ANATOMY OF THE ORBIT

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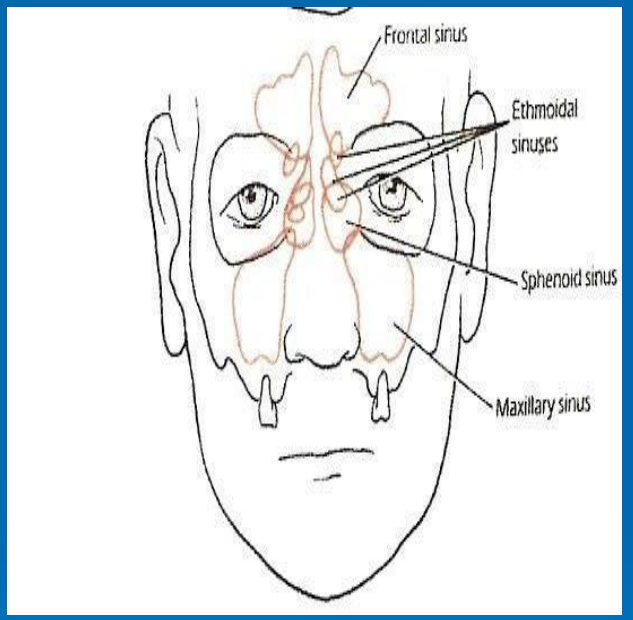
Facial cosmetic Surgery

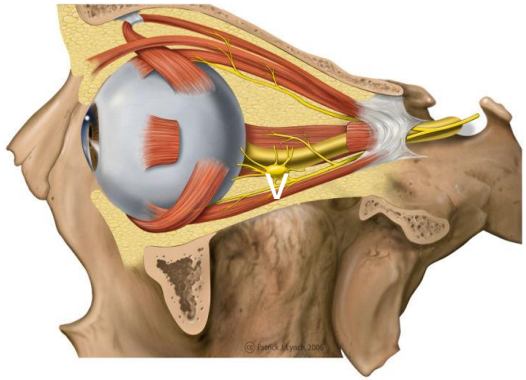
Periorbital Sinuses

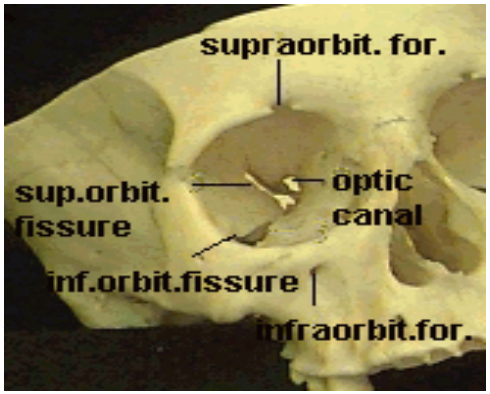
- The eyes lie within two bony orbits, located on either side of the root of the nose.
- They border the nasal cavity anteriorly and the ethmoidal air cells and the sphenoid sinus posteriorly.
- The lateral walls border the middle cranial, temporal, and pterygopalatine fossae.
- Superior to the orbit are the anterior cranial fossa and the frontal and supraorbital sinus.
- The maxillary sinus and the palatine air cells are located inferiorly.



Margins

- Superior: By frontal bone
- Lateral: By processes of frontal and zygomatic bones
- Inferior: By zygomatic and maxilla
- Medial: By processes of maxilla and frontal bones





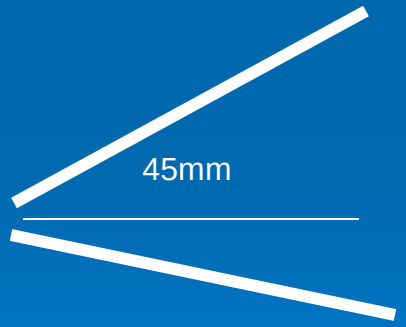
Ethmoid bone

Medial orbital walls

Lateral orbital walls

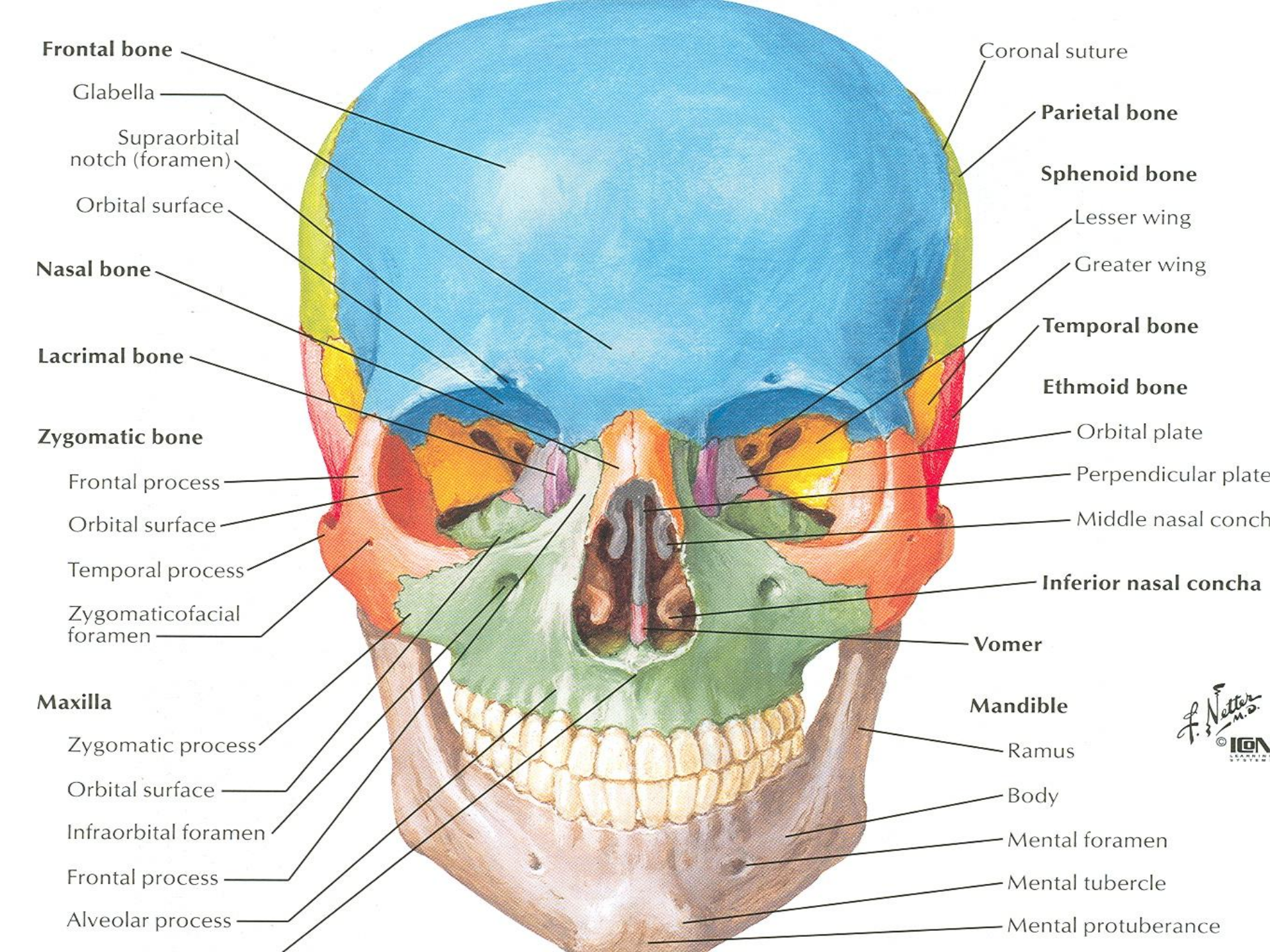
Adult orbital dimensions

Entrance height	35 mm
Entrance width	40 mm
Medial wall length / depth	45 mm
Volume	30 cc
Distance from the back of the globe to the optic foramen	18 mm



SALIENT ANATOMICAL FEATURES

- 7 bones
- 4 walls
- 4 margins
- 4 important openings
- 6 contents
- 5 important relationships


Frontal bone
Glabella
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Orbital surface
Nasal bone
Lacrimal bone
Zygomatic bone
Frontal process
Orbital surface
Temporal process
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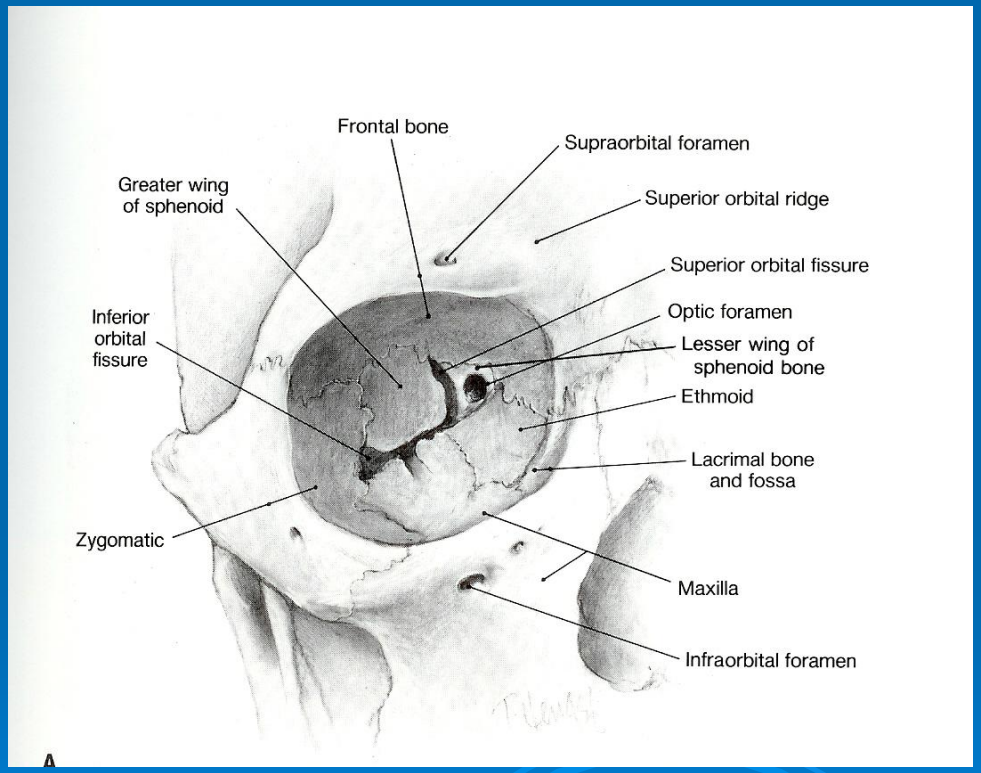
Sphenoid bone
Lesser wing
Greater wing
Temporal bone
Ethmoid bone
Orbital plate
Perpendicular plate
Middle nasal conch
Inferior nasal concha
Vomer
Mandible
Ramus
Body
Mental foramen
Mental tubercle
Mental protuberance

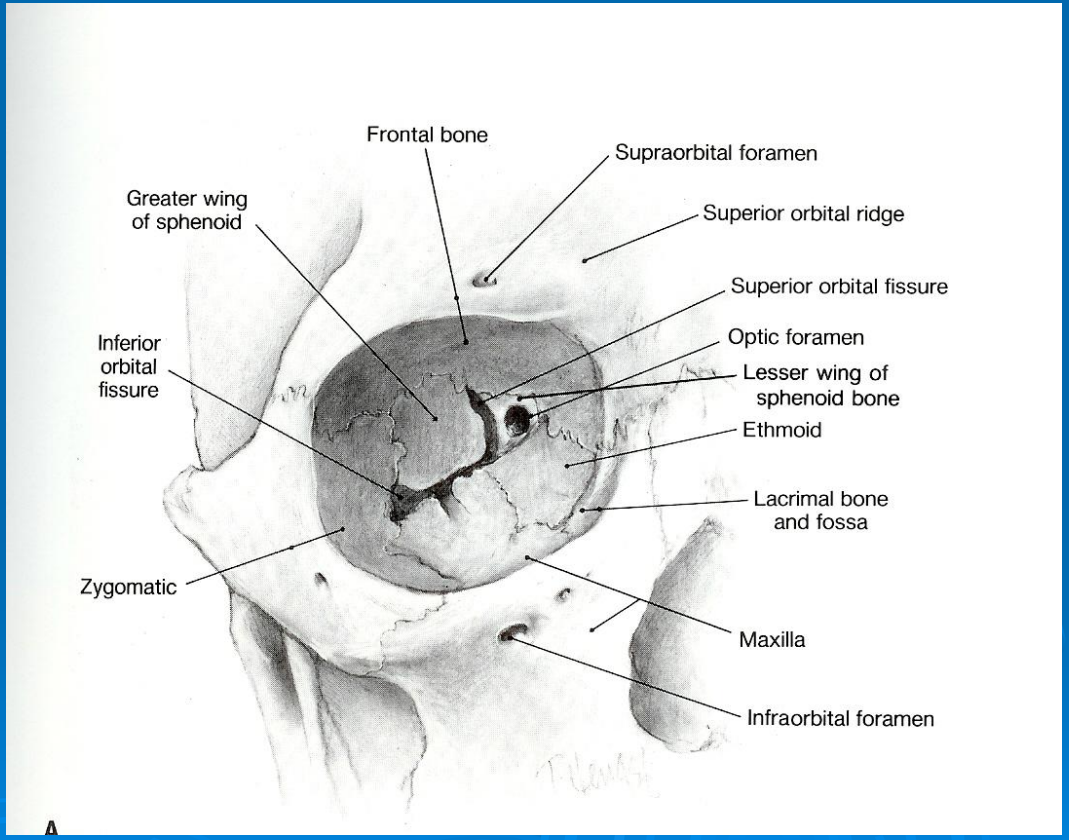
Orbital Volume

- The volume of each adult orbit is slightly less than 30 cc
- The orbital entrance averages about 35 mm in height and 45 mm in width. The maximum width is about 1 cm (behind the anterior orbital margin)
- In adults, the depth of the orbit varies from 40 to 45 mm from the orbital entrance to the orbital apex
- Both race and sex affect each of these measurements.



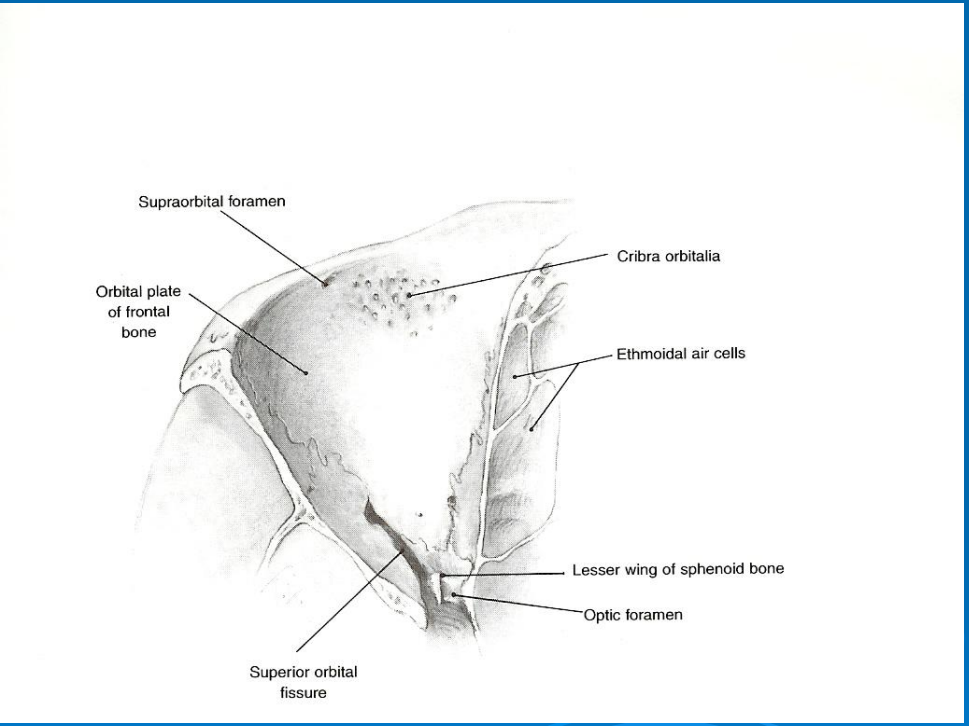
Bony Orbit

- Seven bones make up the bony orbit:
  - Frontal
  - Zygomatic
  - Maxillary
  - Ethmoidal
  - Sphenoid
  - Lacrimal
  - Palatine



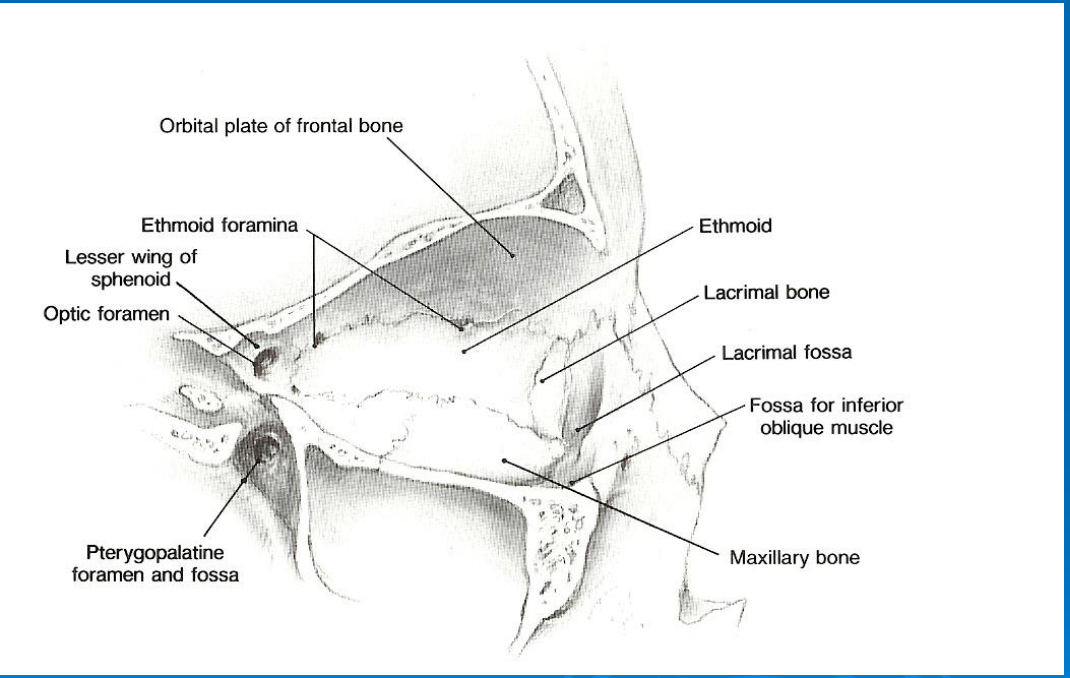
Orbital Roof

- The orbital roof formed from both the orbital plate of the frontal bone and the lesser wing of the sphenoid bone.
- Lacrimal gland
- Fovea trochlearis



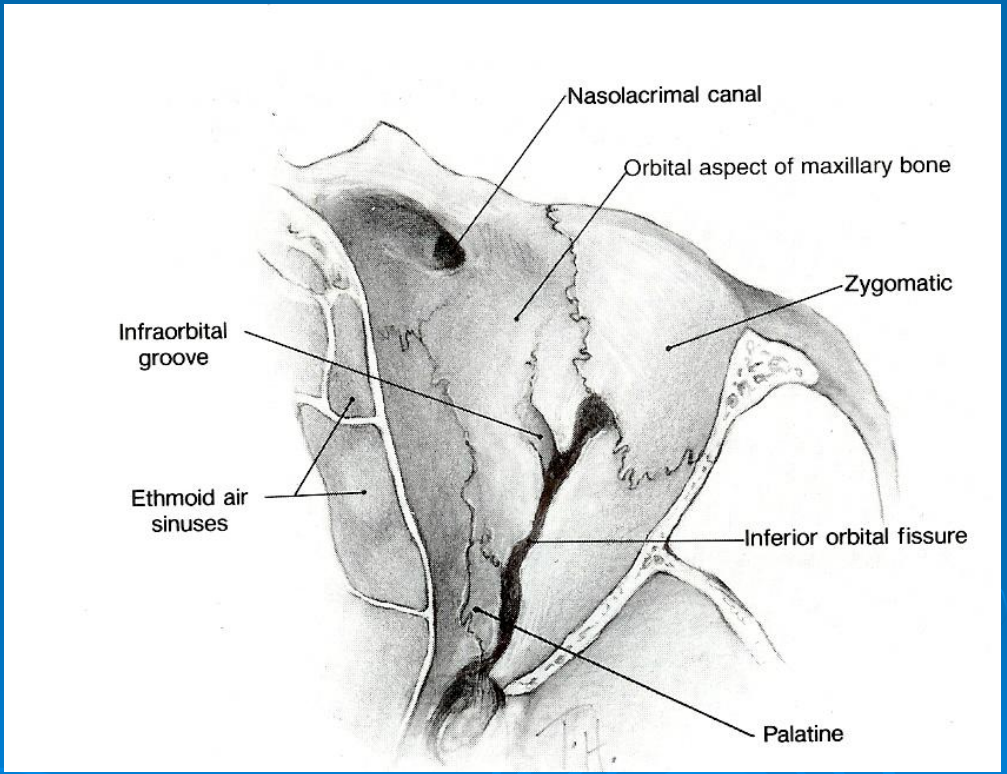
Medial Orbital Wall

- Then medial wall of the orbit is formed from four bones:
  - Frontal process of the maxillary
  - Lacrimal
  - Orbital plate of the ethmoidal
  - Lesser wing of the sphenoid
- Lacrimal fossa
- Lamina papyracea



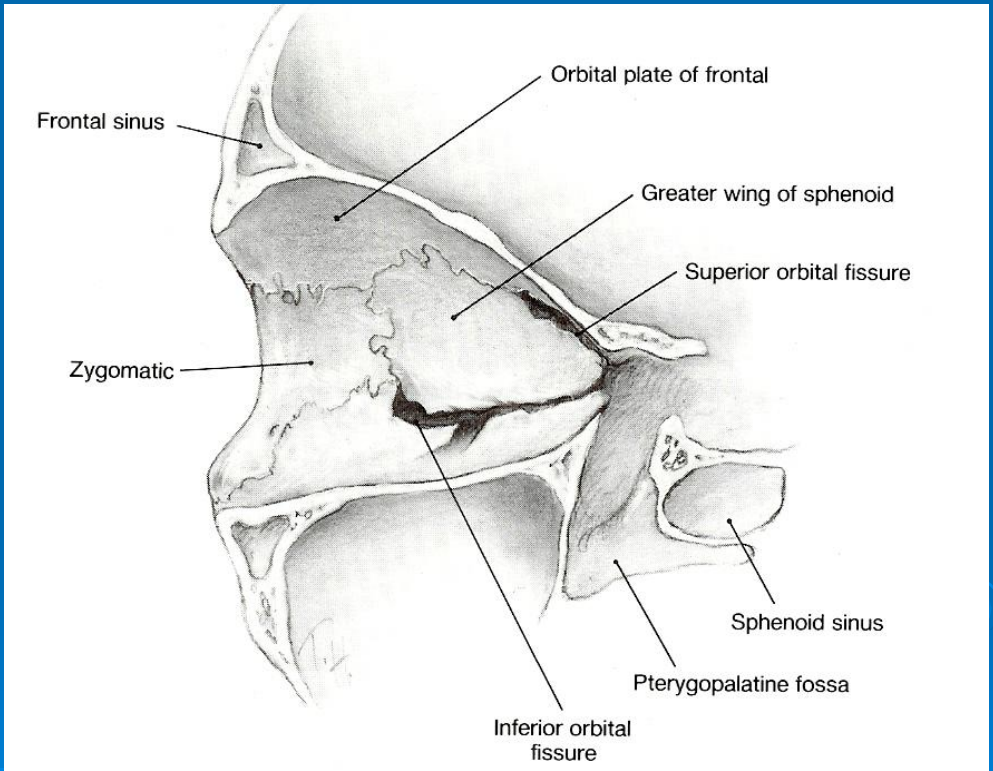
Orbital Floor

- The floor of the orbit is formed from three bones:
  - Maxillary
  - Palatine
  - Orbital plate of the zygomatic
- Infraorbital groove
- Inferior oblique muscle



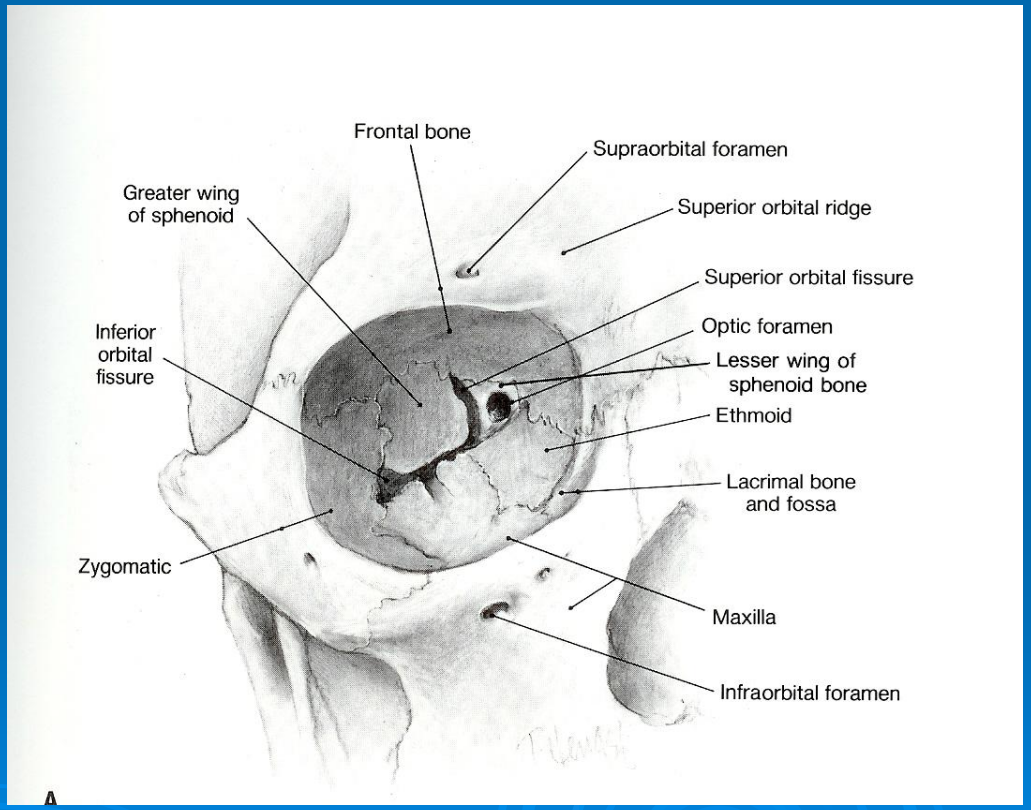
Lateral Orbital Wall

- Formed from two bones:
  - Zygomatic
  - Greater wing of the sphenoid
- Thickest and strongest
- Lateral orbital tubercle (Whitnall's tubercle)

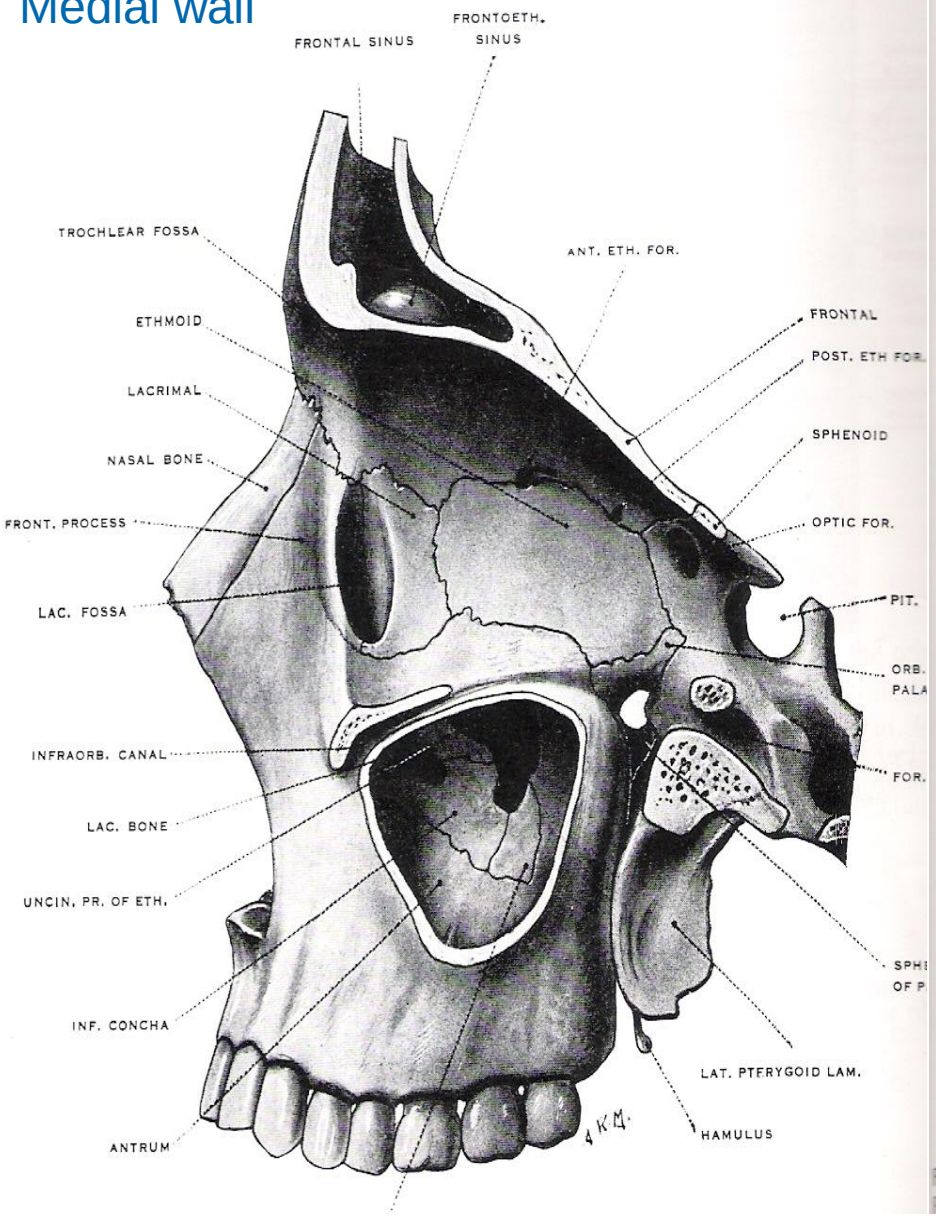


Orbital Foramina

- The optic foramen
- The supraorbital foramen, or notch
- The anterior ethmoidal foramen
- The posterior ethmoidal foramen
- The zygomatic foramen
- Nasolacrimal duct
- Infraorbital canal
- Superior orbital fissure
- Inferior orbital fissure



Medial wall



Floor

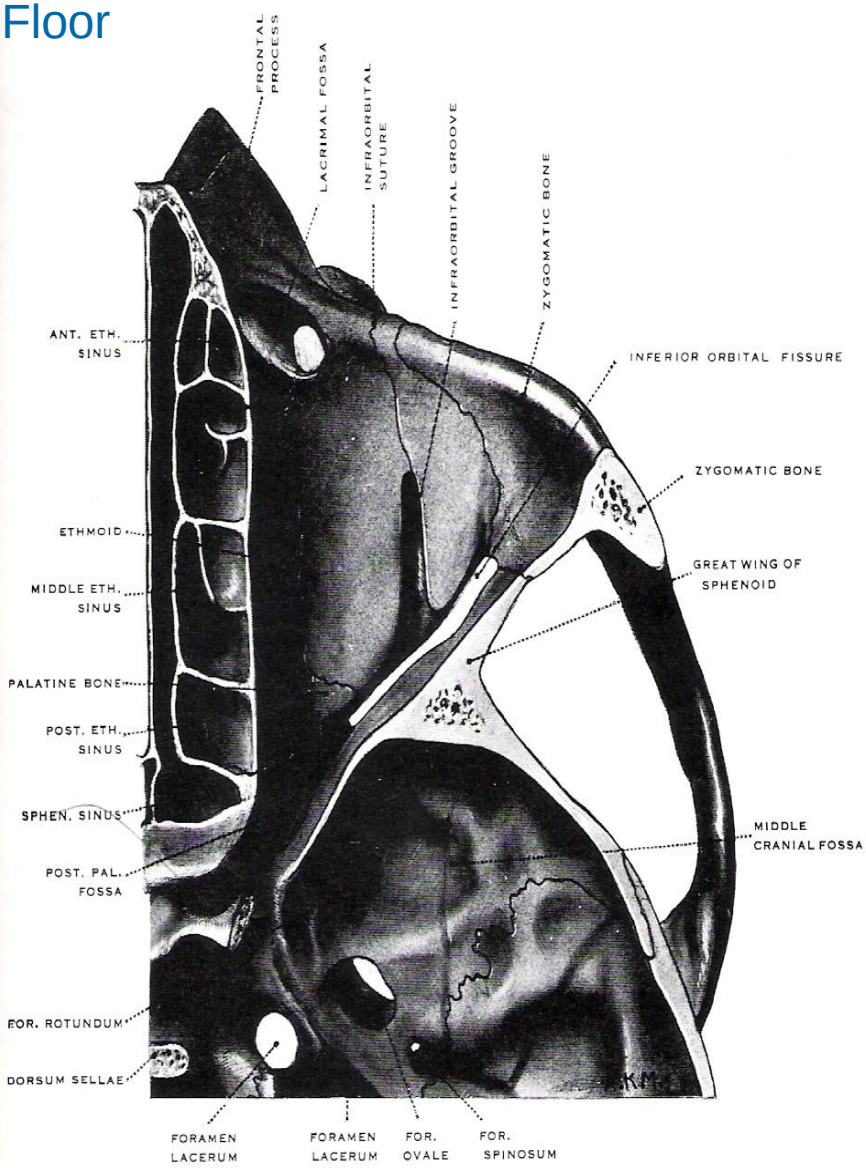
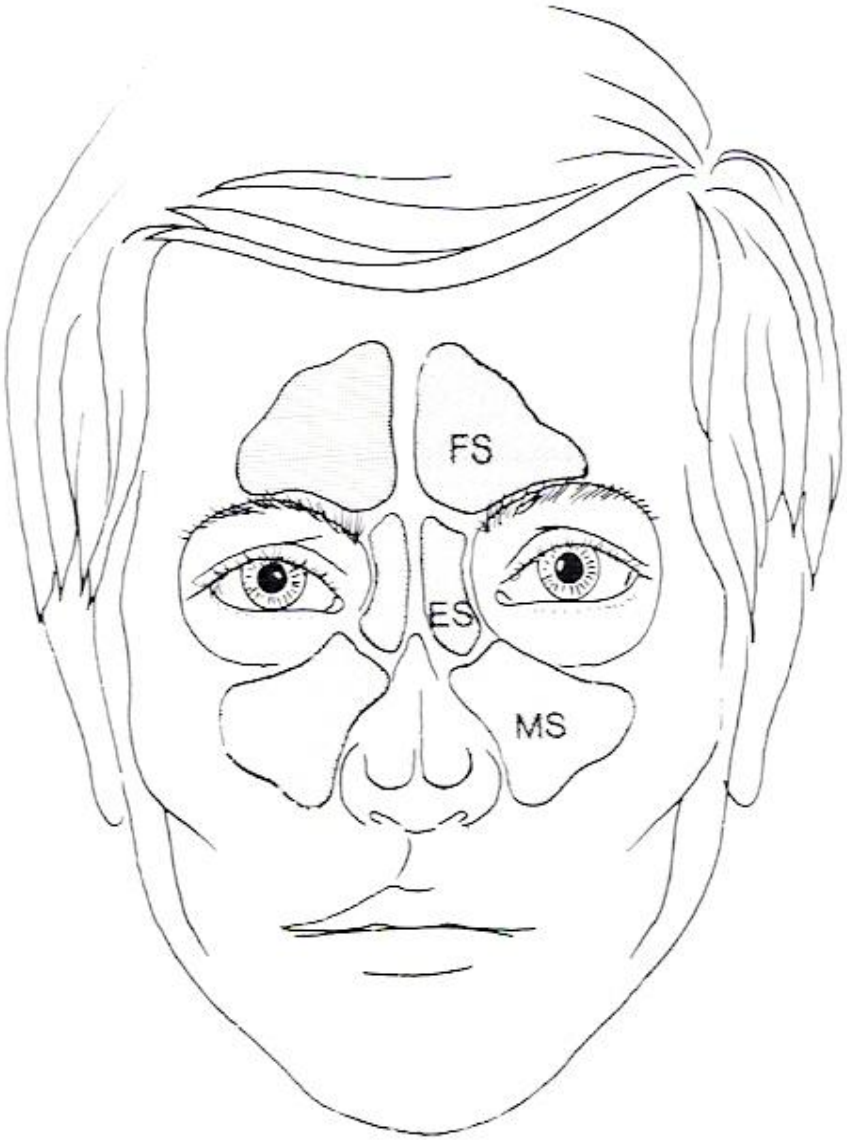


FIG 1-3—Floor of orbit. (From Warwick R. *Eugene Wolff's Anatomy of the Eye and Orbit*. 7th ed. Philadelphia: WB Saunders Co; 1976.)

IMPORTANT RELATIONS OF THE ORBIT

1. **Brain :** Orbit is closely related to the brain in relation to its roof and lateral wall.
2. **Para nasal sinuses:** Orbit is intimately connected to the paranasal sinuses.
   - Maxillaly sinus via the floor.
   - Ethmoidal and sphenoidal sinus via the medial wall.
   - Frontal sinus at the roof.
   - Any infection can easily spread to the orbit from the sinuses.
3. **Nasal cavity:** Nasal cavity is related to the orbit at its medial or inner wall & through the nasolacrimal duct
4. **Cavernous sinus** via the veins of the orbit
5. **Pterygopalatine fossa** via the inferior orbital fissure



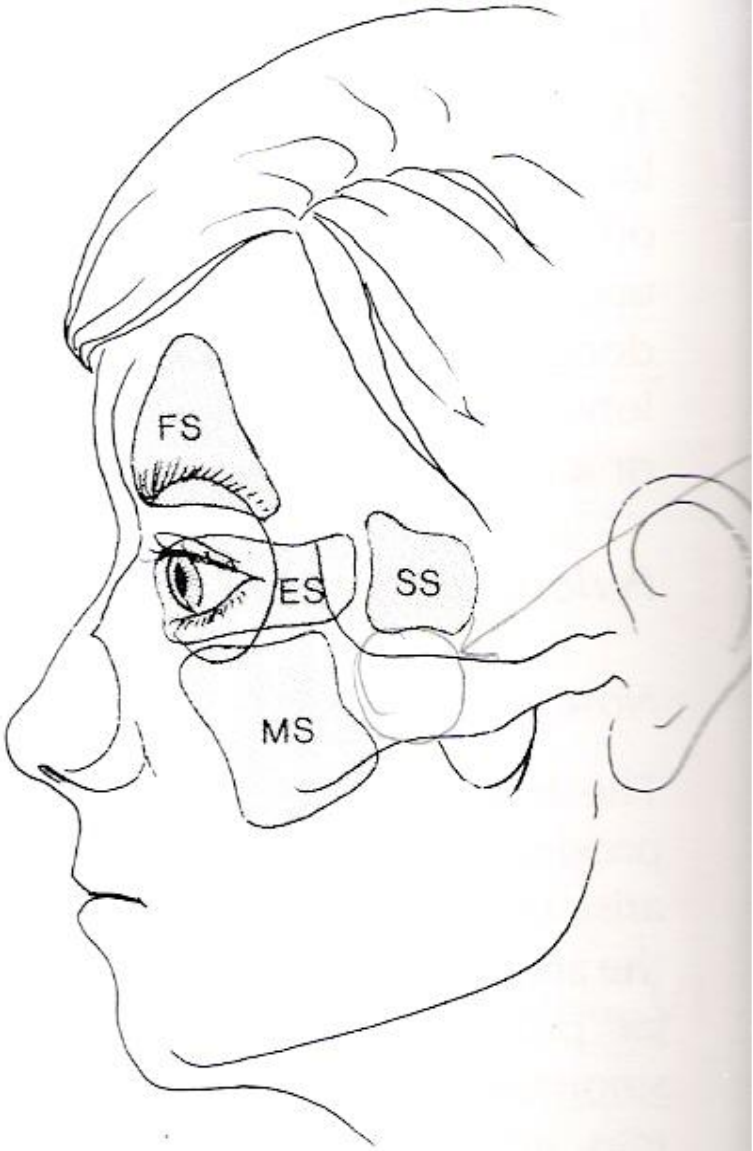


FIG 1-9—Relationship of the orbits to the paranasal sinuses: *FS,* frontal sinus; *ES,* ethmoid sinus; *M* maxillary sinus; *SS,* sphenoid sinus.

Boundaries

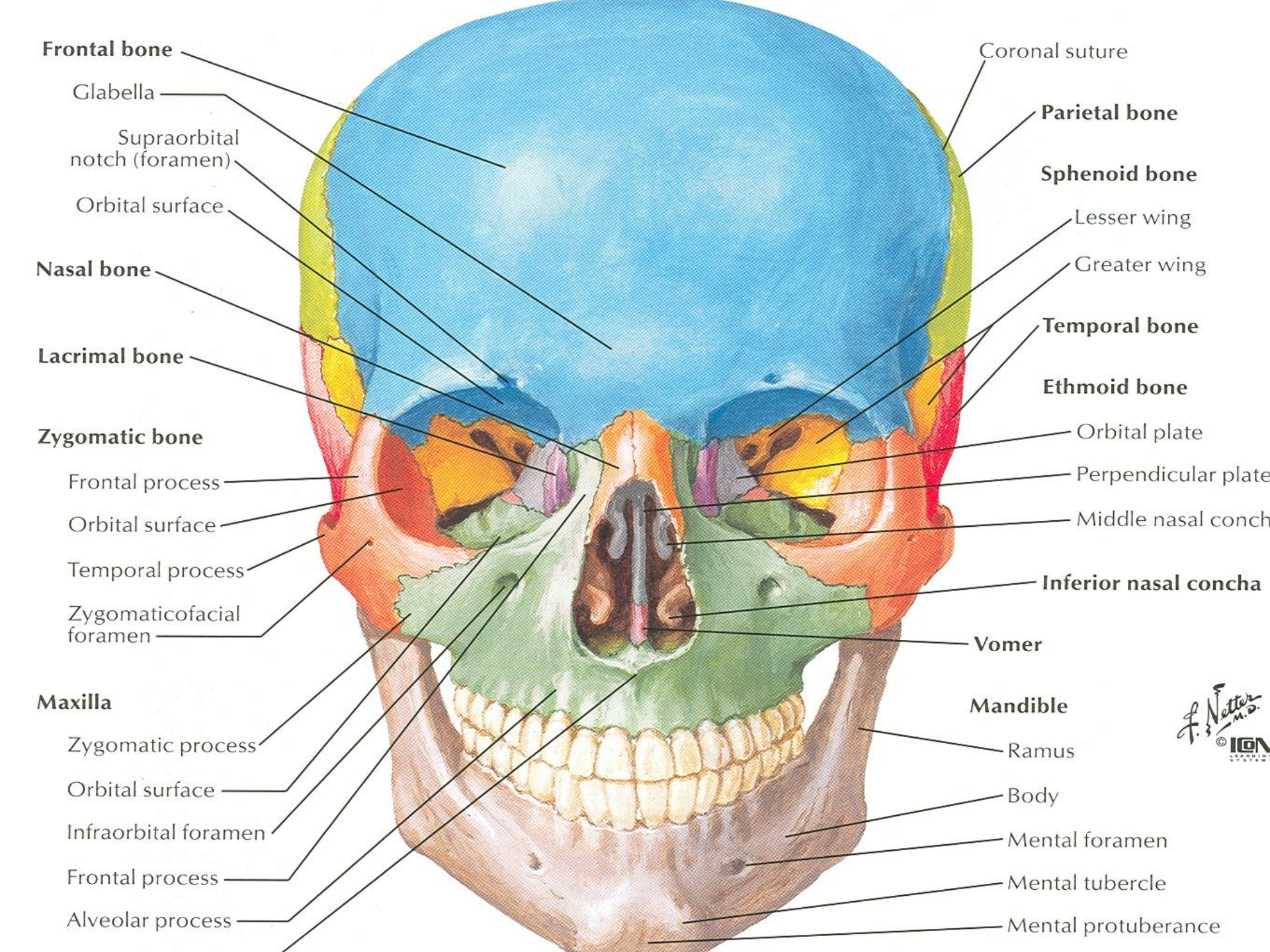
- Roof: Is formed by orbital plate of frontal bone
- Lateral wall: Composed of zygomatic bone & greater wing of sphenoid bone
- Floor: Formed by the orbital plate of maxilla
- Medial wall: Frontal process of maxilla, Lacrimal bone, orbital plate of ethmoid & body of sphenoid bone

Orbital Opening

- Lies anteriorly
- About one-sixth of the eye is exposed
- The remainder is protected by the walls of the orbit

Supraorbital Notch

- The supraorbital notch is situated on the superior orbital margin
- It transmits the supraorbital nerve and blood vessels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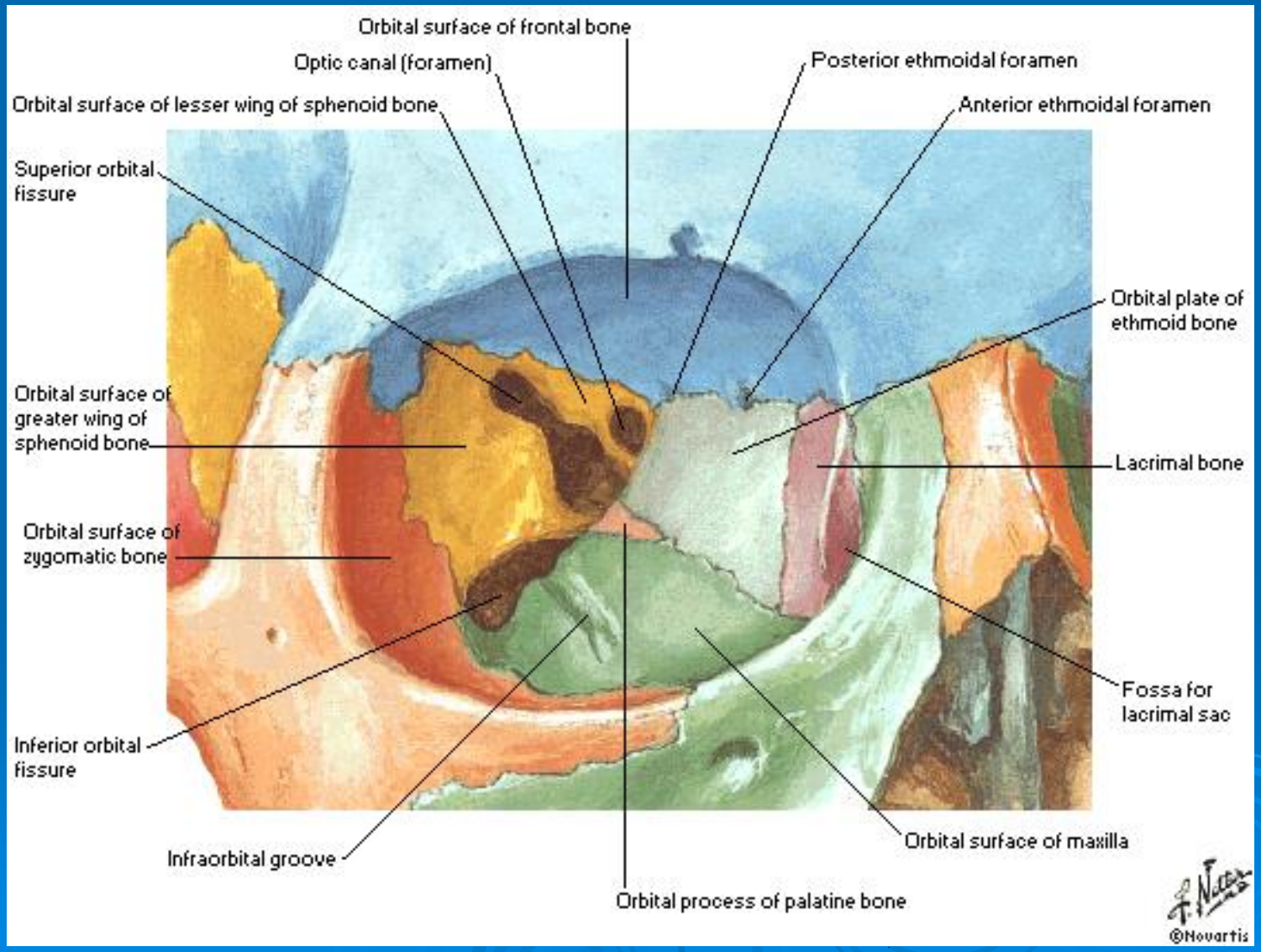
Orbital plate
Perpendicular plate
Middle nasal conch
Inferior nasal concha
Vomer
Mandible
Ramus
Body
Mental foramen
Mental tubercle
Mental protuberance

Infraorbital Groove & Canal

- Situated on the floor of the orbit in the orbital plate of the maxilla
- They transmit the infraorbital nerve (a continuation of the maxillary nerve) and blood vessels


Orbital surface of frontal bone
Optic canal (foramen)
Posterior ethmoidal foramen
Orbital surface of lesser wing of sphenoid bone
Anterior ethmoidal foramen
Superior orbital fissure
Orbital plate of ethmoid bone
Orbital surface of greater wing of sphenoid bone
Lacrimal bone
Orbital surface of zygomatic bone
Fossa for lacrimal sac
Inferior orbital fissure
Orbital surface of maxilla
Infraorbital groove
Orbital process of palatine bone
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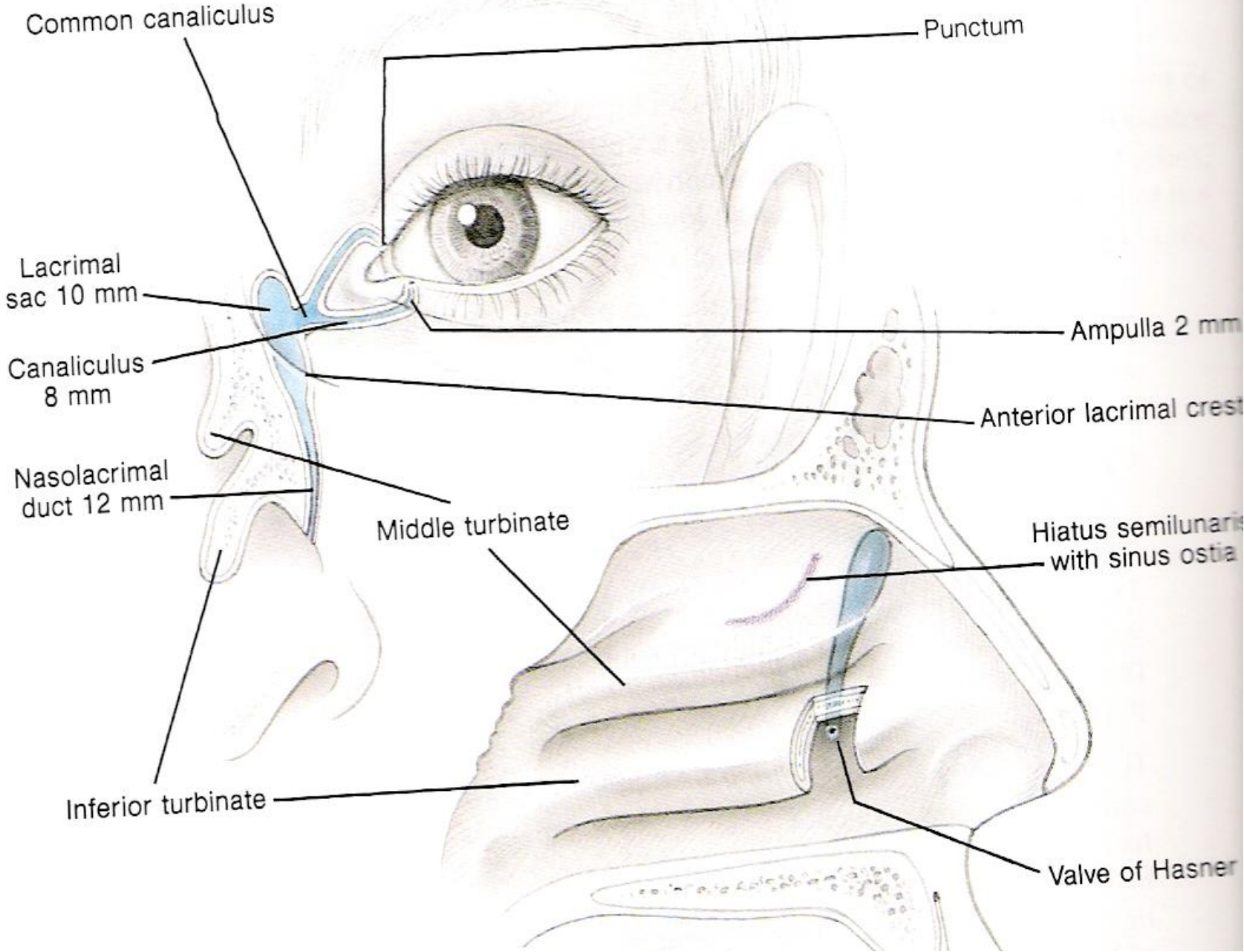
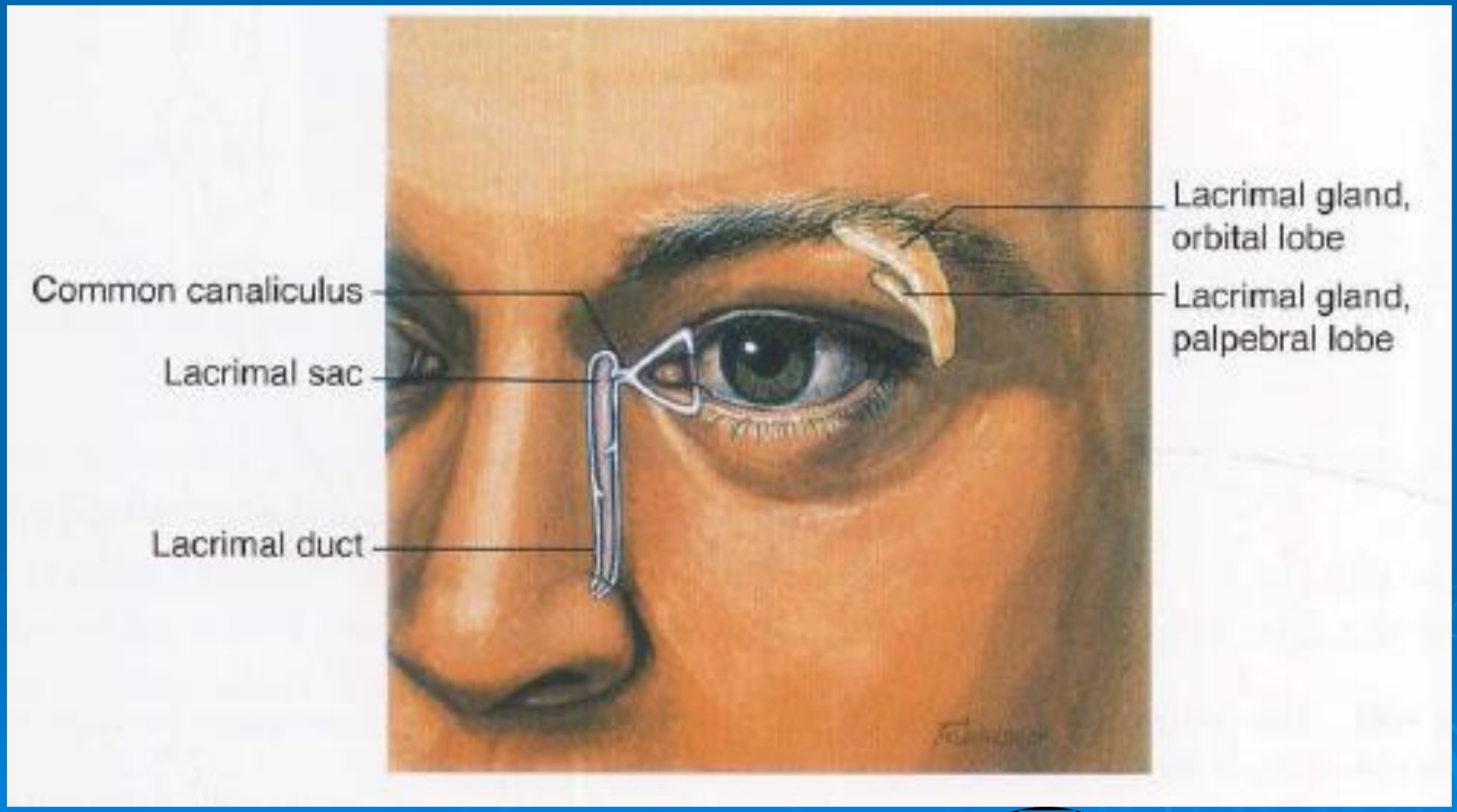
Nasolacrimal Canal

- Located anteriorly on the medial wall
- It communicates with the inferior meatus of the nose
- It transmits the nasolacrimal duct


Common canaliculus
Punctum
Lacrimal sac 10 mm
Ampulla 2 mm
Canaliculus 8 mm
Anterior lacrimal crest
Nasolacrimal duct 12 mm
Middle turbinate
Hiatus semilunaris with sinus ostia
Inferior turbinate
Valve of Hasner

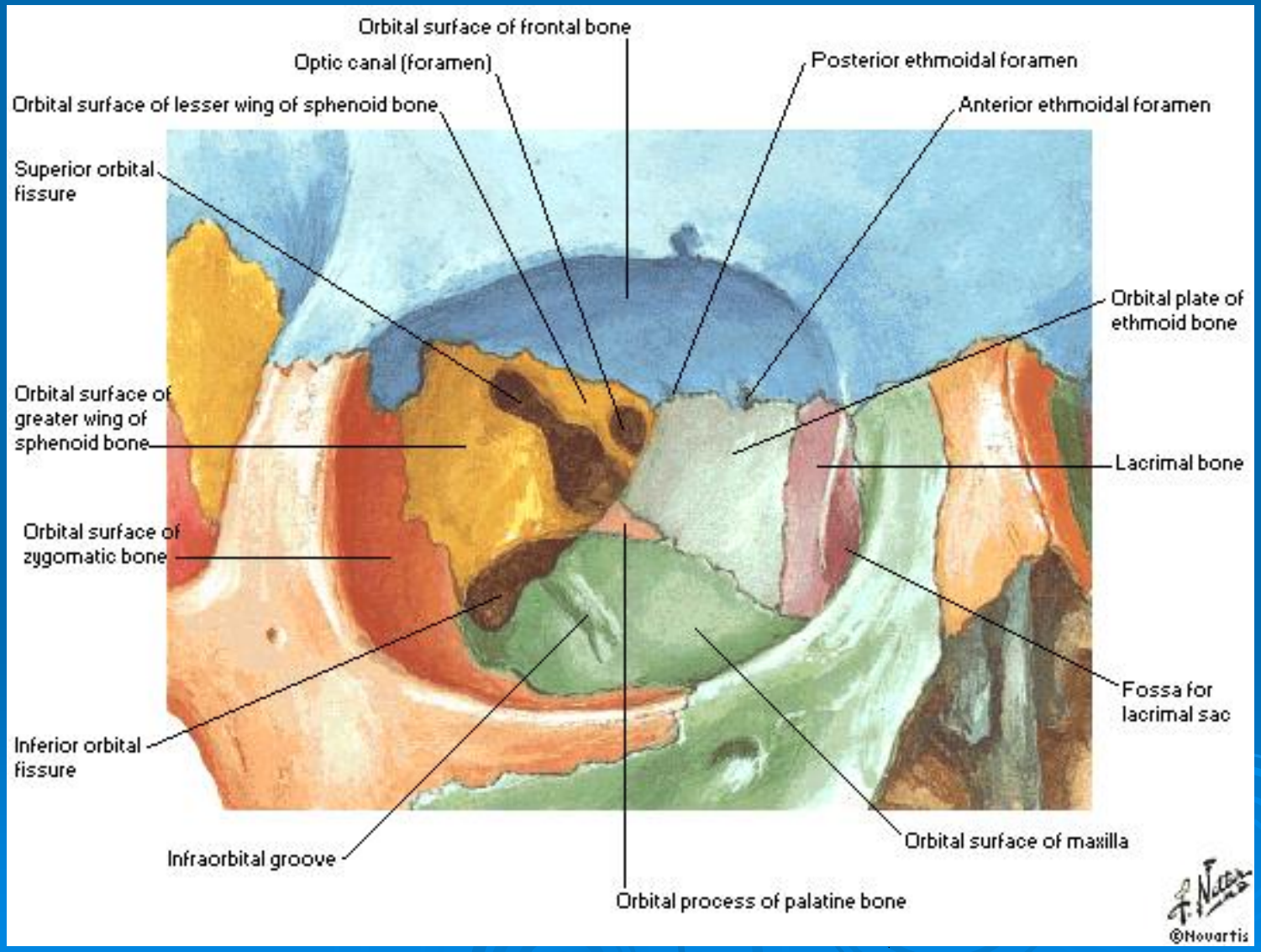
Lacrimal Gland and Excretory System

- The main lacrimal gland is located in a shallow depression within the orbital part of the frontal bone.
- The gland is divided into 2 parts.
- When the upper eyelid is everted, the smaller, palpebral part can be seen in the superolateral conjunctival fornix.


Common canaliculus
Lacrimal sac
Lacrimal duct
Lacrimal gland, orbital lobe
Lacrimal gland, palpebral lobe

Inferior Orbital Fissure

- Located posteriorly between the maxilla and the greater wing of the sphenoid
- It communicates with the pterygopalatine fossa
- It transmits the maxillary nerve and its zygomatic branch, the inferior ophthalmic vein, and sympathetic nerves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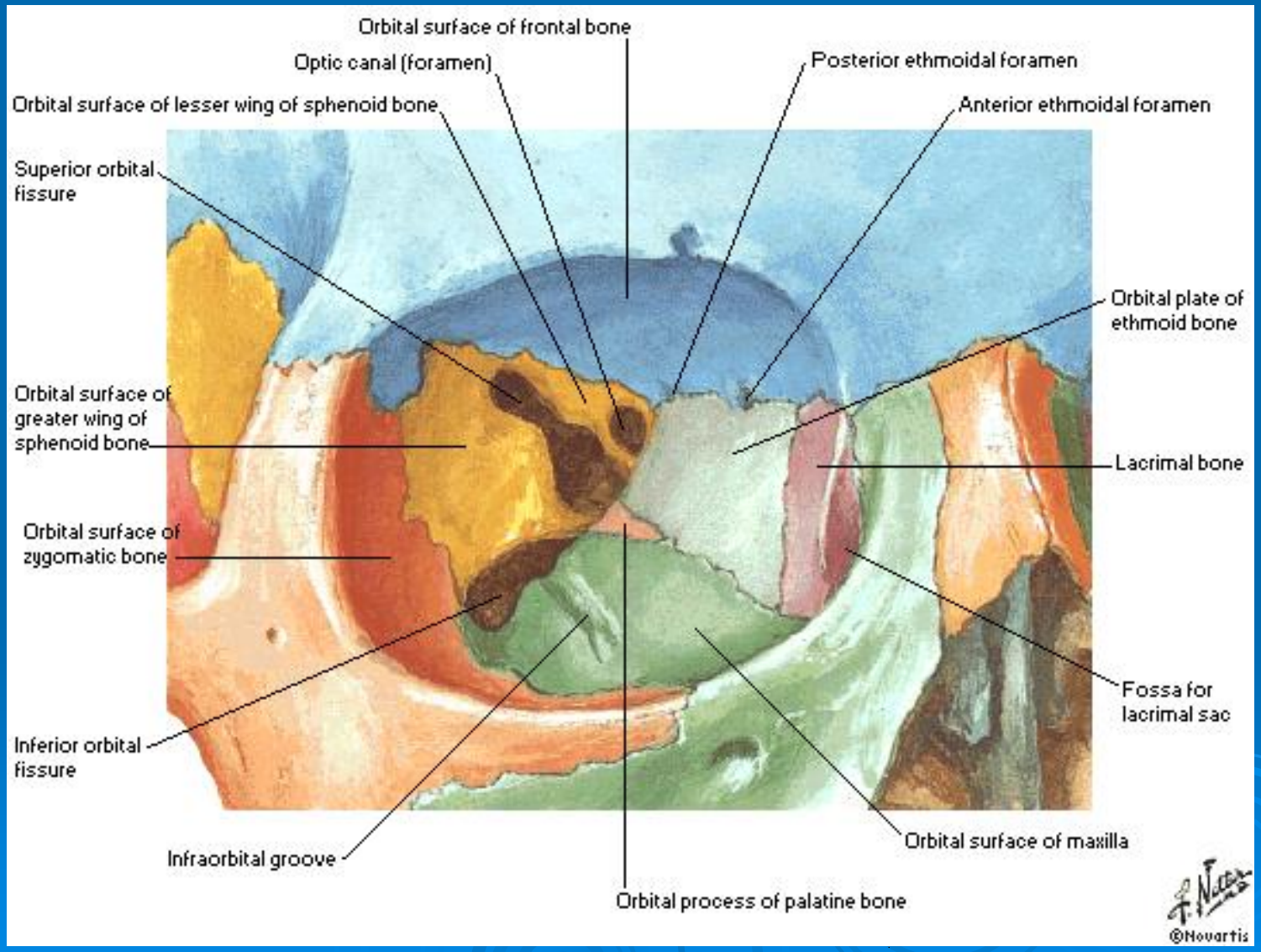
Anterior ethmoidal foramen
Superior orbital fissure
Orbital plate of ethmoid bone
Orbital surface of greater wing of sphenoid bone
Lacrimal bone
Orbital surface of zygomatic bone
Fossa for lacrimal sac
Inferior orbital fissure
Orbital surface of maxilla
Infraorbital groove
Orbital process of palatine bone
©Novartis

Superior Orbital Fissure

- Located posteriorly between the greater and lesser wings of the sphenoid
- It communicates with the middle cranial fossa
- It transmits the lacrimal nerve, the frontal nerve, the trochlear nerve, the oculomotor nerve (upper and lower divisions), the abducent nerve, the nasociliary nerve, and the superior ophthalmic vein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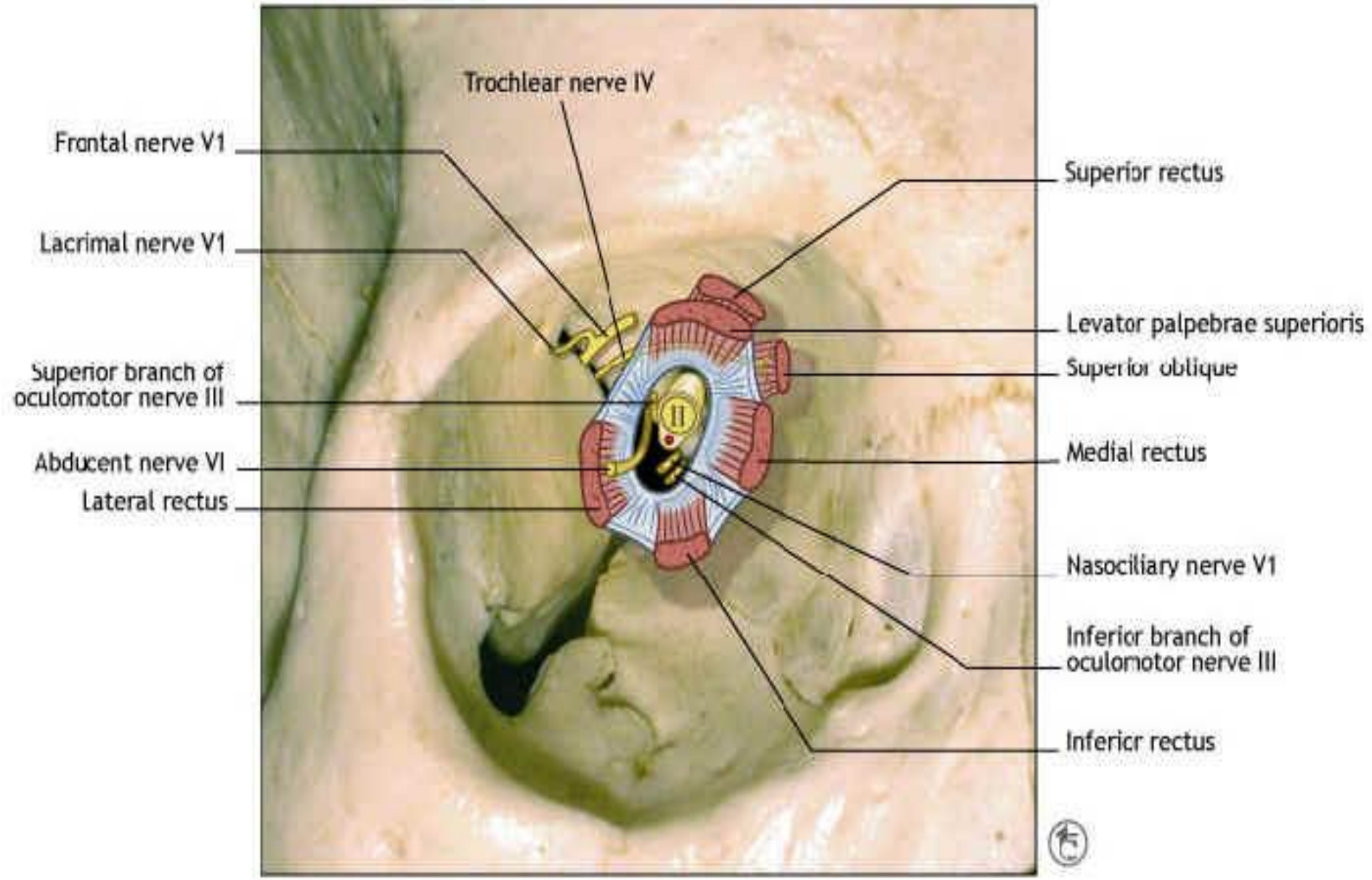
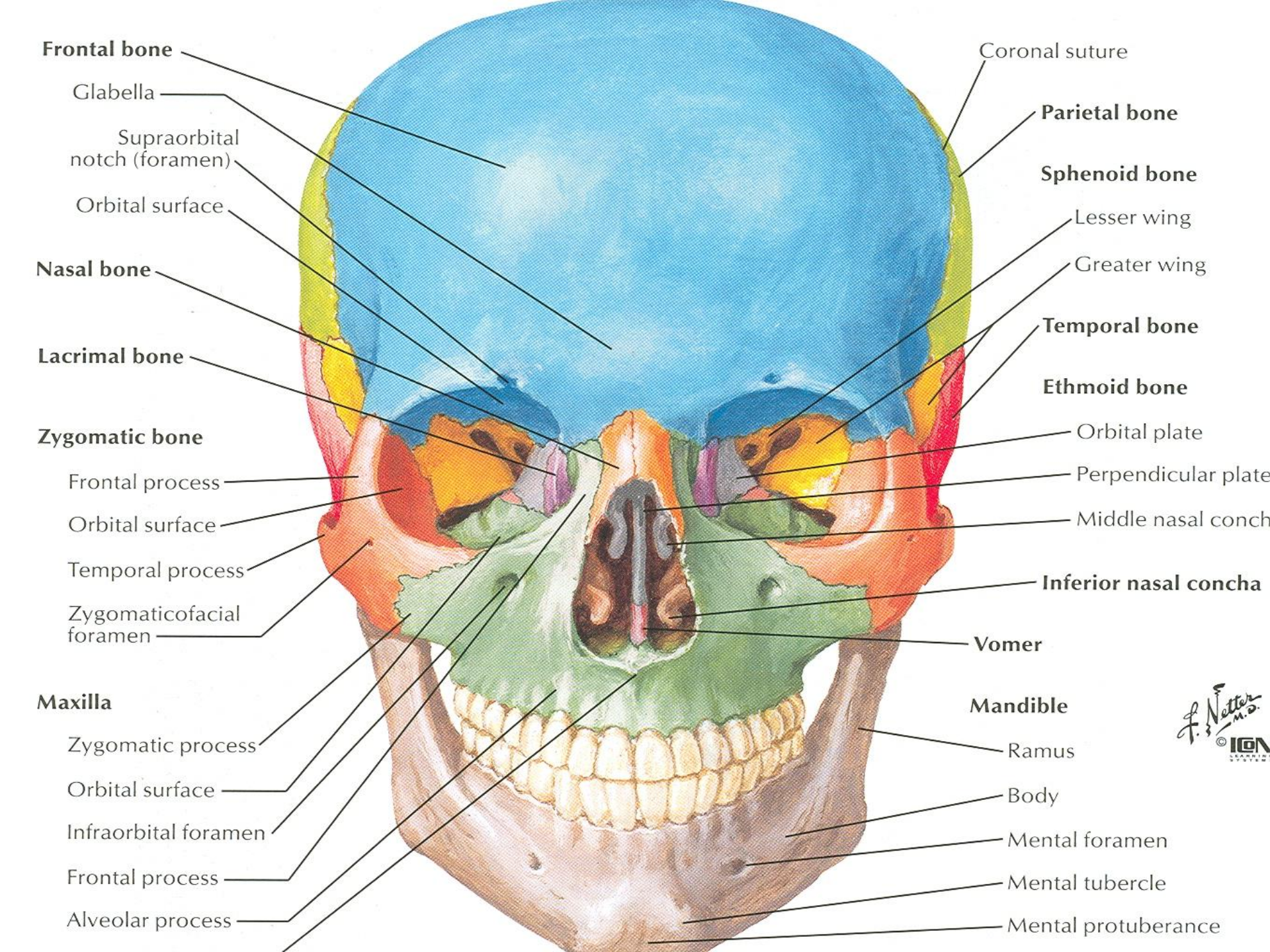

Trochlear nerve IV
Frontal nerve V1
Lacrimal nerve V1
Superior branch of oculomotor nerve III
Abducent nerve VI
Lateral rectus
Superior rectus
Levator palpebrae superioris
Superior oblique
Medial rectus
Nasociliary nerve V1
Inferior branch of oculomotor nerve III
Inferior rectus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Orbital plate
Perpendicular plate
Middle nasal conch
Inferior nasal concha
Vomer
Mandible
Ramus
Body
Mental foramen
Mental tubercle
Mental protuberance

Optic Canal

- Located posteriorly in the lesser wing of the sphenoid
- It communicates with the middle cranial fossa
- It transmits the optic nerve and the ophthalmic artery

Optic nerve

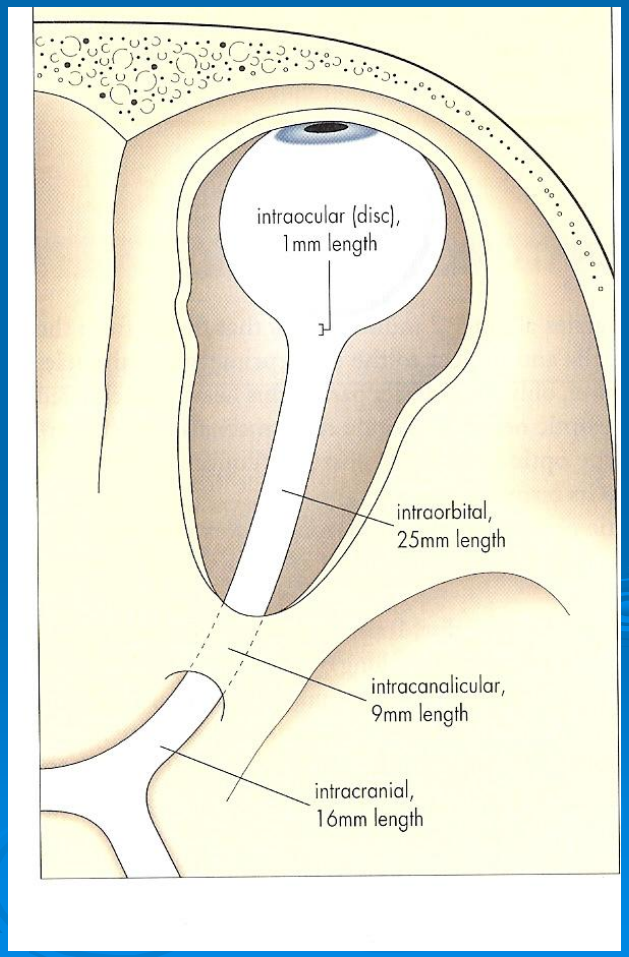
The optic nerve may be divided into the following topographic areas:

Intraocular portion of the optic nerve: optic disc, or nerve head; prelaminar; and laminar portions

Intraorbital portion (located within the muscle cone)

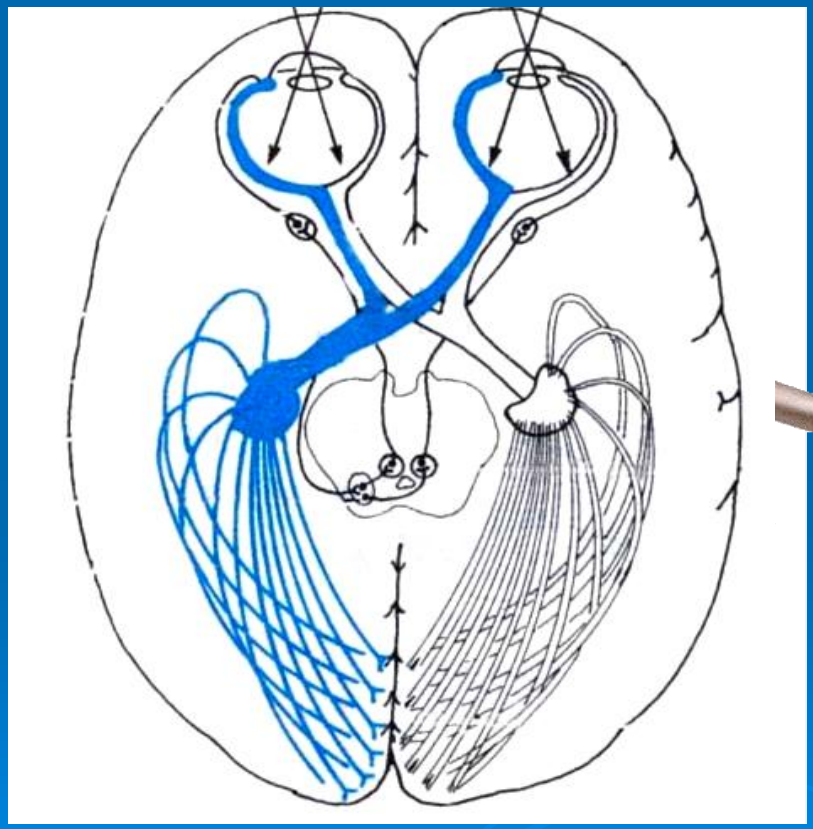
Intracanalicular portion (located within the optic canal)

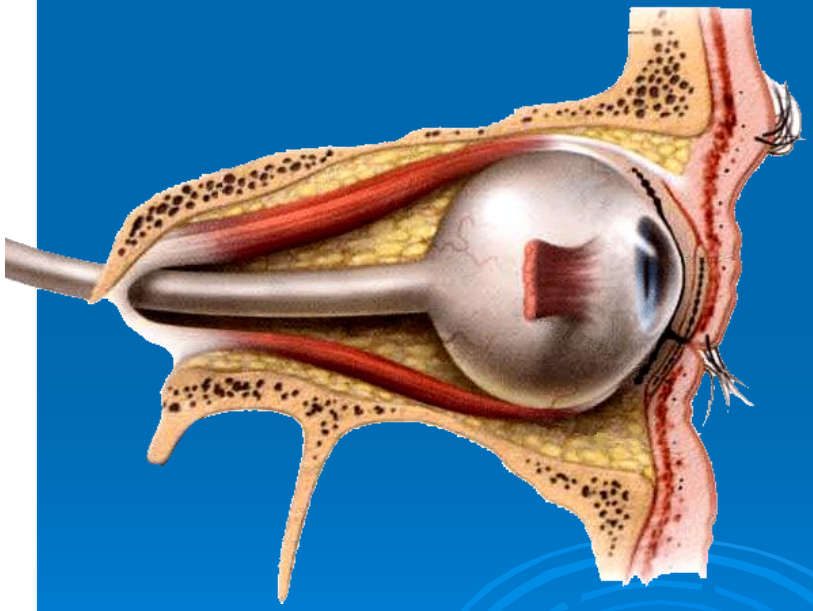
Intracranial portion (ending in the optic chiasm)



Optic Nerve

Ganglion cells (SSA) → Optic canal → Lateral geniculate body





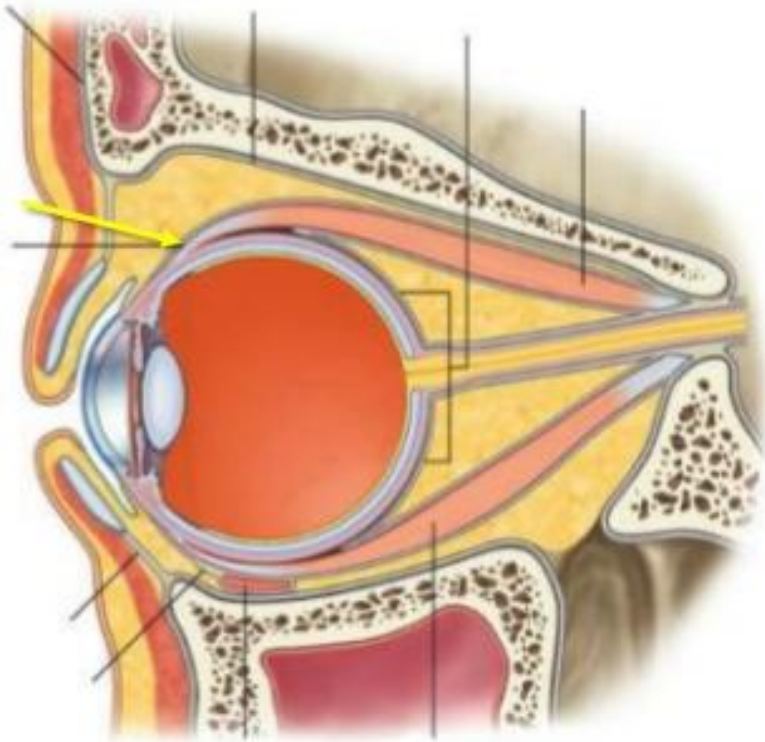
Orbital Fascia

- The orbital fascia is the periosteum of the bones that form the walls of the orbit
- It is loosely attached to the bones and is continuous through the foramina and fissures with the periosteum covering the outer surfaces of the bones

The fascial sheath o f the eyeball

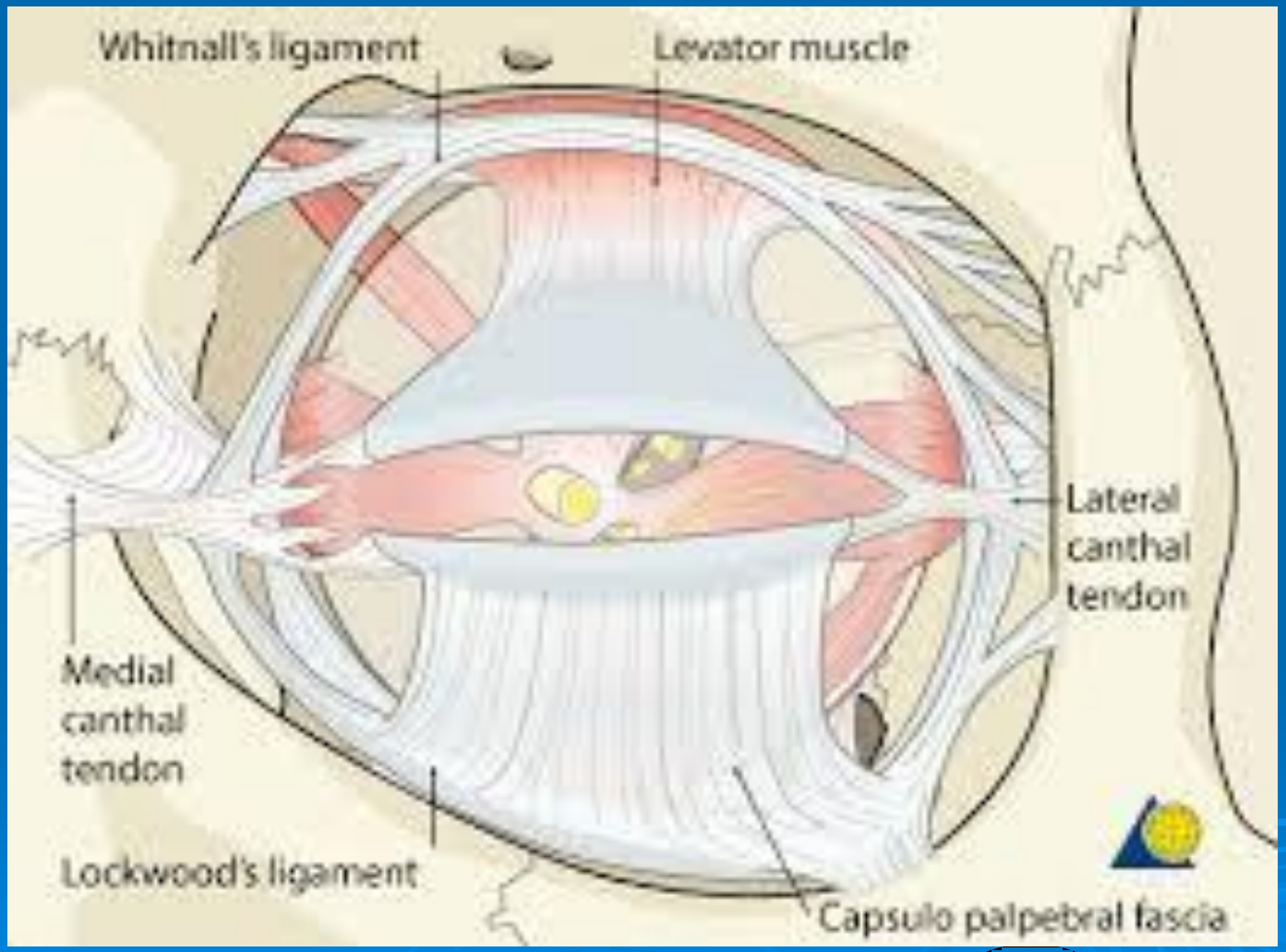
- The fascial sheath o f the eyeball (bulbar sheath) is a layer of fascia that encloses a major part of the eyeball.

- Posteriorly, it is firmly attached to the sclera (the white part of the eyeball) around the point of entrance of the optic nerve into the eyeball.
- Anteriorly, it is firmly attached to the sclera near the edge of the cornea (the clear part of the eyeball).
- Additionally, as the muscles approach the eyeball, the investing fascia surrounding each muscle blends with the fascial sheath of the eyeball as the muscles pass through and continue to their point of attachment.



Orbital Fascia

- The muscle of Muller or orbitalis muscle, is a thin layer of smooth muscle that bridges the inferior orbital fissure
- It is supplied by sympathetic nerves and its function is unknown

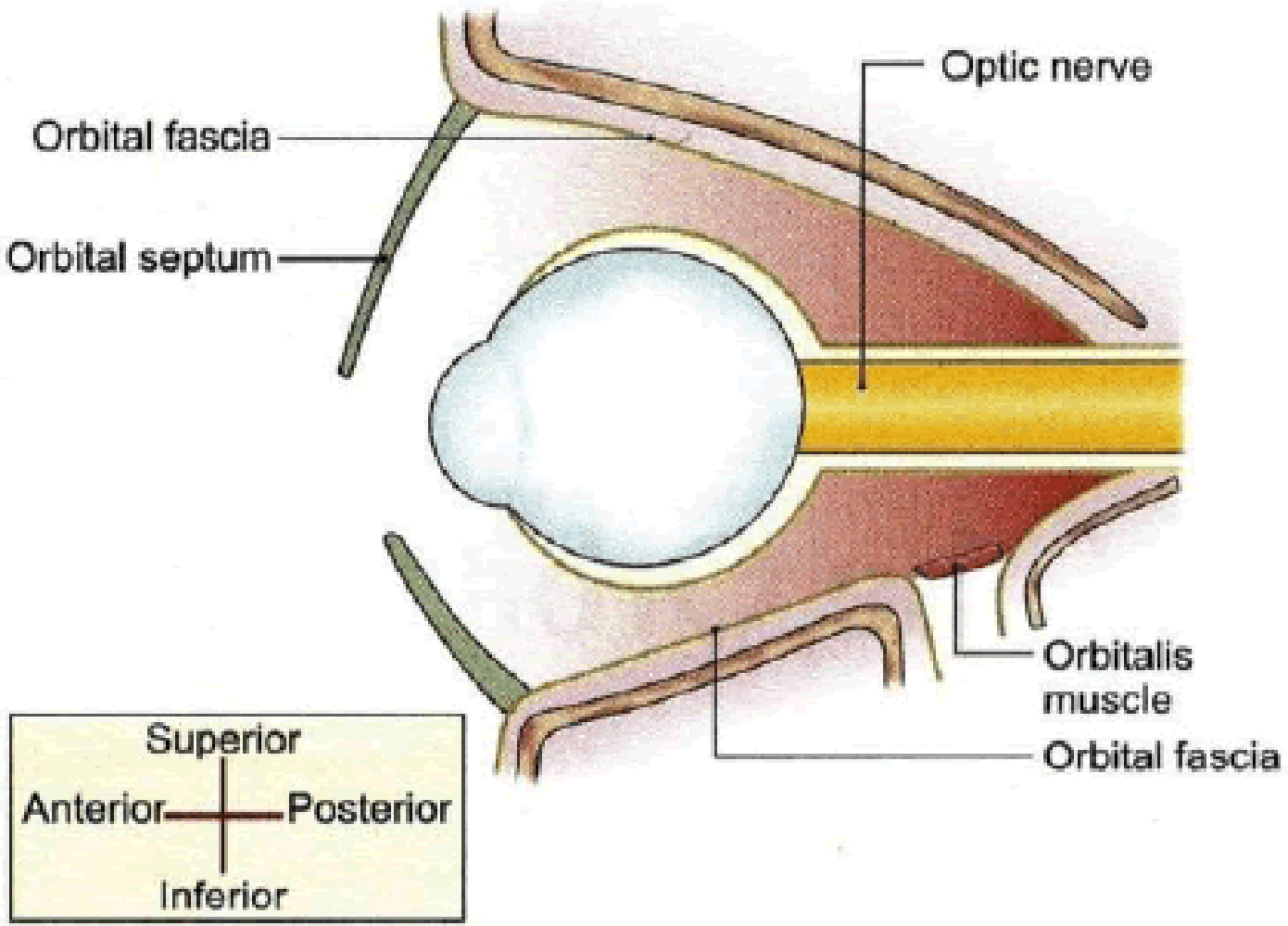

Whitnall's ligament
Levator muscle
Lateral canthal tendon
Medial canthal tendon
Lockwood's ligament
Capsulo palpebral fascia

Fascial Sheath

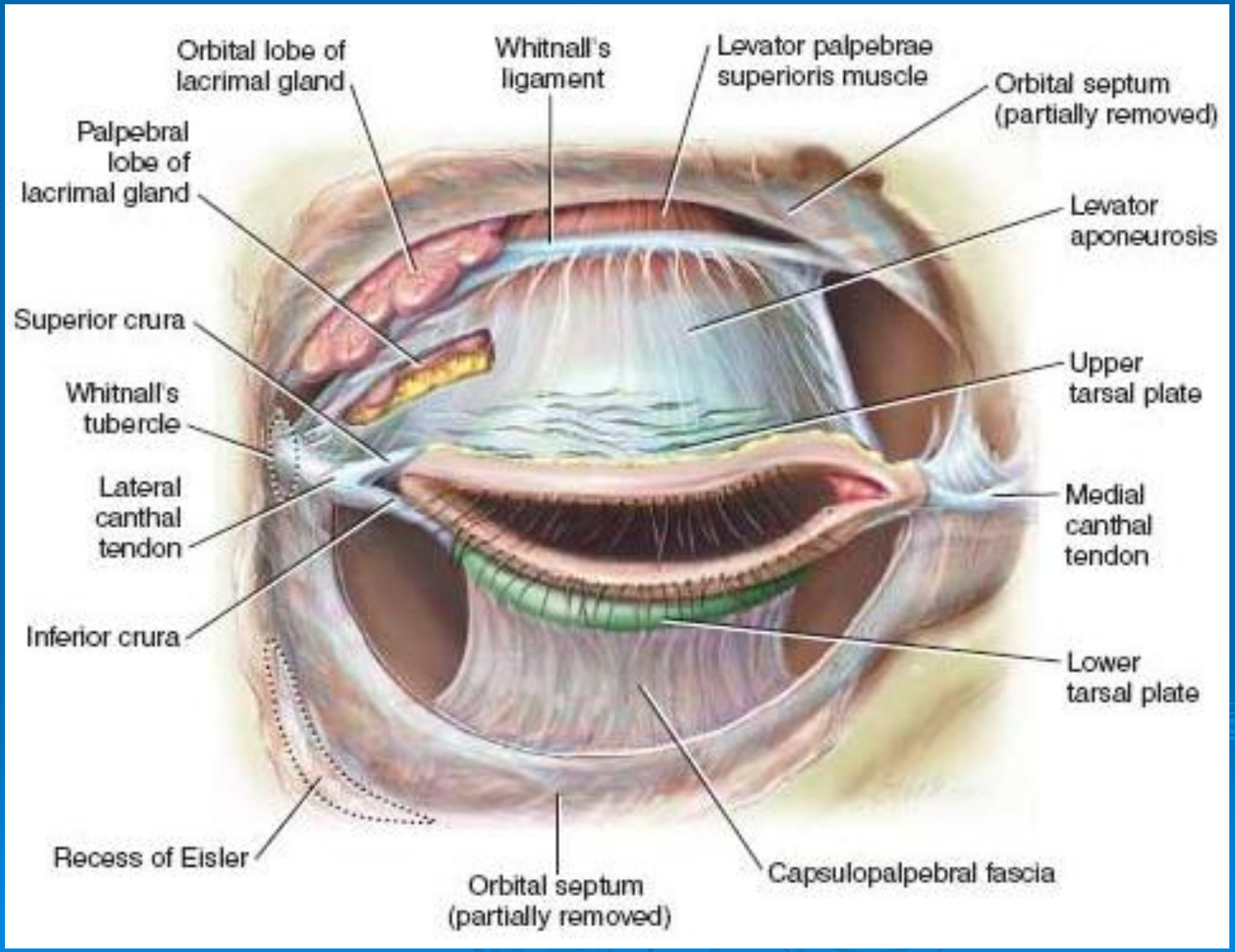
- It surrounds the eyeball from the optic nerve to the corneoscleral junction
- Separates the eyeball from orbital fat
- Provides socket for free eyeball movement
- Perforated by tendons of orbital muscles
- Reflected onto each of them

Fascial Sheath

- Sheath of medial & lateral recti attached to the lateral walls of the orbit by triangular ligaments called medial & lateral check ligaments
- Lower part of the fascial sheath forms the suspensory ligament of the eye

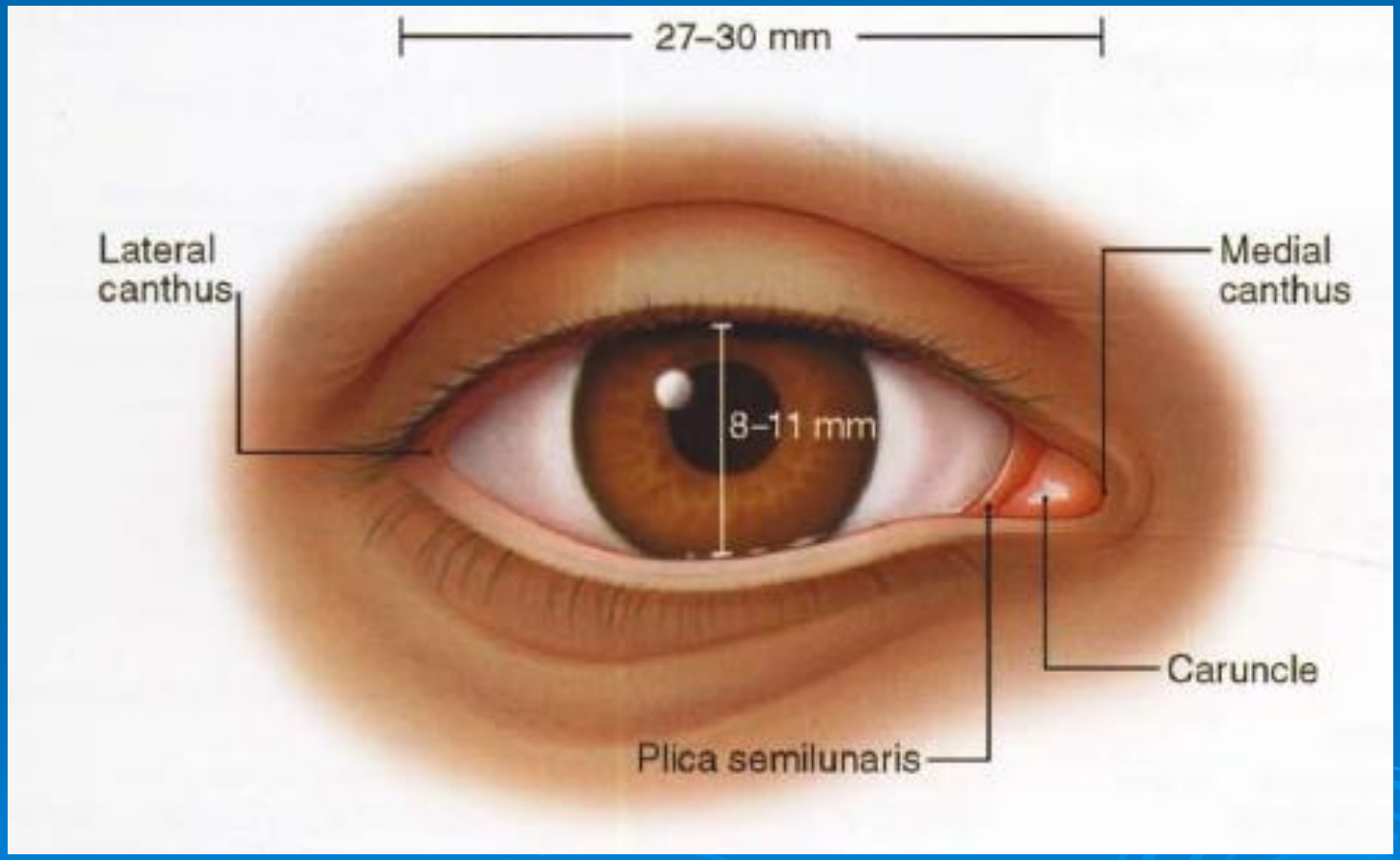


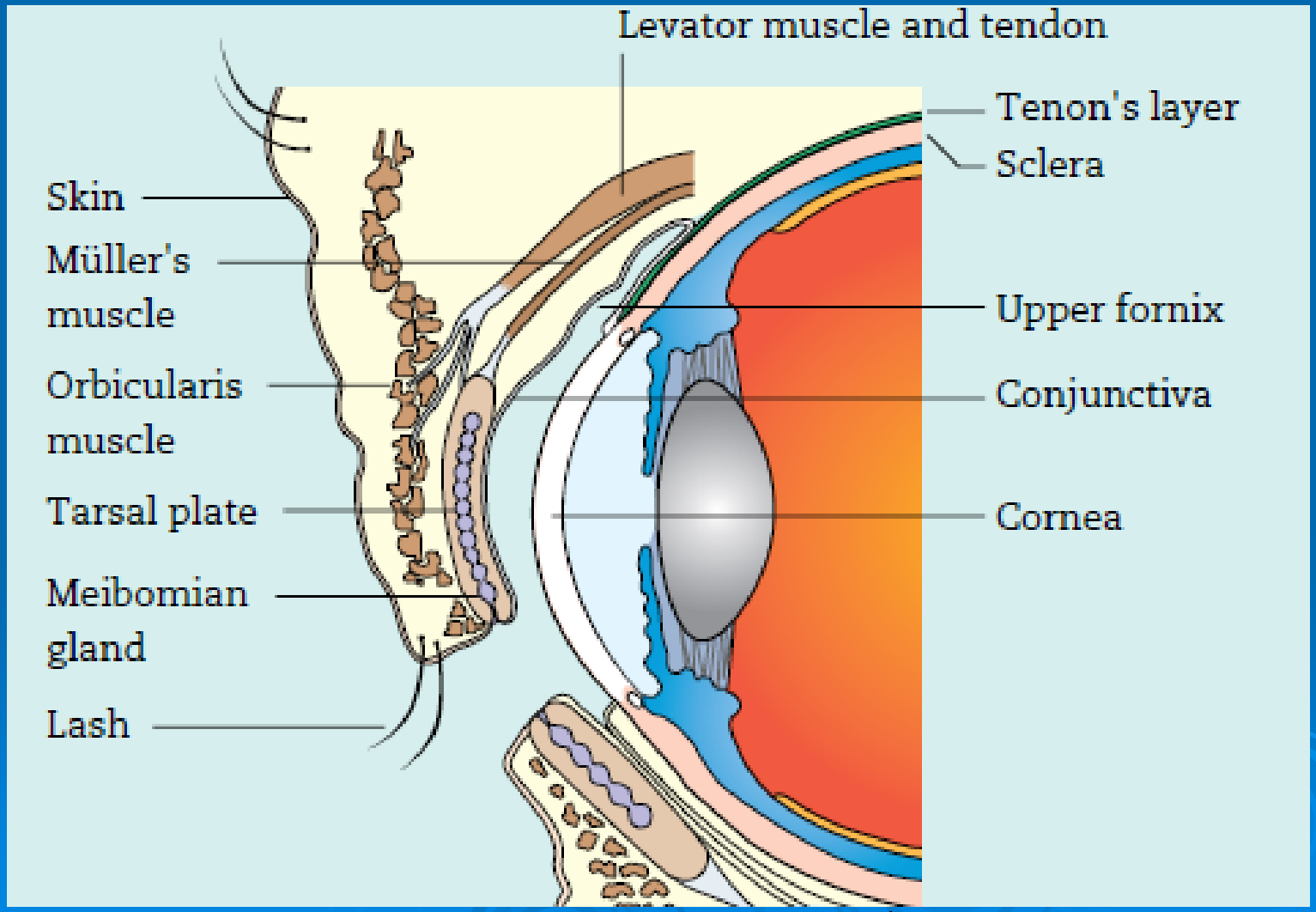
Orbital fascia and fascial sheath of the eyeball as seen in a parasagittal section

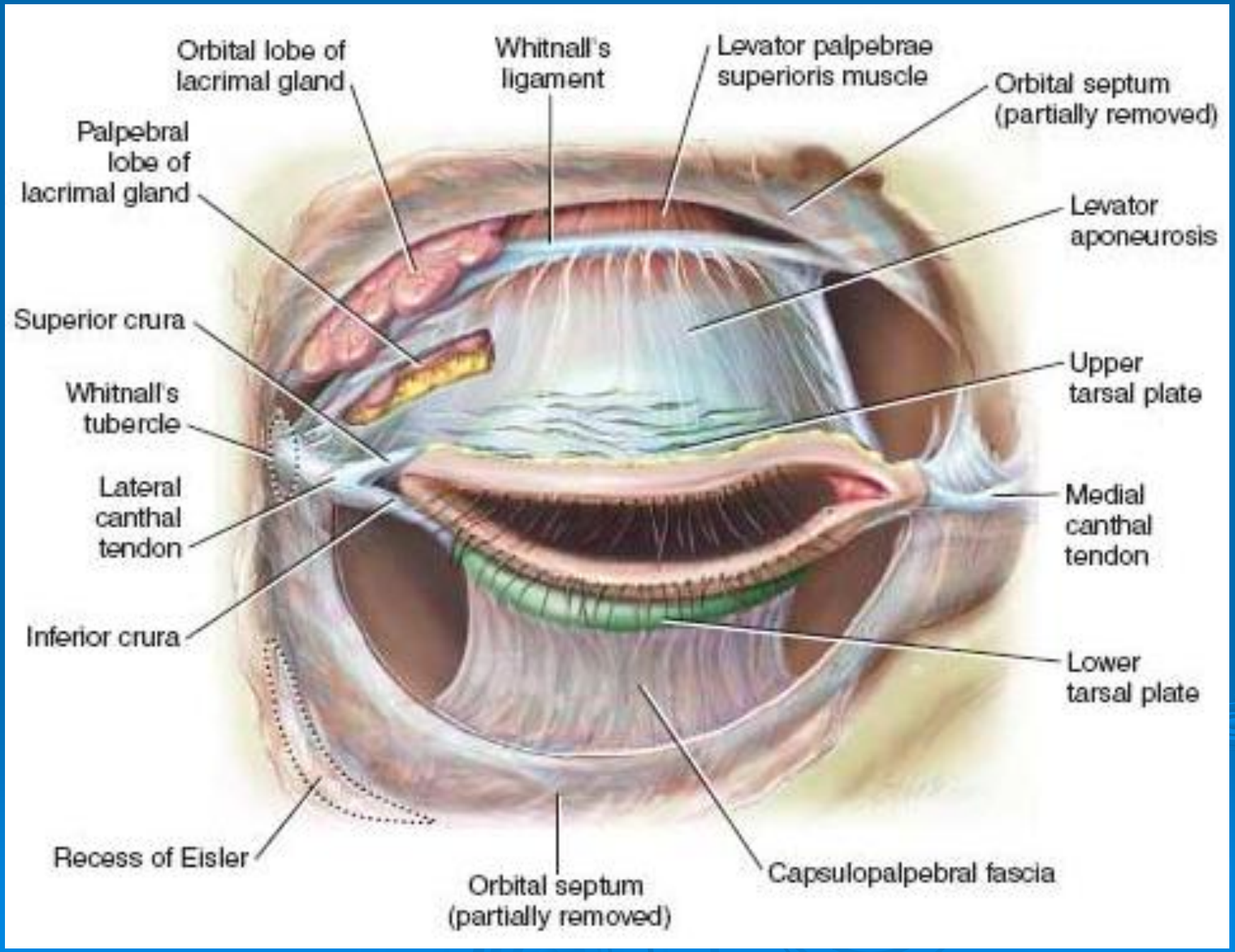

Orbital lobe of lacrimal gland
Whitnall's ligament
Levator palpebrae superioris muscle
Orbital septum (partially removed)
Palpebral lobe of lacrimal gland
Levator aponeurosis
Superior crura
Upper tarsal plate
Whitnall's tubercle
Lateral canthal tendon
Medial canthal tendon
Inferior crura
Lower tarsal plate
Recess of Eisler
Orbital septum (partially removed)
Capsulopalpebral fascia

Eye lid

- The palpebral fissure is the exposed zone between the upper and lower eyelids.
- The upper eyelid is more mobile than the lower and can be raised I5 mm by the action of the levator muscle alone.
- The levator muscle is innervated by CN III.


27–30 mm
Lateral canthus
Medial canthus
8–11 mm
Caruncle
Plica semilunaris


Levator muscle and tendon
Tenon's layer
Sclera
Skin
Müller's muscle
Upper fornix
Orbicularis muscle
Conjunctiva
Tarsal plate
Cornea
Meibomian gland
Lash

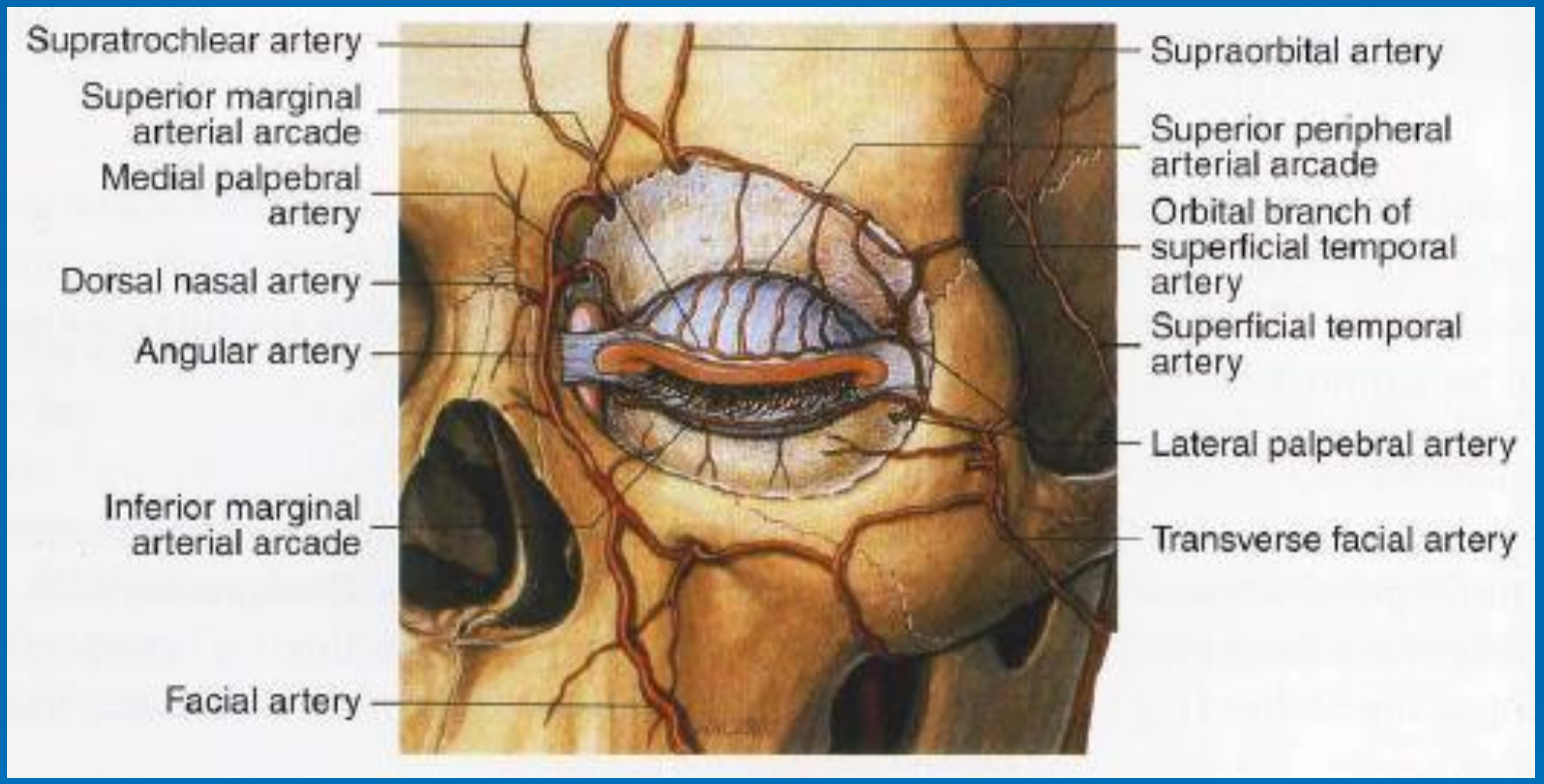

Orbital lobe of lacrimal gland
Whitnall's ligament
Levator palpebrae superioris muscle
Orbital septum (partially removed)
Palpebral lobe of lacrimal gland
Levator aponeurosis
Superior crura
Upper tarsal plate
Whitnall's tubercle
Lateral canthal tendon
Medial canthal tendon
Inferior crura
Lower tarsal plate
Recess of Eisler
Orbital septum (partially removed)
Capsulopalpebral fascia

Conjunctiva

- The palpebral conjunctiva is a transparent vascularized membrane covered by a nonkeratinized epithelium that lines the inner surface of the eyelids.
- Continuous with the conjunctival fornices it merges with the bulbar conjunctiva before terminating at the limbus.

- The conjunctiva consists of bulbar (red), forniceal (black), and palpebral (blue) portions.

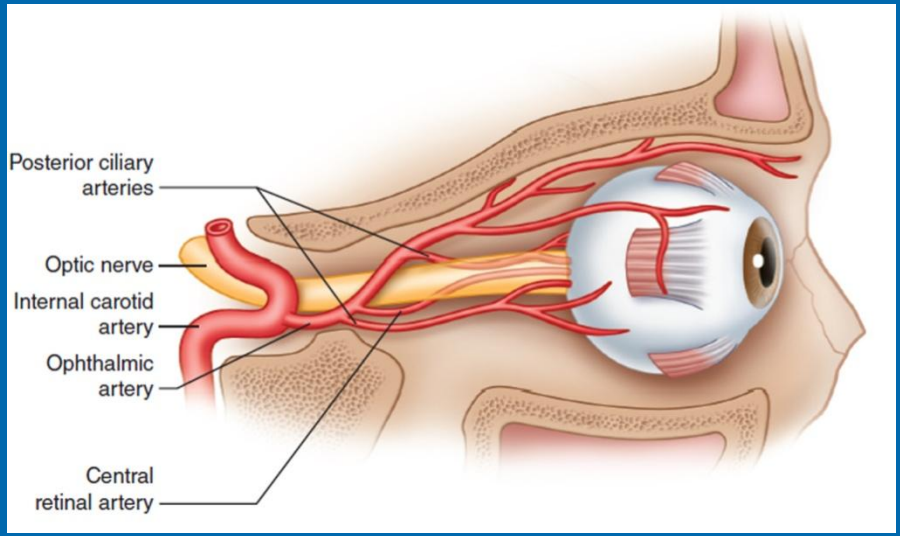
Vascular Supply of the Eyelids

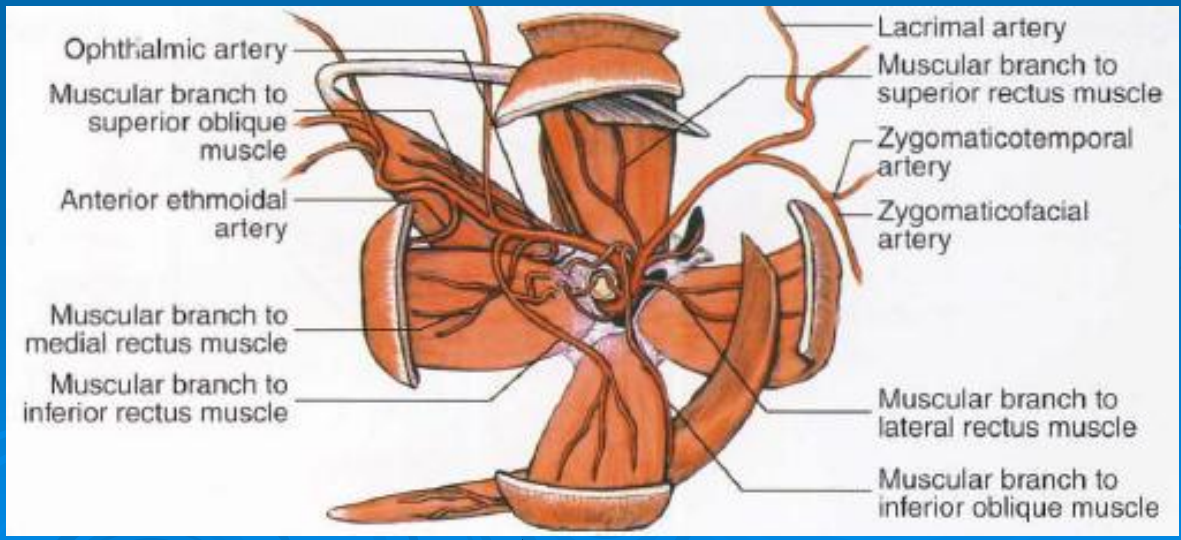


- The blood supply of the eyelids is derived from the facial system, which arises from the external carotid artery, and the orbital system, which originates from the internal carotid artery.

Vascular Supply and Drainage of the Orbit

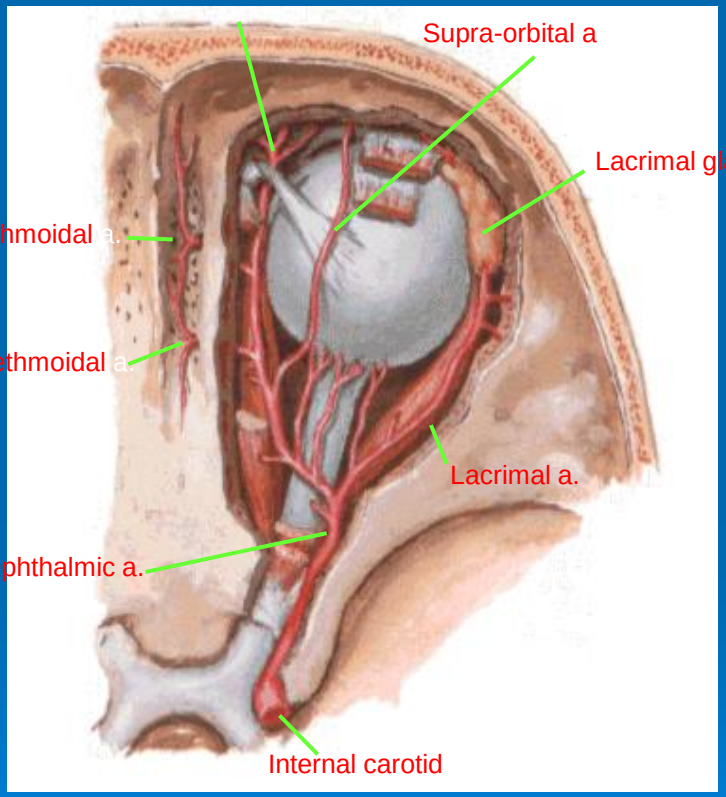
- The posterior ciliary vessels supply the whole uveal tract, the cilioretinal arteries, the sclera, the margin of the cornea, and the adjacent conjunctiva.
- The anterior ciliary arteries supply the rectus muscles.

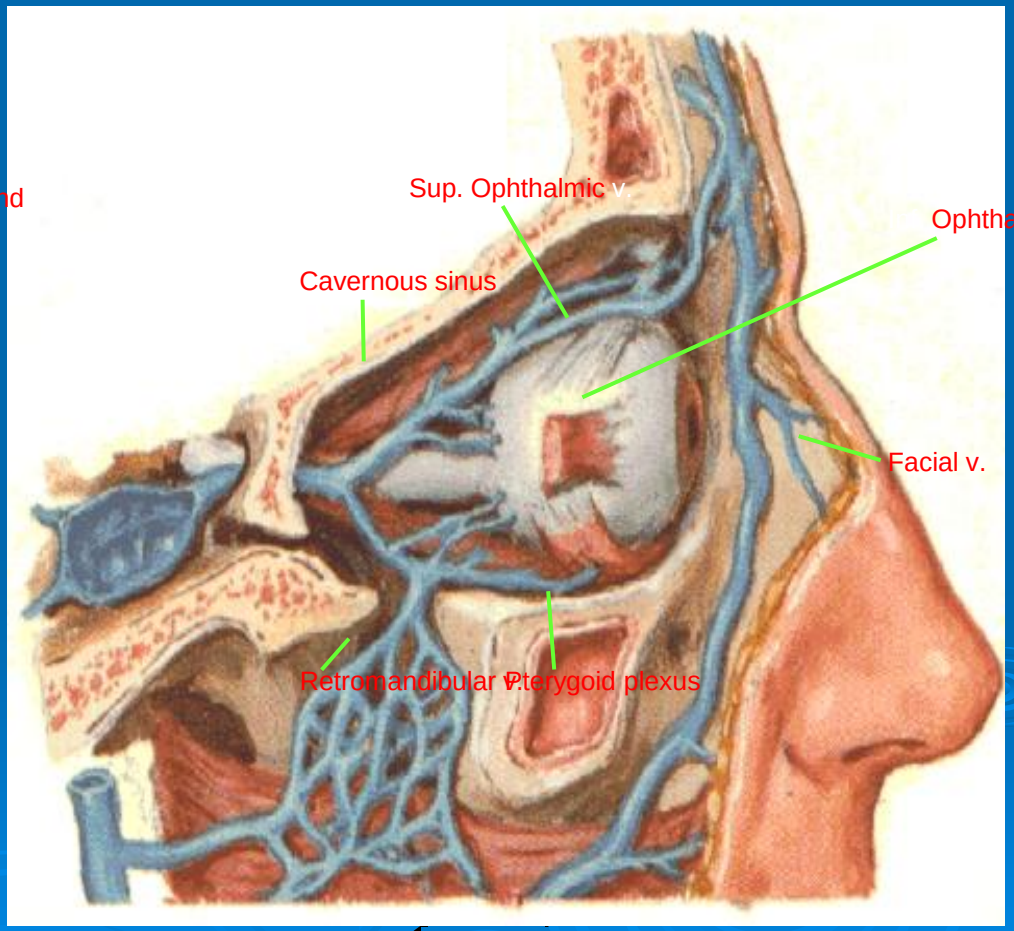




- The venous drainage of the eyelids can be divided into 2 portions:

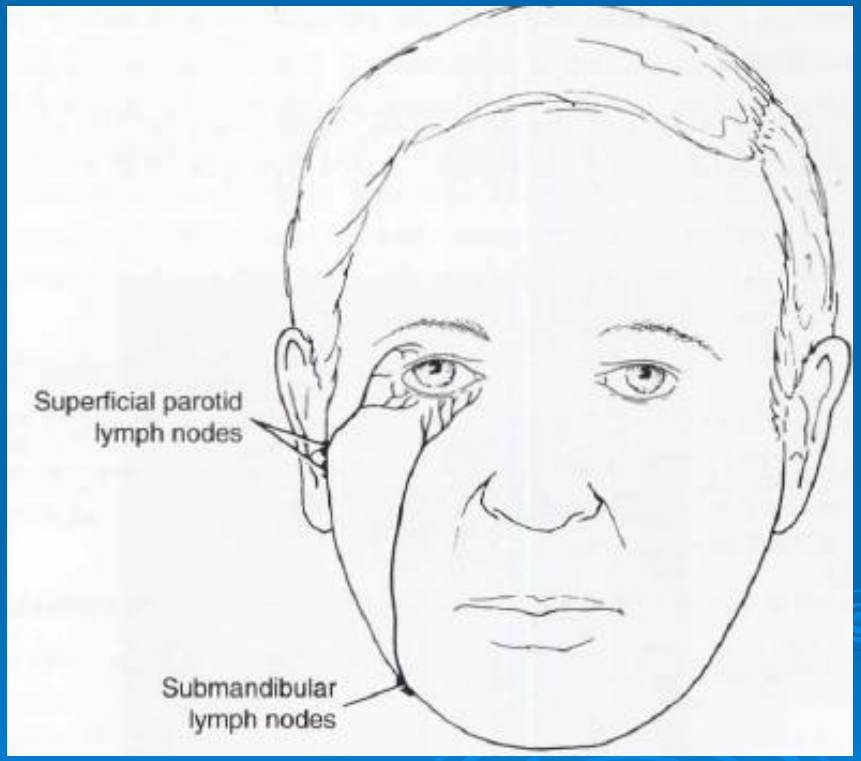
1. Superficial system which drains into the internal and external jugular veins.
2. Deep system which flows into the cavernous sinus.


Supratrochlear a.
Supra-orbital a
Lacrimal gland
Ant. ethmoidal a.
Post. ethmoidal a.
Lacrimal a.
Ophthalmic a.
Internal carotid


Sup. Ophthalmic v.
Ophthalmic v
Cavernous sinus
Facial v.
Retromandibular v.
Pterygoid plexus

Lymphatics of the Eyelids

- Lymphatic vessels are found in the eyelids and conjunctiva, but neither lymphatic vessels nor nodes are present in the orbit.
- Swelling of the lymph nodes is a diagnostic sign of several external eye infections.



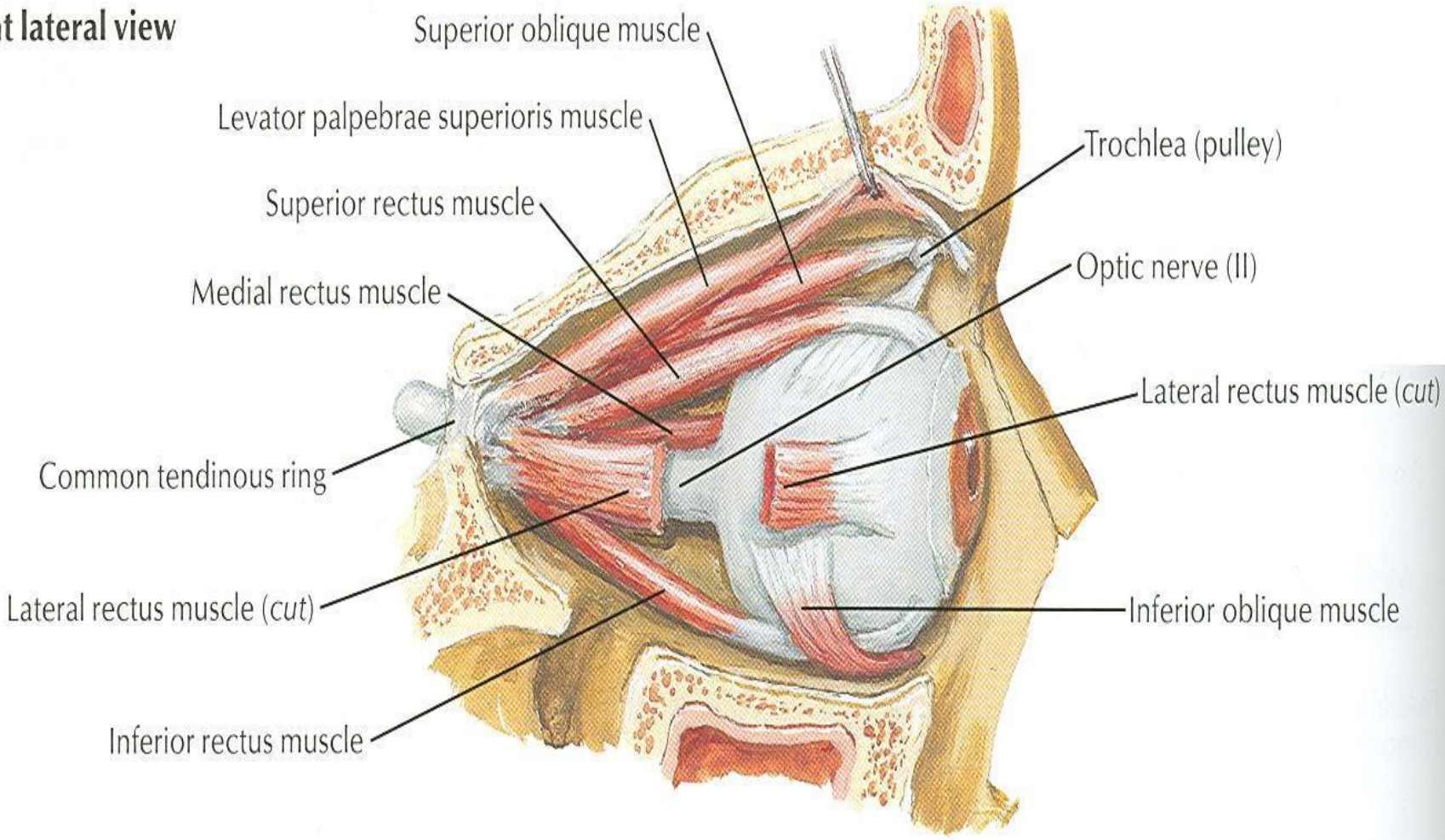
Muscles of Orbit

Muscles of the orbit are the levator palpebrae superioris, the four recti and two oblique muscles

Levator Palpebrae Superioris

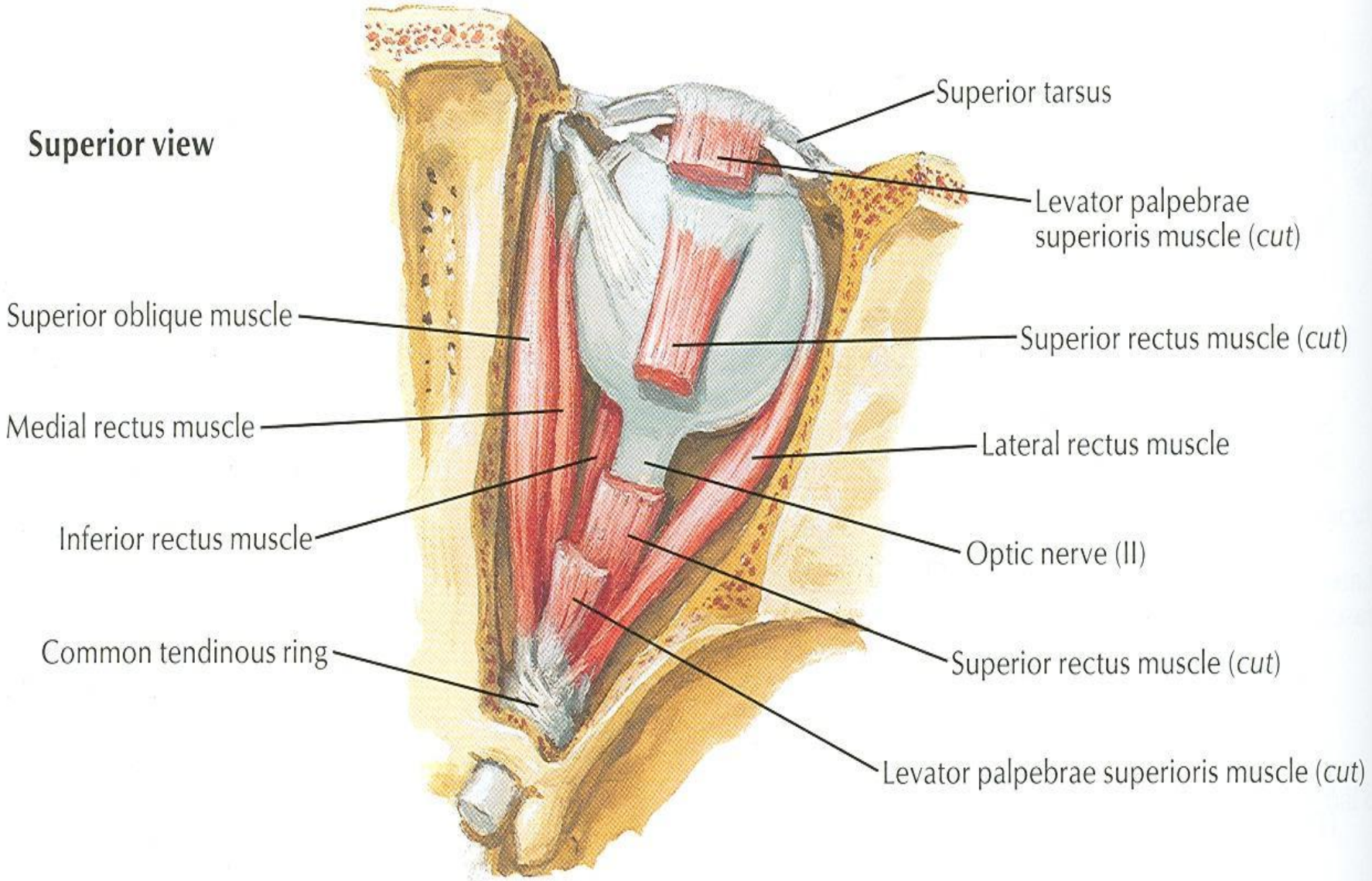
- Origin: Undersurface of lesser wing of sphenoid bone
- Insertion: Splits into 2 lamellae, superior into tarsal plate & skin of upper lid, inferior into upper margin of superior tarsal plate
- NS: Oculomotor nerve
- Action: Raises the upper lid

Right lateral view

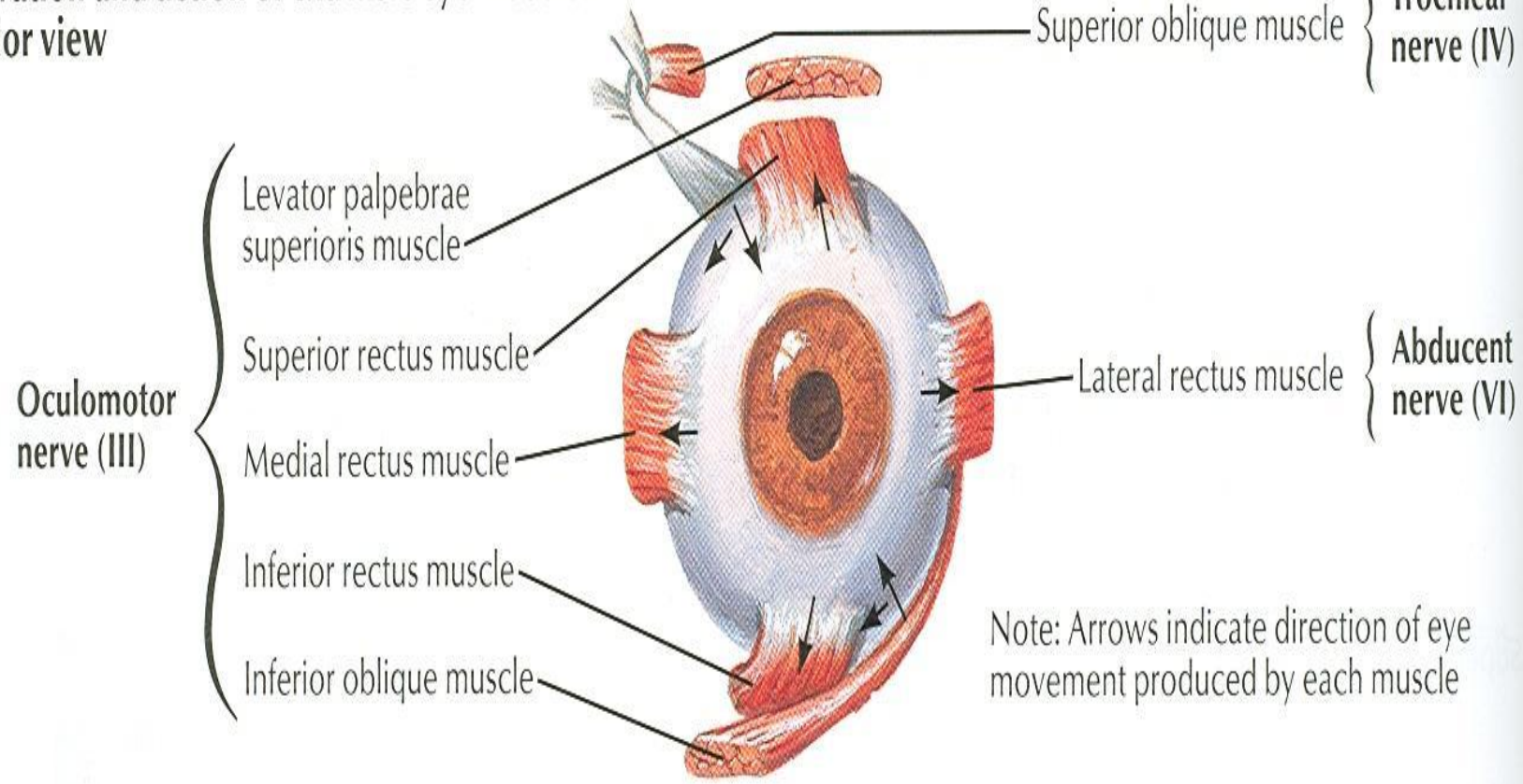


The Recti

- Arise from a fibrous ring called common tendinous ring
- Insertion: form the muscular cone that encloses the optic nerve, pierces the facial sheath of the eyeball, in the sclera about 6 mm behind the margin of cornea


Superior view
Superior tarsus
Levator palpebrae superioris muscle (*cut*)
Superior oblique muscle
Superior rectus muscle (*cut*)
Medial rectus muscle
Lateral rectus muscle
Inferior rectus muscle
Optic nerve (II)
Common tendinous ring
Superior rectus muscle (*cut*)
Levator palpebrae superioris muscle (*cut*)

Innervation and action of extrinsic eye muscles: anterior view



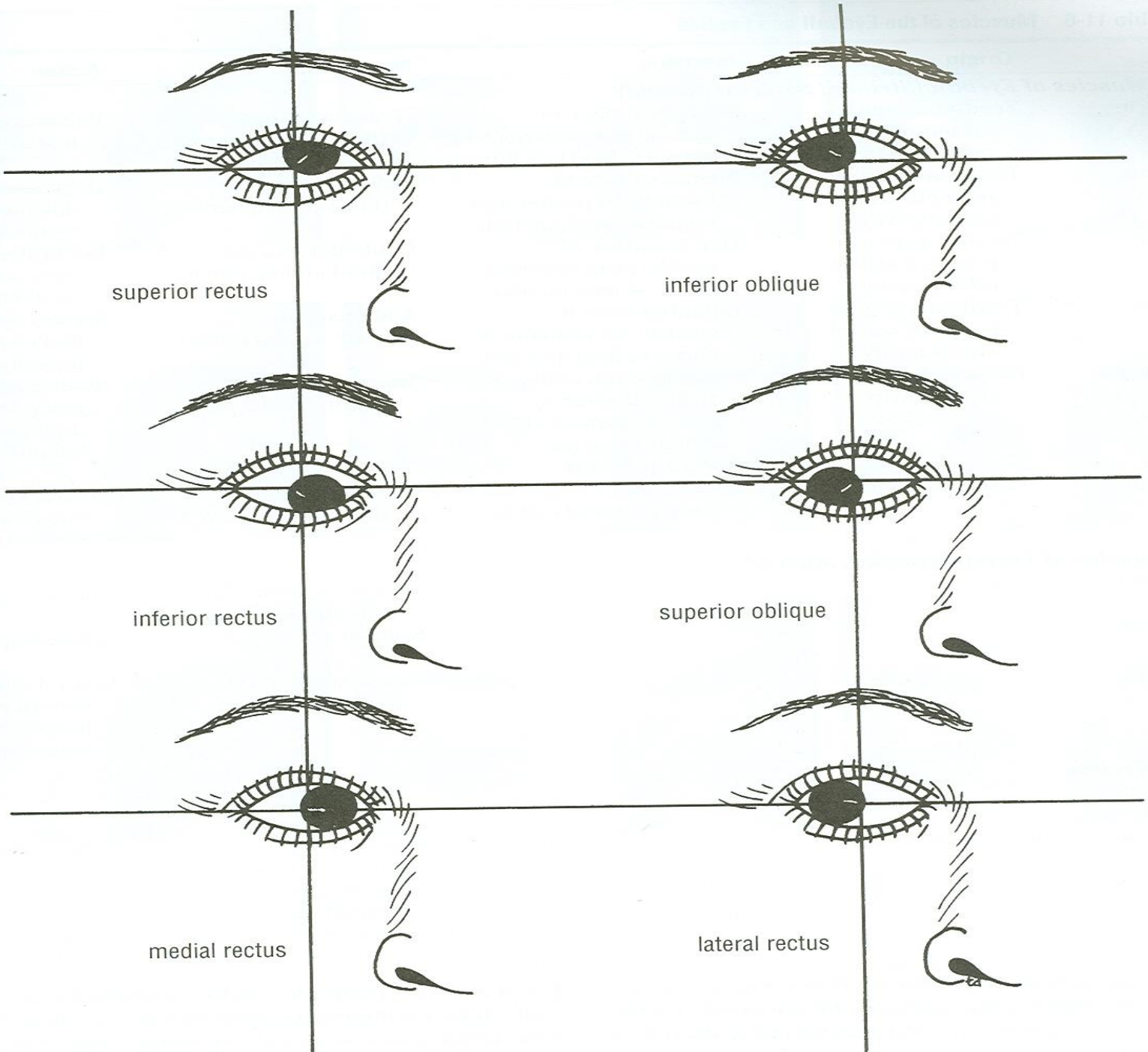
Muscle	Innervation	Movement
Lateral rectus	Abducens (VI)	Abduction
Medial rectus	Oculomotor (III)	Adduction
Superior rectus	Oculomotor (III)	Elevation and intorsion
Inferior rectus	Oculomotor (III)	Depression and extorsion
Inferior oblique	Oculomotor (III)	Extorsion and elevation
Superior oblique	Trochlear (IV)	Intorsion and depression

The Recti

- NS: Lateral by abducent, all others by oculomotor

- Action: lateral rectus rotates the eyeball so that the cornea looks laterally

  Medial rectus rotates the eyeball so that the cornea looks medially


superior rectus
inferior oblique
inferior rectus
superior oblique
medial rectus
lateral rectus

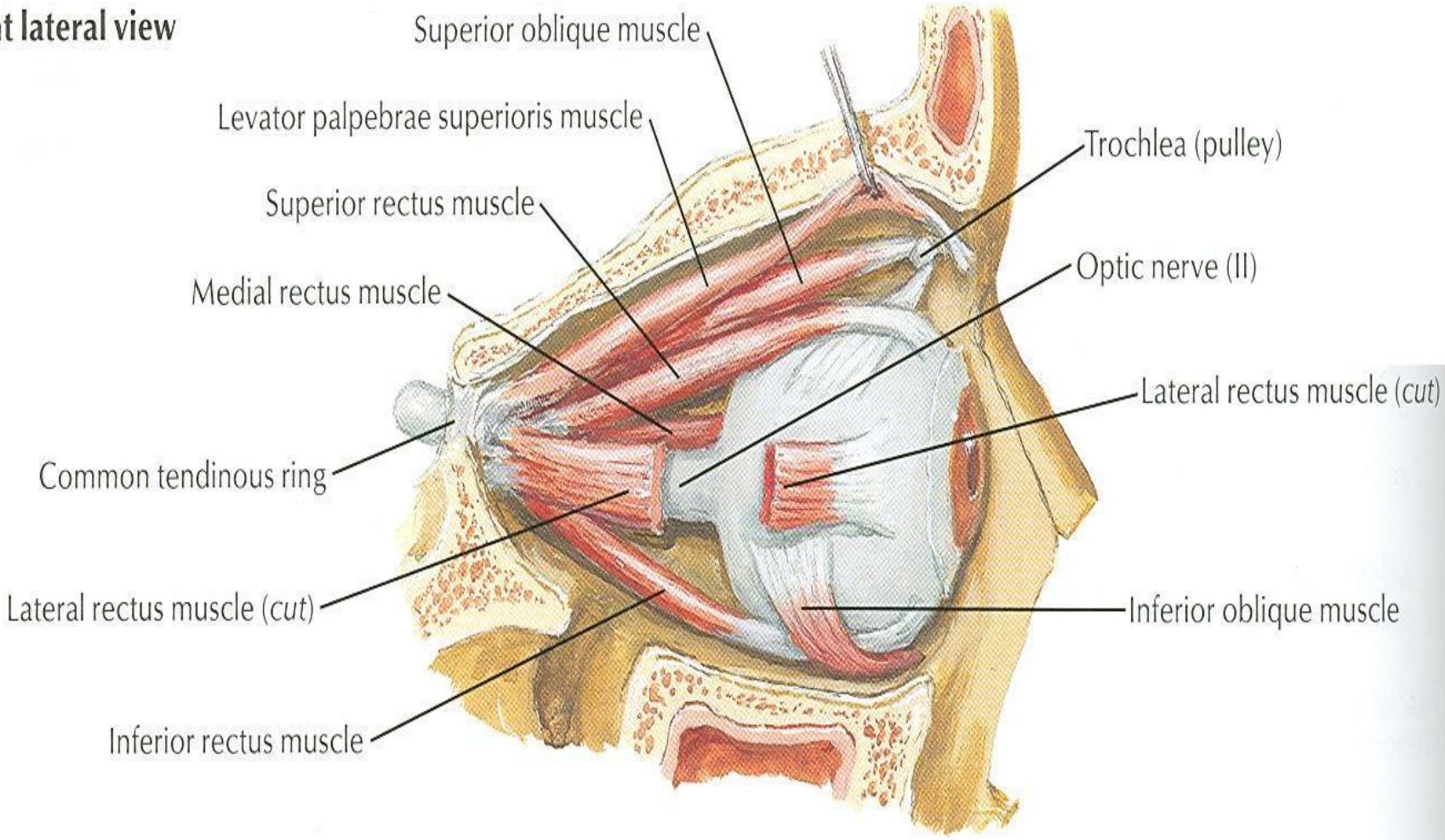
The Recti

- Superior and inferior recti are inserted on the medial side of the vertical axis of the eyeball
- Superior rectus raises the cornea and rotates it medially
- Inferior rectus depresses the cornea and rotates it medially

Superior Oblique

- Origin: From body of the sphenoid bone
- Insertion: into the sclera beneath the superior rectus after passing through the fibrocartilaginous pulley
- NS: Trochlear nerve
- Action: Rotates the eyeball so that the cornea looks downward & laterally

Right lateral view



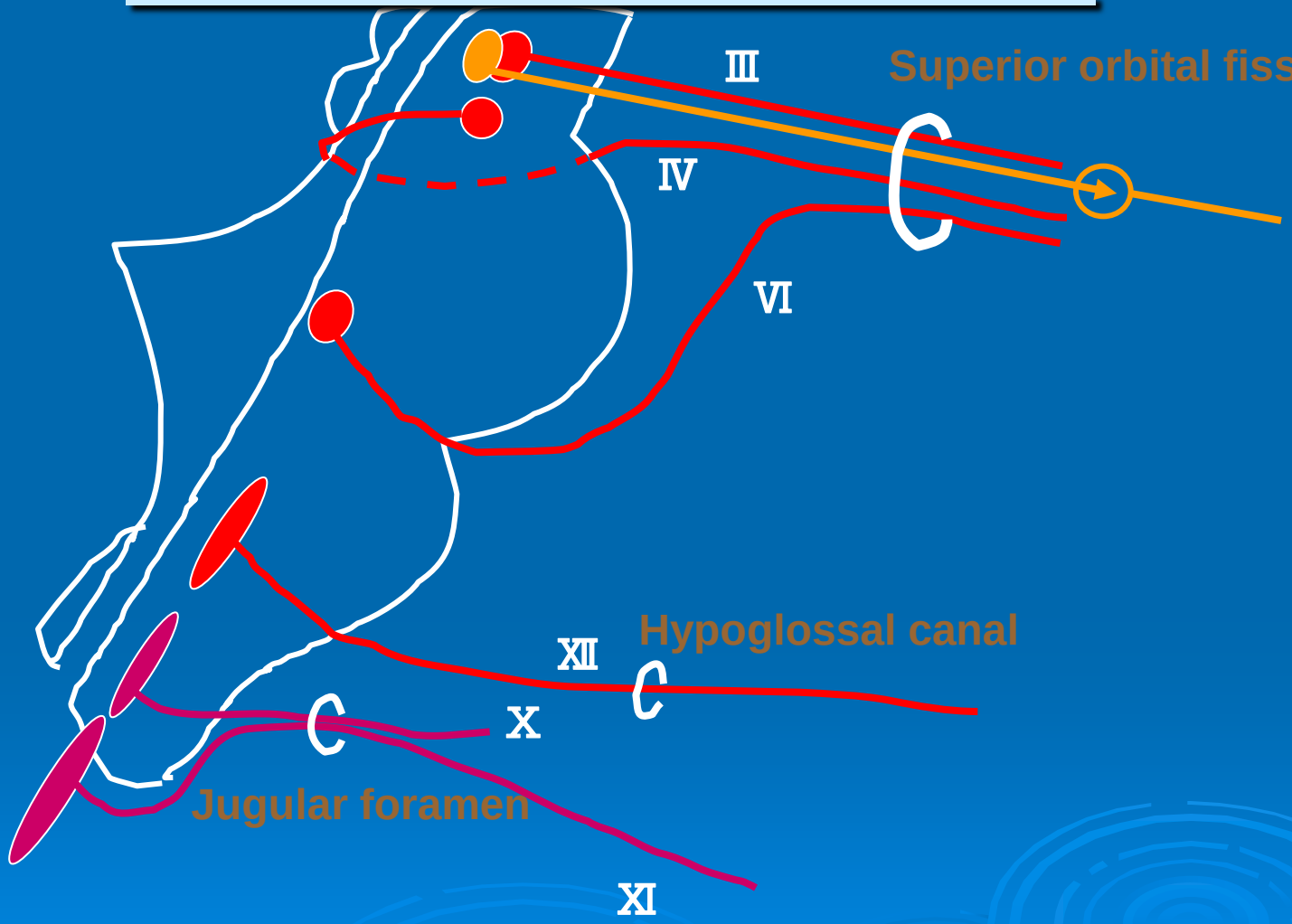
Inferior Oblique

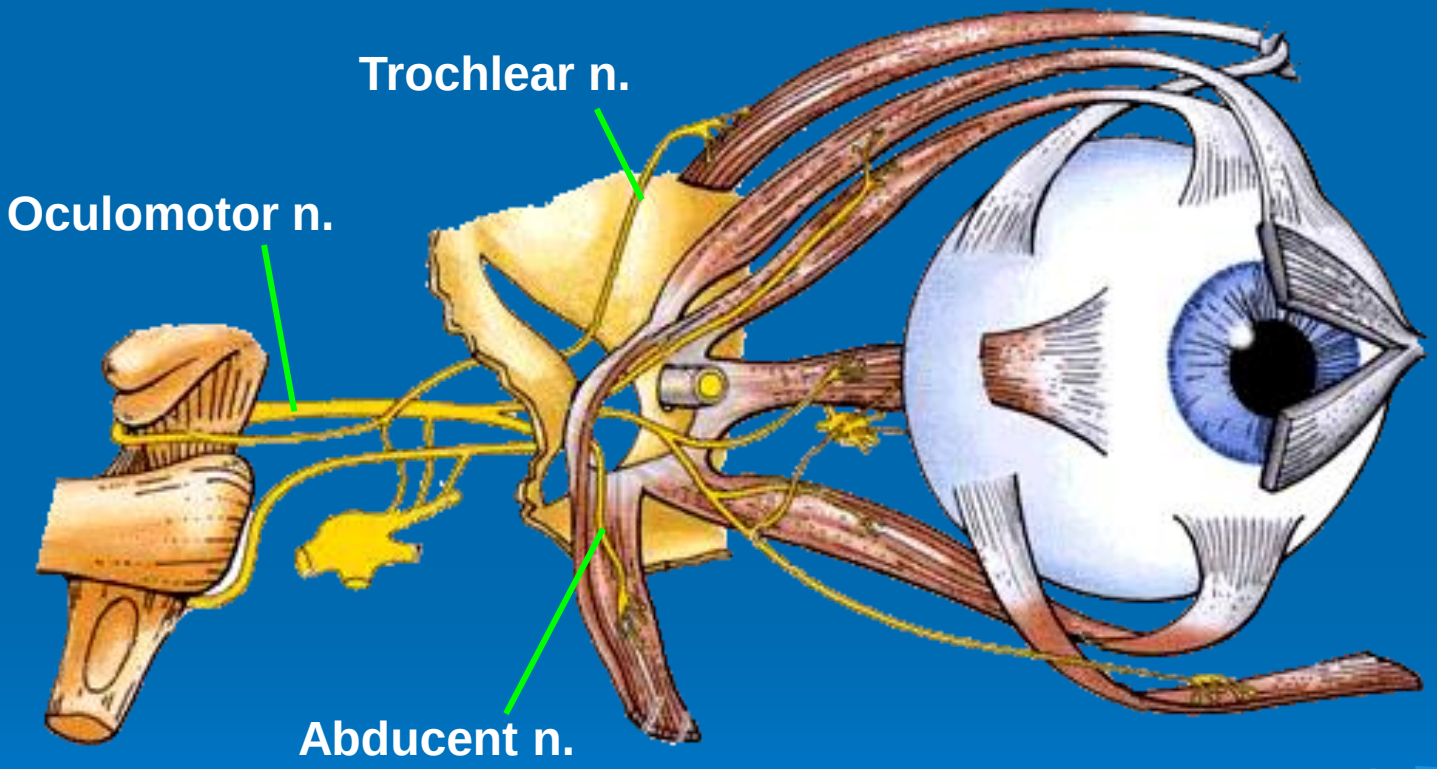
- Origin: Anterior part of floor of the orbit
- Insertion: In the sclera behind the coronal equator
- NS: Oculomotor
- Action: Rotates the eyeball so that the cornea looks upward and laterally

Motor Supply

- Lacrimal Nerve
- Frontal Nerve
- Trochlear Nerve
- Oculomotor Nerve
- Abducent Nerve

Motor Cranial Nerves



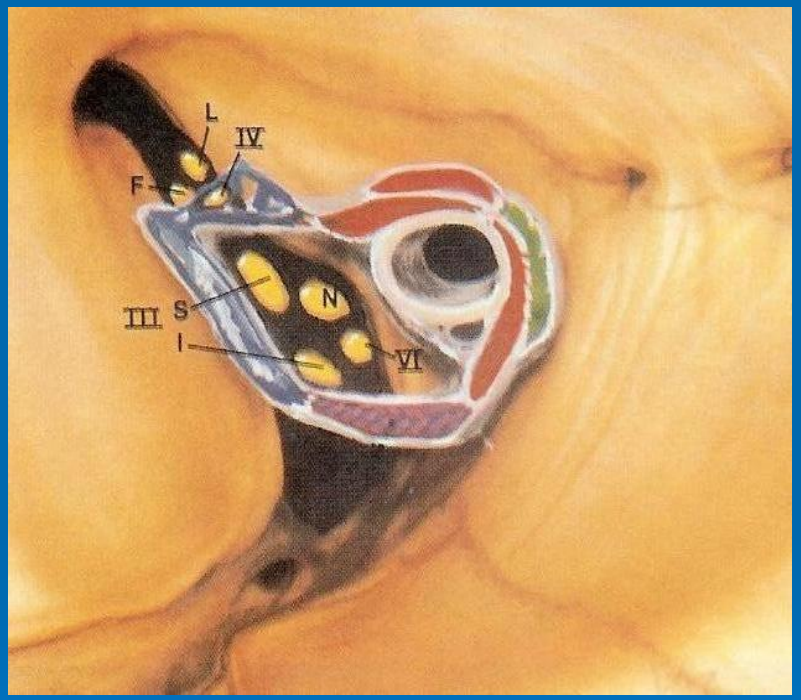

Trochlear n.
Oculomotor n.
Abducent n.

Cranial Nerve V (Trigeminal)

- The largest cranial nerve
- Possesses both sensory and motor divisions The sensory portion subserves the greater part of the scalp, forehead, face, eyelids, eye, lacrimal gland, extraocular muscles, ear, dura mater, and tongue
- The motor portion innervates the muscles of mastication through branches of the mandibular division

Divisions of Cranial Nerve V

- Ophthalmic
  - Frontal
  - Lacrimal
  - Nasociliary
- Maxillary
- Mandibular



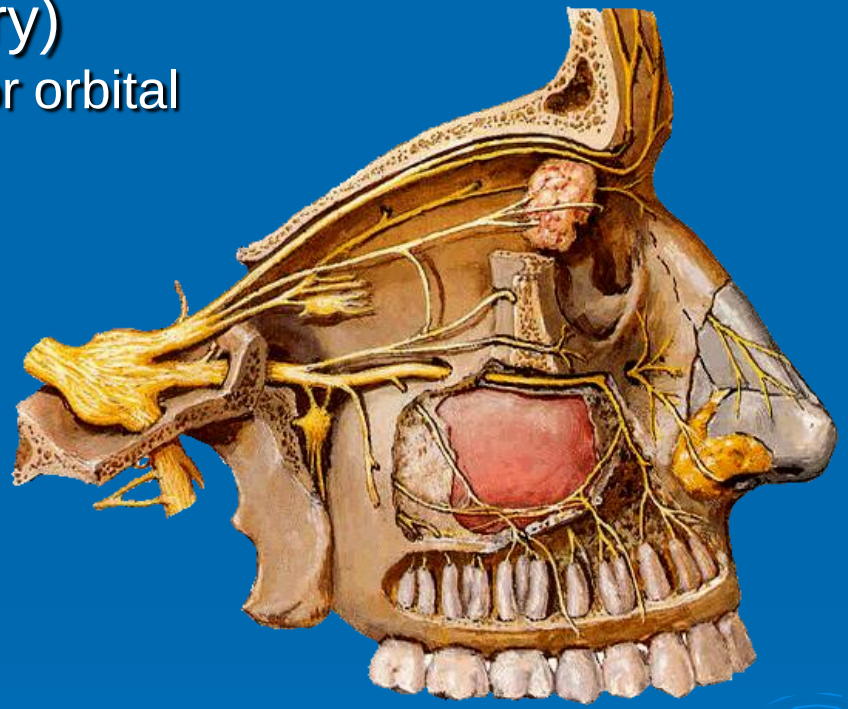
Cranial Nerve VI (Abducens)

- The nucleus of cranial nerve VI is situated in the floor of the fourth ventricle, beneath the facial colliculus, in the caudal pons
- CN VI runs below and lateral to the carotid artery and may transiently carry sympathetic fibers from the carotid plexus
- It passes through the superior orbital fissure within the annulus of Zinn and innervates the lateral rectus muscle on its ocular surface

Trigeminal Nerve (Ⅴ)

Ophthalmic nerve (Ⅴ1, sensory)

- Leave the skull through the superior orbital fissure, to enter orbital cavity
- Branches
  - Frontal nerve
    - Supratrochlear nerve
    - Supraorbital nerve
  - Lacrimal nerve
  - Nasociliary nerve



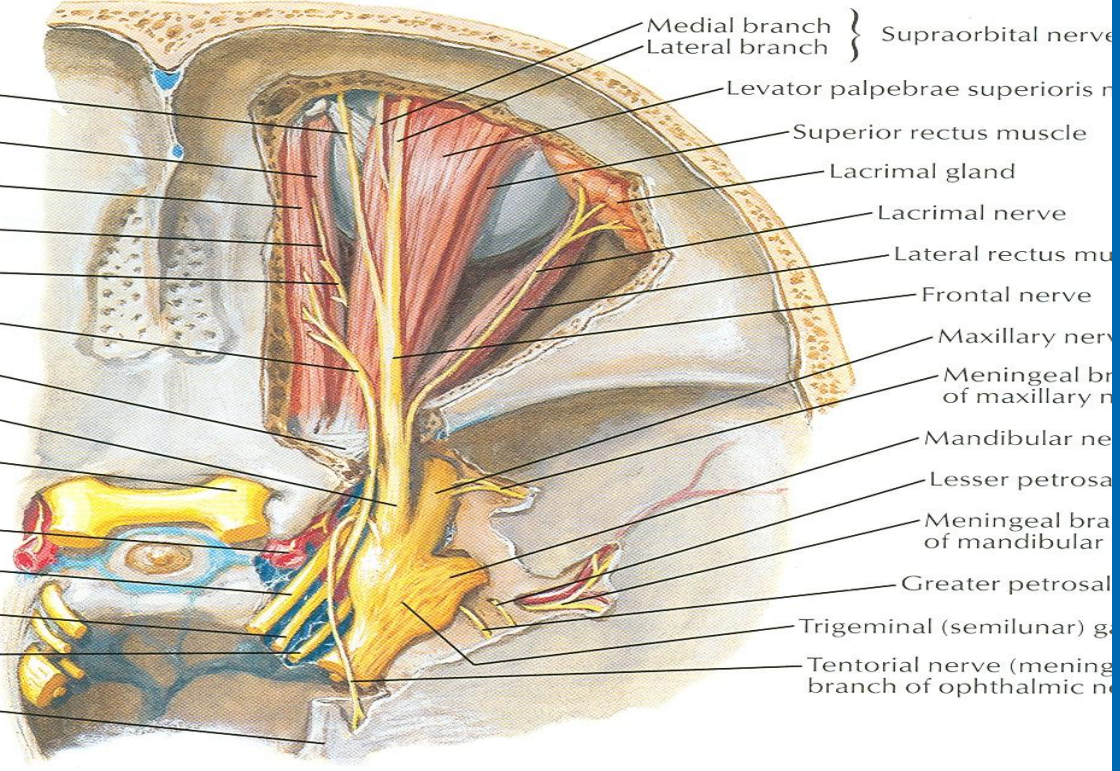
Frontal Nerve

- Arises from ophthalmic division of trigeminal nerve
- Enters orbit through the upper part of the orbital fissure
- Divides into supratrochlear & supraorbital
- Supratrochlear supplies the skin of the forehead
- Supraorbital supplies skin of the forehead laterally

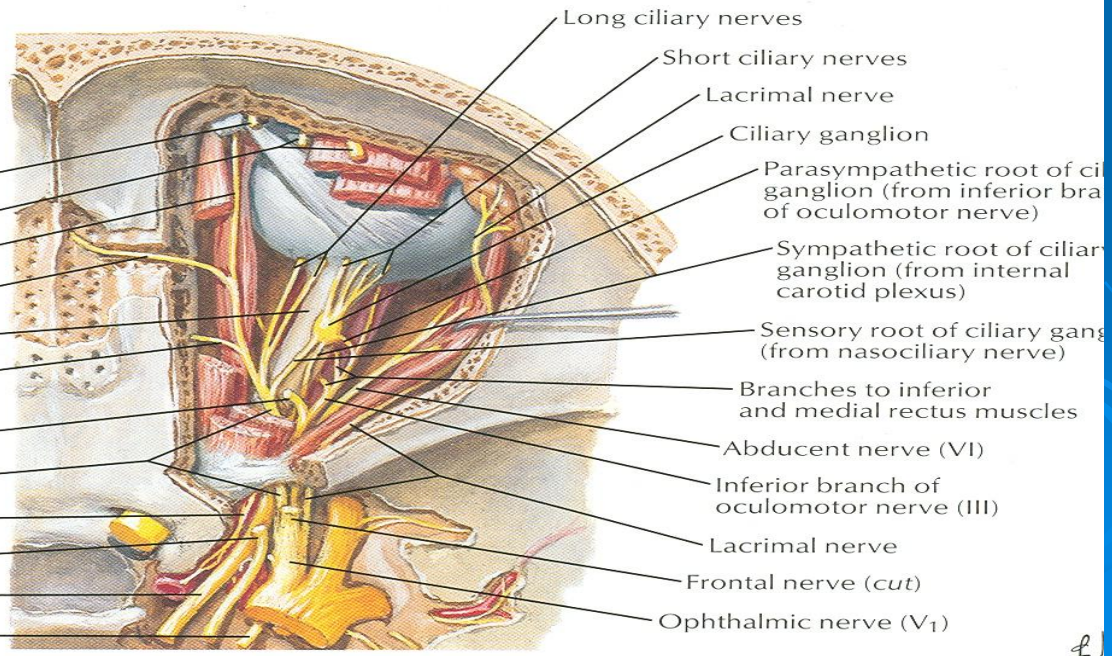
Lacrimal Nerve

- Arises from the ophthalmic division of the trigeminal nerve
- Enters the orbit through the upper part of superior orbital fissure
- Enters the lacrimal gland
- Ends by supplying the skin of lateral part of upper eye lid

Superior view

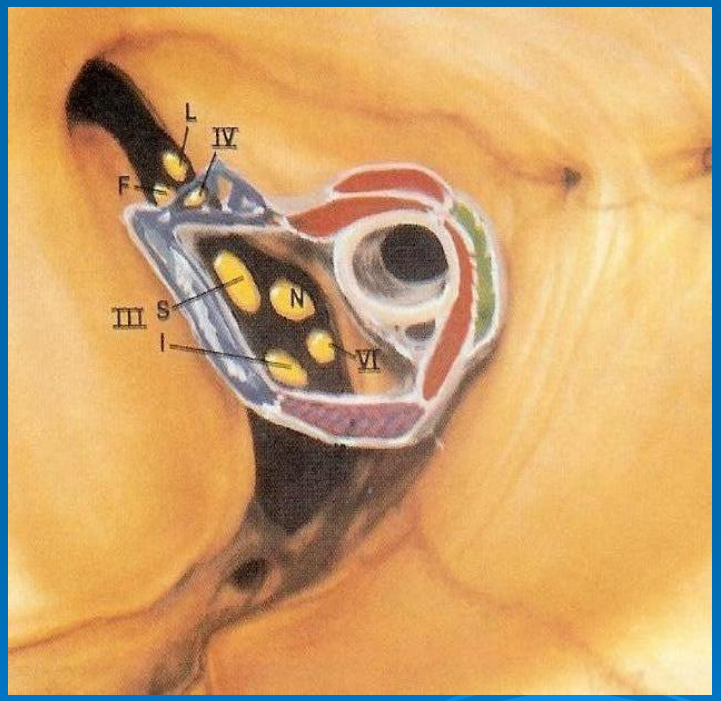


Superior view:
levator palpebrae superioris, superior rectus and superior oblique muscles partially cut away



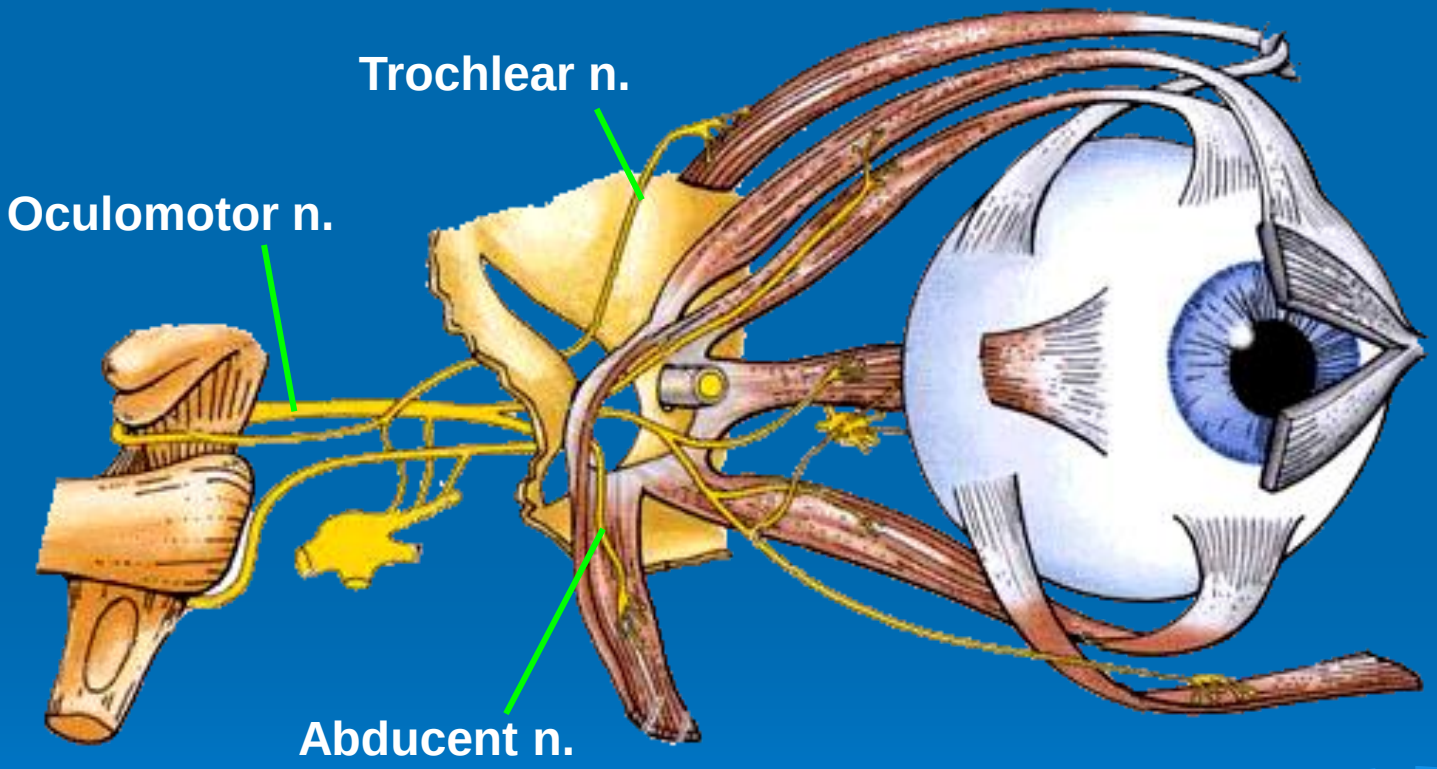
Cranial Nerve IV (Trochlear)

- Cranial nerve IV has the longest intracranial course
- The CN IV the only cranial nerve that is completely decussated and the only motor nerve to exit dorsally from the nervous system.
- CN IV enters the orbit through the superior orbital fissure outside the annulus of Zinn and runs superiorly to innervate the superior oblique muscle



Trochlear Nerve

- Enters the orbit through the upper part of orbital fissure
- Runs forward and medially
- Enters and supply the superior oblique muscle


Trochlear n.
Oculomotor n.
Abducent n.

Cranial Nerve III (Oculomotor)

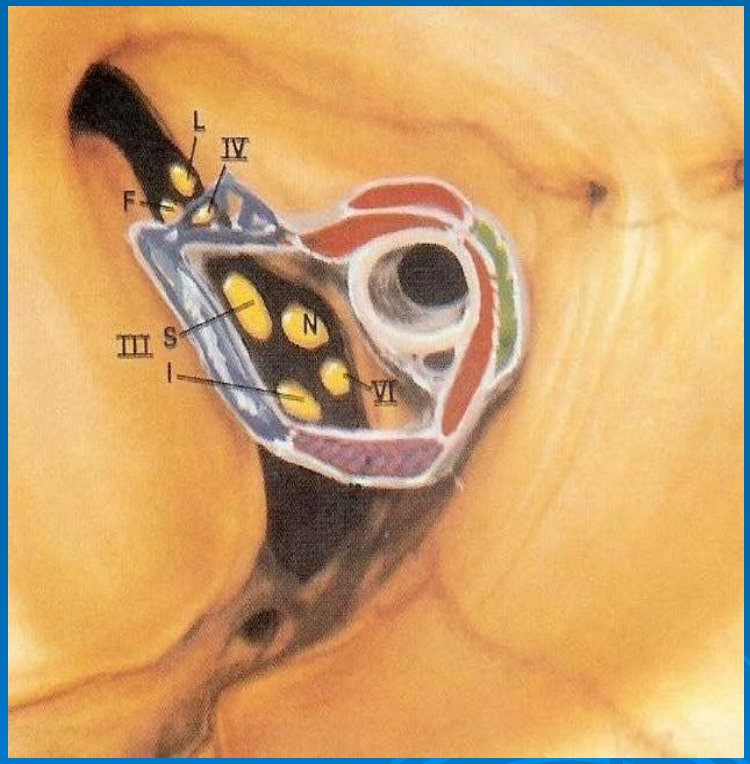
- It supplies all the extraocular muscles except the superior oblique and the lateral rectus
- It also carries cholinergic innervation to the pupillary sphincter and the ciliary muscle

Cranial Nerve III

- The CN III nucleus consists of several distinct, large motor cell subnuclei, each of which subserves the extraocular muscle it innervates
- The Edinger-Westphal nucleus provides the parasympathetic preganglionic efferent innervation to the ciliary muscle and pupillary sphincter

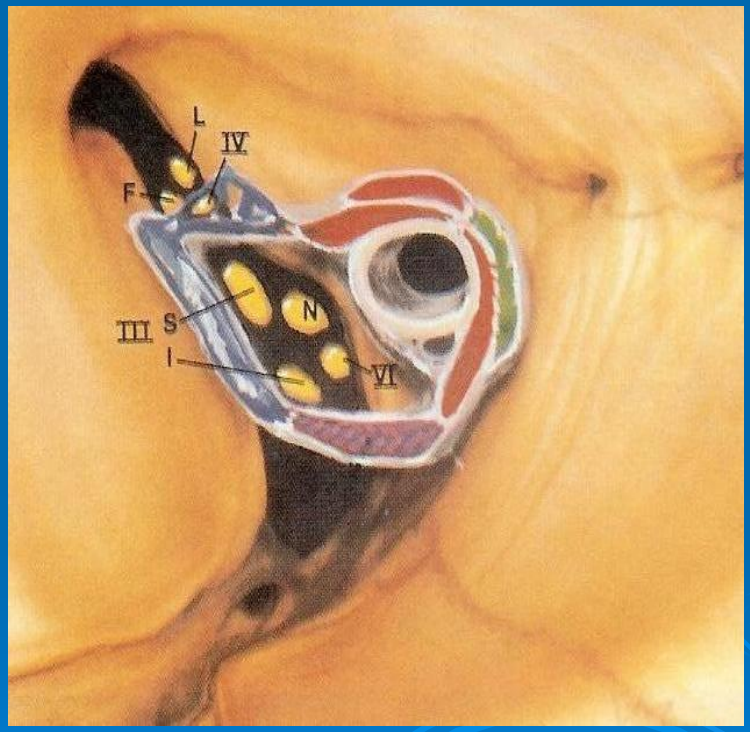
Cranial Nerve III

- CN III usually divides into superior and inferior divisions after passing through the annulus of Zinn in the orbit
- The superior division of CN III innervates the superior rectus and levator palpebrae muscles. The larger inferior division splits into three branches to supply the medial and inferior rectus muscles and the inferior oblique.



Cranial Nerve III

- The parasympathetic fibers wind around the periphery of the nerve
- Enter the inferior division, and course through the branch that supplies the inferior oblique muscle. They join the ciliary ganglion
- They synapse with the postganglionic fibers, which emerge as many short ciliary nerves

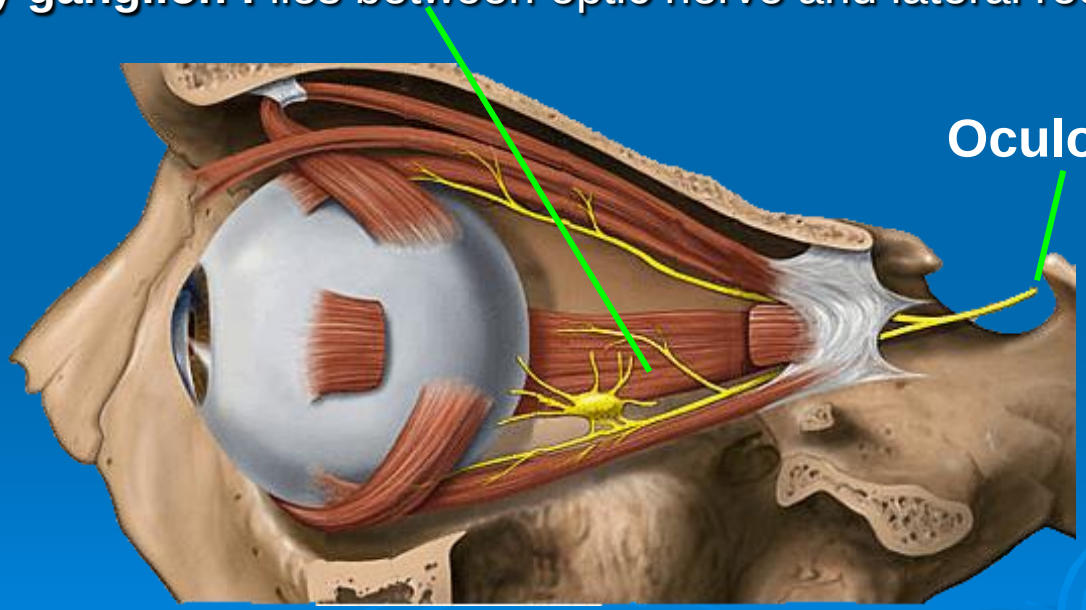


Oculomotor Nerve

- SUPERIOR RAMUS: Enters the orbit through lower part of superior orbital fissure
- Supplies the superior rectus muscle and levator palpebrae superioris

Oculomotor Nerve

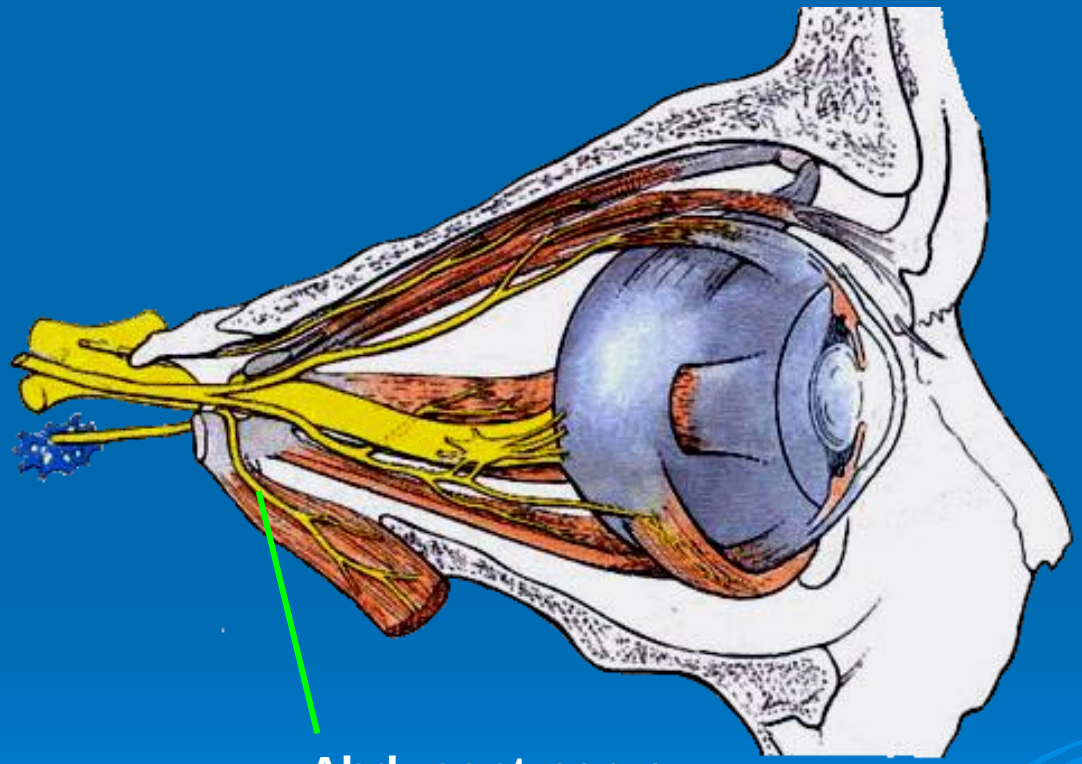
- **Components**
  - General somatic efferent fibers (GSE)
  - General visceral efferent fibers (GVE)
- **Main action—supplies**
  - Superior, inferior and medial recti; inferior obliquus; levator palpebrae superioris
  - Sphincter pupillea and ciliary muscle
- **Ciliary ganglion :** lies between optic nerve and lateral rectus

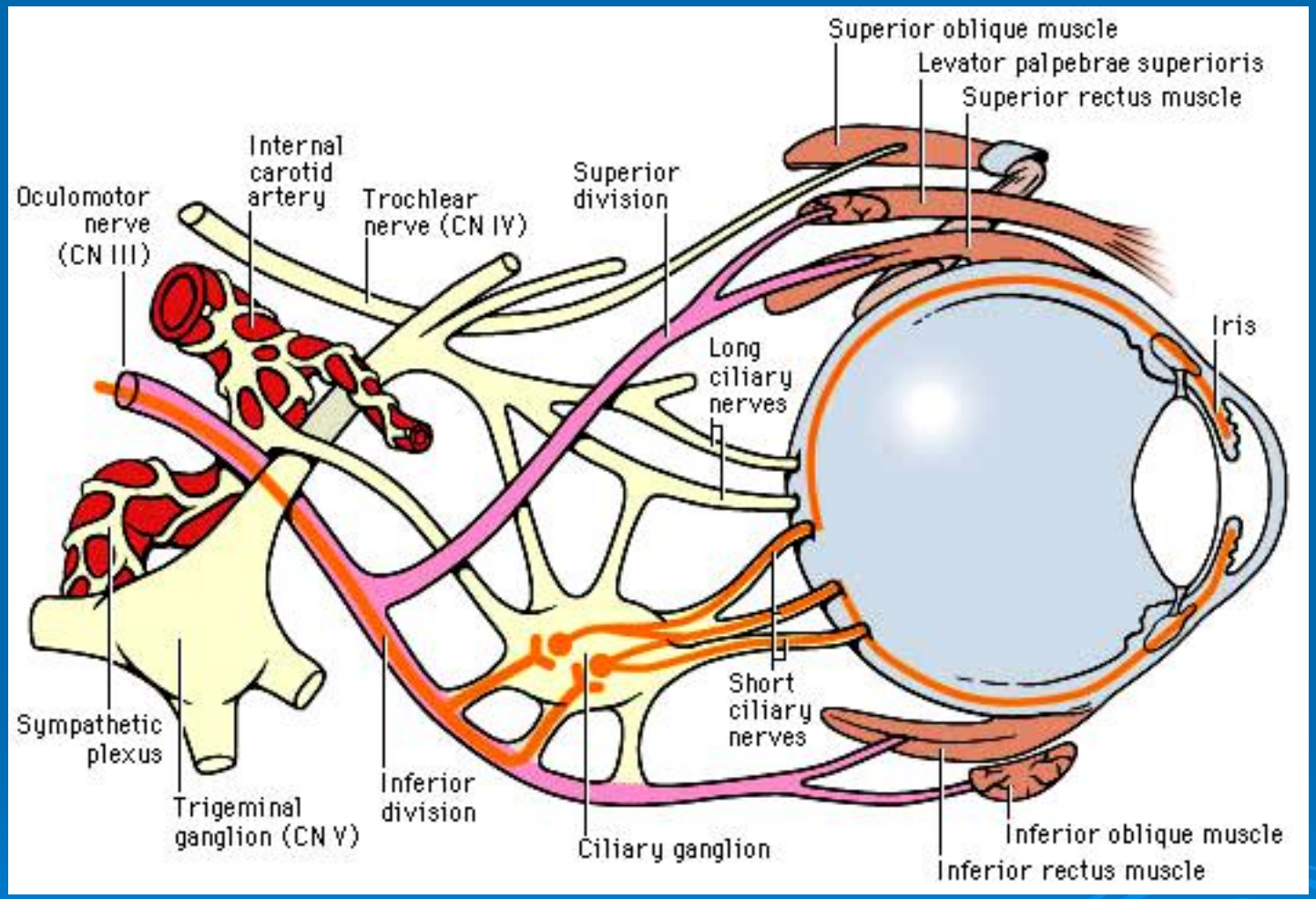


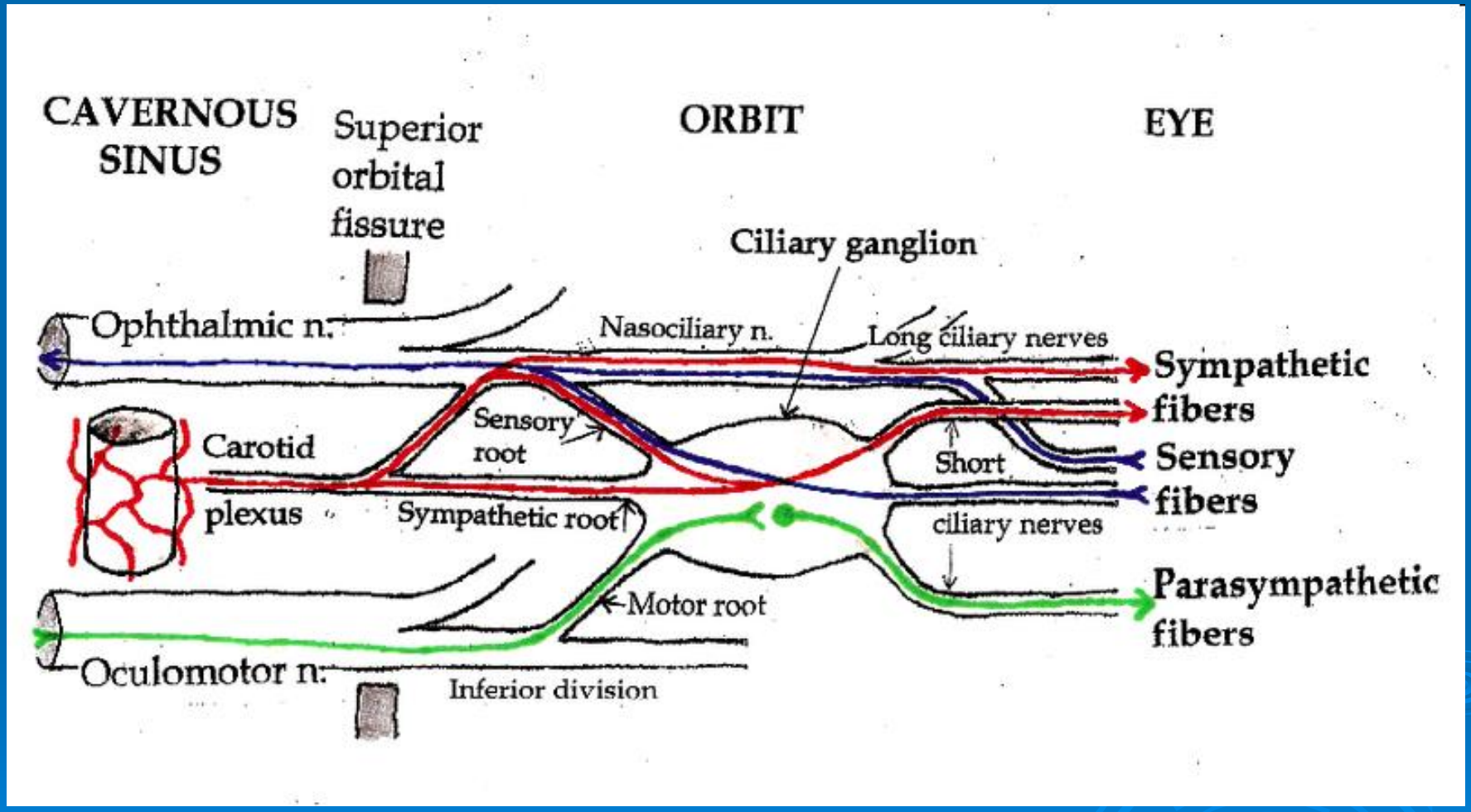
Abducent Nerve

- Enters the orbit through lower part of the superior orbital fissure
- Within the tendinous ring, it supplies the lateral rectus muscle

Abducent Nerve




Superior oblique muscle
Levator palpebrae superioris
Superior rectus muscle
Internal carotid artery
Oculomotor nerve (CN III)
Trochlear nerve (CN IV)
Superior division
Iris
Long ciliary nerves
Short ciliary nerves
Sympathetic plexus
Trigeminal ganglion (CN V)
Inferior division
Ciliary ganglion
Inferior oblique muscle
Inferior rectus muscle


CAVERNOUS SINUS
Superior orbital fissure
ORBIT
EYE
Ciliary ganglion
Ophthalmic n.
Nasociliary n.
Long ciliary nerves
Sympathetic fibers
Sensory fibers
Parasympathetic fibers
Carotid plexus
Sensory root
Sympathetic root
Short ciliary nerves
Motor root
Oculomotor n.
Inferior division