The University of Jordan
Faculty Of Medicine

The Orbital Cavity Part 2

Dr. Ahmed Salman

Associate professor of anatomy & embryology

The Eye

The Wall of the Eyeball: is formed by three coats surrounding its cavity, they are:

I.Outer Fibrous layer :consists of:

A.Cornea: Is the transparent anterior part of this coat.

B.Sclera: Is opaque and formed by dense white fibrous tissue.

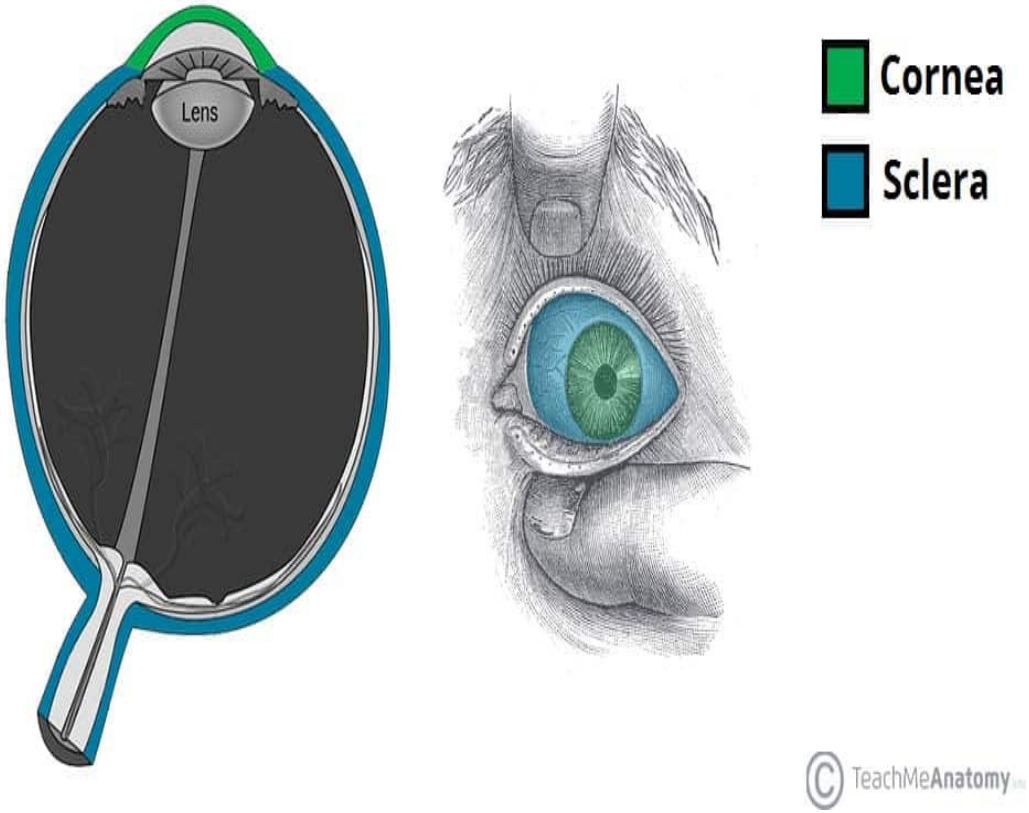
II. Middle Vascular layer: consists of three parts :

A. Ciliary body : Consists of the ciliary muscle.

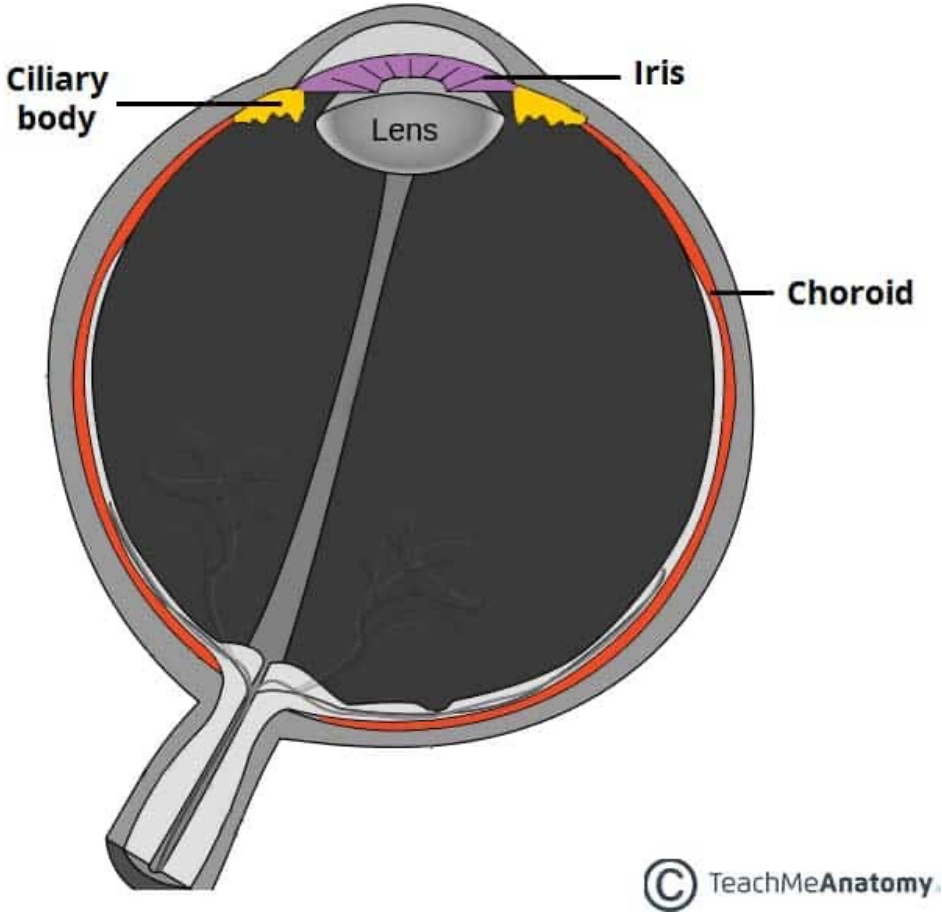
B. Choroid: A thin brown highly vascular membrane which lines the inner surface of the sclera.

C. Iris:

- The contractile colored disc that surrounds the pupil.
- It is pigmented and contains circular and radial muscle fibers which are involuntary.
- The **circular** part forms the **sphincter pupillae**, while the **radial** part forms the **dilator pupillae.**



Outer Fibrous layer

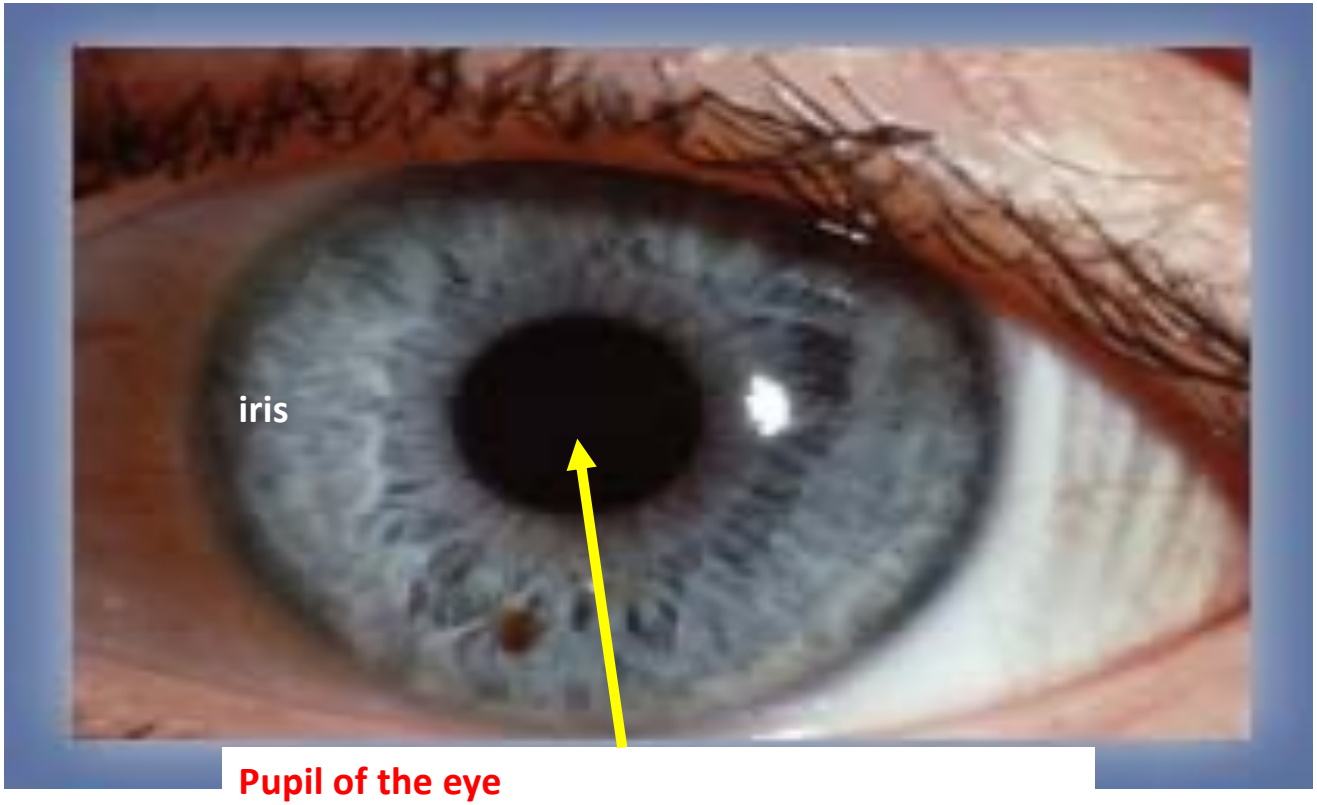


Middle Vascular layer

Ciliary body

Dilator pupillae

Sphincter pupillae

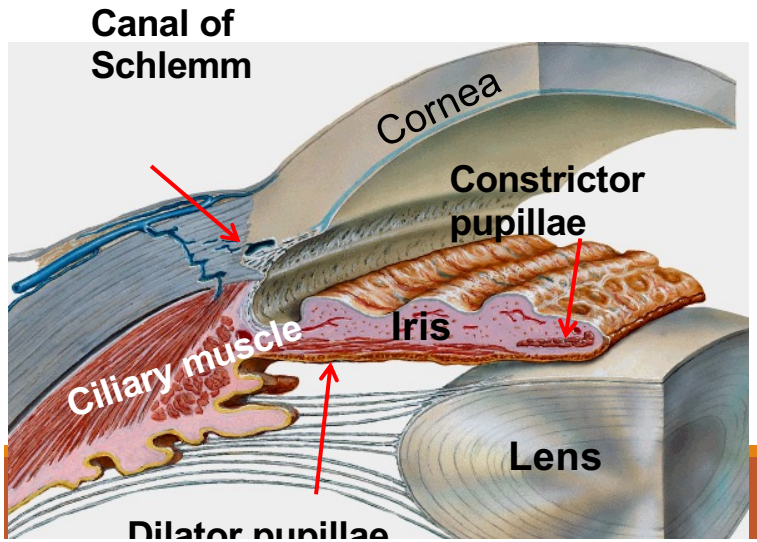

iris
Pupil of the eye

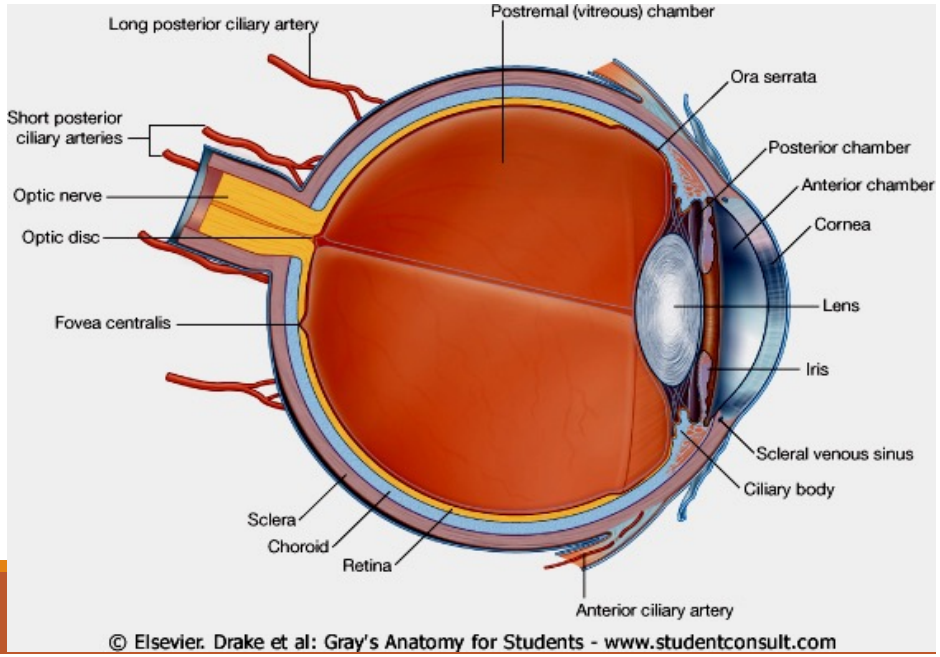
III. Internal nervous coat (retina):

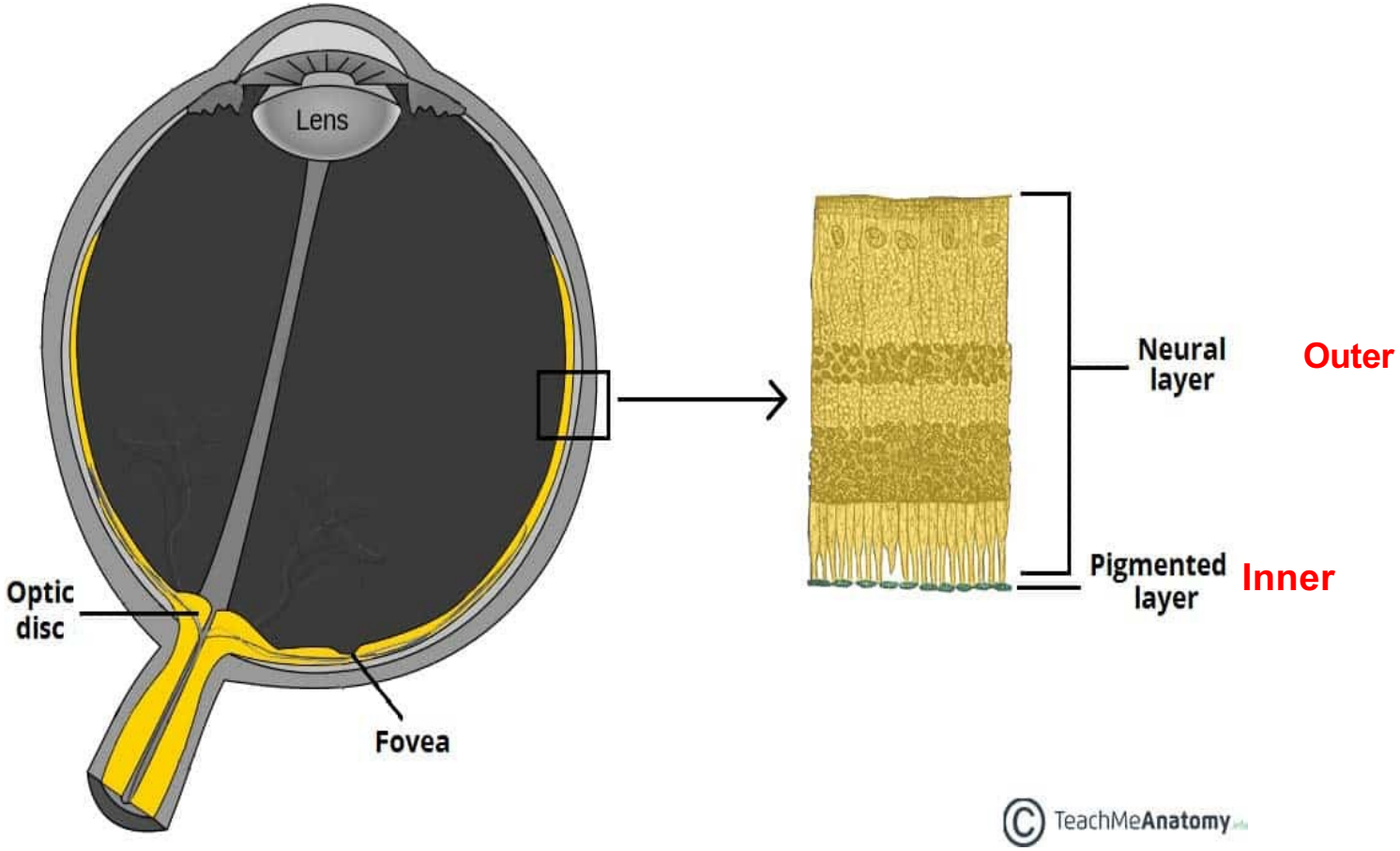
- The retina consists of an ***outer pigmented part***, and an ***inner nervous part***.
- From the ***ganglionic layer*** of the retina arises the ***optic nerve*** which pierces the posterior pole of the eyeball.

The cavity of the eye is divided into:

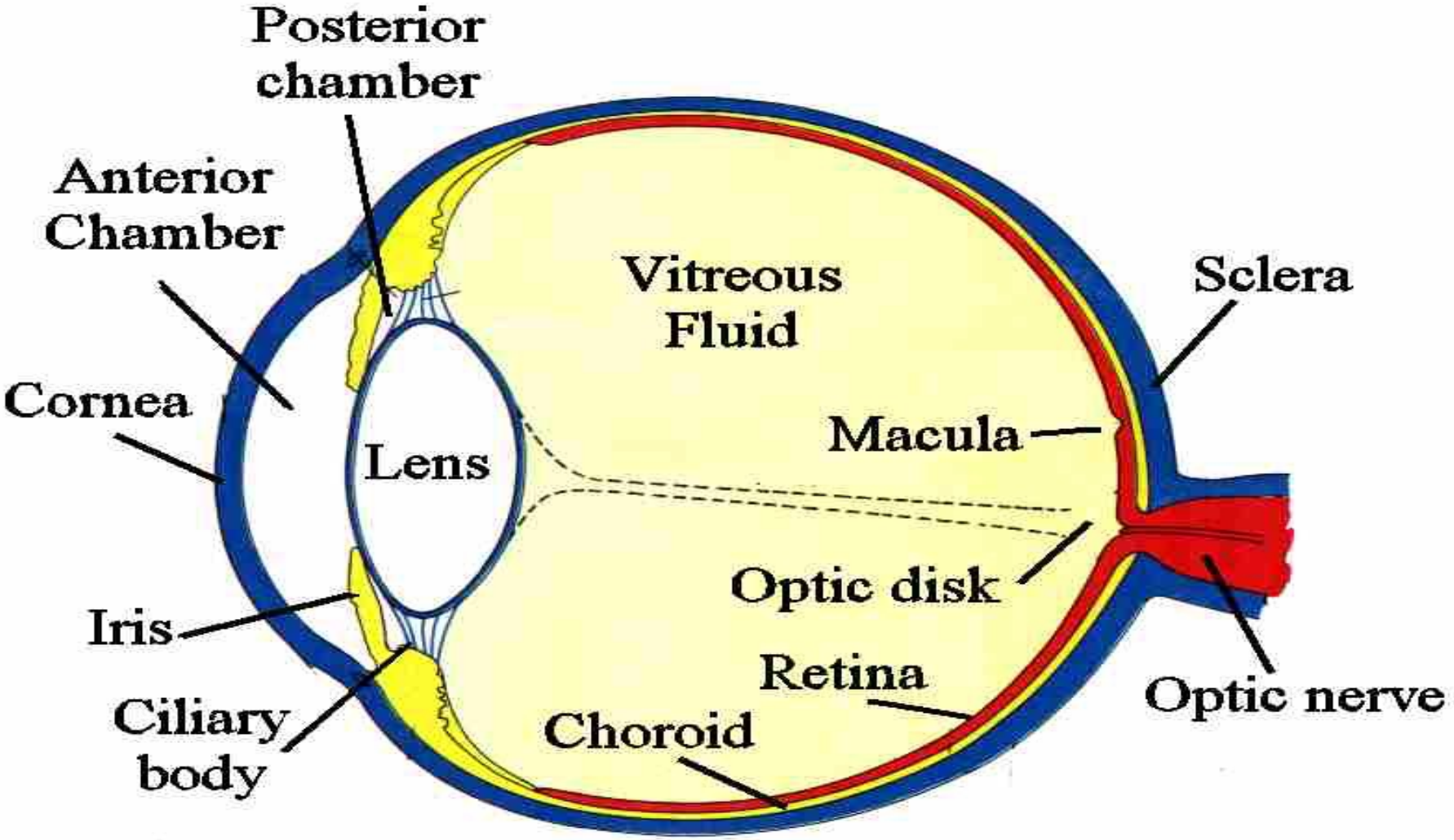
- **Anterior chamber**: It is the space between the cornea & iris.
- **Posterior chamber**: is the space between the iris & lens of the eye.
- They communicate through the **pupil** .



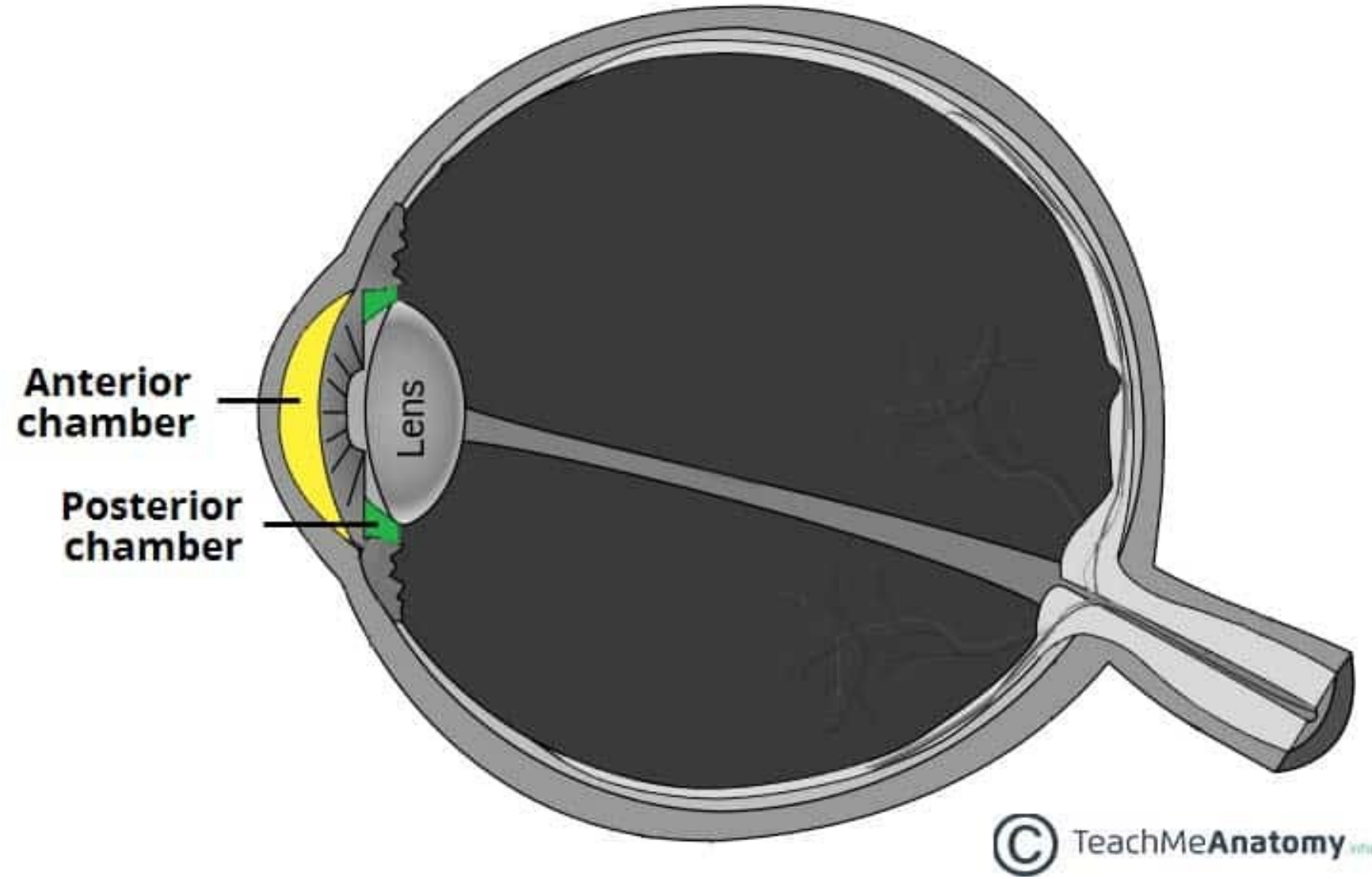




Internal nervous coat (retina):



Kimber, D.C.; C.E. Gray, and C.E. Stackpole. (1966).


Anterior chamber
Posterior chamber
Lens
© TeachMeAnatomy

The Cavity of the Eyeball contains:

Read Only

A. Aqueous humour :

It is a **fluid secreted** from the vessels of the iris and ciliary body and **fills** the anterior and posterior chambers of the eye.

A. The vitreous body :

It is a **transparent** colourless **jelly**-like substance that fills the ***posterior 5/6*** of the eyeball.

It is ***enveloped by*** the hyaloid membrane.

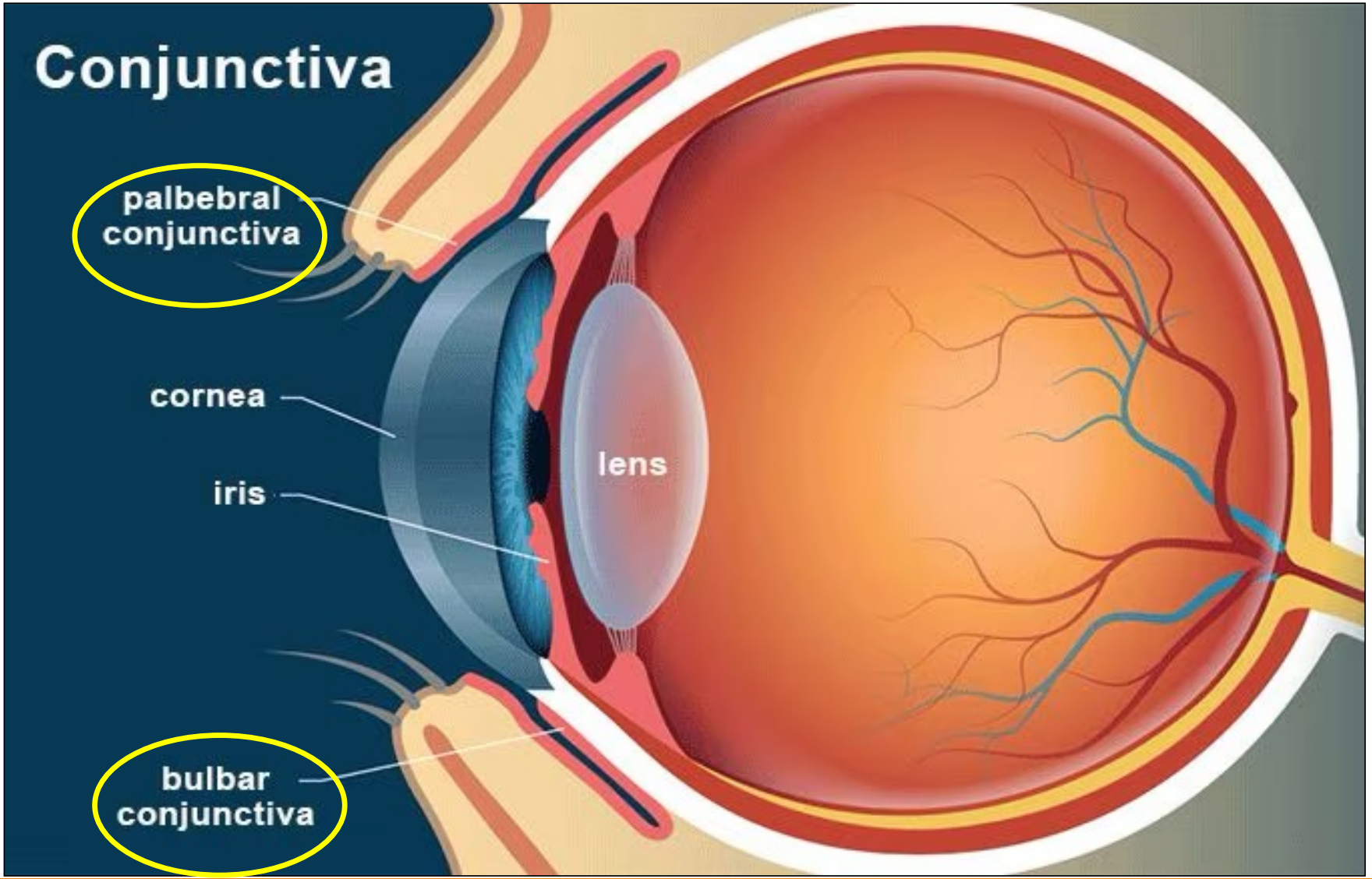
A. The lens : transparent ***biconvex*** lens , situated in ***between*** the posterior chamber in front, and the vitreous body behind. It is surrounded by a ***capsule***, to which is attached the ***suspensory ligament*** of the lens that keeps it in place.

Fascial Sheath of the Eyeball

- It is the thin fibrous capsule which envelops the eyeball from the **optic N. posteriorly** to the **corneo-scleral junction anteriorly**.
- It provides a socket which supports the eye and allows its movement in all directions.
- 1ts outer surface is pierced by the tendons of the extraocular muscles

The Conjunctiva:

- The conjunctiva is a transparent mucous membrane which lines the upper and lower eyelids (palpebral part) and is reflected over the front of the sclera (Bulbar or ocular part).
- The line of reflection above is called the superior fornix, while the line of reflection below is called the inferior fornix.
- The superior fornix receives the ducts of the lacrimal gland.


Conjunctiva
palbebral conjunctiva
cornea
iris
lens
bulbar conjunctiva

Read Only

Eye Lid

- They are thin **movable folds** cover the **front of the eyes** and **protecting** them from injury by rapid closure.
- The **upper** eye lid is **larger** and **more mobile** than the lower lid.
- the elliptical **space** which appears between their margins is called the **palpebral fissure**.

Structures of the eye lids: It consists of the following layers from superficial to deep:

1-Skin: very thin.

2-Superficial fascia: very lax, delicate and devoid of fat.

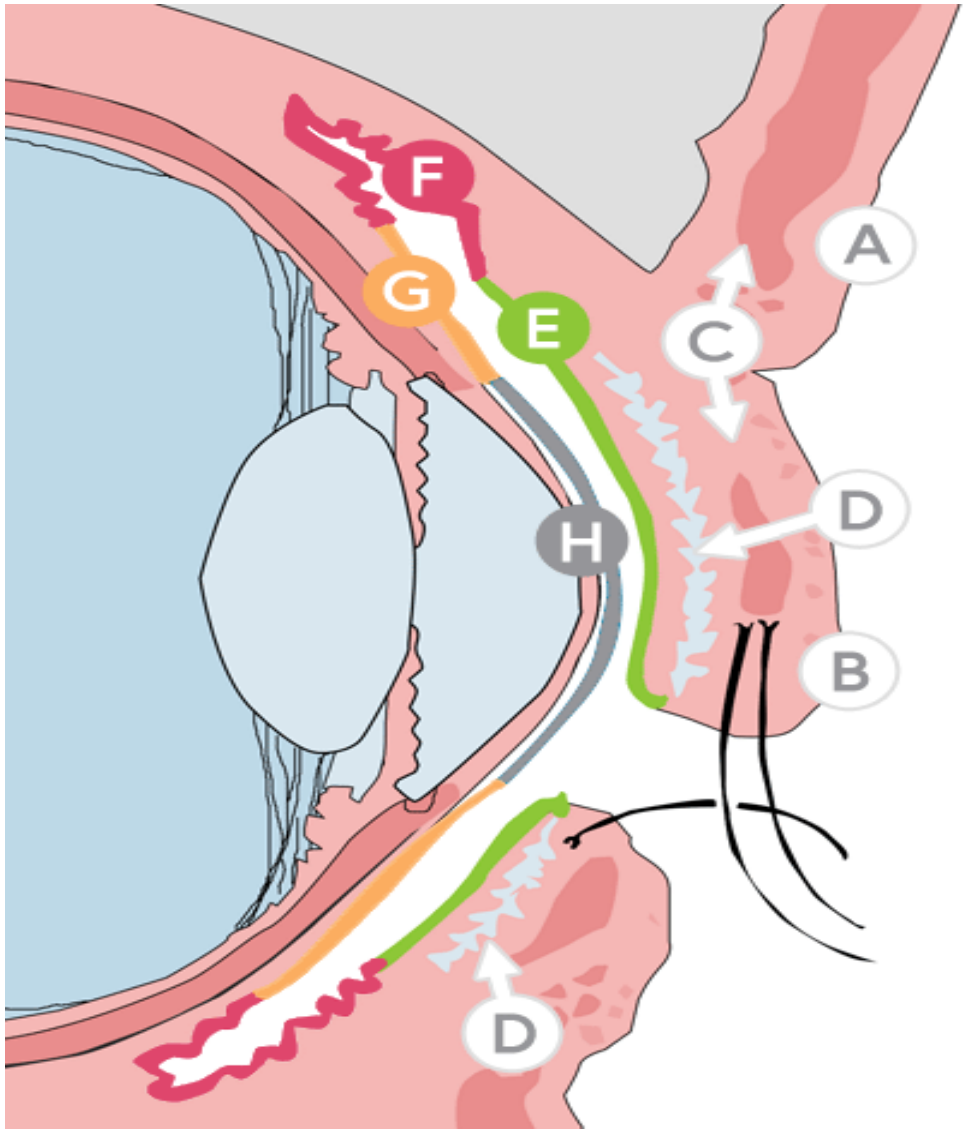
3-Palpebral part of the orbicularis oculi.

4-Loose connective tissue layer: lies deep to the orbicularis oculi and contains the main nerves and vessels of the eye lid. **Local anesthesia should be injected deep to the orbicularis oculi.**

5-Tarsus: A plate of dense fibrous tissue

6-Tarsal glands: they secretes oily secretion spreads over the lid margins and prevents overflow of lacrimal secretion on to the cheek.

7-Conjunctiva.



A Skin

B Lid margin

C Orbicularis oculi

D Tarsal plate

E Palpebral conjunctiva

F Conjunctival fornix

G Bulbar conjunctiva

H Surface of cornea

The lacrimal apparatus

It consists of:

1) Lacrimal gland: It lies in the anterolateral part of the roof of the orbit.

It is formed of **two parts**; **large orbital part** which lies in the **lacrimal fossa** at the anterolateral part of the roof of the orbit, above the **levator palpebrae superioris muscle** and a **small palpebral part**, that lies below the muscle.

- The gland ducts open in the lateral part of the **superior fornix** of the conjunctiva.

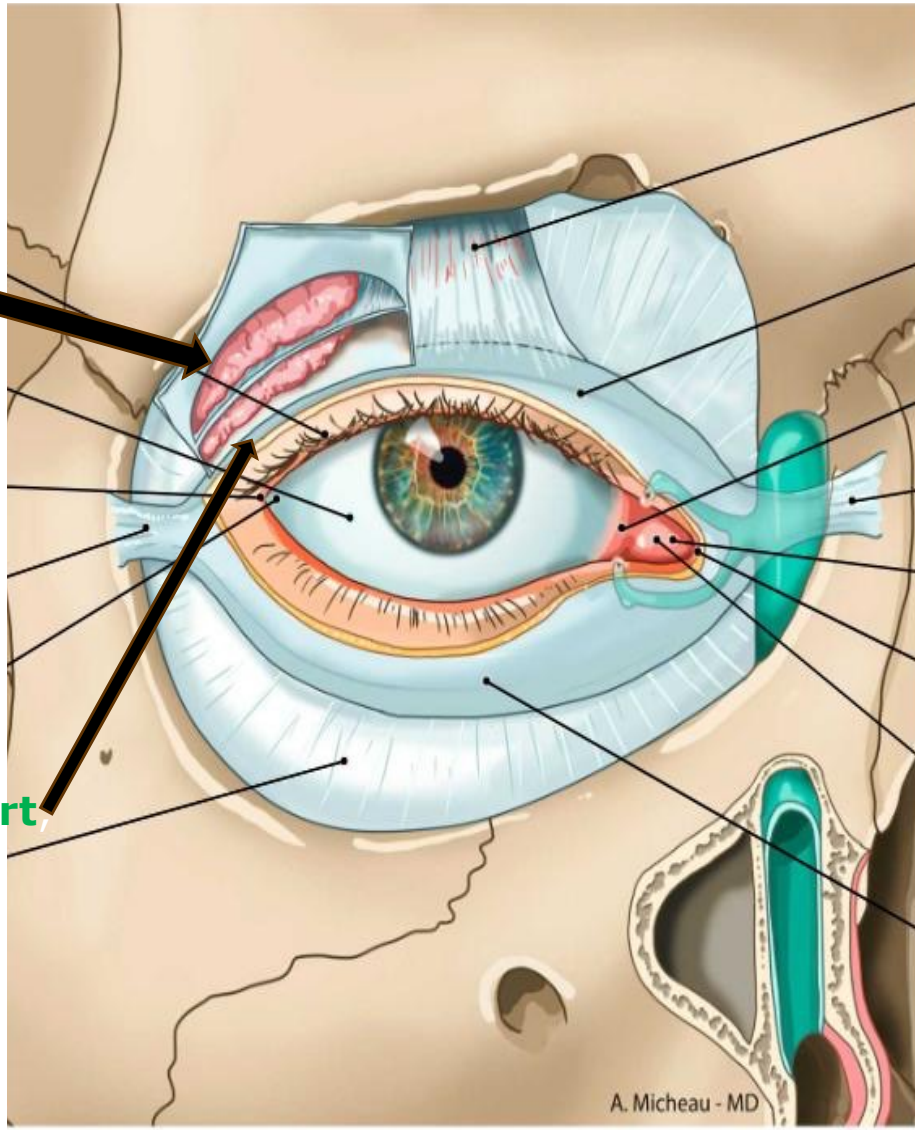
It is **innervated by** the **greater superficial petrosal** nerve (facial nerve)

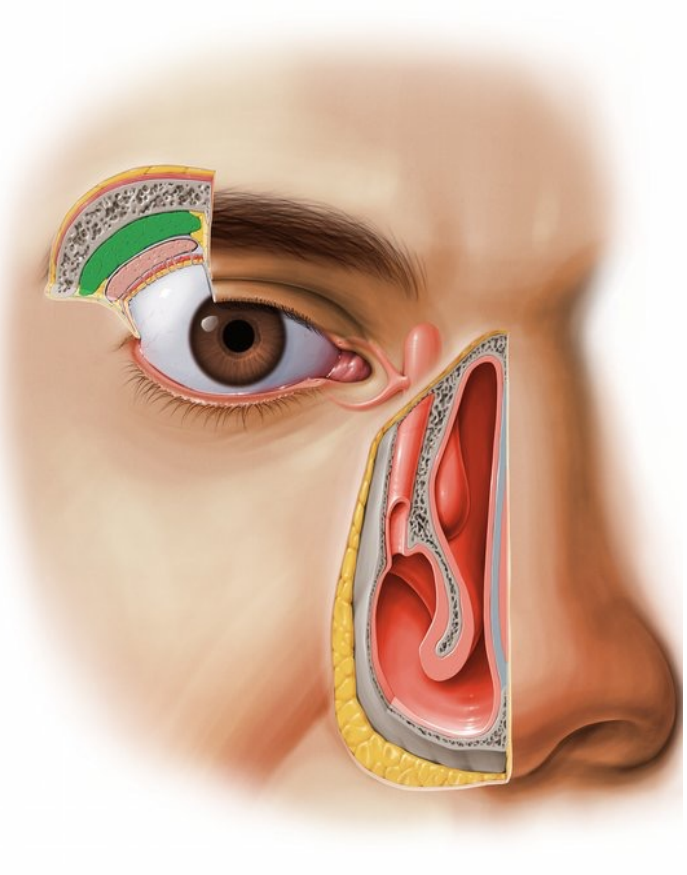
2) lacrimal canaliculi connects Lacrimal gland and lacrimal sac.

3) Lacrimal sac lies in the on the medial wall of the orbit & & is drained by **nasolacrimal duct** which opens in the inferior meatus of the nose.

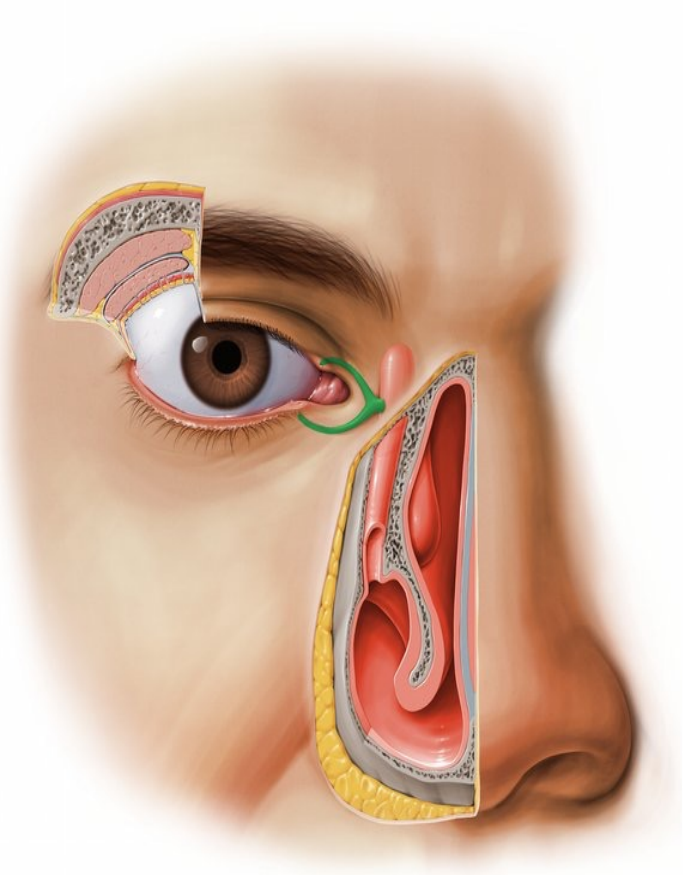
orbital part

palpebral part

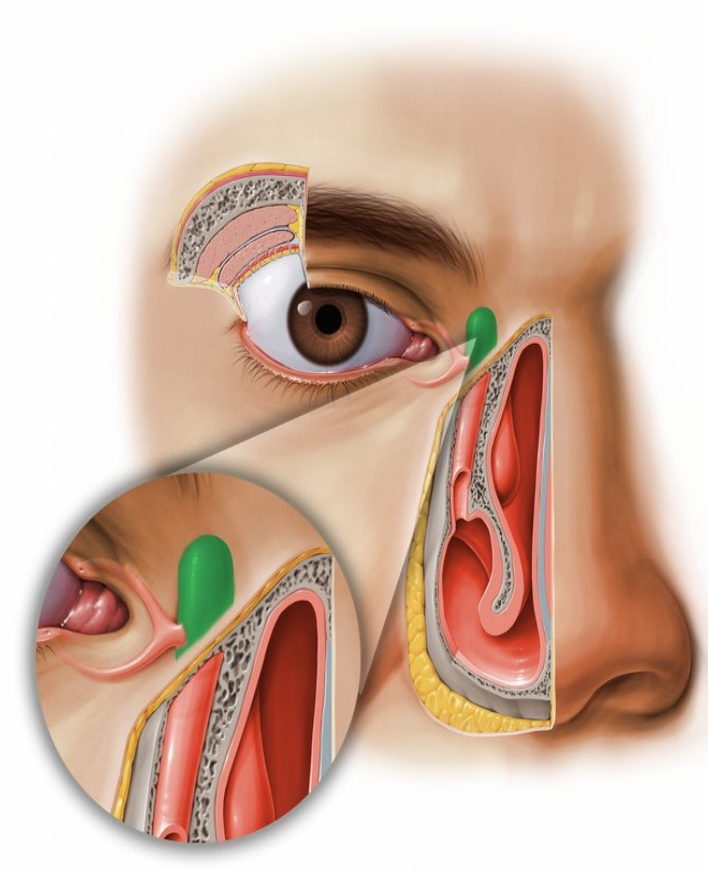




Lacrimal gland



lacrimal canaliculi



Lacrimal sac

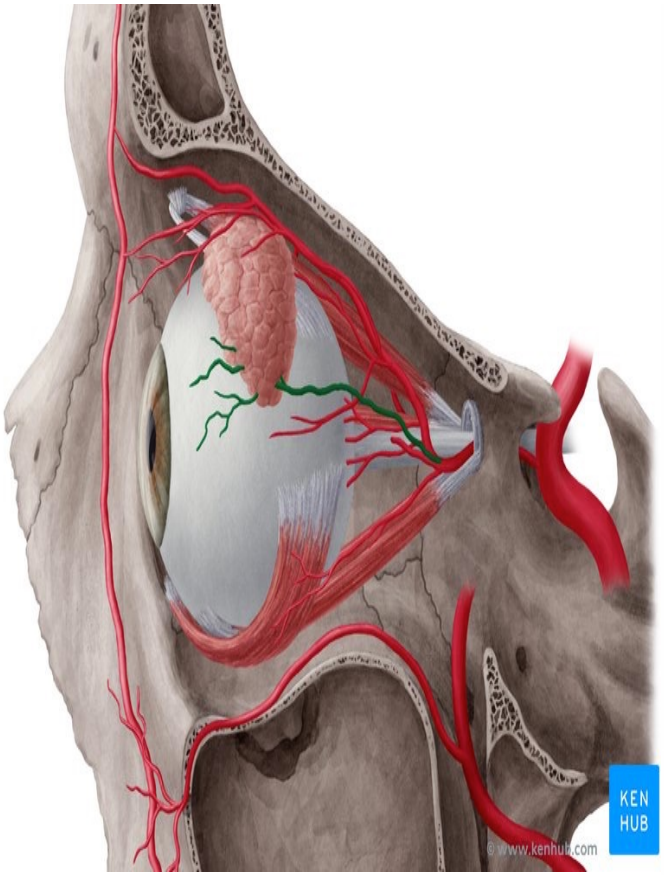
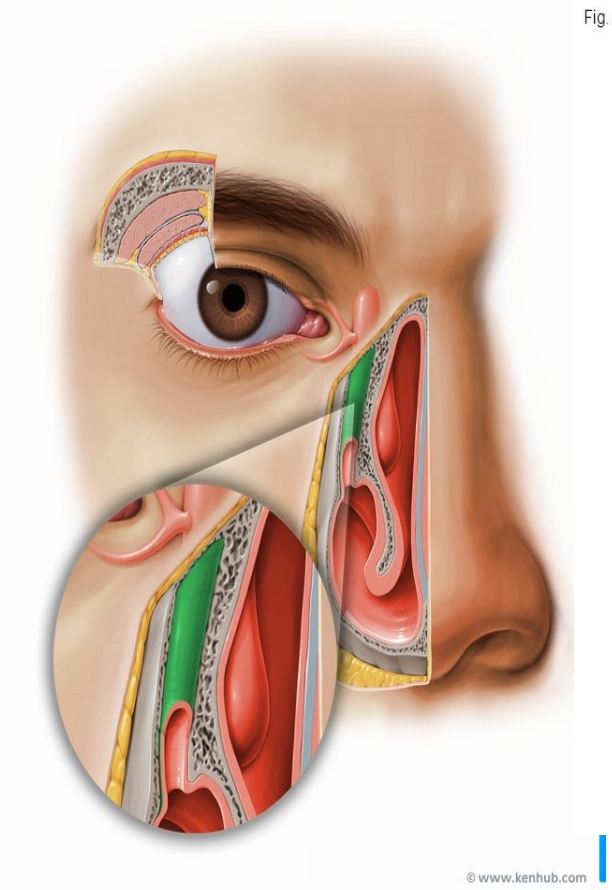
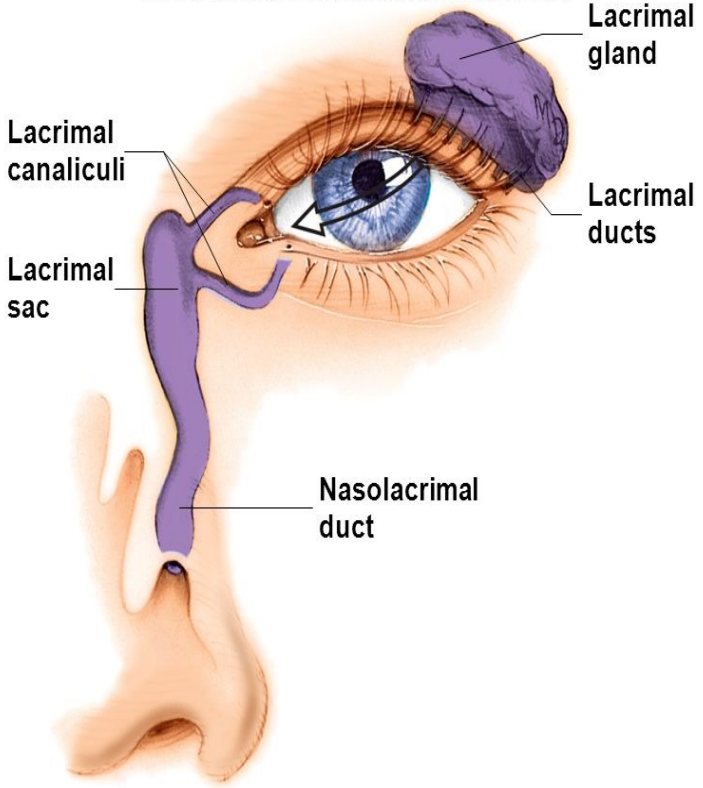


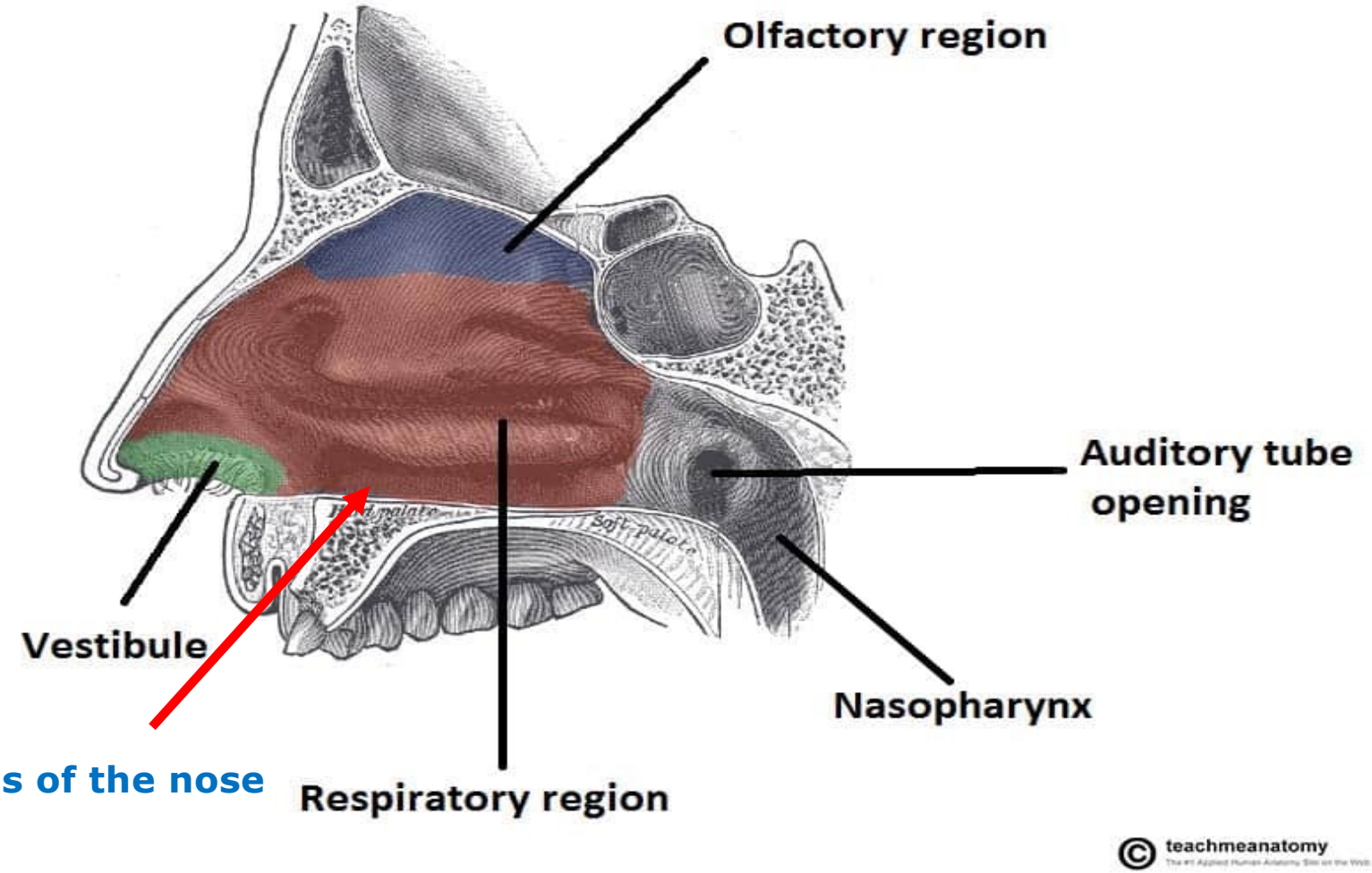
Fig. 9.7





Lacrimal gland

Nasolacrimal duct



Inferior meatus of the nose

Nerves of the Orbit

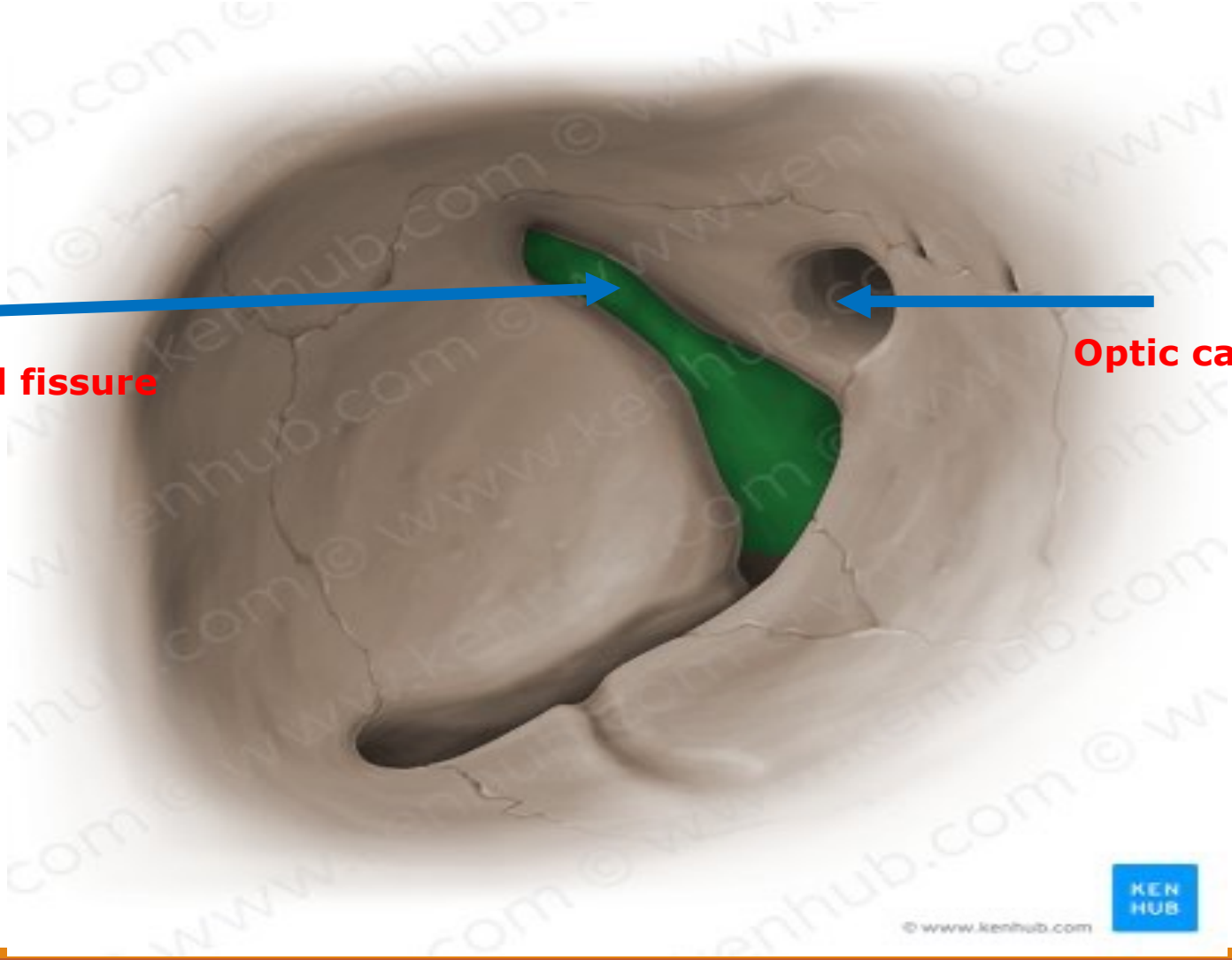
Motor nerve	Sensory nerves		Autonomic nerves	
(3)	**General sensation (3)**	**vision**	**Sympathetic (3)**	**Parasympathetic (3)**
3 cranial nerves supply extra-ocular muscles : - Oculomotor - Trochlear - Abducens	3 branches of ophthalmic N. - Lacrimal - Frontal - Nasociliary	Optic N.	- Muller's muscle (of L.P.S.). - Dilator pupillae -Blood vessels of the eyeball.	- Ciliary muscle **(oculomotor N.)** - Constrictor pupillae **(oculomotor N.)** - Lacrimal gland **(facial N.)**

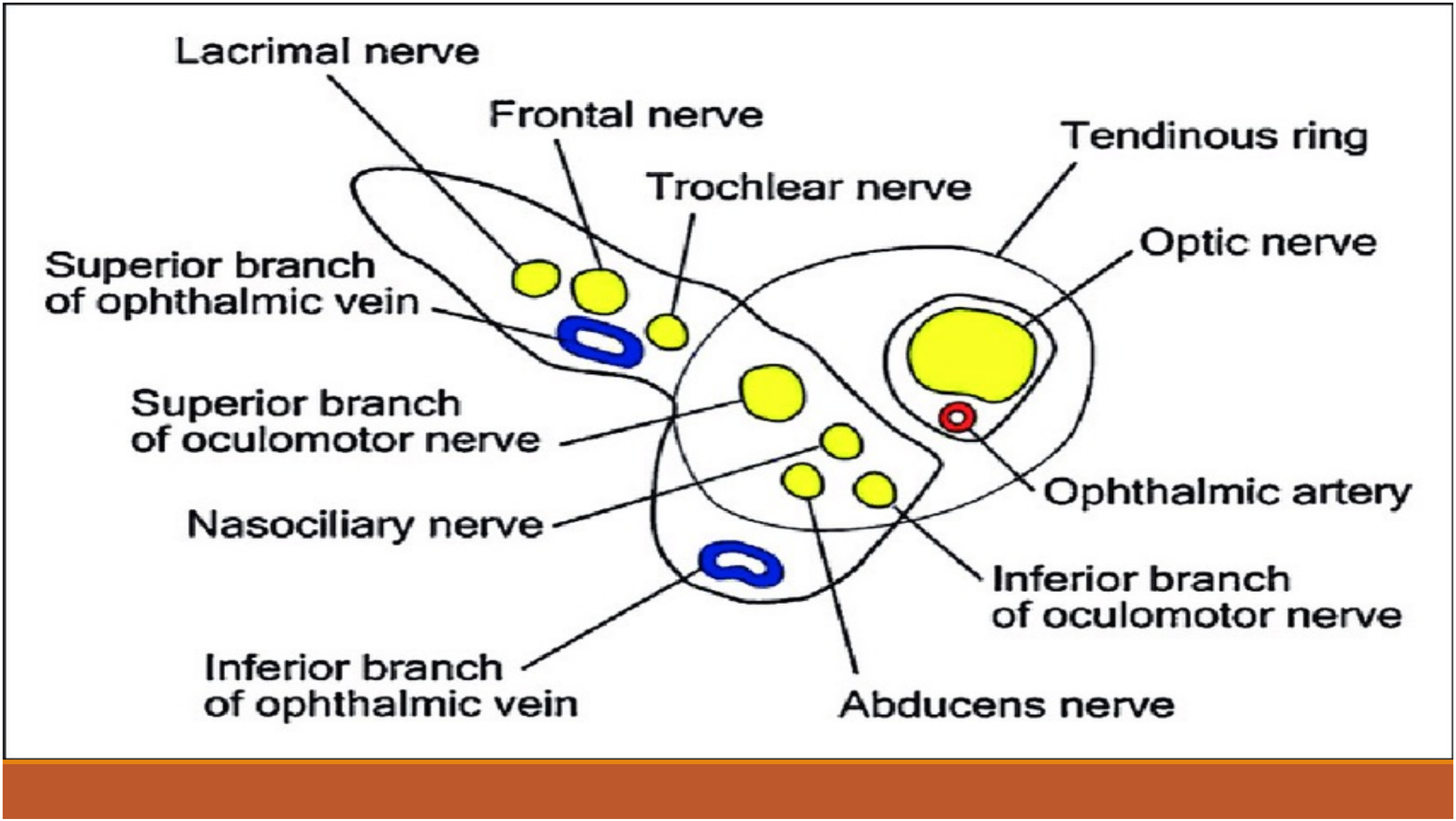
- All the nerves enter the orbit via the **superior orbital fissure (SOF)** ***EXCEPT*** the optic N. which enter the orbit (with the ophthalmic Artery) through the **optic canal**.
- The nerves entering SOF from above downwards could be remembered by the famous statement :

Live free To See No Insult At All

(Lacrimal, Frontal, Trochlear, Superior division of oculomotor, Nasociliary, Inferior division of oculomotor, Abducens).

- 3 nerves (lacrimal, frontal, trochlear nerves) pass through SOF *outside* the common tendinous ring.
- 3 nerves (the superior and inferior divisions of the oculomotor N. ,nasociliary N. and the Abducens N.) pass through the SOF *within* the common tendinous ring.


superior orbital fissure
Optic canal
© www.kenhub.com
KEN HUB


Lacrimal nerve
Frontal nerve
Tendinous ring
Trochlear nerve
Optic nerve
Superior branch
of ophthalmic vein
Superior branch
of oculomotor nerve
Ophthalmic artery
Nasociliary nerve
Inferior branch
of oculomotor nerve
Inferior branch
of ophthalmic vein
Abducens nerve

I-Motor Nerves of the Orbit

1- Oculomotor nerve (the 3rd cranial nerve):

origin: It arises from the upper part of midbrain by 2 nuclei:

A-Motor nucleus:

B- Parasympathetic nucleus: **Edinger Westphal** nucleus.

- **Course and relations:**

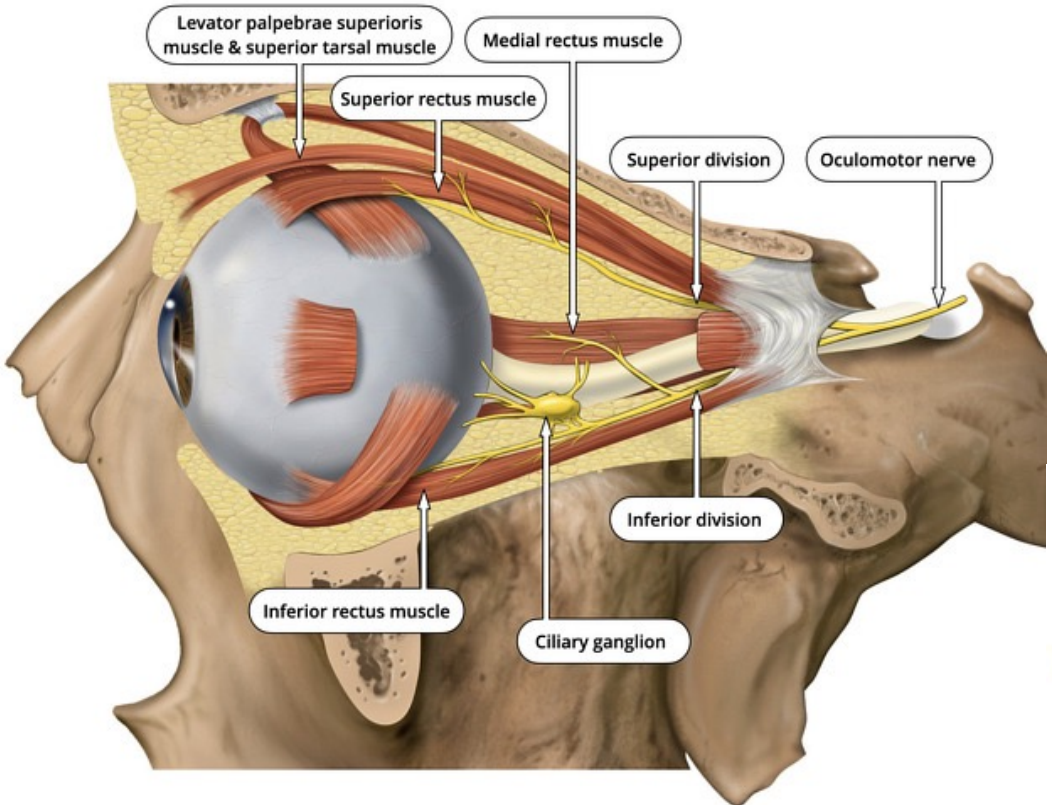
➢ **In the orbit**:

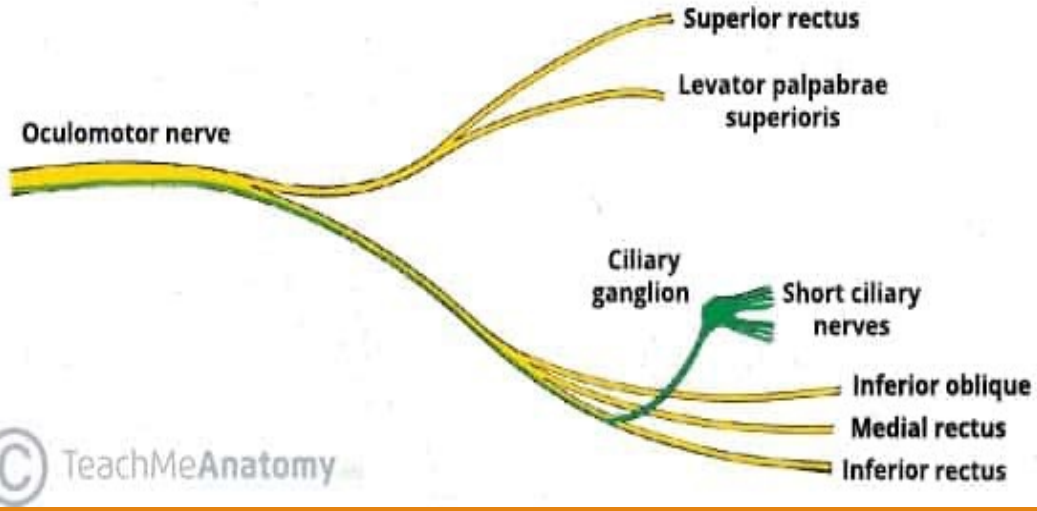
The superior division supplies two muscles: superior rectus and levator palpebrae superioris.

The inferior division passes forwards supplying the medial rectus, inferior rectus and ends in the inferior oblique supplying it.

It **contains** the parasympathetic fibers which relay in the **ciliary ganglion** and postganglionic fibers supply the **ciliary and the sphincter pupillae muscles**.

Oculomotor nerve





•Palsy of the Oculomotor nerve

•**Ptosis** (drooping upper eyelid) – due to paralysis of the levator palpabrae superioris and unopposed activity of the orbicularis oculi muscle.

•**Down and out** : position of the eye at rest – due to paralysis of the superior, inferior and medial rectus, and the inferior oblique (and therefore the unopposed activity of the lateral rectus and superior oblique).

The patient is unable to elevate, depress or adduct the eye.

•**Dilated pupil** – due to the unopposed action of the dilator pupillae muscle.

•**Watch this videos**

https://youtu.be/AEL0xeJ_NSw?feature=shared

https://youtu.be/g5sIeCgy7tg?feature=shared

Right oculomotor nerve palsy

Oculomotor nerve palsy

•Palsy of the Oculomotor nerve

•**Down and out** : position of the eye at rest – due to unopposed activity of the lateral rectus and superior oblique).

Oculomotor nerve palsy

Right oculomotor nerve palsy

2-Trochlear Nerve (the 4th cranial nerve):

- **Origin:** From the trochlear **motor nucleus** in the lower part of the **midbrain**.
- **Exit from brain:** In the midbrain the nerve crosses to opposite side and the nerve appears on the **back of midbrain** (the right nerve comes from the left nucleus and vice versa).
- **Course:** It enters the orbit through the **superior orbital fissure** to supply superior oblique muscle

Palsy of the Trochlear Nerve

Trochlear nerve palsy commonly presents with vertical diplopia, exacerbated when looking downwards and inwards **(such as when reading or walking down the stairs).**

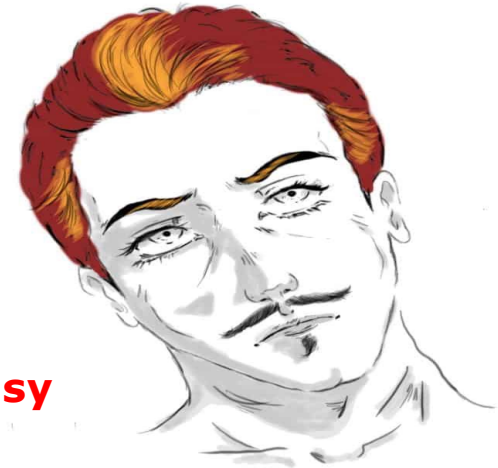
Patients can also develop a head tilt away from the affected side

Watch this videos

https://youtu.be/6K1733HbaTw?feature=shared

https://www.youtube.com/watch?v=H0V1O4oxx24

Left trochlear nerve palsy



Trochlear nerve palsy

3- Abducens Nerve (the 6th cranial nerve):

- **Origin:** Abducent motor nucleus in the pons.
- **Course:** it enters the orbit through the superior orbital fissure to supply lateral rectus muscle.

Abducens Nerve Palsy

Clinical features of include diplopia, the affected eye resting in adduction (due to unopposed activity of the medial rectus), and inability to abduct the eye.

The patient may attempt to compensate by rotating their head to allow the eye to look sideways.

Watch this videos

https://youtu.be/Pl2ozPSWfHs?feature=shared

https://youtu.be/IKJ2Sd1Lb9Y?feature=shared

Right abducens nerve palsy

Abducens nerve palsy

II- Sensory Nerves of the Orbit

Ophthalmic Division of the Trigeminal Nerve:

- It divides into **three branches before** they enter the **orbit** through the superior orbital fissure : Nasociliary ,Frontal and Lacrimal

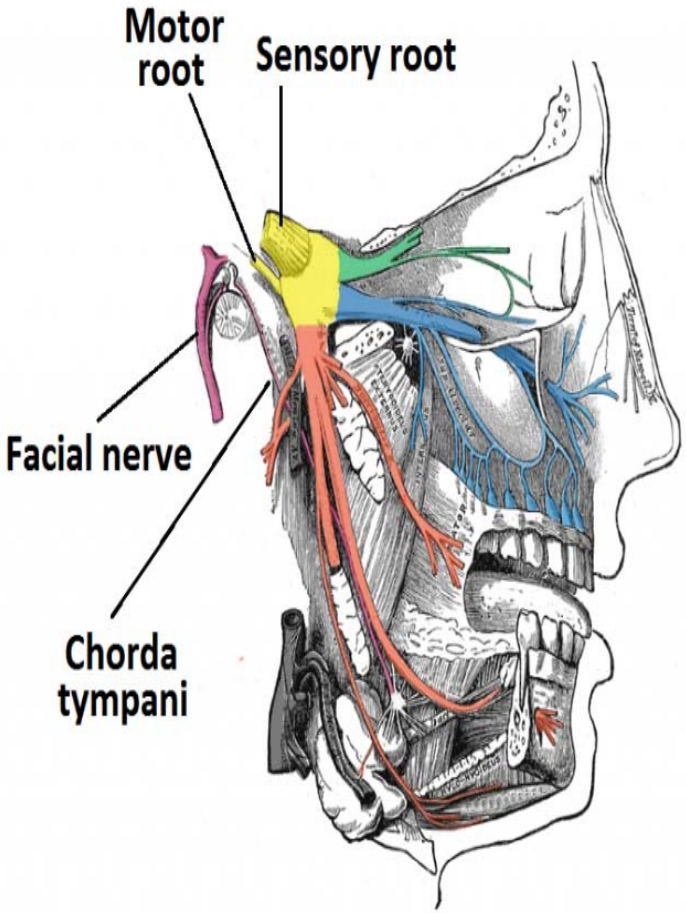
I-Nasociliary nerve: Which carries the ciliary ganglion.

It ends by dividing into anterior ethmoidal and infratochlear nerves.

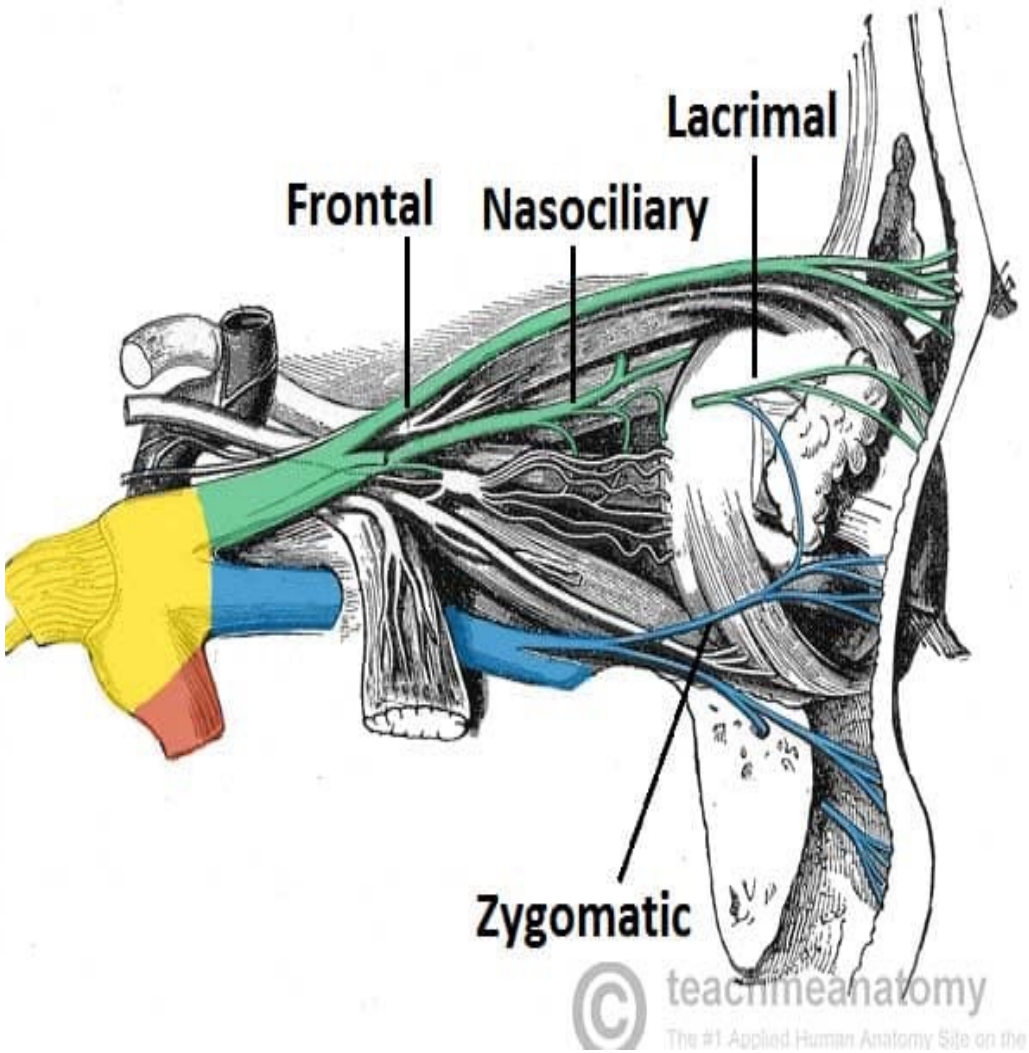
Branches:

- **Long ciliary nerves:** They carry also sympathetic fibers to the dilator pupillae muscle.
- **Sensory root to the ciliary ganglion**
- **Infratrochlear nerve**
- **Posterior ethmoidal nerve**
- **Anterior ethmoidal nerve** ,it ends by dividing into :

  Internal nasal nerve and **External nasal nerve**



Opthalmic (V1)
Maxillary (V2)
Mandibular (V3)

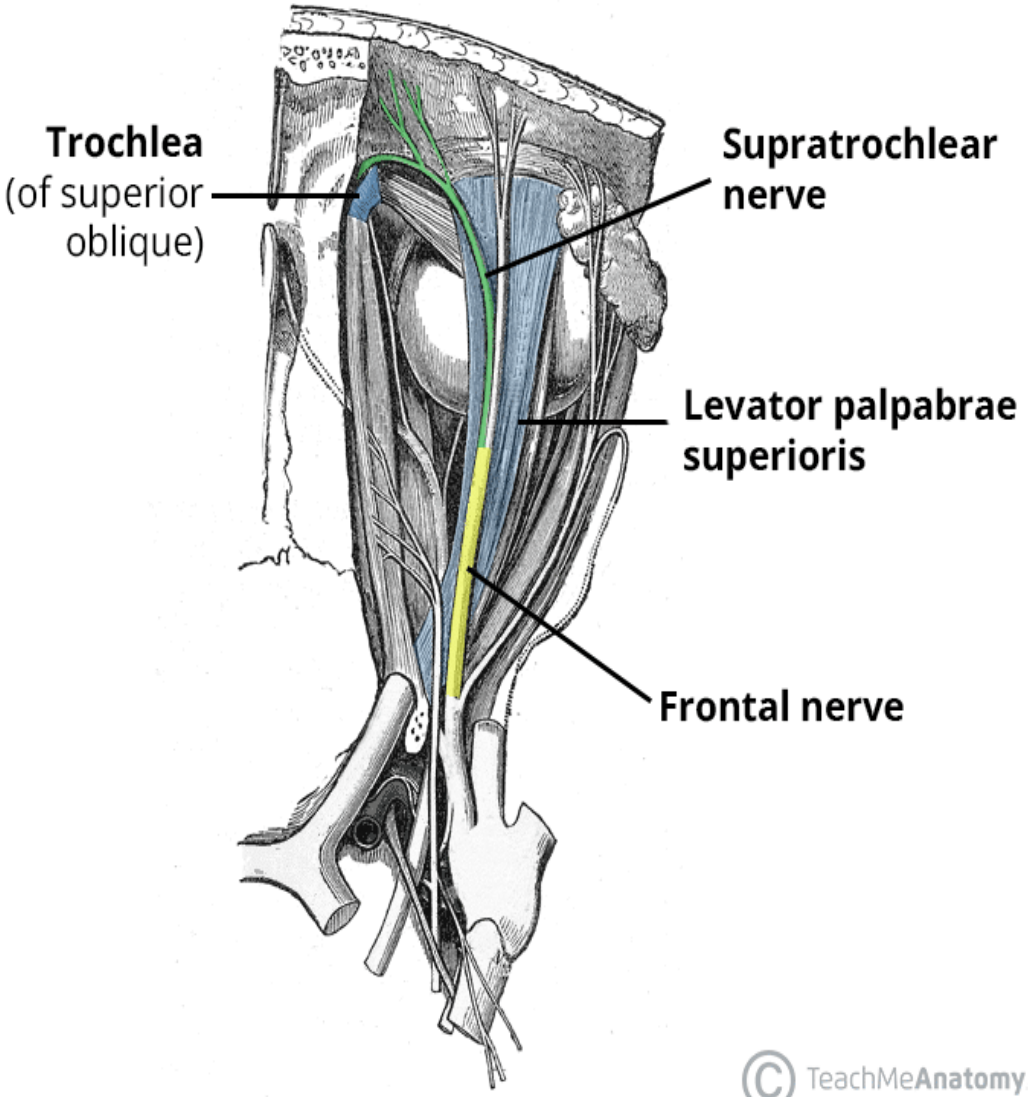


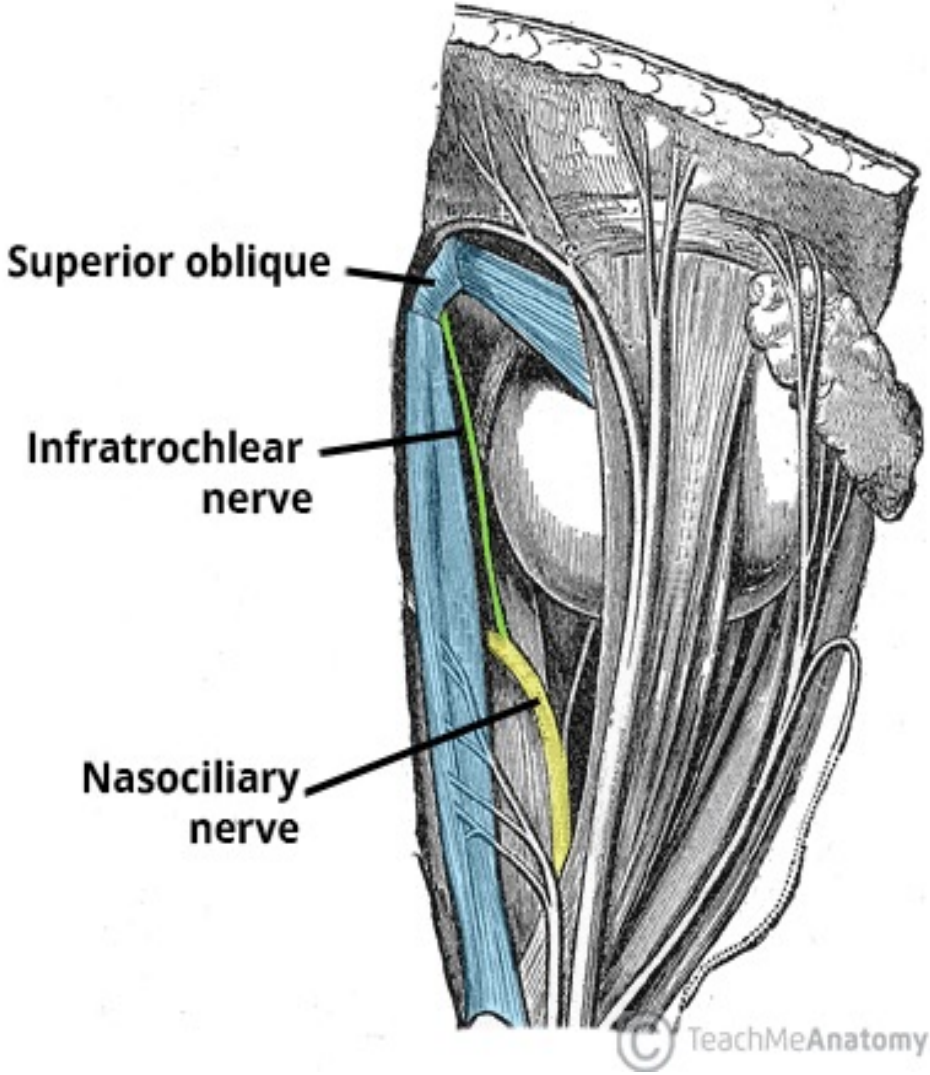
II) Frontal nerve:

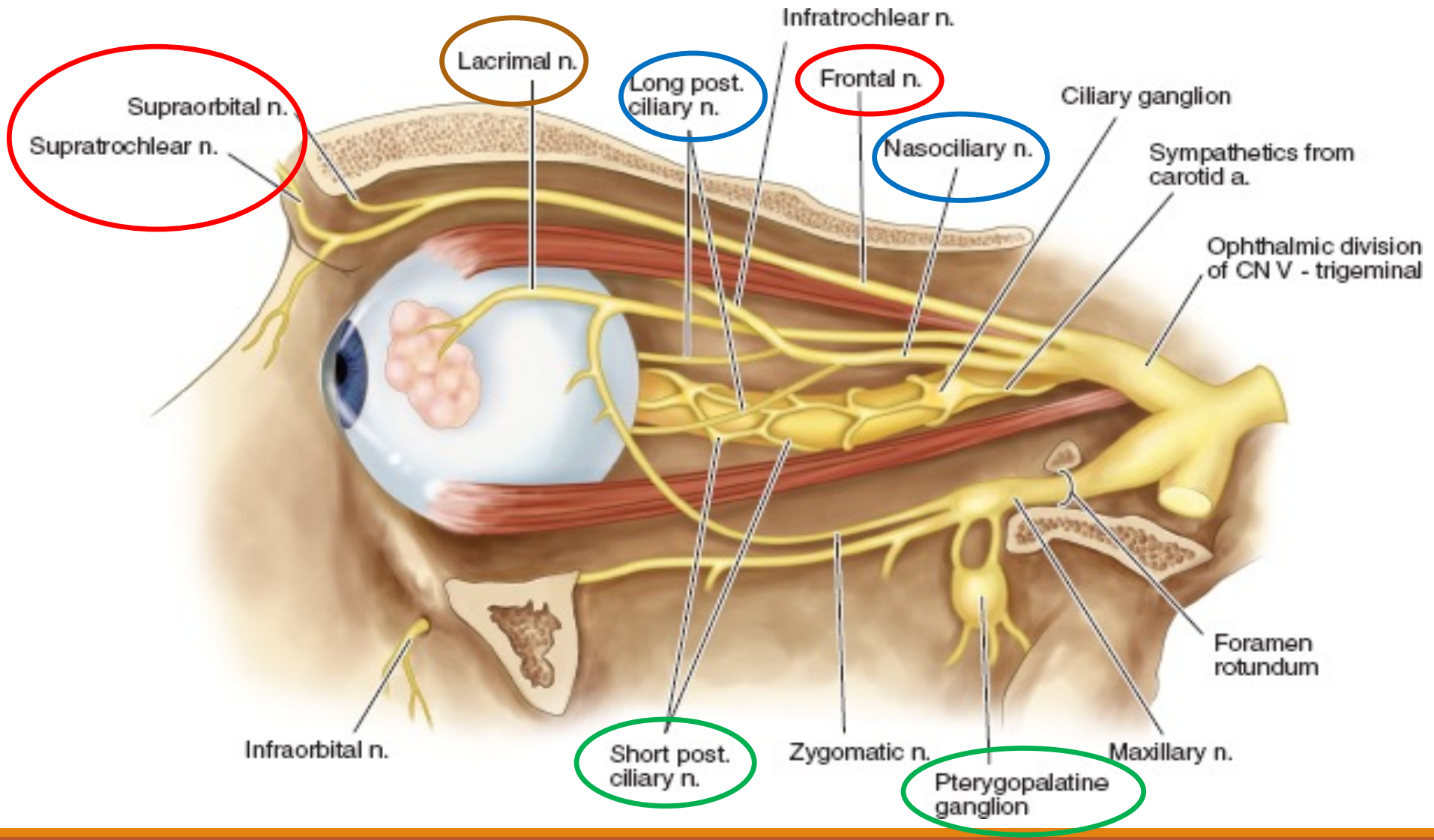
- It divides into **two terminal branches**; supraorbital and supratrochlear nerves.

III) Lacrimal nerve:

- It **ends** in the lacrimal gland.
- It gives **palpebral branch** supplying the lateral 1/3 of the upper lid.
- It receives a **twig from the zygomaticotemporal** branch of maxillary nerve which contains the **postganglionic parasympathetic & sympathetic fibers from pterygopalatine ganglion** to the lacrimal gland






Infratrochlear n.
Lacrimal n.
Long post. ciliary n.
Frontal n.
Ciliary ganglion
Supraorbital n.
Supratrochlear n.
Nasociliary n.
Sympathetics from carotid a.
Ophthalmic division of CN V - trigeminal
Foramen rotundum
Infraorbital n.
Short post. ciliary n.
Zygomatic n.
Maxillary n.
Pterygopalatine ganglion

Optic Nerve (the 2nd cranial nerve):

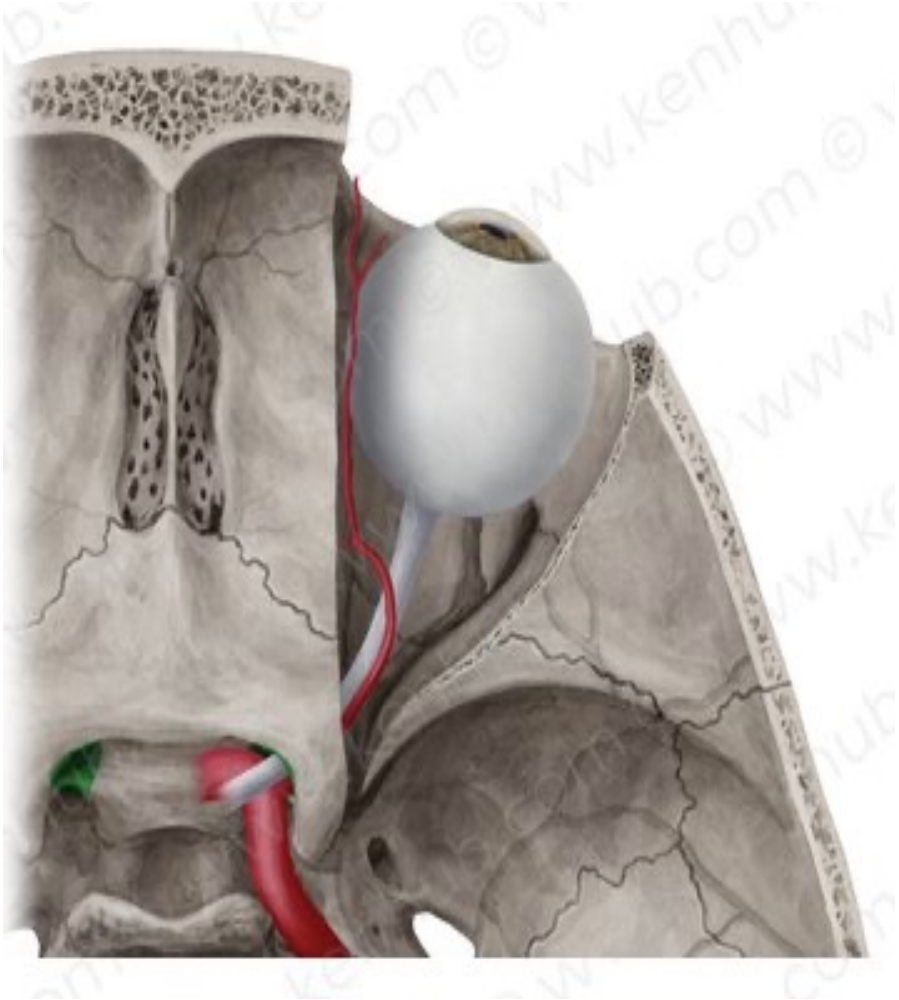
- **Origin:** It is the **axons of the ganglionic cells** of the retina which leaves the posterior part of the eyeball.
- **Course, relations and termination:**

➢ The optic nerve **leaves the orbit** and enters the **cranial cavity** through the **optic foramen** with ophthalmic artery .

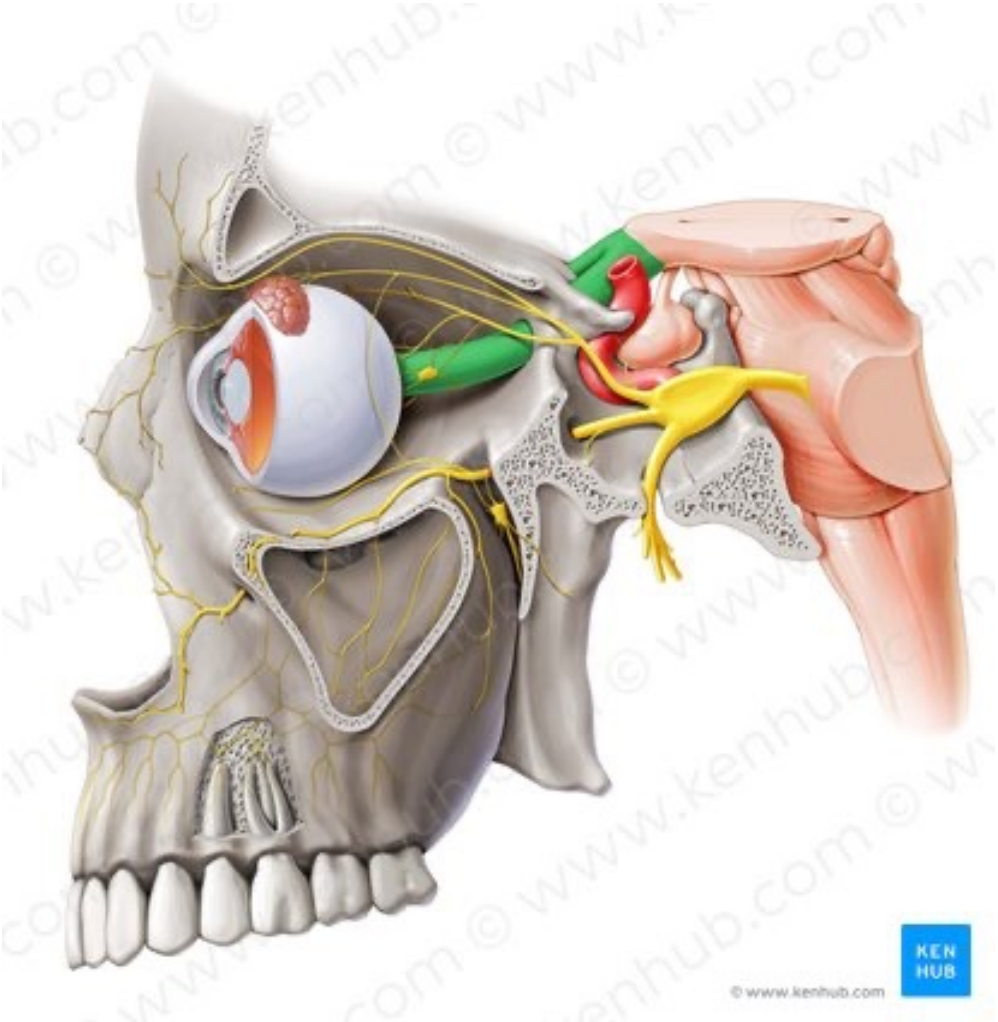
➢ The central retinal artery **arises** as a branch from ophthalmic artery in the optic canal, **pierces** the optic nerve sheath **1 cm behind the eyeball**, then passes **inside** it to reach the retina. It is an **end artery** and its obstruction leads to blindness. It is accompanied by central retinal vein.

➢ It is **surrounded by** extension of **meninges and CSF**. So any increase in intracranial and CSF pressure is reflected on the optic nerve and causes edema of the optic disc (**papilloedema**).

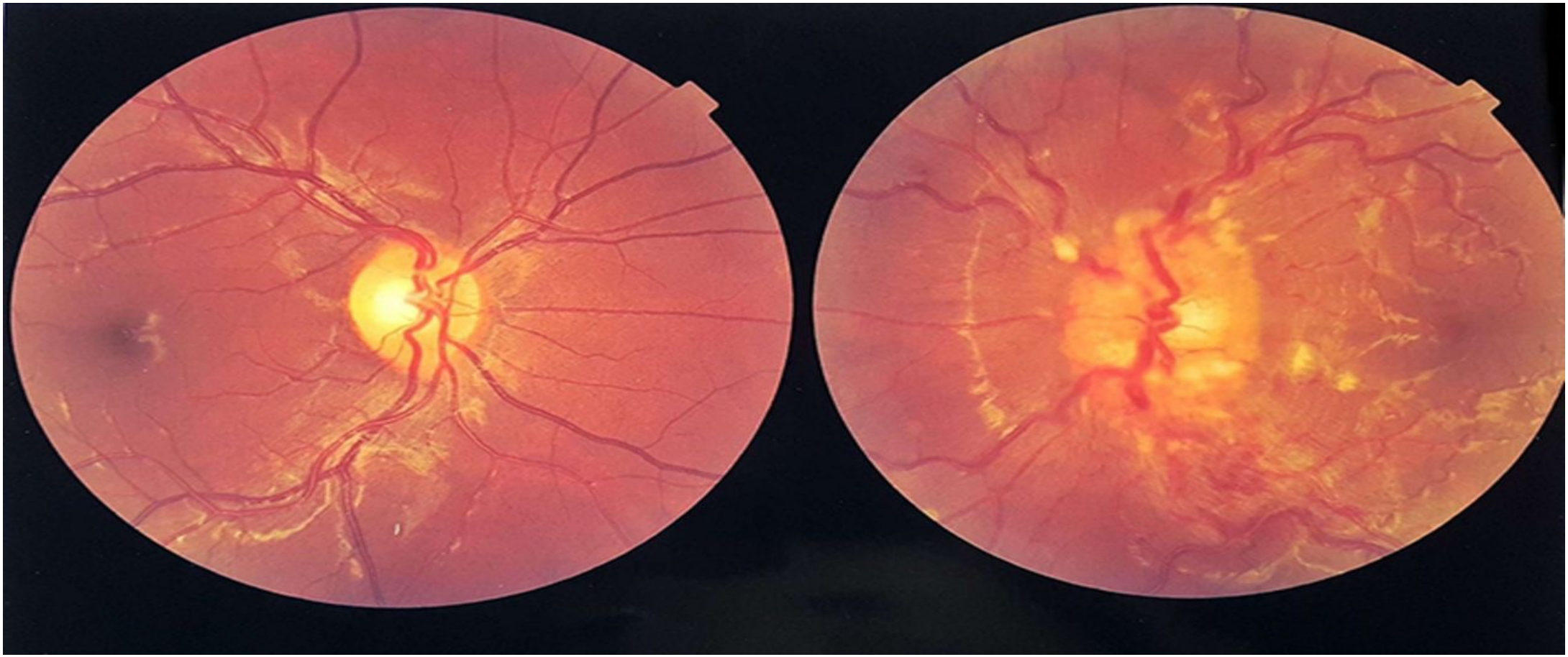
➢ It does not regenerate after injury.



Optic nerve and central artery of the retina pass through optic canal



Optic nerve



Unilateral Papilloedema

Watch This video

https://youtube.com/shorts/N4r6YUmTq-E?feature=shared

III- Autonomic Nerves of the Orbit

The Ciliary Ganglion

It is a parasympathetic ganglion which is functionally linked to the oculomotor N.

Location :

it lies in front of the optic canal between the optic N. and the lateral rectus muscle

Roots :

Parasympathetic root : Edinger-Westphal nucleus in the upper midbrain → oculomotor N.

Inferior division → nerve to the *inferior* oblique → *relay* in the ciliary ganglion

Sympathetic root: contains postganglionic fibers derived from the carotid plexus.

It reaches the ganglion along the communicating sensory branch of the nasociliary N.

Sensory root: is the communicating branch of the nasociliary N.

N.B. : ***only*** the parasympathetic root synapse in the ganglion. The sympathetic and sensory roots travel through the ganglion ***without*** synapsing.

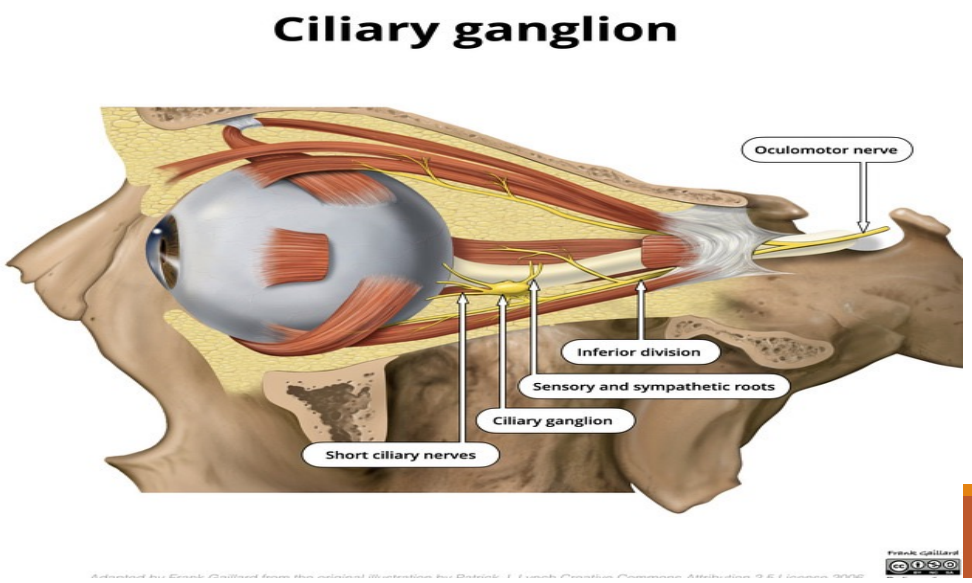
Efferent branches from the ganglion :

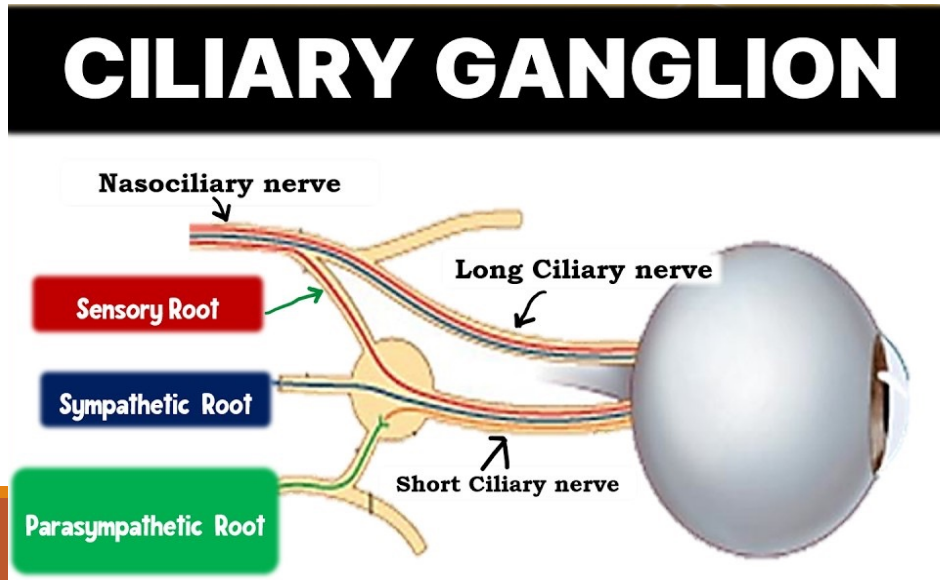
the ganglion gives rise to 10-12 short ciliary nerves, they carry 3 functional types of fibers :

1. **Postganglionic parasympathetic** → ciliary muscle and constrictor pupillae.
2. **Postganglionic sympathetic** : vasomotor
3. **Sensory fibers** : carry sensation from the cornea, ciliary body and the iris.

N.B The parasympathetic supply to the lacrimal gland :

- Is supplied by the facial N. Vai **pterygopalatine ganglion**.





Vessels of the Orbit

Ophthalmic artery:

- It **arises** from the **internal carotid** artery as it leaves the **cavernous sinus** and **enters** the optic foramen with **optic nerve.**
- **In the orbit:** The artery **passes** forwards along the **medial wall** of the orbit.
- It **ends** by dividing into two terminal branches: **supratrochlear and dorsal nasal arteries**.

Branches:

1-Central artery of the retina: It is the **most important** branch.

- It **arises** in the optic canal and **pierces** the optic nerve sheath **1 cm behind the eyeball**, then passes **inside** it to reach the retina.
- It is an **end artery** and its obstruction leads to blindness.

2-Lacrimal artery:

It **supply** the lacrimal gland and lateral part of eyelids.

It **ends** as **lateral palpebral arteries**

3-Anterior and posterior ciliary arteries: pierce the sclera and supply the eyeball.

4-Anterior and posterior ethmoidal arteries

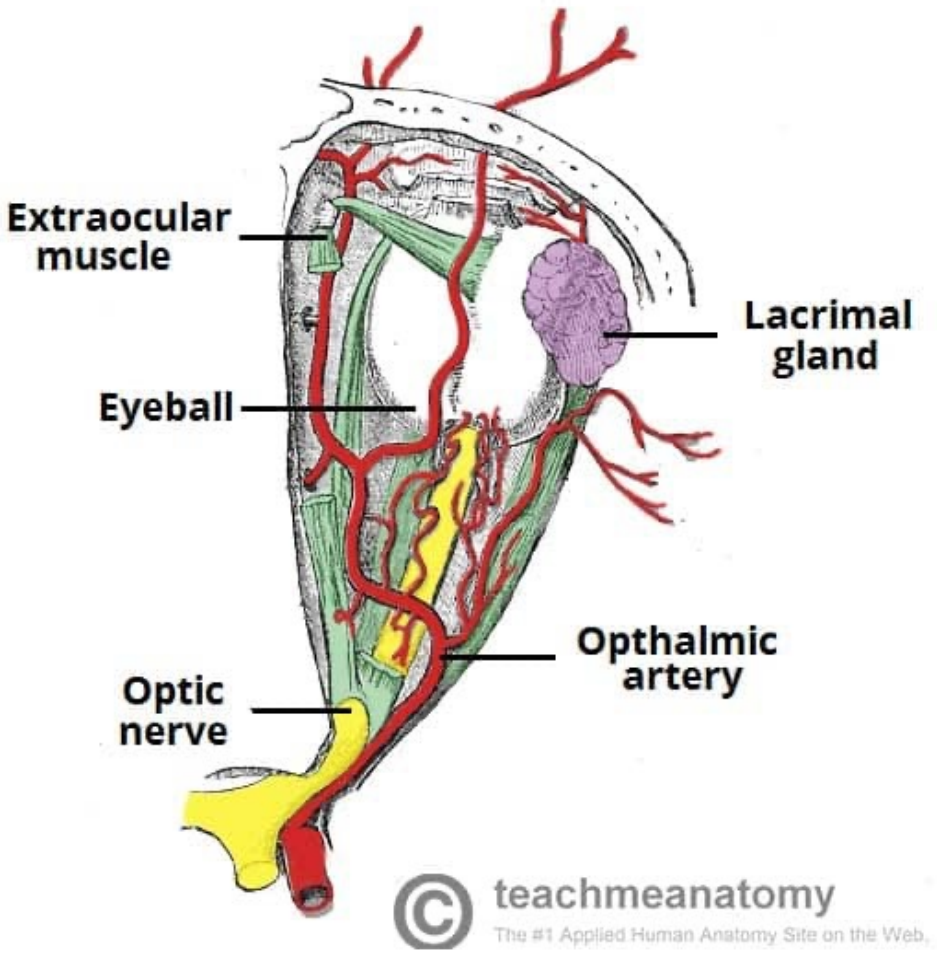
5-Medial palpebral arteries: Two arteries supplying the **upper and lower eyelid**.

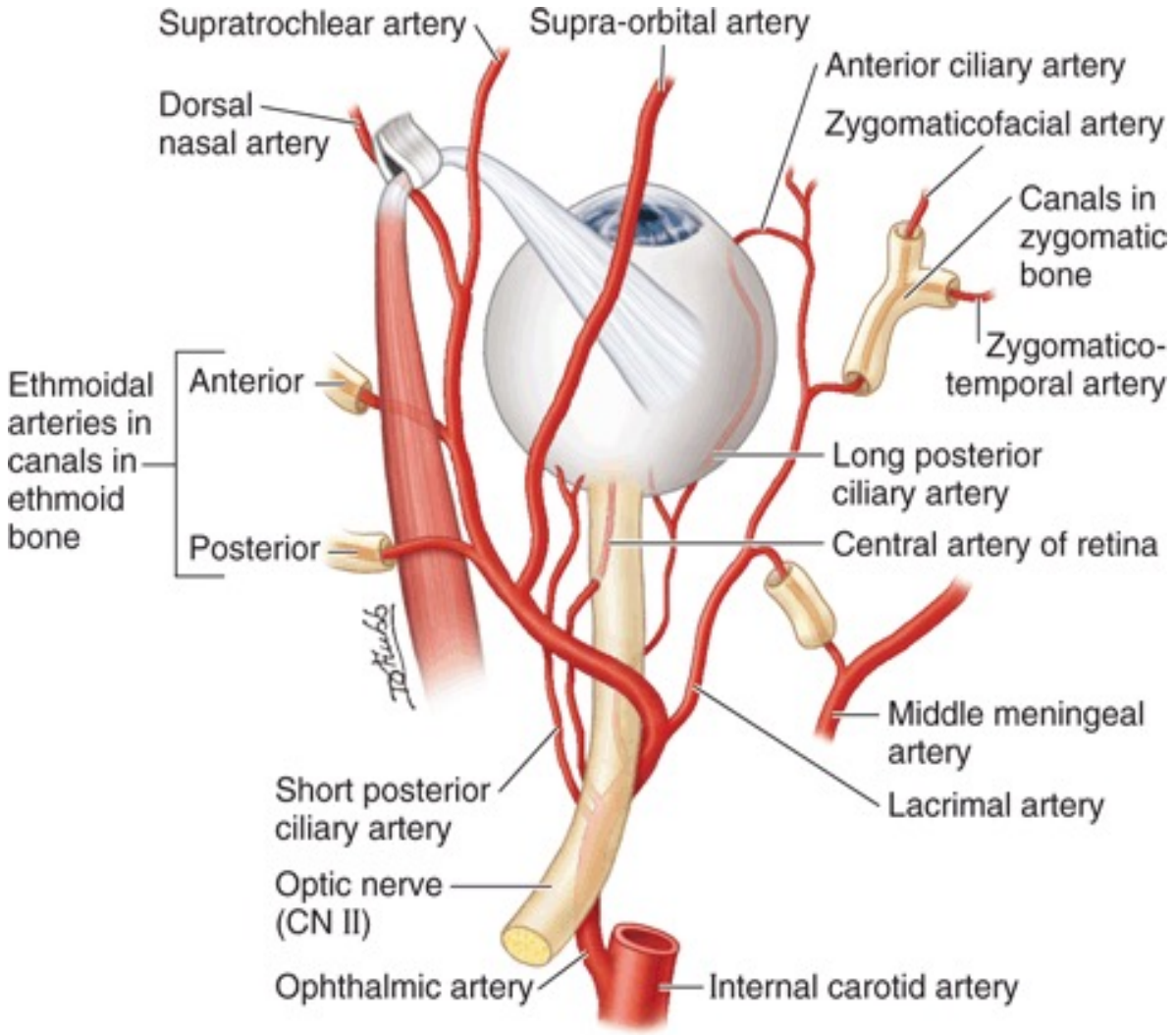
6-Supra-orbital artery

7-Supratrochlear artery

8-Dorsal nasal artery

9-Muscular : Supplies the orbital muscles.

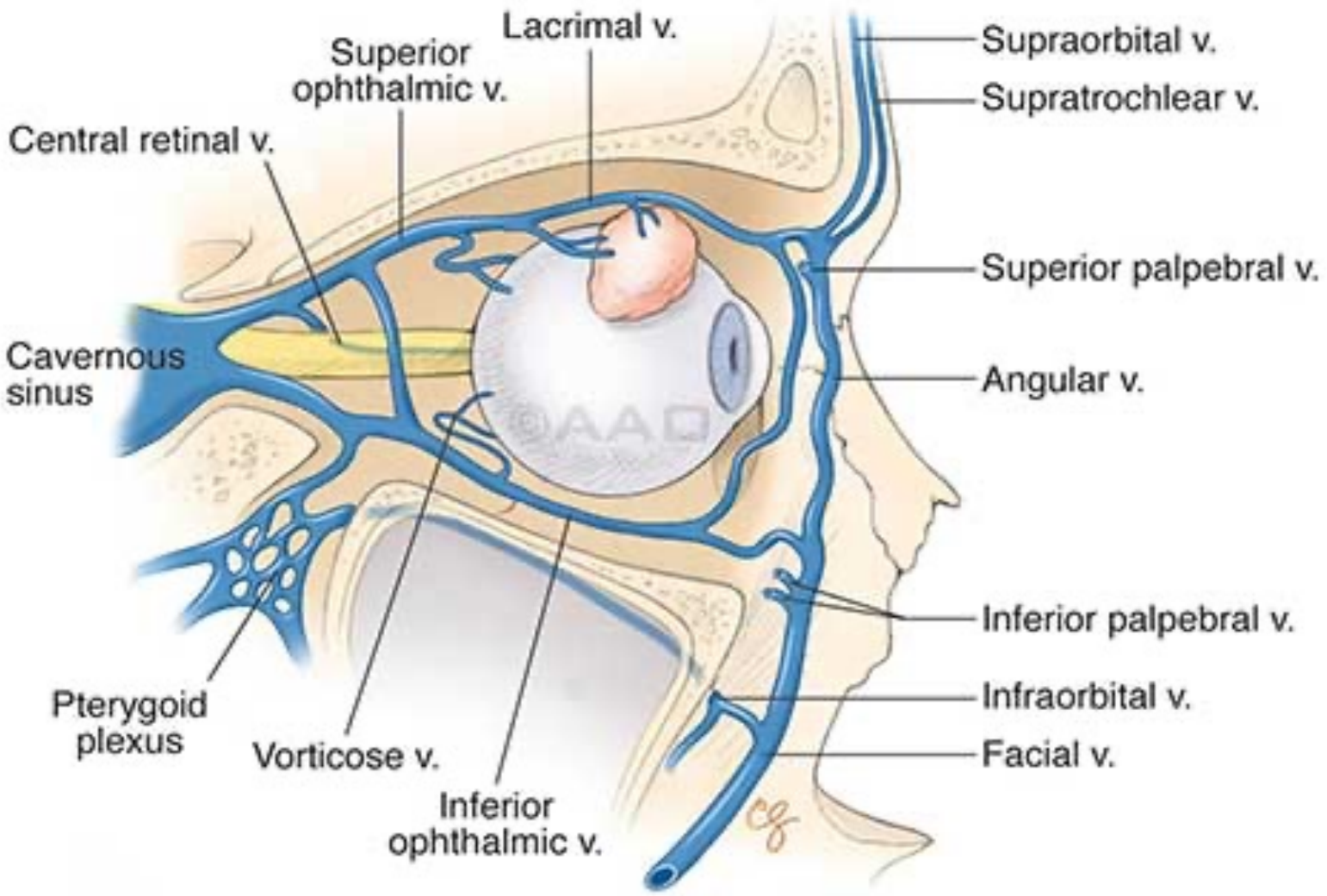

Extraocular muscle
Lacrimal gland
Eyeball
Opthalmic artery
Optic nerve
teachmeanatomy
The #1 Applied Human Anatomy Site on the Web.


Supratrochlear artery
Supra-orbital artery
Anterior ciliary artery
Dorsal nasal artery
Zygomaticofacial artery
Canals in zygomatic bone
Zygomatico-temporal artery
Ethmoidal arteries in canals in ethmoid bone
Anterior
Posterior
Long posterior ciliary artery
Central artery of retina
Middle meningeal artery
Lacrimal artery
Short posterior ciliary artery
Optic nerve (CN II)
Ophthalmic artery
Internal carotid artery

Ophthalmic veins:

- They are **superior and inferior** ophthalmic veins, formed by **union of veins accompanying** branches of ophthalmic artery.
- **Superior and inferior** ophthalmic veins leave the orbit through the **superior orbital fissure** to end in the **cavernous sinus**.
- The **superior** ophthalmic vein **communicates** with **anterior facial vein** and considered as the **largest emissary** vein.
- The **inferior** ophthalmic vein **communicates** with the **pterygoid** venous plexus through veins passing in the **inferior orbital fissure**.
- The **central retinal vein ends** in the **cavernous sinus** or **superior ophthalmic** vein.

1


Lacrimal v.
Superior ophthalmic v.
Central retinal v.
Supraorbital v.
Supratrochlear v.
Superior palpebral v.
Cavernous sinus
Angular v.
Inferior palpebral v.
Infraorbital v.
Facial v.
Pterygoid plexus
Vorticose v.
Inferior ophthalmic v.

Thank You