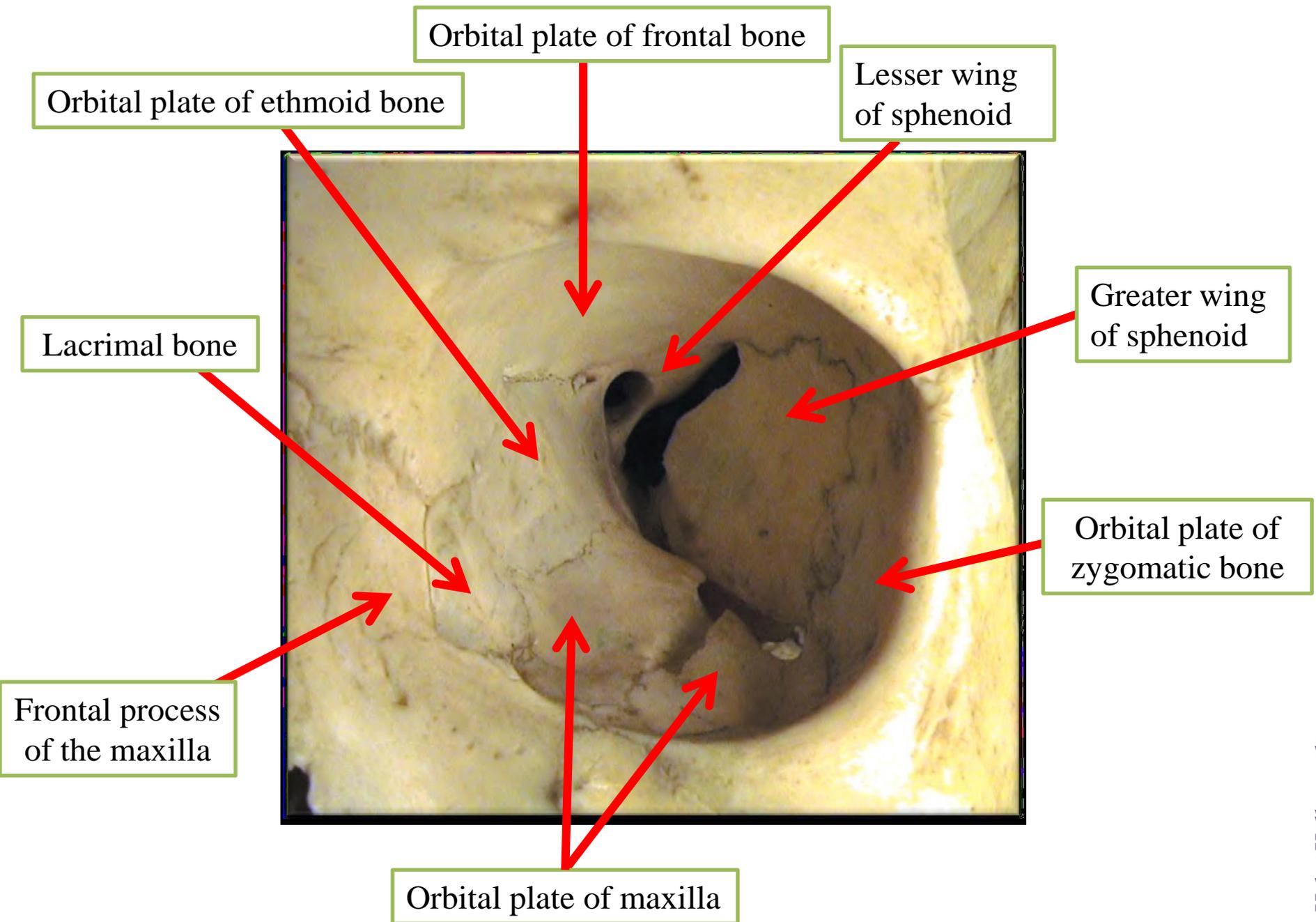
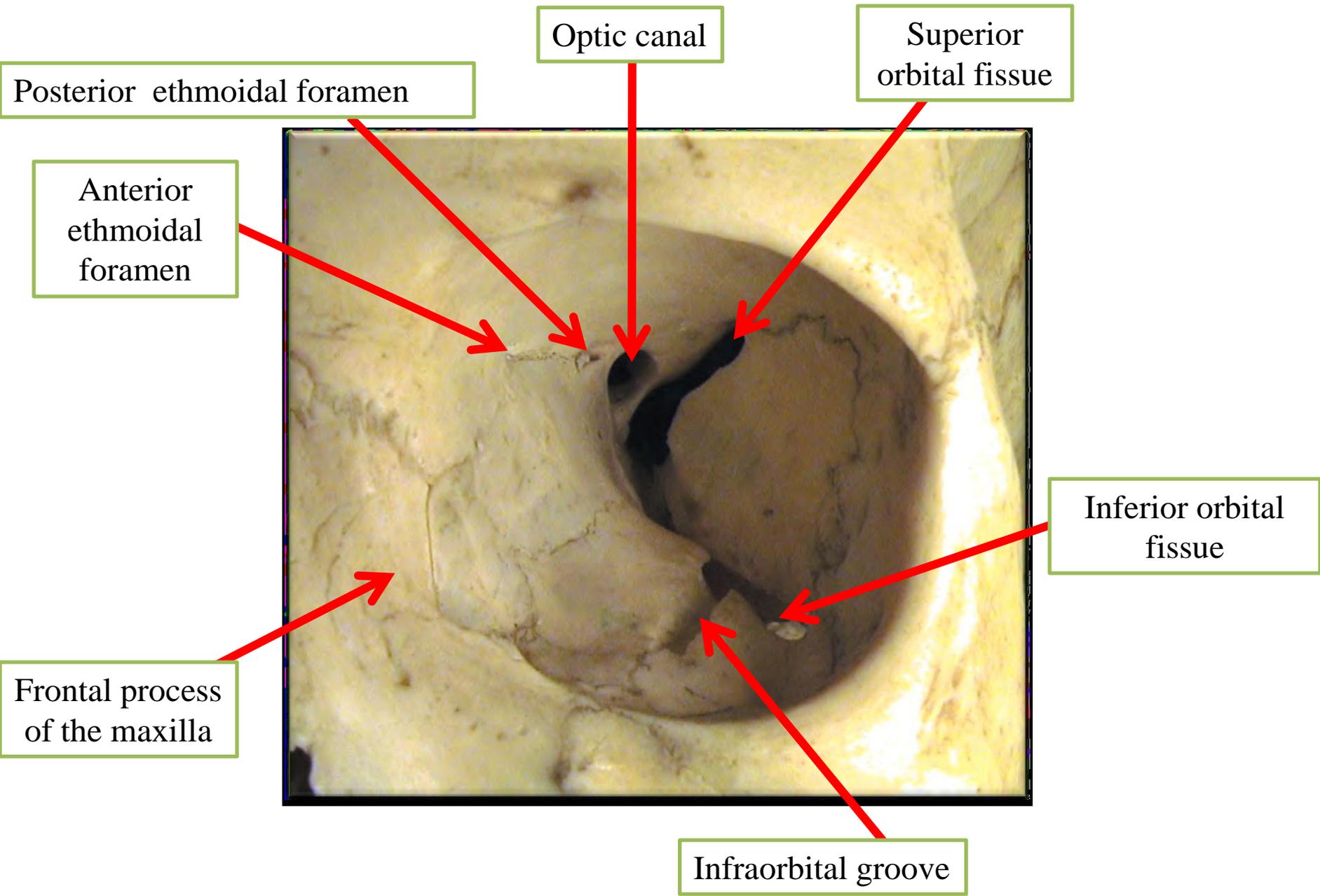




# The orbit-1

Dr. Heba Kalbouneh  
Associate Professor of Anatomy and Histology





Orbital plate of frontal bone

Lesser wing of sphenoid

Greater wing of sphenoid

Orbital plate of ethmoid bone

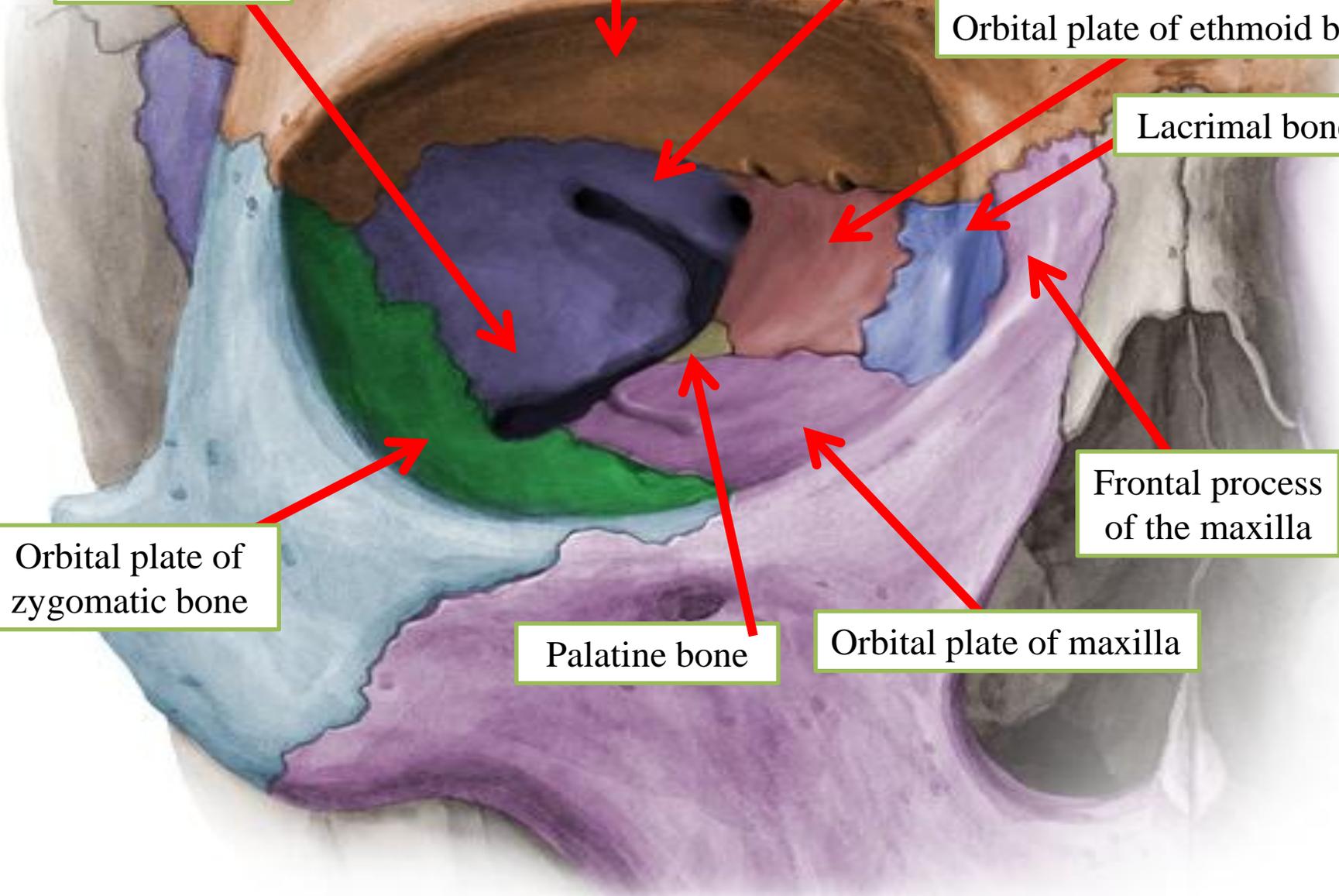
Lacrimal bone

Frontal process of the maxilla

Orbital plate of zygomatic bone

Palatine bone

Orbital plate of maxilla



# Orbit

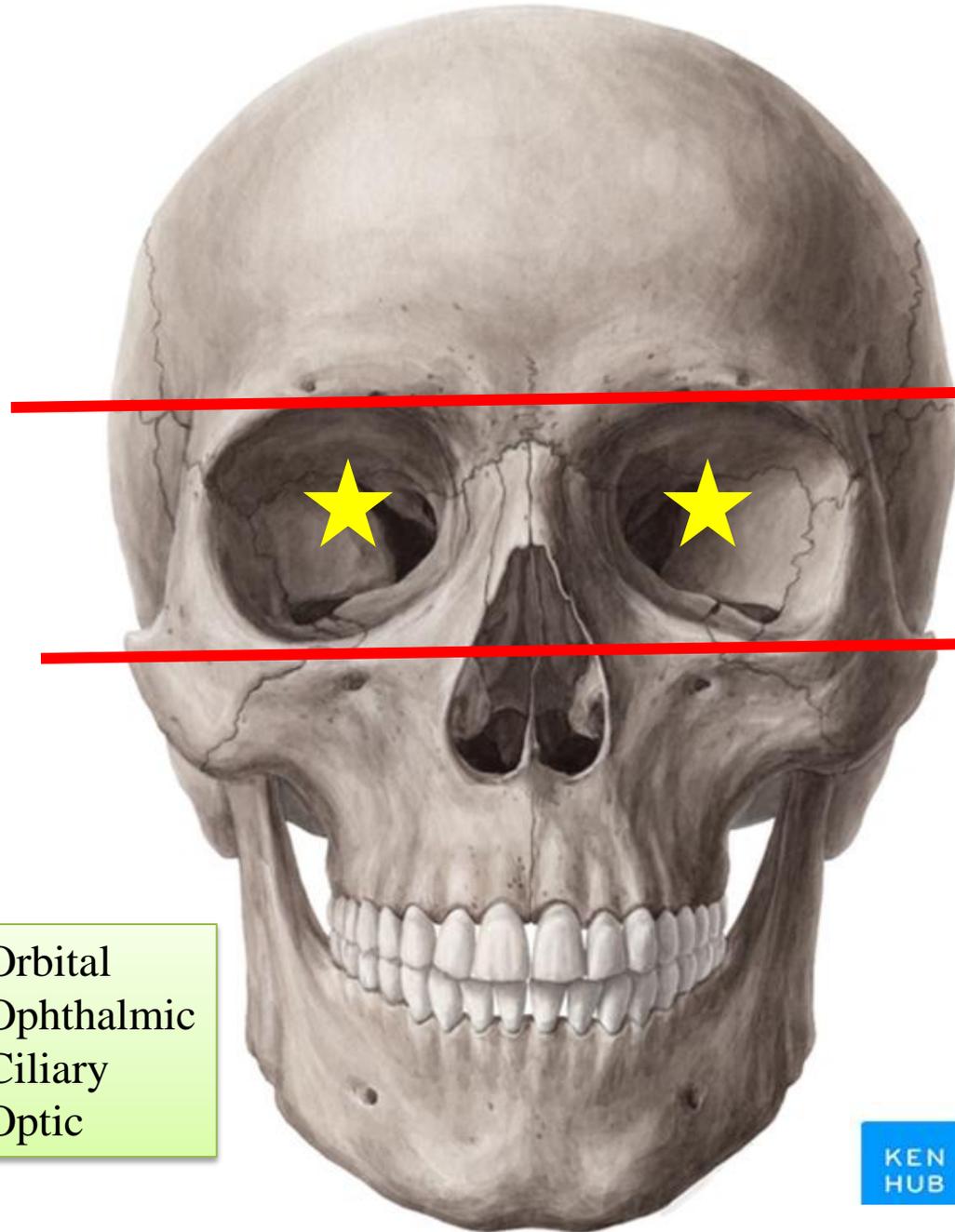
The orbits are bilateral structures below the anterior cranial fossa and anterior to middle cranial fossa

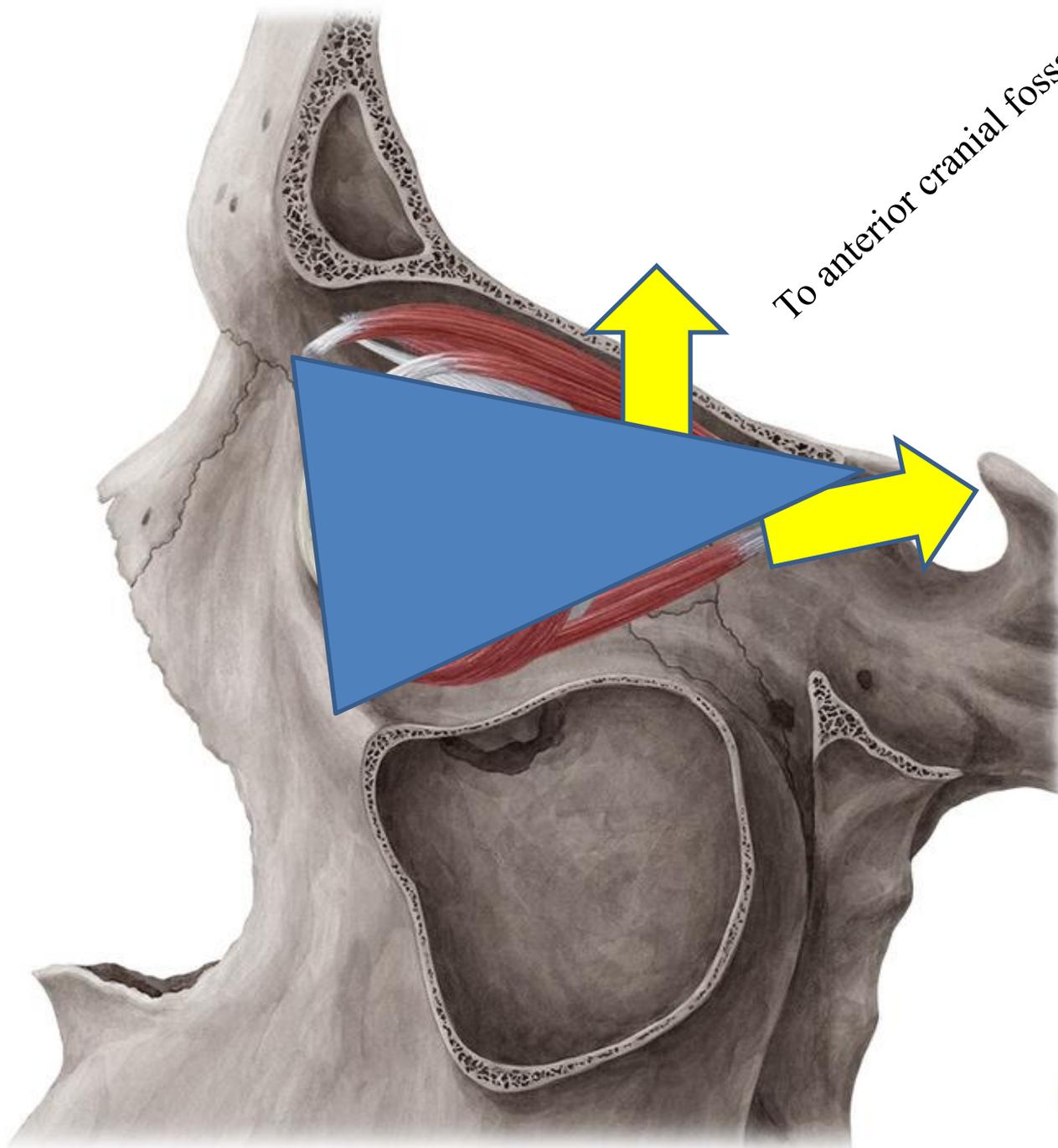
The bony orbit is pyramidal in shape, with its base opening anteriorly onto the face and its apex extending in a posteromedial direction

Has medial, lateral, superior (roof), inferior (floor) walls

The apex of the pyramid is the **optic foramen**, whereas the base is the orbital rim

Orbital  
Ophthalmic  
Ciliary  
Optic



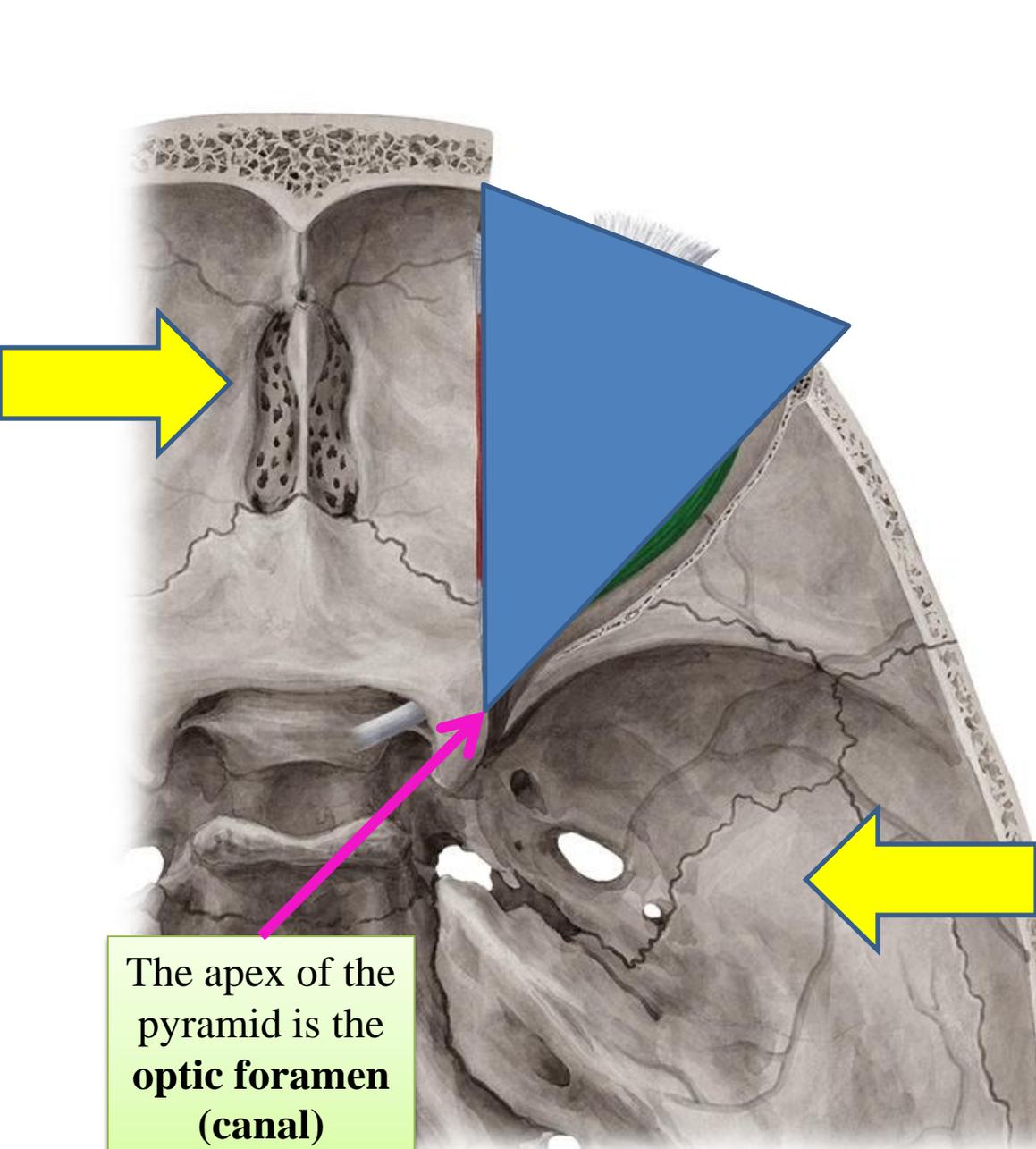


To anterior cranial fossa

To middle cranial fossa

## Contents of the orbit:

1. Eyeball
2. Extraocular muscles
3. Intraocular muscles
4. Nerves: Optic, branches of ophthalmic, branches from maxillary, divisions of oculomotor, trochlear, abducent, sympathetic fibers and ciliary ganglion
5. Ophthalmic artery and veins
6. Lacrimal apparatus
7. Fat

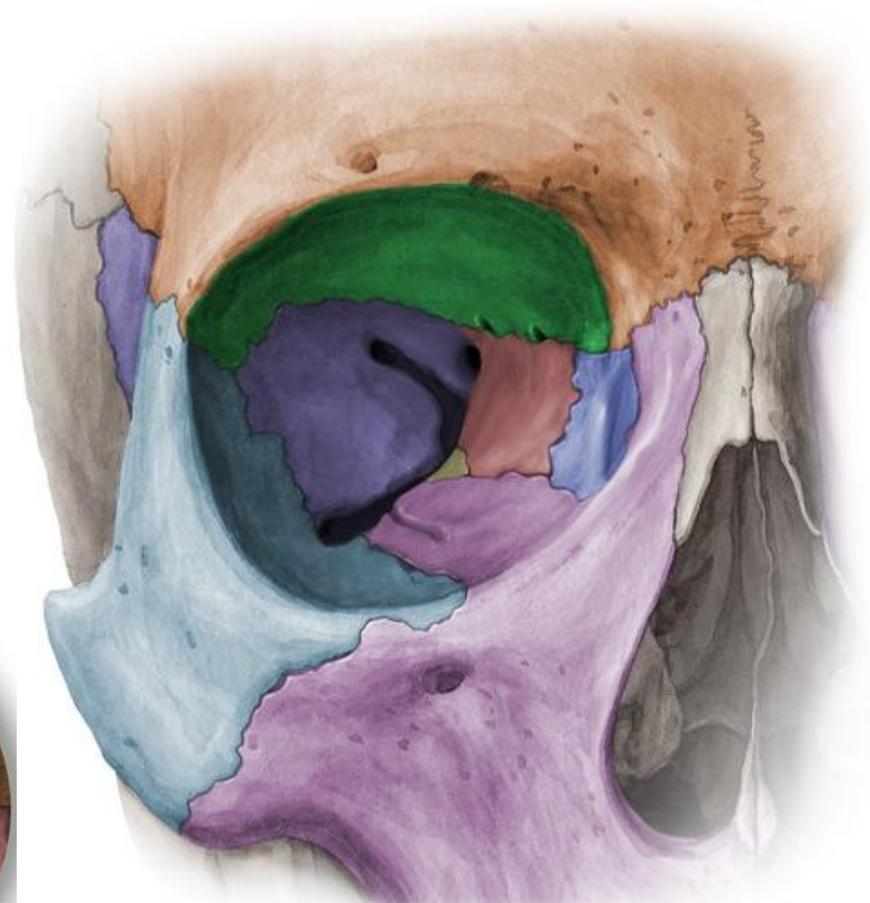
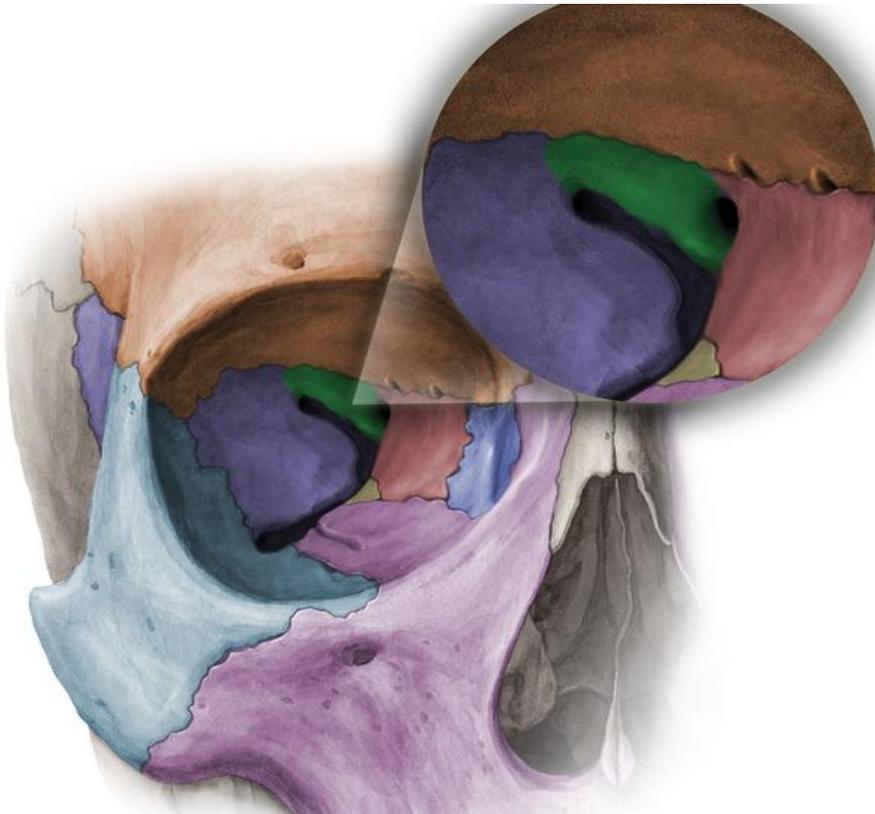


The apex of the pyramid is the **optic foramen (canal)**

# Roof:

Formed by:

**1- The orbital plate of frontal bone,** which separates the orbital cavity from the anterior cranial fossa and the frontal lobe of the cerebral hemisphere



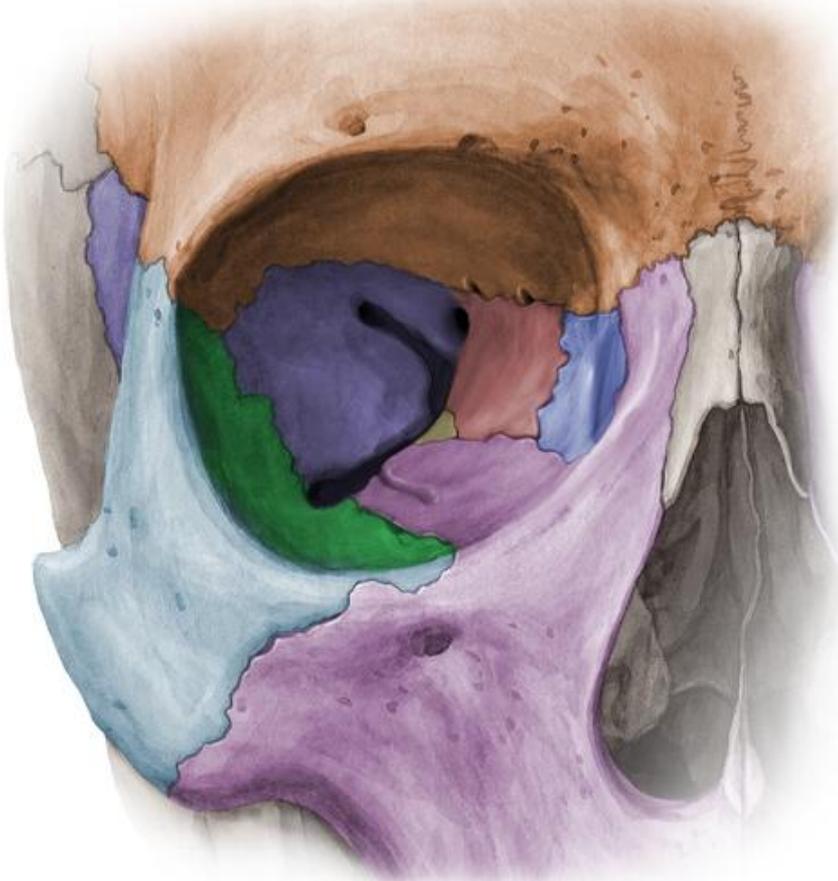
KEN  
HUB

**2- The lesser wing of sphenoid**

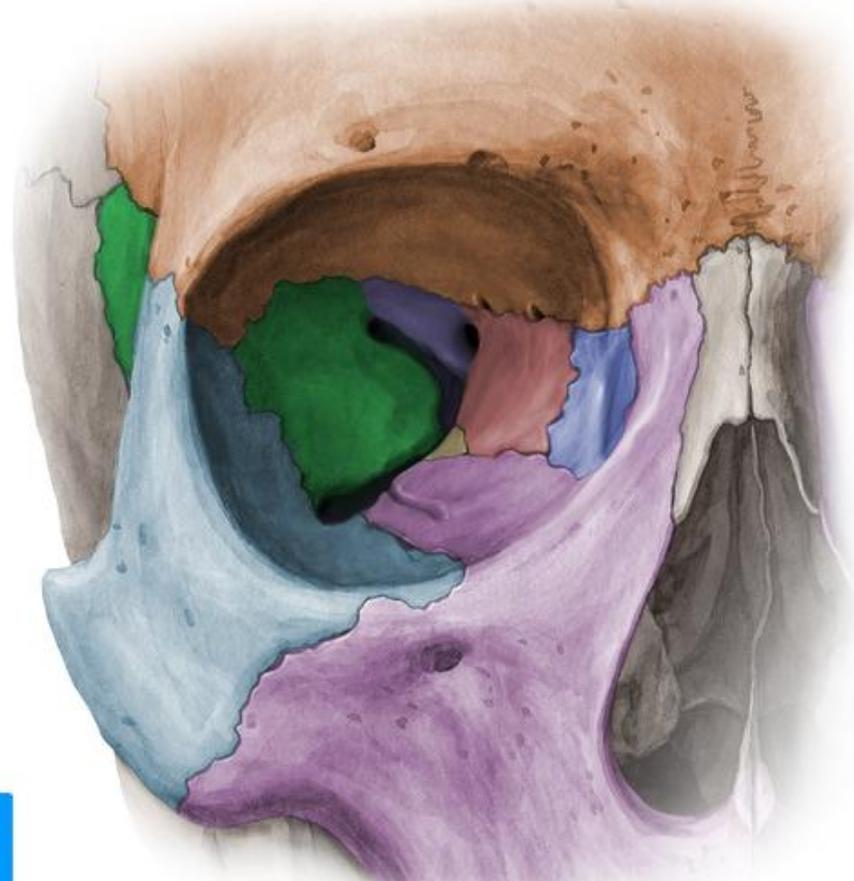
## **Lateral wall:**

Formed by:

**1- The orbital plate of zygomatic bone**



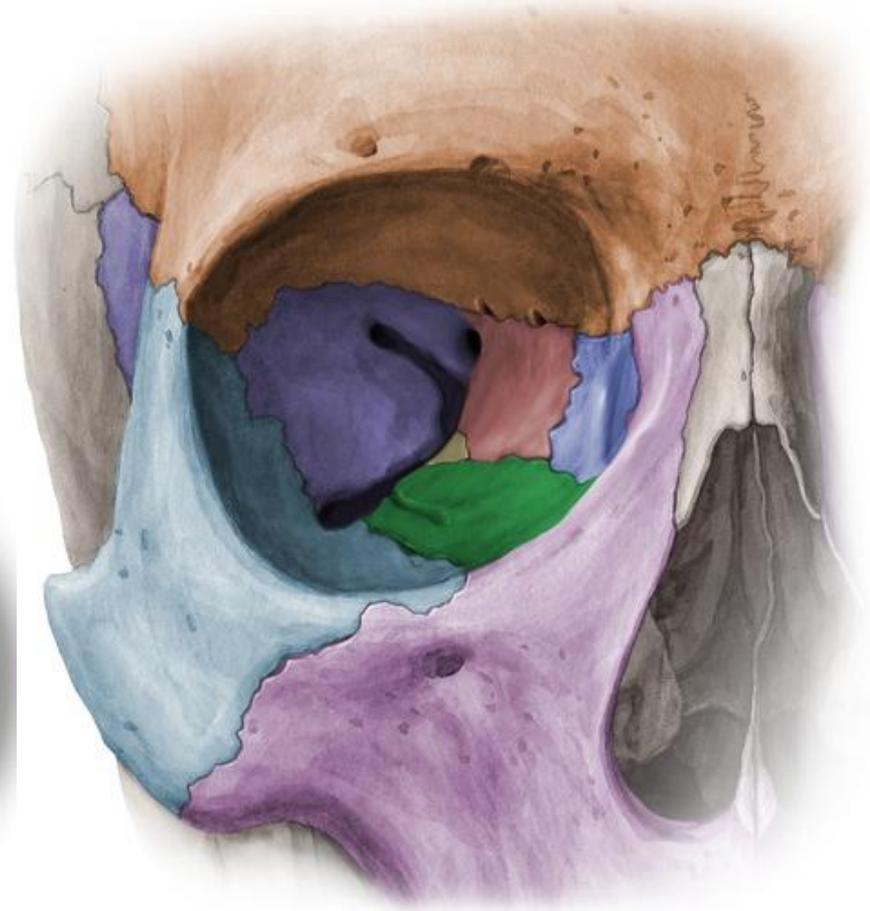
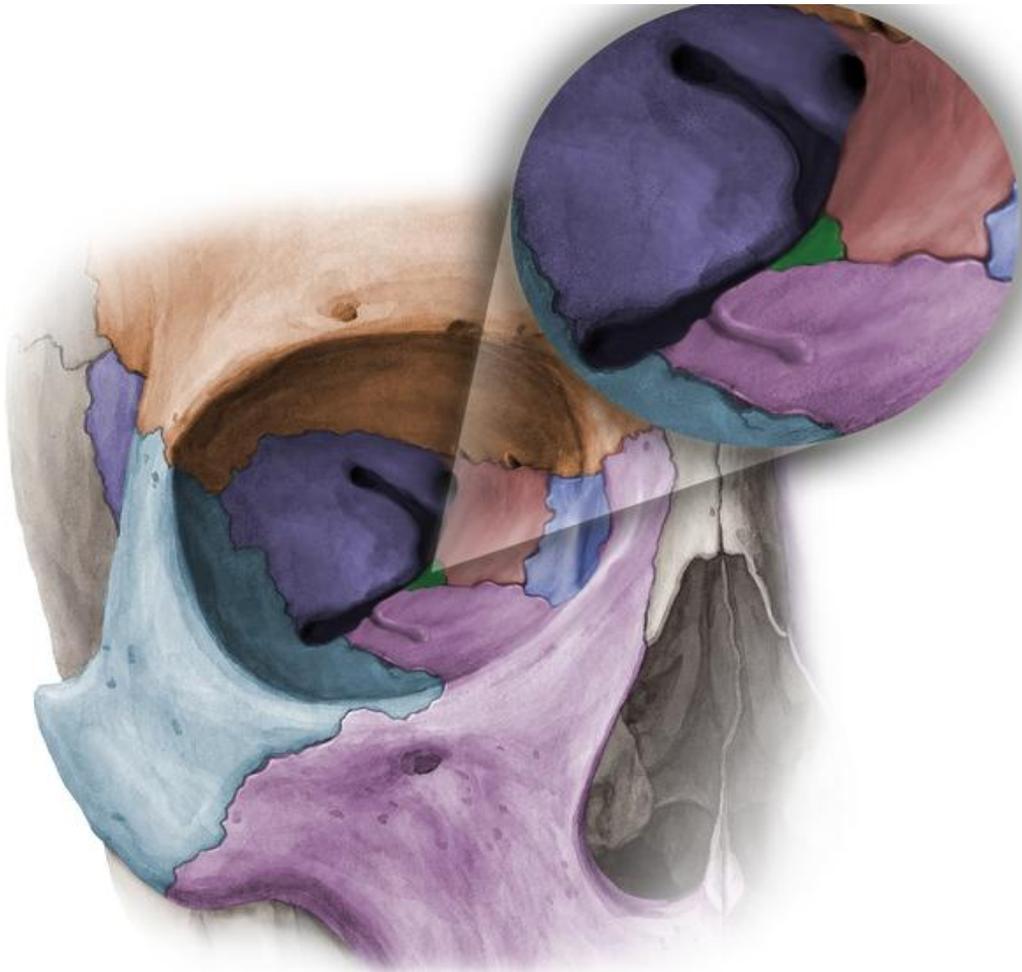
**2- The greater wing of sphenoid**



# Floor:

Formed by:

**1- The orbital plate of maxilla:** separates the orbital cavity from the maxillary sinus



**2- Palatine bone**

KEN  
HUB

# Palatine bone

Participates in the floor of the orbit

Forms the medial wall of pterygopalatine fossa

Vertical plate

Horizontal plate

Participates in the hard palate

PTERYGOMAXILLARY FISSURE

PTERYGOPALATINE FOSSA

Sphenopalatine foramen

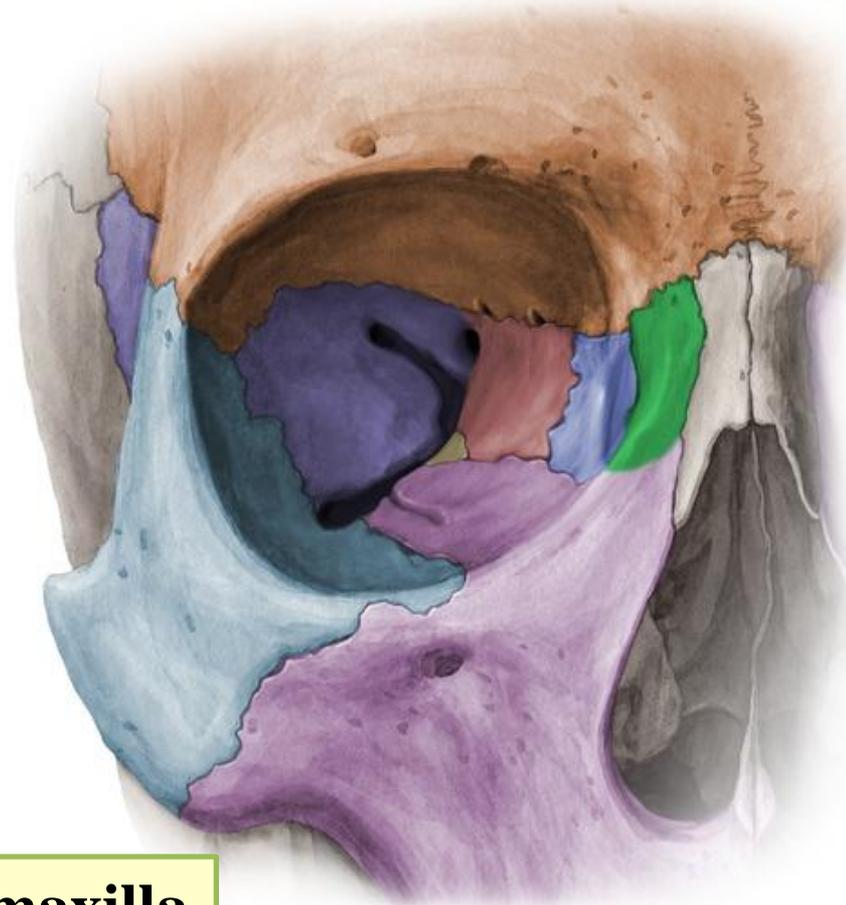
F. Netter M.D. © IGV

## **Medial wall:**

Formed from before backward by:

- 1. The frontal process of maxilla**
- 2. The lacrimal bone**
- 3. The orbital plate of ethmoid**

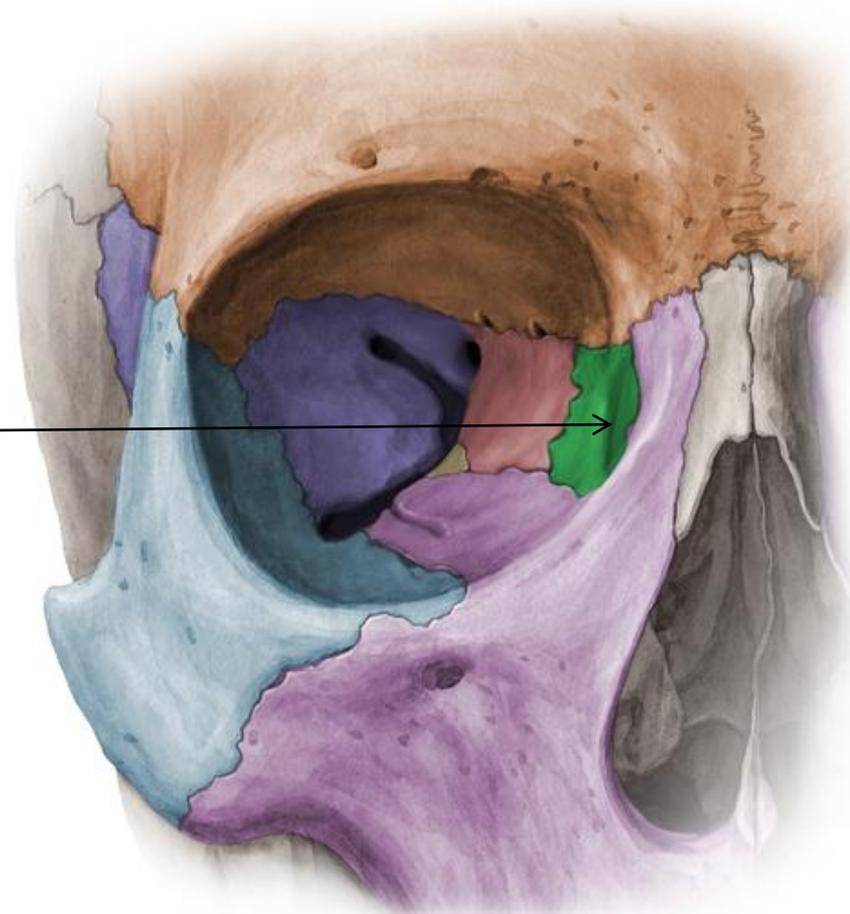
Medial walls are parallel to each other



- 1. The frontal process of maxilla**

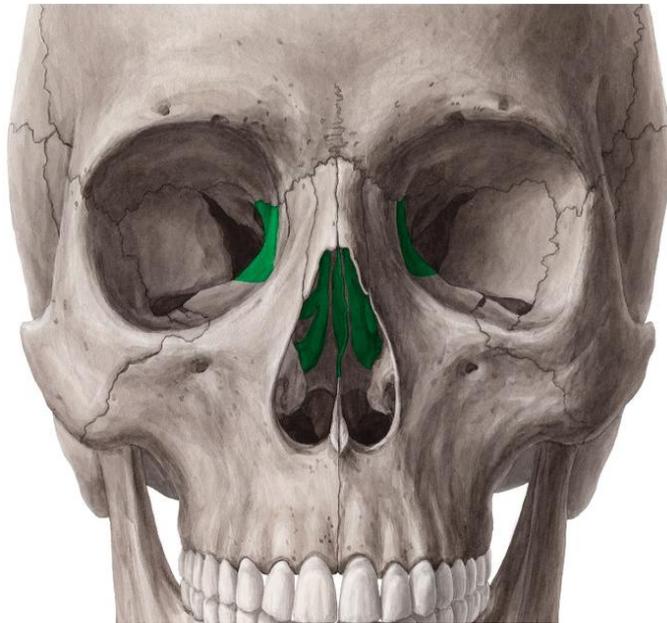
## 2. The lacrimal bone

Fossa for the lacrimal  
sac

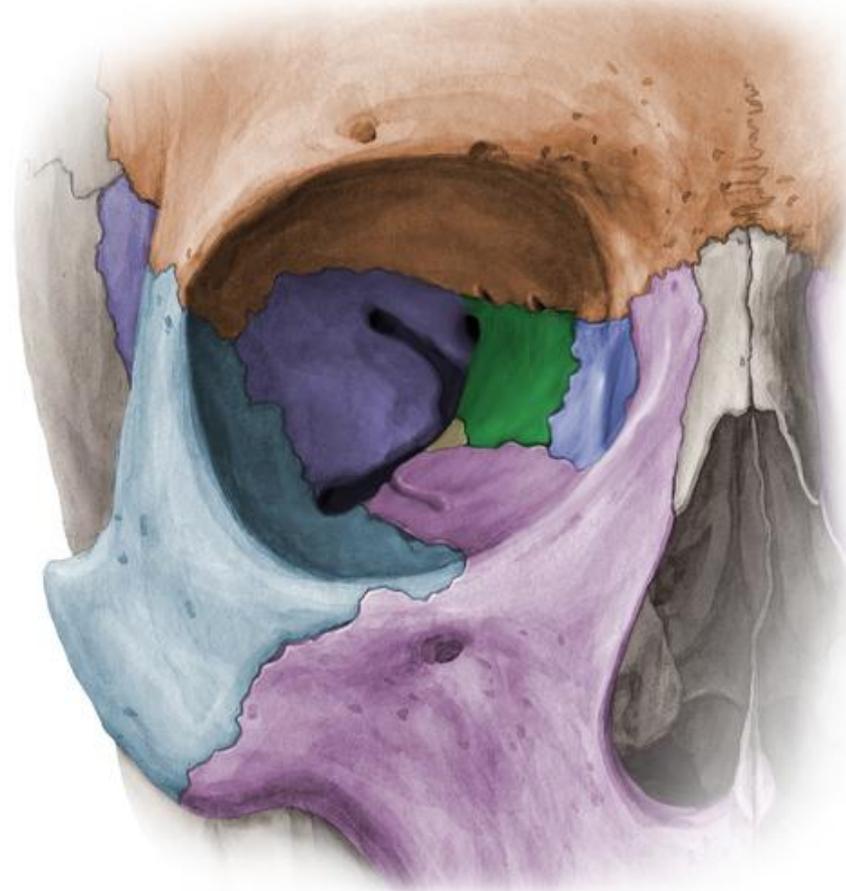


### 3. The orbital plate of ethmoid

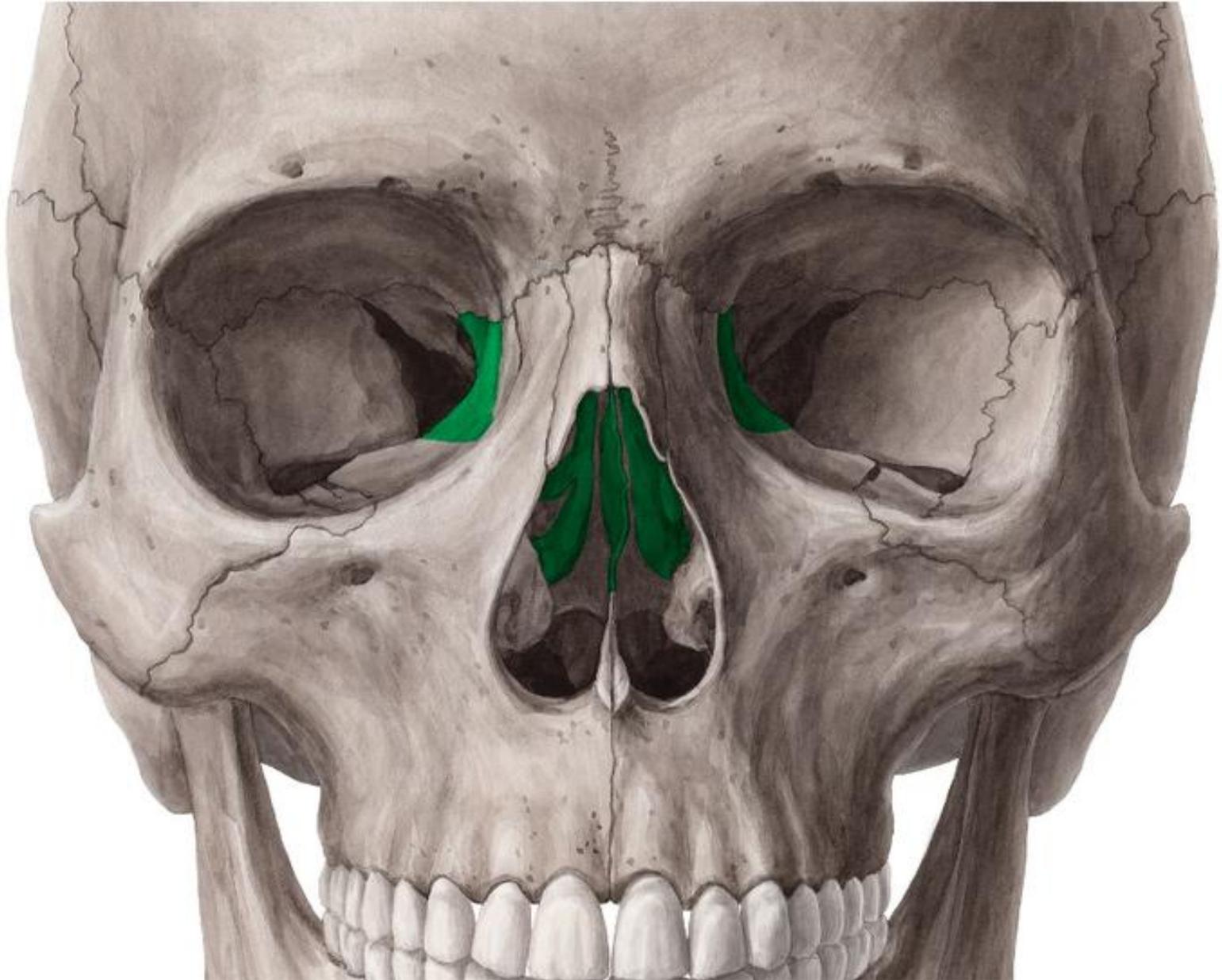
- The orbital plate of ethmoid separates the orbital cavity from the ethmoidal air sinuses
- It is a very thin wall



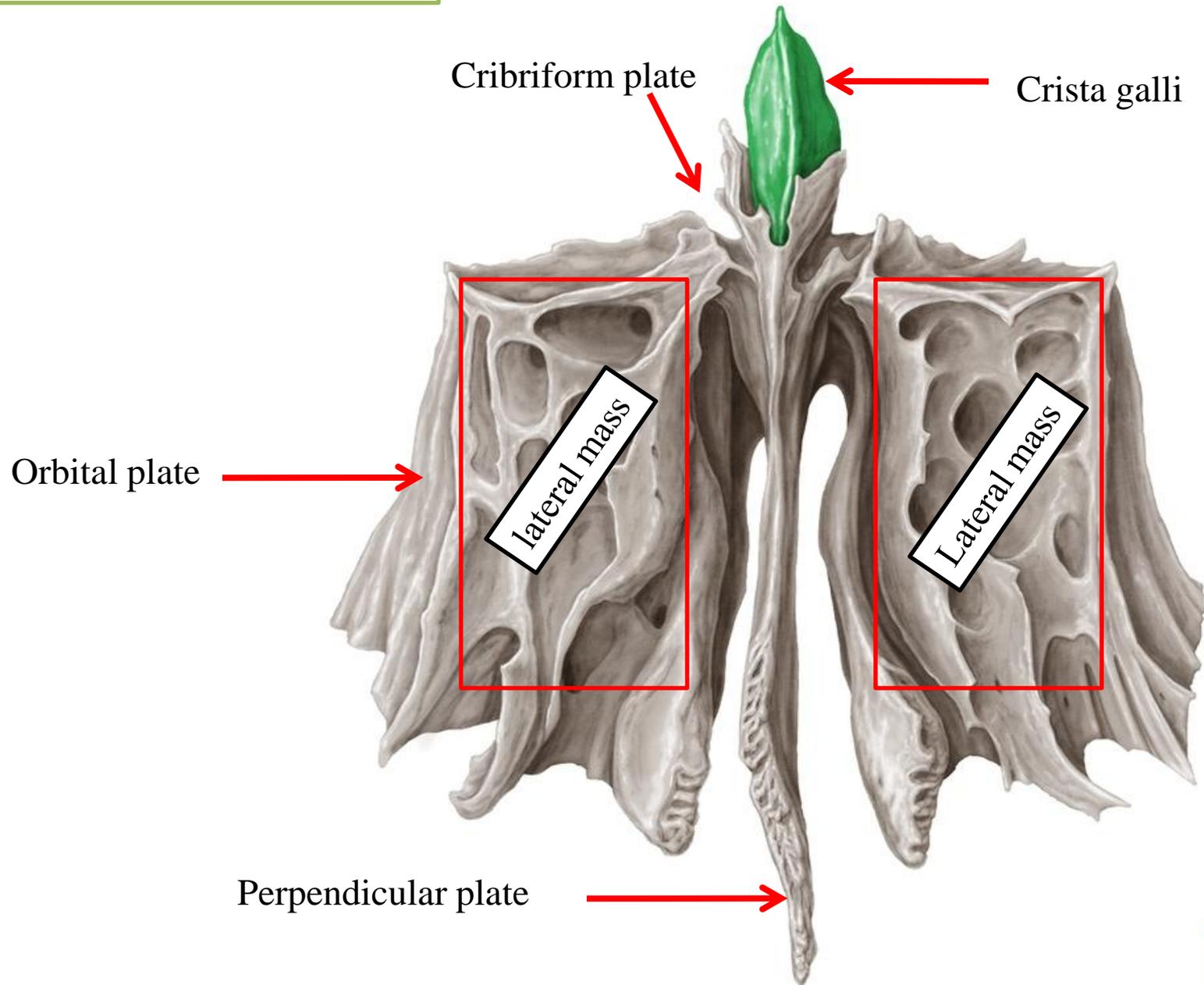
**Ethmoid bone**



# Ethmoid bone

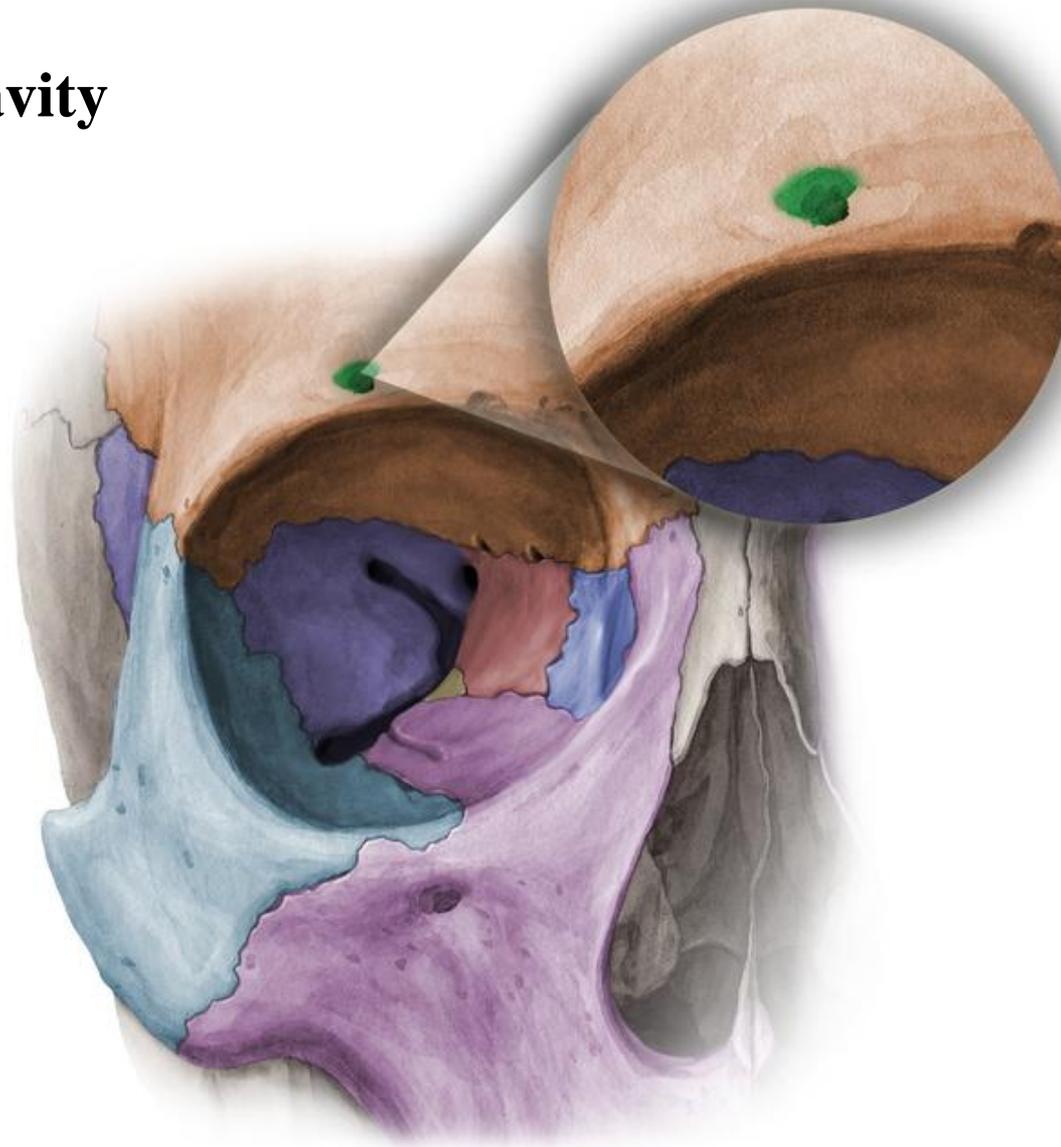


# Ethmoid bone



# Openings Into the Orbital Cavity

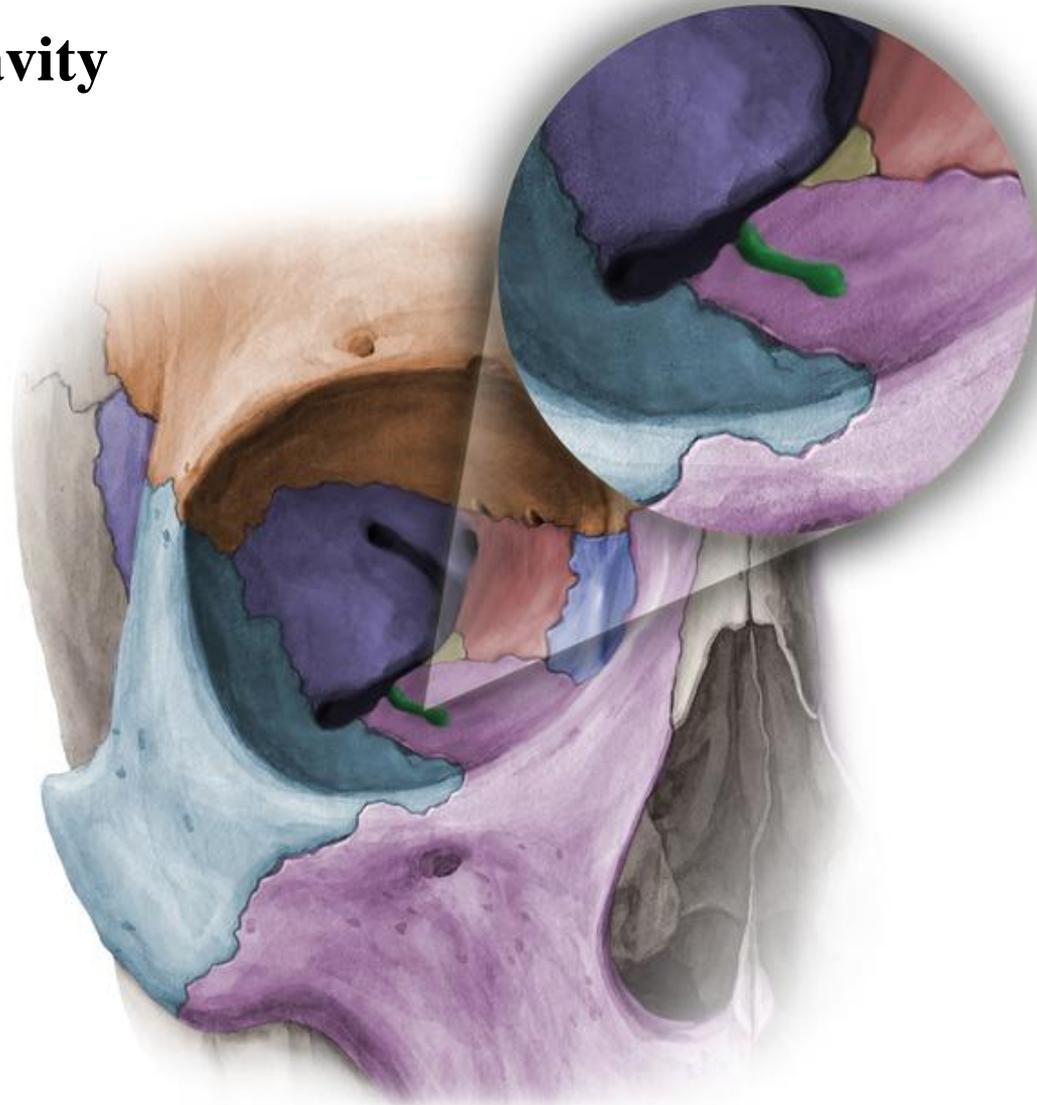
1- **Supraorbital notch (Foramen)**: transmits the supraorbital nerve and blood vessels



# Openings Into the Orbital Cavity

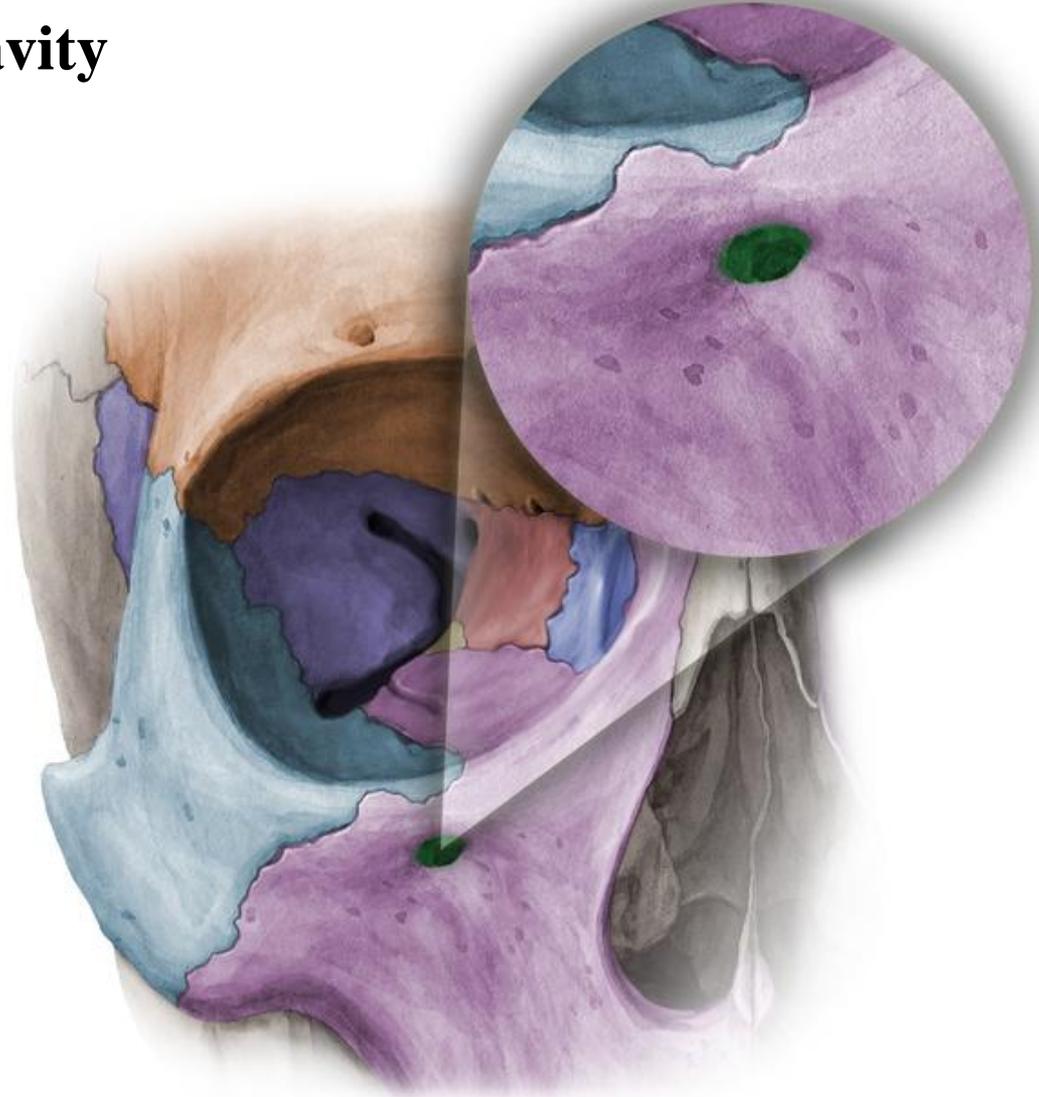
**2-Infraorbital groove and canal:** Situated on the floor of the orbit

They transmit the infraorbital nerve (a continuation of the maxillary nerve) and blood vessels



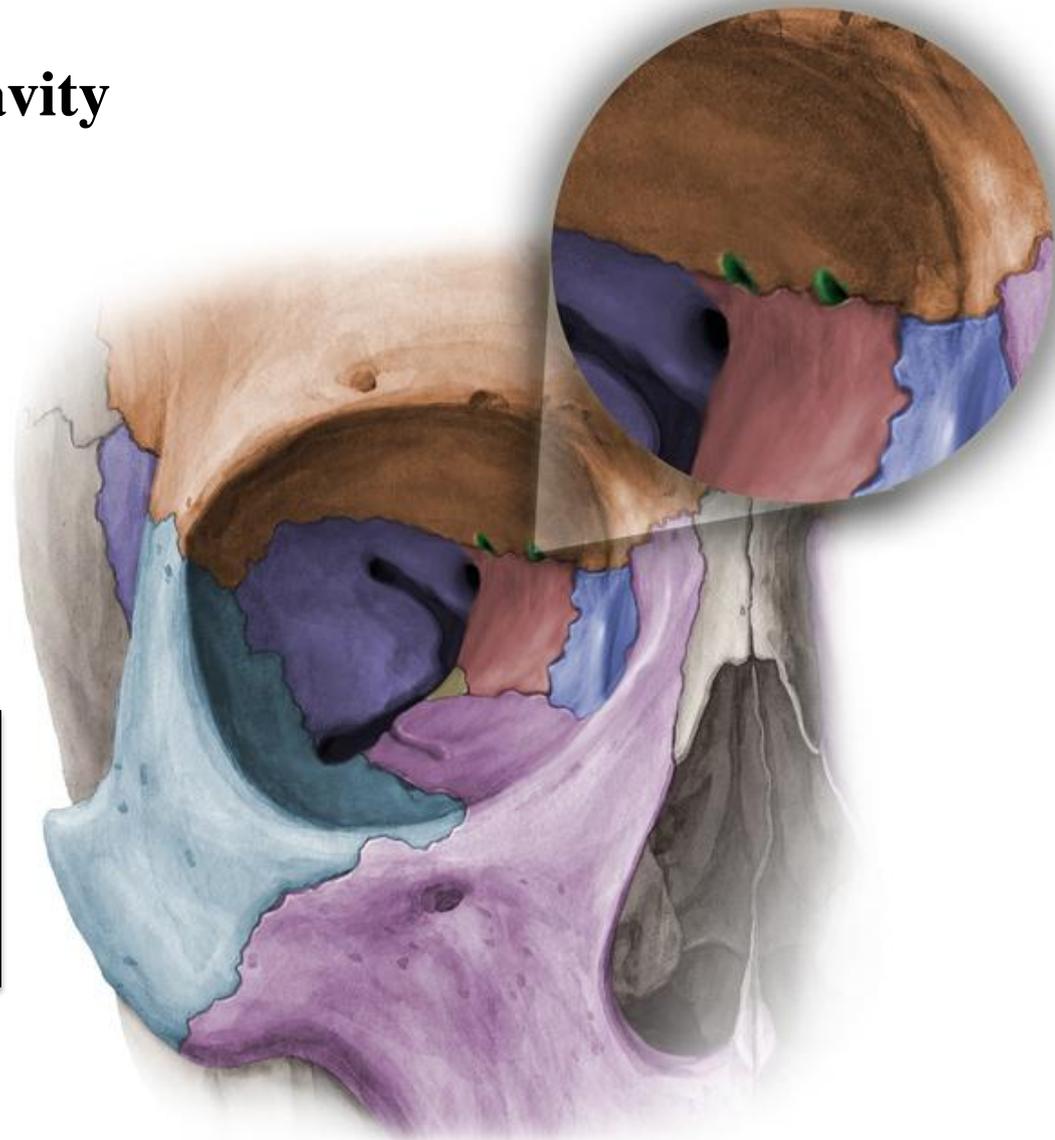
# Openings Into the Orbital Cavity

**3-Infraorbital foramen:**  
transmits the infraorbital  
nerve (a continuation of  
the maxillary nerve) and  
blood vessels



# Openings Into the Orbital Cavity

**5- Anterior and posterior ethmoidal foramina:**  
transmit anterior and posterior ethmoidal nerves and vessels



Remember:

Anterior and posterior ethmoidal nerves are branches of nasociliary nerve (ophthalmic nerve)

**Note:** Anterior and posterior ethmoidal foramina are located between the roof and the medial wall

# Openings Into the Orbital Cavity

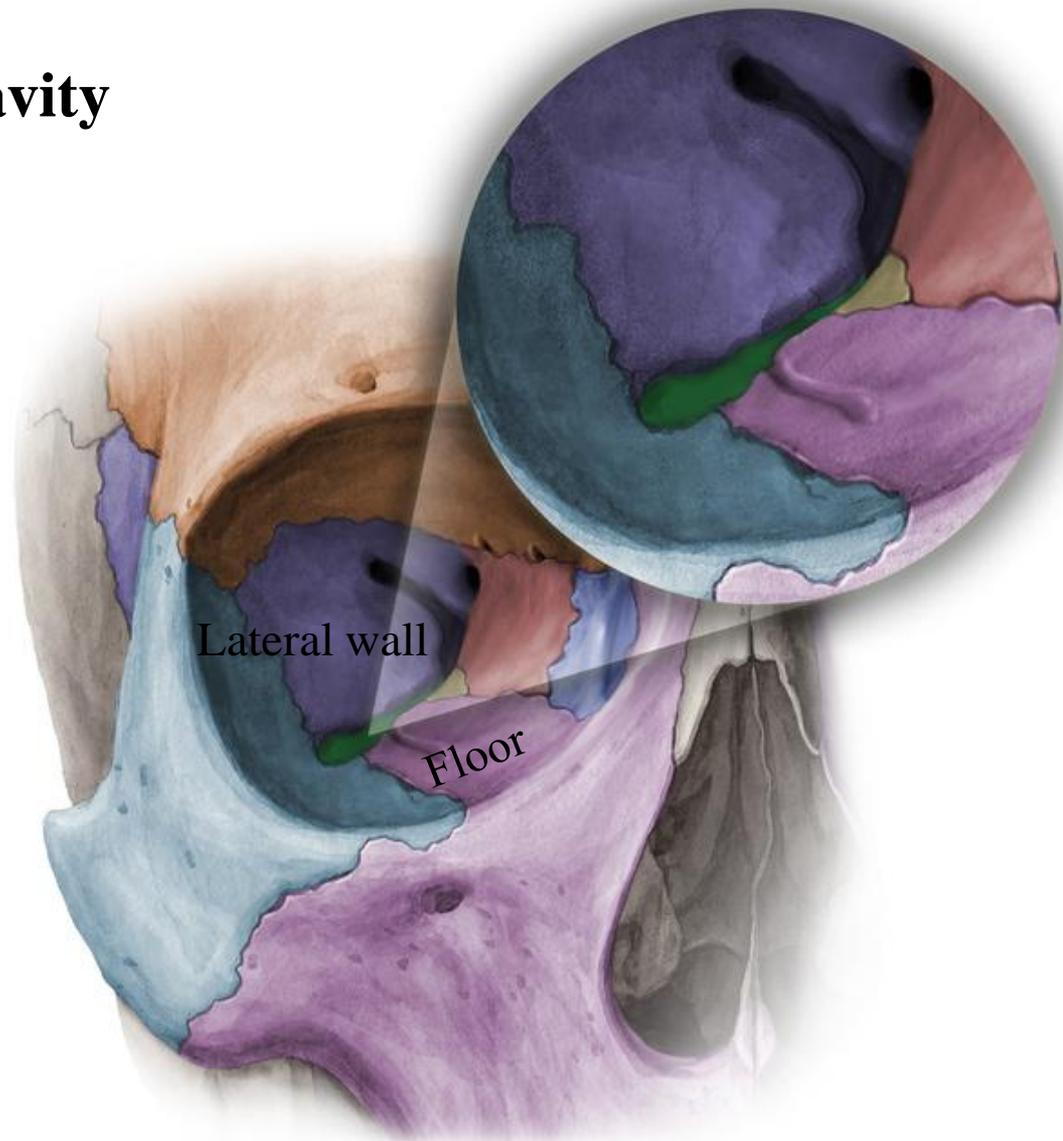
## 6-Inferior orbital fissure:

Located posteriorly between the maxilla and the greater wing of sphenoid

It communicates with the infratemporal and pterygopalatine fossae.

It transmits

- 1-Maxillary nerve and its zygomatic branch
- 2-Infraorbital vessels
- 3- Inferior ophthalmic vein (or a vein communicating with pterygoid plexus of veins)

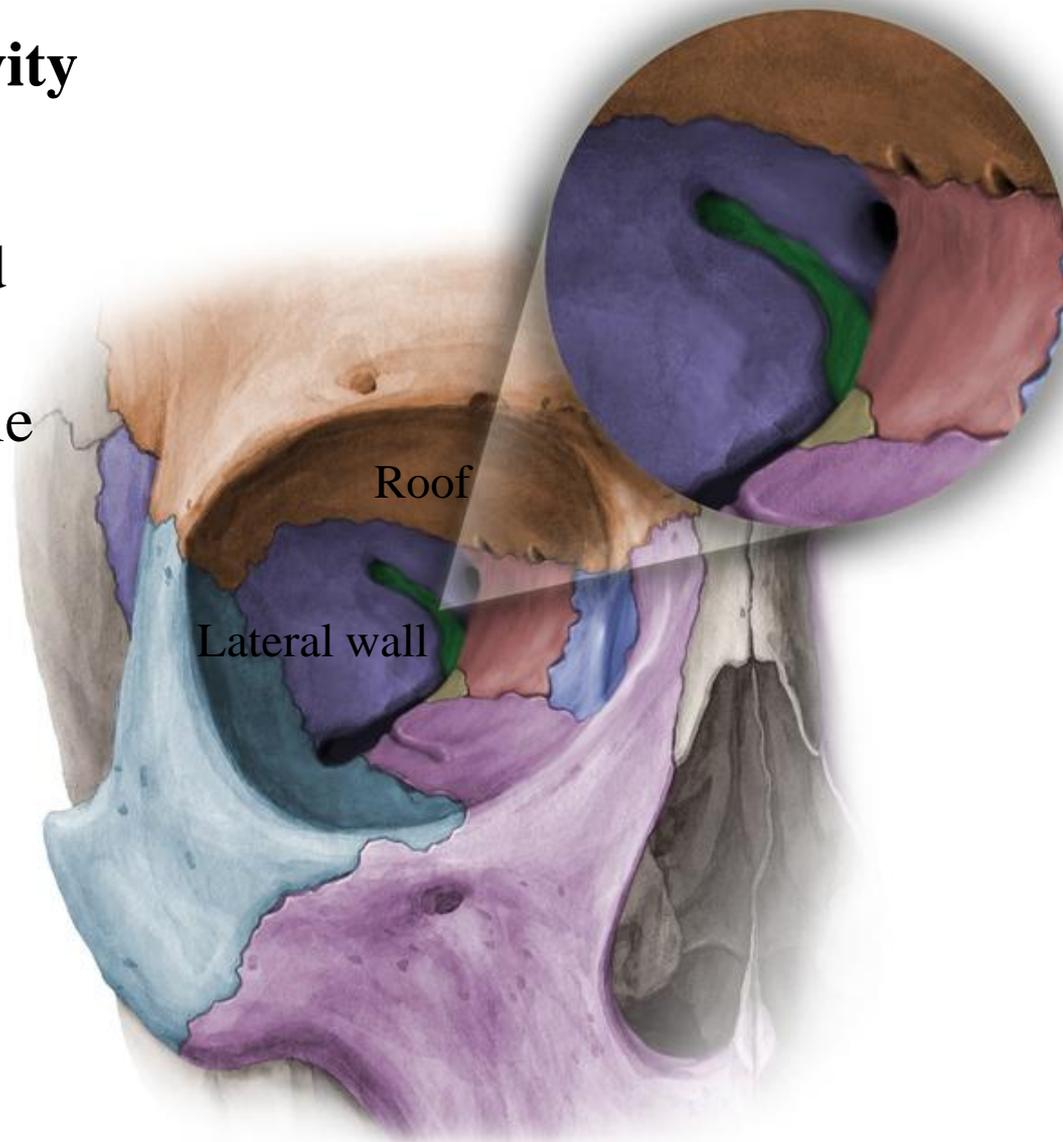


Note: **inferior orbital fissure** is located between the floor and the lateral wall

# Openings Into the Orbital Cavity

## 7- Superior orbital fissure:

- Located between the greater and lesser wings of sphenoid
- It communicates with the middle cranial fossa.
- It transmits
  - Lacrimal nerve
  - Frontal nerve
  - Trochlear nerve
  - Oculomotor nerve (upper and lower divisions)
  - Abducent nerve
  - Nasociliary nerve
  - Superior ophthalmic vein



Note: **superior orbital fissure** is located between the roof and the lateral wall

Lab notes

Note the **superior orbital fissure** opens anteriorly into orbit and posteriorly into middle cranial fossa

Note the **inferior orbital fissure** opens anteriorly into orbit and posteriorly into two fossae: one big (infratemporal fossa) and one small (Pterygo-palatine fossa)

**Use the wire within each of the skull fissures to determine precisely the communications of superior and inferior orbital fissures**

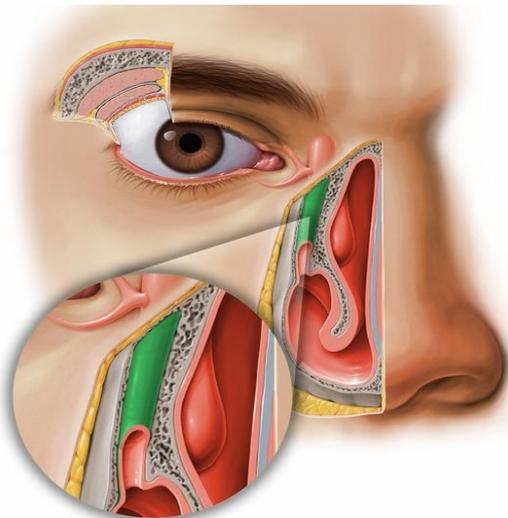
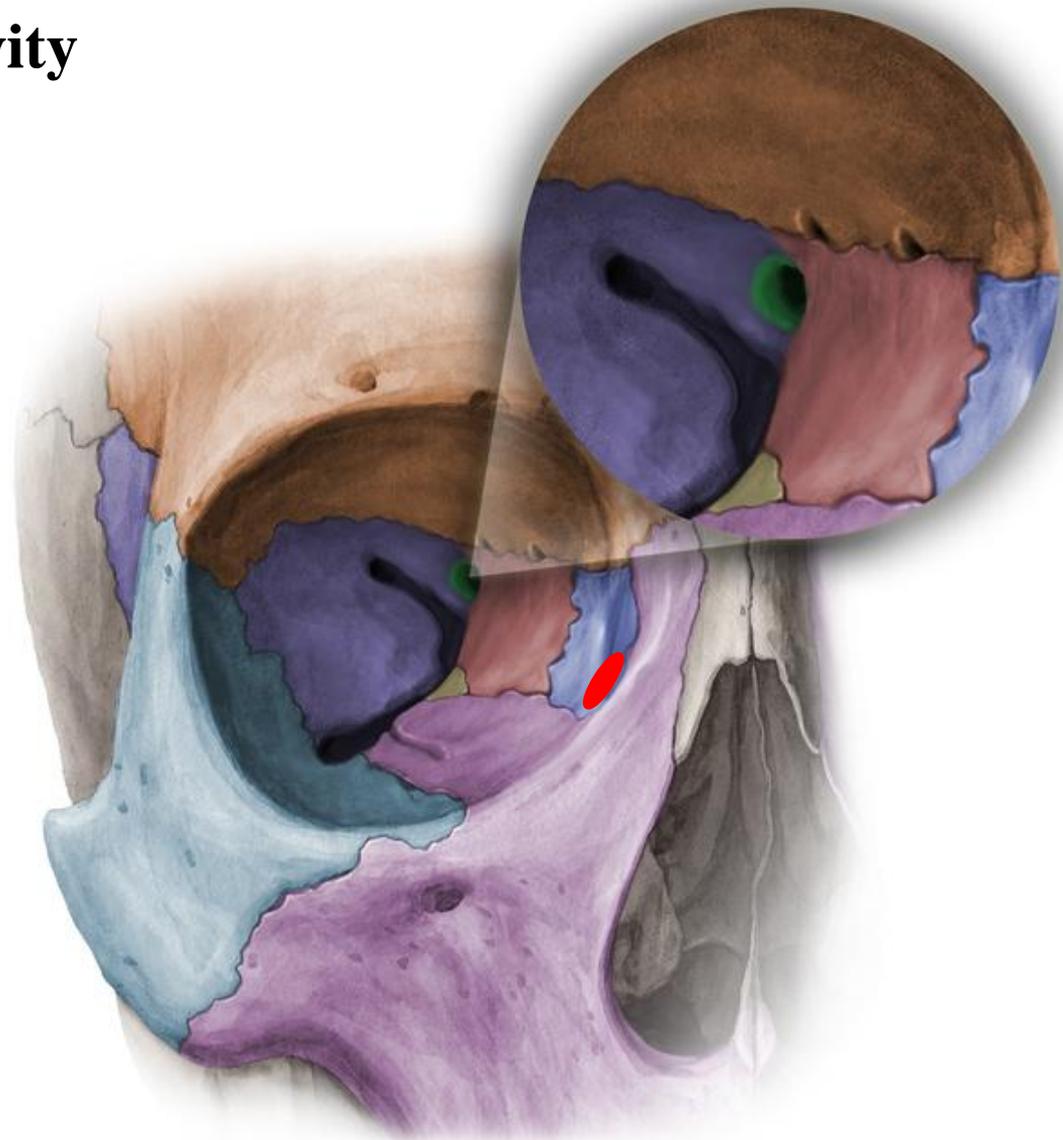
# Openings Into the Orbital Cavity

## 8-Optic canal:

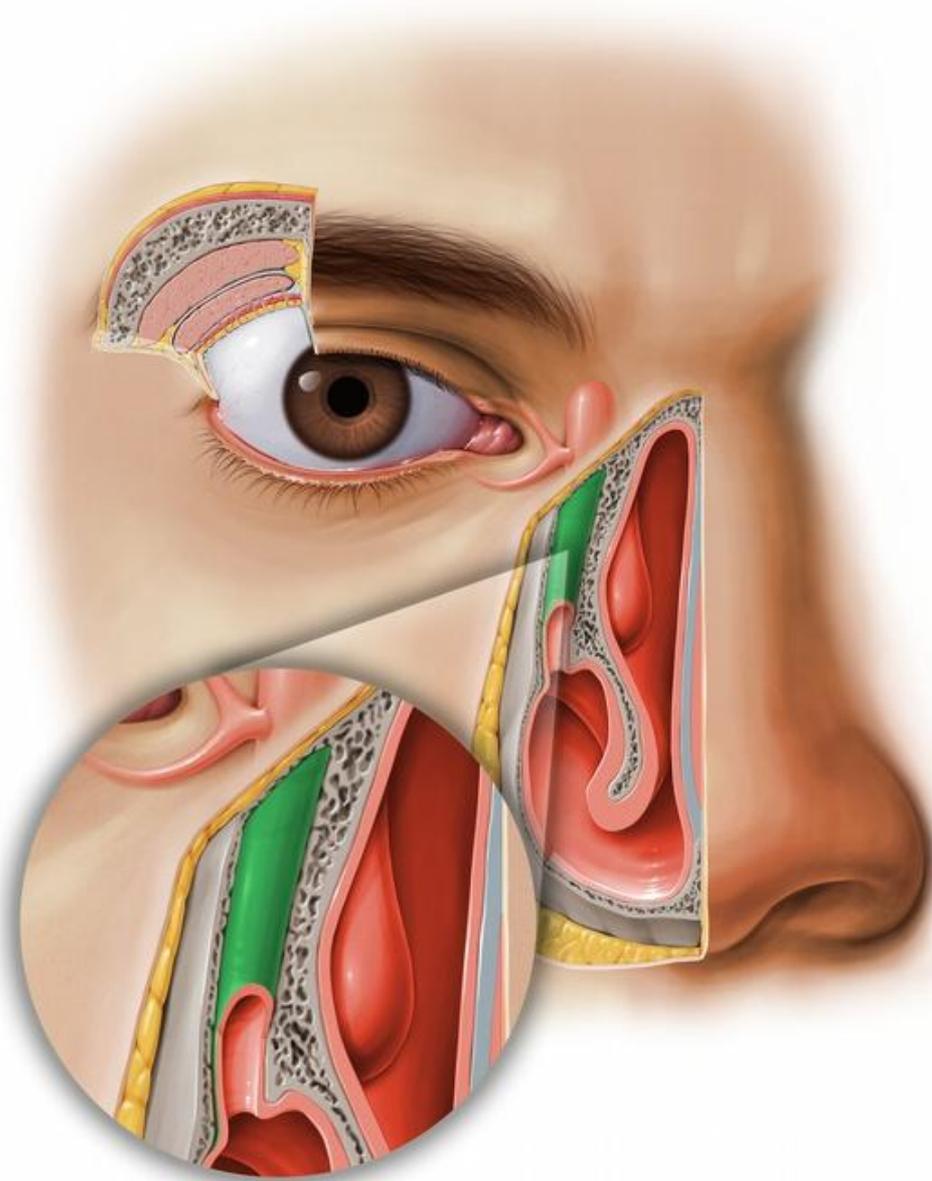
- Located in the lesser wing of the sphenoid (at the junction with the body)
- It communicates with the middle cranial fossa.
- It transmits the optic nerve and the ophthalmic artery

## 9-Nasolacrimal canal:

Located anteriorly on the medial wall; it communicates with the nose  
It transmits the nasolacrimal duct.



# Nasolacrimal canal



## MUSCLES OF THE EYE

There are two groups of muscles within the orbit:

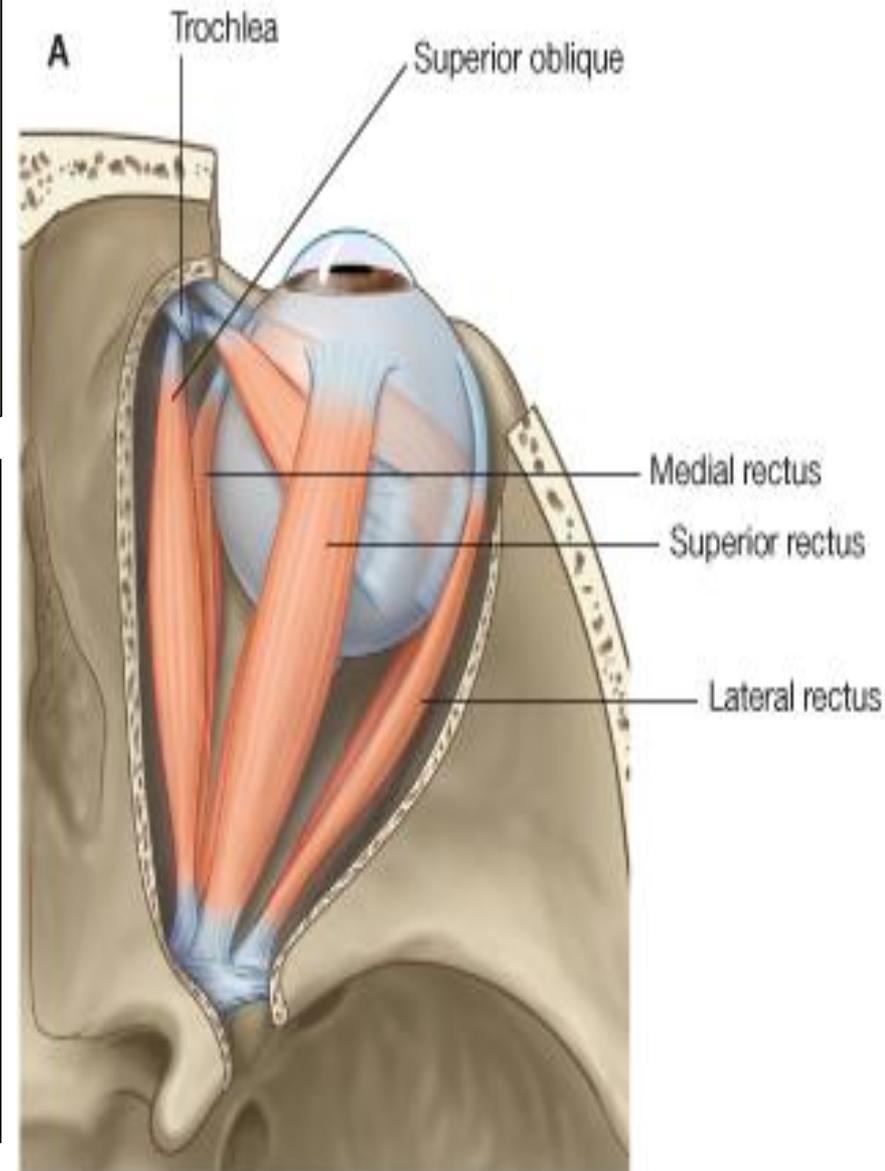
**1-Extrinsic muscles of eyeball** (extra-ocular muscles) involved in movements of the eyeball or raising upper eyelid

**2-Intrinsic muscles** within the eyeball, which control the shape of the lens and size of the pupil.

The extrinsic muscles include

1. SUPERIOR RECTUS
2. INFERIOR RECTUS
3. MEDIAL RECTUS
4. LATERAL RECTUS
5. SUPERIOR OBLIQUE
6. INFERIOR OBLIQUE
7. **LEVATOR PALPEBRAE SUPERIORIS**

4 recti muscles  
2 oblique muscles



The intrinsic muscles include: 1- Ciliary muscle 2- Sphincter pupillae 3- Dilator pupillae

# Movements of the eyeball

**Elevation**-moving the pupil/cornea superiorly

**Depression**-moving the pupil/cornea inferiorly

**Abduction**-moving the pupil/cornea laterally

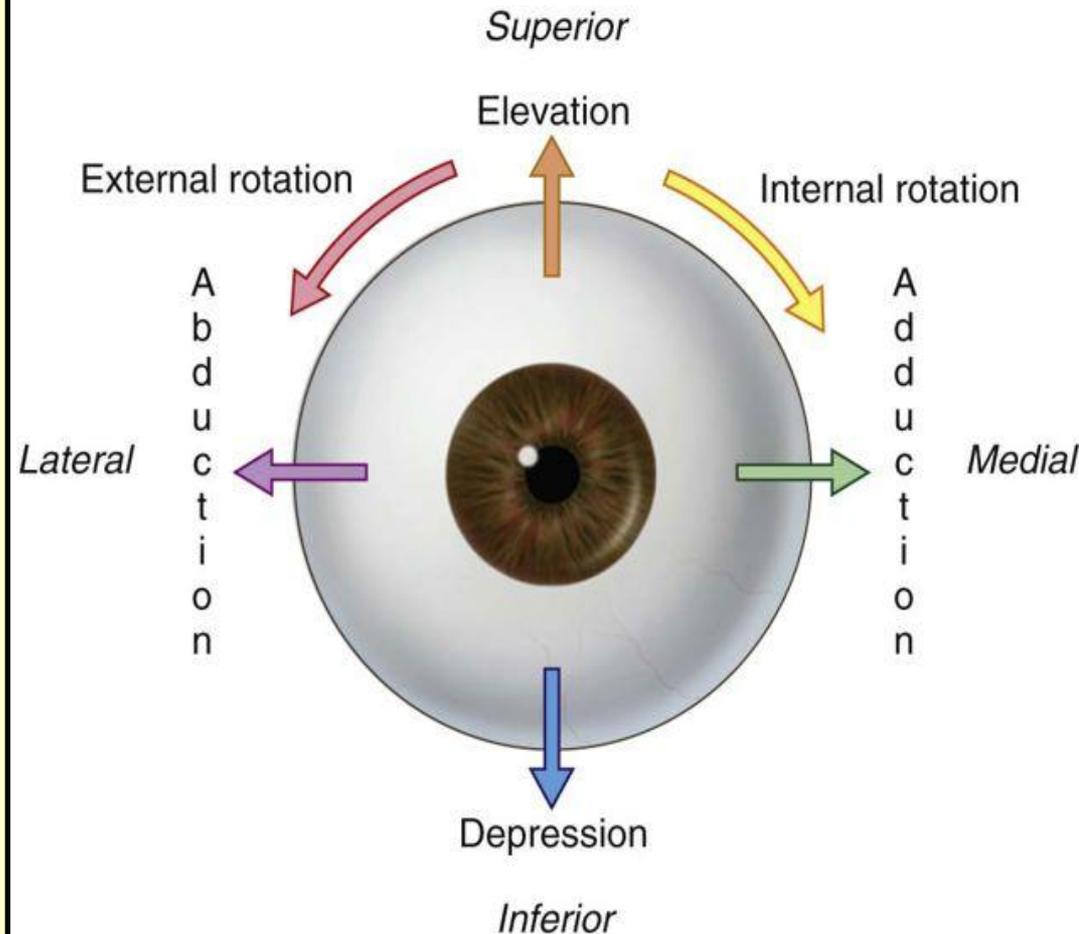
**Adduction**-moving the pupil/cornea medially

**Internal rotation**-rotating the upper part of the pupil/cornea medially (or towards the nose)

**Intorsion**

**External rotation**-rotating the upper part of the pupil/cornea laterally (or towards the temple)

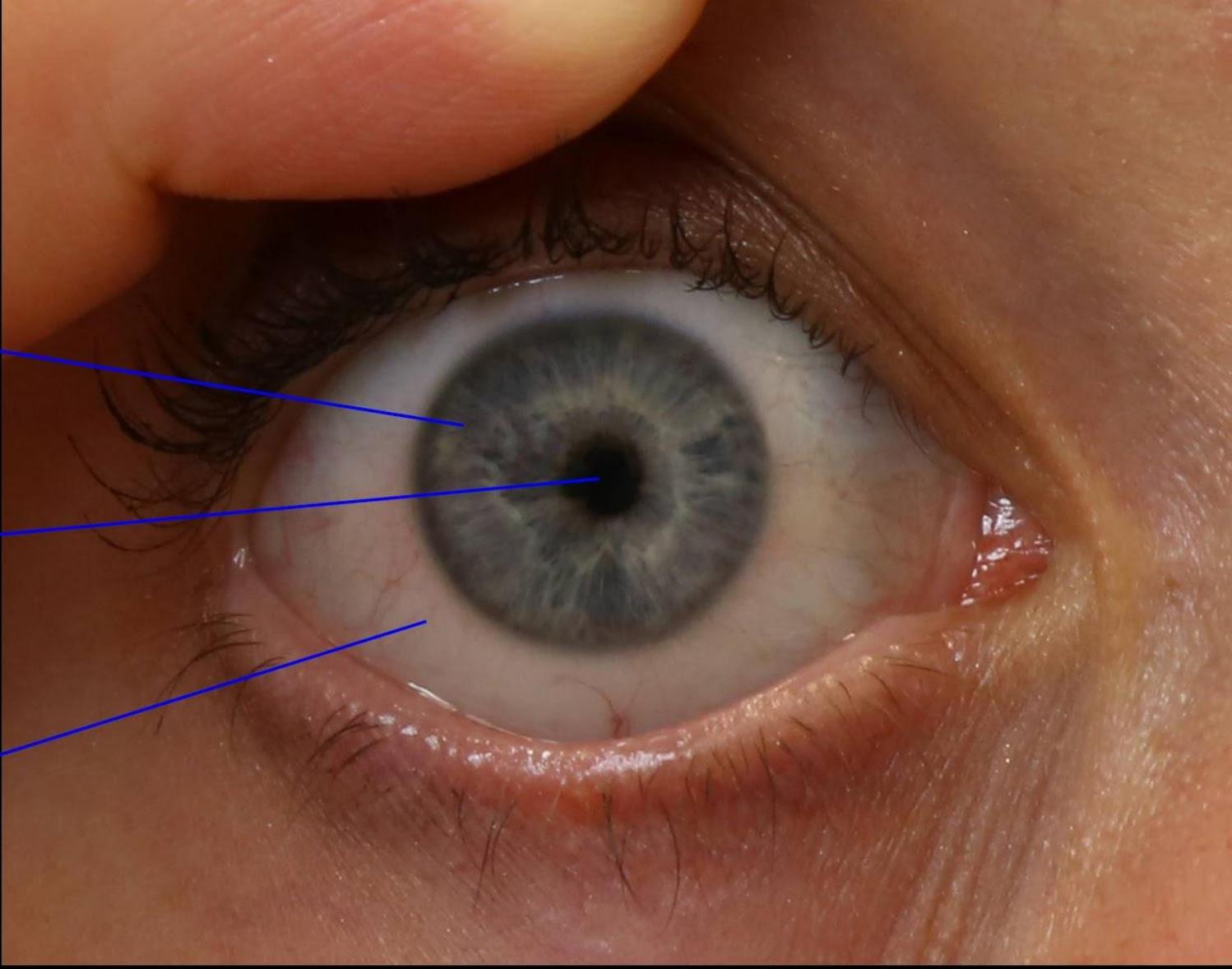
**Extorsion**



Iris

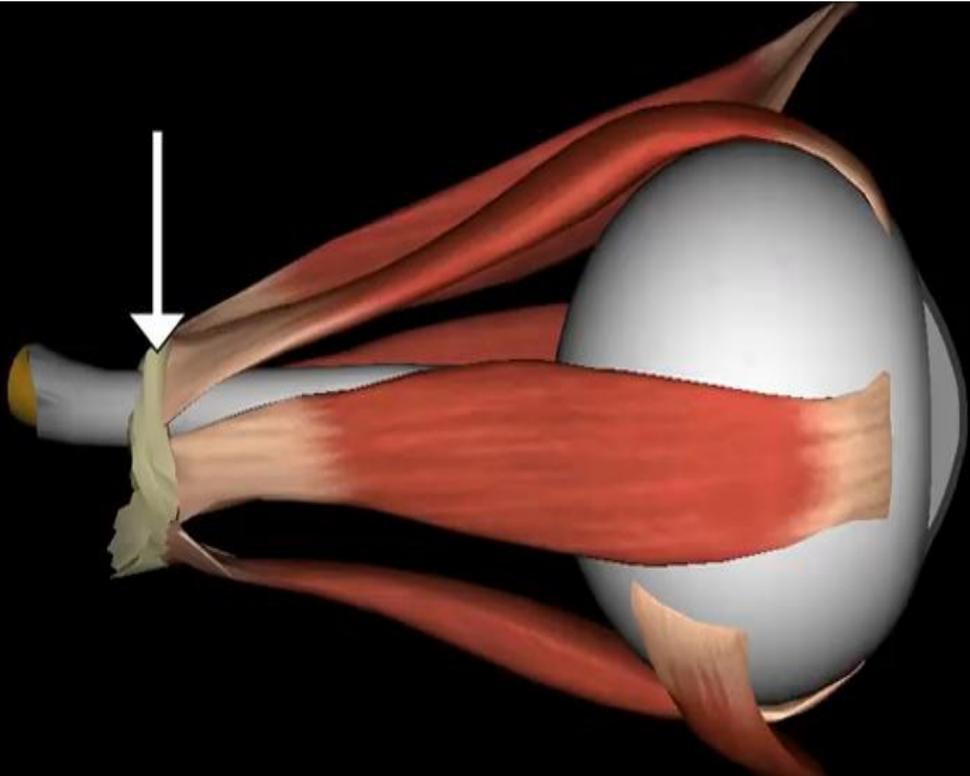
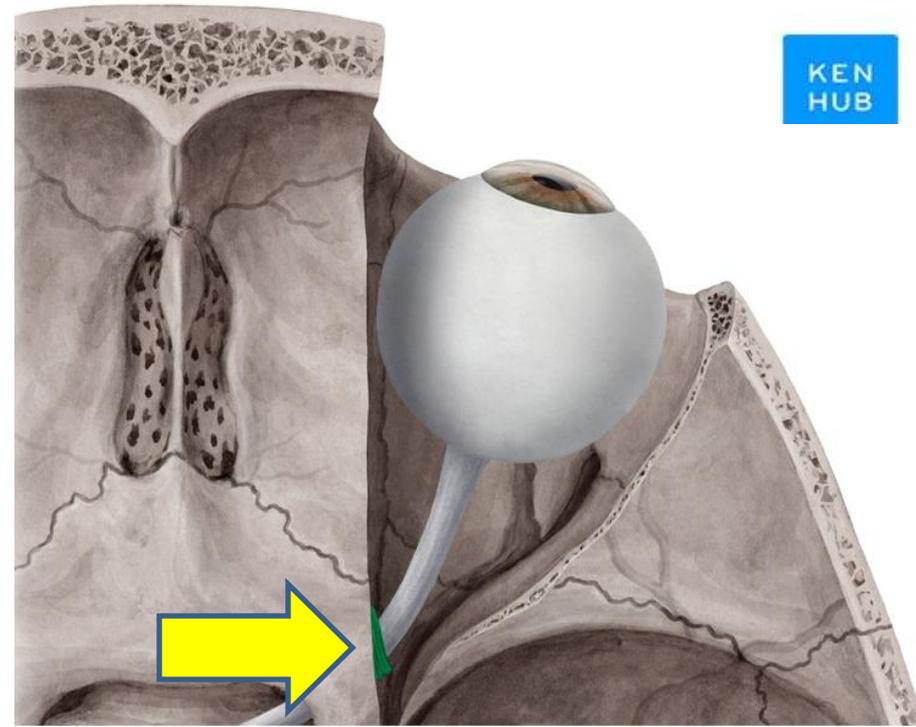
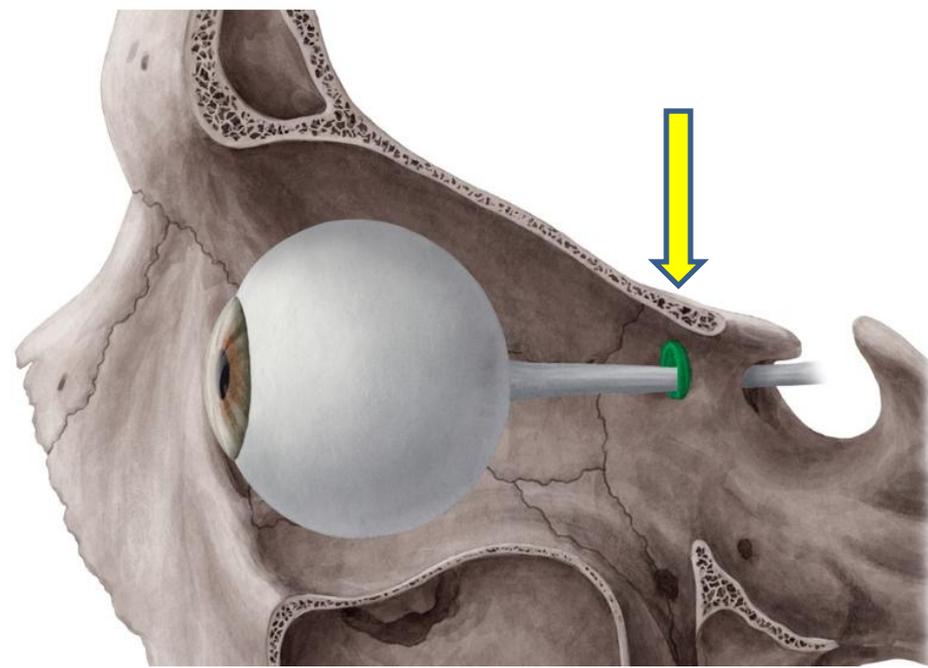
Pupil

Sclera



Orbital region, anterior

**Common tendinous ring** is a fibrous ring which surrounds the optic canal and part of the superior orbital fissure at the apex of the orbit. It is the common origin of the four recti muscles



# 1-Superior rectus

**Origin:** Superior part of common tendinous ring

**Insertion:** Anterior half of eyeball superiorly (*in front of the equator*)

**Nerve supply:** Oculomotor nerve/ superior division

**Action:** Elevation, adduction (Raises cornea upward and medially)

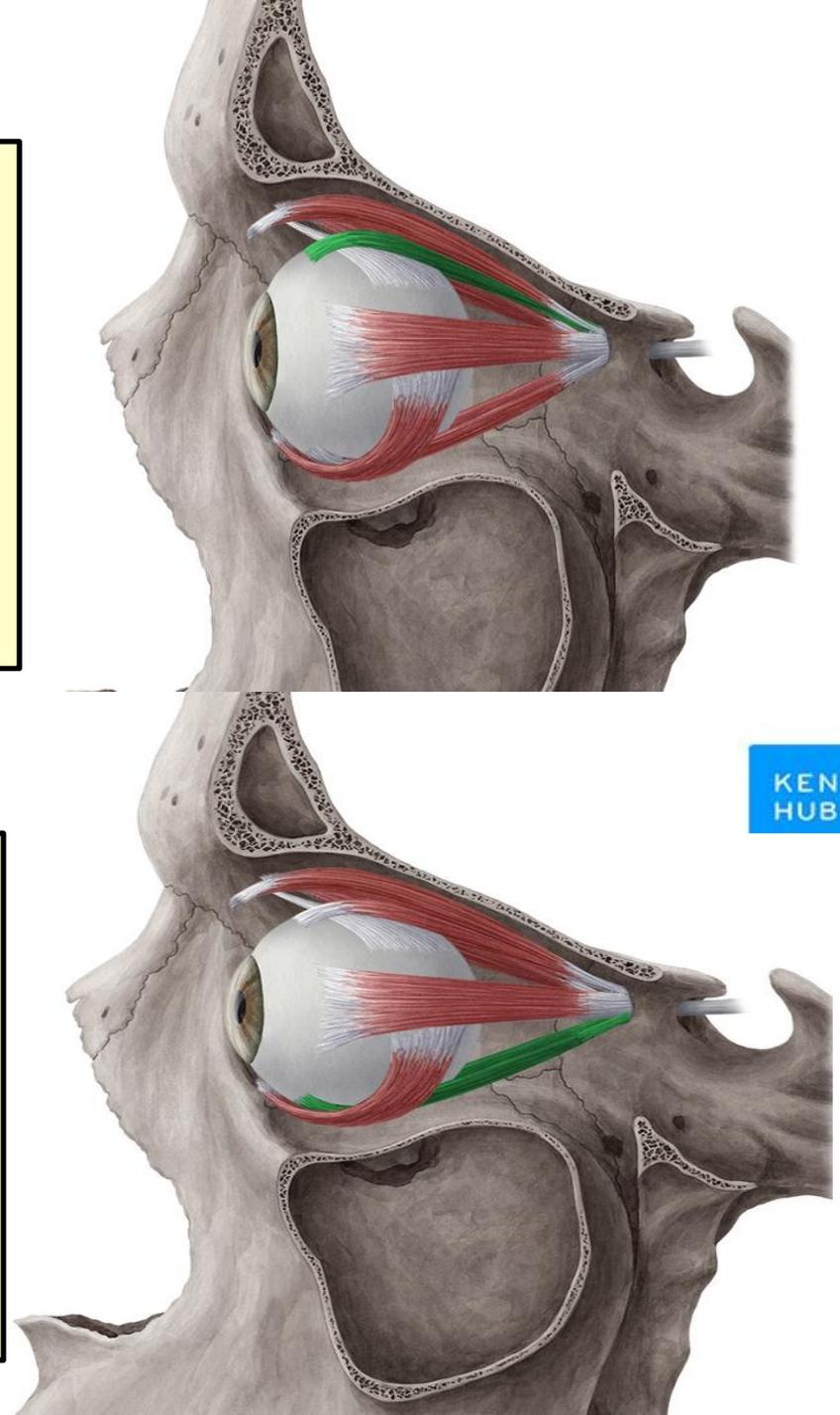
# 2-Inferior rectus

**Origin:** Inferior part of common tendinous ring

**Insertion:** Anterior half of eyeball inferiorly (*in front of the equator*)

**Nerve supply:** Oculomotor nerve /inferior division

**Action:** Depression, adduction (Depresses cornea downward and medially)



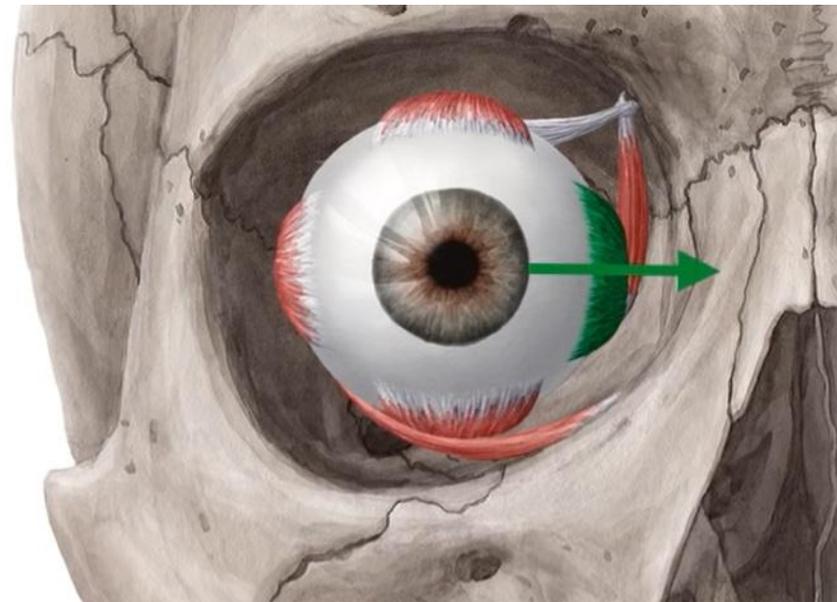
### 3-Medial rectus

**Origin:** Medial part of common tendinous ring

**Insertion:** Anterior half of eyeball medially (*in front of the equator*)

**Nerve supply:** Oculomotor nerve/ inferior division

**Action:** Adduction ((Rotates eyeball so that cornea looks medially))



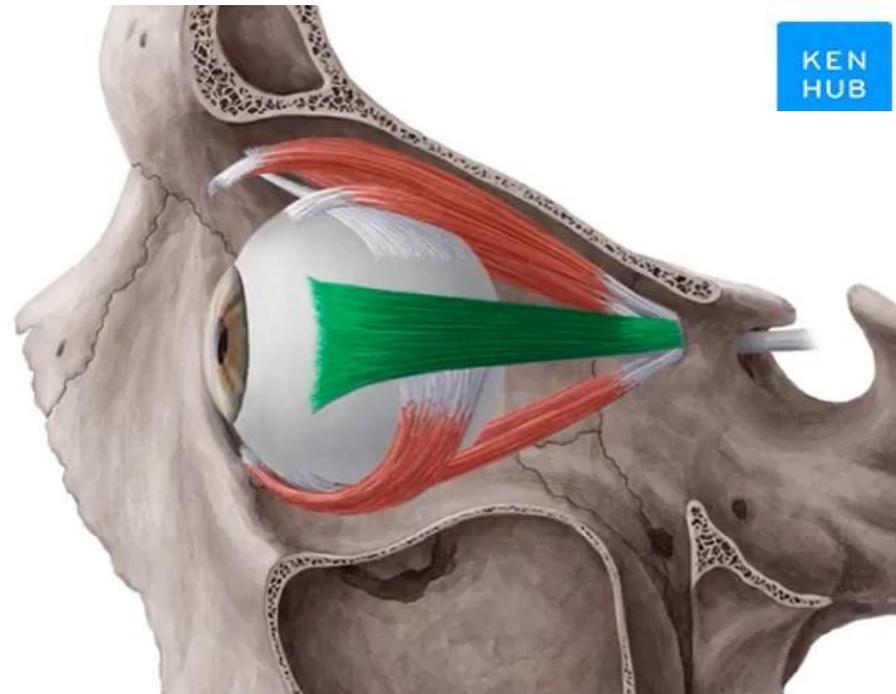
### 4-Lateral rectus

**Origin:** Lateral part of common tendinous ring

**Insertion:** Anterior half of eyeball laterally (*in front of the equator*)

**Nerve supply:** Abducent nerve [VI]

**Action:** Abduction (Rotates eyeball so that cornea looks laterally)



## 5-Superior oblique

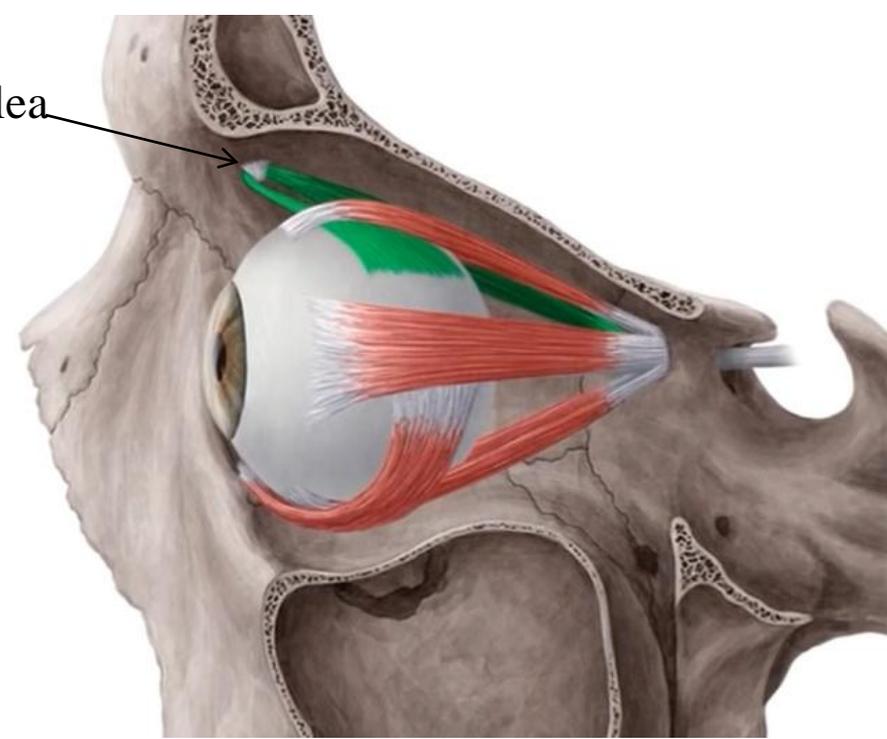
**Origin:** Posterior part of the roof

**Insertion:** Passes through pulley (trochlea) and is attached to lateral posterior half of eyeball (*behind the equator*)

**Nerve supply:** Trochlear nerve

**Action:** Depression, abduction, intorsion (Rotates eyeball so that cornea looks downward and laterally)

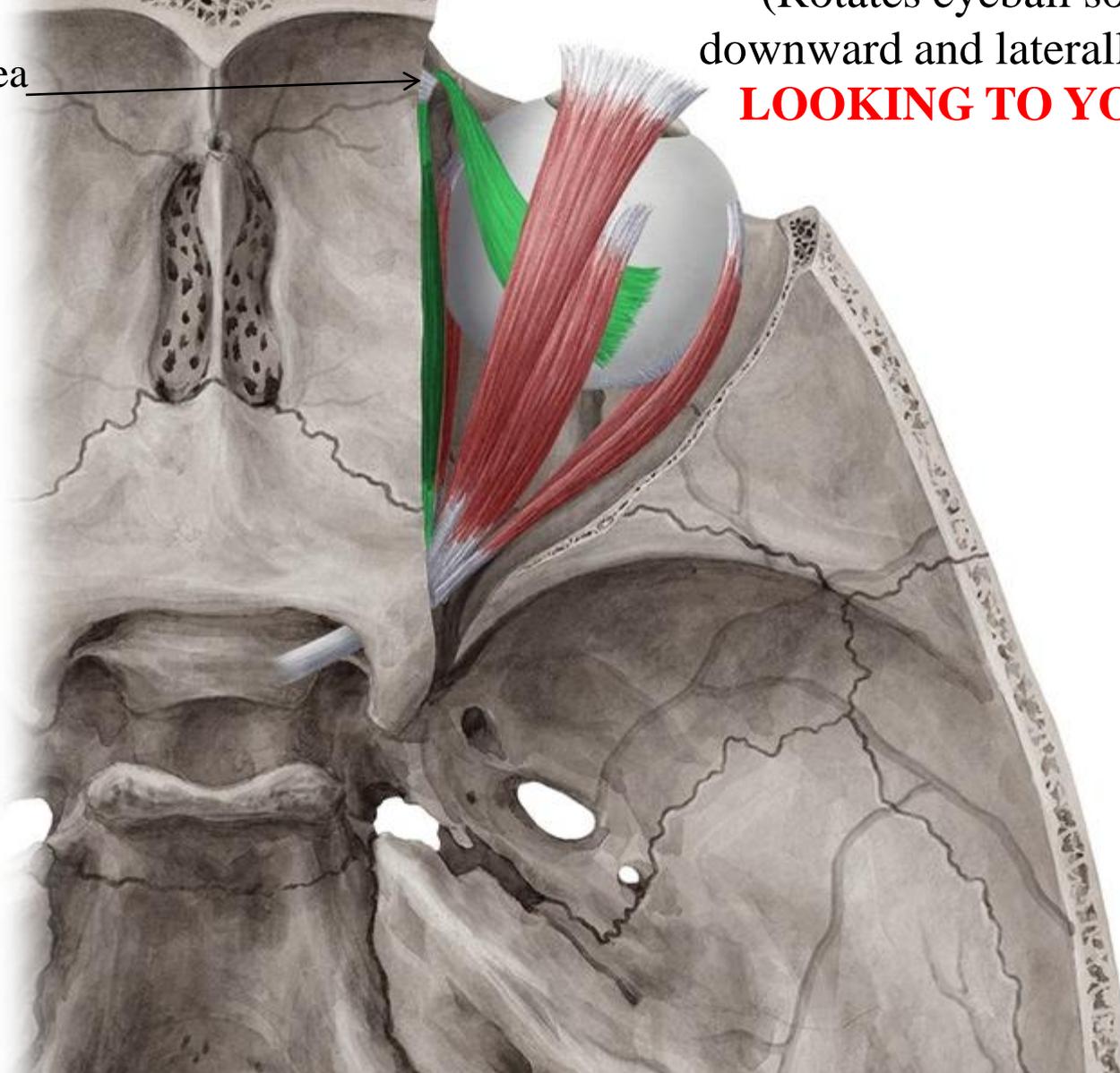
Trochlea



## 5-Superior oblique

(Rotates eyeball so that cornea looks downward and laterally) **AS IF YOU ARE LOOKING TO YOUR SHOULDER**

Trochlea



## 6-Inferior oblique

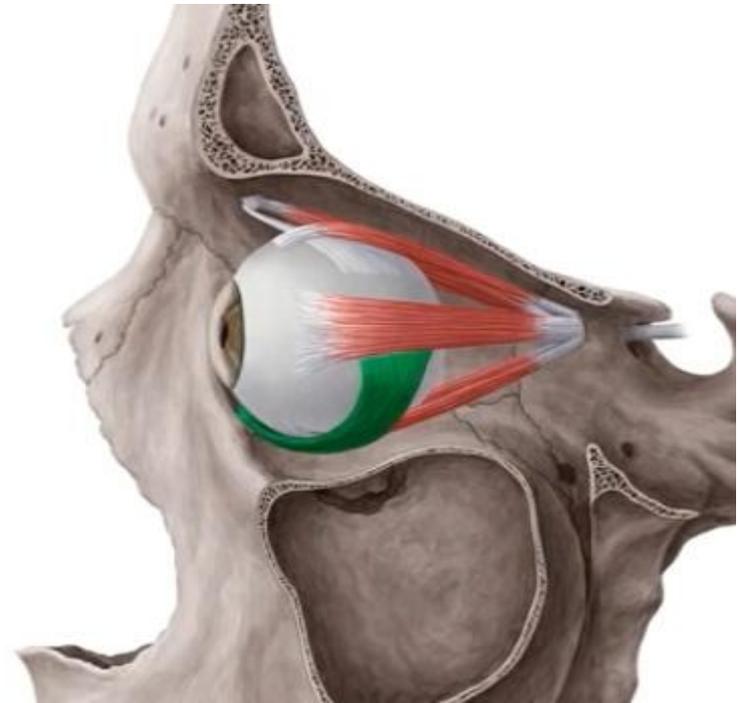
**Origin:** medial part of the floor (anteriorly)

**Insertion:** lateral posterior half of eyeball (*behind the equator*)

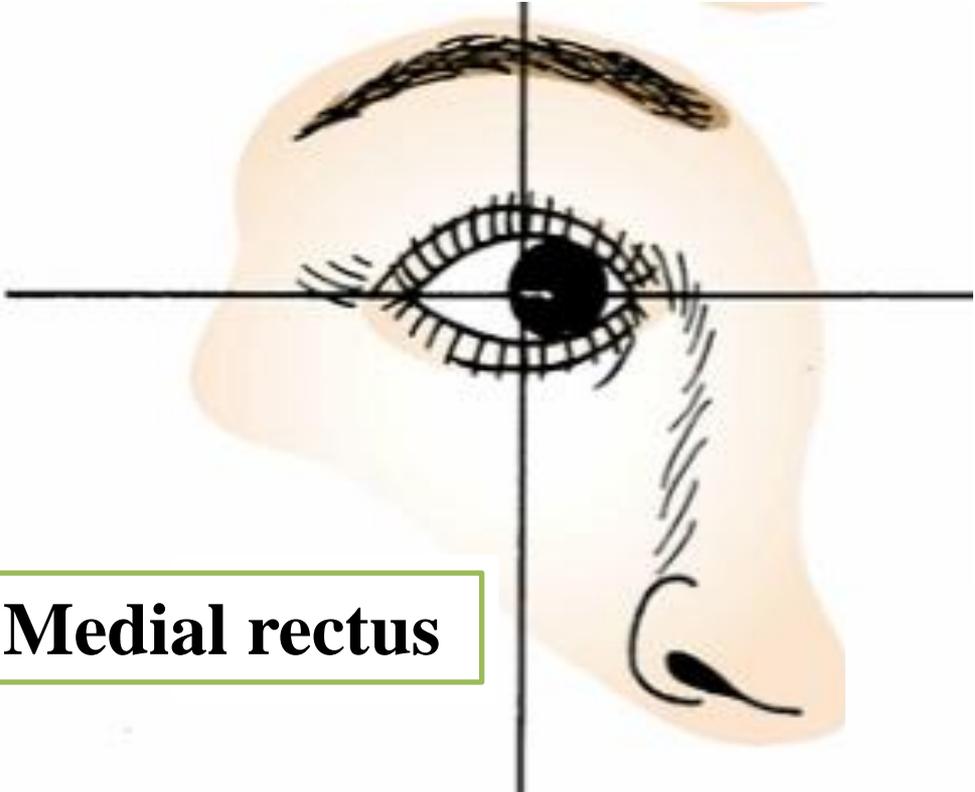
**Nerve supply:** Oculomotor nerve/ inferior division

**Action:** Elevation, abduction, extorsion

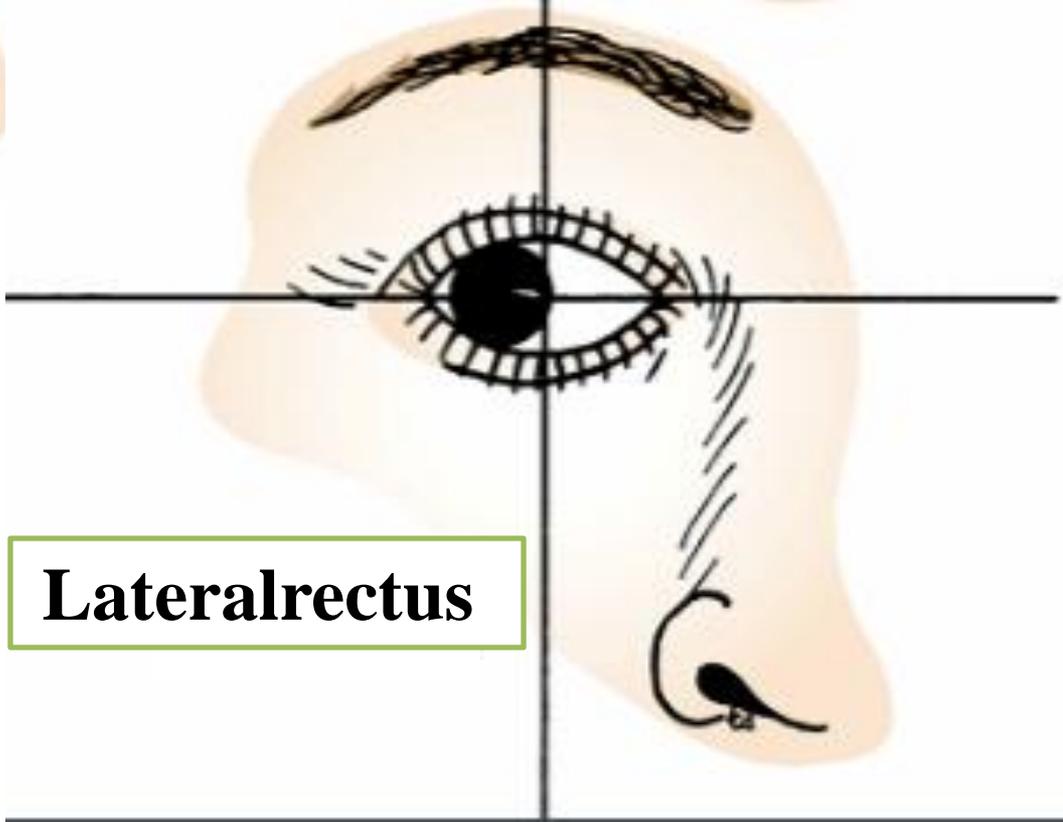
(Rotates eyeball so that cornea looks upward and laterally)

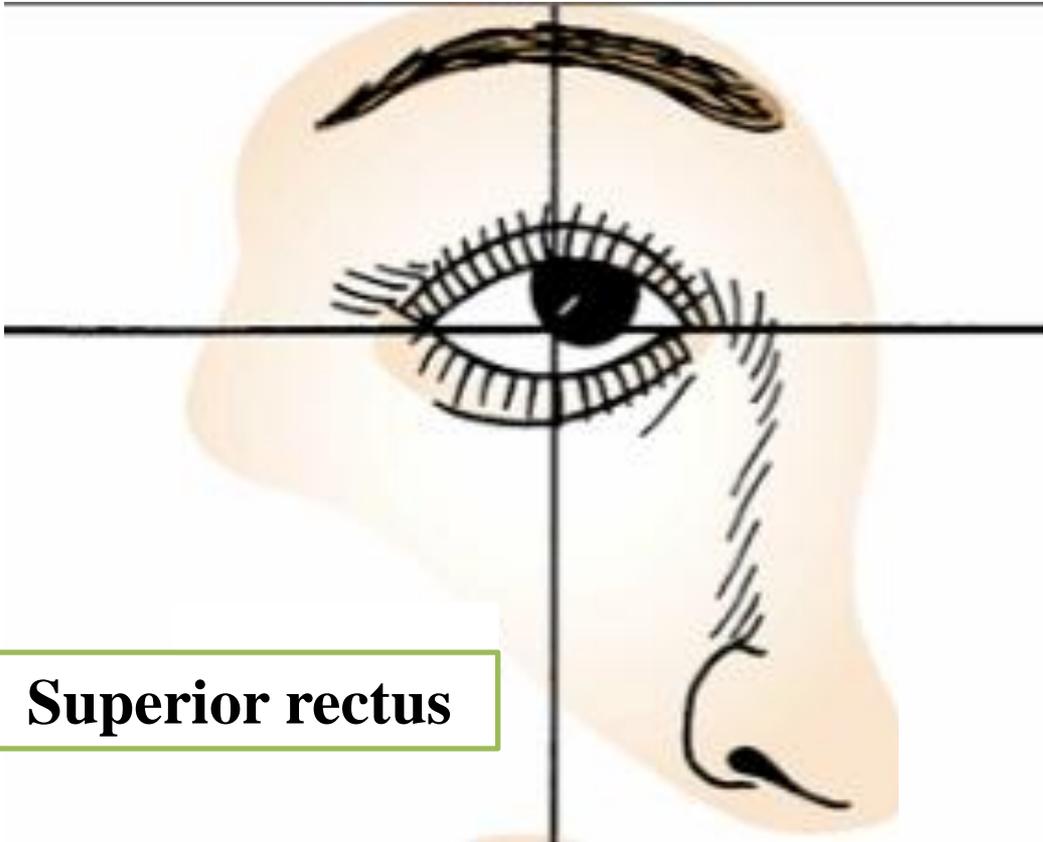


**Medial rectus**

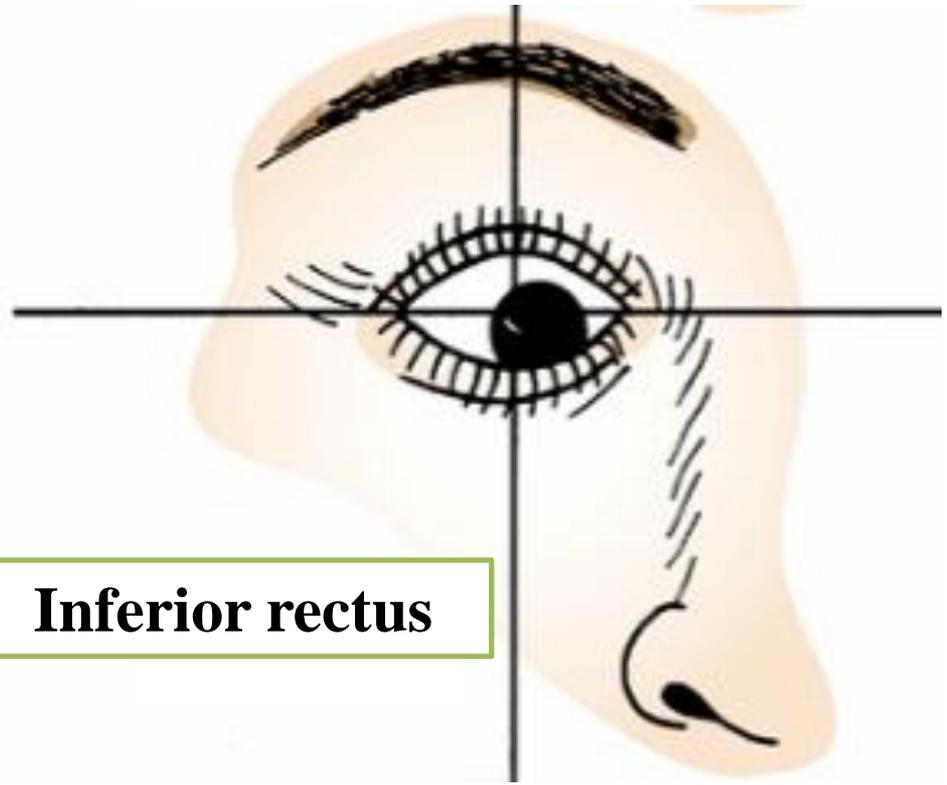


**Lateralrectus**

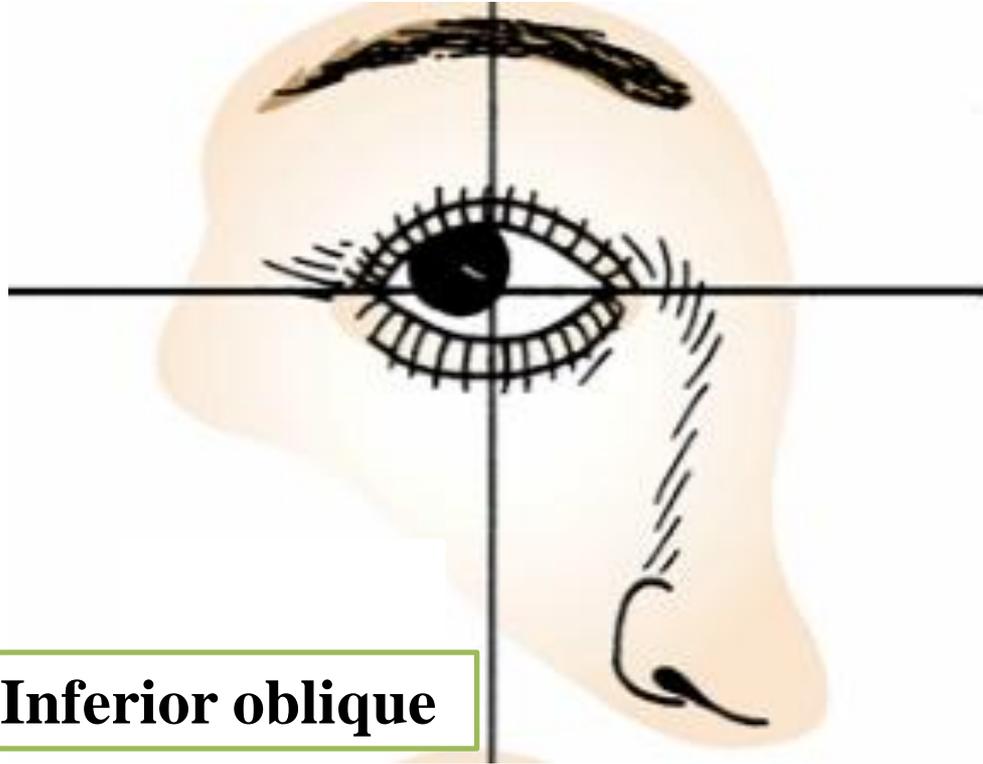




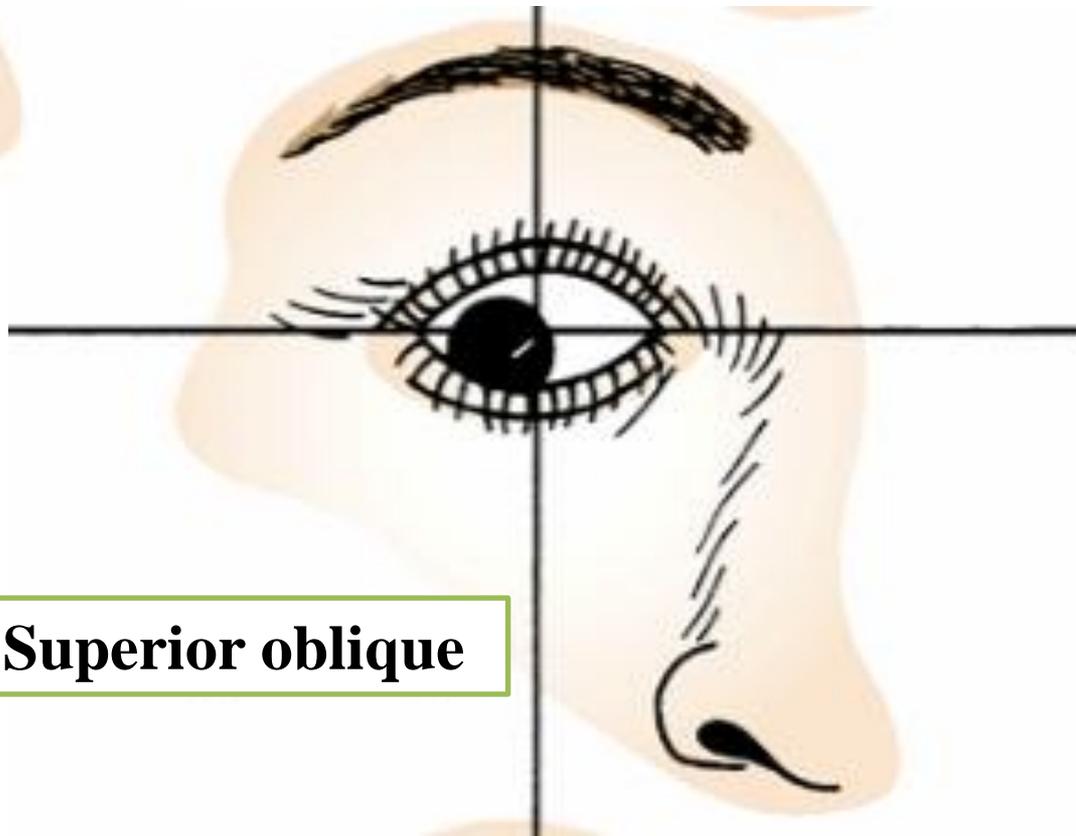
**Superior rectus**



**Inferior rectus**



**Inferior oblique**



**Superior oblique**



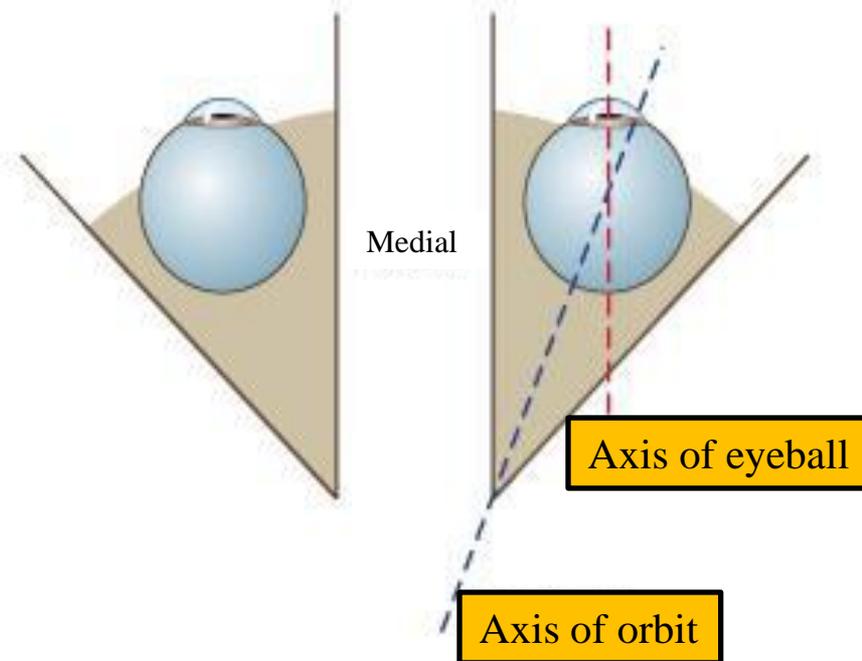
The extraocular muscles do not act in isolation. They work as teams of muscles in the coordinated movement of the eyeball to position the pupil as needed

*For example, although the lateral rectus is the muscle primarily responsible for moving the eyeball laterally, it is assisted in this action by the superior and inferior oblique muscles*

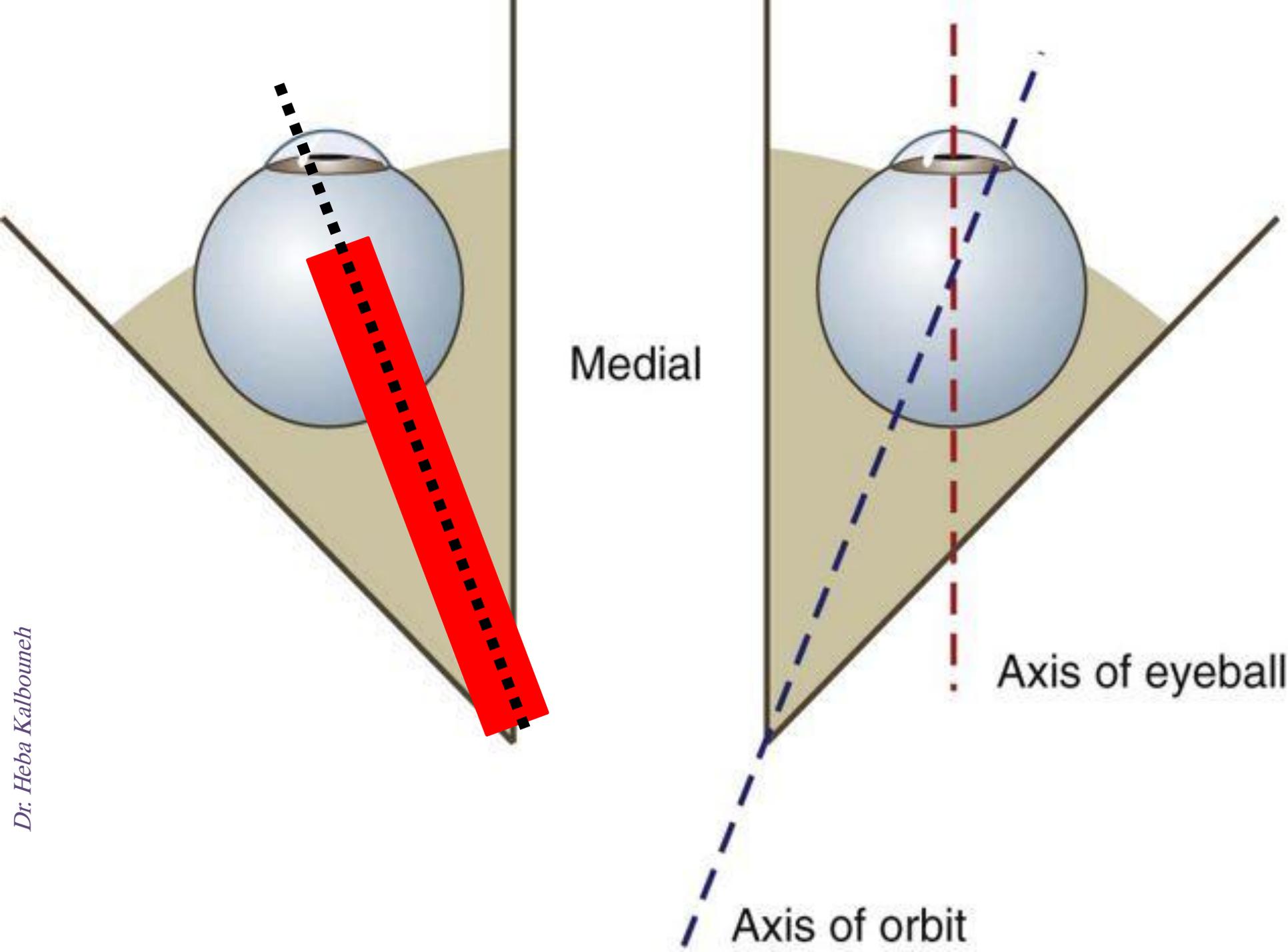
The origins of the superior and inferior recti are situated about  $23^\circ$  medial to their insertions, and, therefore, when the patient is asked to turn the cornea laterally, these muscles are placed in the optimum position to raise (superior rectus) or lower (inferior rectus) the cornea

The superior and inferior oblique muscles can be tested. The pulley (trochlea) of the superior oblique and the origin of the inferior oblique muscles lie medial and anterior to their insertions. The physician tests the action of these muscles by asking the patient first to look medially, thus placing these muscles in the optimum position to lower (superior oblique) or raise (inferior oblique) the cornea

Because the lateral and medial recti are simply placed relative to the eyeball, asking the patient to turn his or her cornea directly laterally tests the lateral rectus and turning the cornea directly medially tests the medial rectus



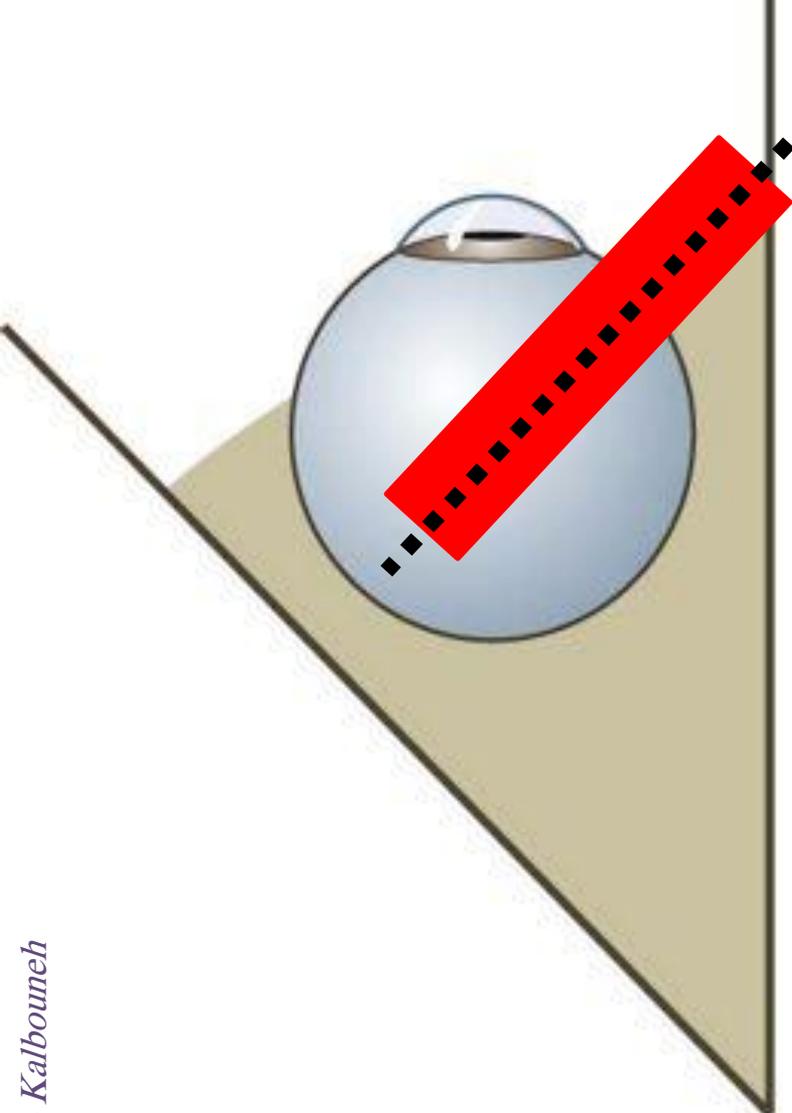
Direction to move eye  
when testing the  
extraocular muscles



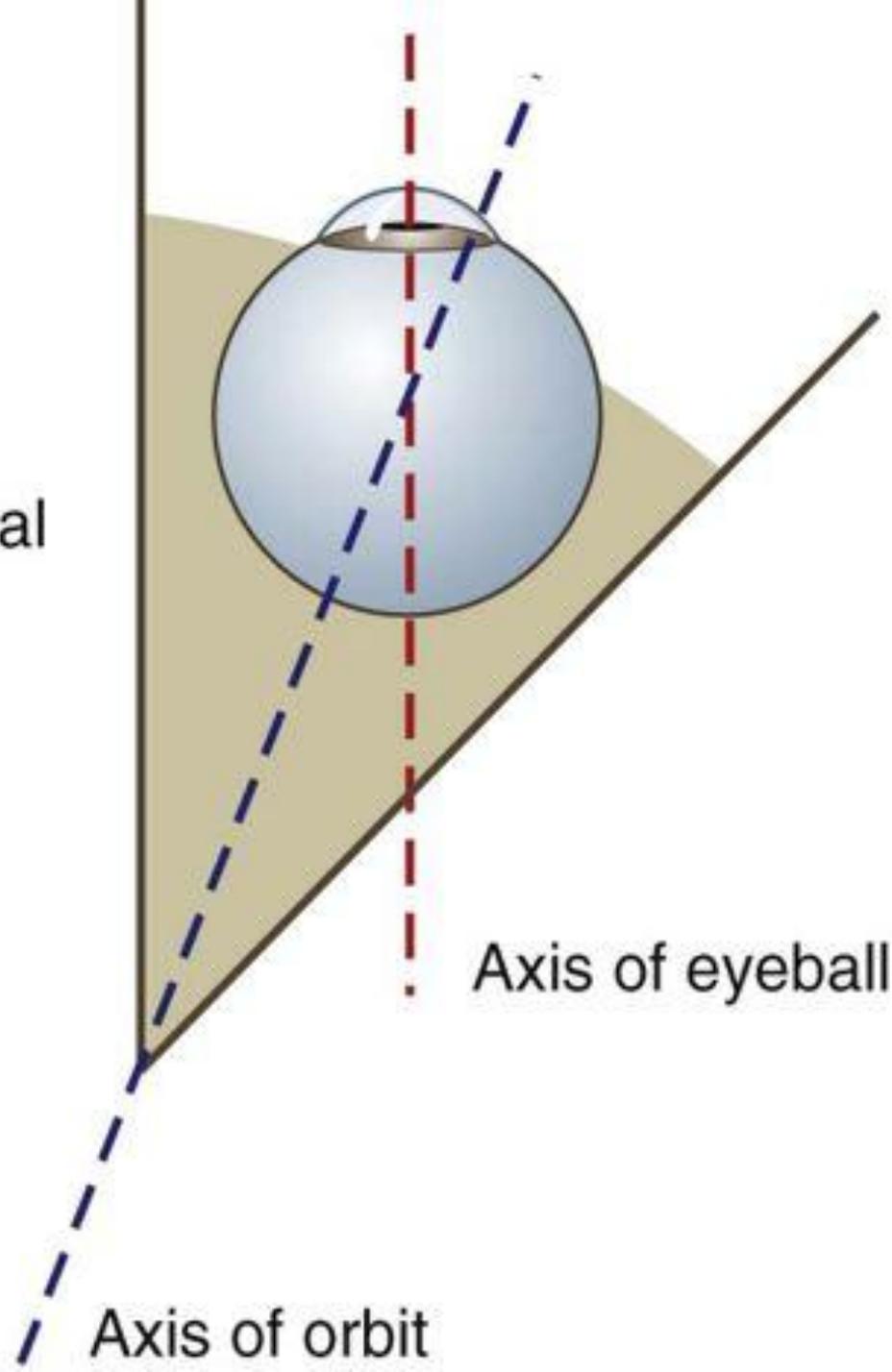
Medial

Axis of eyeball

Axis of orbit

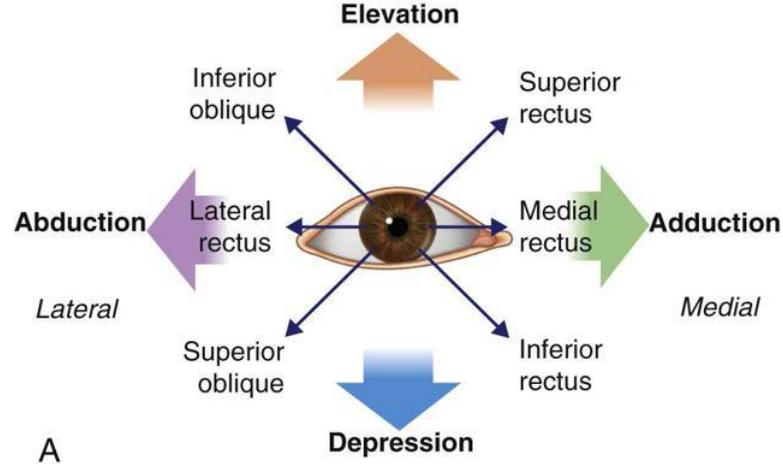


Medial



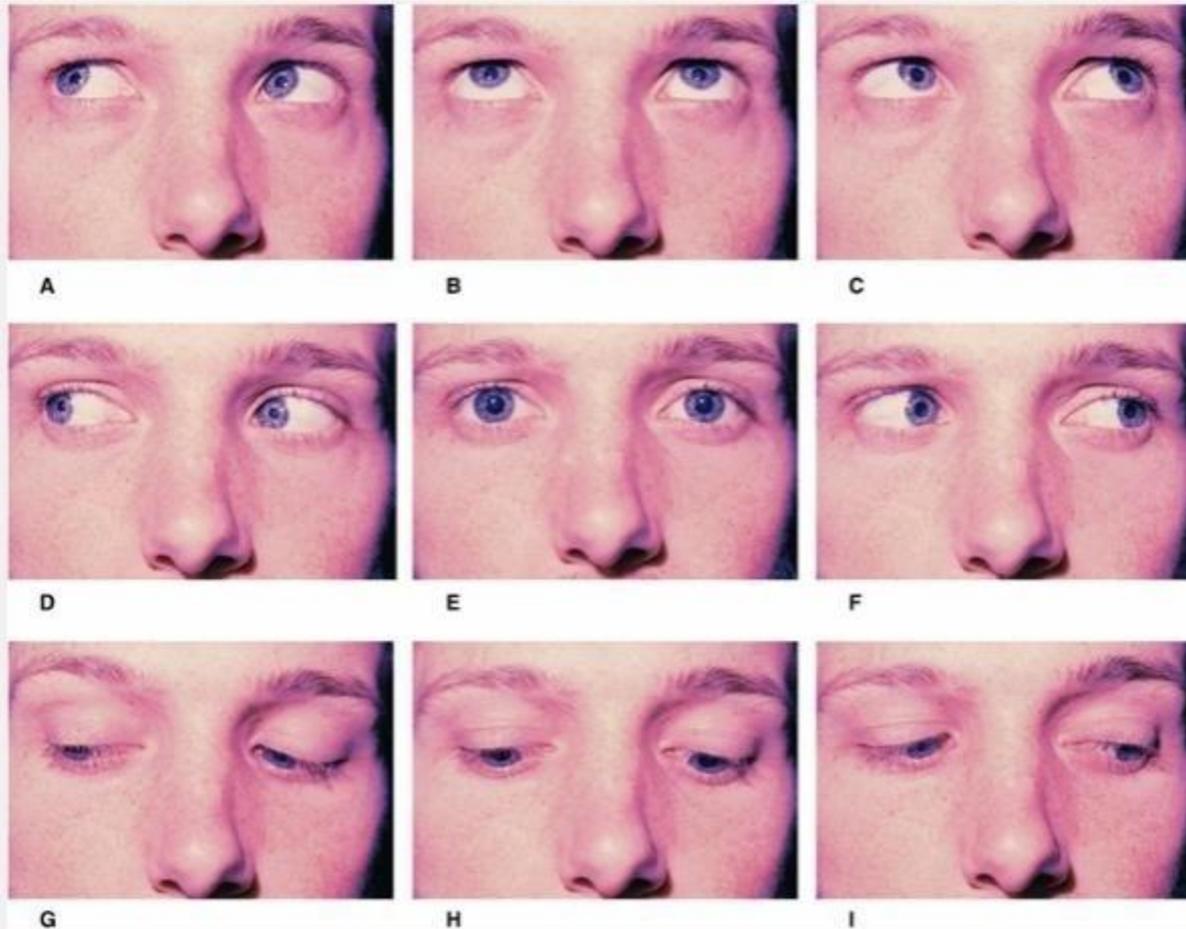
Axis of eyeball

Axis of orbit



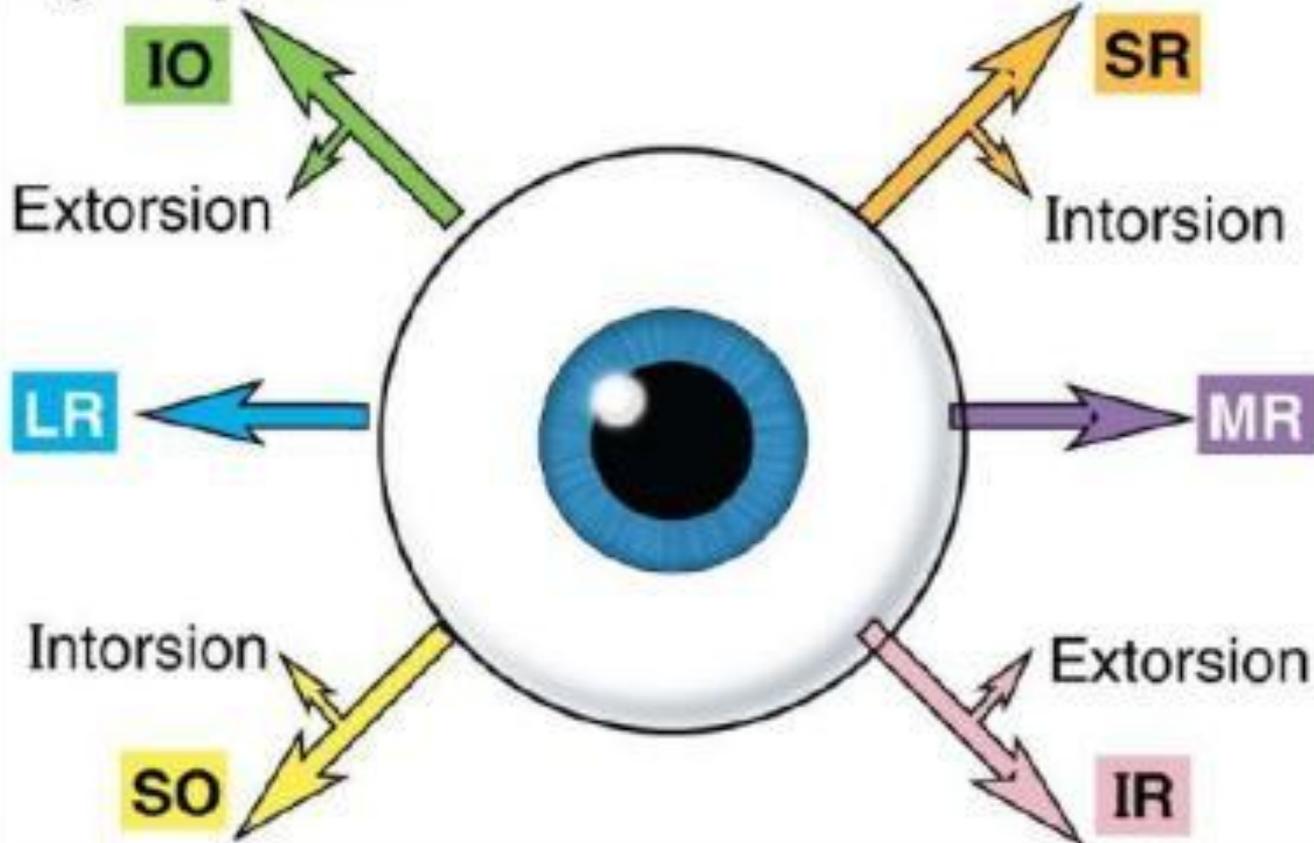
Muscle tested		Direction to move eye when testing muscle
Superior rectus		Look laterally and <b>upward</b>
Inferior rectus		Look laterally and <b>downward</b>
Lateral rectus		Look <b>laterally</b>
Medial rectus		Look <b>medially</b>
Inferior oblique		Look medially and <b>upward</b>
Superior oblique		Look medially and <b>downward</b>

**B**



**Figure 11-24** The cardinal positions of the right and left eyes and the actions of the recti and oblique muscles principally responsible for the movements of the eyes. **A.** Right eye, superior rectus muscle; left eye, inferior oblique muscle. **B.** Both eyes, superior recti and inferior oblique muscles. **C.** Right eye, inferior oblique muscle; left eye, superior rectus muscle. **D.** Right eye, lateral rectus muscle; left eye, medial rectus muscle. **E.** Primary position, with the eyes fixed on a distant fixation point. **F.** Right eye, medial rectus muscle; left eye, lateral rectus muscle. **G.** Right eye, inferior rectus muscle; left eye, superior oblique muscle. **H.** Both eyes, inferior recti and superior oblique muscles. **I.** Right eye, superior oblique muscle; left eye, inferior rectus muscle.

**Right eyeball:**



Inferior muscles-----Extorsion  
Superior muscles----- Intorsion

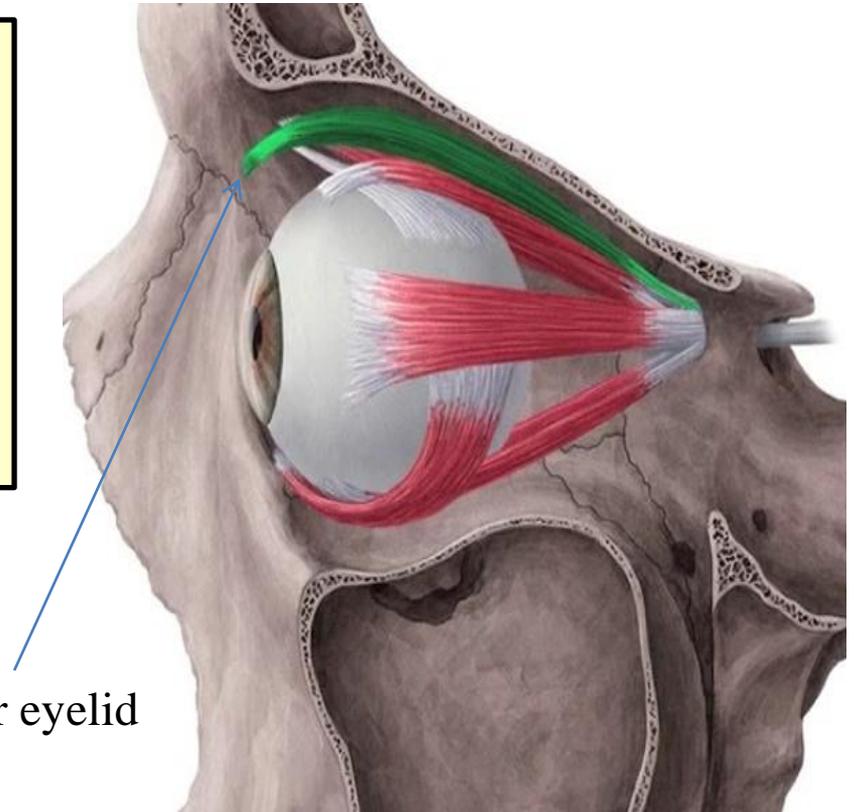
# LEVATOR PALPEBRAE SUPERIORIS

**Origin:** Posterior part of the roof

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

**Nerve supply:** Oculomotor nerve/  
superior branch

**Action:** Elevation of upper eyelid



Into upper eyelid

# Nerves of orbit

## Motor

1. **Oculomotor**
2. **Trochlear**
3. **Abducent**

## Sensory

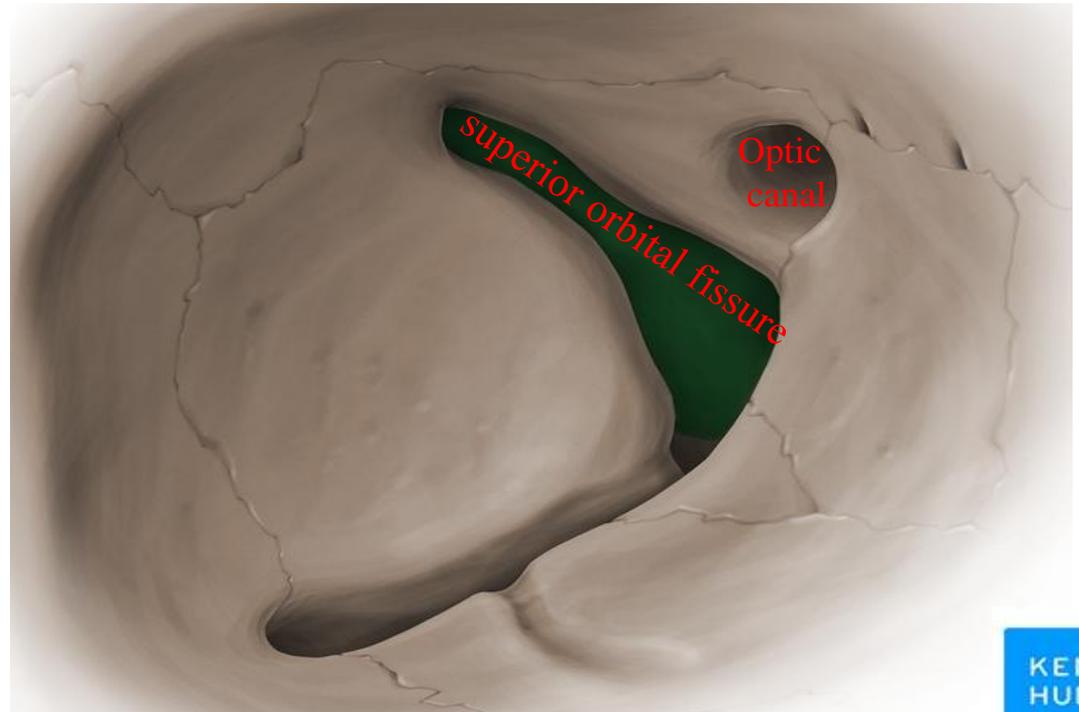
1. **Ophthalmic**  
(General sensations)
2. **Optic**  
(Special sensations)

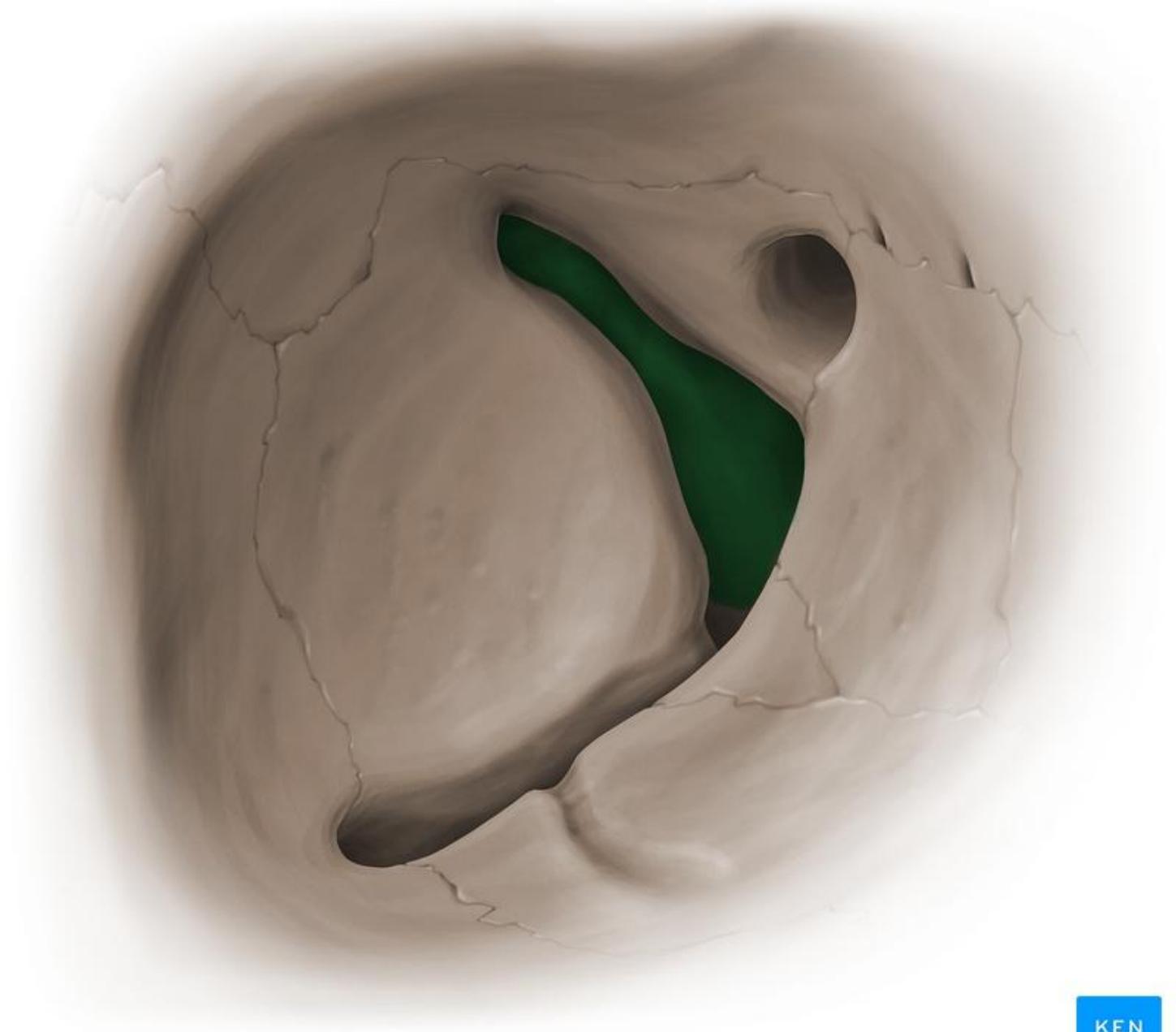
Lacrimal

Frontal

Nasociliary

**SO4LR6**





# LEVATOR PALPEBRAE SUPERIORIS

Superior rectus

Superior oblique

Lateral rectus

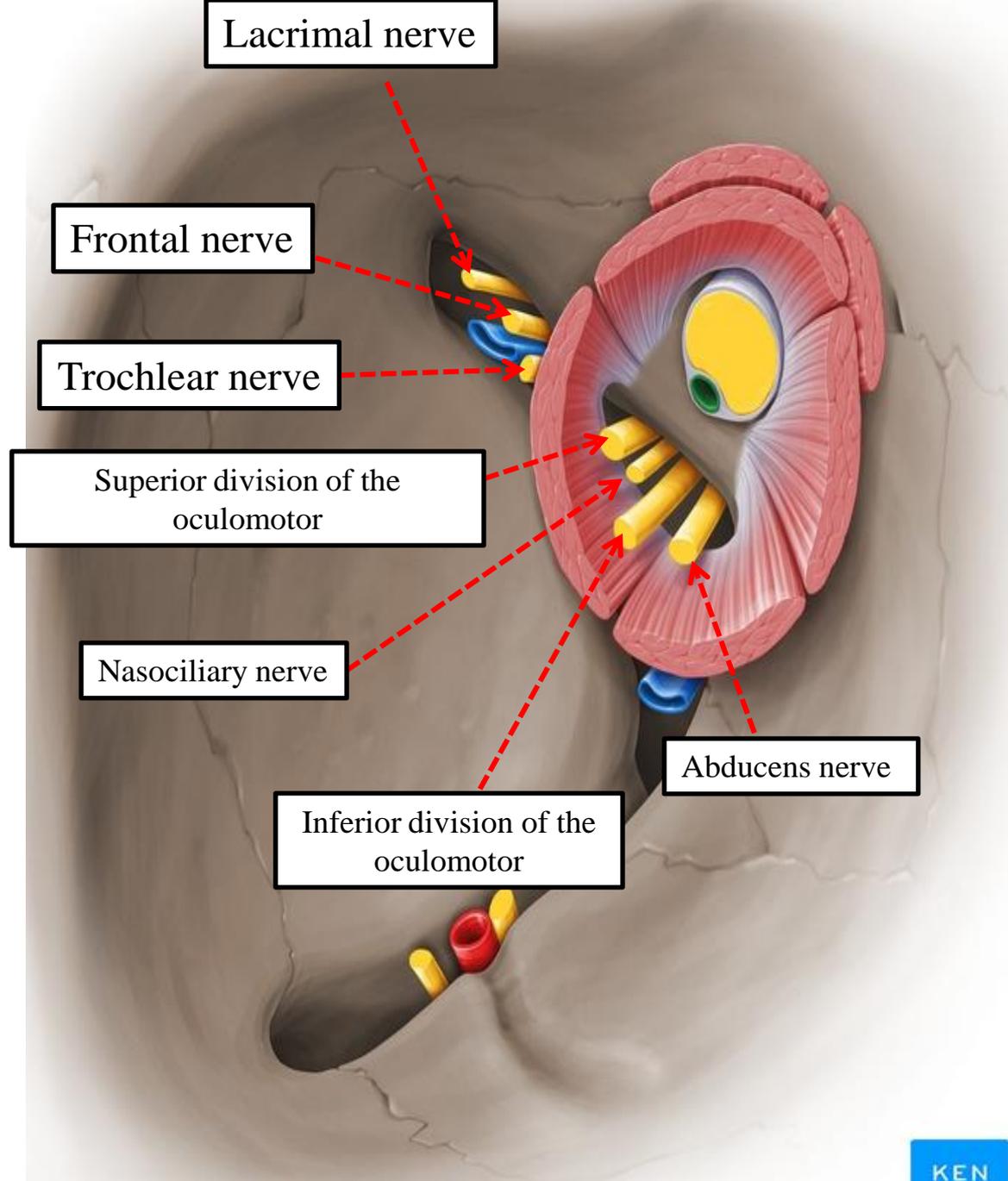
Medial rectus

Inferior rectus

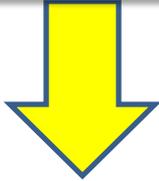
The tendinous ring surrounds the optic canal and the medial margin of superior orbital fissure

# Nerves of orbit

**L**ive  
**F**ree  
**T**o  
**S**ee  
**N**o  
**I**nsult  
**A**t All



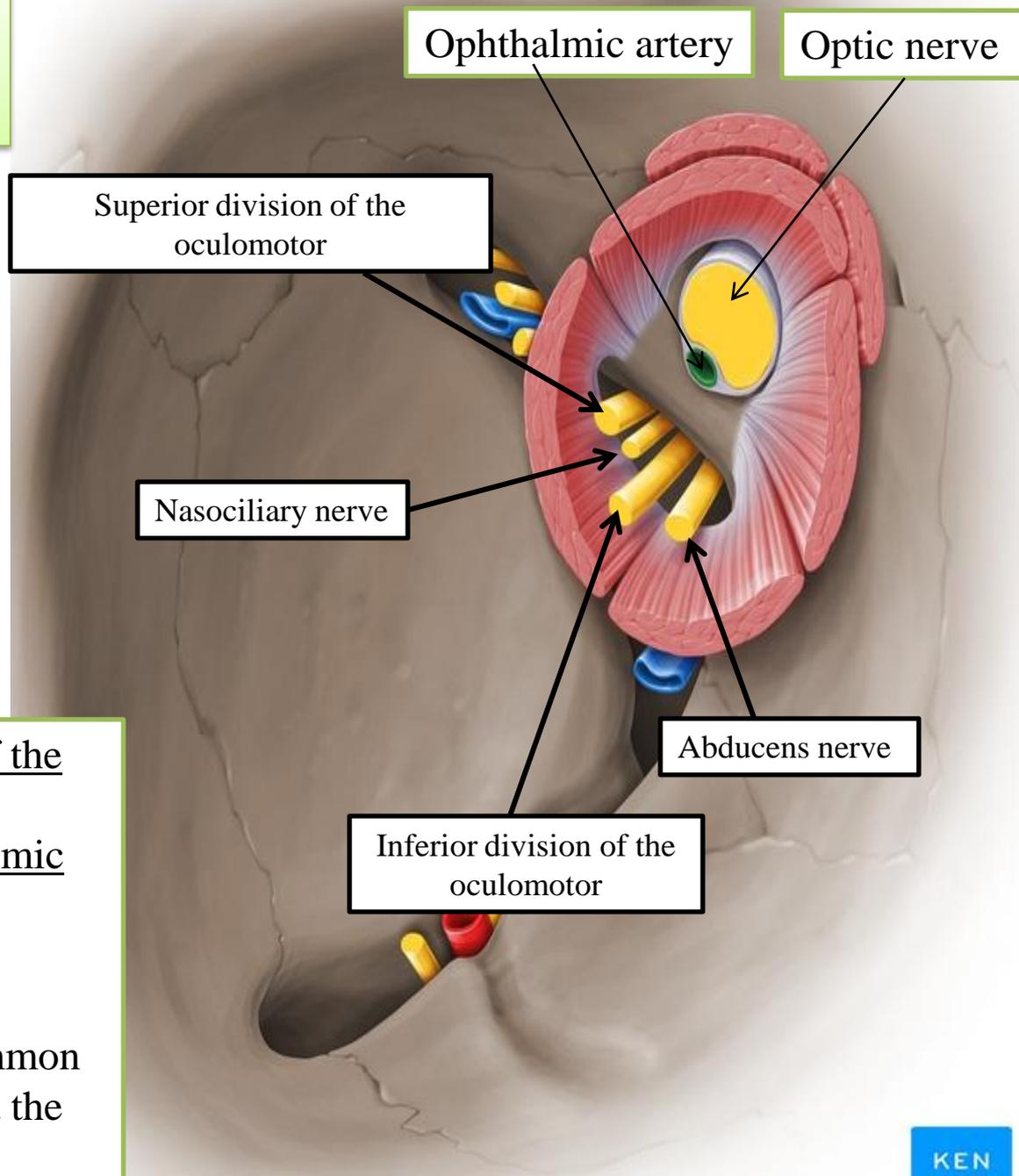
Lie within the common tendinous ring



Optic nerve  
Ophthalmic artery  
enter the orbit via the **optic canal**, and so lie **within** the common tendinous ring

Superior and inferior divisions of the oculomotor nerve  
Nasociliary branch of the ophthalmic nerve  
Abducens nerve

also enter the orbit **within** the common tendinous ring, but they do so via the **superior orbital fissure**

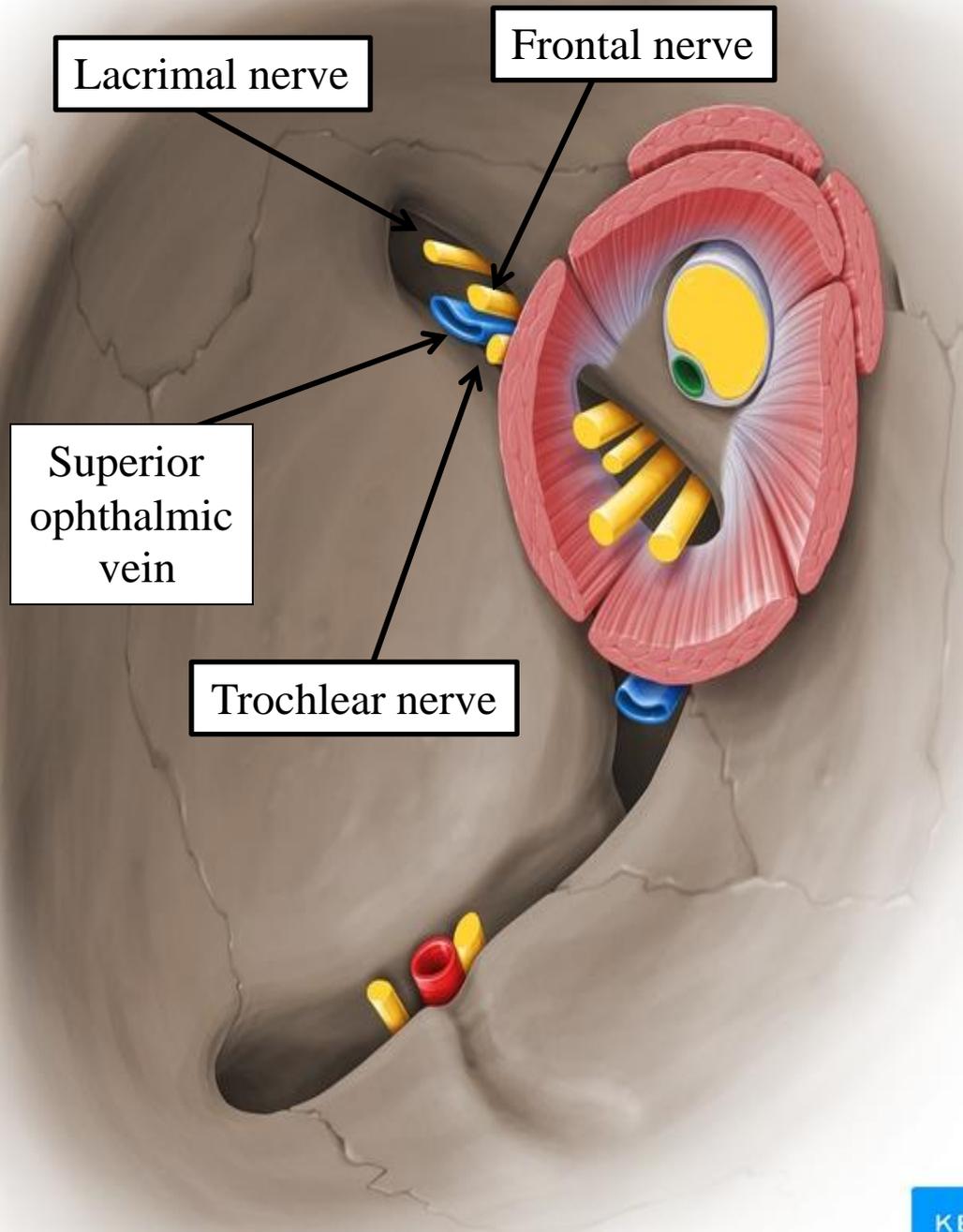


Lie outside the common tendinous ring



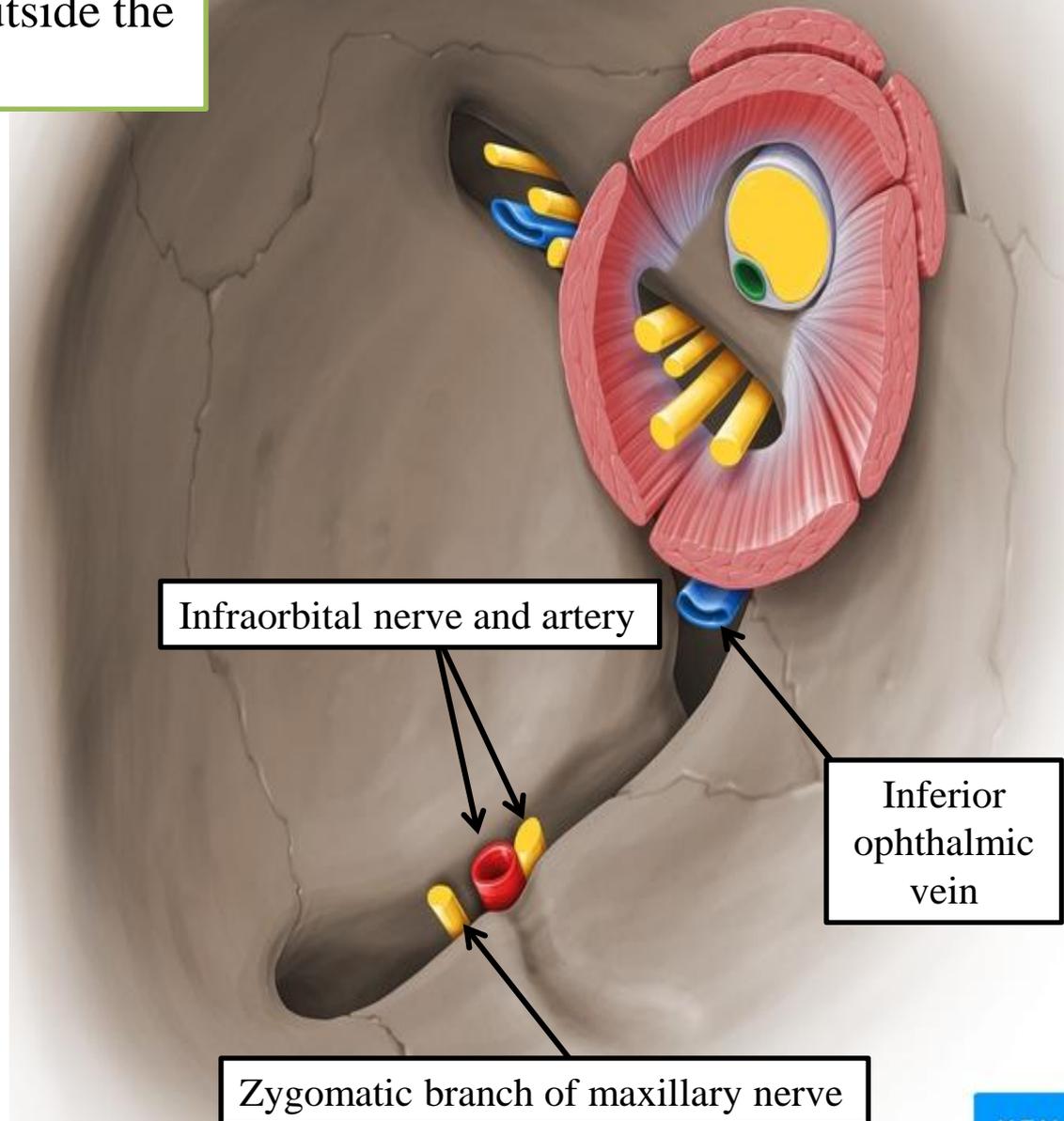
Trochlear nerve  
Frontal branch of ophthalmic nerve  
Lacrimal branch of ophthalmic nerve  
Superior ophthalmic vein

all enter the orbit through the **superior orbital fissure** but lie **outside** the common tendinous ring



Structures which enter the orbit through the **inferior orbital fissure** lie outside the common tendinous ring.

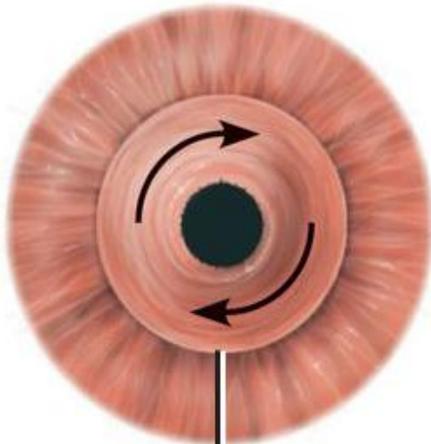
The close anatomical relationship of the optic nerve and other cranial nerves at the orbital apex means that lesions in this region may lead to a combination of visual loss from optic neuropathy and ophthalmoplegia from multiple cranial nerve involvement



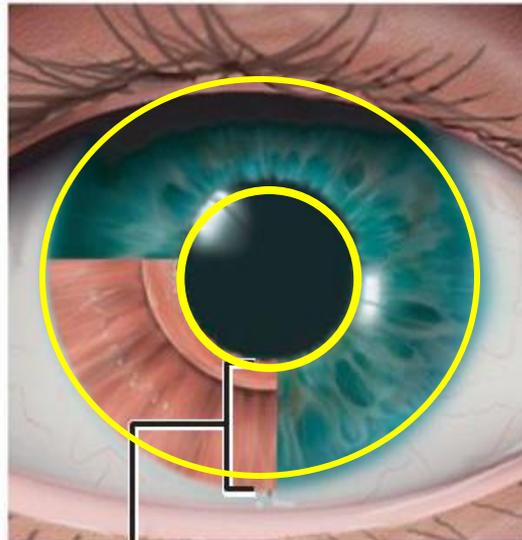
The **intrinsic** muscles include  
**CILIARY MUSCLE**  
**SPHINCTER PUPILLAE**  
**DILATOR PUPILLAE**

**Ciliary muscle:** Controls the shape of lens; in accommodation, makes lens more globular  
Supplied by Parasympathetic via oculomotor nerve

**Parasympathetic +**



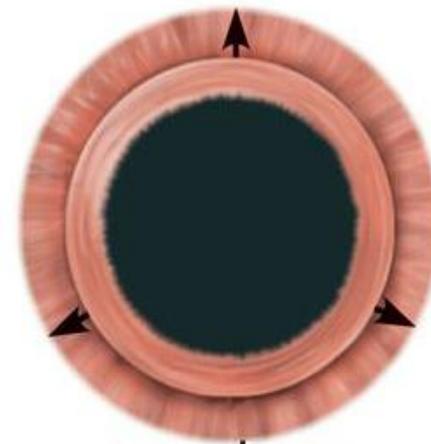
**Sphincter pupillae**  
Constricts pupil



**Iris (two muscles)**

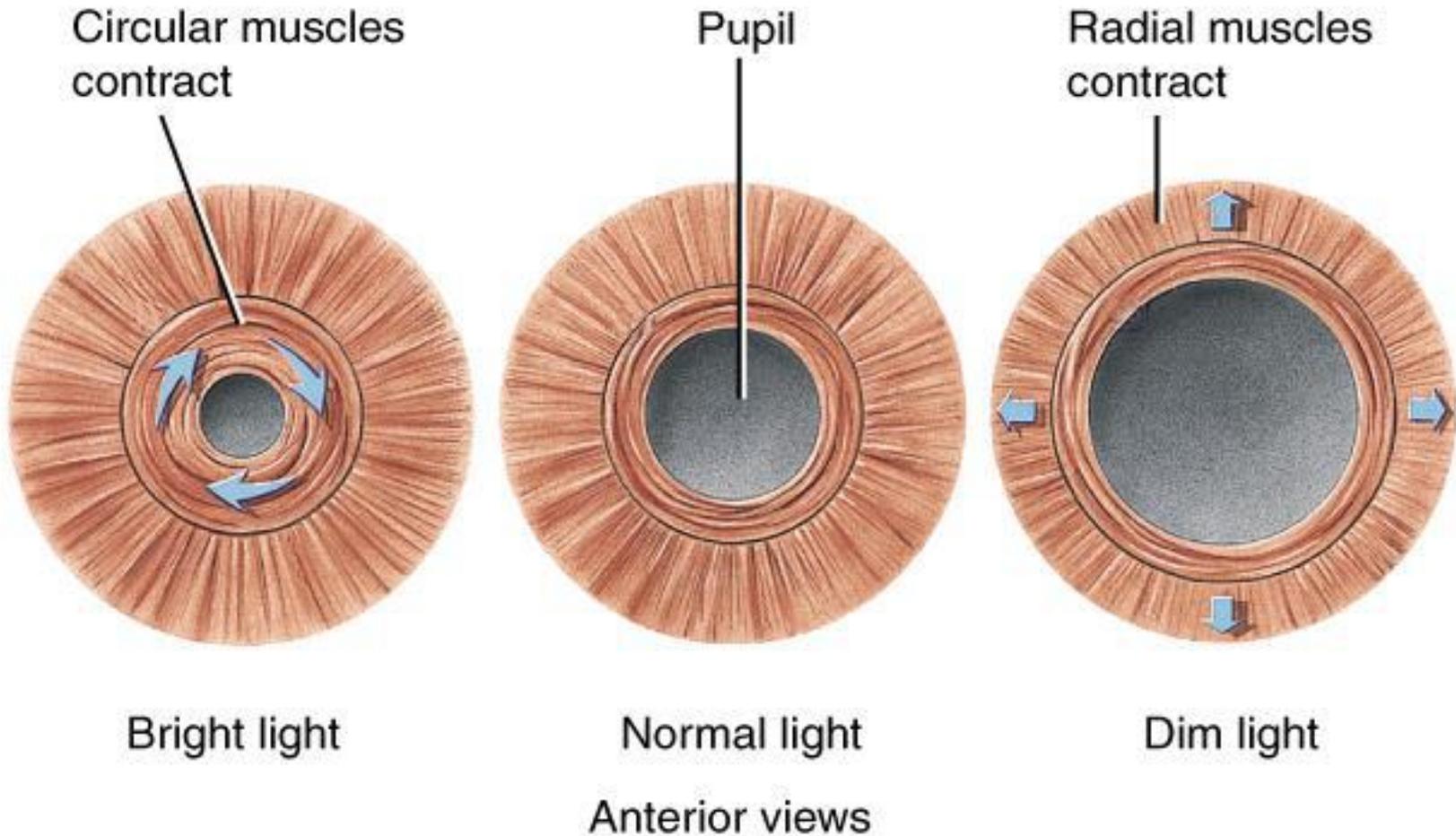
- Sphincter pupillae
- Dilator pupillae

**Sympathetic +**



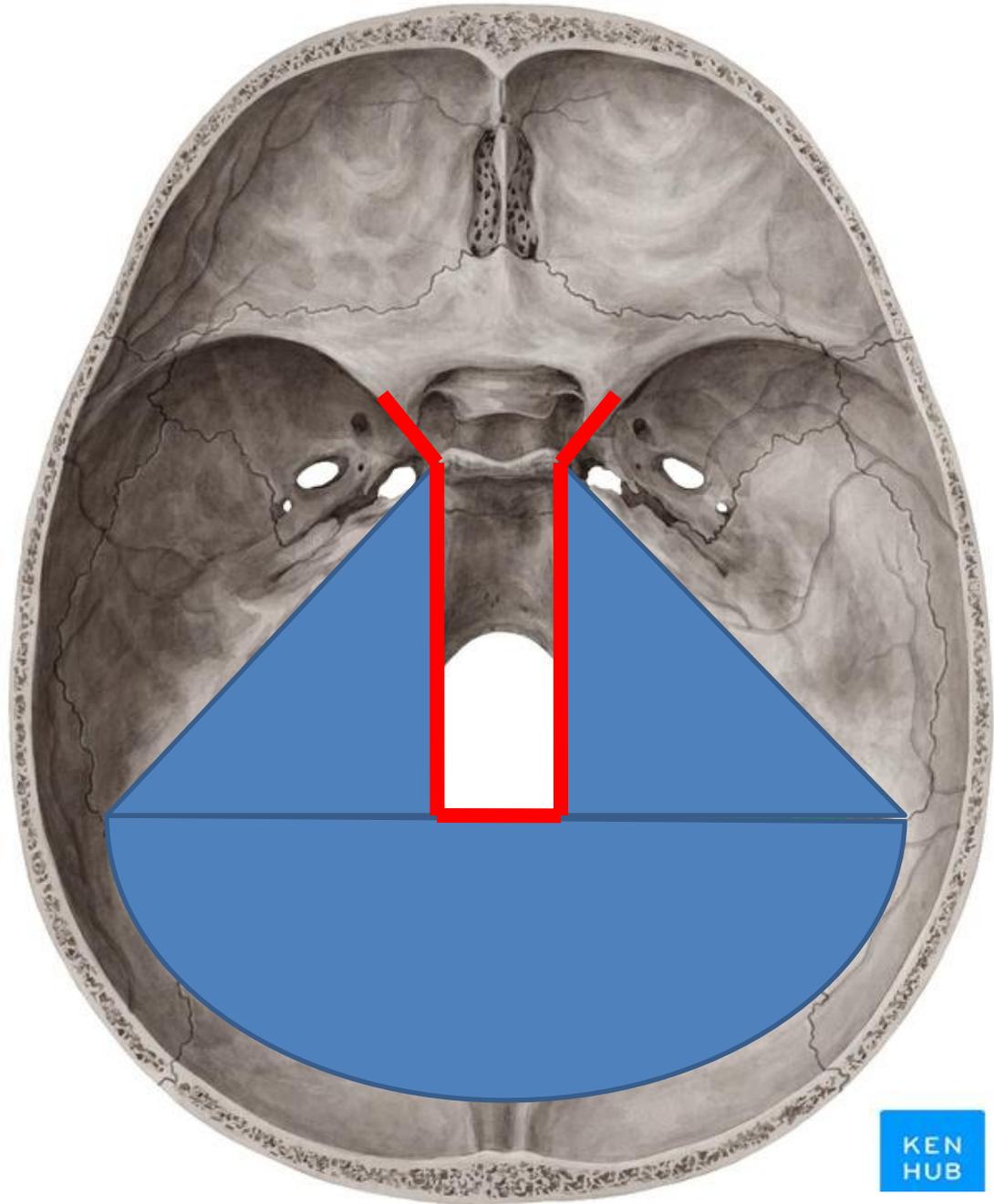
**Dilator pupillae**  
Dilates pupil

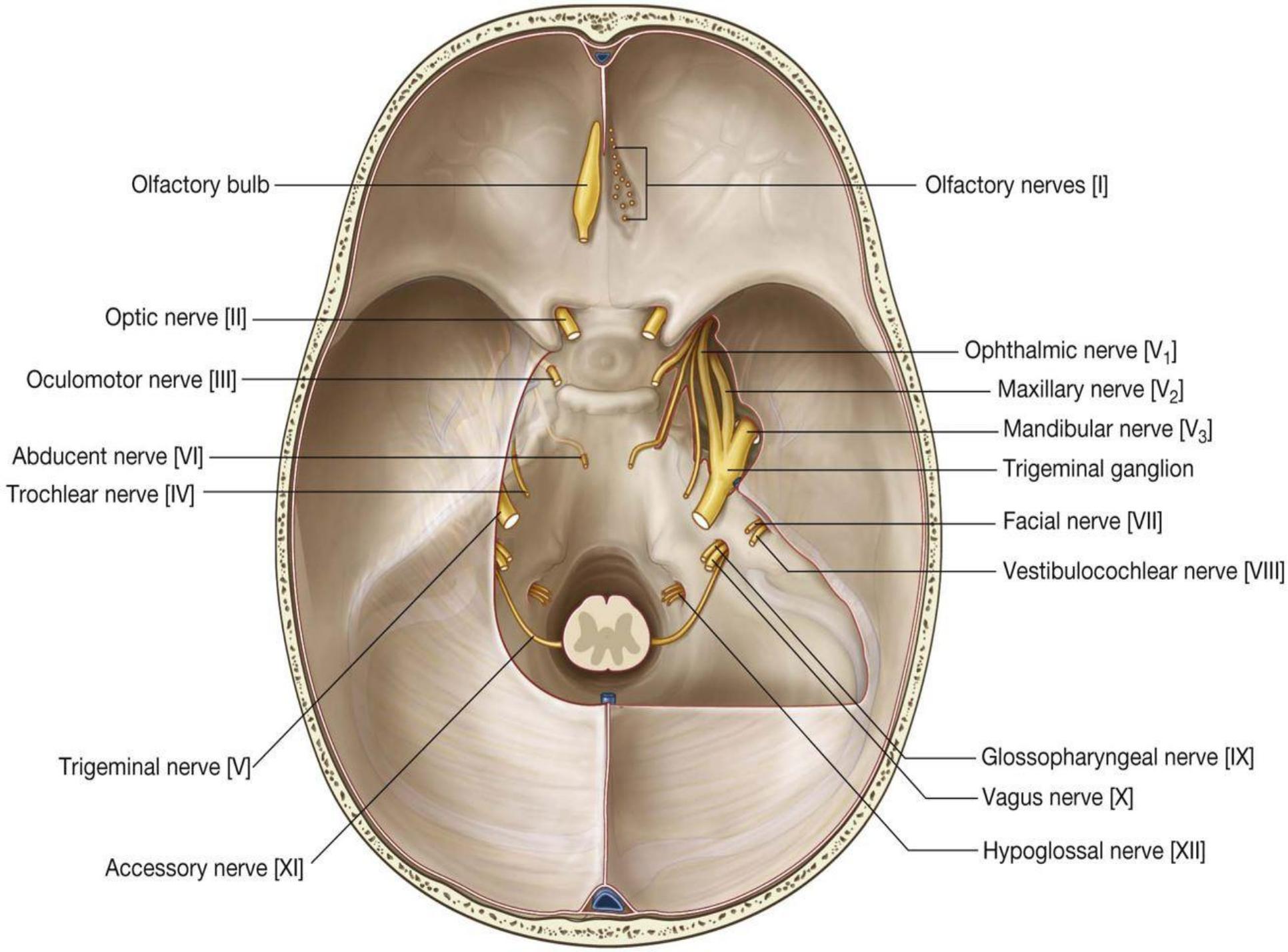
# Intrinsic Eye Muscles and their response to light



At the apex of petrous bone, the free border of tentorium cerebelli crosses over the attached border

At this point, the third and fourth cranial nerves pass forward to enter the lateral wall of the cavernous sinus

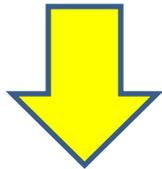




CT-Brain

Epidural Hemorrhage

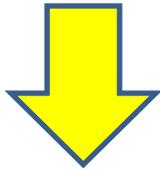
May  
Cause



**Temporal Lobe  
Herniation**



Remember that the dura is a tough structure and its tentorium as well, thus one should think about it as a real septa



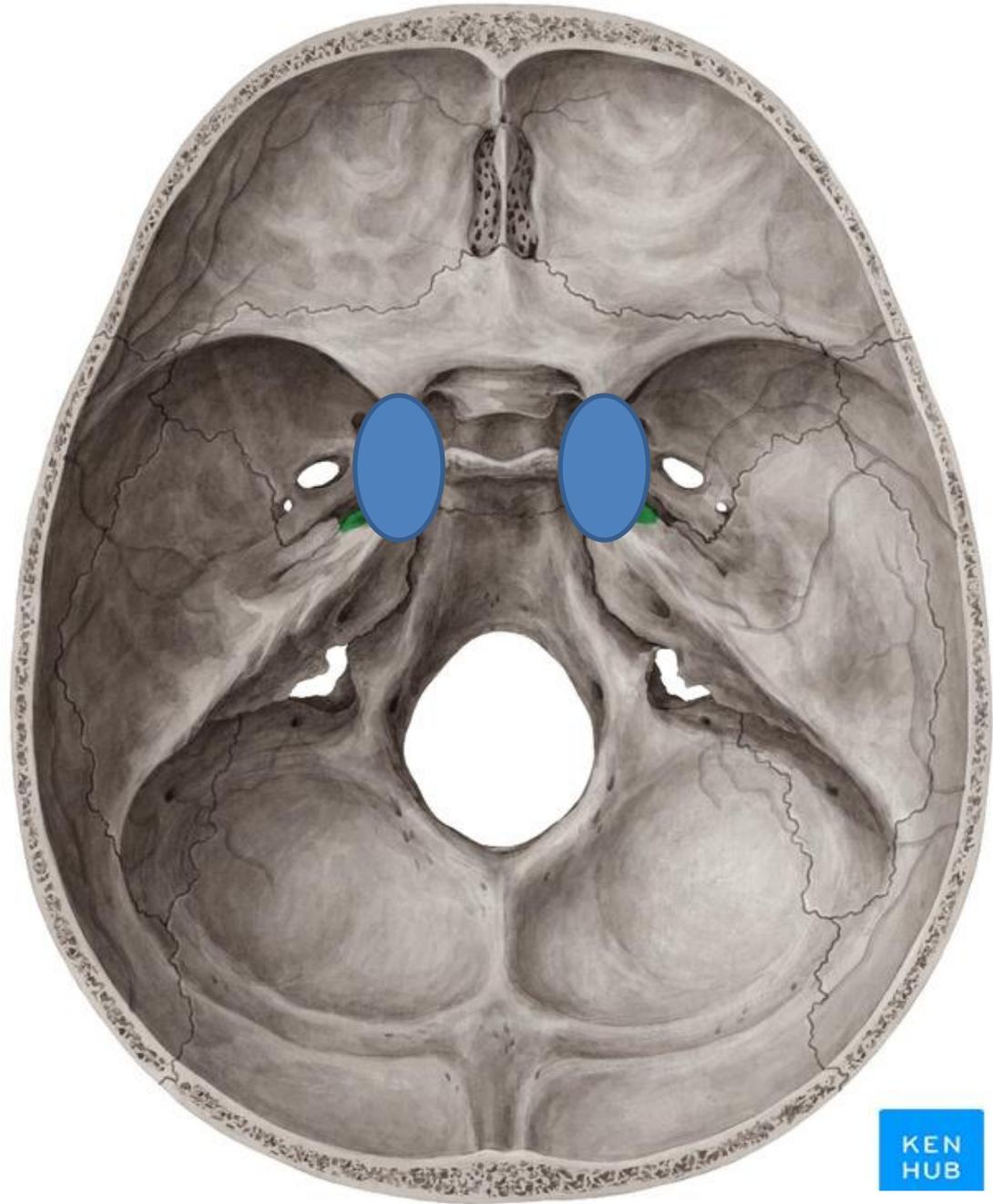
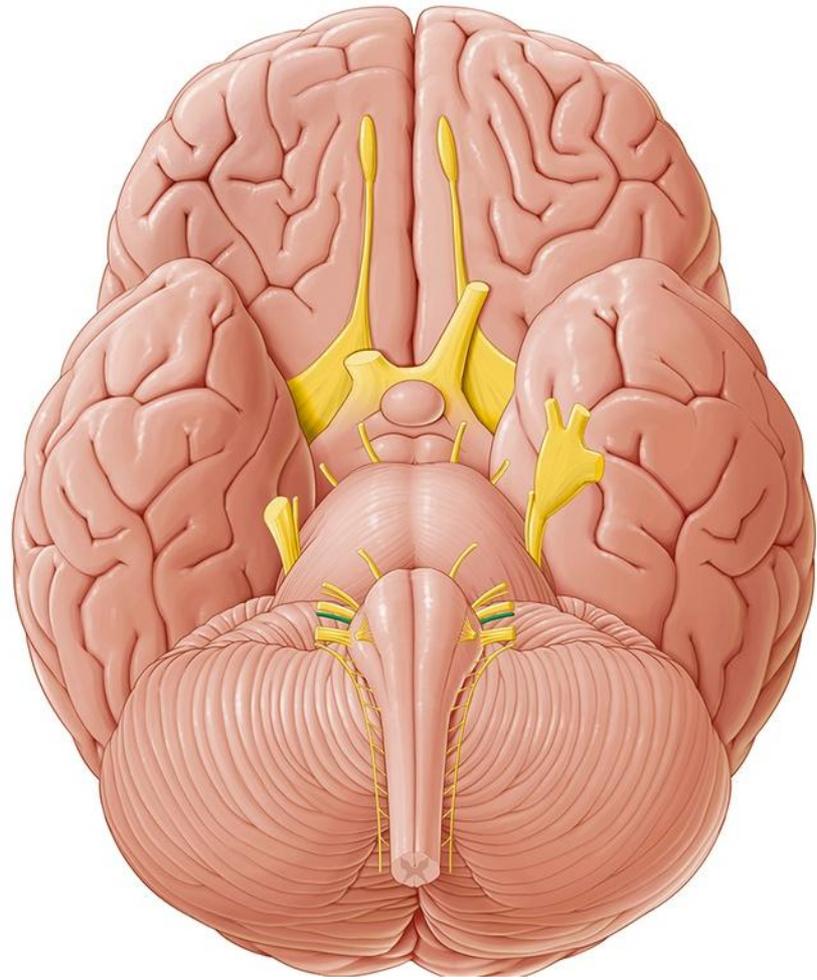
Any intracranial mass inside the skull (tumor, bleeding...) may force its neighboring structures to herniate

**Compression of oculomotor nerve (III) is the first clinical sign**

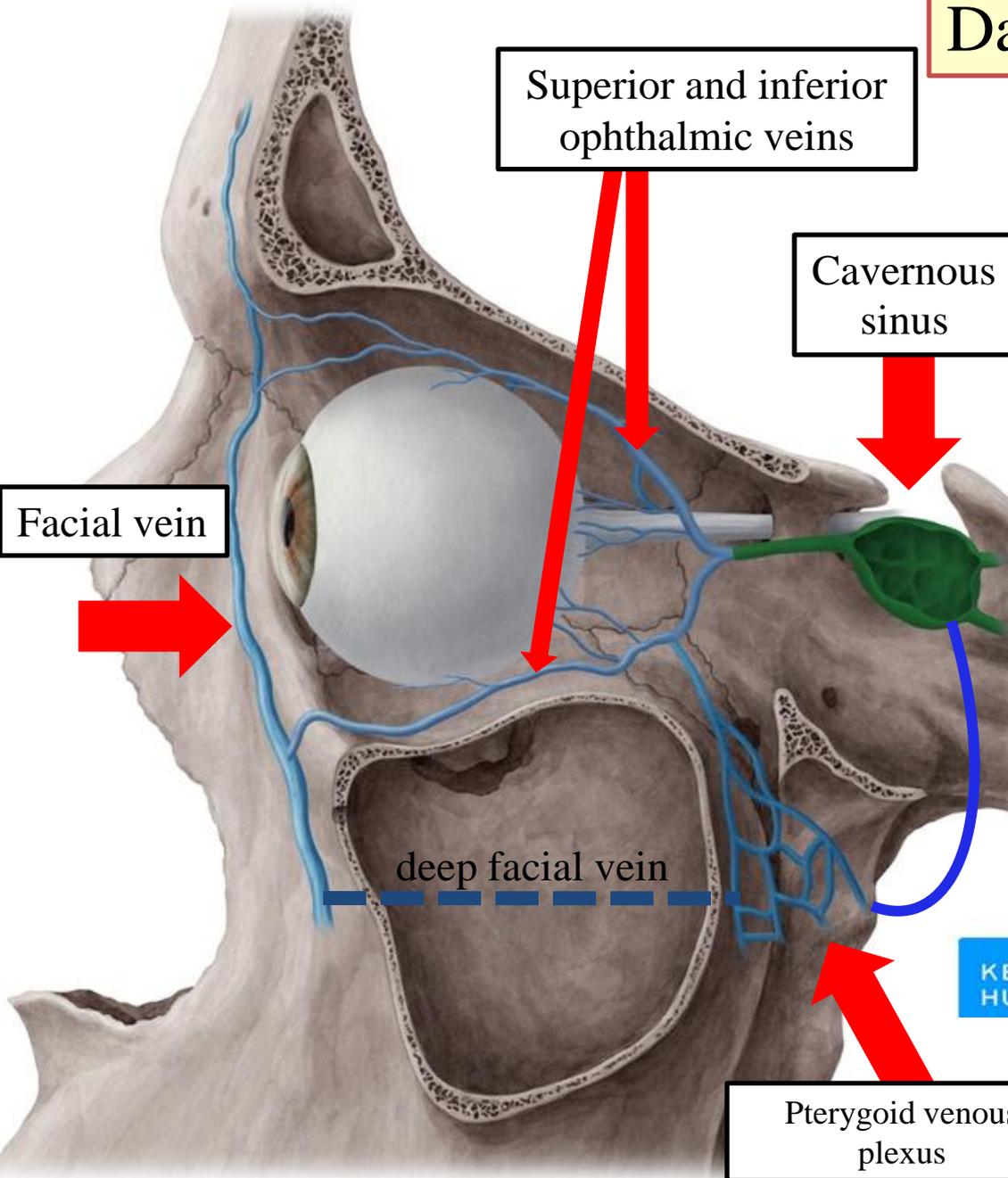
**ipsilateral pupil dilation**

since the parasympathetic fibers that supply the constrictor pupillae are located on the outside of the nerve and are inactivated first by compression

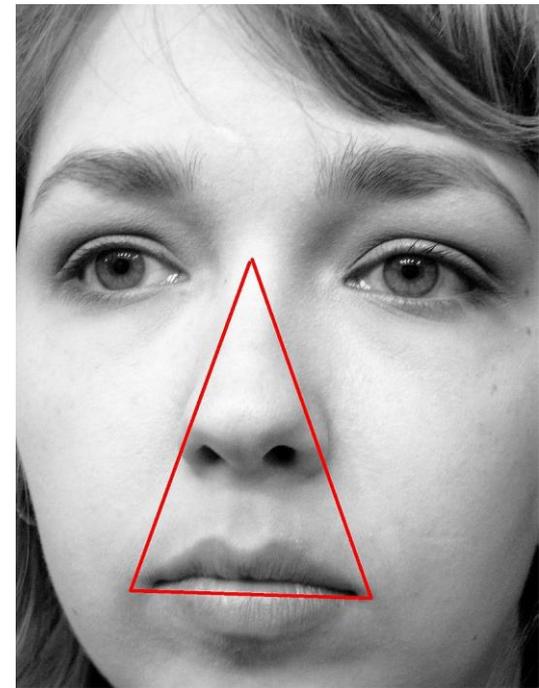




# Danger triangle of the face



Note: venous communication (via the ophthalmic veins) between the **facial vein** and the **cavernous sinus**



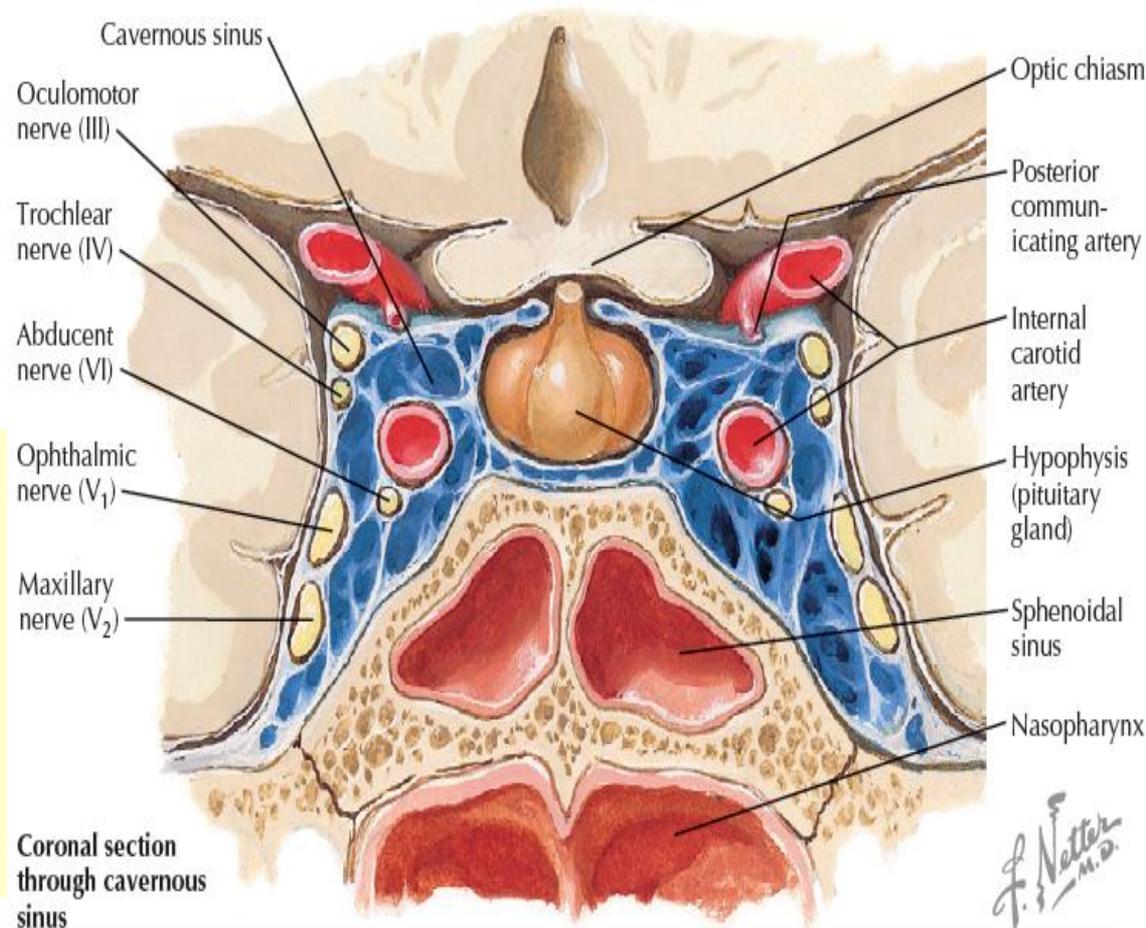
Cavernous sinus syndrome

# Cavernous sinus syndrome

Can result from sepsis from the central portion of the face or paranasal sinuses

## Clinical manifestations:

- Ophthalmoplegia with diminished pupillary light reflexes
- Venous congestion leading to periorbital edema
- Exophthalmos
- Pain or numbness of the face



Coronal section through cavernous sinus

Subsequent infection or inflammation in the cavernous sinus can result in damage to any of the cranial nerves that pass through it

**Exophthalmos** is a bulging of the eye anteriorly out of the orbit

*Note the periorbital edema*

**Ophthalmoplegia** is the paralysis or weakness of the eye muscles

