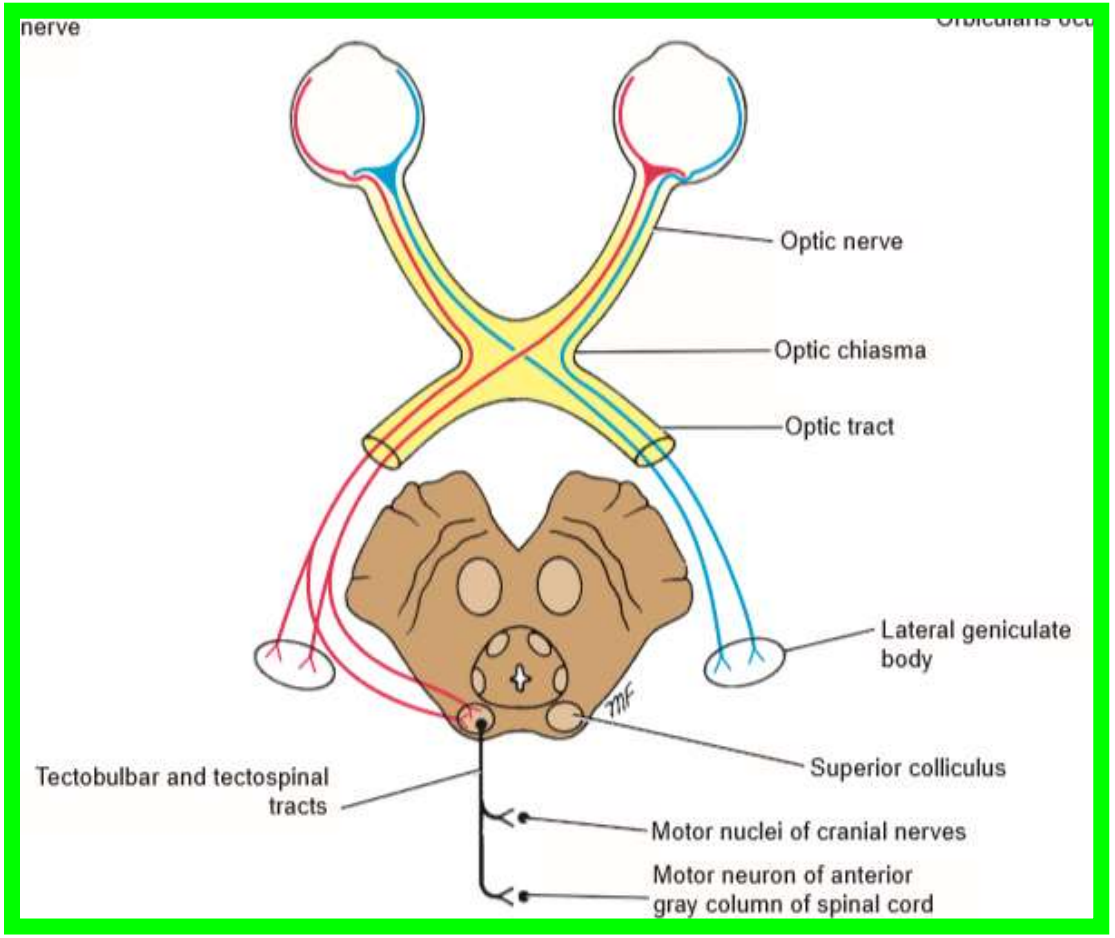
4. Visual Body Reflexes

- ✓ *The automatic scanning movements of the eyes and head that are made when reading*,
- ✓ *the automatic movement of the eyes , head, and neck toward the source of the visual stimulus, and*
- ✓ *the protective closing of the eyes and*
- ✓ *even the raising of the arm for protection are reflex actions that involve the following reflex arcs:*



4. Visual Body Reflexes

The visual impulses follow the optic nerves, optic chiasma ,and optic tracts to the superior colliculi. Here, the impulses are relayed to the tectospinal and tectobulbar (tectonuclear) tracts and to the neurons of the anterior gray columns of the spinal cord and cranial motor nuclei.

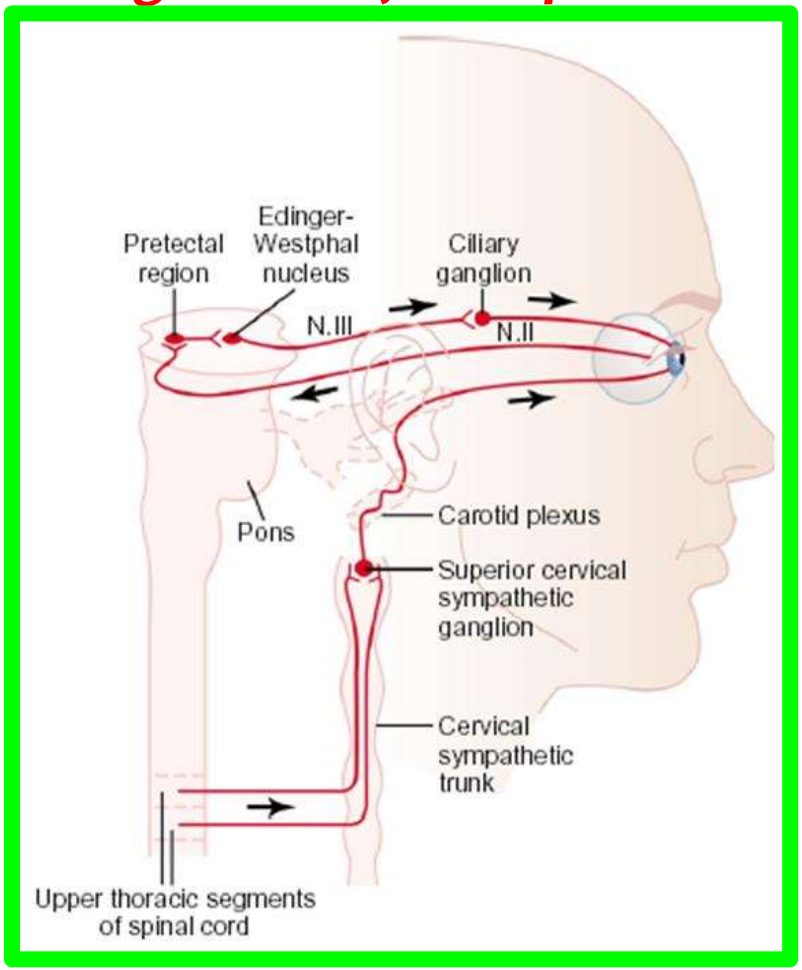


5. Pupillary Skin Reflex

The pupil will dilate if the skin is painfully stimulated by pinching. *The afferent sensory fibers are believed to have connections with the efferent preganglionic sympathetic neurons in the lateral gray columns of the first and second thoracic segments of the spinal cord*

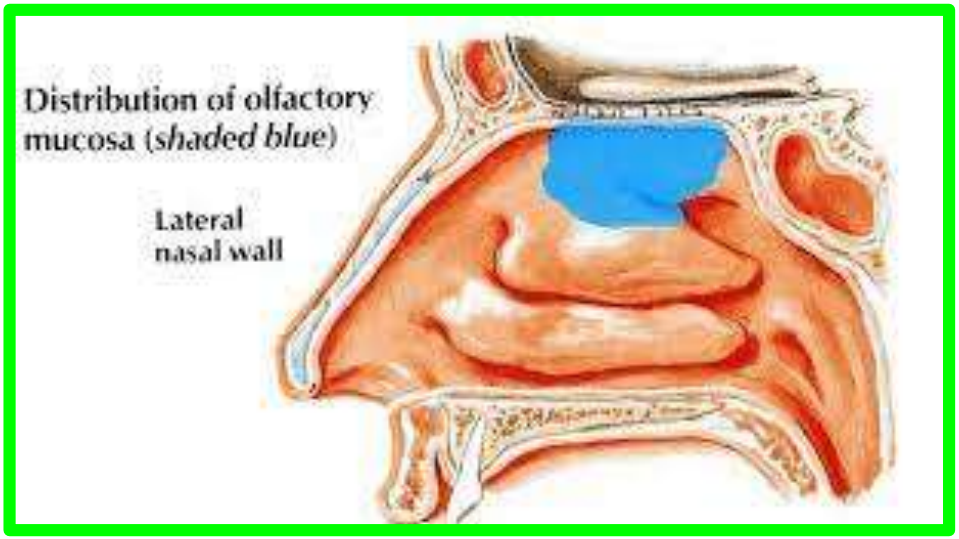
The white rami communicantes of these segments pass to the sympathetic trunk, and the preganglionic fibers ascend to the superior cervical sympathetic ganglion.

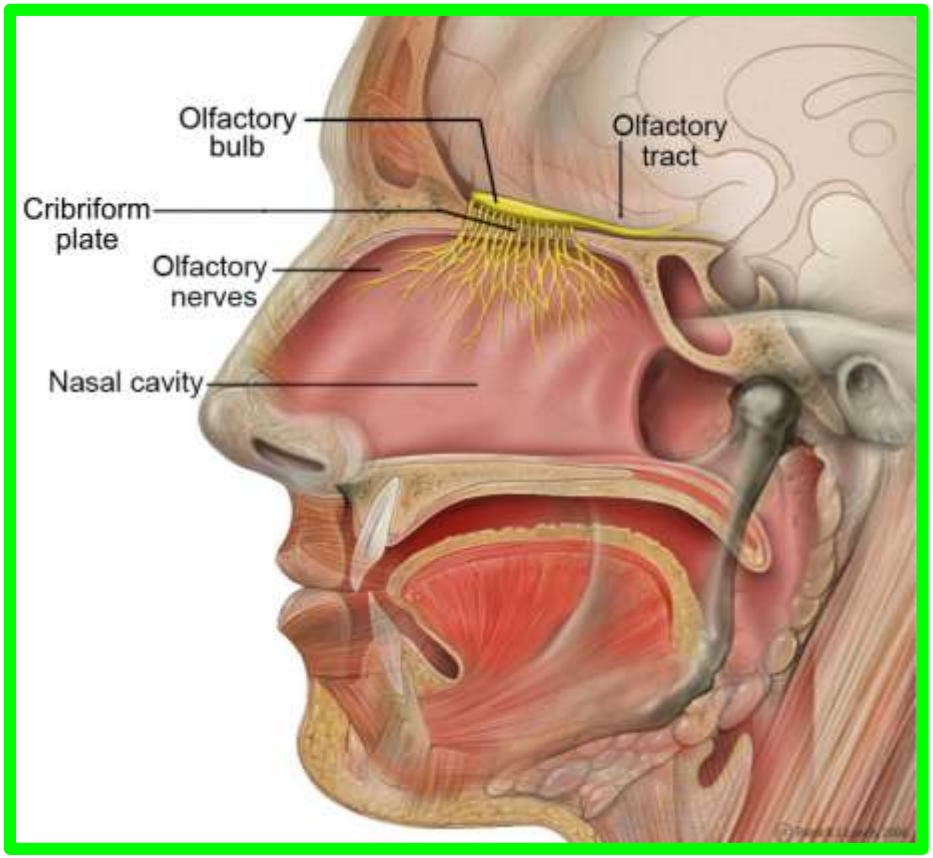
The postganglionic fibers pass through the internal carotid plexus and the long ciliary nerves to the dilator pupillae muscle of the iris



Olfactory pathways

- Olfactory receptor in olfactory mucosa of the upper part of the nose
- Bundles of olfactory nerve (first cranial nerve and the shortest one) pass through the cribriform plate of the ethmoid to olfactory bulb.

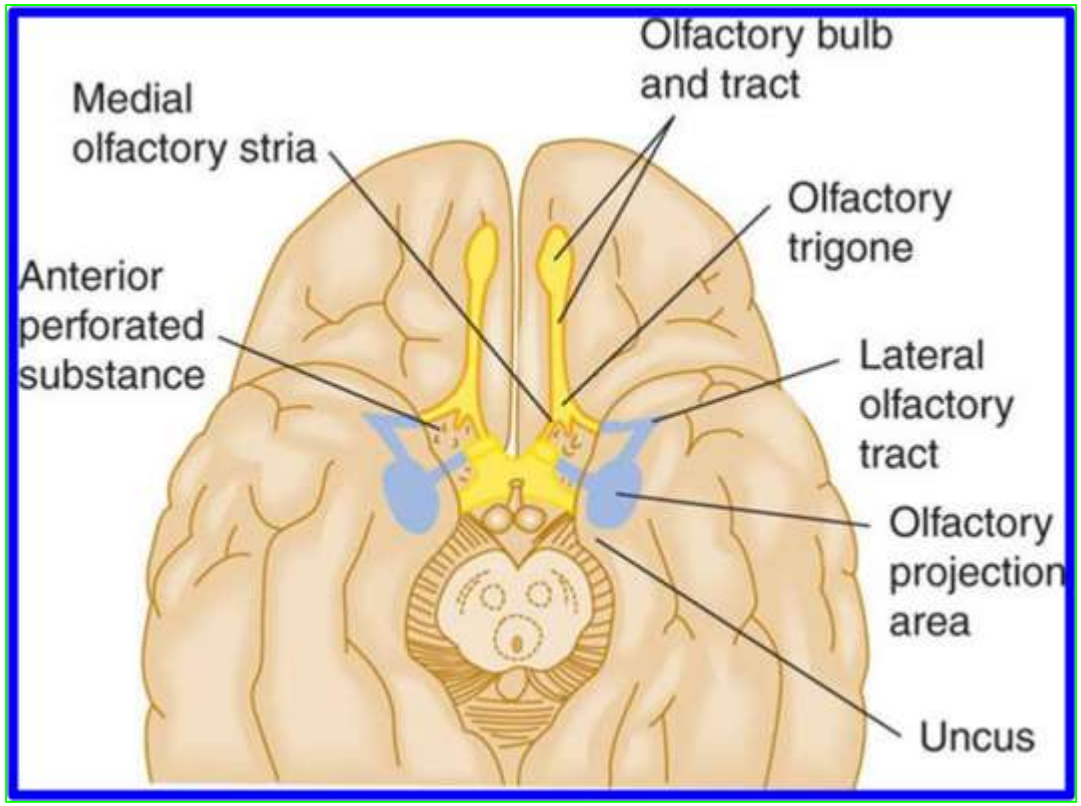


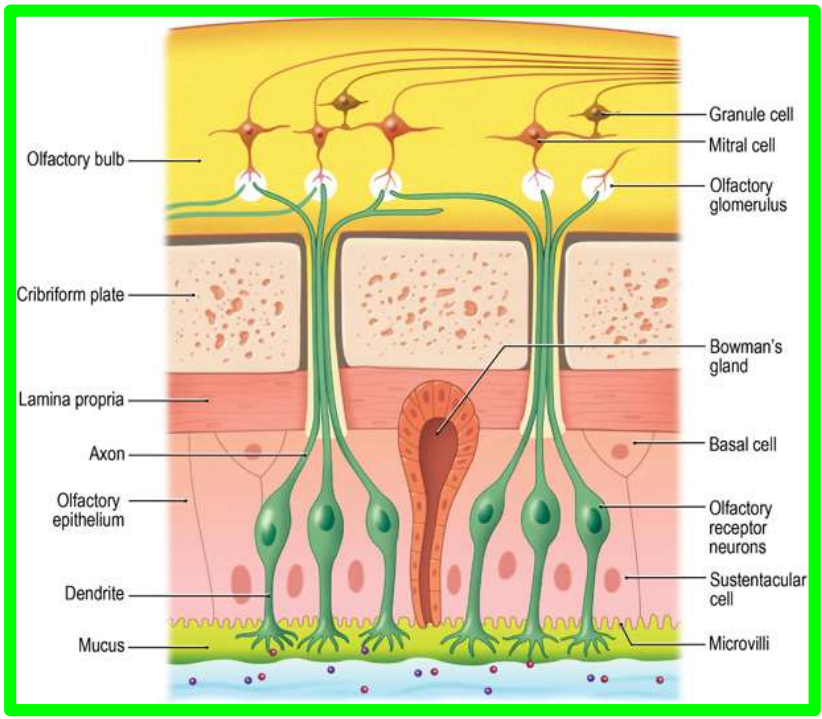


Olfactory pathways

Dr. Aiman Qais Afar

- Olfactory bulb contain special neurons called mitral cells
- The axons of these cells form the olfactory tract
- Each olfactory tract at the anterior perforated substances divided into lateral and medial stria

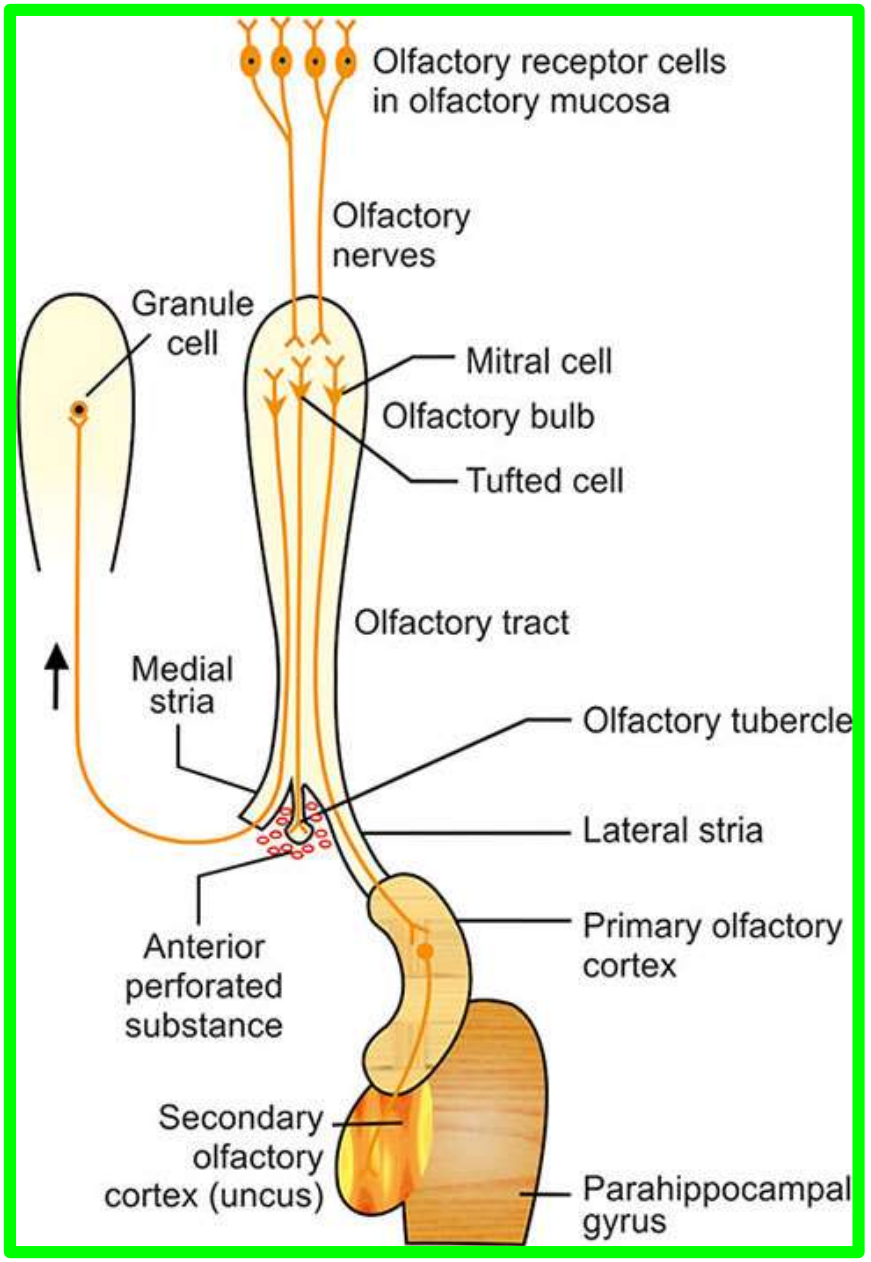




Olfactory pathways

- ***Medial stria*** *crosses midline through the anterior commissure to* ***the olfactory bulb of the opposite side***

- ***Lateral stria*** *passes to* ***the uncus*** *of the temporal lobe* ***(primary olfactory cortex)***



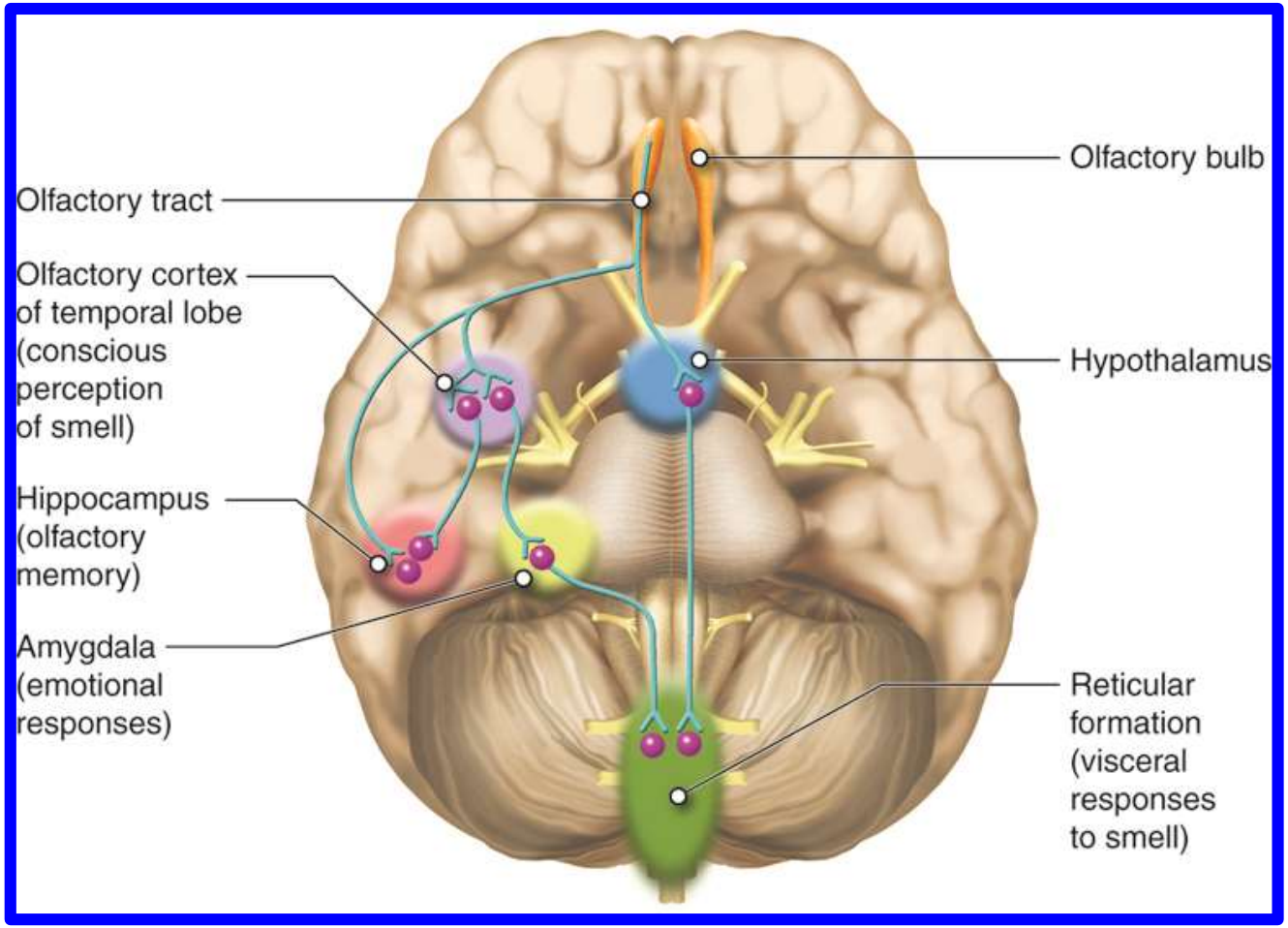
Olfactory pathways

- ***The mitral cells*** *of the olfactory bulb send information through lateral stria to ….*

1.Hypothalamus and amygdaloid body (Limbic system)… ***Emotional response to smell***

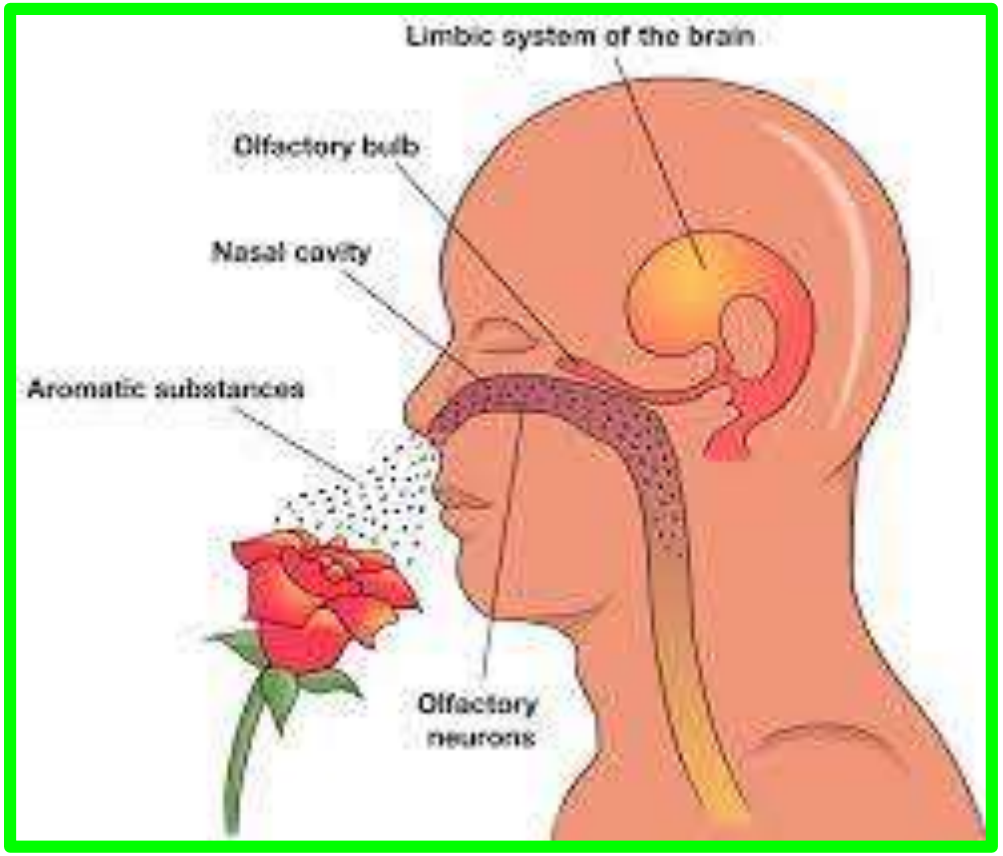
2. Reticular formation *…..autonomic response to smell as gastric secretion*

3. Hippocampus *……Olfactory memory*



Olfactory pathways

- Olfaction is a link between the smell ,memory and emotion
- The mitral cells of olfactory bulb send information through the medial stria to the olfactory bulb of the opposite side
- Each olfactory center receive smell sensation from both halves of the nasal cavity

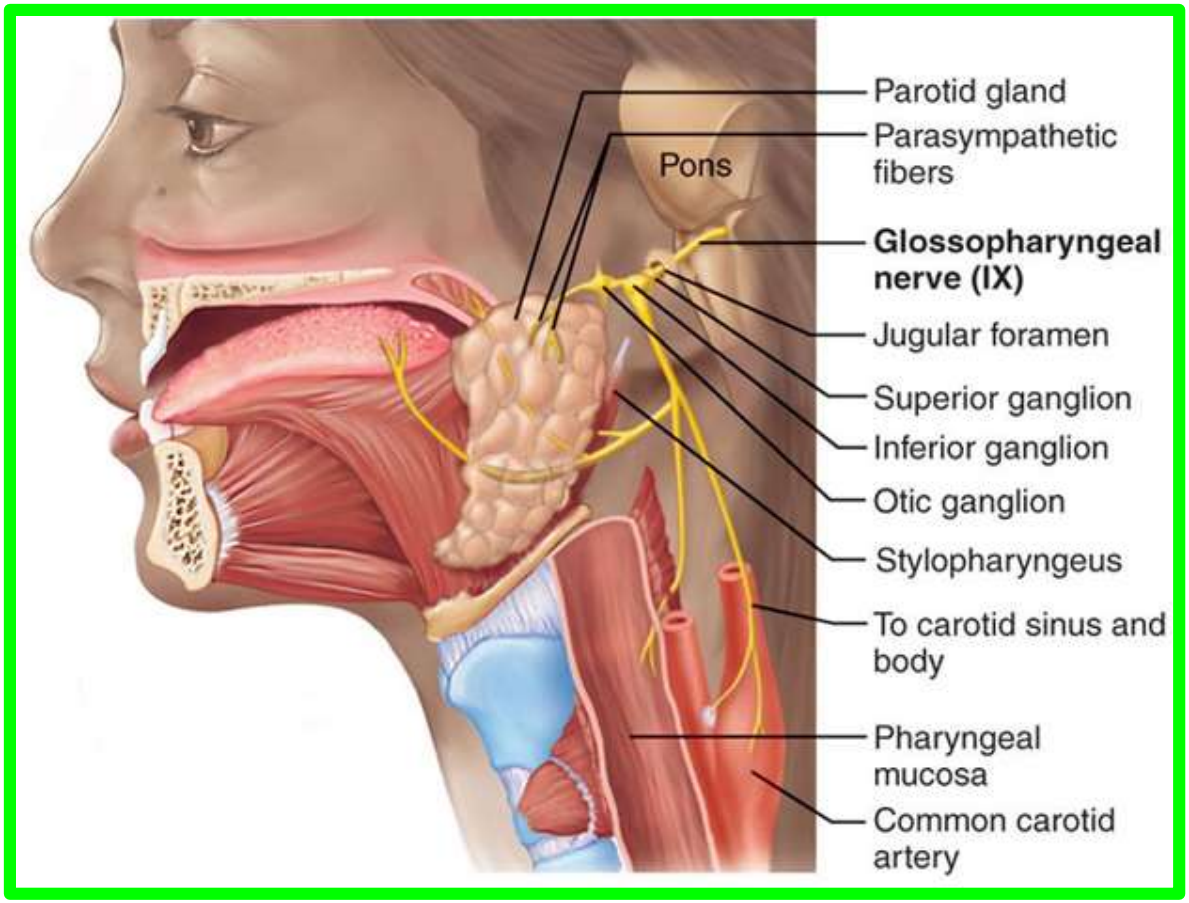


Glossopharyngeal Nerve CN IX

❖*The glossopharyngeal nerve is a motor and sensory nerve*

❖*It emerges from the anterior surface of the medulla oblongata between the olive and the inferior cerebellar peduncle.*

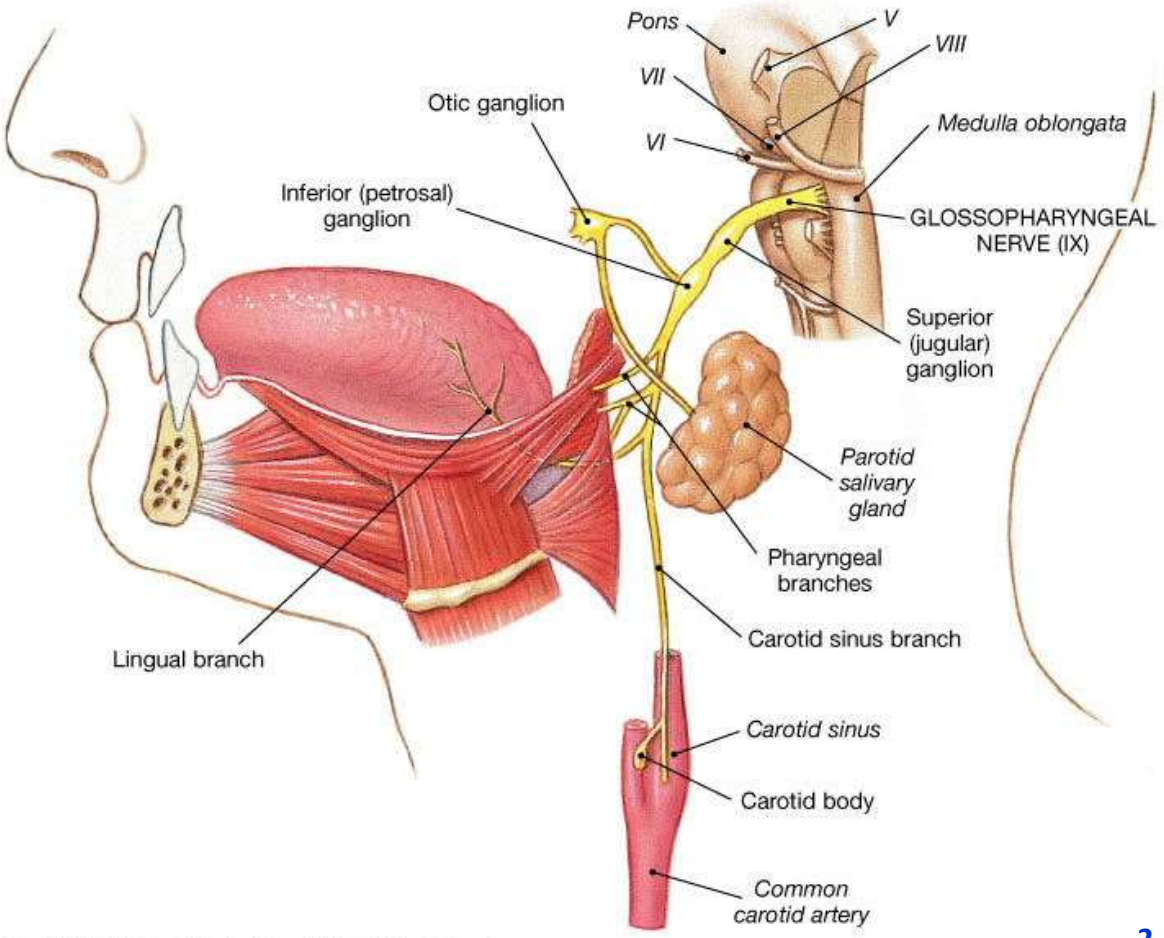
❖ *It passes laterally in the posterior cranial fossa and leaves the skull by passing through the jugular foramen.*



Glossopharyngeal Nerve CN IX

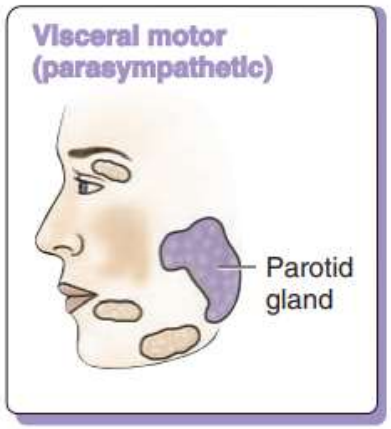
❖*The superior and inferior sensory ganglia are located on the nerve as it passes through the foramen.*

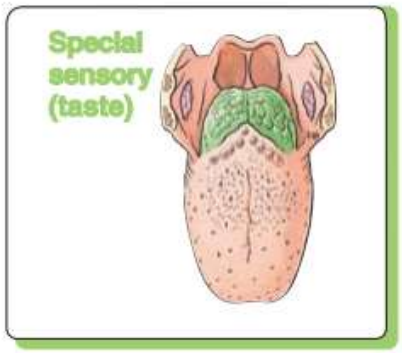
❖*The glossopharyngeal nerve then descends through the upper part of the neck to the back of the tongue*

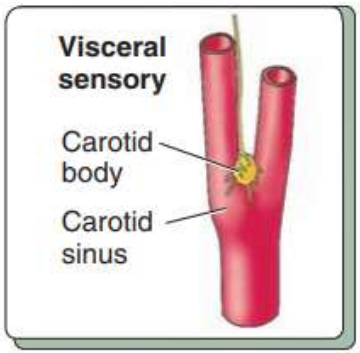


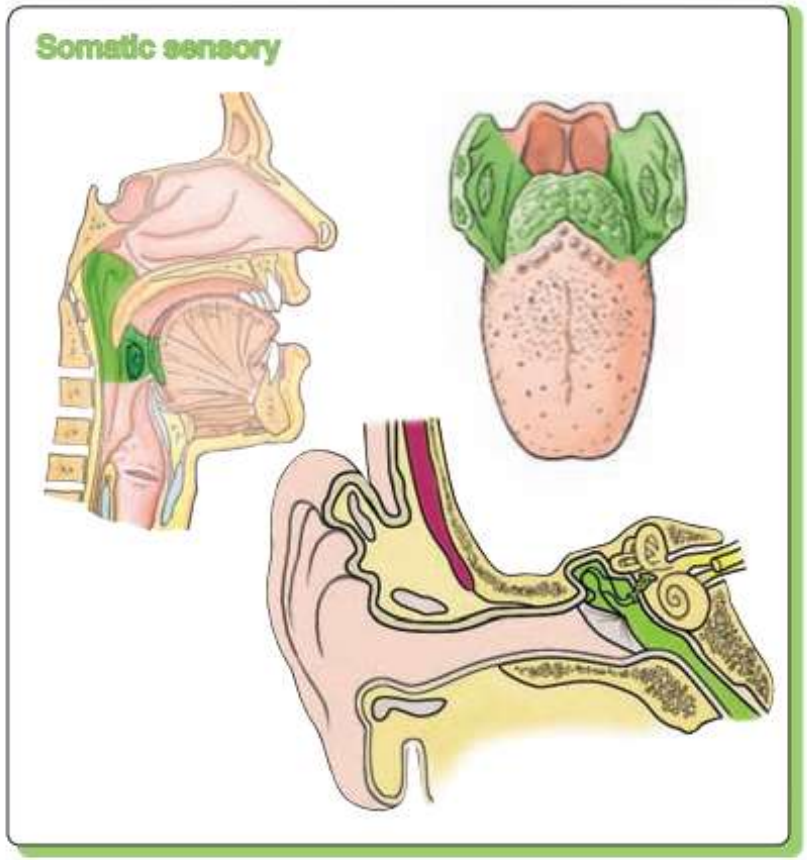
Functions:

- ❑ Visceral Sensory
- ❖Somatic (Branchial) Motor
- ❖Visceral (Parasympathetic) Motor
- ❖Somatic (General) Sensory
- ❖Special Sensory (Taste)



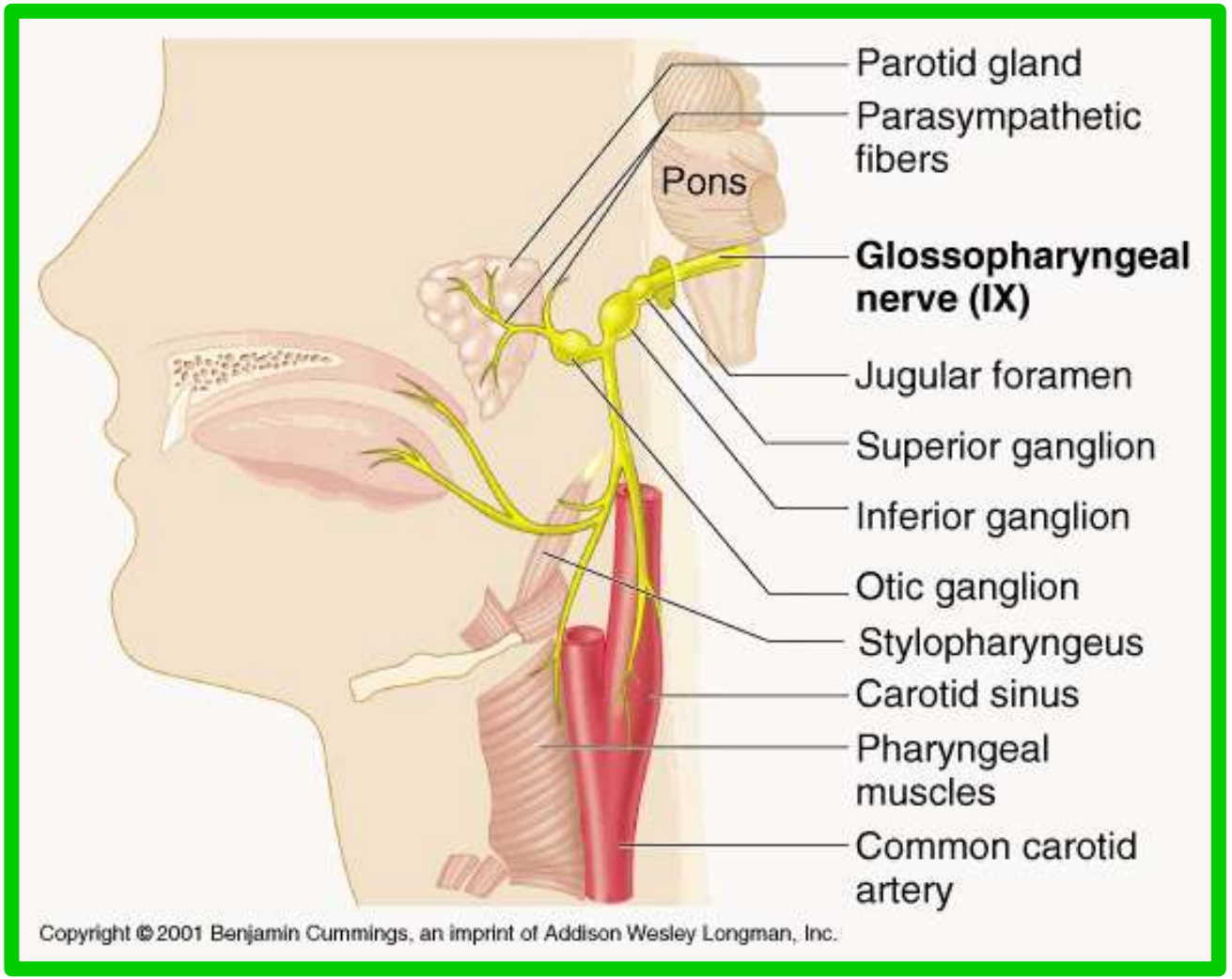






Glossopharyngeal Nerve CN IX

- Somatic (Branchial) Motor
- Motor fibers pass to one muscle, the stylopharyngeus, derived from the 3rd pharyngeal arch.



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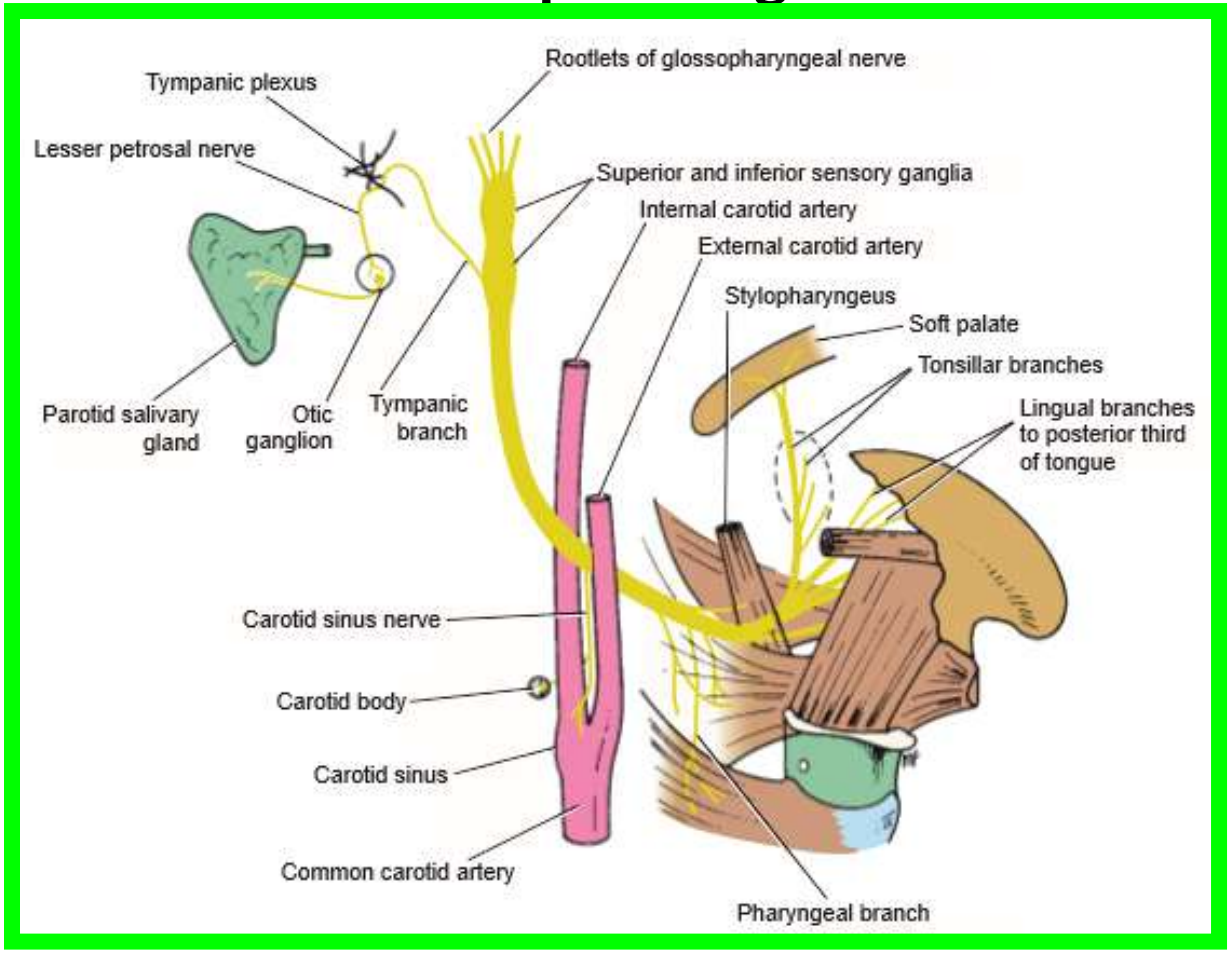
Glossopharyngeal Nerve CN IX

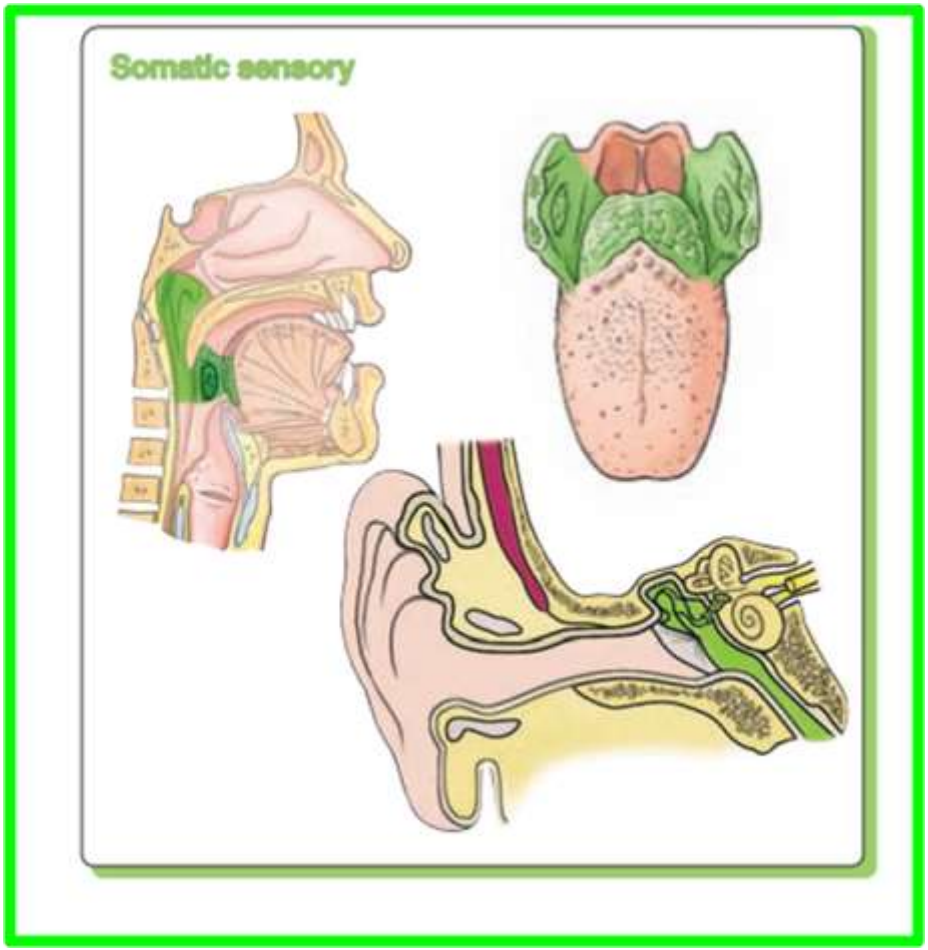
- Visceral (Parasympathetic) Motor
- Following a circuitous route initially involving the tympanic nerve, presynaptic parasympathetic fibers are provided to the otic ganglion for innervation of the parotid gland.



Glossopharyngeal Nerve CN IX

- ❑ Somatic (General) Sensory
  - ✓ The tympanic nerve.

Via the tympanic plexus, CN IX supplies the mucosa of the tympanic cavity, pharyngotympanic tube, and the internal surface of the tympanic membrane.

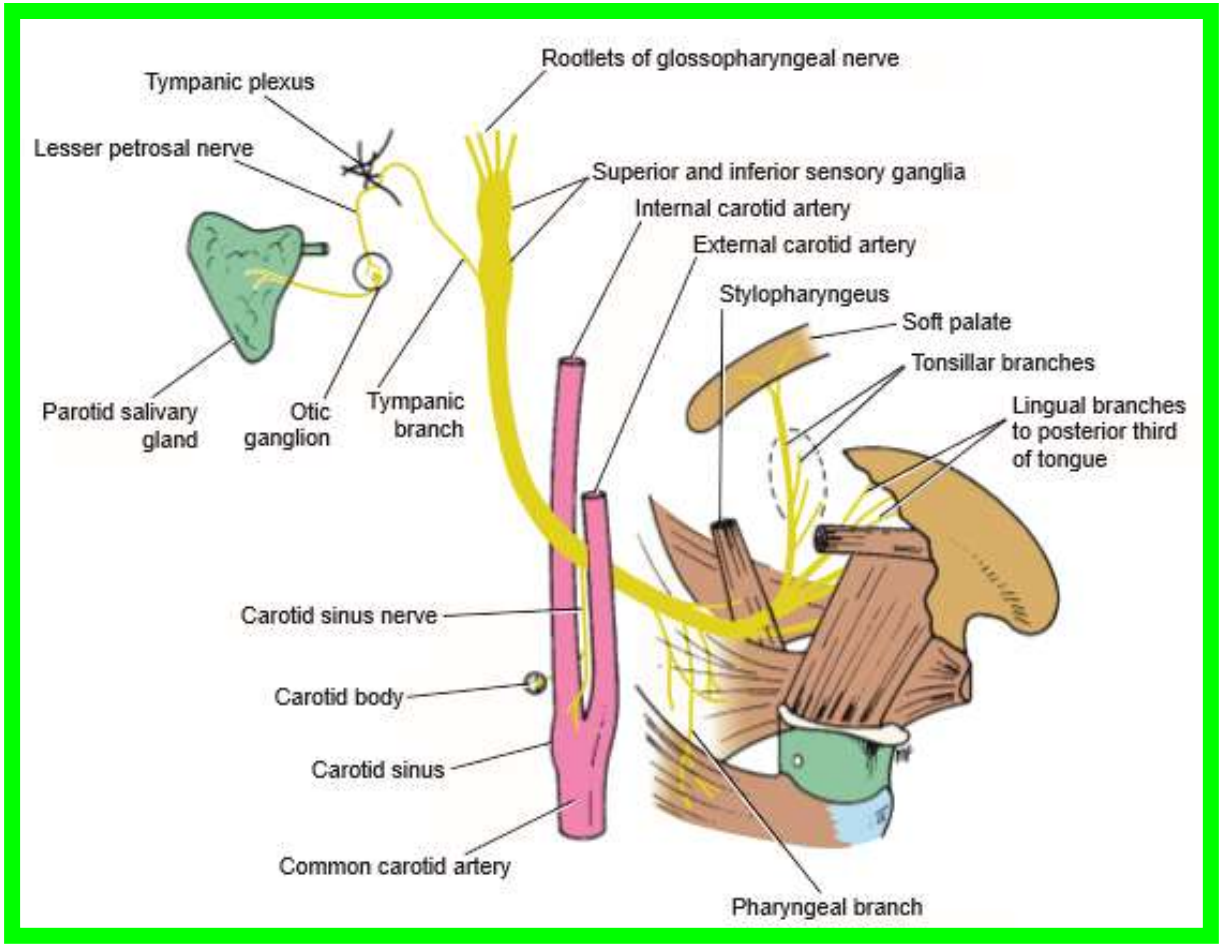


Glossopharyngeal Nerve CN IX

✓**The pharyngeal, tonsillar, and lingual nerves to the mucosa of the oropharynx** and **isthmus of the fauces (L., throat), including palatine tonsil, soft palate,** and **posterior third of the tongue**.

In addition to general sensation (touch, pain, temperature),

tactile (actual or threatened) stimuli determined to be unusual or unpleasant here may evoke the gag reflex or even vomiting.

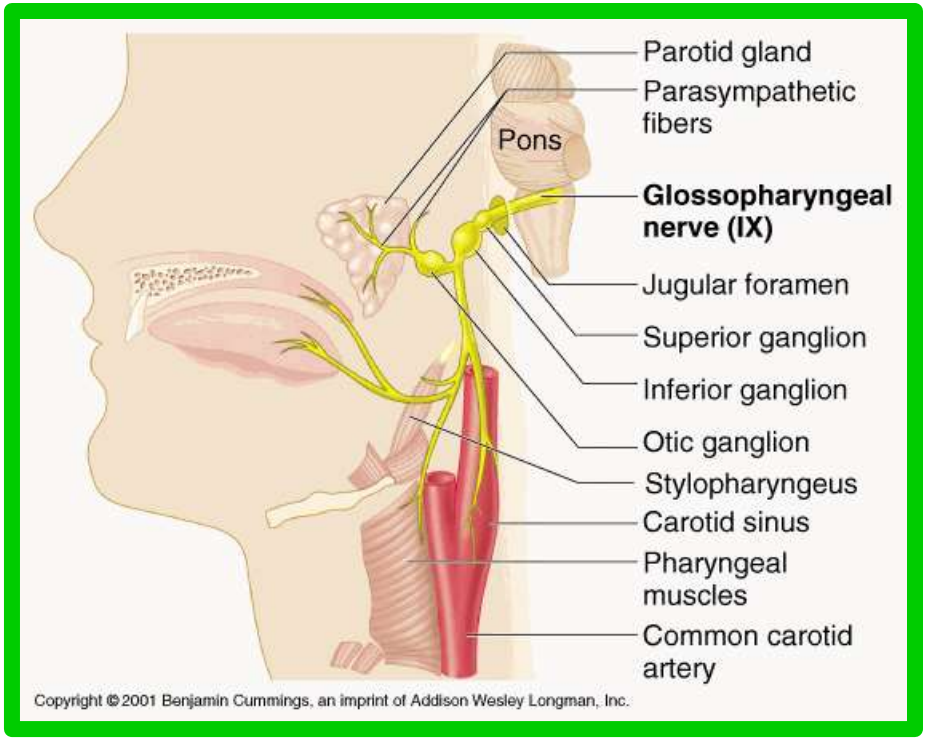


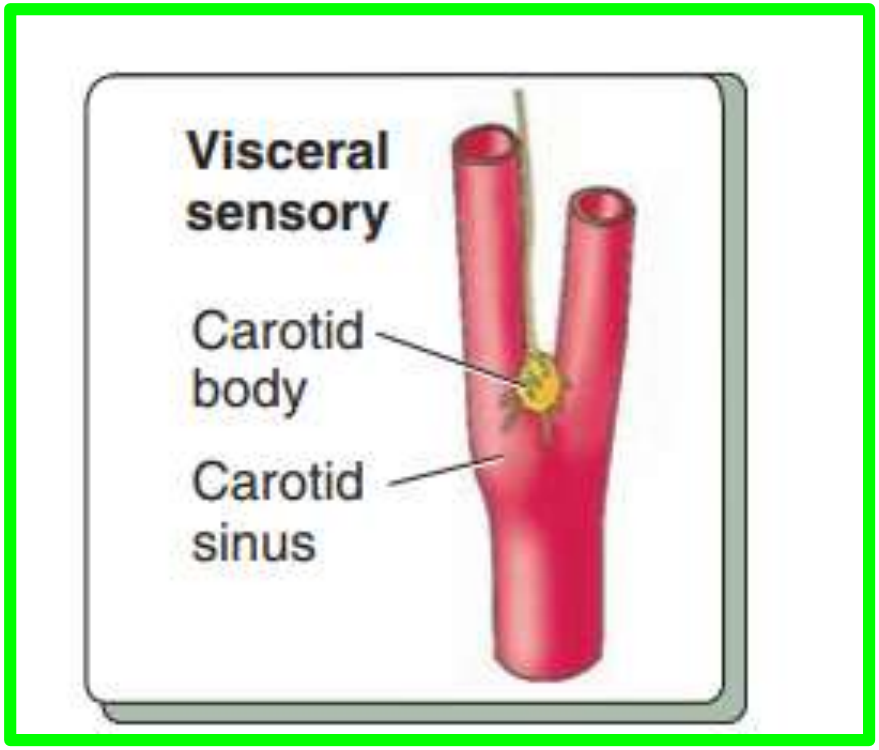
Glossopharyngeal Nerve CN IX

❑ *Visceral Sensory*

✓The carotid sinus nerve to the carotid sinus, a baro-(presso-) receptor sensitive to changes in blood pressure,

✓and the carotid body, a chemoreceptor sensitive to blood gas (oxygen and carbon dioxide levels).

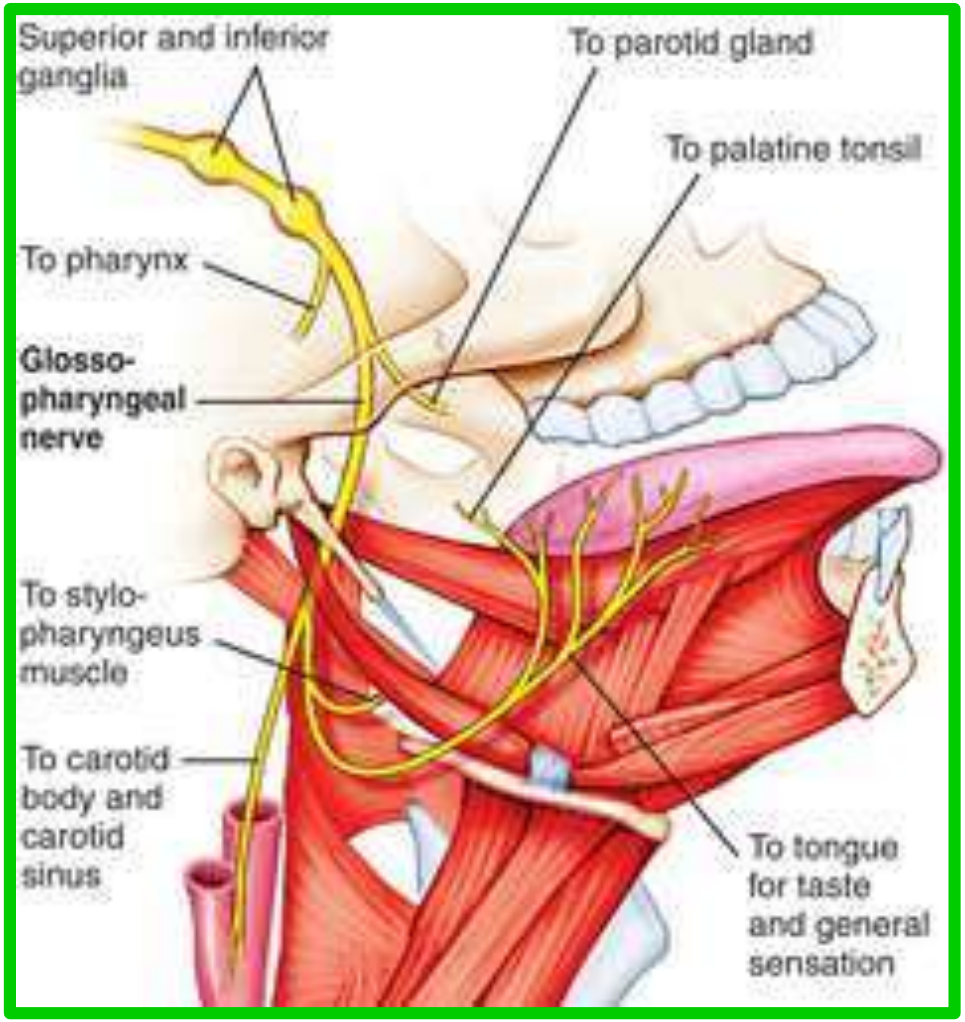




Glossopharyngeal Nerve CN IX

❑Special Sensory (Taste)

Taste fibers are conveyed from the posterior third of the tongue to the sensory ganglia, the superior and inferior ganglia of CN IX

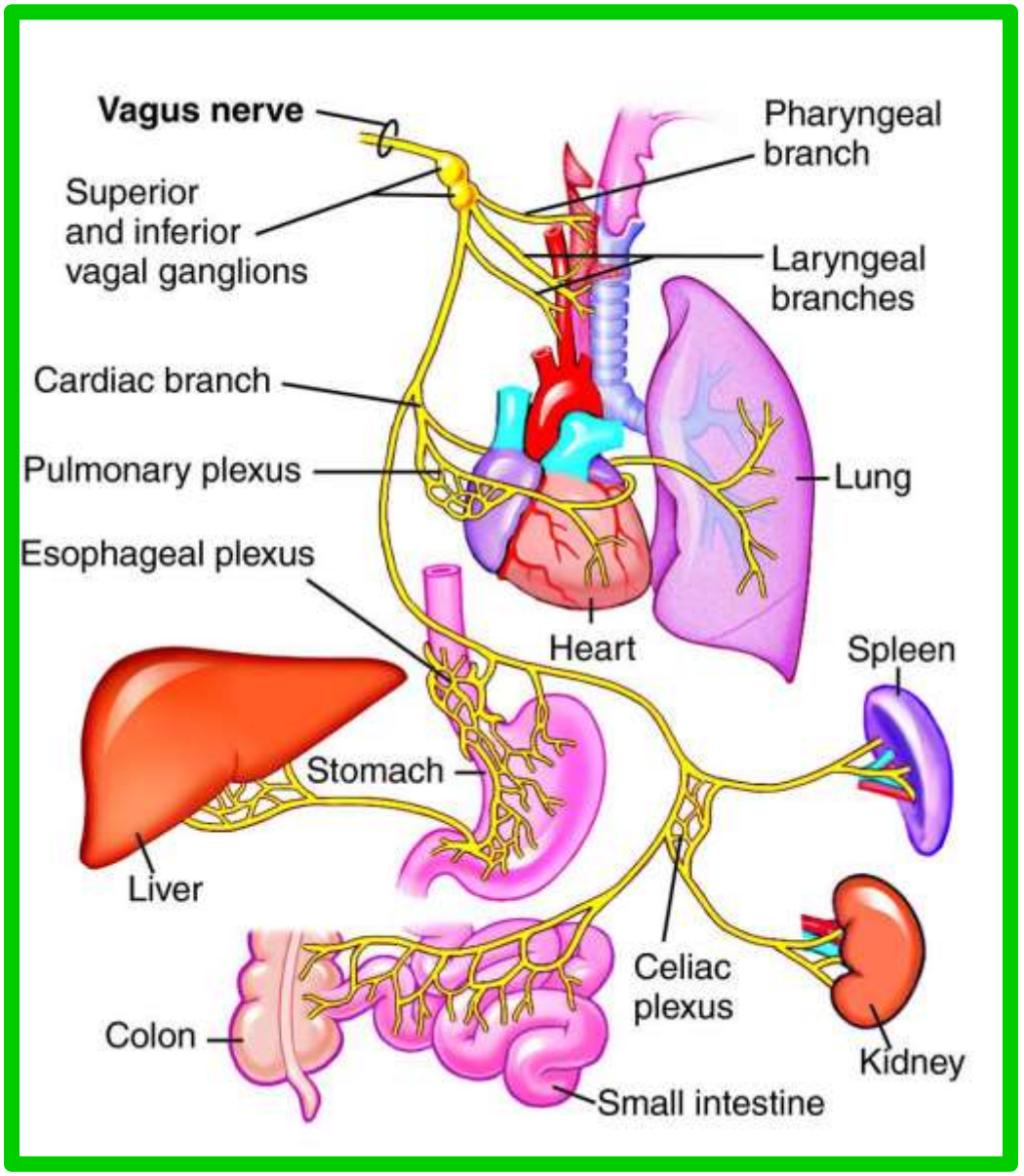


Vagus Nerve CN X

❖The vagus nerve is composed of motor and sensory fibers

❖It emerges from the anterior surface of the medulla oblongata between the olive and the inferior cerebellar peduncle.

❖The nerve passes laterally through the posterior cranial fossa and leaves the skull through the jugular foramen.



Vagus Nerve CN X

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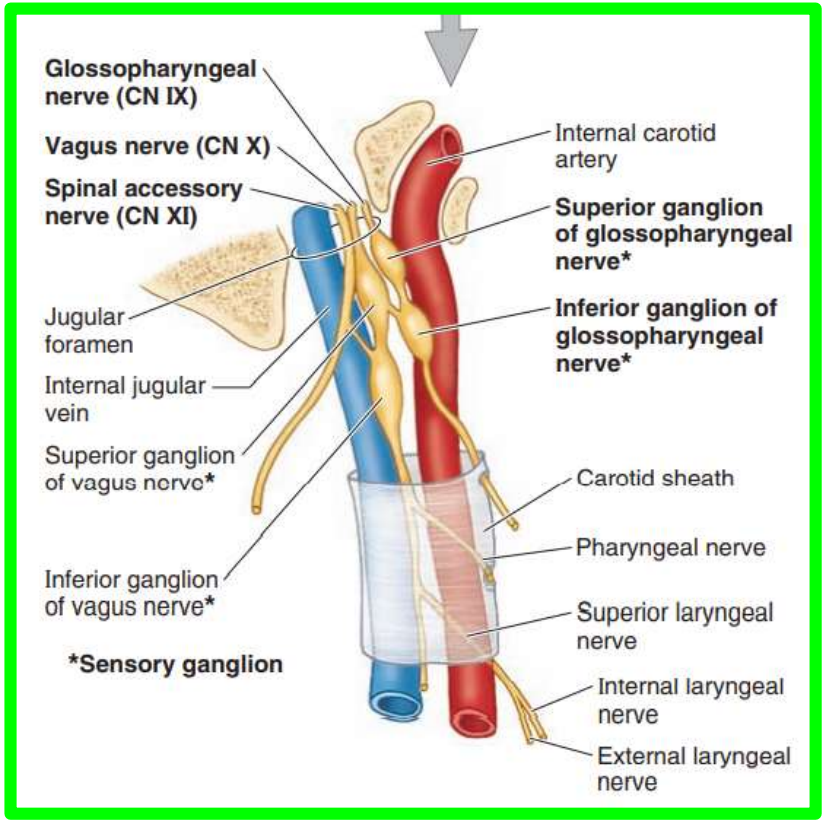
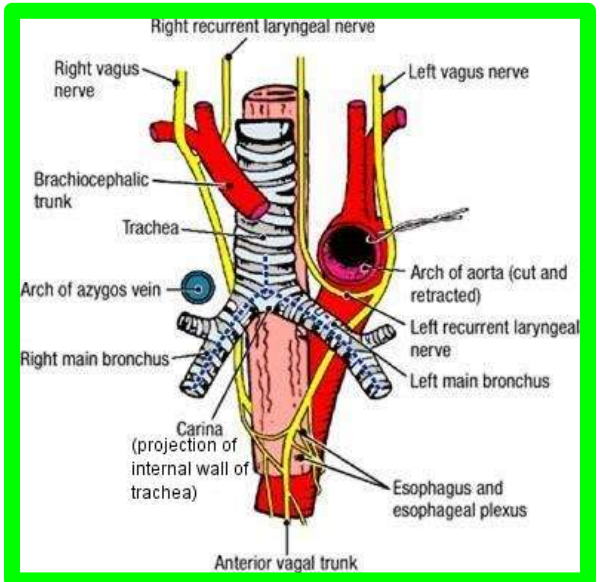
The vagus nerve has both superior and inferior sensory ganglia.

- ***Below the inferior ganglion, the cranial root of the accessory nerve joins the vagus nerve and is distributed mainly in its pharyngeal and recurrent laryngeal branches.***
- ***The vagus nerve descends through the neck alongside the carotid arteries and internal jugular vein within the carotid sheath***
- ***It passes through the mediastinum of the thorax passing behind the root of the lung, and enters the abdomen through the esophageal opening in the diaphragm***





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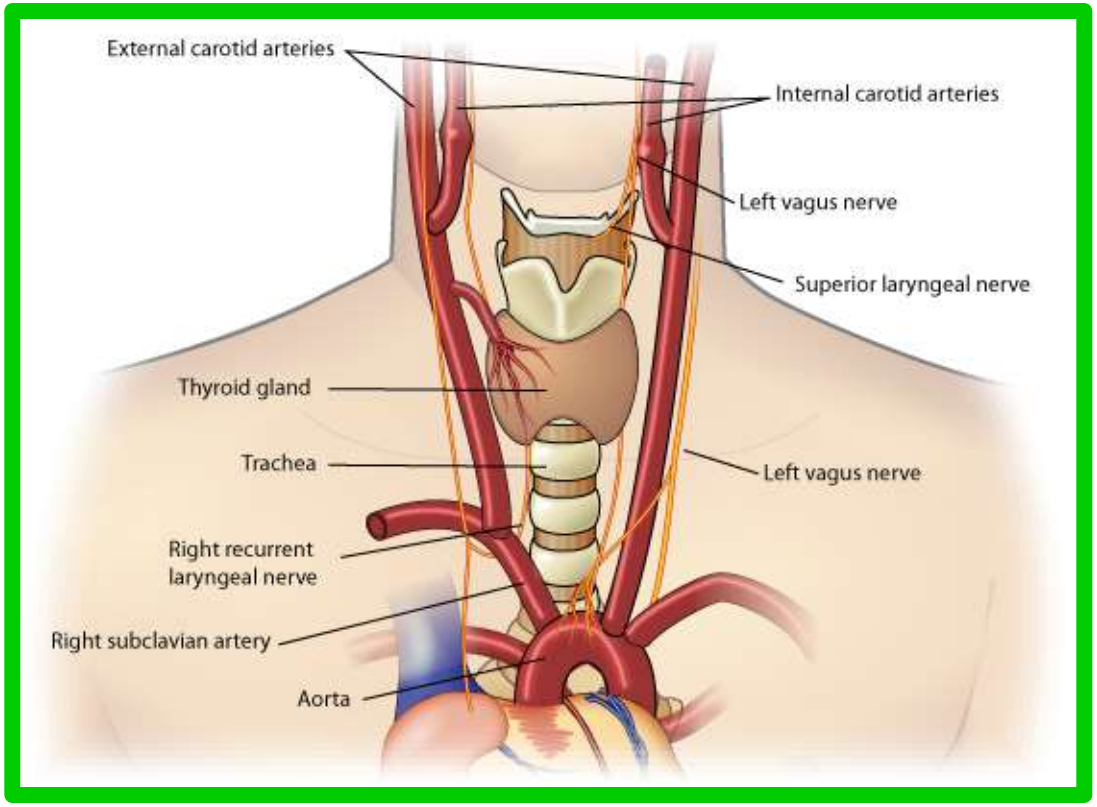
Vagus Nerve CN X

Important Branches of the Vagus Nerve in the Neck

- **Meningeal and auricular branches**
- **Pharyngeal branch** contains nerve fibers from the cranial part of the accessory nerve.
- **Superior laryngeal nerve** divides into the internal and the external laryngeal nerves.



✓The internal laryngeal nerve is sensory to the piriform fossa and the larynx down as far as the vocal cords.

✓The external laryngeal nerve is motor and it supplies the cricothyroid muscle.

Vagus Nerve CN X

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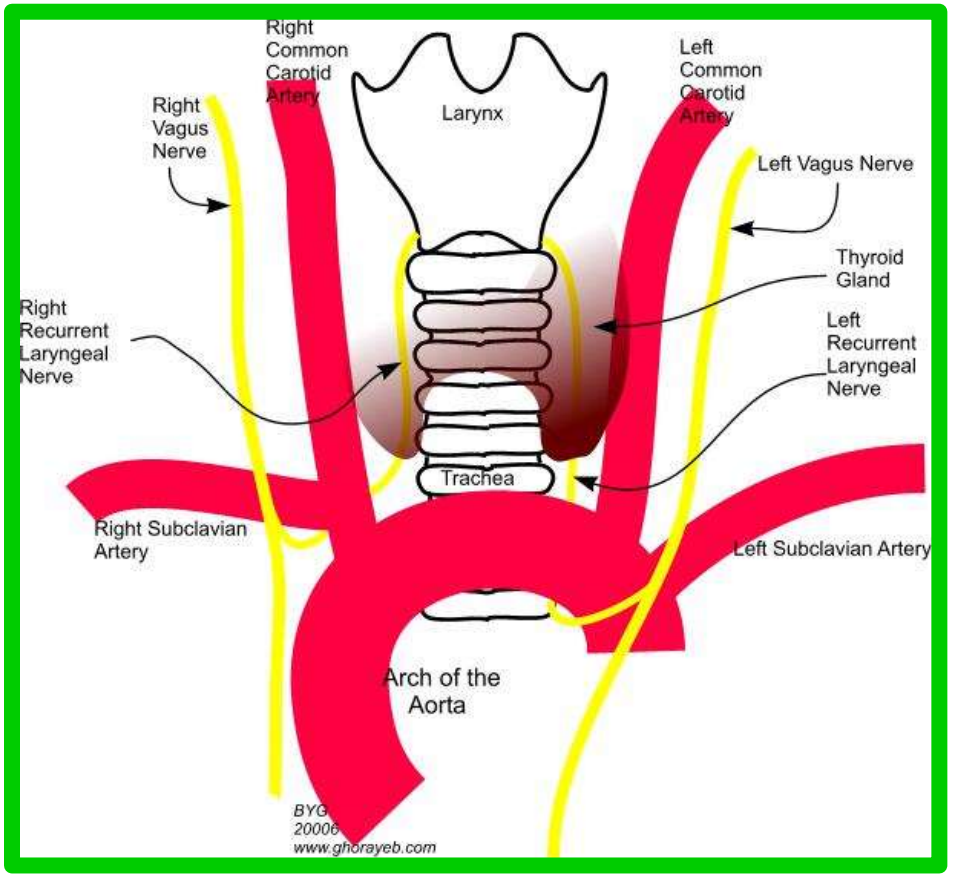
Important Branches of the Vagus Nerve in the Neck

■ *Recurrent laryngeal nerve*

On the right side, the nerve hooks around the first part of the subclavian artery
On the left side, the nerve hooks around the arch of the aorta

The nerve is closely related to the inferior thyroid artery, and it supplies all the muscles of the larynx, except the cricothyroid muscle, the mucous membrane of the larynx below the vocal cords, and the mucous membrane of the upper part of the trachea.

■■ *Cardiac branches (two or three) arise in the neck, descend into the thorax, and end in the cardiac plexus*



Vagus Nerve CN X

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The vagus nerve thus innervates:

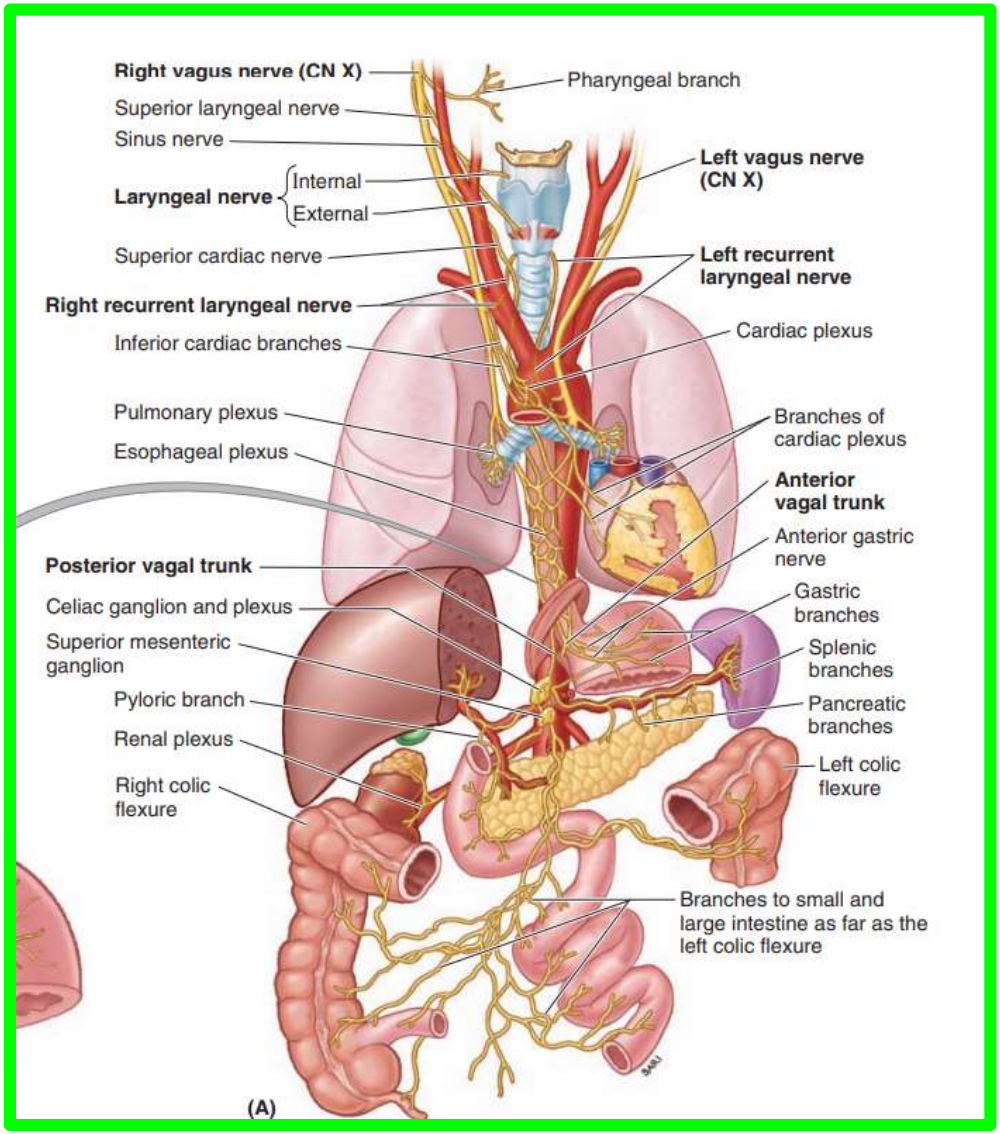
✓The heart and great vessels within the thorax

✓The larynx, trachea, bronchi, and lungs

✓ Much of the alimentary tract from the pharynx to the splenic flexure of the colon.

✓It also supplies glands associated with the alimentary tract, such as the liver and pancreas.

✓The vagus nerve has the most extensive distribution of all the cranial nerves and supplies the forementioned structures with afferent and efferent fibers.

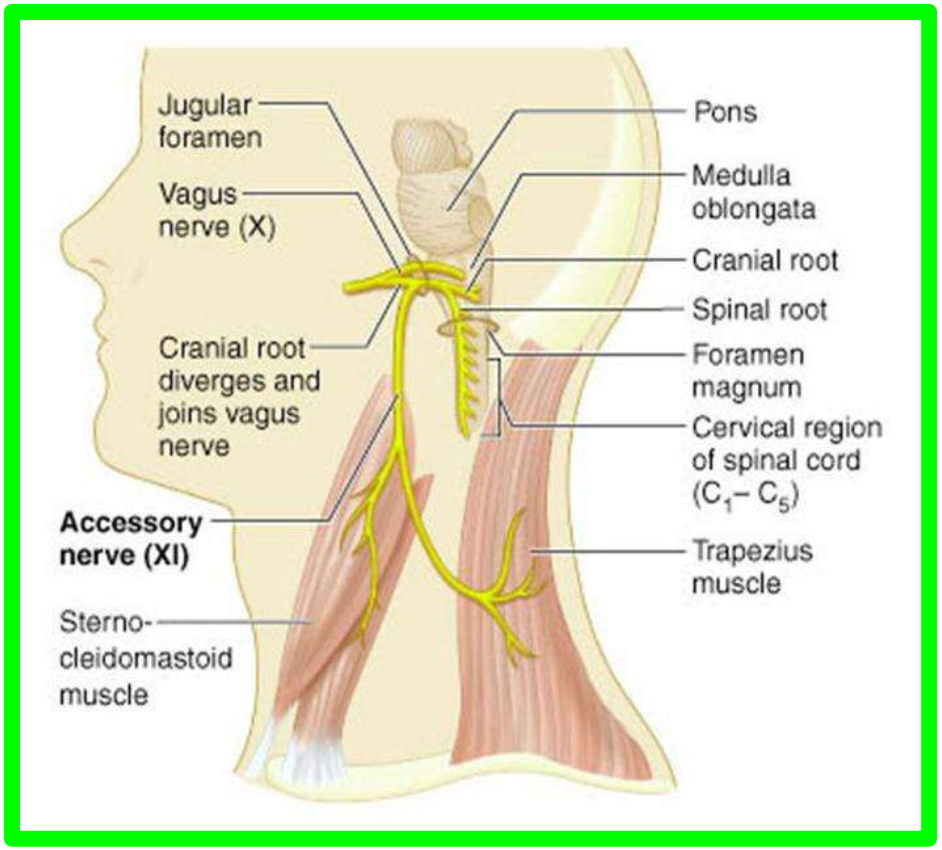


Accessory Nerve CN XI

- ***The accessory nerve is a motor nerve.***
- ***It consists of a cranial root (part) and a spinal root (part)***

Cranial Root

Emerges from the anterior surface of the medulla oblongata between the olive and the inferior cerebellar peduncle
The nerve runs laterally in the posterior cranial fossa and joins the spinal root

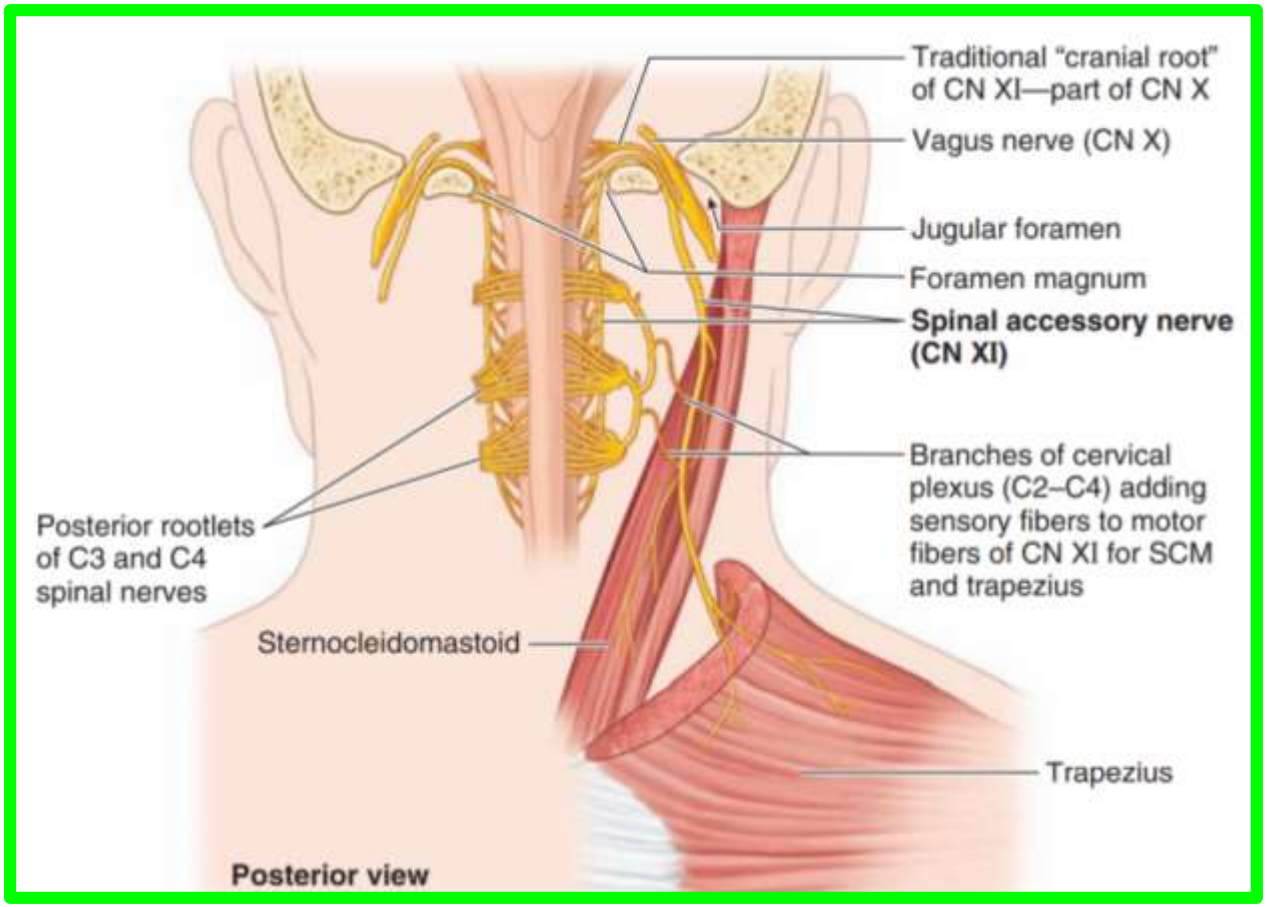


Spinal Root

- ✓***Arises from nerve cells in the anterior gray column (horn) of the upper five segments of the cervical part of the spinal cord***
- ✓***The nerve ascends alongside the spinal cord and enters the skull through the foramen magnum. It then turns laterally to join the cranial root***

Accessory Nerve CN XI

❖*The two roots unite and leave the skull through the jugular foramen. The roots then separate:*



❖*The cranial root joins the vagus nerves and is distributed in its branches to the muscles of the soft palate and pharynx (via the pharyngeal plexus) and to the muscles of the larynx (except the cricothyroid muscle).*

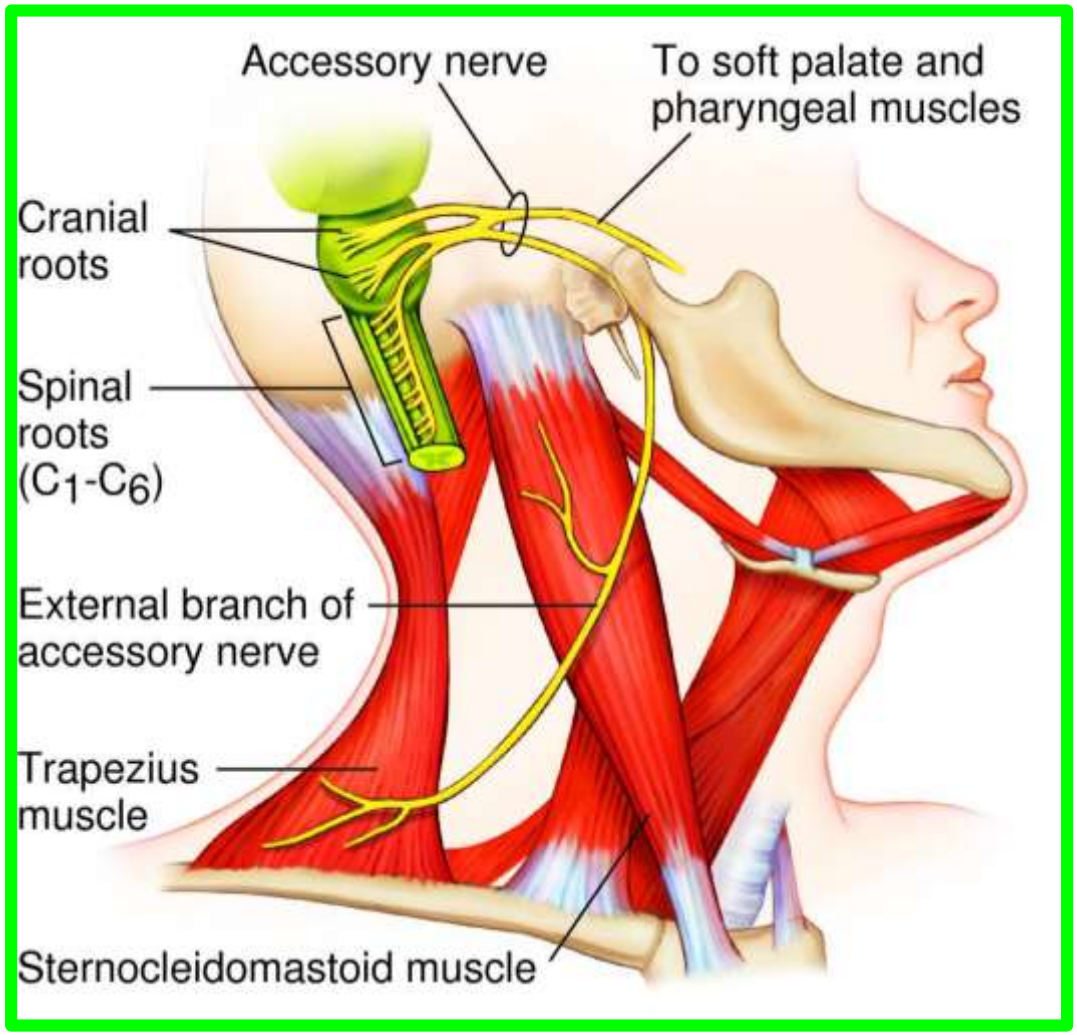
Accessory Nerve CN XI

❖*The spinal root* runs downward and laterally and enters the deep surface of *the sternocleidomastoid muscle*, which it supplies, and then crosses the posterior triangle of the neck to *supply the trapezius muscle*

The accessory nerve thus brings about:

✓*Movements of the soft palate, pharynx, and larynx*

✓*Controls the movements of the sternocleidomastoid and trapezius muscles,* two large muscles in the neck



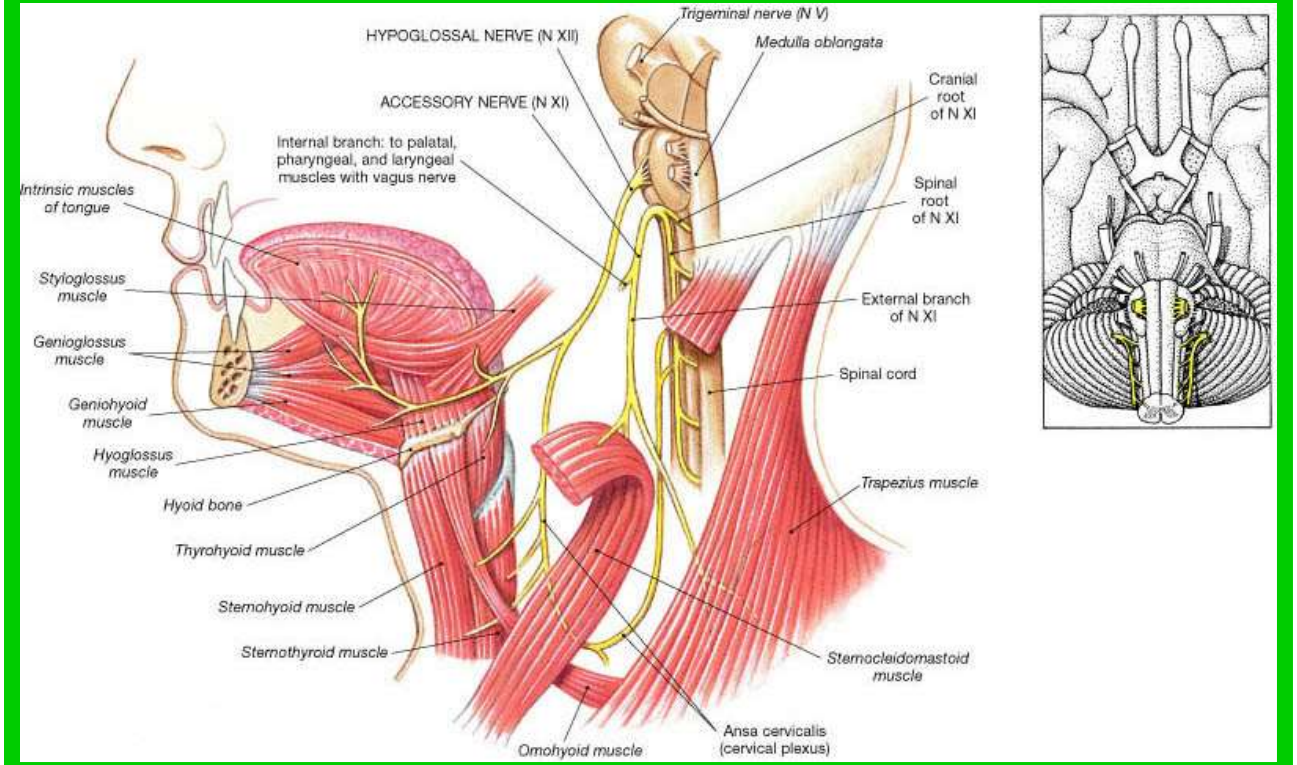
Hypoglossal Nerve CN XII

❖The hypoglossal nerve is a motor nerve.

❖It emerges on the anterior surface of the medulla oblongata between the pyramid and the olive, crosses the posterior cranial fossa, and leaves the skull through the hypoglossal canal.

❖The nerve then passes downward and forward in the neck and crosses the internal and external carotid arteries to reach the tongue

❖In the upper part of its course, it is joined by C1 fibers from the cervical plexus



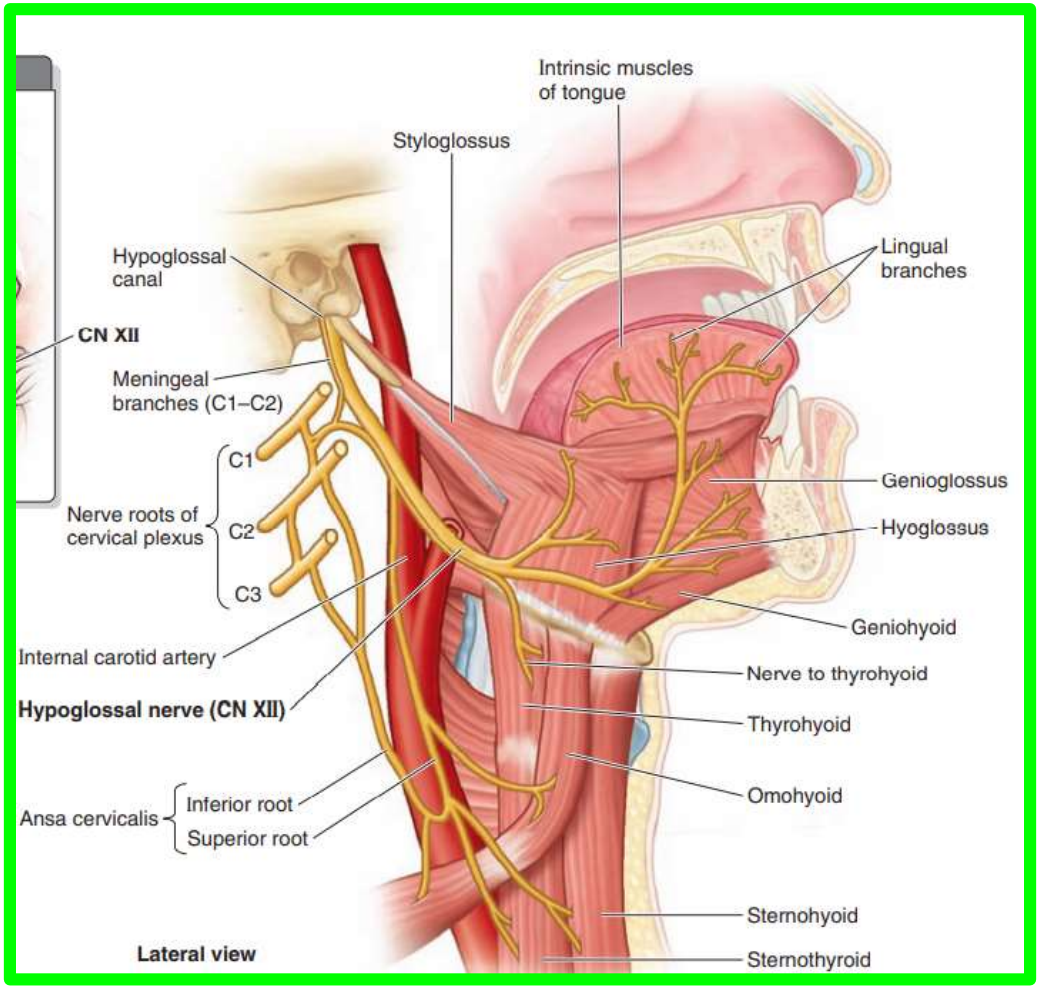
Hypoglossal Nerve CN XII

Important Branches of the Hypoglossal Nerve

- **Meningeal branch**
- **Descending branch (C1 fibers) passes downward and joins the descending cervical nerve (C2 and 3) to form the ansa cervicalis.**

Branches from this loop supply the omohyoid, the sternohyoid, and the sternothyroid muscles.

- **Nerve to the thyrohyoid muscle (C1)**



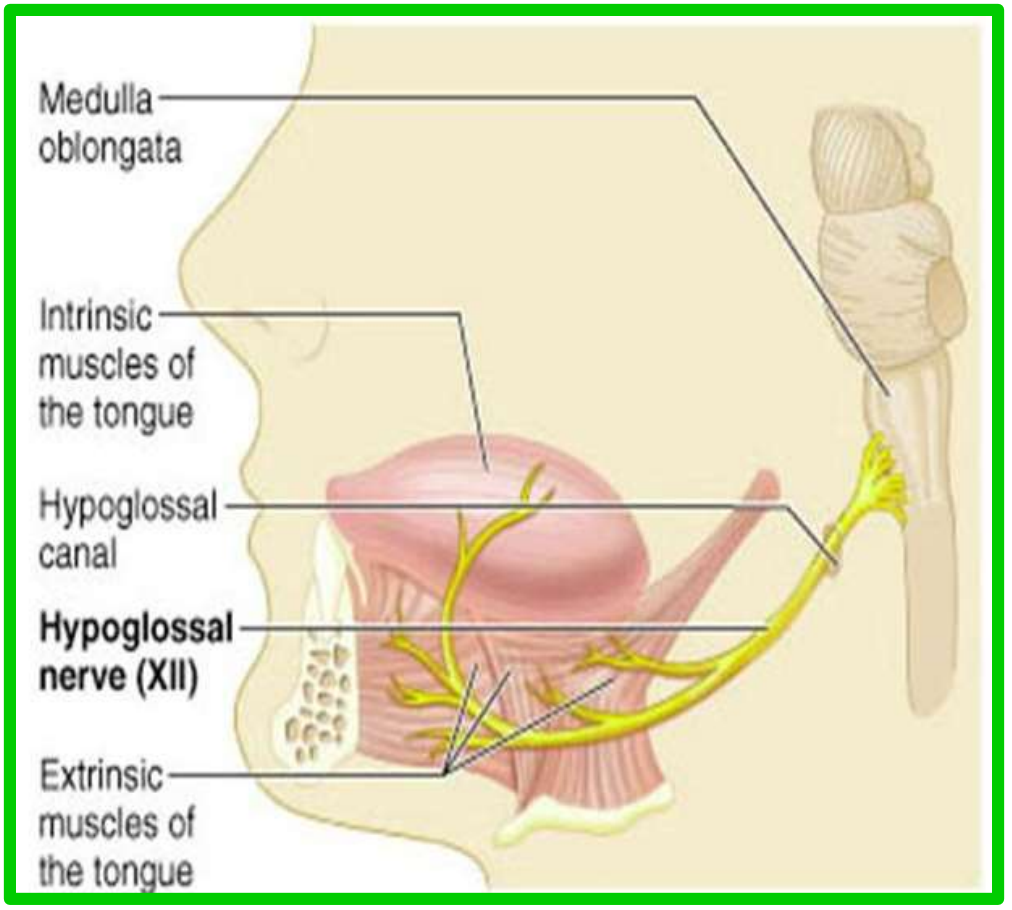
Hypoglossal Nerve CN XII

Important Branches of the Hypoglossal Nerve

■■ *Muscular branches* to all the muscles of the tongue except the palatoglossus (pharyngeal plexus)

■■ Nerve to the geniohyoid muscle (C1).

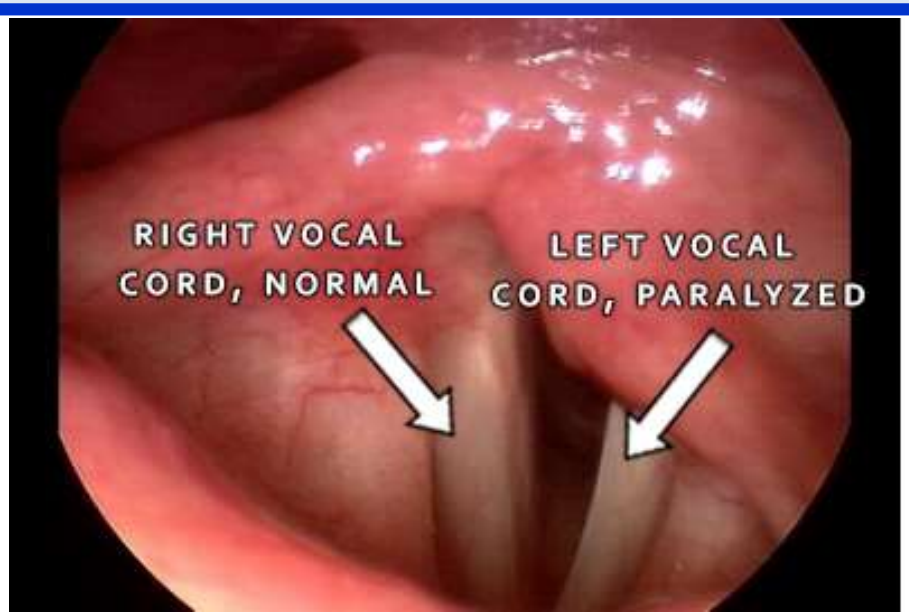
The hypoglossal nerve thus innervates the muscles of the tongue (except the palatoglossus) and therefore controls the shape and movements of the tongue.

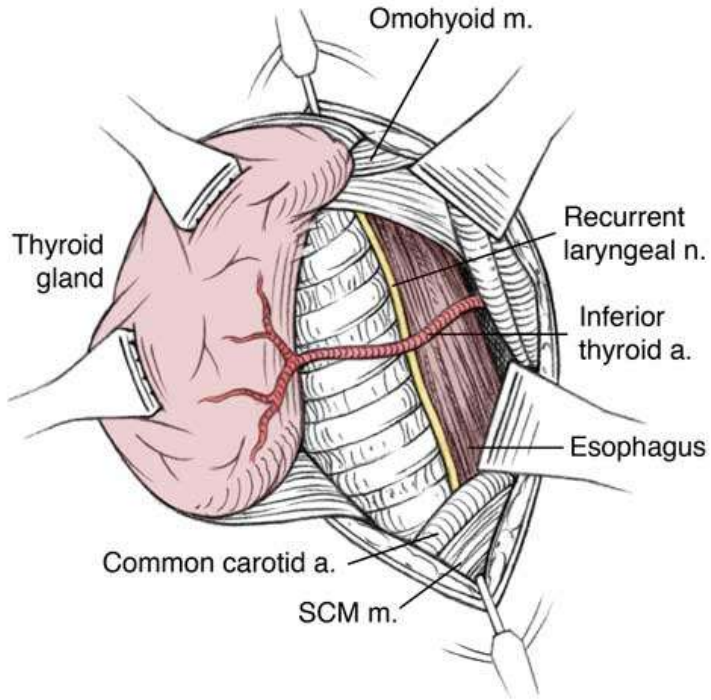


VAGUS NERVE INJURY *Injury to pharyngeal branches of CN X results in dysphagia (difficulty in swallowing).*

Injury of the recurrent laryngeal nerve causes hoarseness and dysphonia (difficulty in speaking) because of paralysis of the vocal folds (cords).

Paralysis of both recurrent laryngeal nerves causes aphonia (loss of voice) and inspiratory stridor (a harsh, high pitched respiratory sound). All these may results from cancer of the larynx and thyroid gland and/or from injury during surgery on the thyroid gland, neck.





SPINAL ACCESSORY NERVE INJURY

Because of its nearly subcutaneous passage through the posterior cervical region, CN XI is susceptible to injury during surgical procedures such as lymph node biopsy, cannulation of the internal jugular vein, and carotid endarterectomy result in marked ipsilateral weakness of shoulder (Drooping of the shoulder)

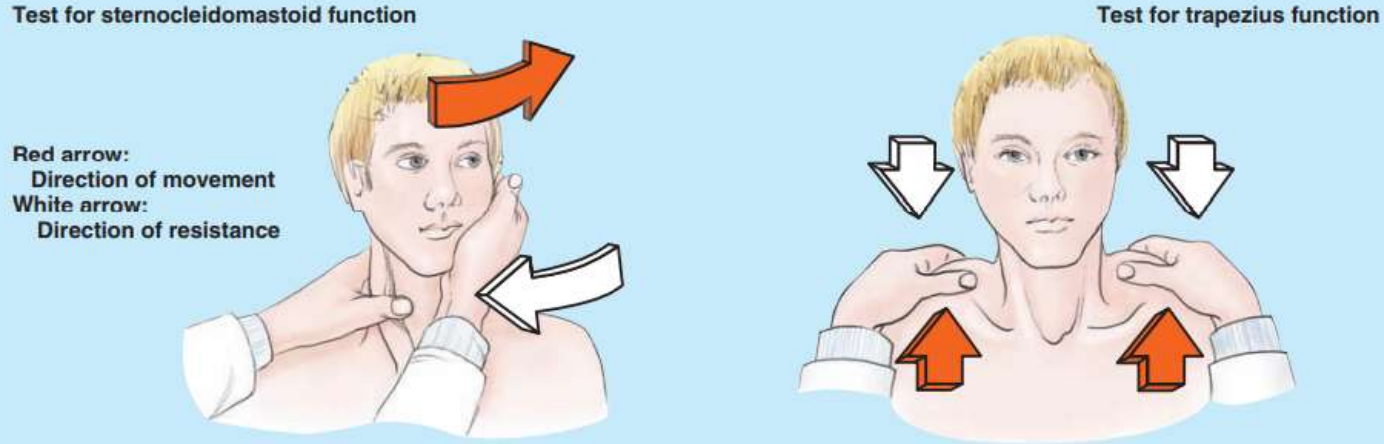


FIGURE B9.6. Muscle test for sternocleidomastoid and trapezius.

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Injury to Hypoglossal Nerve

Injury to CN XII paralyzes the ipsilateral half of the tongue. After some time, the tongue atrophies, making it appear shrunken and wrinkled. When the tongue is protruded, its apex deviates toward the paralyzed side because of the unopposed action of the genioglossus muscle on the normal side of the tongue

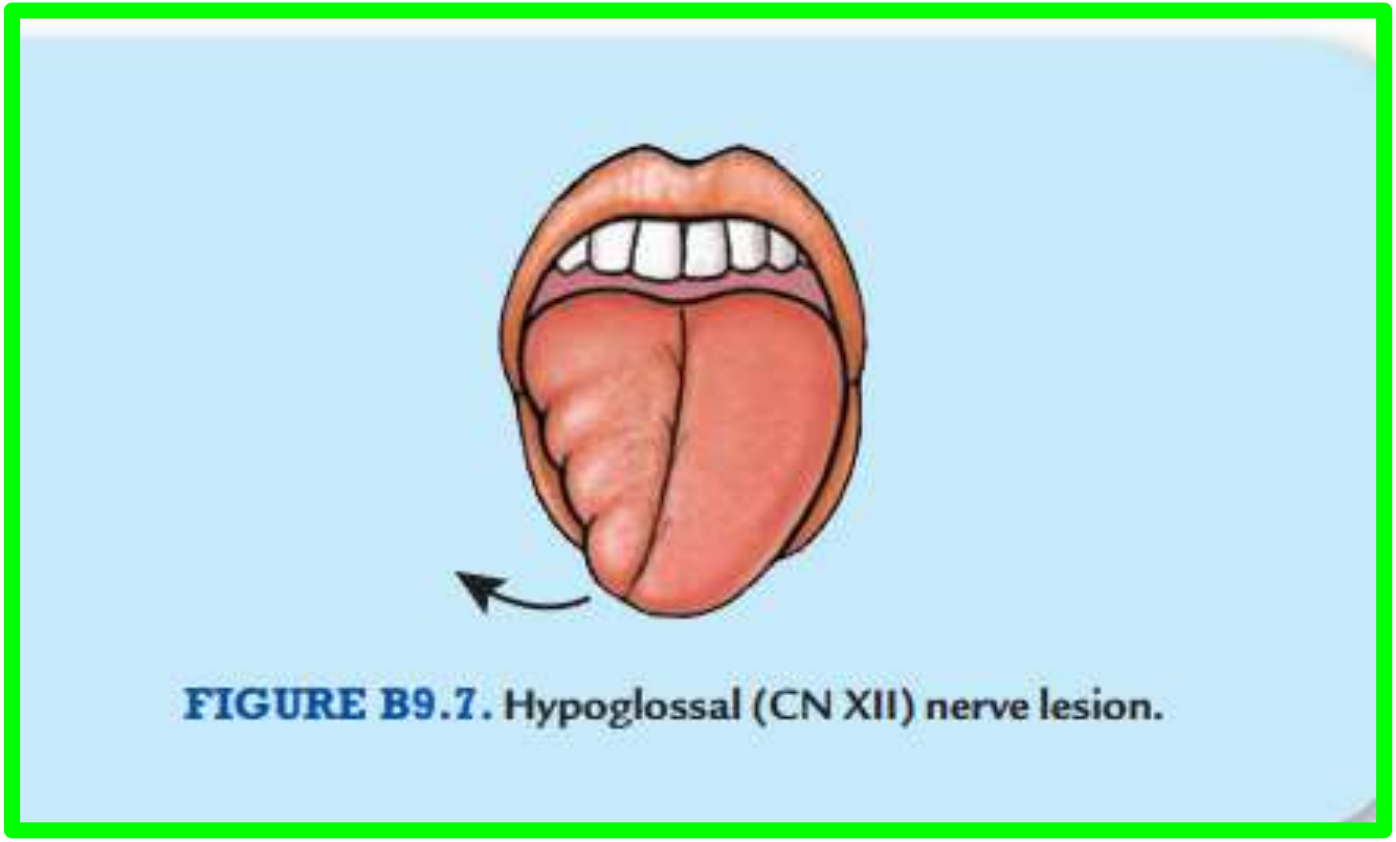

FIGURE B9.7. Hypoglossal (CN XII) nerve lesion.

تم بحمد الله

لا تنسونا من صالح دعواتكم