# The orbital region

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# The orbital region

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.

Eyelids are formed by a fibrous sheet, the orbital septum, which thickened at the margins of the lids to form the superior and inferior tarsal plates. The lateral ends of the plates are attached by the **lateral palpebral ligament** to a **bony tubercle** just within the orbital margin. **The medial ends of the plates** are attached by the **medial palpebral ligament** to the crest of the **lacrimal bone**. (Fig. 1,2).

The **eyelashes** are short, curved hairs on the free edges of the eyelids (Figs. 1 & 2). 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.

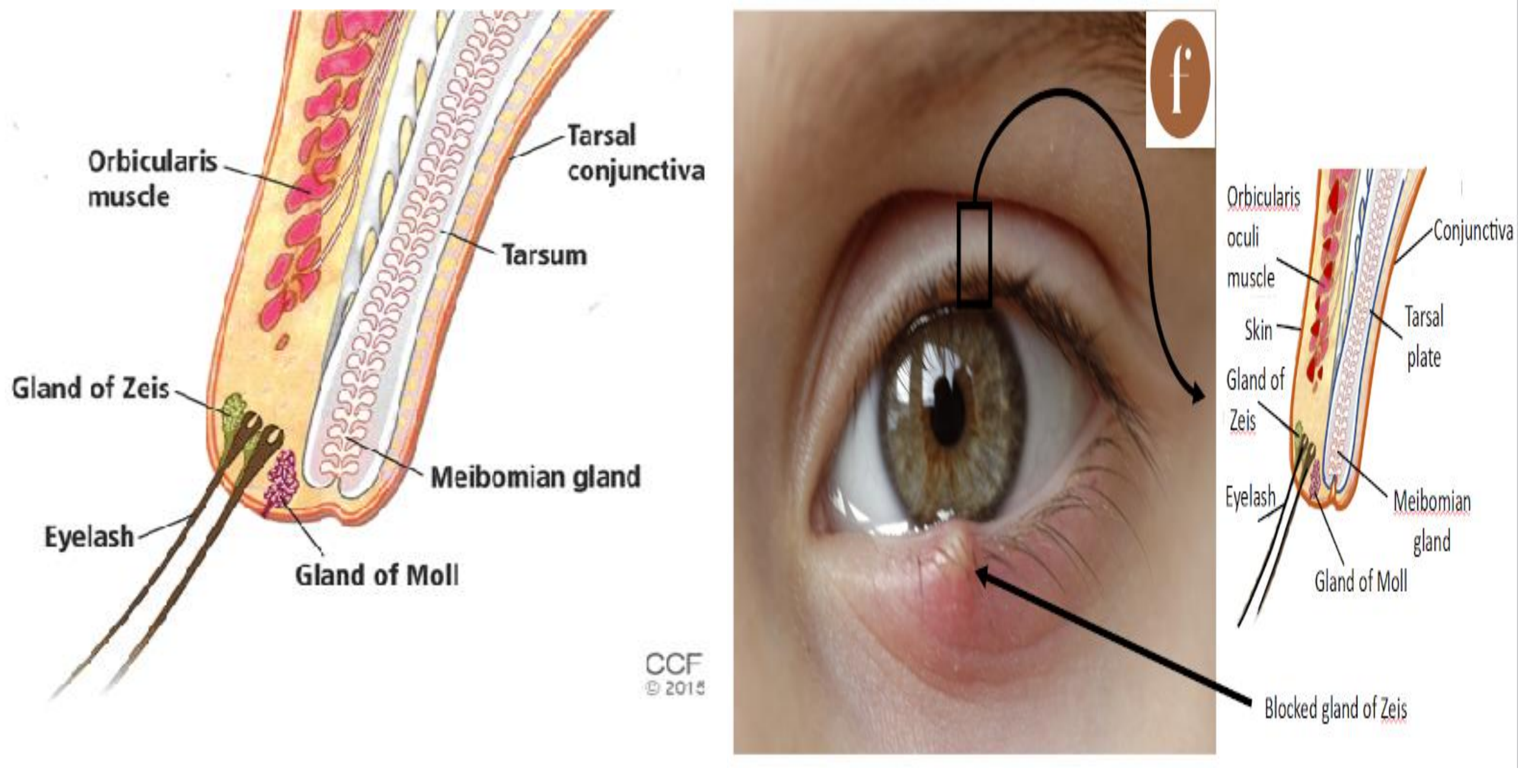



**Figure 1: Glands of the orbital region**

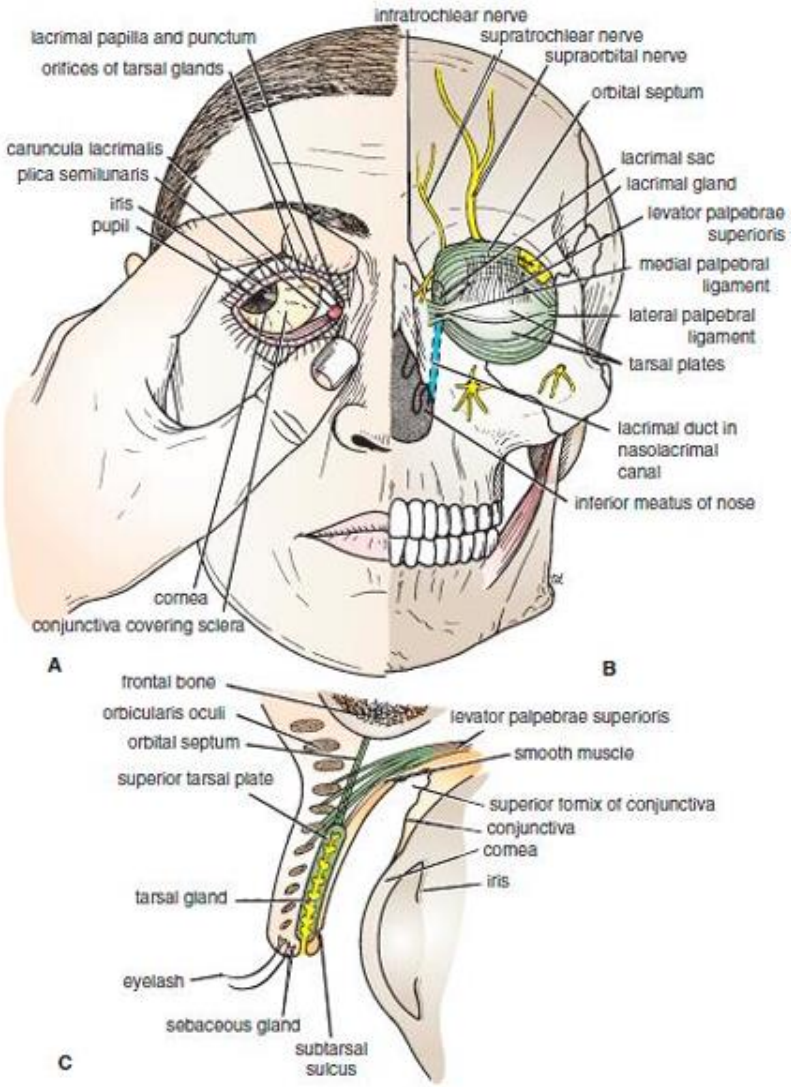
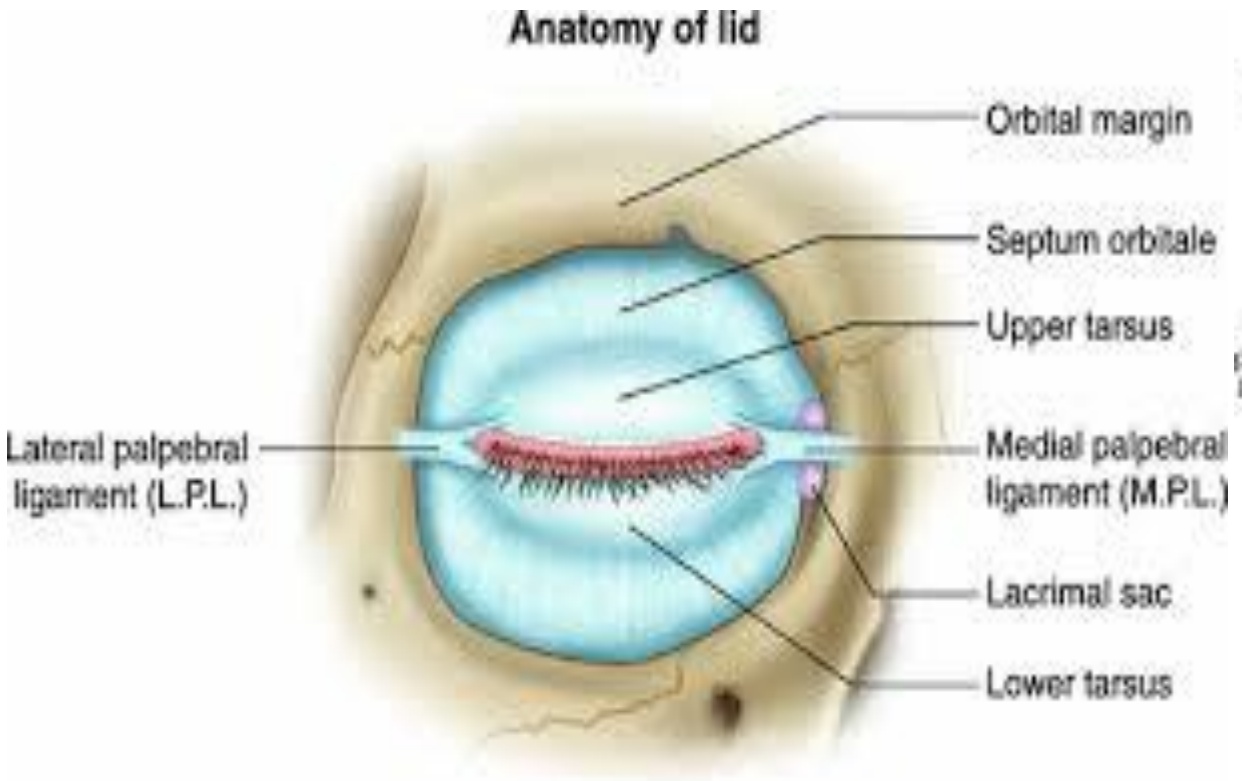
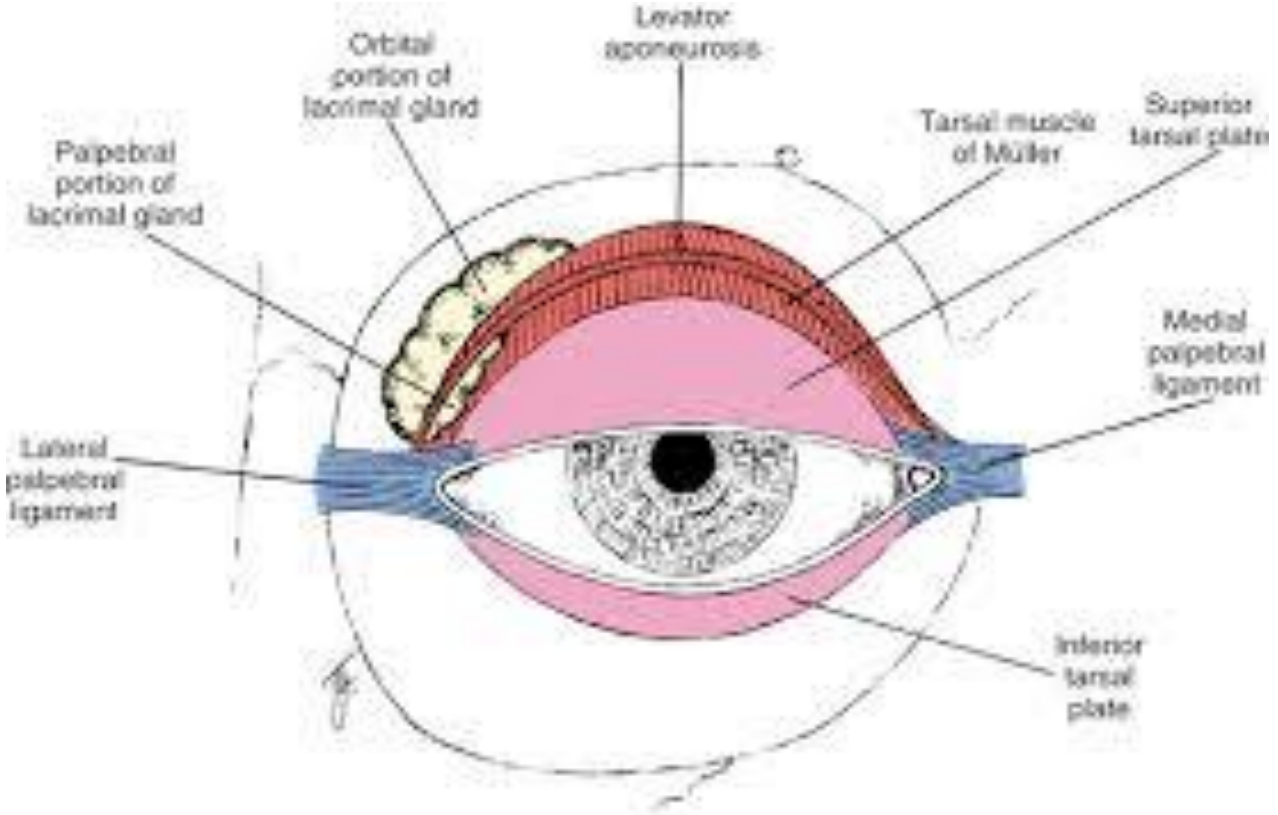


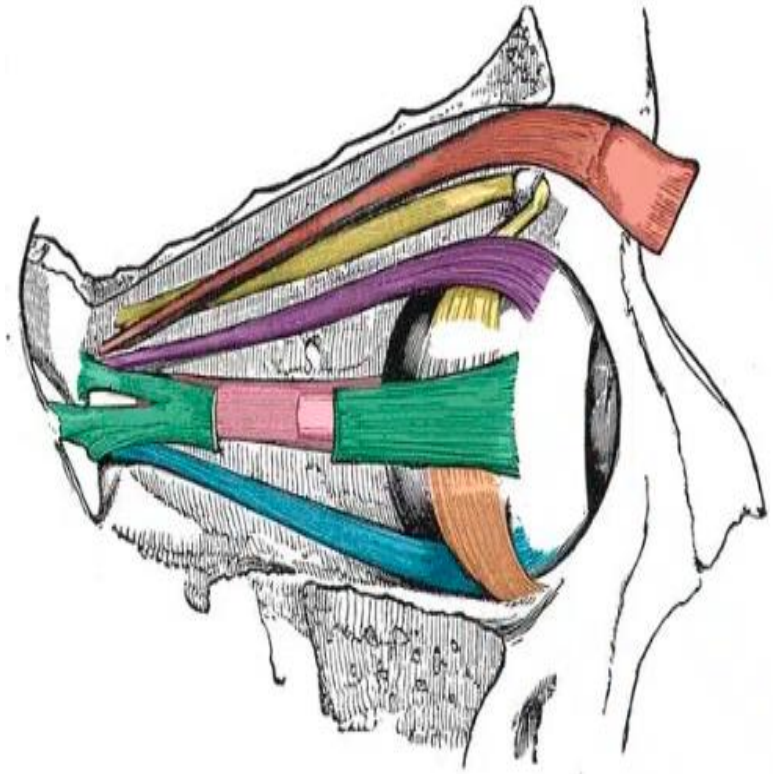

**Figure 2: A. Right eye, with the eyelids separated. B. Left eye, showing the superior and inferior tarsal plates and the lacrimal gland, sac, and duct. C. Sagittal section through the upper eyelid.**

The **tarsal glands (Meibomian glands)** are long, modified sebaceous glands that pour their oily secretion onto the margin of the lid; their openings lie behind the eyelashes **(Fig. 1)**. This oily material prevents the overflow of tears and helps make the closed eyelids airtight. 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 lacrimal, which leads into the canaliculus lacrimalis (Figs. 1 & 2). The punctum and canaliculus carry tears down into the nose.

The **conjunctiva:** The palpebral conjunctiva forms the **deepest layer** of the eyelid. It is a thin **mucous membrane**, which is reflected onto the sclera of the eyeball (bulbar conjunctiva) (Fig. 1).

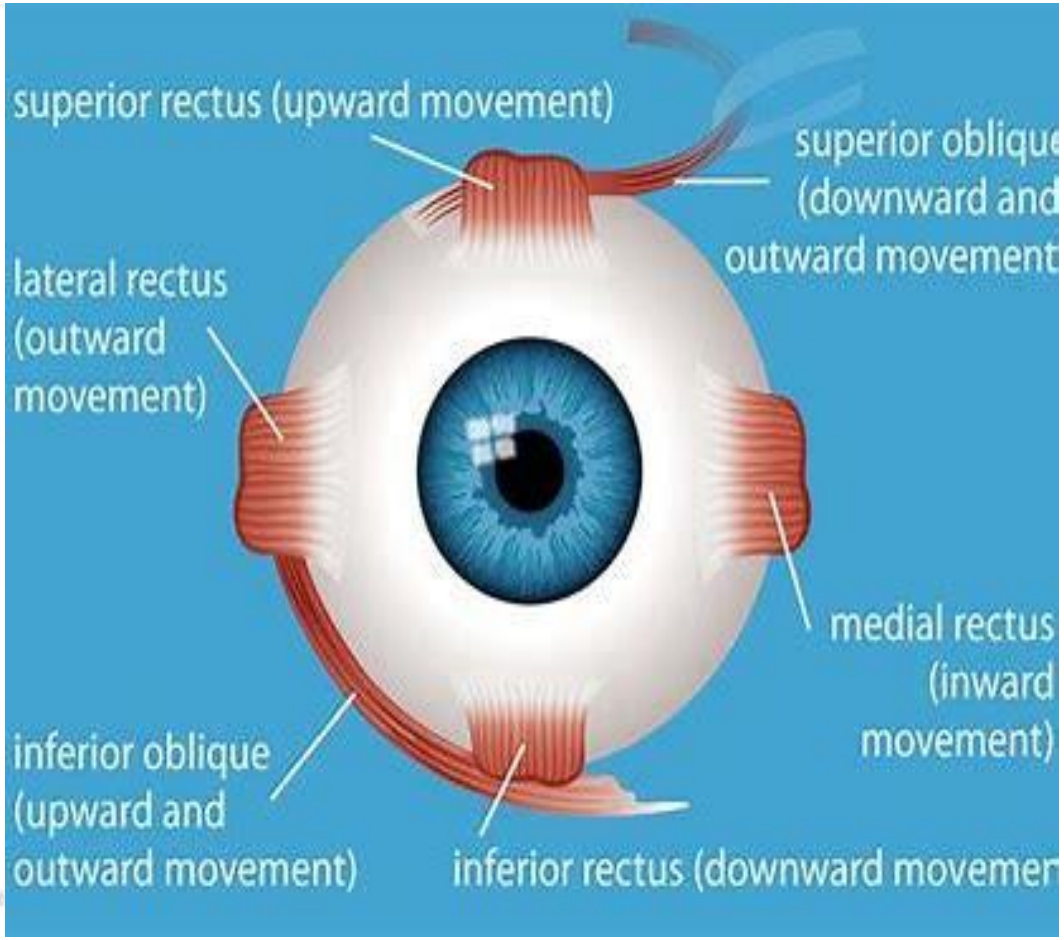

Anatomy of lid
Orbital margin
Septum orbitale
Upper tarsus
Lateral palpebral ligament (L.P.L.)
Medial palpebral ligament (M.P.L.)
Lacrimal sac
Lower tarsus

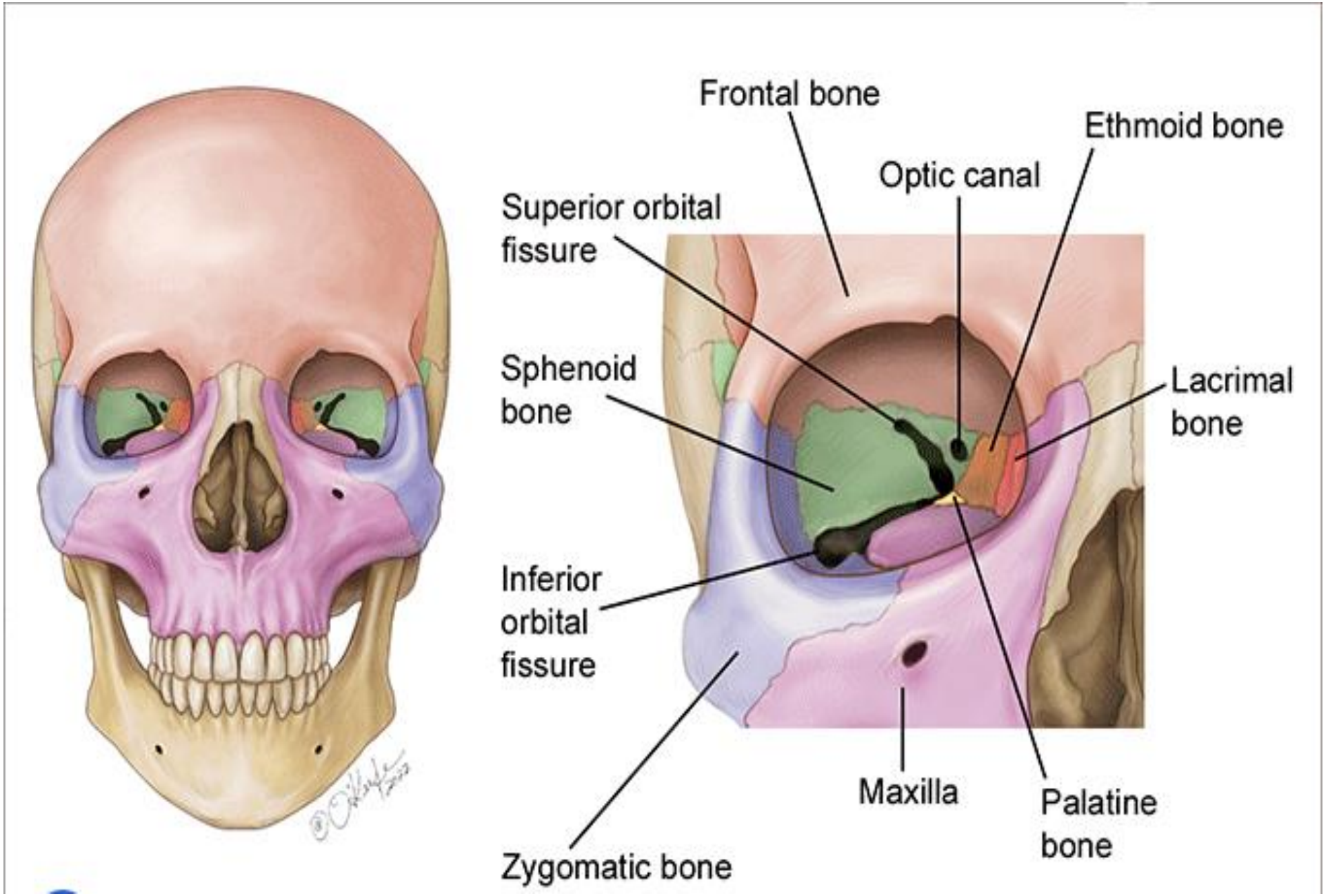

Levator aponeurosis
Orbital portion of lacrimal gland
Palpebral portion of lacrimal gland
Tarsal muscle of Müller
Superior tarsal plate
Medial palpebral ligament
Lateral palpebral ligament
Inferior tarsal plate

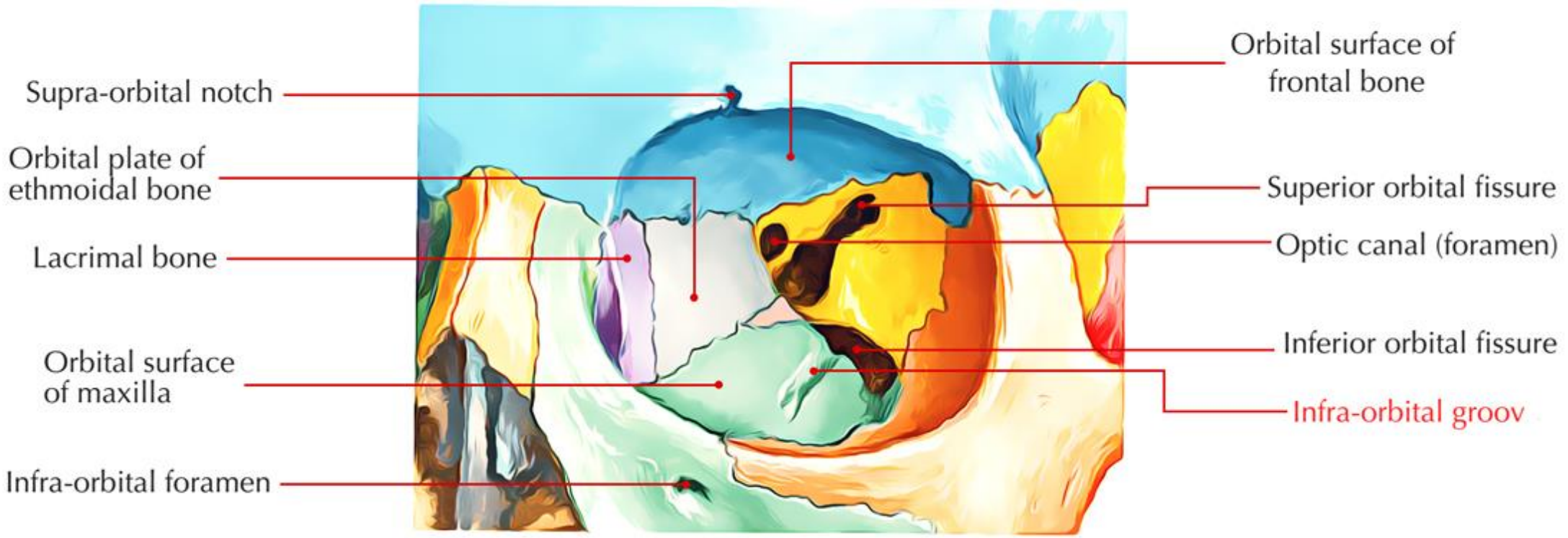


Levator palpebrae superioris
Superior oblique
Inferior oblique
Superior rectus
Medial rectus
Lateral rectus
Inferior rectus






Frontal bone
Ethmoid bone
Optic canal
Superior orbital fissure
Sphenoid bone
Lacrimal bone
Inferior orbital fissure
Maxilla
Palatine bone
Zygomatic bone

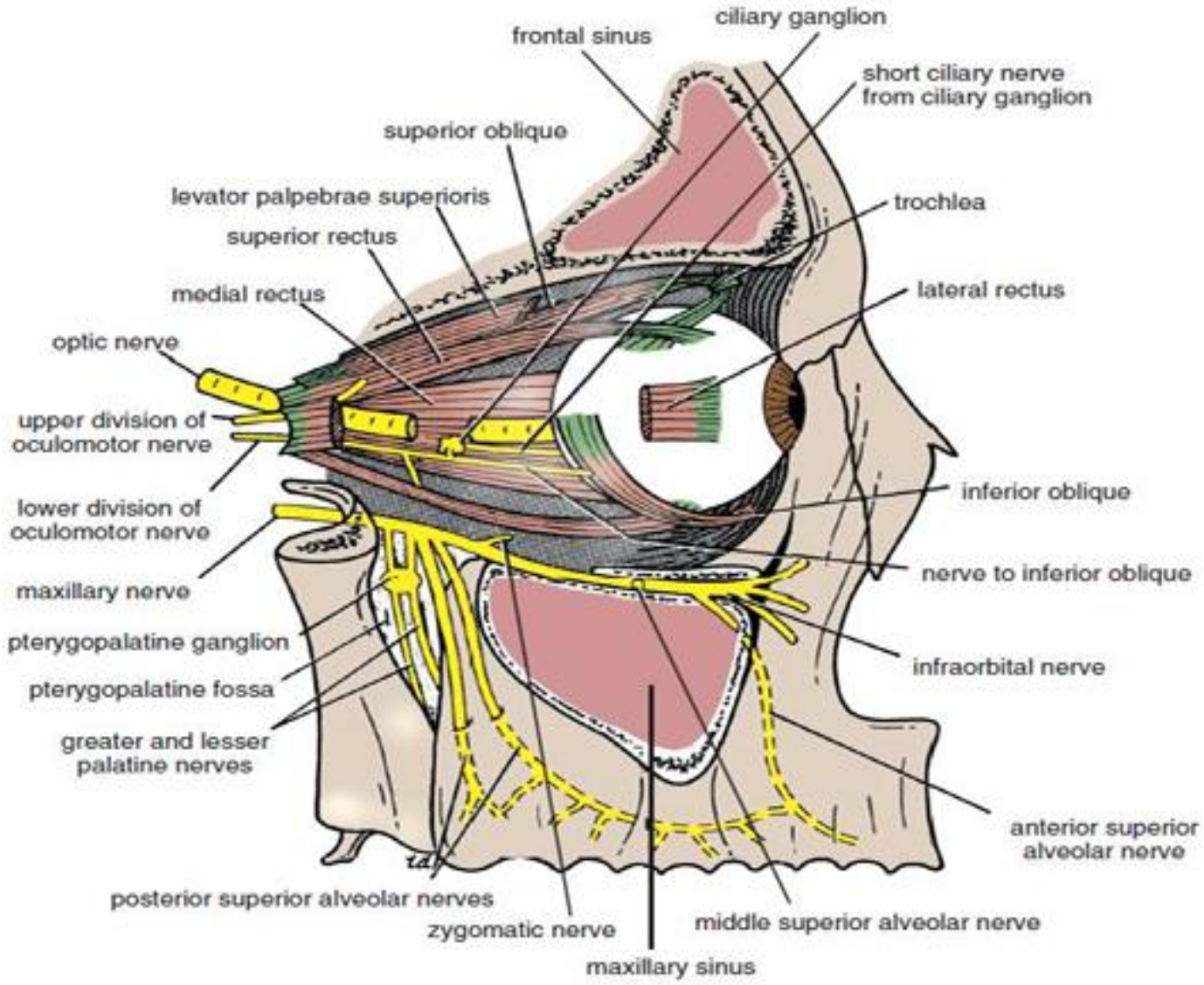

Supra-orbital notch
Orbital plate of ethmoidal bone
Lacrimal bone
Orbital surface of maxilla
Infra-orbital foramen
Orbital surface of frontal bone
Superior orbital fissure
Optic canal (foramen)
Inferior orbital fissure
Infra-orbital groov

# Movement of Eyelids

The extraocular muscles are located within the orbit, but are extrinsic and separate from the eyeball itself. They act to control the movements of the eyeball and the superior eyelid (Fig.3).

There are **seven extraocular** muscles: the levator palpebrae superioris, superior rectus, inferior rectus, medial rectus, lateral rectus, inferior oblique and superior oblique. Functionally, they can be divided into two groups:

- ❑ Responsible for eye movement: **Recti and oblique** muscles.
- ❑ Responsible for superior eyelid movement: **Levator palpebrae superioris.**


ciliary ganglion
frontal sinus
short ciliary nerve
from ciliary ganglion
superior oblique
levator palpebrae superioris
trochlea
superior rectus
medial rectus
lateral rectus
optic nerve
upper division of
oculomotor nerve
lower division of
oculomotor nerve
inferior oblique
nerve to inferior oblique
maxillary nerve
pterygopalatine ganglion
infraorbital nerve
pterygopalatine fossa
greater and lesser
palatine nerves
anterior superior
alveolar nerve
posterior superior alveolar nerves
zygomatic nerve
middle superior alveolar nerve
maxillary sinus

# Lacrimal Apparatus

The lacrimal gland consists of a **large orbital part** and a small palpebral part, which are continuous with each other around the lateral edge of the aponeurosis of the **levator palpebrae superioris**. It is situated above the eyeball and opens by 12 ducts into the lateral part of the superior fornix of the **conjunctiva**.

# Openings into the Orbital Cavity

There are three main pathways by which structures can enter and leave the orbit (Fig.4):

- **Optic canal**: Transmits the optic nerve and ophthalmic artery.
- **Superior orbital fissure**: Transmits the **lacrimal, frontal, trochlear** (CN IV), **oculomotor (CN III), nasociliary and abducens (CN VI)** nerves. It also carries the **superior ophthalmic vein**.
- **Inferior orbital fissure**: Transmits the zygomatic branch of the maxillary nerve, the **inferior ophthalmic vein**, and sympathetic nerves.

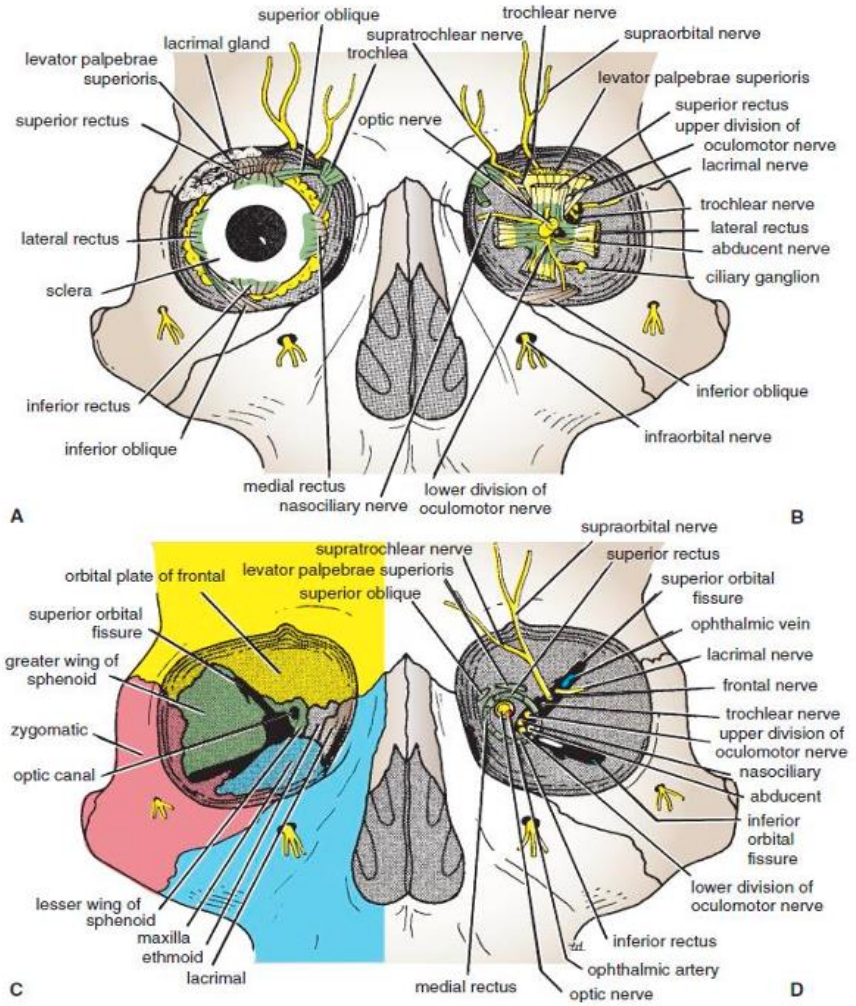
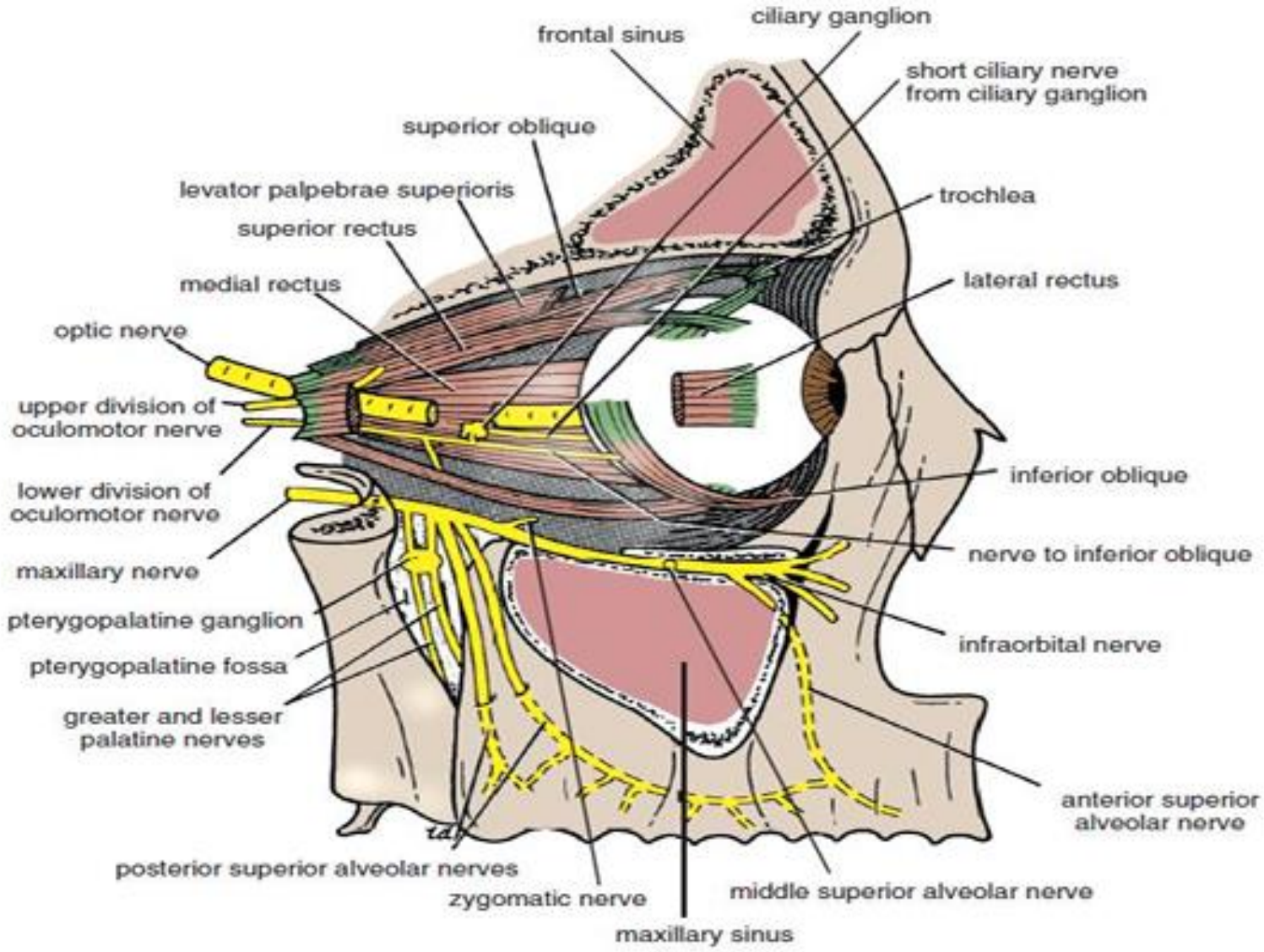



**Fig 3: A. Right eyeball exposed from in front. B. Muscles and nerves of the left orbit as seen from in front. C. Bones forming the walls of the right orbit. D. The optic canal and the superior and inferior orbital fissures on the left side. 5**




**Muscles and nerves of the right orbit viewed from the lateral side.**

# Nerves of the Orbit

- **Optic Nerve:** The nerve is surrounded by **sheaths of pia mater, arachnoid mater, and dura mater**. It pierces the sclera at a point medial to the posterior pole of the eyeball. Here, the meninges fuse with the sclera; a rise in pressure of the cerebrospinal fluid (CSF) within the cranial cavity therefore is transmitted to the **back of the eyeball**.
- **Lacrimal Nerve:** The lacrimal nerve arises from the **ophthalmic division of the trigeminal nerve.** It is joined by a branch of **the zygomaticotemporal nerve**, which later leaves it to enter the lacrimal gland (parasympathetic secretomotor fibers). The lacrimal nerve ends by supplying the skin of the **lateral part of the upper lid.**

- **Frontal Nerve:** The frontal nerve arises from the ophthalmic division of **the trigeminal nerve**. It divides into the **supratrochlear and supraorbital nerves** that supply the skin of the forehead; the supraorbital nerve also supplies the mucous membrane of the frontal air sinus.
- **Trochlear Nerve:** It supplies the superior oblique muscle (Fig. 5).
- **Oculomotor Nerve:** The oculomotor nerve (CN III) controls the following muscles:

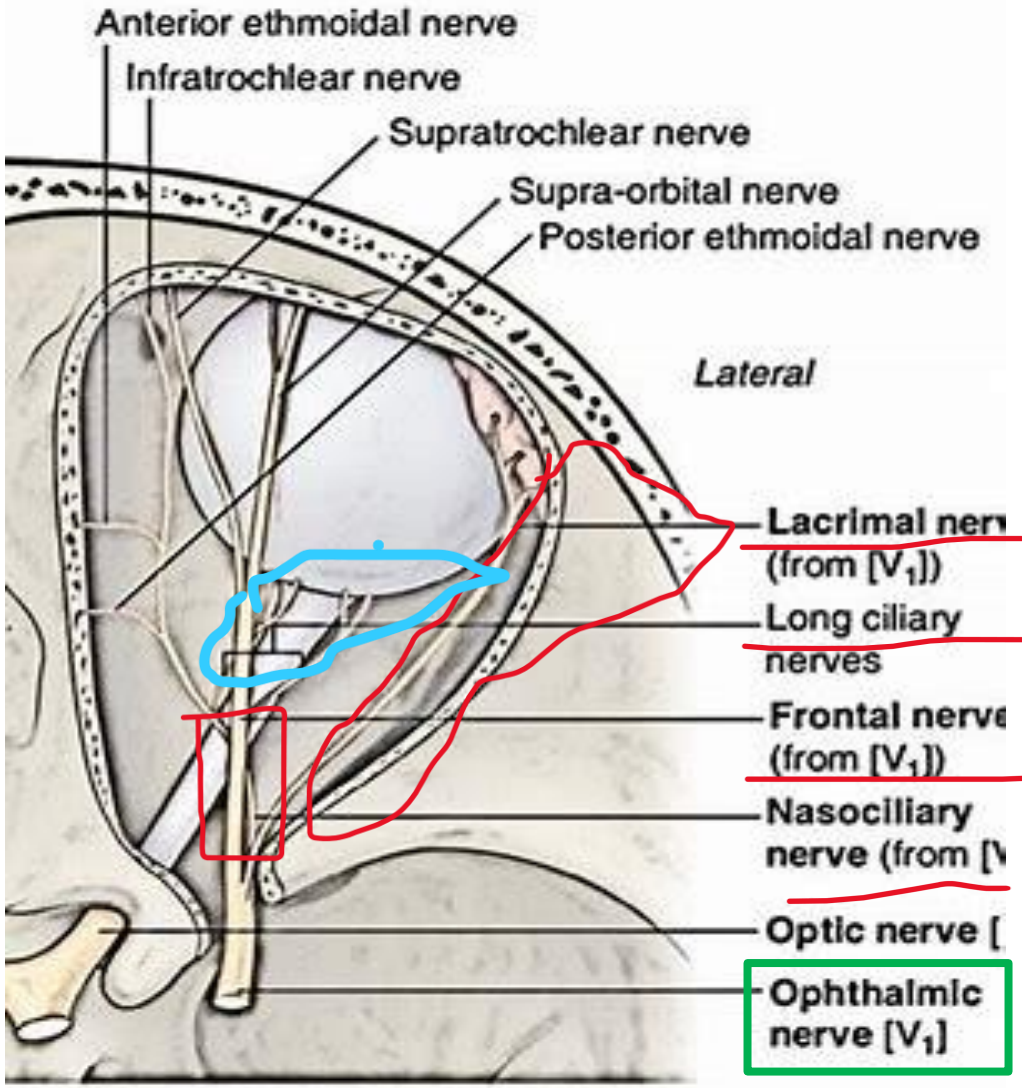
**Superior rectus muscle** (superior branch of CN III): responsible for elevation, in cyclotorsion, and adduction of the eye.

**Inferior rectus muscle** (inferior branch of CN III): responsible for depression, extorsion, adduction and abduction of the eye.

**Medial rectus muscle** (inferior branch of CN III): responsible for adduction of the eye.

**Inferior oblique muscle** (inferior branch of CN III): responsible for extorsion, elevation and abduction of the eye.

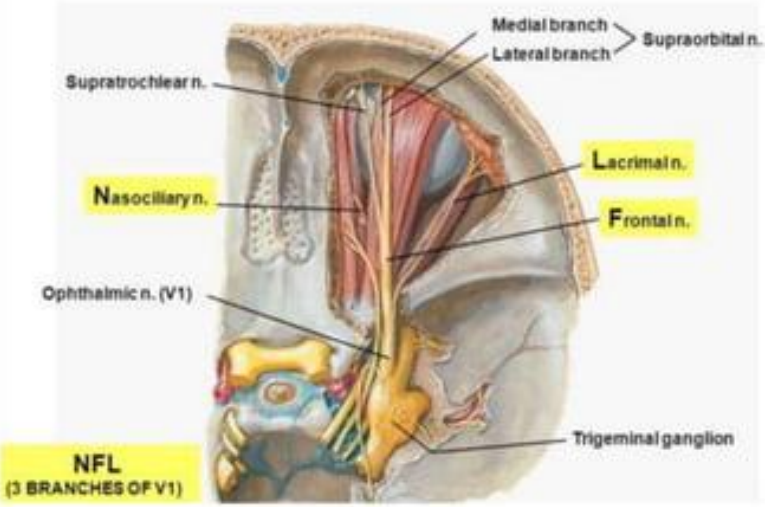
- **Levator palpebrae superioris muscle:** responsible for retracting and elevating the eyelid.
- **Abducent Nerve:** It supplies the **lateral rectus muscle**.
- **The long ciliary nerves:** Two or three in number, contain sympathetic fibers for the **dilator pupillae muscle**. ( Fig.5,6).

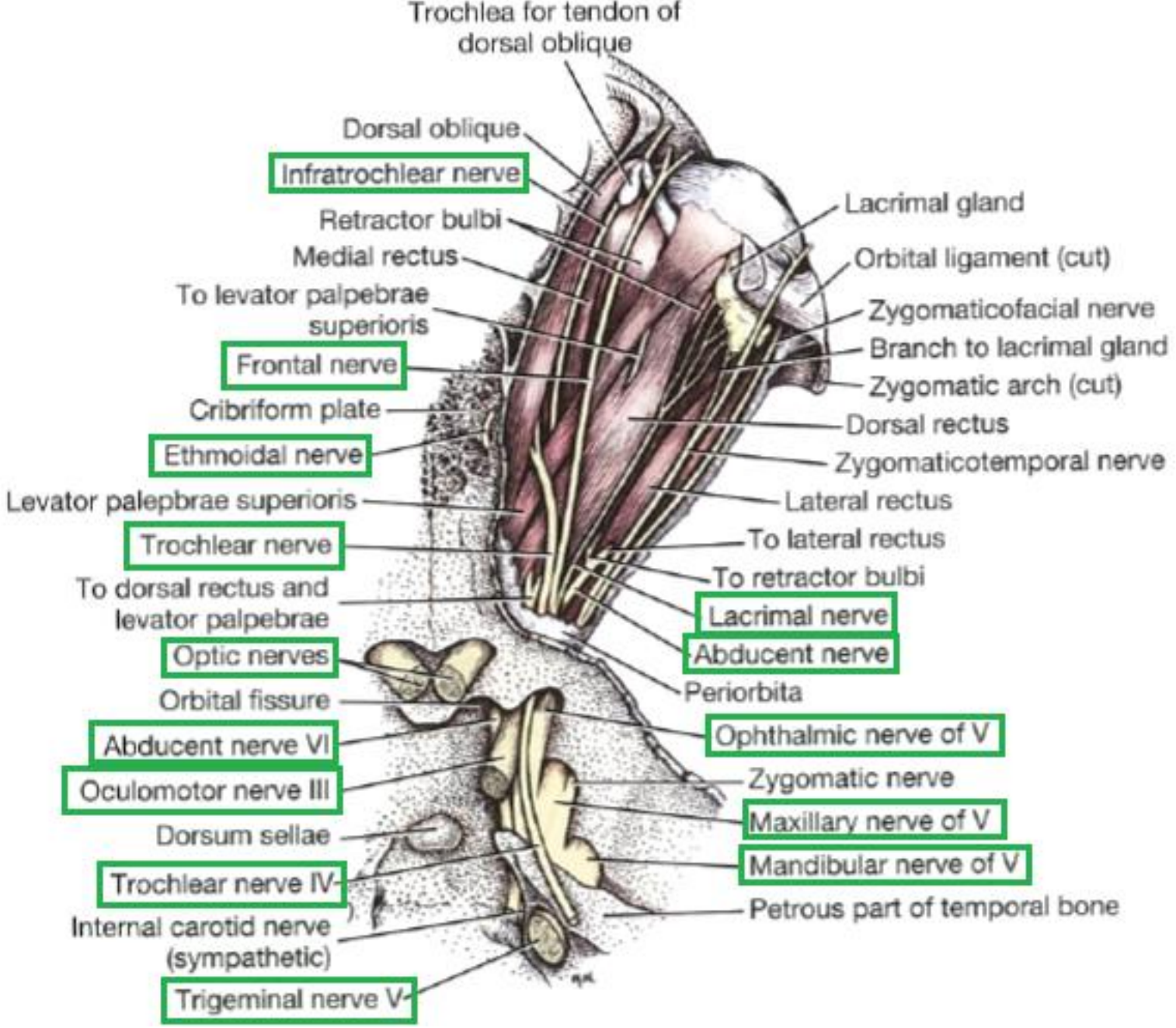


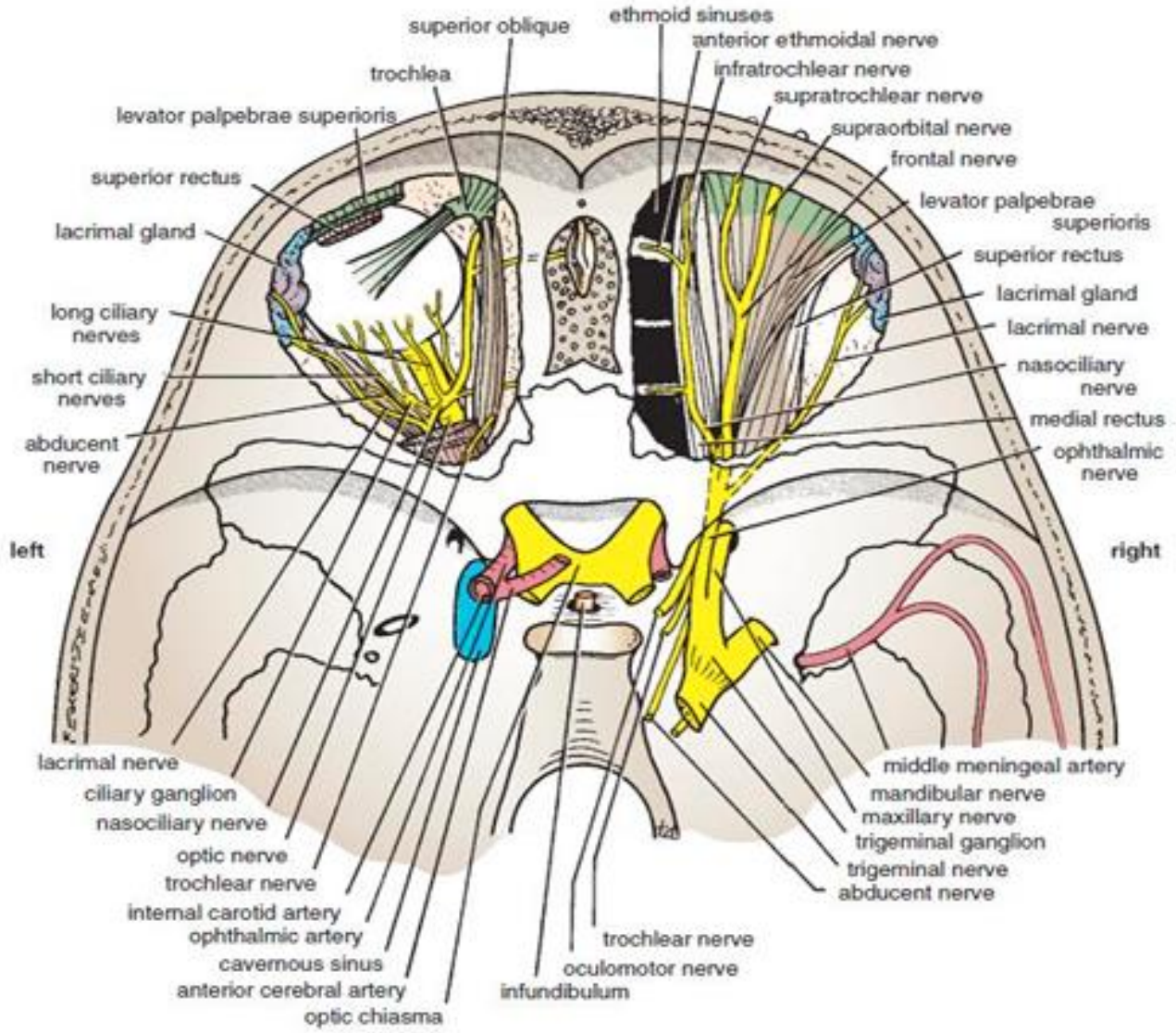

# Lacrimal Nerve

- The lacrimal nerve arises from the ophthalmic division of the trigeminal nerve.
- It enters the orbit through the upper part of the superior orbital fissure outside the common tendinous ring and passes forward along the upper border of the lateral rectus muscle with the lacrimal artery.
- It is joined by a branch of the zygomaticotemporal nerve, which later leaves it to enter the lacrimal gland (parasympathetic secretomotor fibers). The lacrimal nerve ends by supplying the skin of the lateral part of the upper eye lid through its palpebral branches

OPHTHALMIC NERVE (V1)




Trochlea for tendon of dorsal oblique
Dorsal oblique
Infratrochlear nerve
Retractor bulbi
Medial rectus
To levator palpebrae superioris
Frontal nerve
Cribriform plate
Ethmoidal nerve
Levator palepbrae superioris
Trochlear nerve
To dorsal rectus and levator palpebrae
Optic nerves
Orbital fissure
Abducent nerve VI
Oculomotor nerve III
Dorsum sellae
Trochlear nerve IV
Internal carotid nerve (sympathetic)
Trigeminal nerve V
Lacrimal gland
Orbital ligament (cut)
Zygomaticofacial nerve
Branch to lacrimal gland
Zygomatic arch (cut)
Dorsal rectus
Zygomaticotemporal nerve
Lateral rectus
To lateral rectus
To retractor bulbi
Lacrimal nerve
Abducent nerve
Periorbita
Ophthalmic nerve of V
Zygomatic nerve
Maxillary nerve of V
Mandibular nerve of V
Petrous part of temporal bone




**Right and left orbital cavities viewed from above.**

## Blood Vessels of the Orbit

- **Ophthalmic Artery**: is a branch of the internal carotid artery. It enters the orbit through the optic canal with the optic nerve **(Fig. 7).** It has the following branches:
  - **The central retinal artery**: is the first (and one of the smaller) branches of the ophthalmic artery, which runs in the **dura mater (meninges)** inferior to the optic nerve.
  - **The posterior ciliary arteries**: When the ophthalmic artery turns medially, it branches off into 1 to 5 **posterior ciliary arteries** (PCA) which are near to the optic nerve to supply the **posterior uveal tract.**

- **The lacrimal artery:** It is the next branch of the ophthalmic artery and its function to supply the lacrimal gland and eyelids.
- **Muscular branches:** superior and inferior muscular branches and their functions
- **The supratrochlear and supraorbital arteries** are distributed to the skin of the forehead.
- **anterior ethmoidal artery and posterior ethmoidal arteries.**

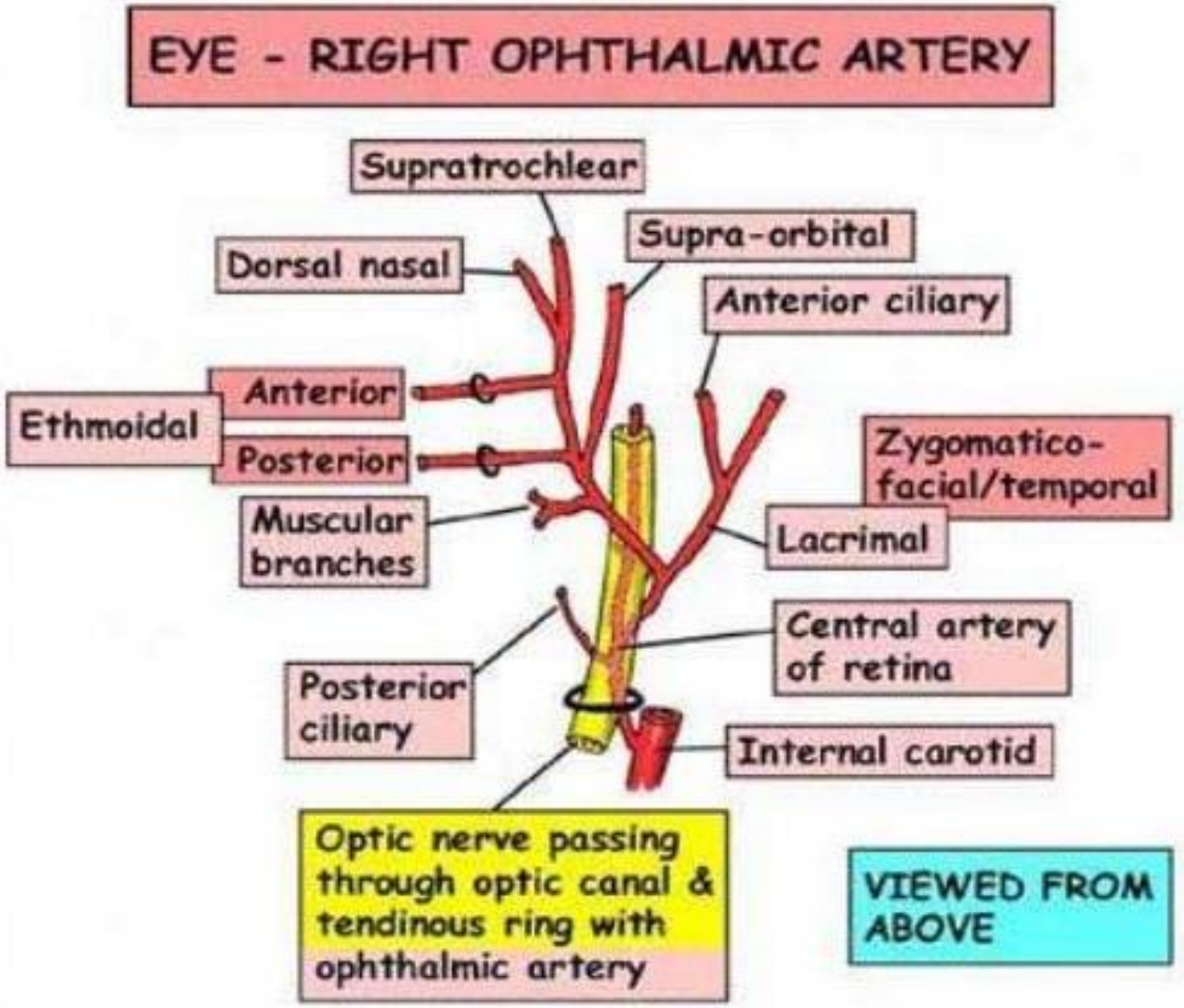



**Figure 7: Arterial supply of the orbital cavity.**

# 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** (Fig.8).

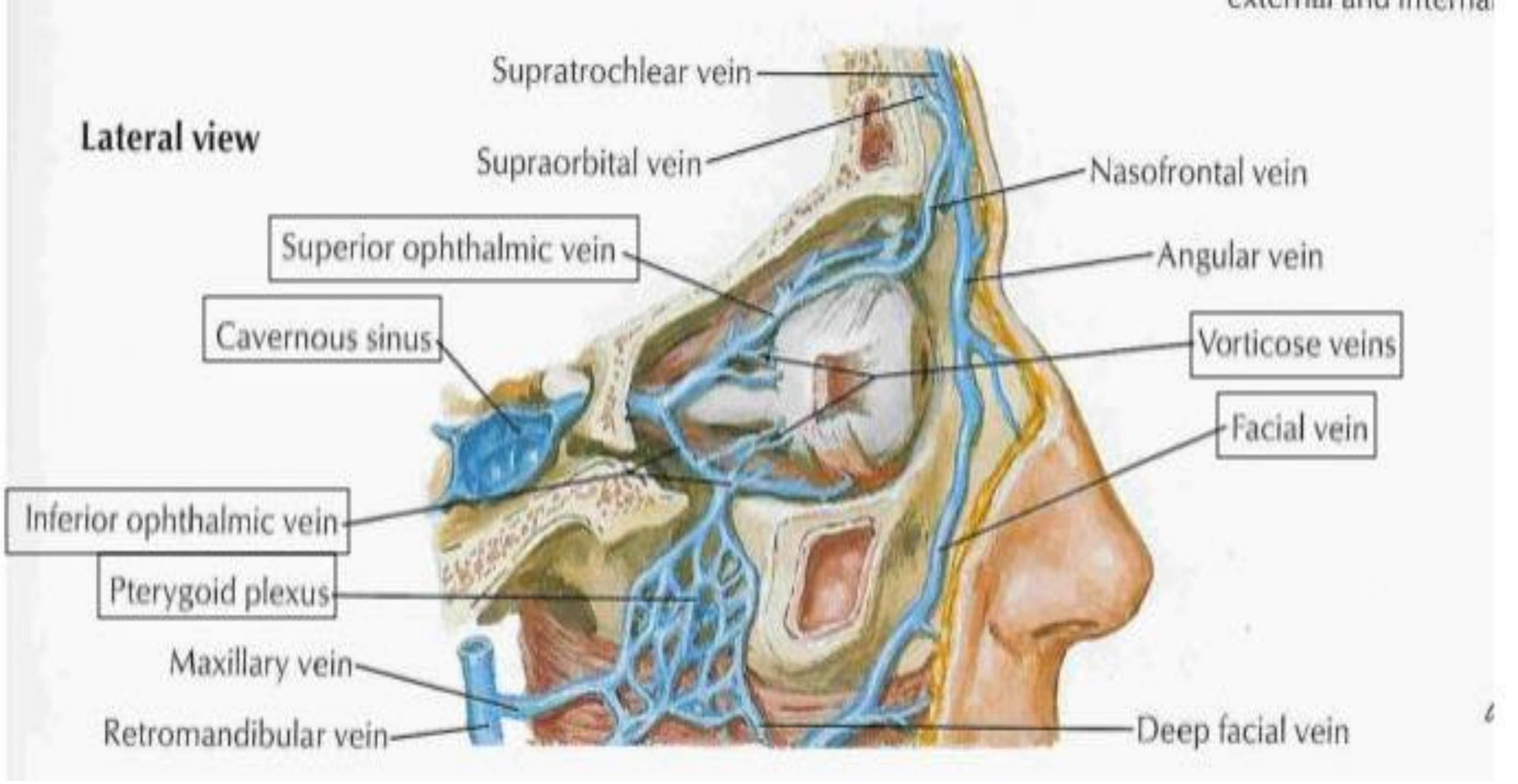



**Figure 8: Venous supply of the orbital cavity.**

## ❖ Lymph Vessels

**No lymph vessels or nodes** are present in the orbital cavity.

## ❖ Structure of the Eye

The eyeball (Fig. 9) is embedded in orbital fat but is separated from it by the **fascial sheath** of the eyeball. The eyeball consists of three coats, which are the **fibrous coat, the vascular pigmented coat, and the nervous coat.**

**1. Fibrous Coat:** The fibrous layer of the eye is the outermost layer. It consists of the **sclera and cornea**, which are continuous with each other. Their main functions are to provide **shape to the eye** and support the **deeper structures.**

- The **sclera** comprises the majority of the fibrous layer (approximately 85%). It provides attachment to the extraocular muscles; these muscles are responsible for the movement of the eye. It is visible as the white part of the eye.
- The **cornea** is transparent and positioned centrally at the front of the eye. Light entering the eye is refracted by the cornea.

**2.Vascular Pigmented Coat:** The vascular pigmented layer consists of, from behind forward, the **choroid, the ciliary body, and the iris.** The **choroid** is composed of an **outer** **pigmented layer** and an **inner**, highly vascular layer is the **ciliary body** which is composed of the ciliary ring, the ciliary processes, and the ciliary muscle. Contraction of the ciliary muscle pulls the **ciliary body forward**. This relieves the tension in the suspensory ligament, and the elastic lens becomes more **convex**. The **iris** is a thin, contractile, pigmented diaphragm with a central aperture, the **pupil** (Fig. 9)

It is suspended in the aqueous humor between the cornea and the lens. The muscle fibers of the iris are involuntary and consist of circular and radiating fibers. The circular fibers form the **sphincter pupillae** which **constricts** the pupil in the presence of bright light and during accommodation while the radial fibers form the **dilator pupillae** which **dilates** the pupil in the presence of low light intensity or in the presence of excessive sympathetic activity such as occurs in fright.

**3-Nervous coat** which includes the **retina** that consists of an outer **pigmented layer** and an inner **nervous layer**. Its outer surface is in contact with the **choroid**, and its inner surface is in contact with the **vitreous body** (Fig. 9). The posterior three quarters of the retina is the receptor organ.

afferent pathway travels to the parasympathetic nuclei of both oculomotor nerves.

The **accommodation reflex** is the contraction of the pupil that occurs when a person suddenly focuses on a near object after having focused on a distant object.

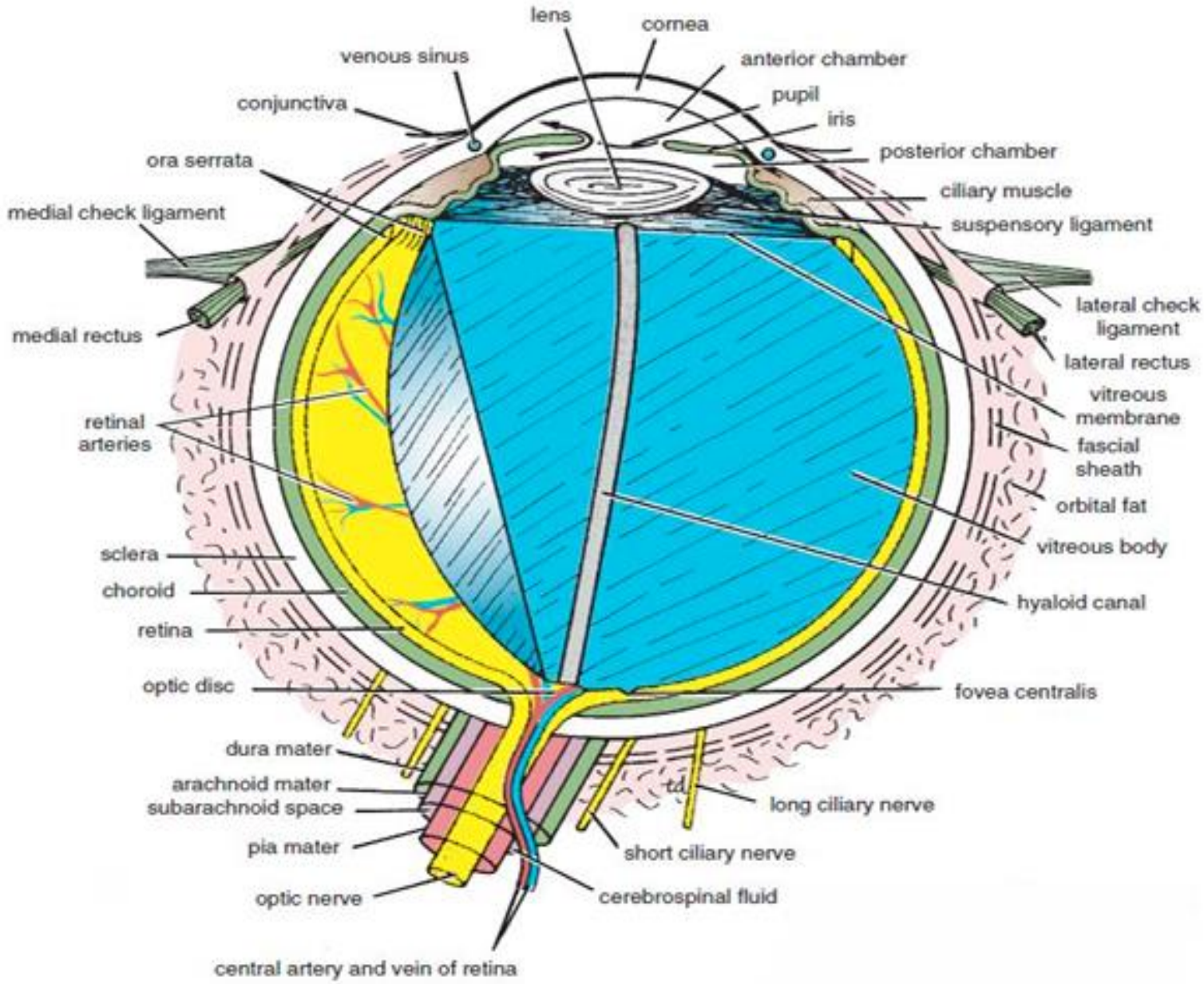
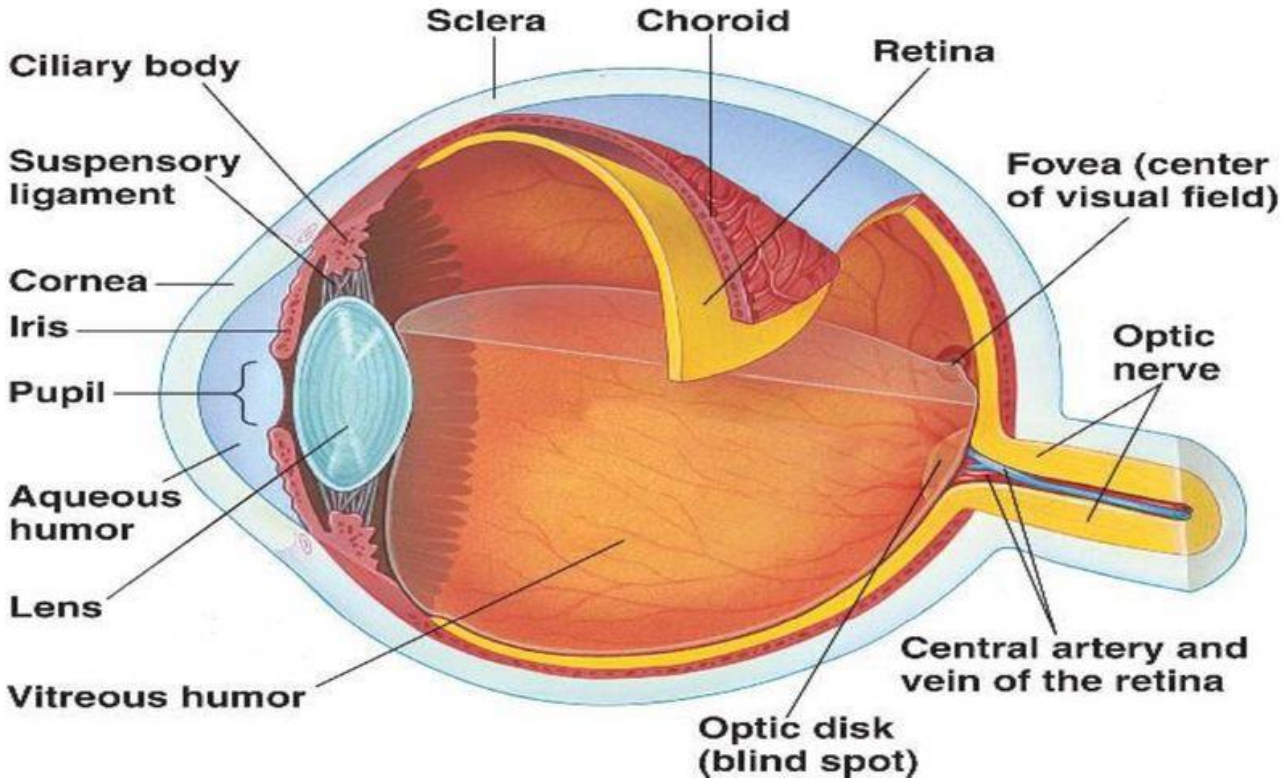



**Figure 9: Horizontal section through the eyeball and the optic nerve**

# Vascular Layer

A rich vascular coat (the uvea ) lies underneath the fibrous layer

Forms ciliary body and iris anteriorly, choroid posteriorly



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