



# The orbit-1

- Edited by: Hamzeh Badaine

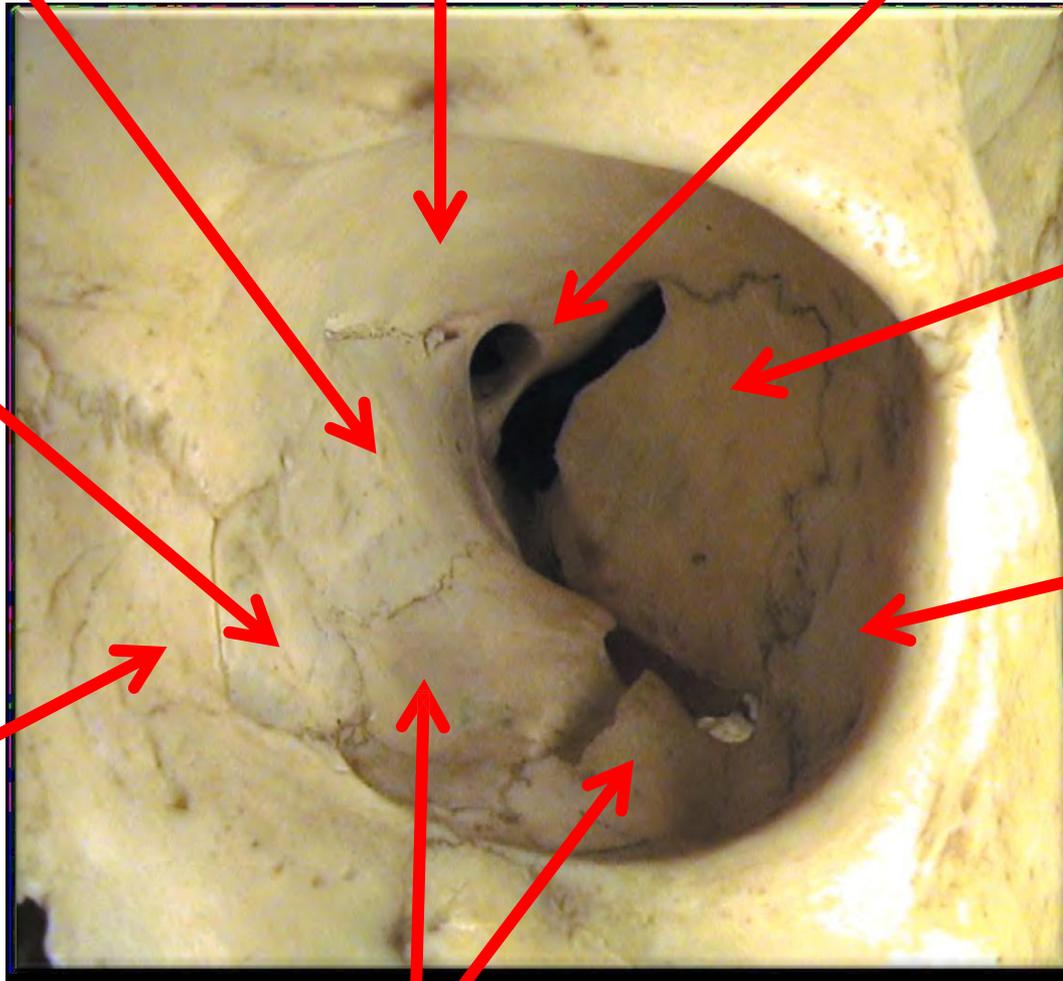
Dr. Heba Kalbouneh

Associate Professor of Anatomy and Histology

Orbital plate of frontal bone

Orbital plate of ethmoid bone

Lesser wing  
of sphenoid



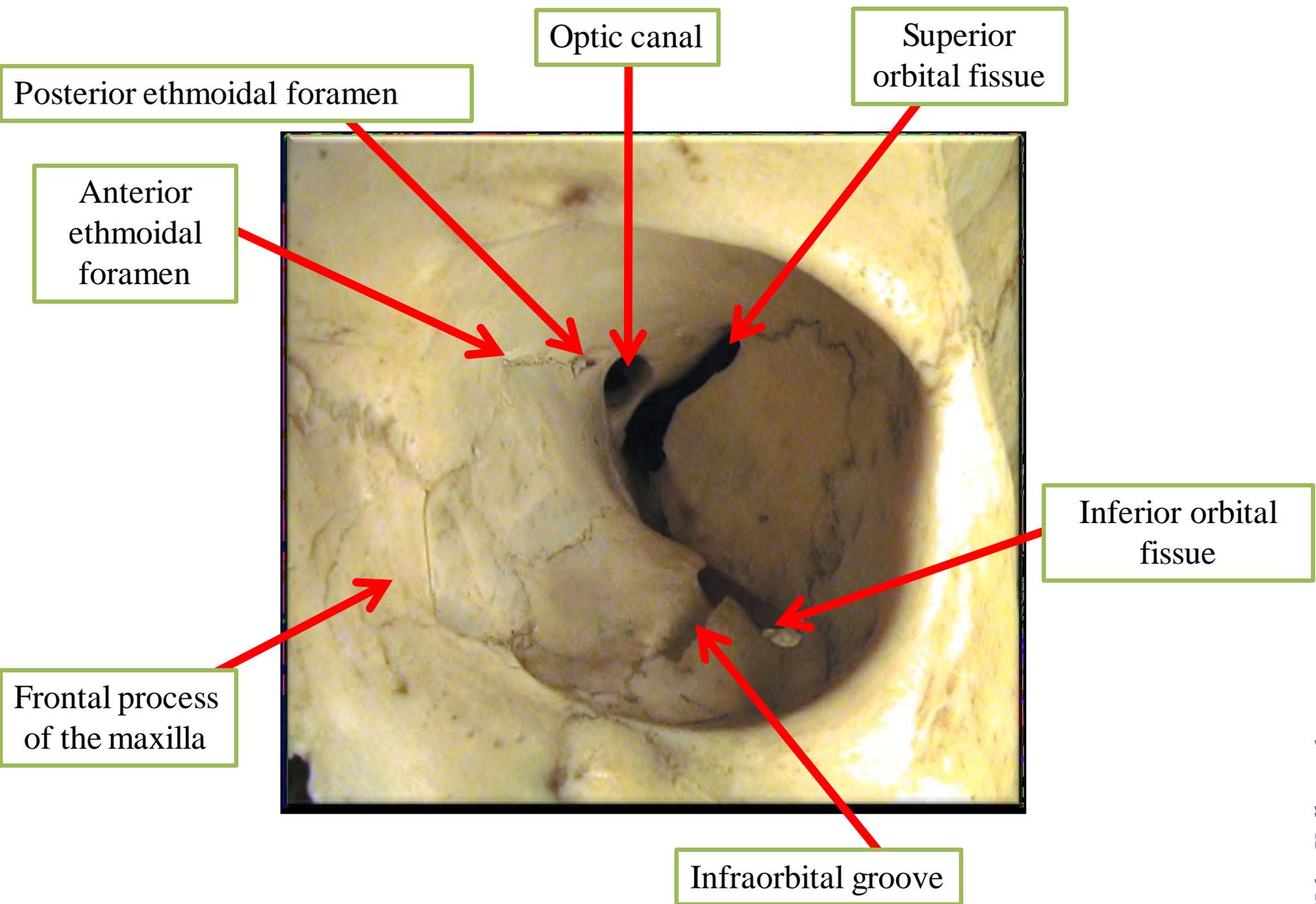
Lacrimal bone

Greater wing  
of sphenoid

Orbital plate of  
zygomatic bone

Frontal process  
of the maxilla

Orbital plate of maxilla



Orbital plate of frontal bone

Lesser wing of sphenoid

Greater wing of sphenoid

Orbital plate of ethmoid bone

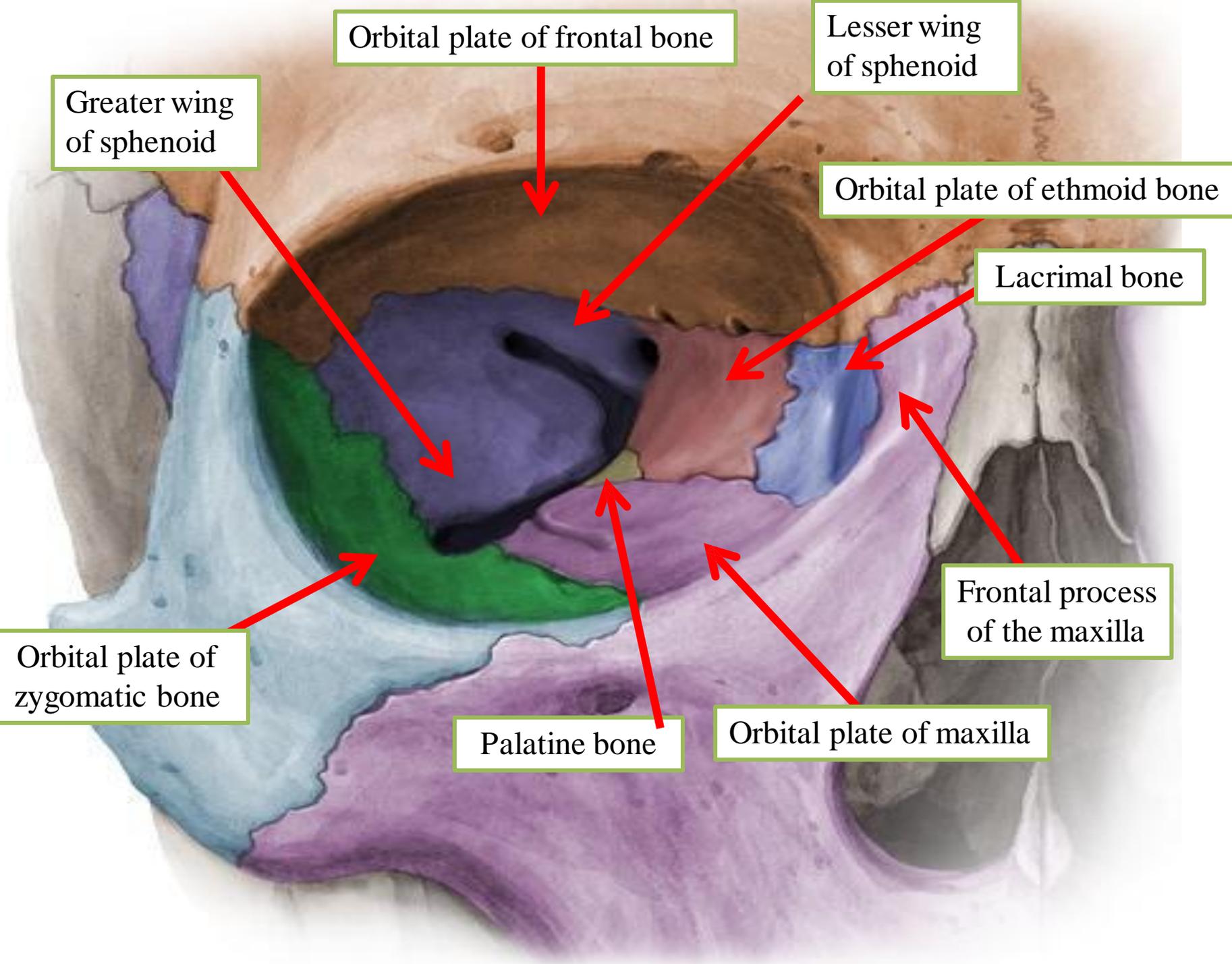
Lacrimal bone

Orbital plate of zygomatic bone

Frontal process of the maxilla

Palatine bone

Orbital plate of maxilla



# Orbit

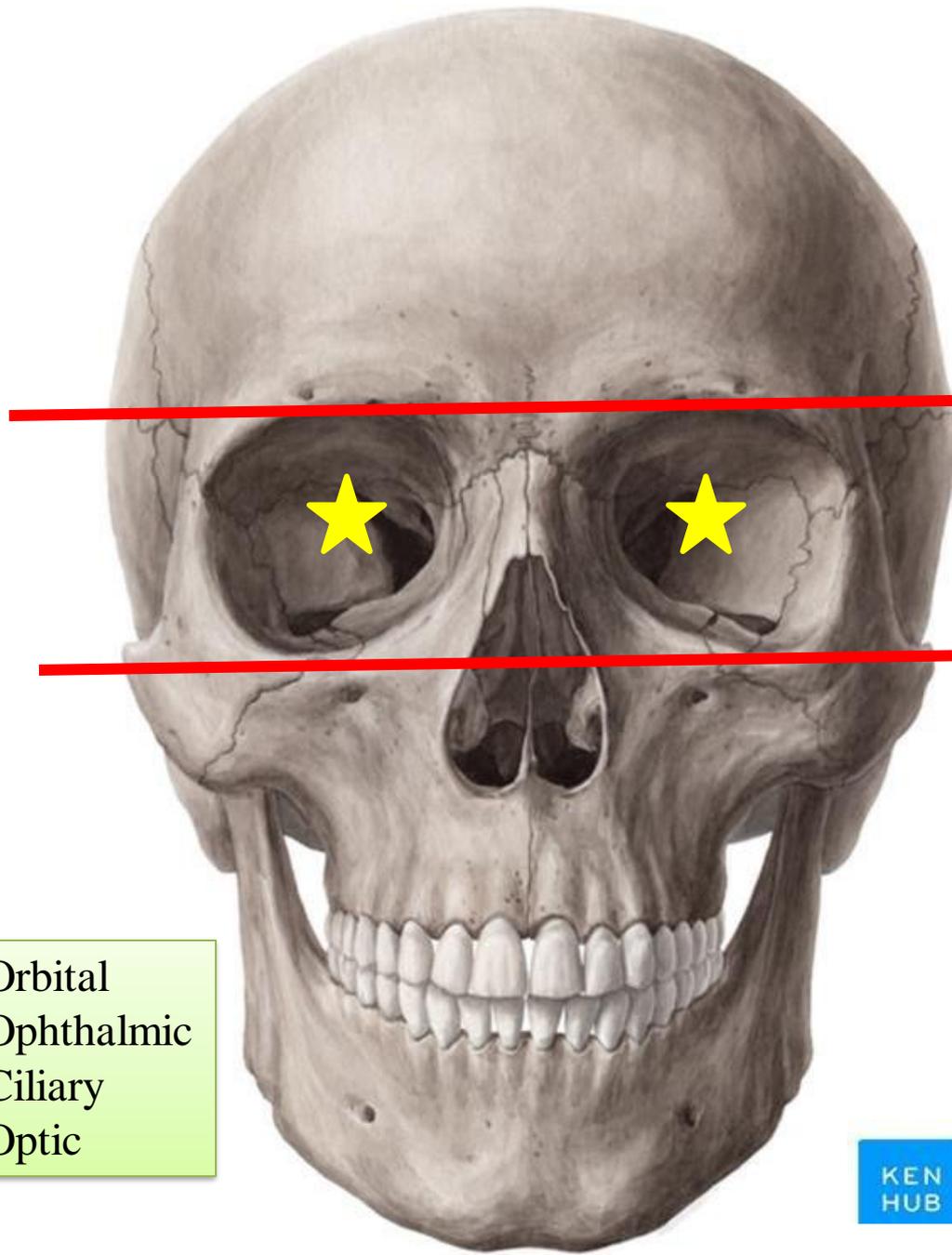
The orbits are bilateral structures below the anterior cranial fossa and anterior to middle cranial fossa

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

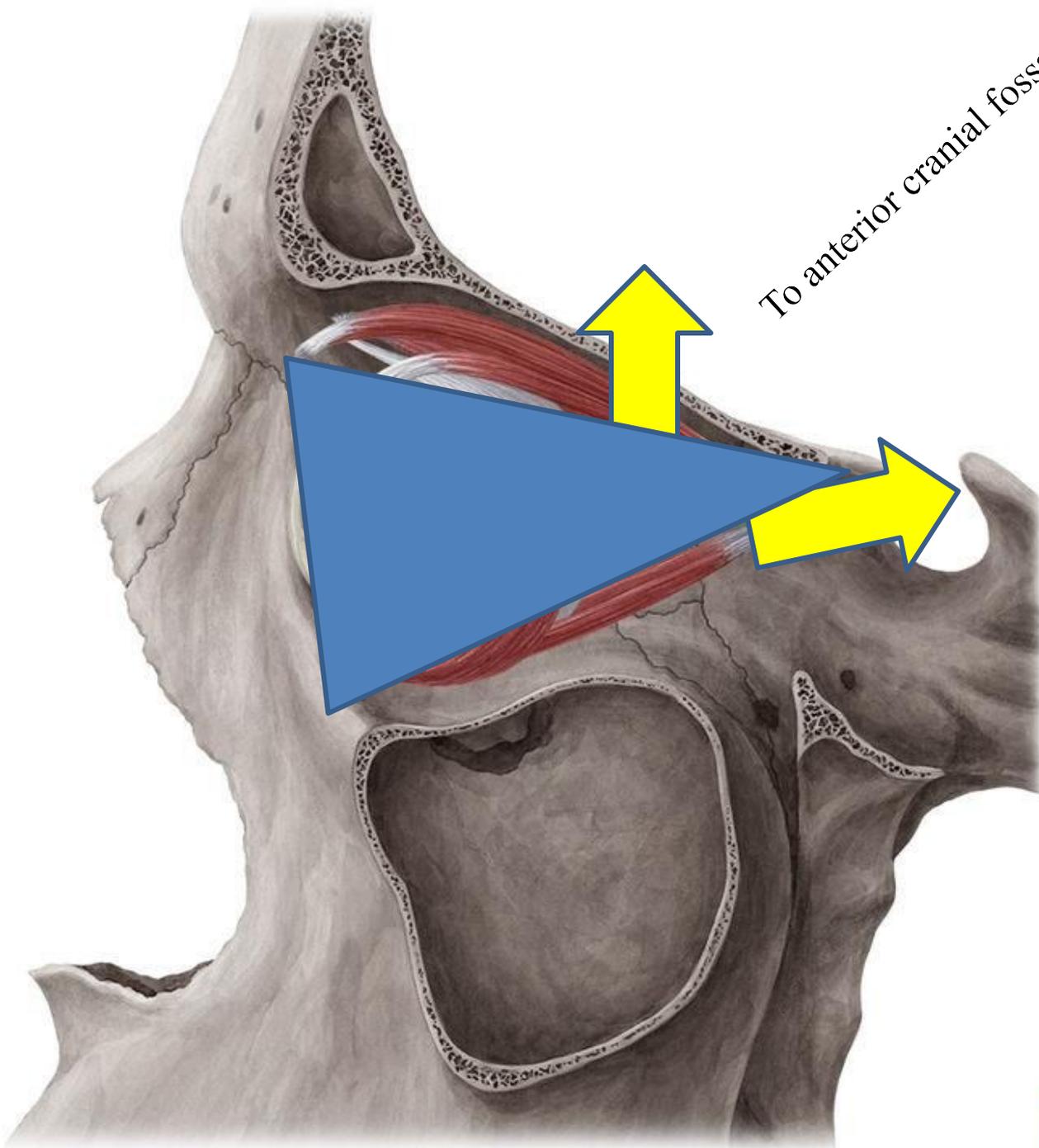
Has medial, lateral, superior (roof), inferior (floor) walls

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

Orbital  
Ophthalmic  
Ciliary  
Optic



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To anterior cranial fossa

To middle cranial fossa

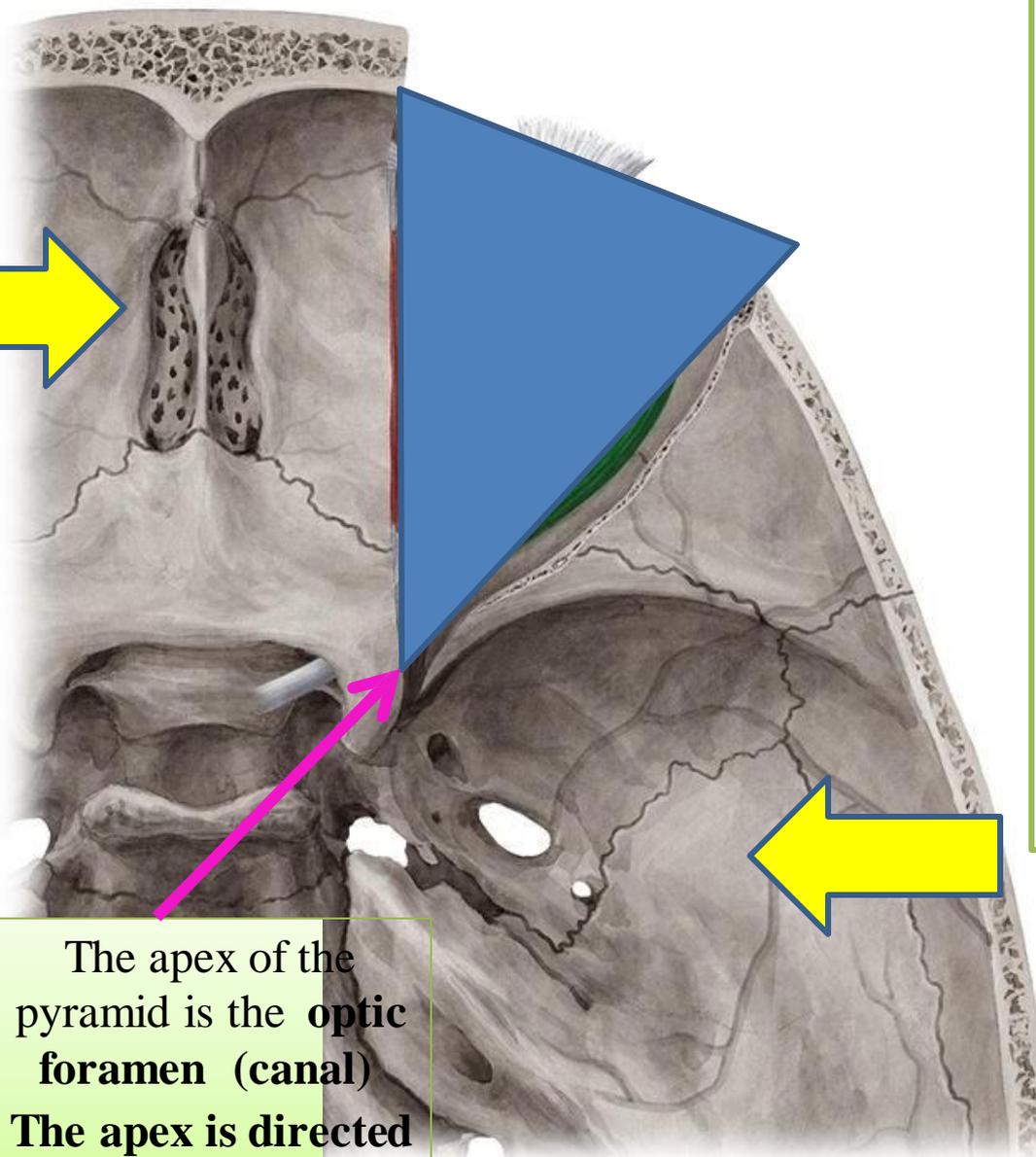
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## Contents of the orbit:

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)**  
The apex is directed **posteriorly (posteromedial**

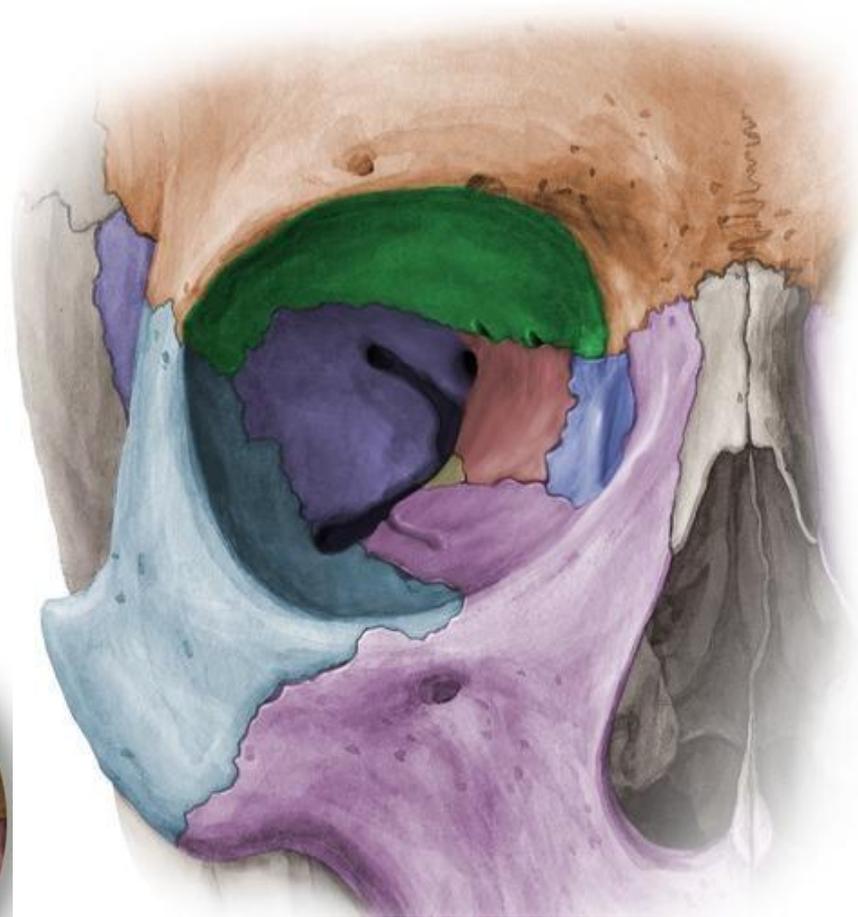
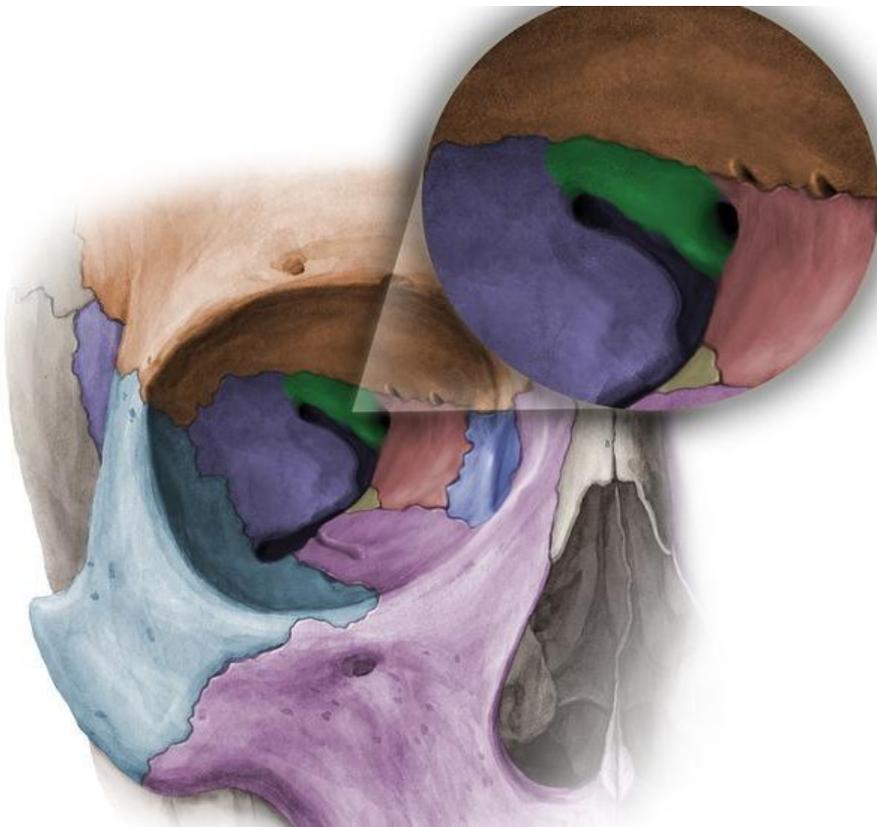
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# Roof:

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



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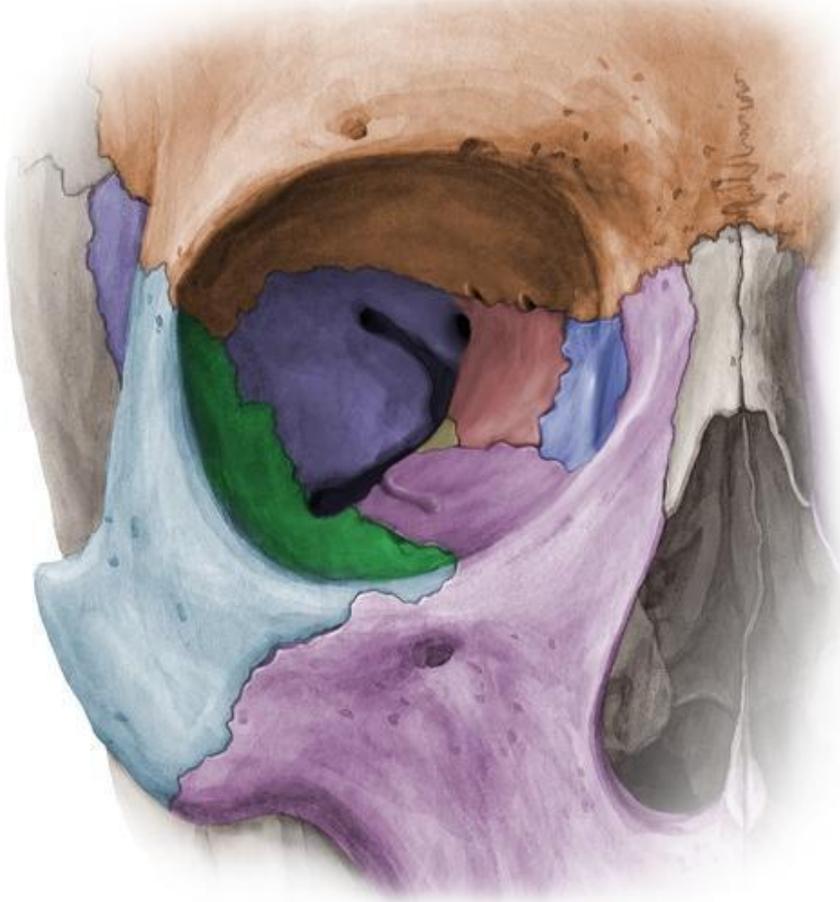
**2- The lesser wing of sphenoid**

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## Lateral wall:

Formed by:

1- The orbital plate of zygomatic bone



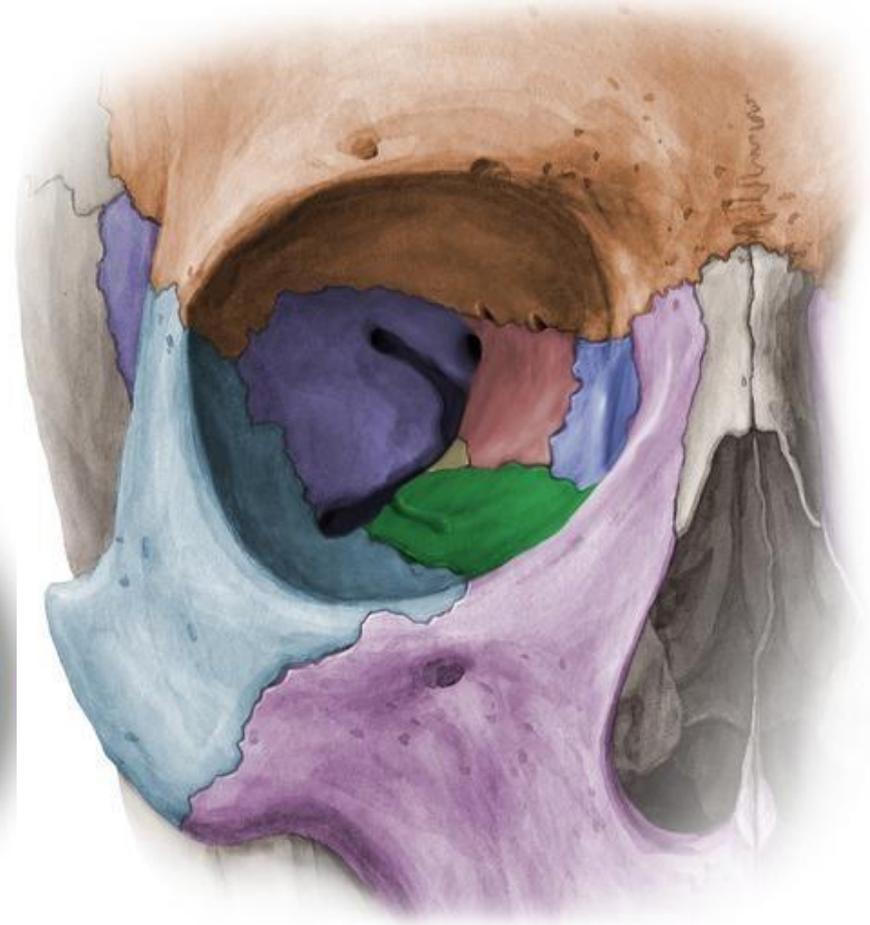
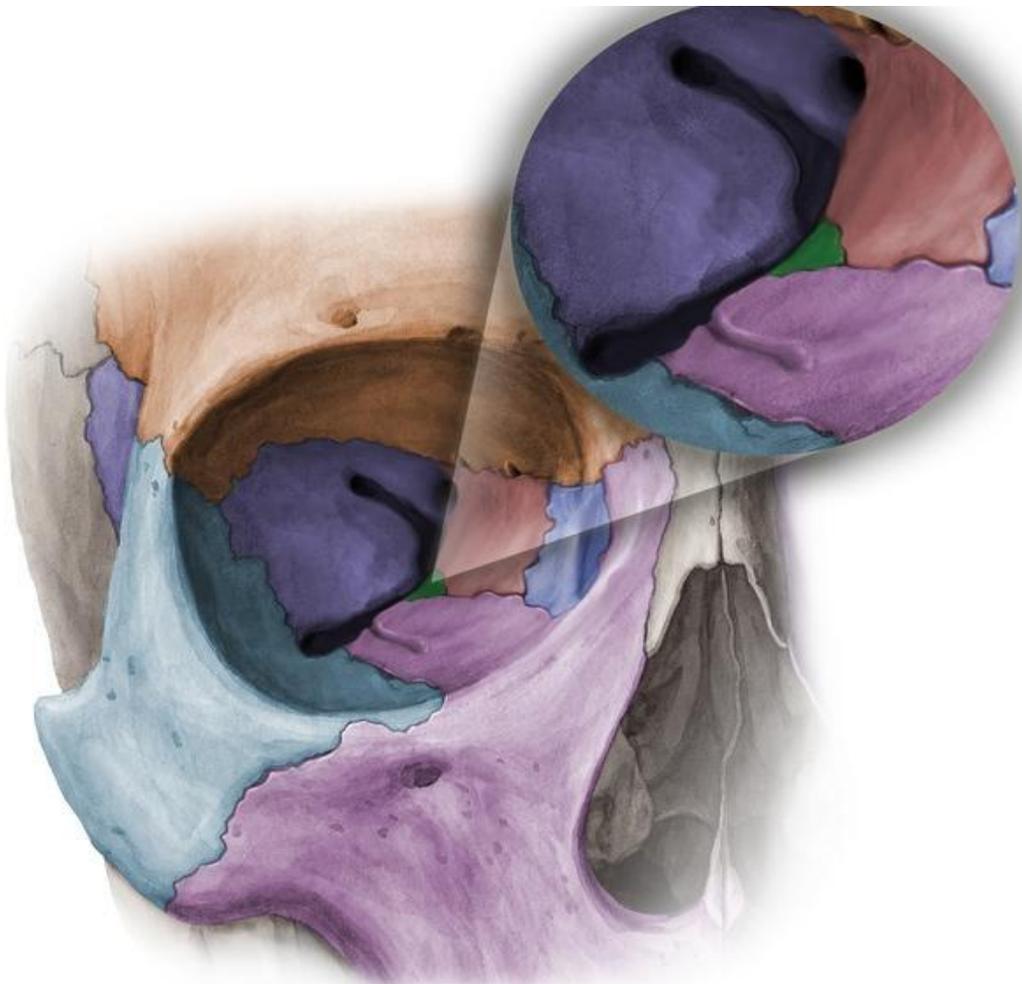
2- The greater wing of sphenoid



# Floor:

Formed by:

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



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**2- Palatine bone**

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Participates in the floor of the orbit

**Palatine bone**

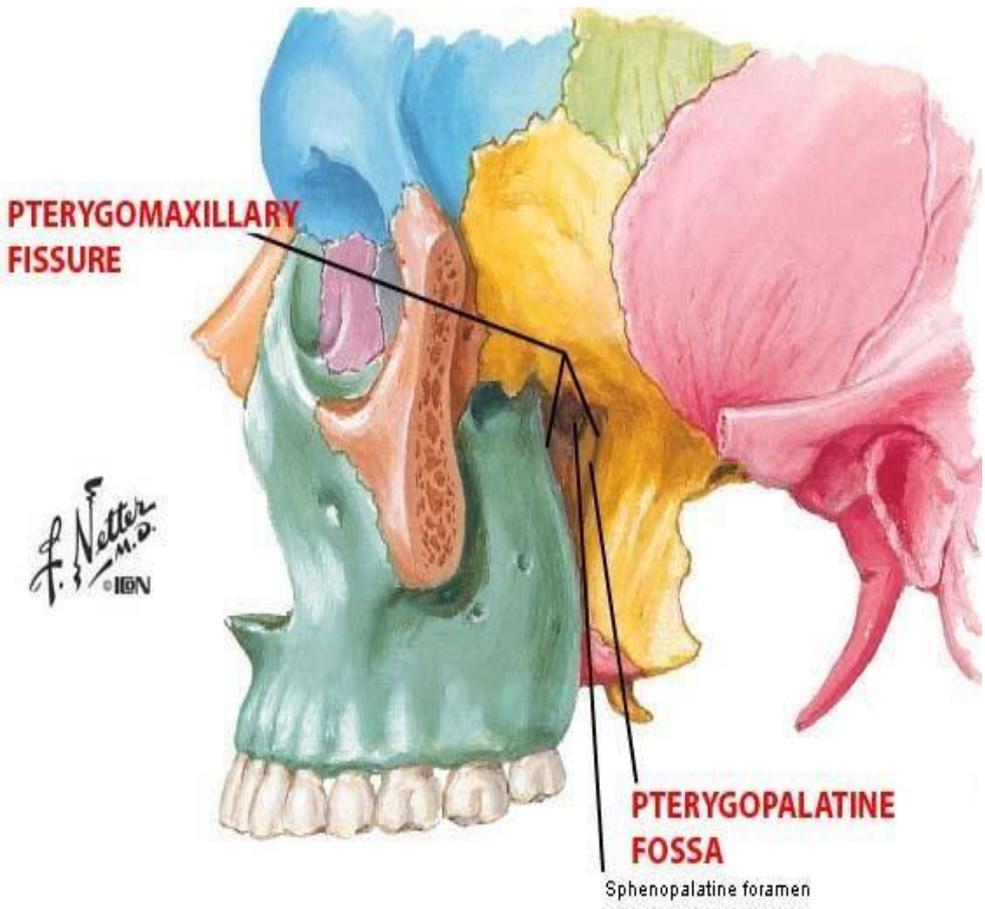
Forms the medial wall of pterygopalatine fossa

**Vertical plate**

**Horizontal plate**

Participates in the hard palate

Posterior third of hard palate



F. Netter M.D. © IGV

Pterygopalatine fossa: located between the pterygoid plate, palatine bone and maxilla

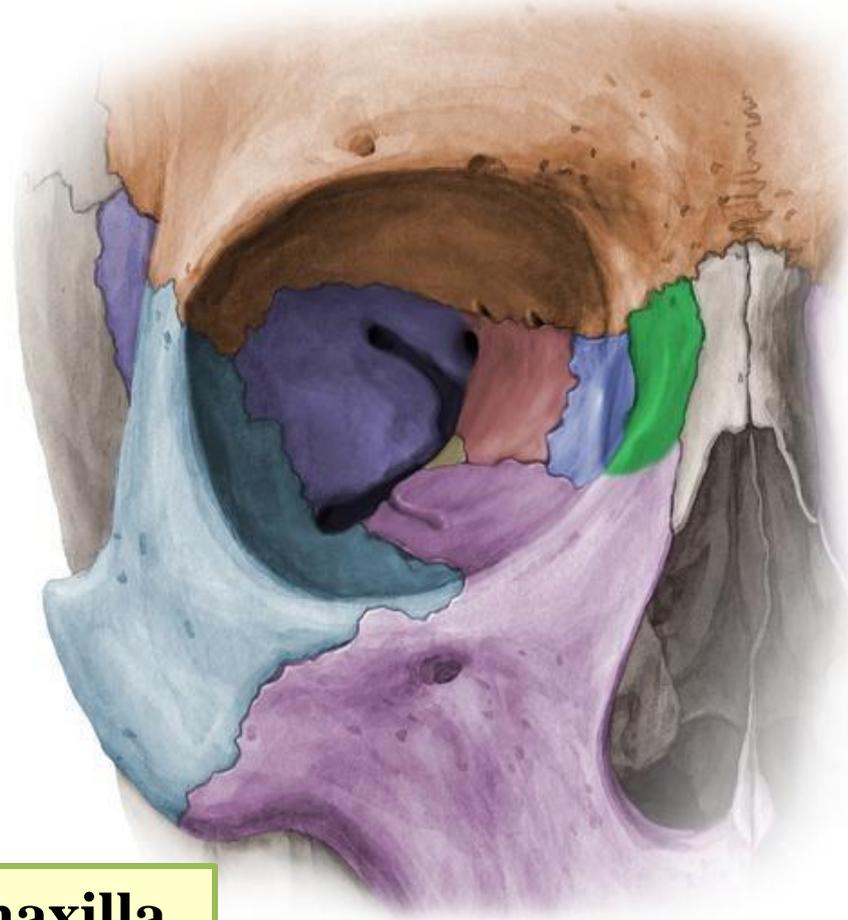
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## **Medial wall:**

Formed from before backward by:

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

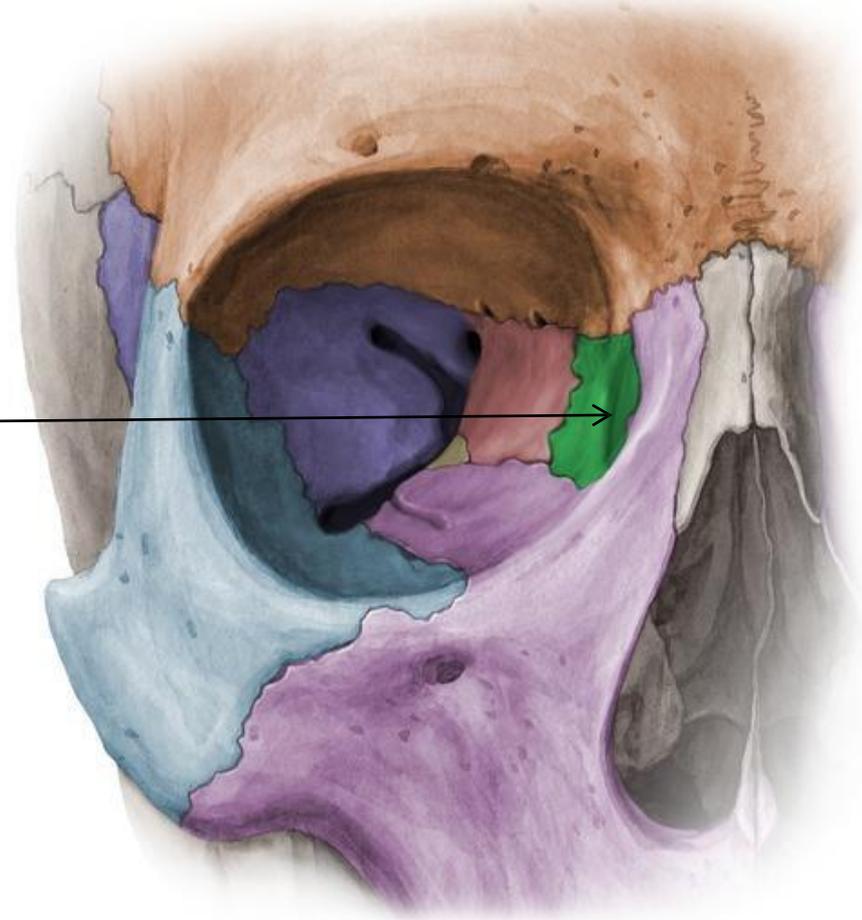
Medial walls are parallel to each other



- 1. The frontal process of maxilla**

## 2. The lacrimal bone

Fossa for the lacrimal  
sac



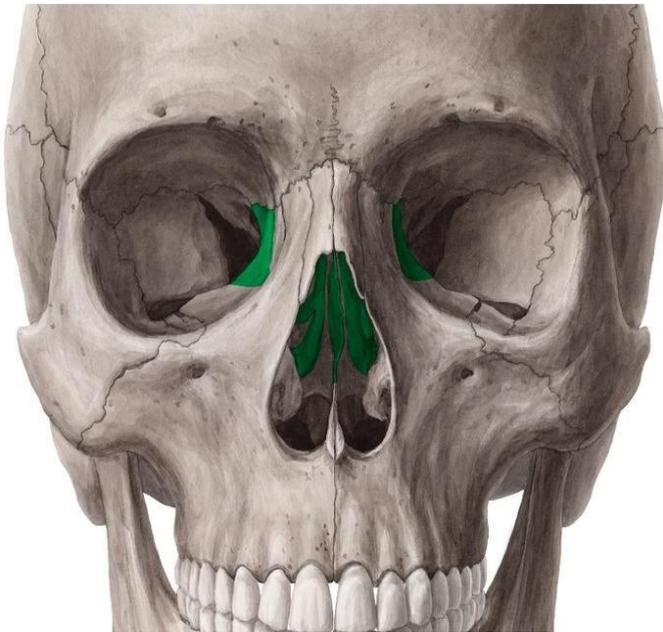
Why it called lacrimal???

On the upper lateral anterior aspect of the orbit we have lacrimal gland [tear producing gland] Tear continuously produced from the gland and cover the anterior surface of the eye ball . The tears will be collected just deep to the medial angle of the eye inside a sac called the lacrimal sac (located in the lacrimal bone )

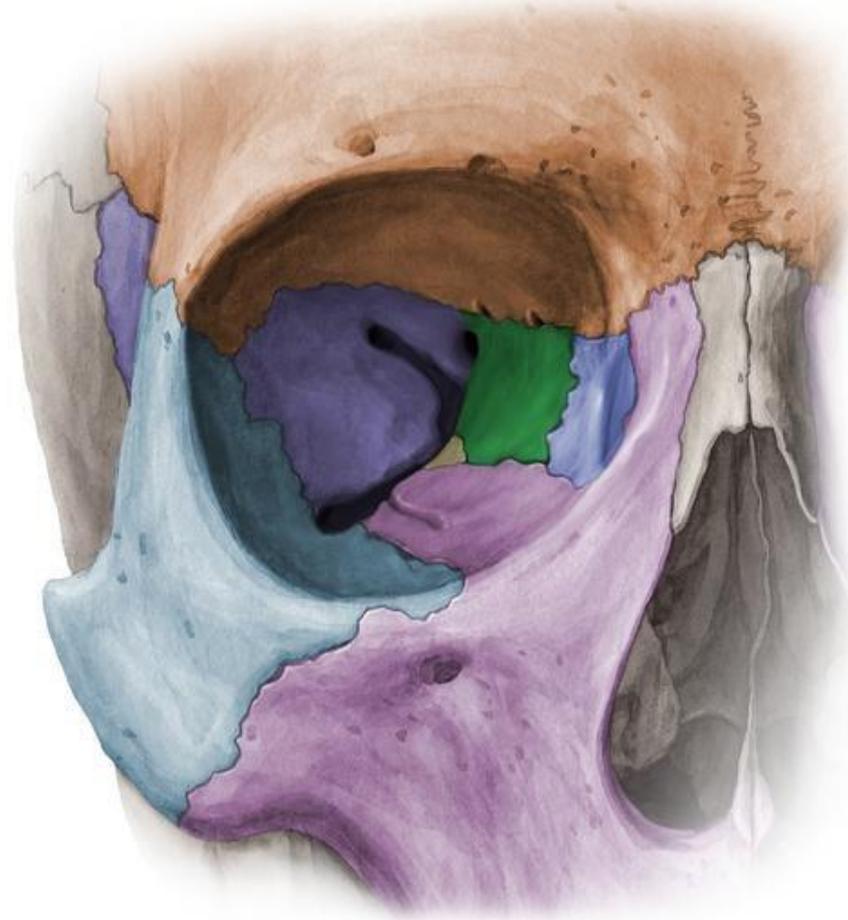
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- The orbital plate of ethmoid separates the orbital cavity from the ethmoidal air sinuses
- It is a very thin wall

### 3. The orbital plate of ethmoid



**Ethmoid bone**



# Ethmoid bone



frontal bone

frontal bone

sphenoid bone

nasal bones

lacrimal bone

ethmoid bone

cribriform plate

sphenoid bone (greater wing)

palatine bone

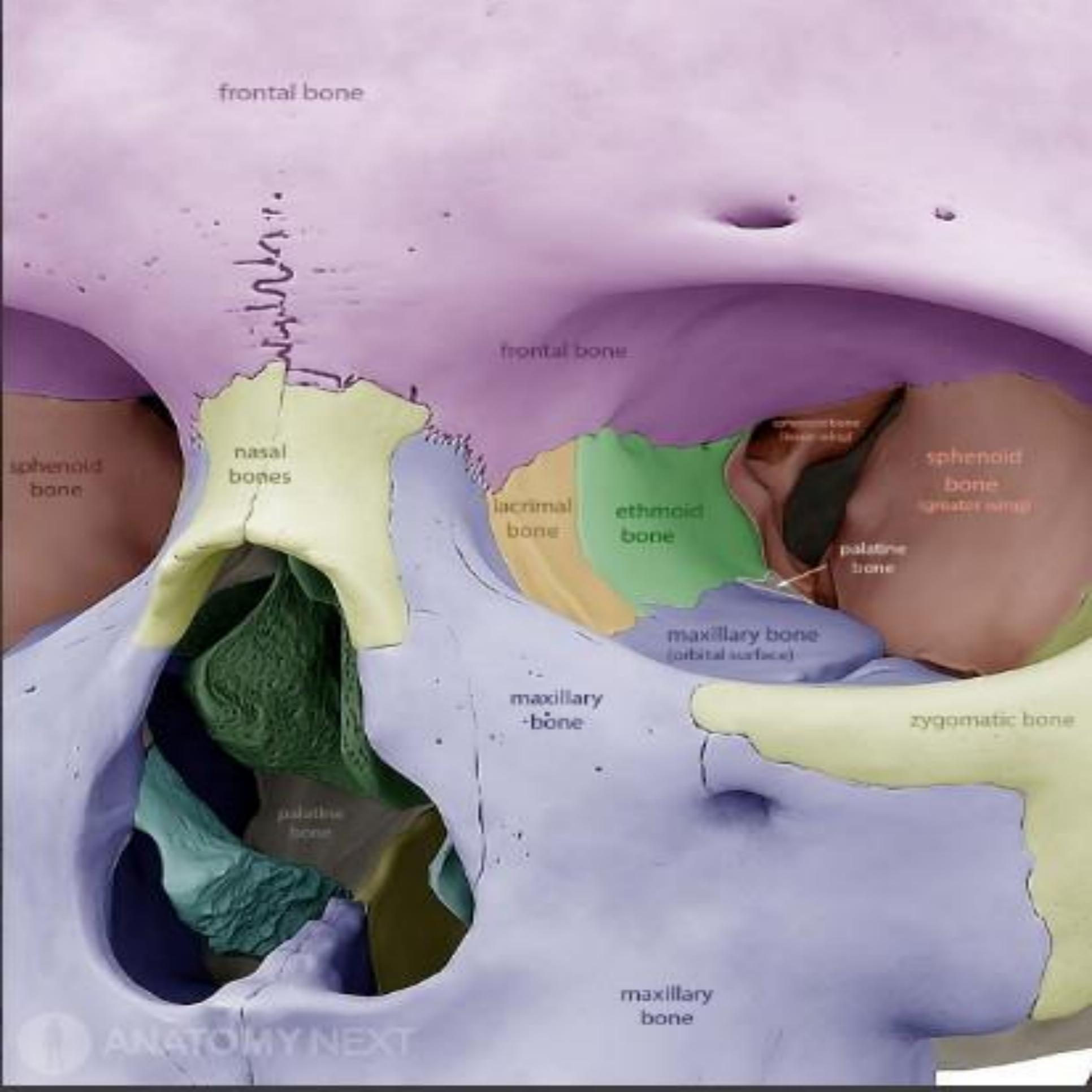
maxillary bone (orbital surface)

maxillary bone

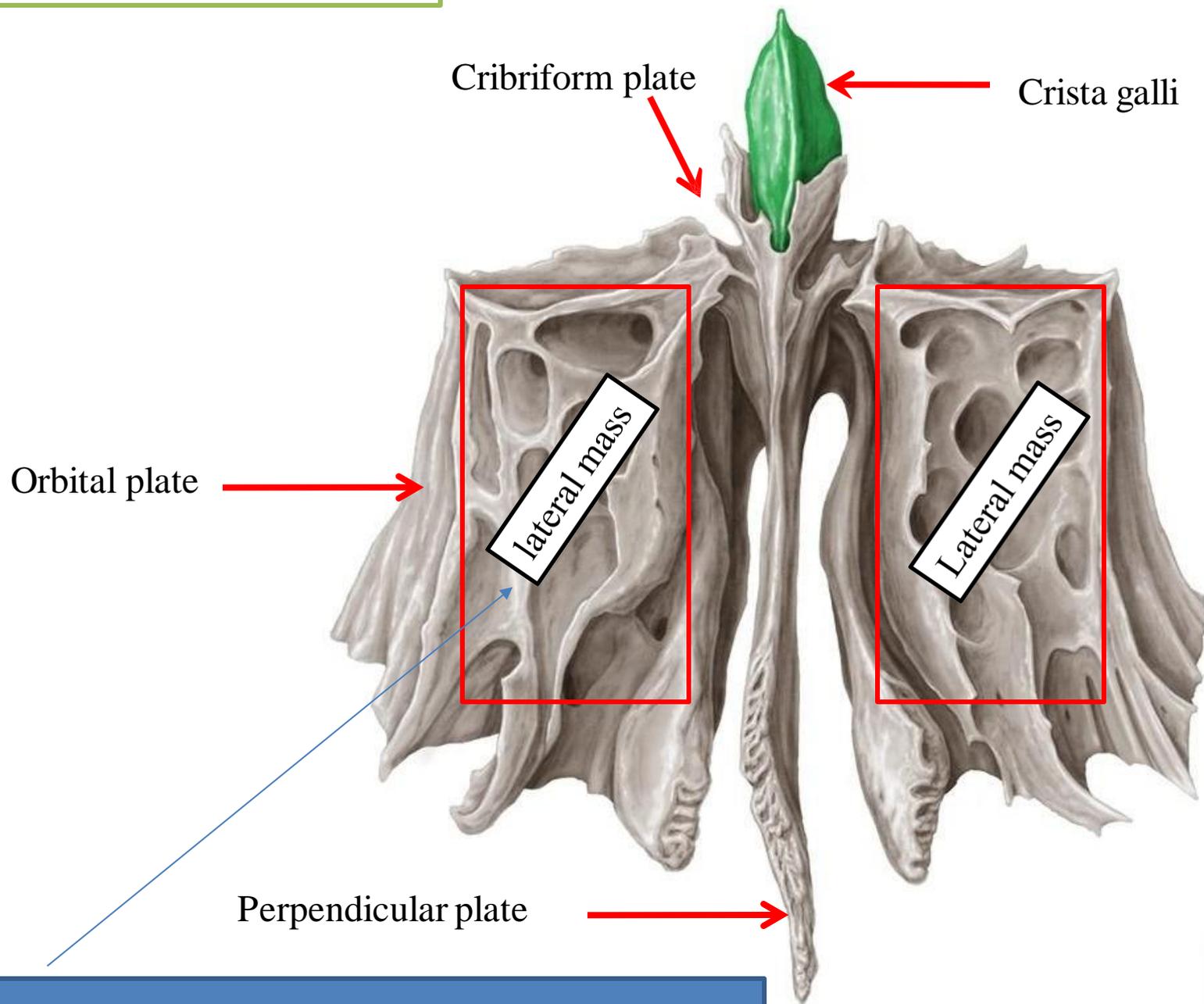
zygomatic bone

palatine bone

maxillary bone



# Ethmoid bone



Lateral mass: it has an air-filled spaces called ethmoidal air sinus.

It has a medial and lateral wall

The medial wall: participate in the formation of nasal cavity

The lateral wall: participate in the formation of medial wall of the orbit (orbital plate of the ethmoid bone )

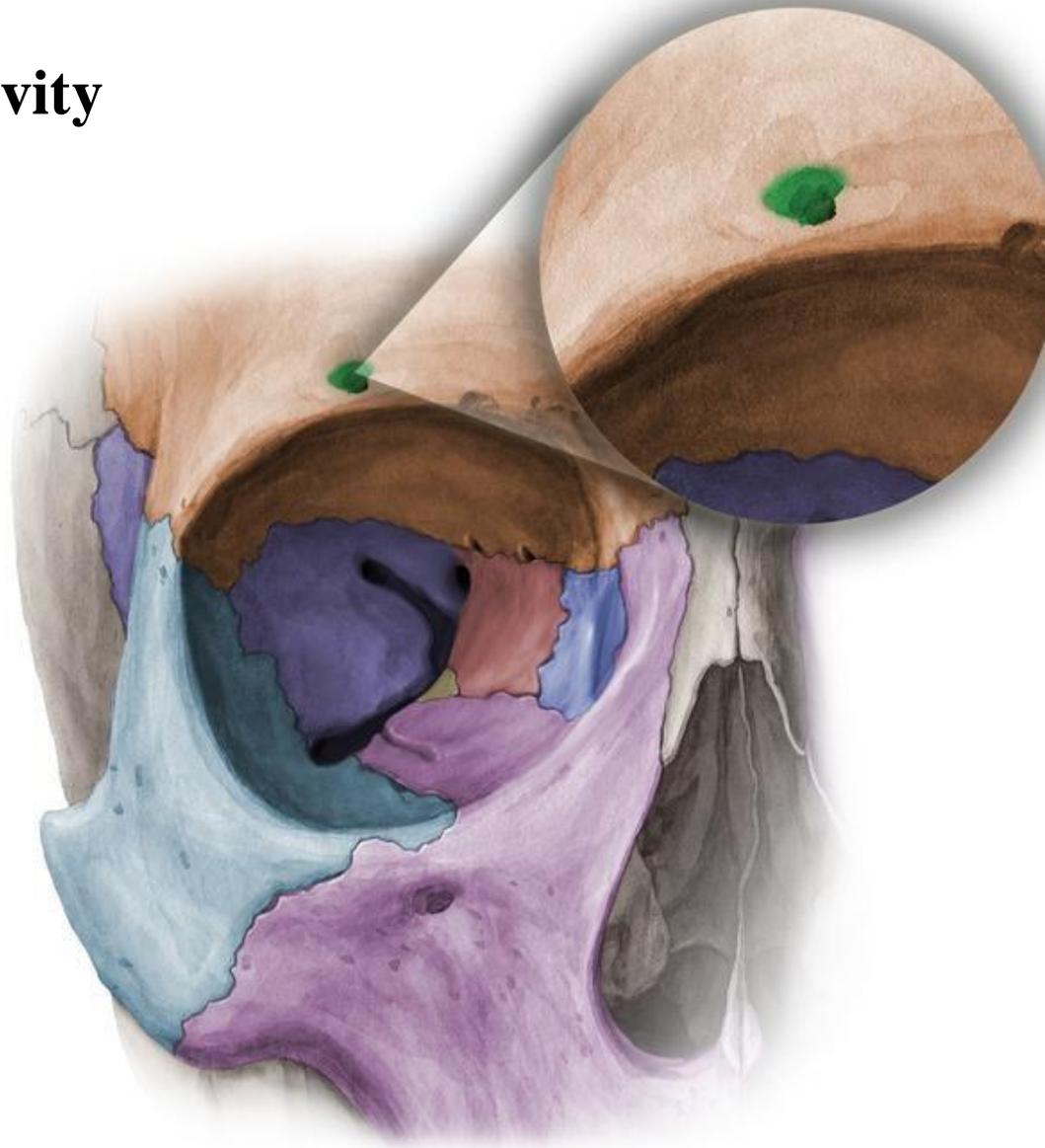
The weakest wall of the orbit is:

A) Medial wall : because it has an ethmoid bone (weak wall) and deep to it we have an ethmoidal air sinuses

B) The floor (inferior wall): because we have inside the maxillary bone a (maxillary sinus)

# Openings Into the Orbital Cavity

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

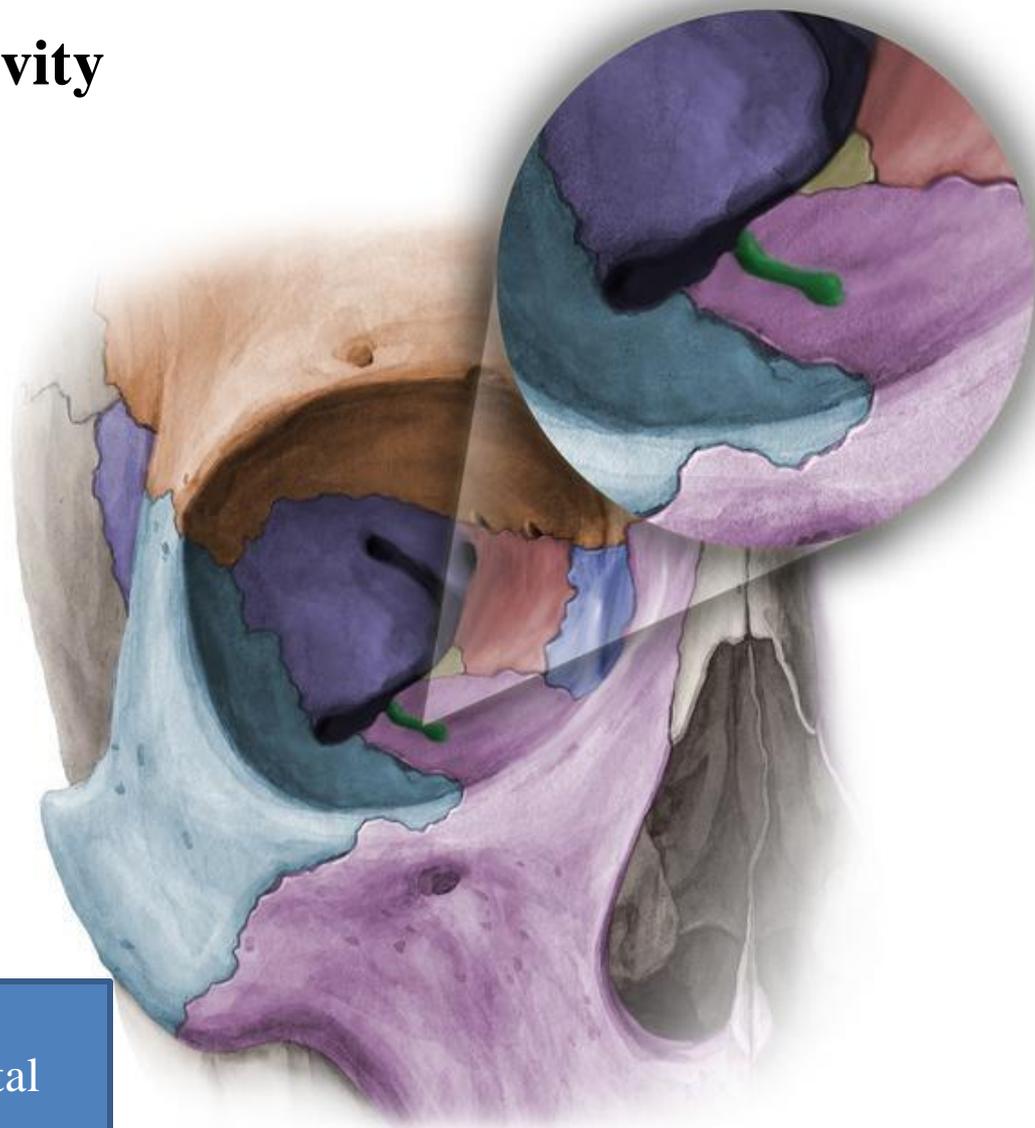


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# Openings Into the Orbital Cavity

**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

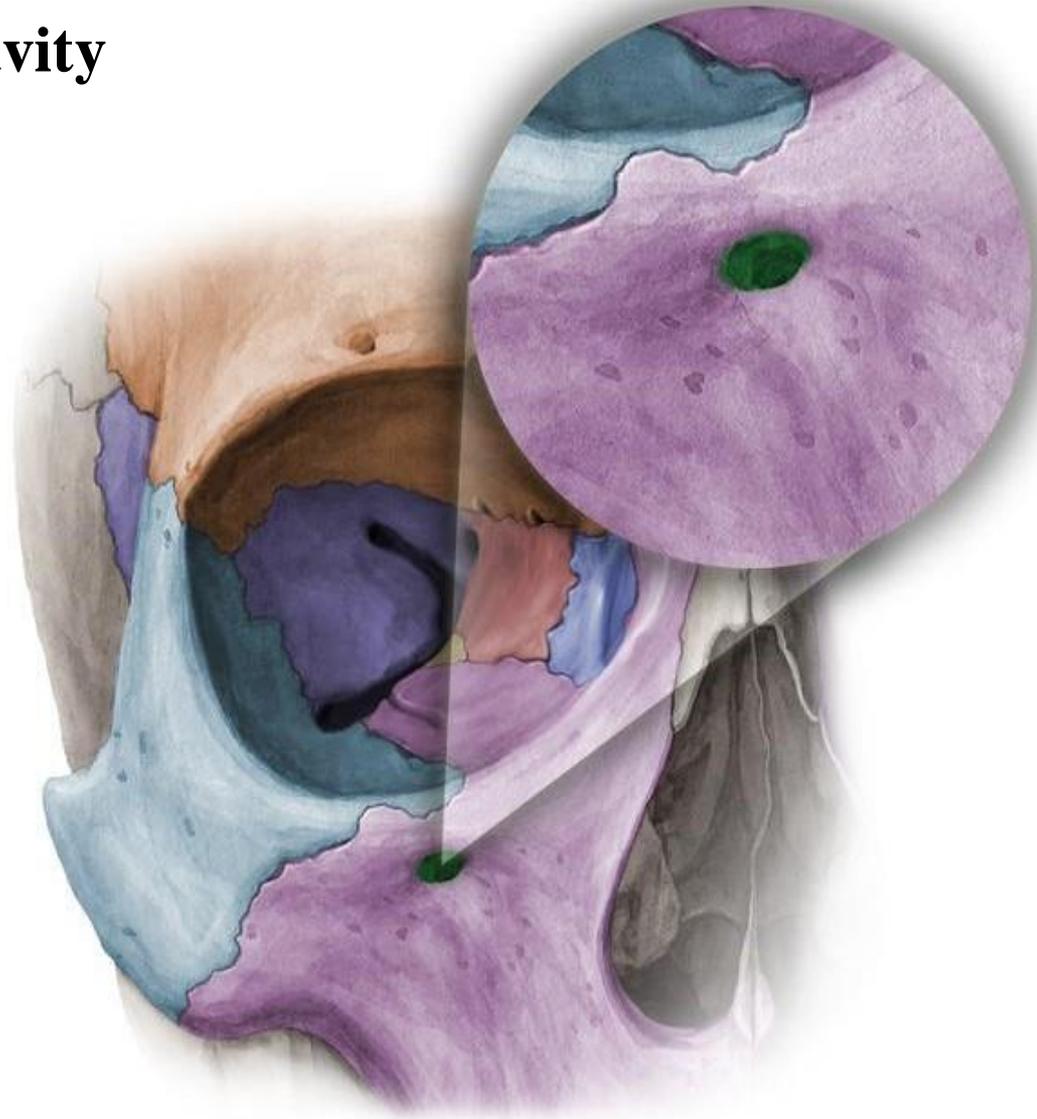


maxillary nerve course :  
**Inferior orbital fissure >>>Infraorbital  
groove >>>infraorbital  
canal>>>>infraorbital foramen**

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# Openings Into the Orbital Cavity

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

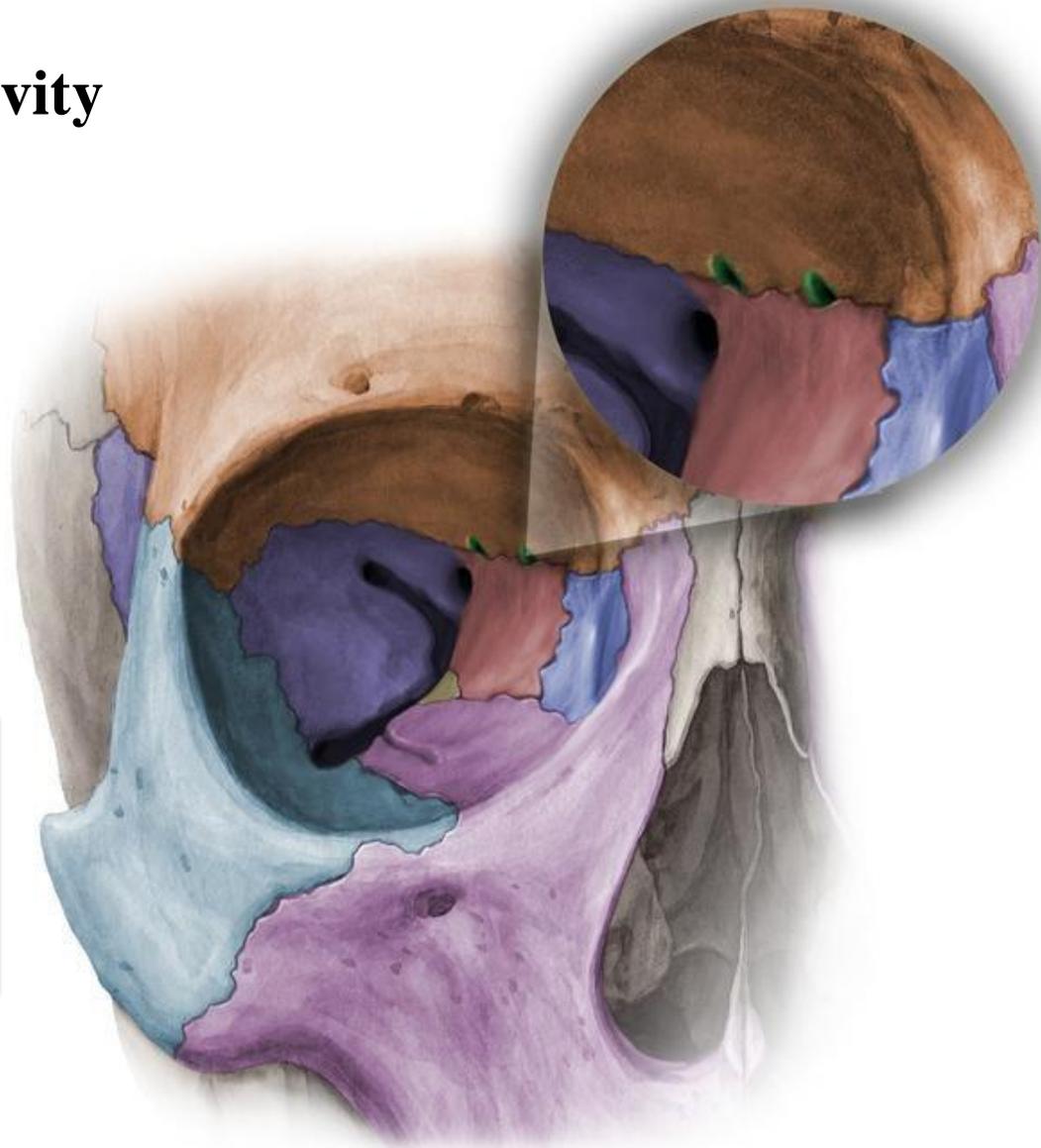


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# Openings Into the Orbital Cavity

**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

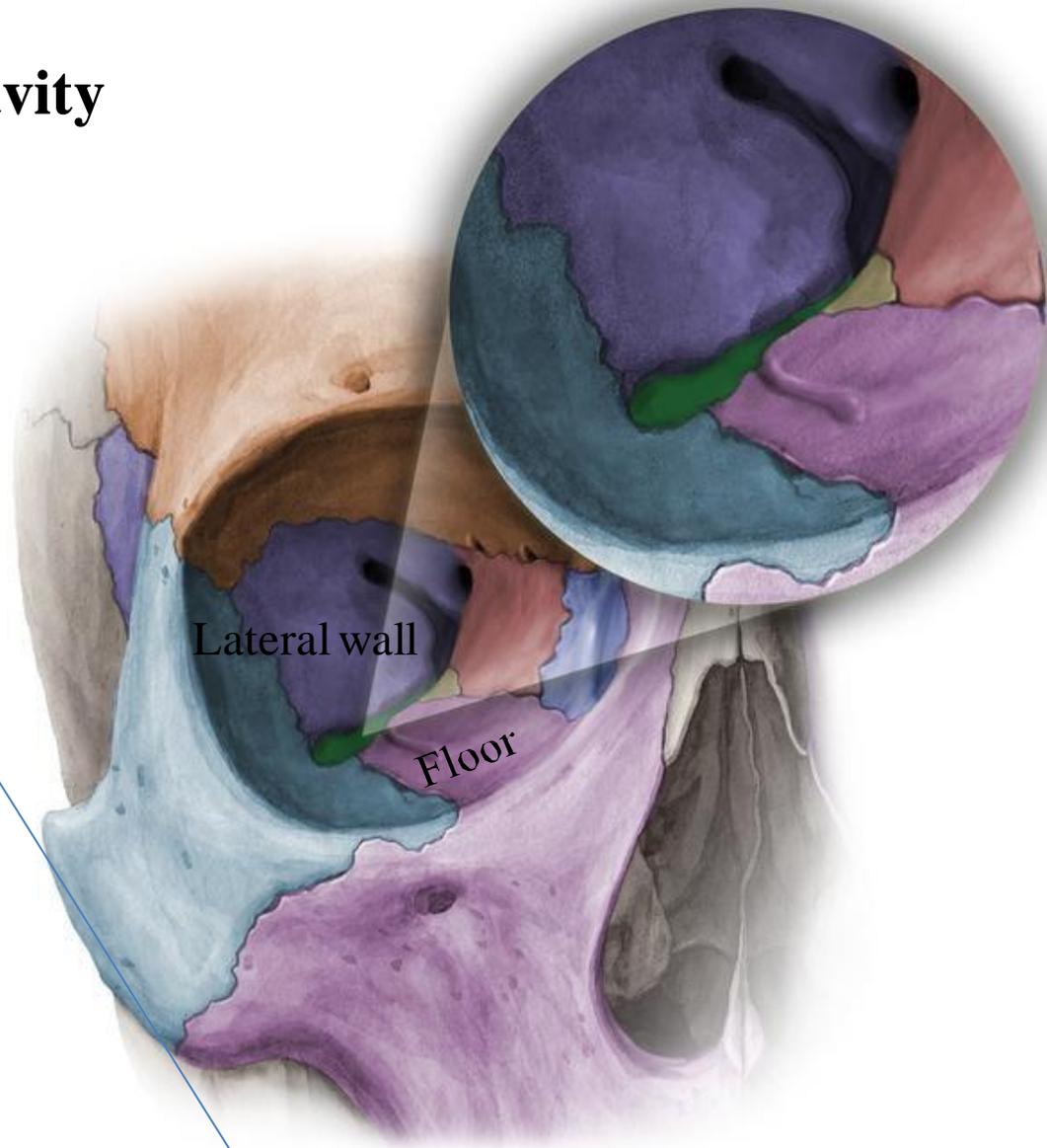
## 6-Inferior orbital fissure:

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

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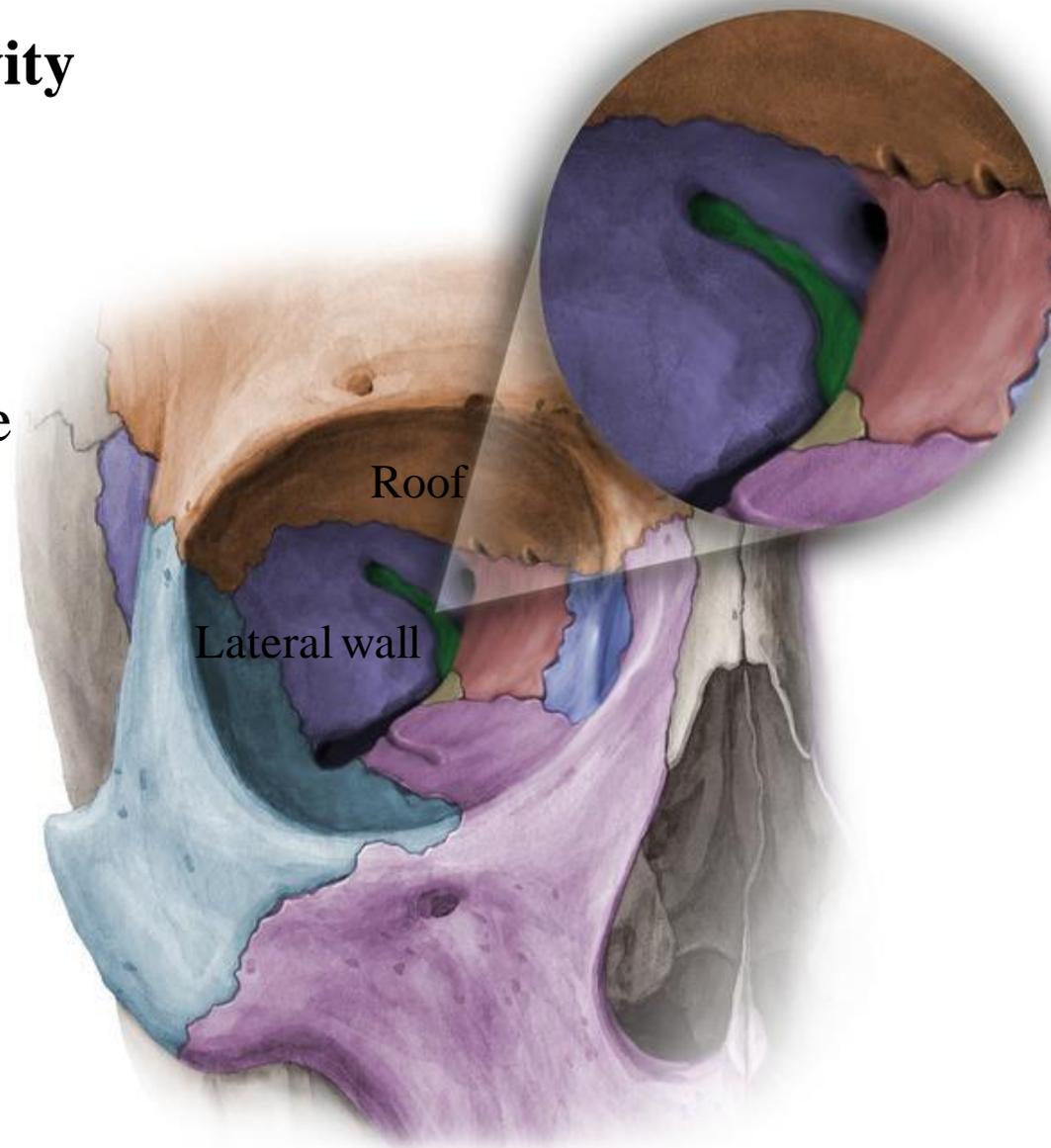
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Use the wire in the lab

# 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**

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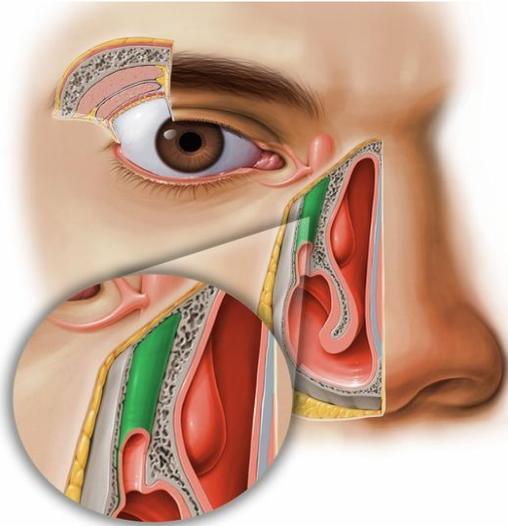
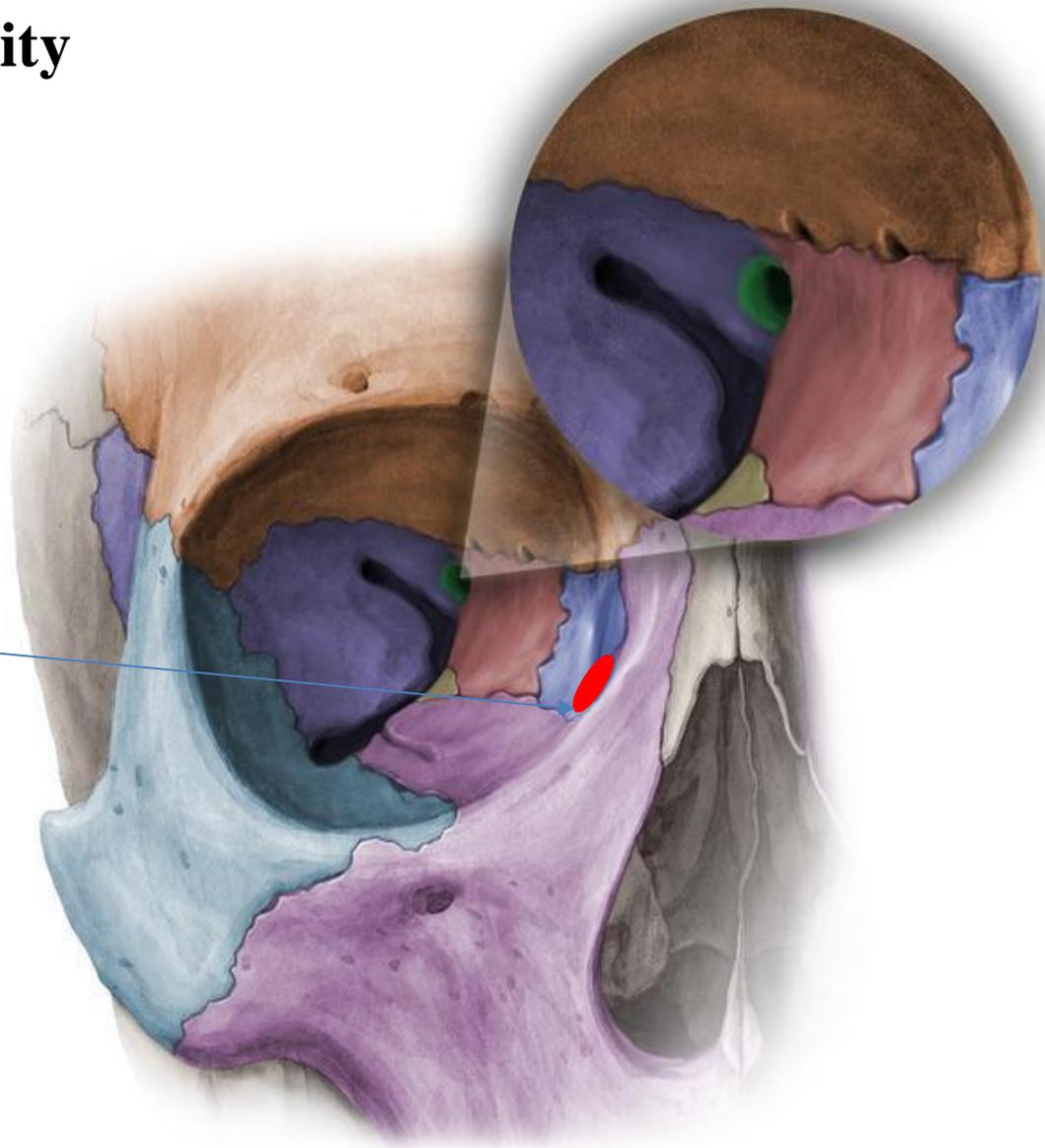
# Openings Into the Orbital Cavity

## 8-Optic canal:

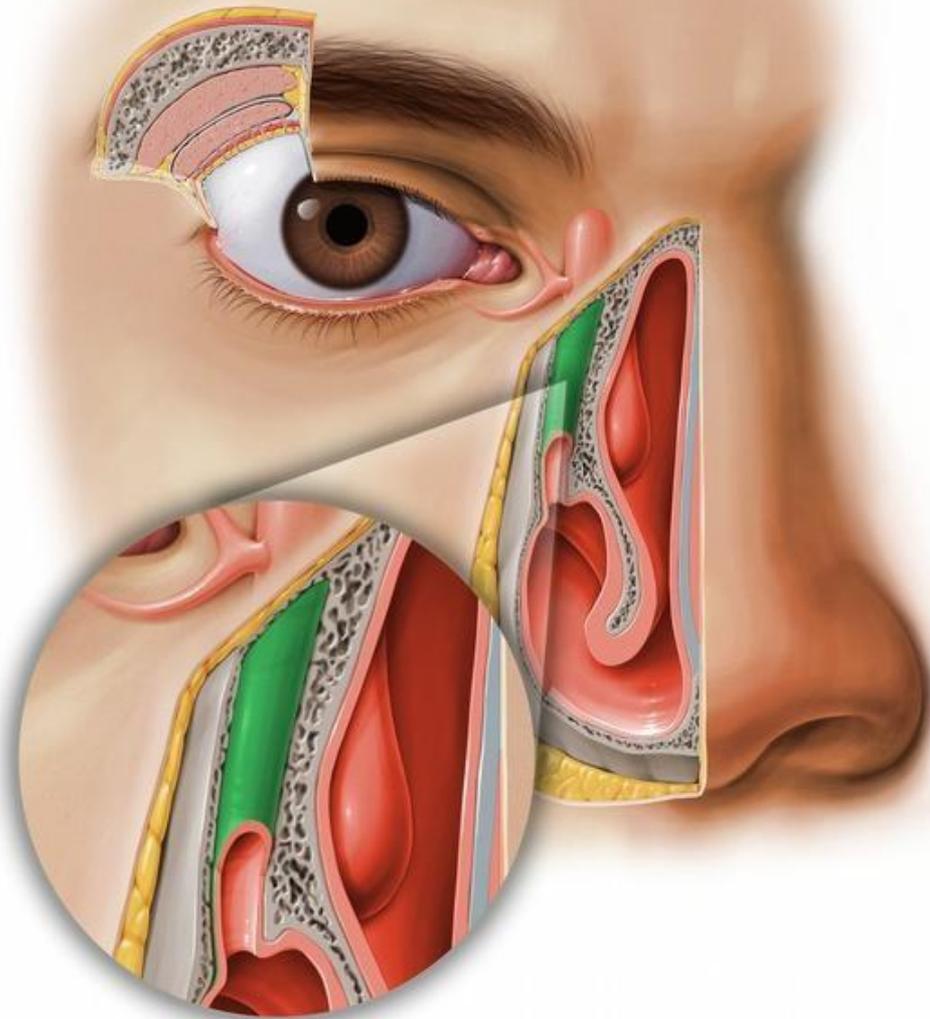
- Located in the lesser wing of the sphenoid (at the junction with the body)
- It communicates with the middle cranial fossa.
- It transmits the optic nerve and the ophthalmic artery

## 9-Nasolacrimal canal:

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



## Nasolacrimal canal



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The tears pass through this canal to nasal cavity.  
High amount of the tears pass to the nasal cavity and a little amount on your cheek

## 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

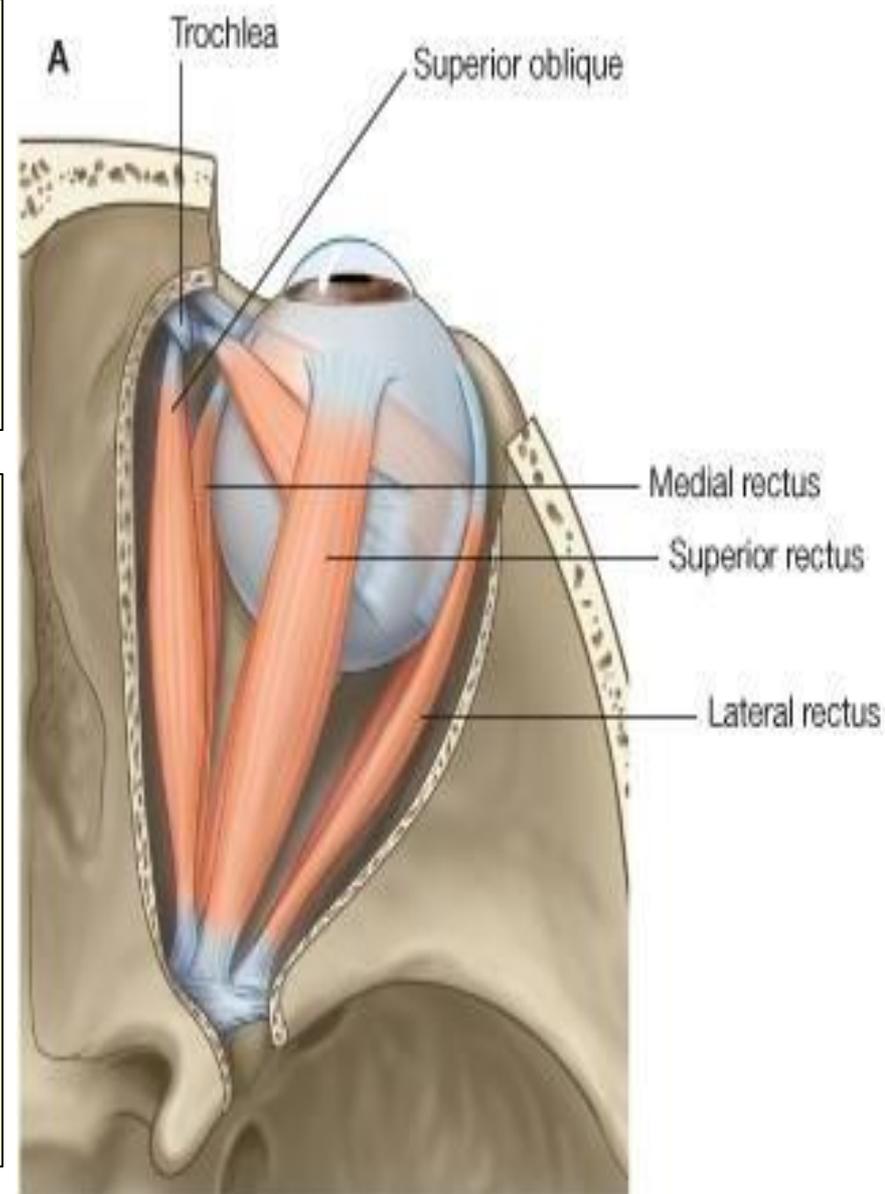
**2 Intrinsic muscles** within the eyeball, which control the shape of the lens and size of the pupil.

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

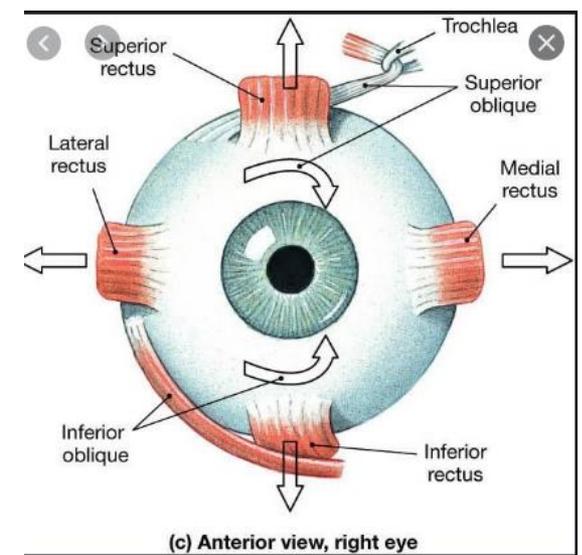
Rectus: straight  
Oblique: oblique  
in direction



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

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The extrinsic muscle  
1-6: inserted into the eyeball so it  
is involved in the movement of  
the eyeball  
7: inserted in the upper eyelid so it  
is involved in raising the upper



# Movements of the eyeball

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

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

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

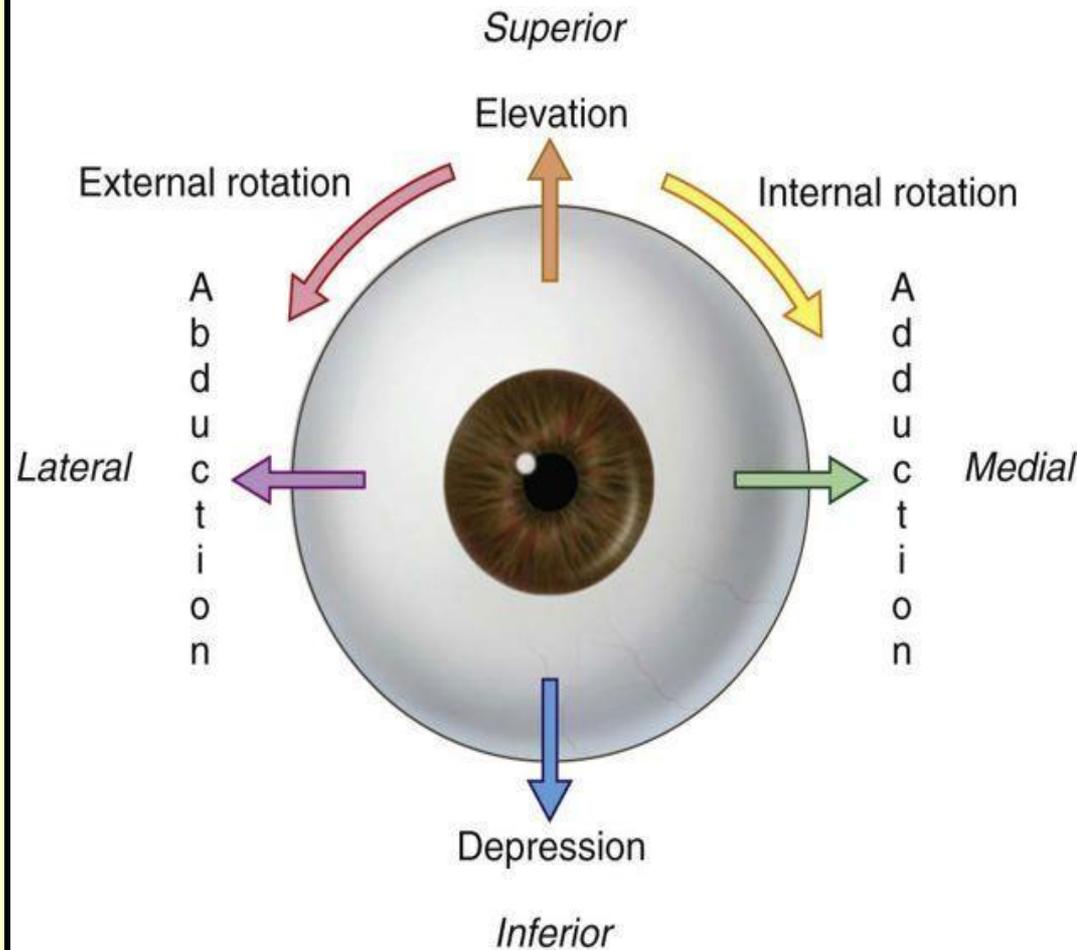
**Adduction**-moving the pupil/cornea medially

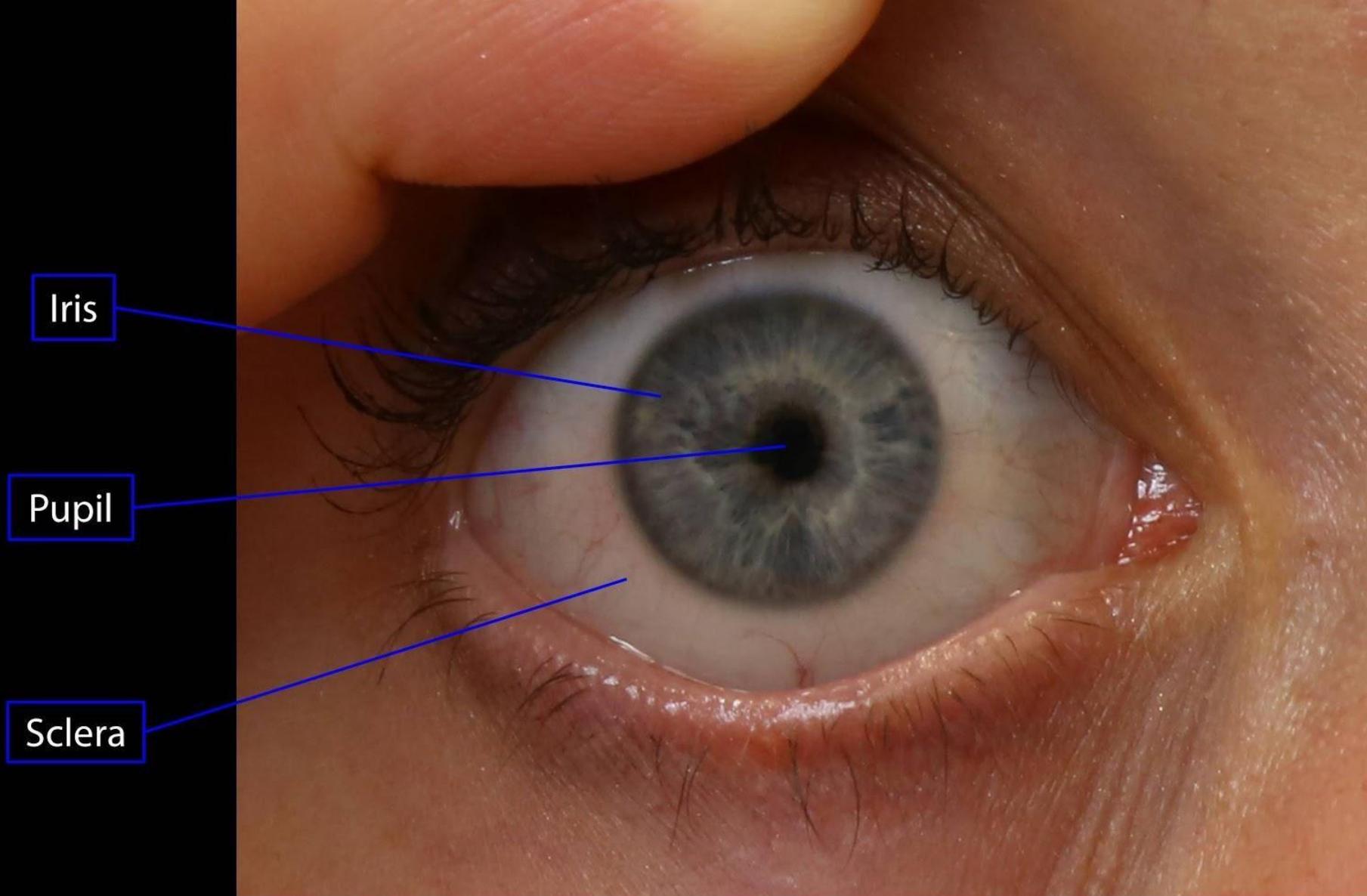
**Internal rotation**-rotating the upper part of the pupil/cornea medially (or towards the nose)

**Intorsion**

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

**Extorsion**





Iris

Pupil

Sclera

Orbital region, anterior

BlueLink

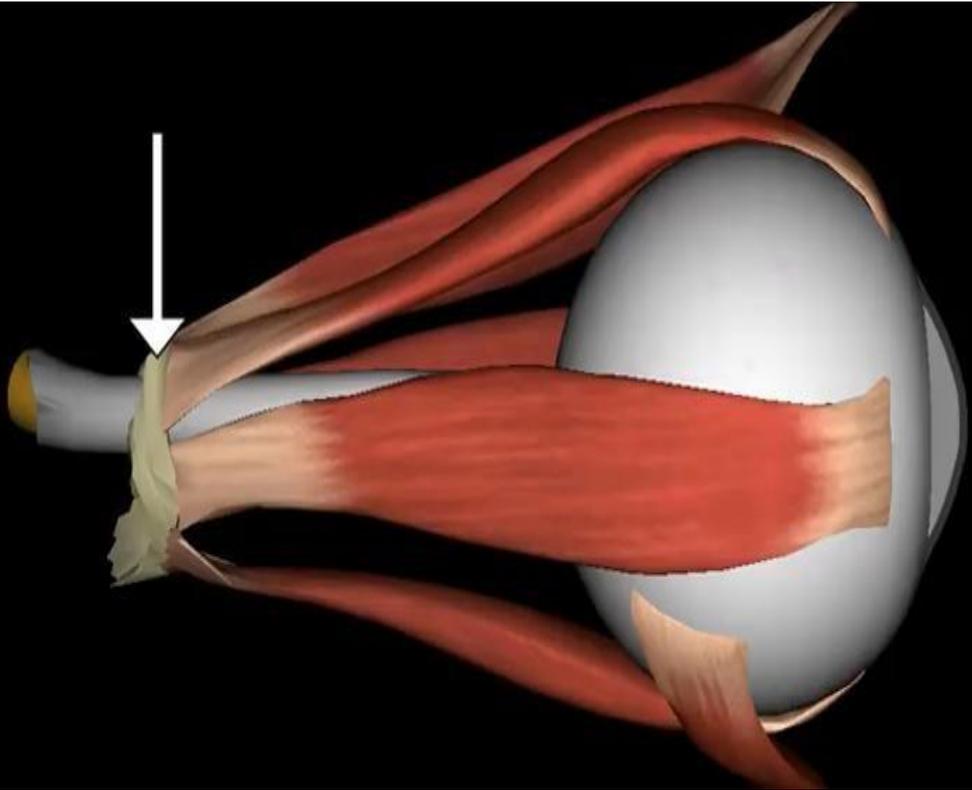
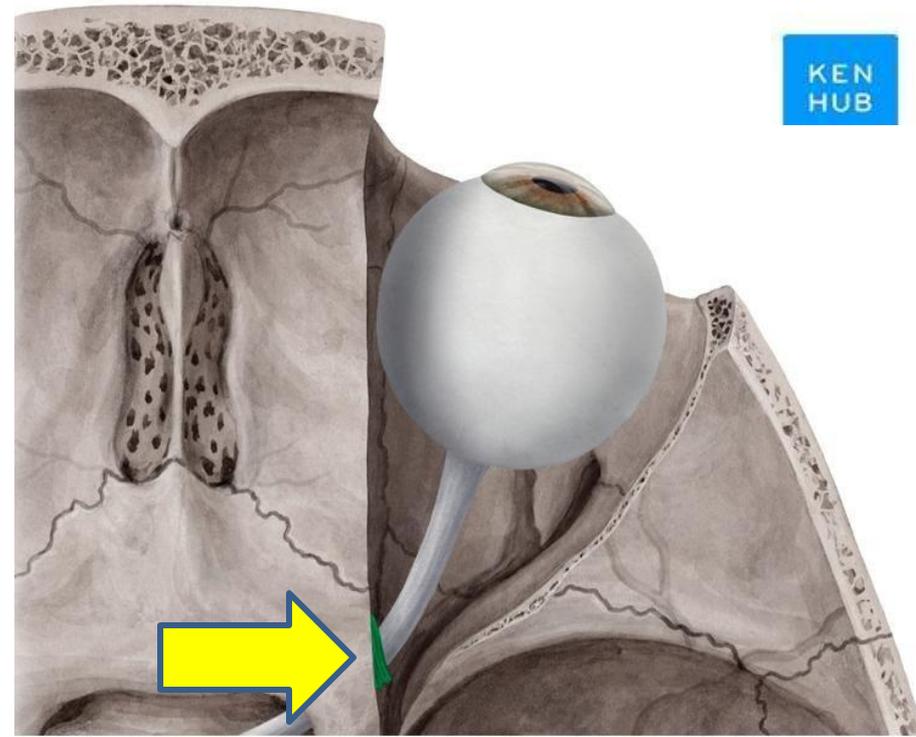
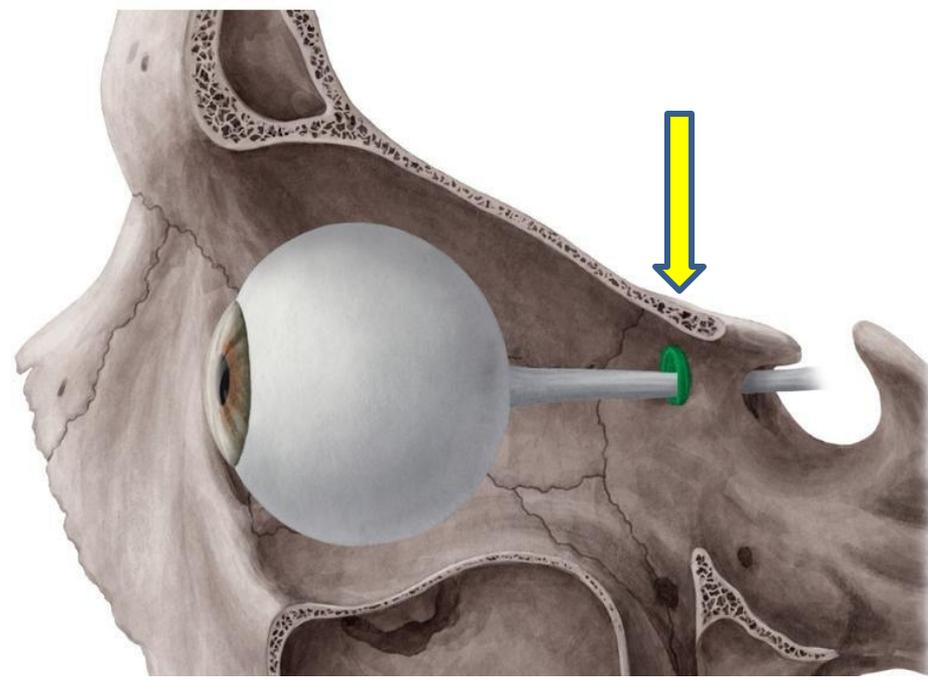
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Sclera: whitish area of the eyeball

Pupil : a hole in the iris

Cornea: a transparent membrane covers the iris and pupil

**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



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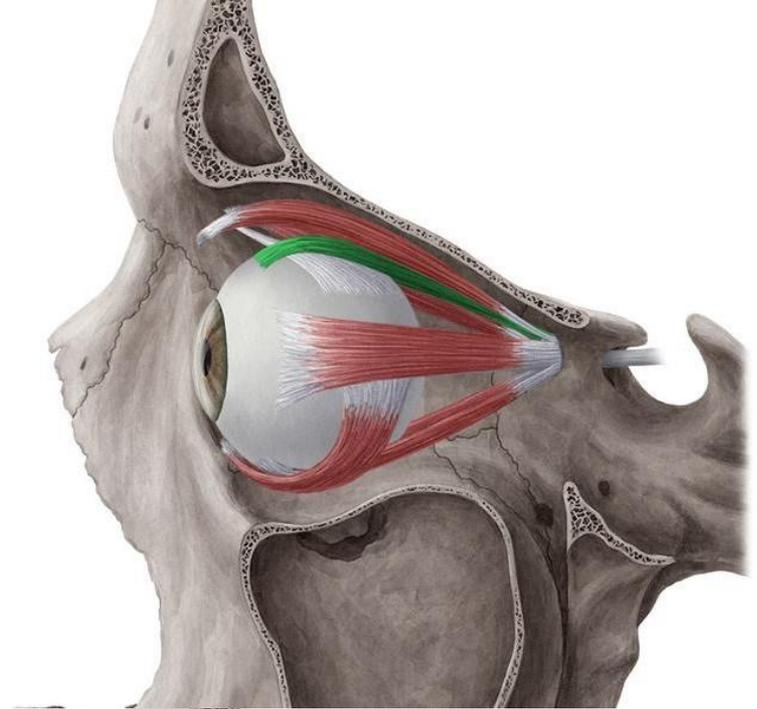
# 1-Superior rectus

**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)



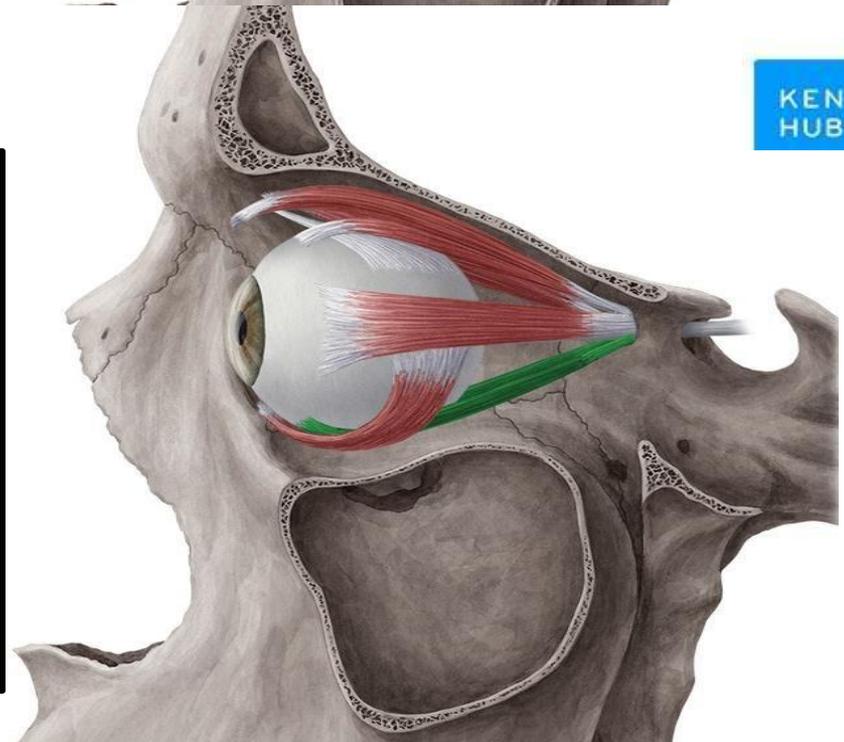
# 2-Inferior rectus

**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)



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Equator of the eye: an imaginary line divides the eyeball into anterior and posterior

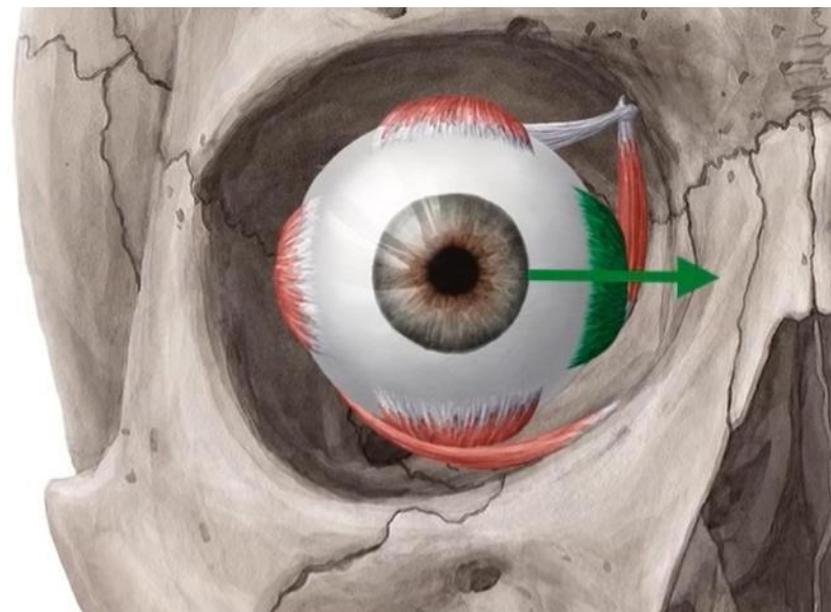
### 3-Medial rectus

**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))



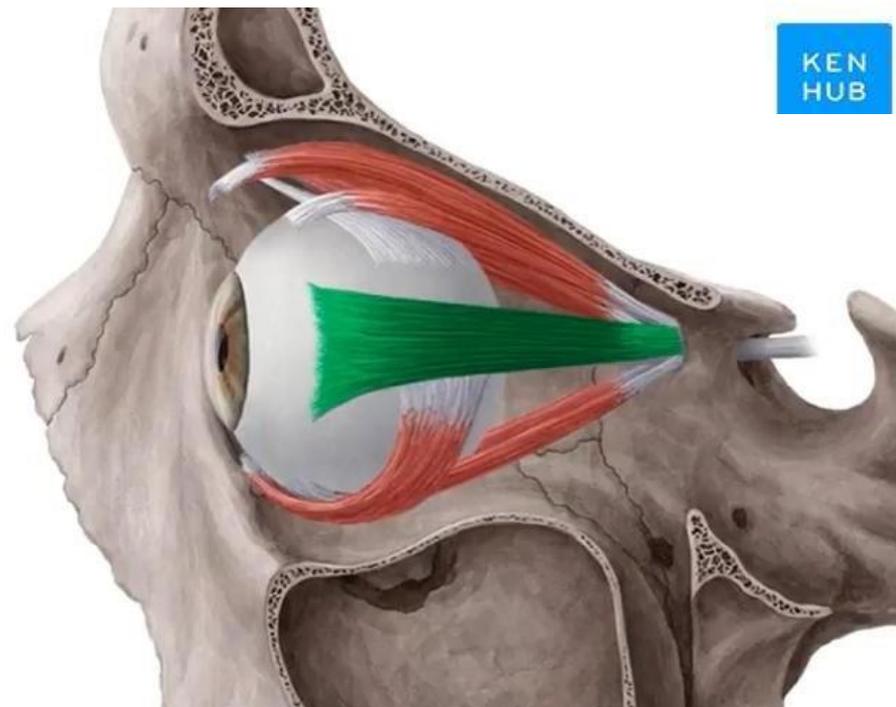
### 4-Lateral rectus

**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)



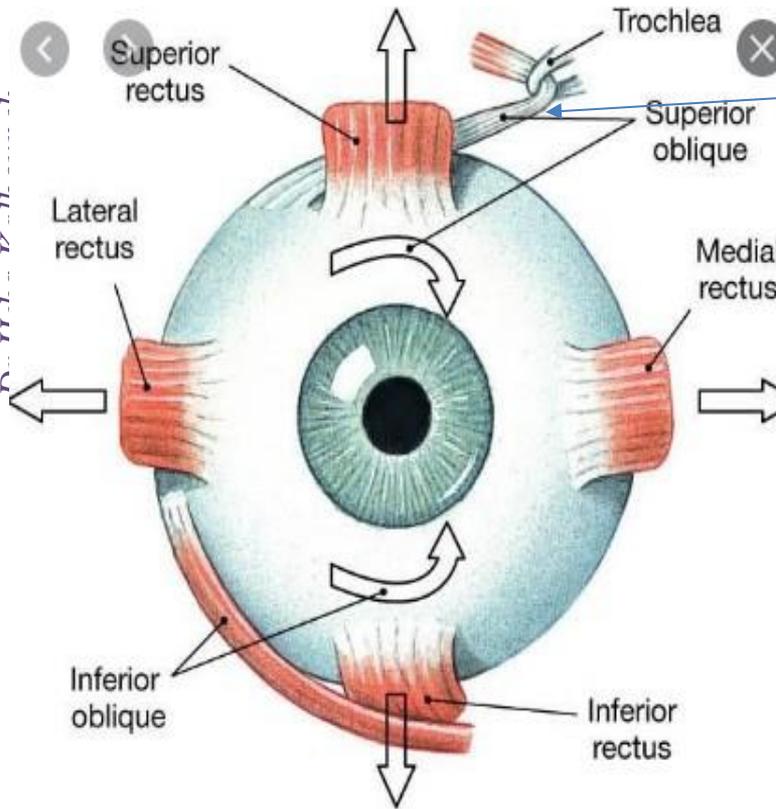
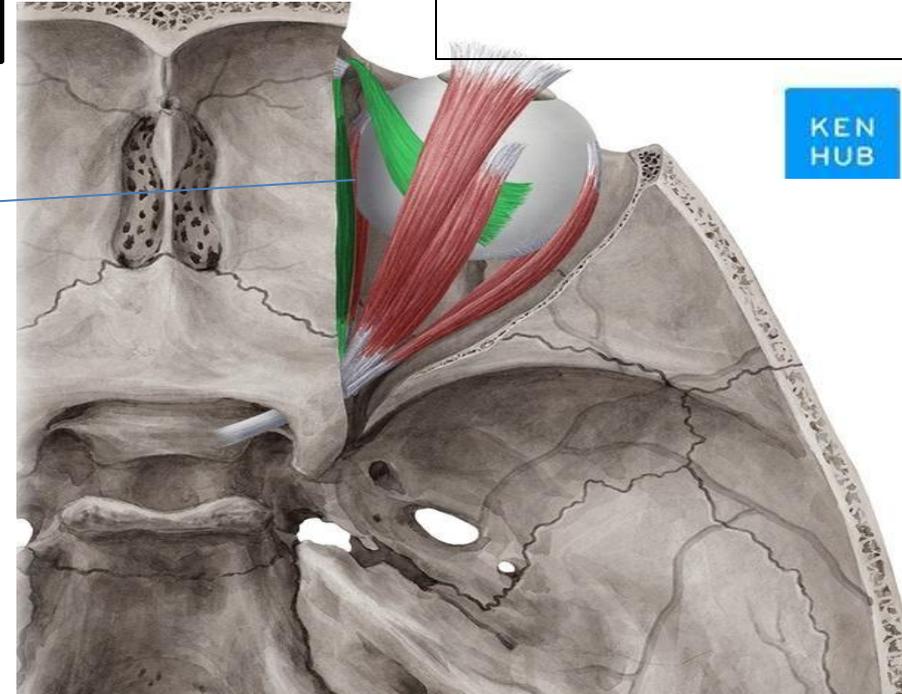
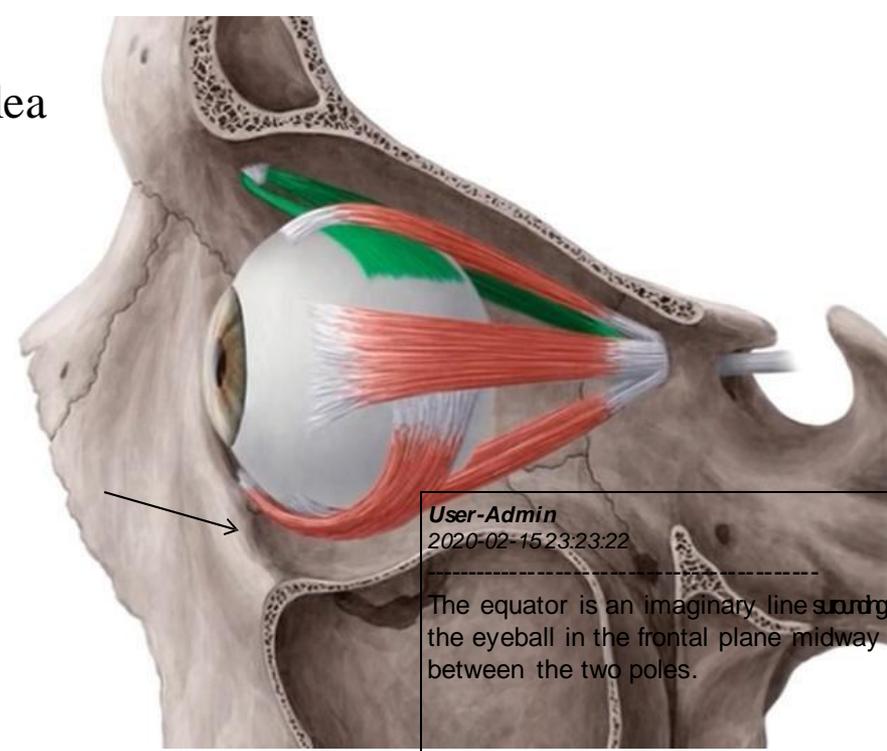
# 5-Superior oblique

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

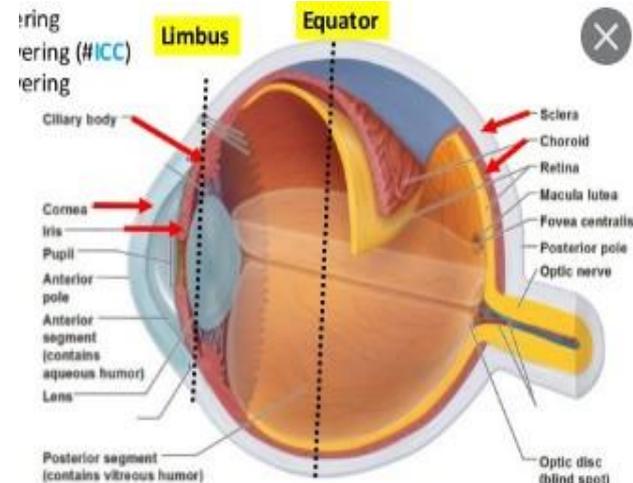
**Nerve supply:** Trochlear nerve

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

Trochlea



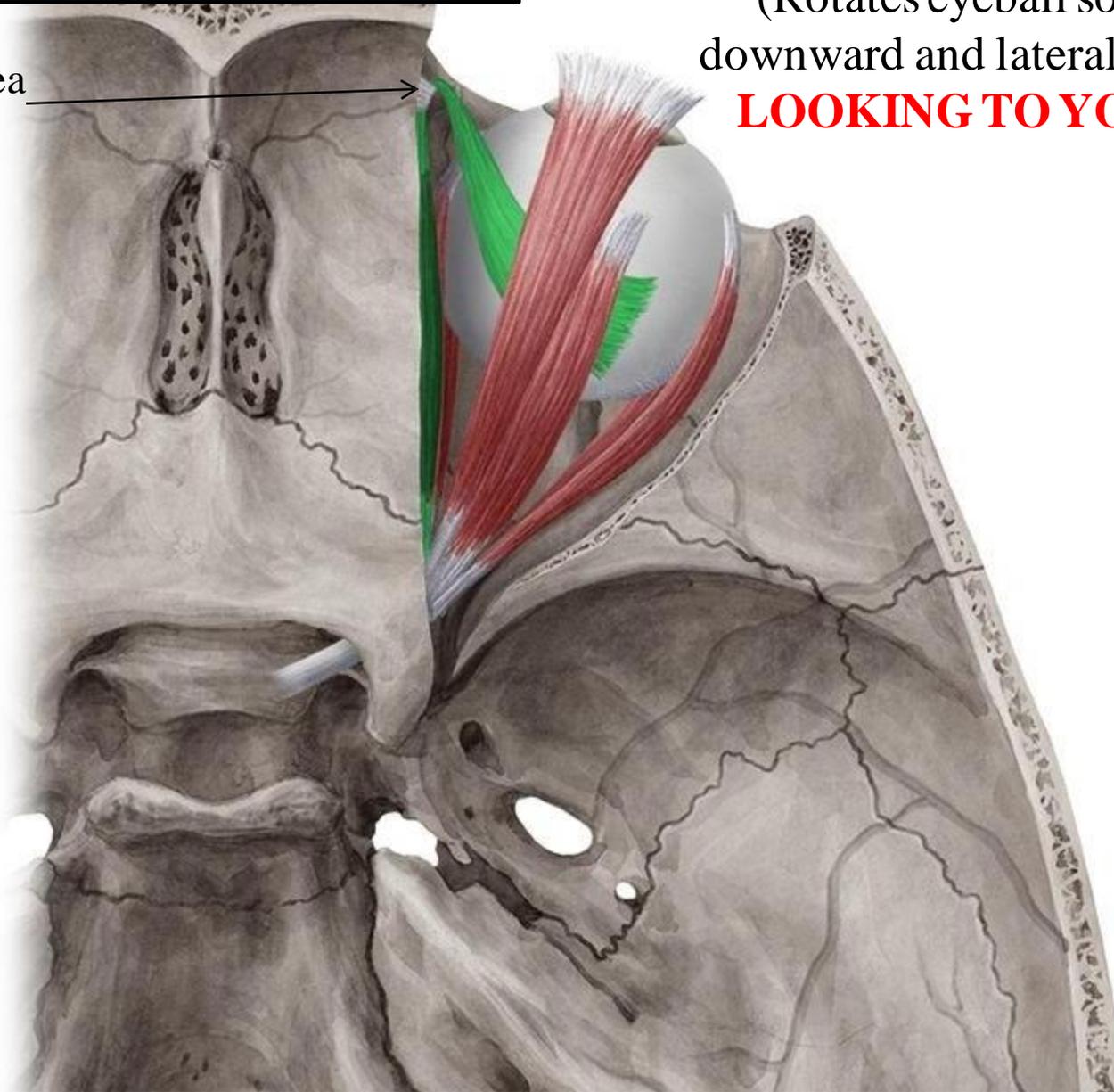
(c) Anterior view, right eye



## 5-Superior oblique

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

Trochlea



## 6-Inferior oblique

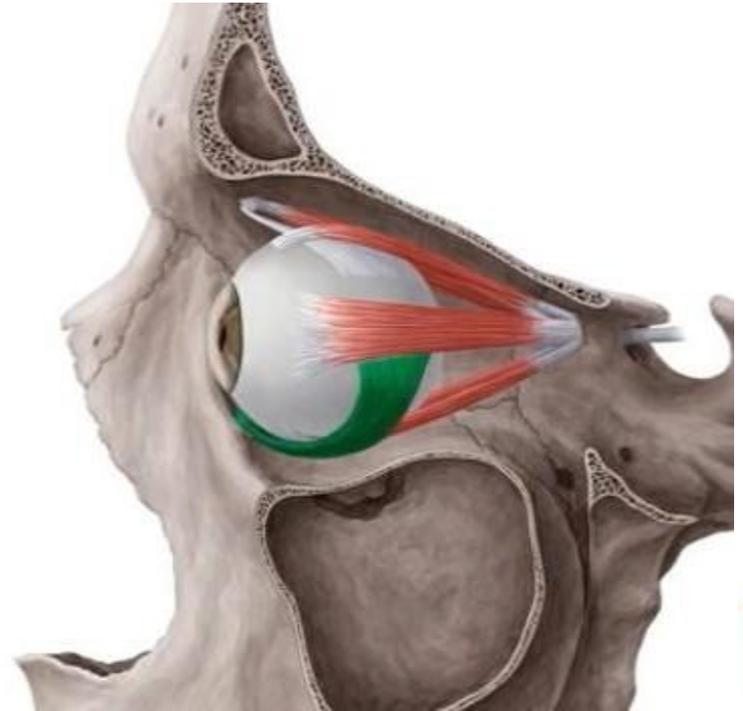
**Origin:** medial part of the floor (anteriorly)

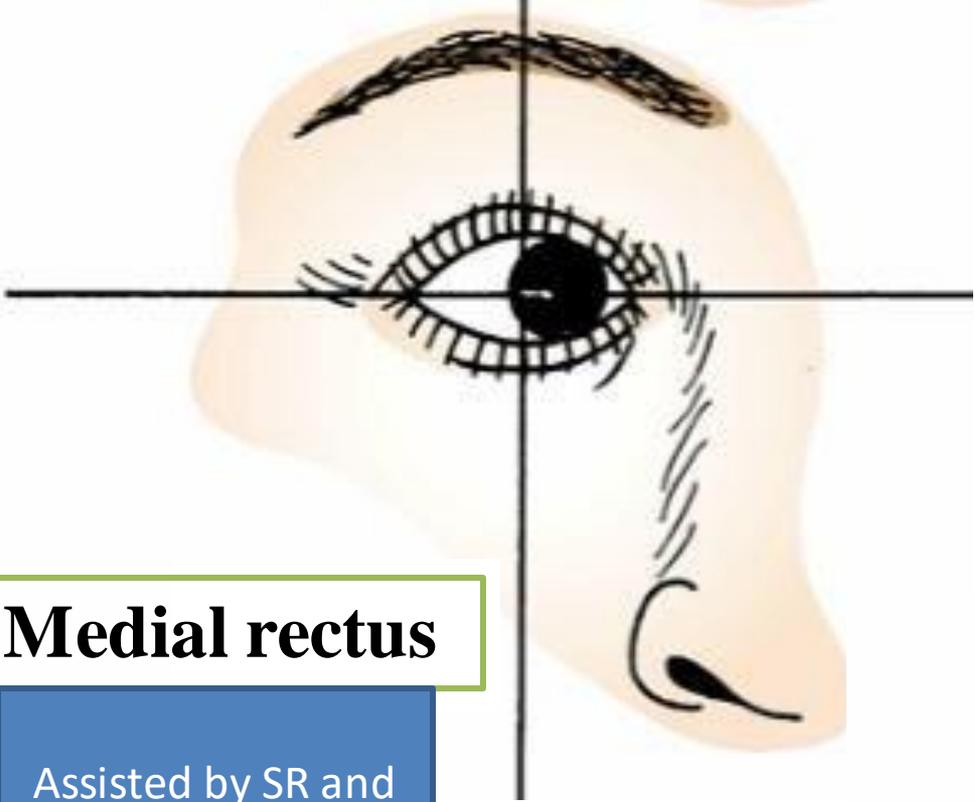
**Insertion:** lateral posterior half of eyeball (*behind the equator*)

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

**Action:** Elevation, abduction, extorsion

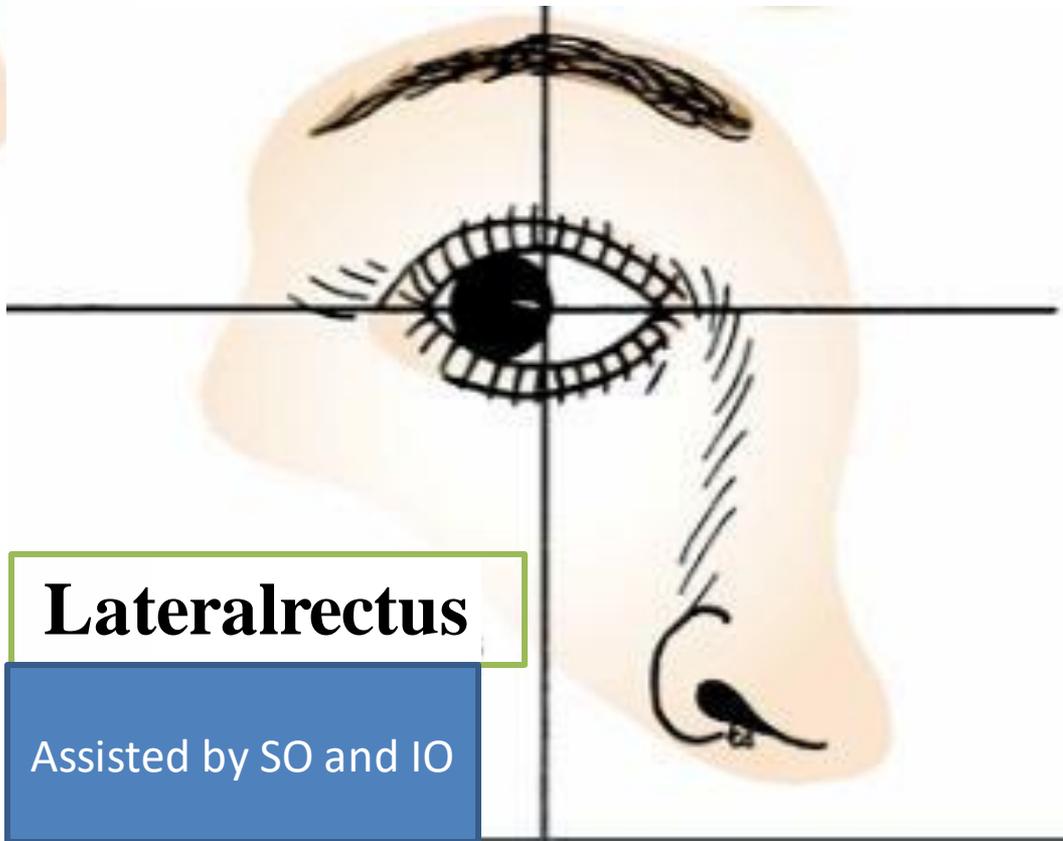
(Rotates eyeball so that cornea looks upward and laterally)





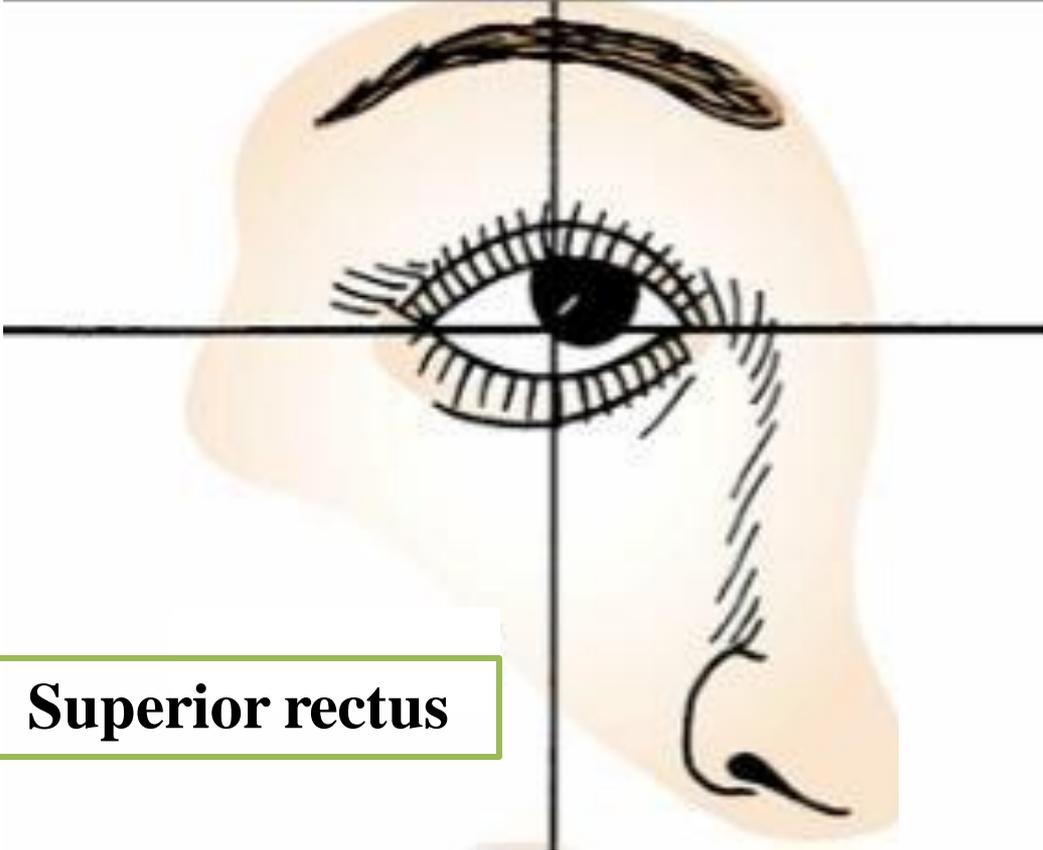
**Medial rectus**

Assisted by SR and IR

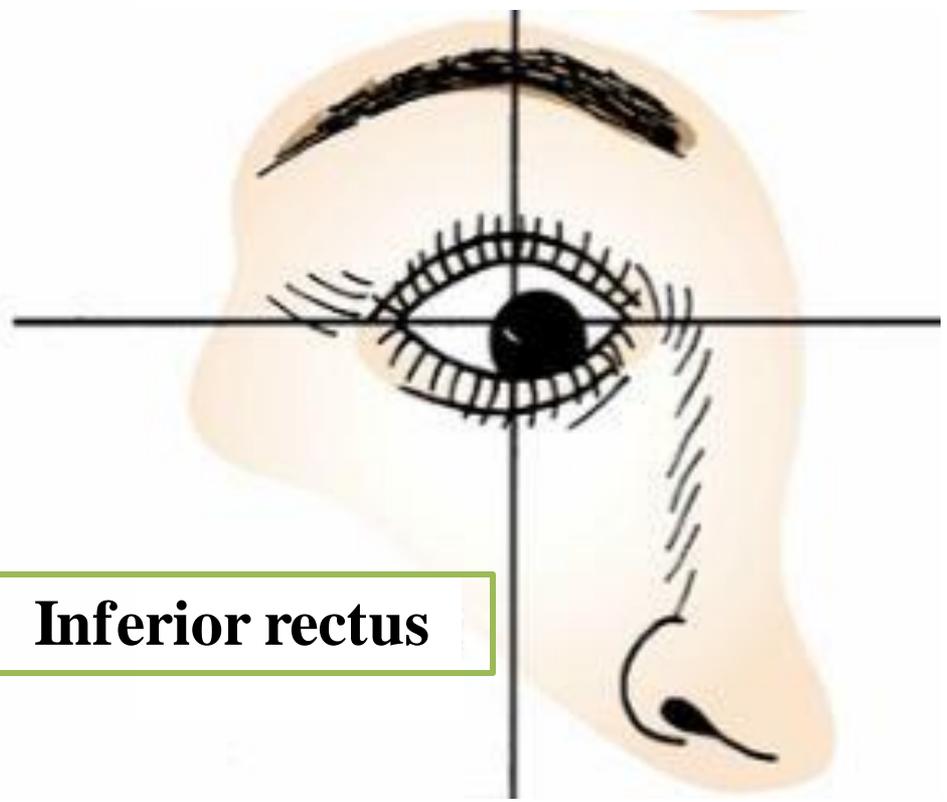


**Lateralrectus**

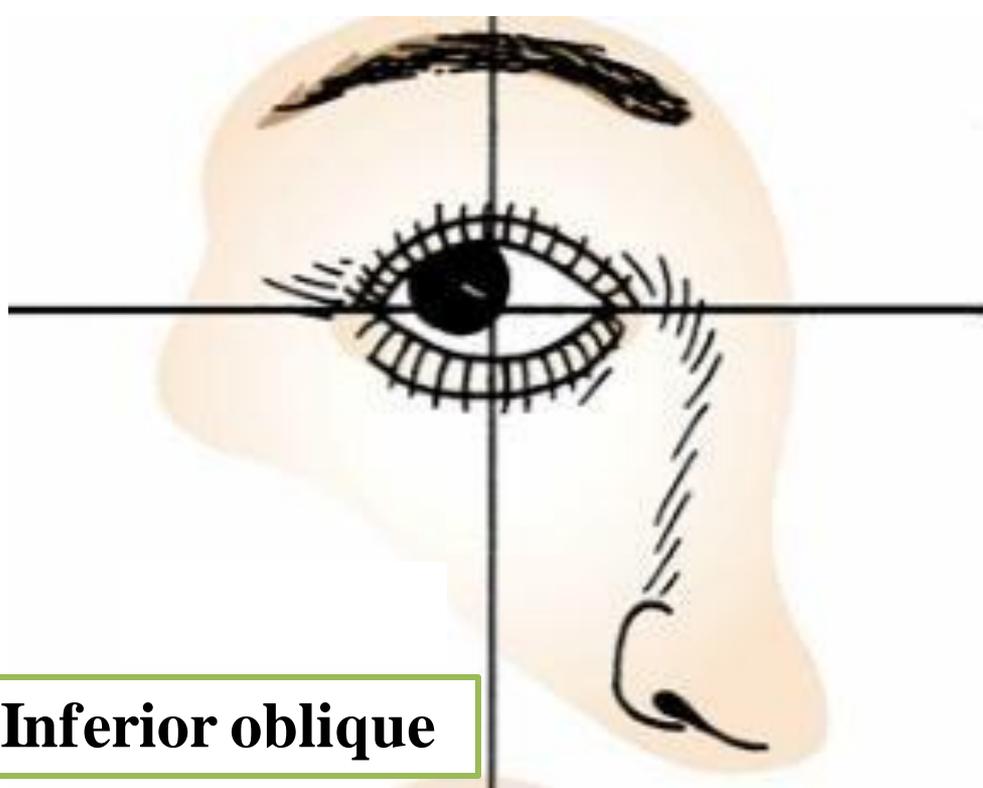
Assisted by SO and IO



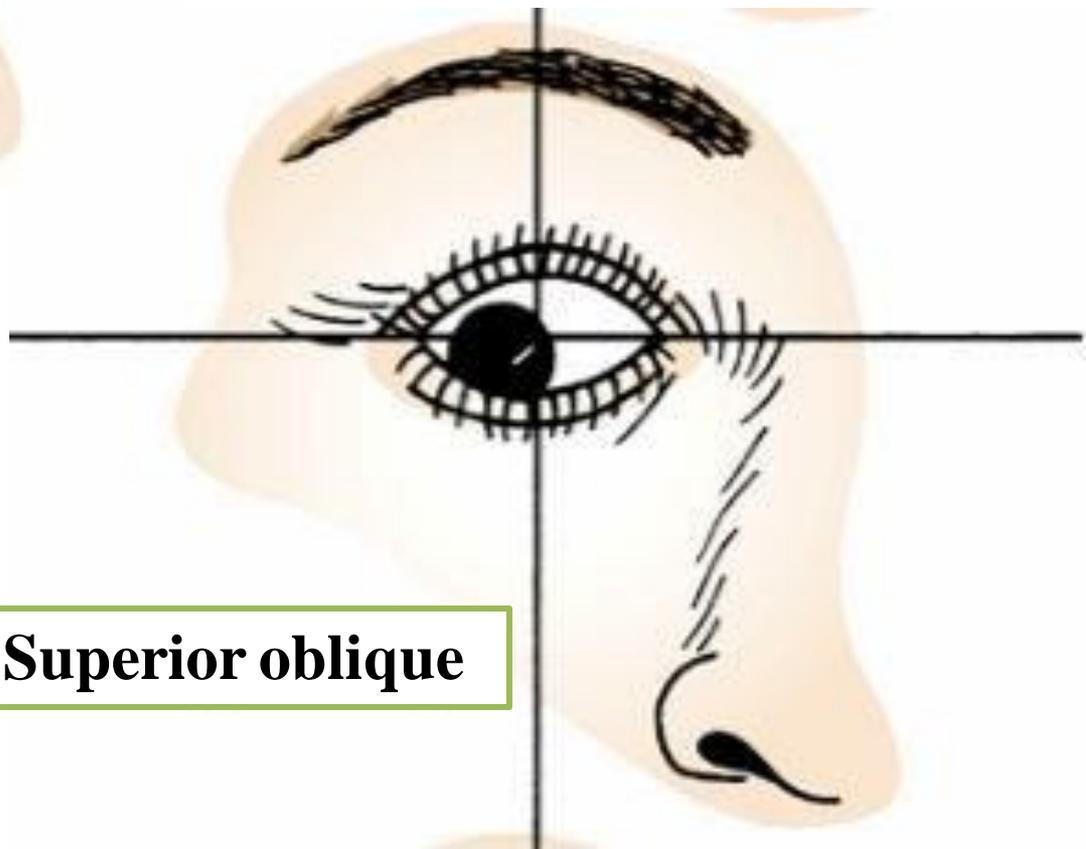
**Superior rectus**



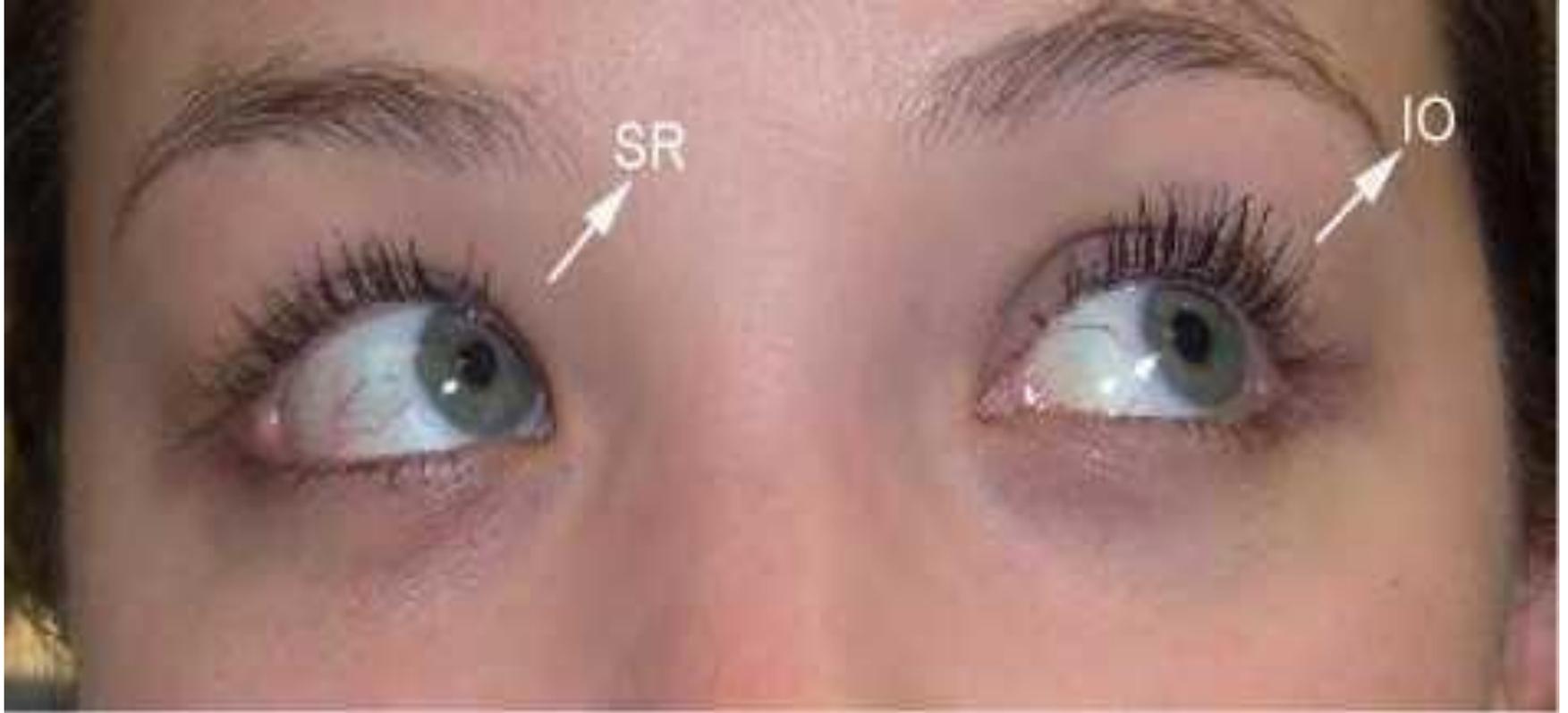
**Inferior rectus**



**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*

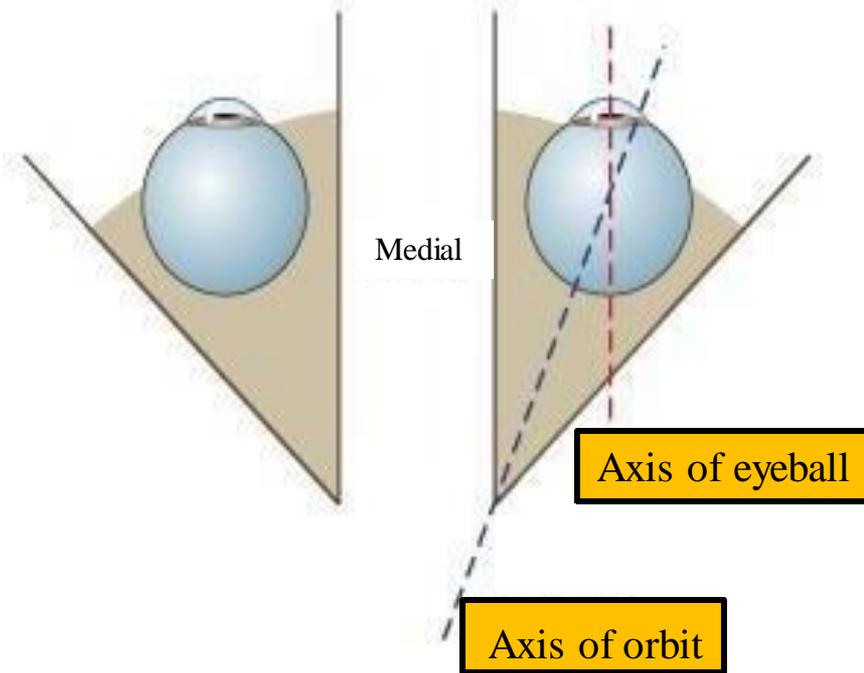
The extraocular muscles don't move in isolation. They produce a coordinated function not only within the extraocular muscles of one eyeball but between the two eyeballs at the level of CNS (you cannot move the two lateral recti together)

The origins of the superior and inferior recti are situated about 23 °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

Why we test extraocular muscle??  
To test their cranial nerves

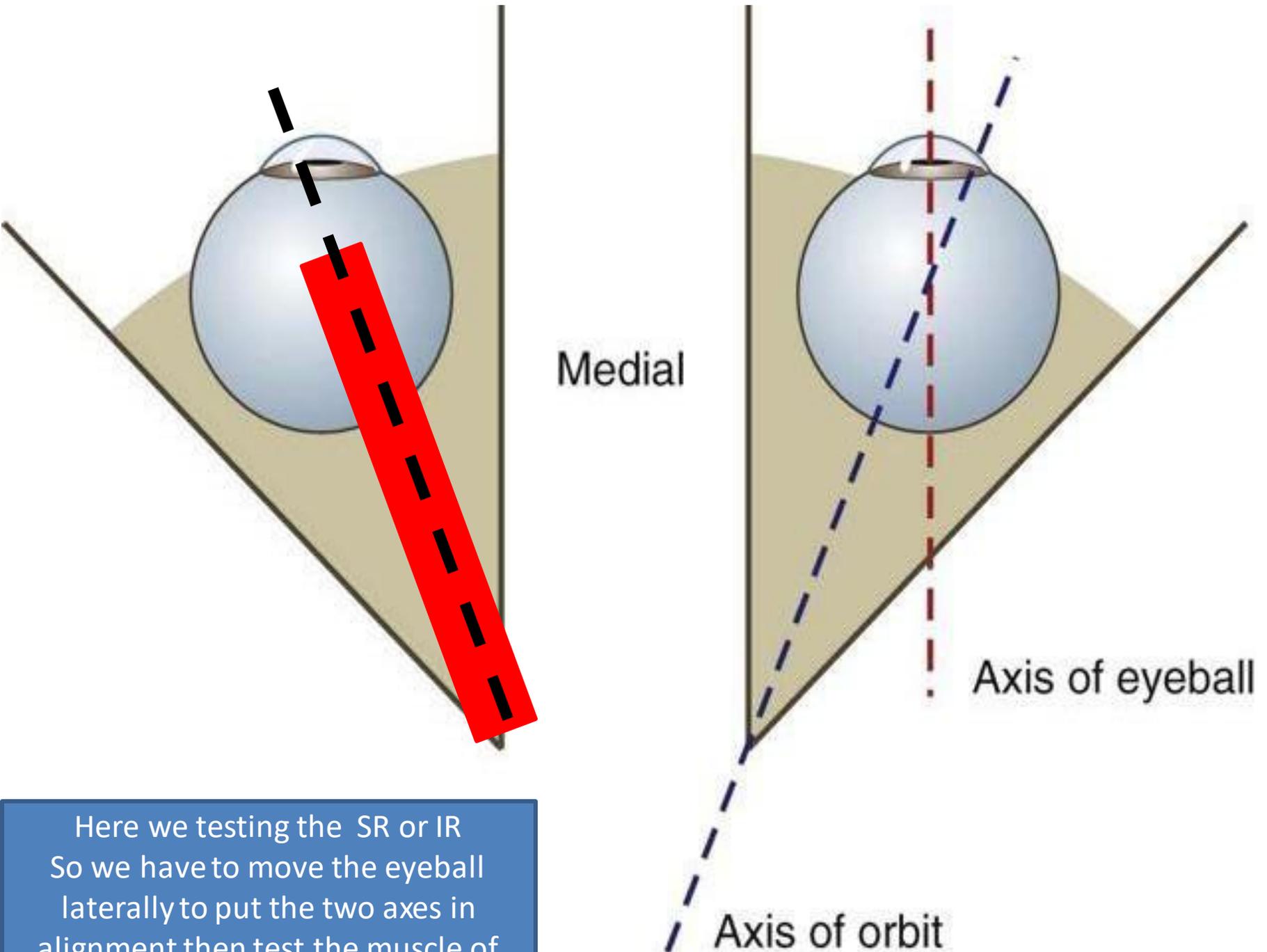


### Clinical Testing

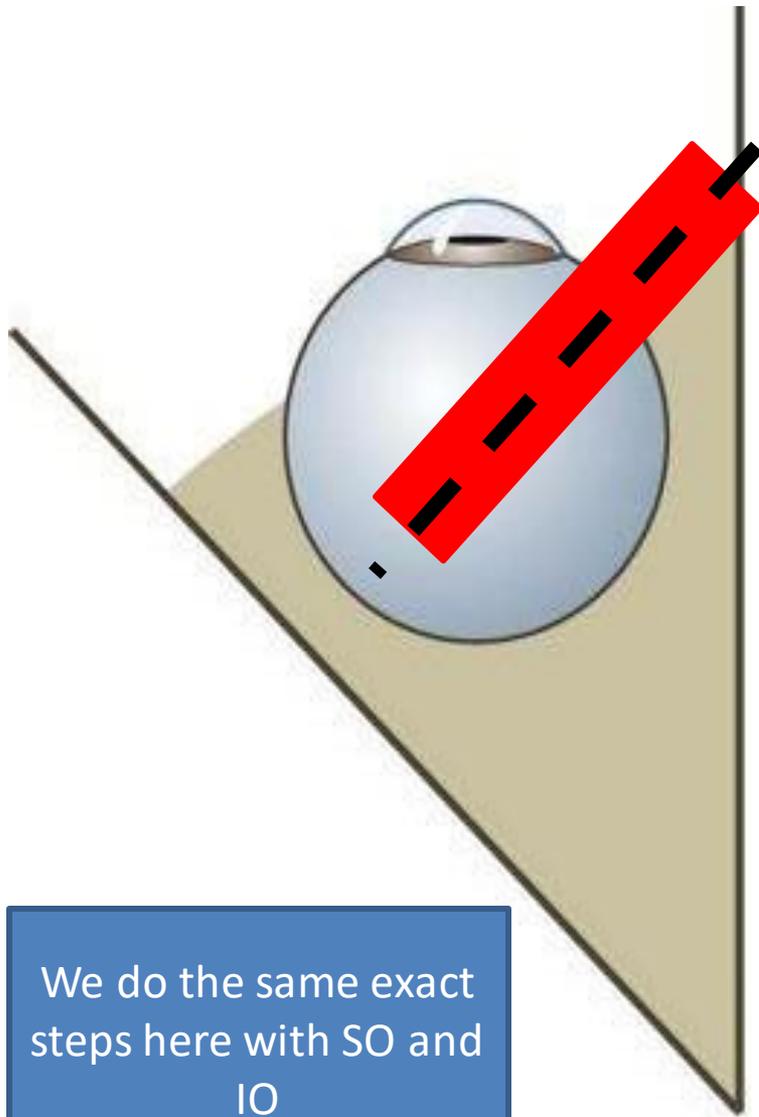
Muscle tested	Movement
SR	Looks laterally and upwards
IR	Looks laterally and downwards
LR	Looks laterally
MR	Looks medially
IO	Looks medially and upwards
SO	Looks medially and downwards

Direction to move eye when testing the extraocular muscles

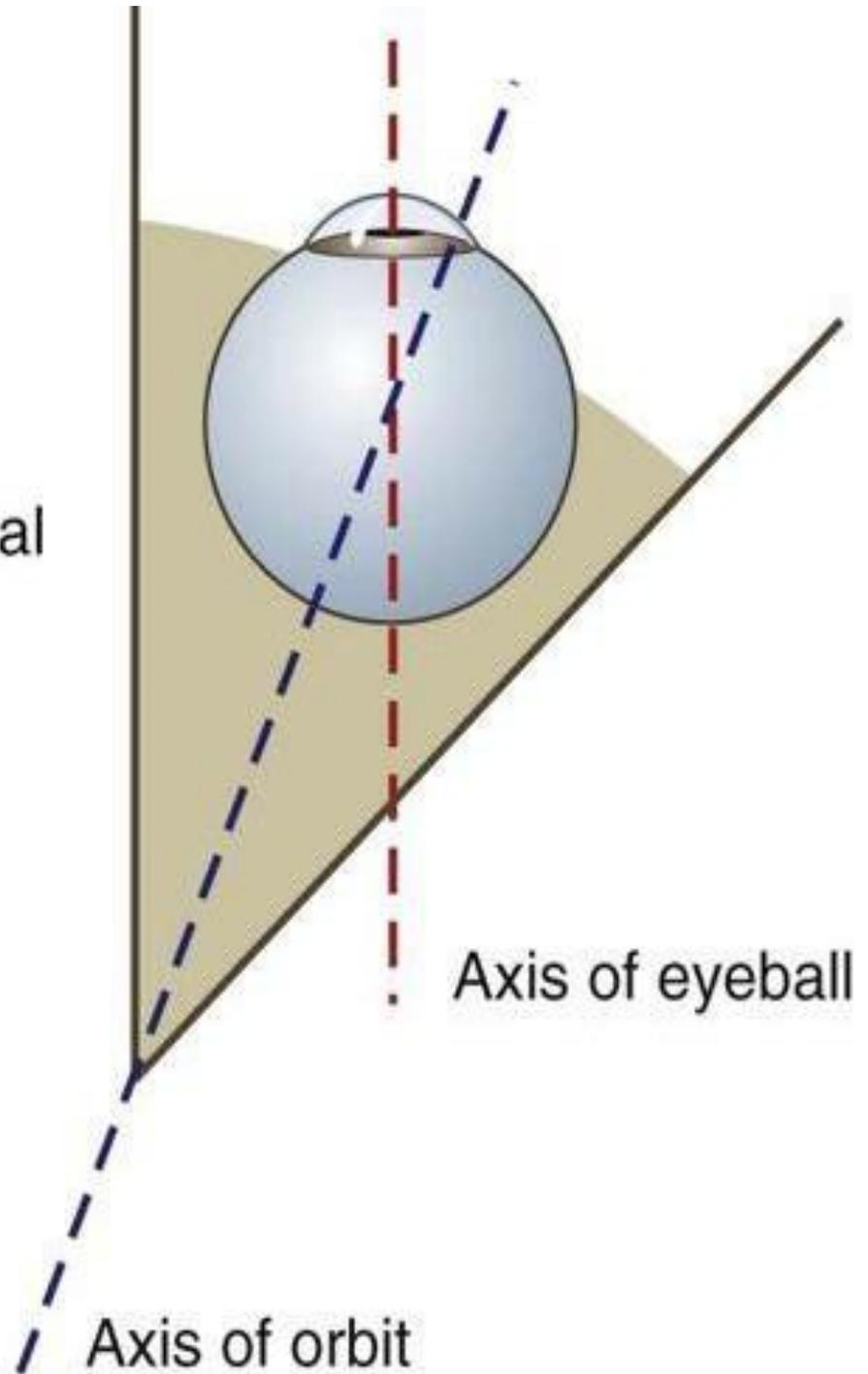
If you want to test a muscle in isolation you have to put the long axis of the muscle (axis of the orbit) in alignment with the long axis of the eyeball



Here we testing the SR or IR  
So we have to move the eyeball  
laterally to put the two axes in  
alignment then test the muscle of  
interest  
If SR: elevate the eyeball  
IR: depress the eyeball



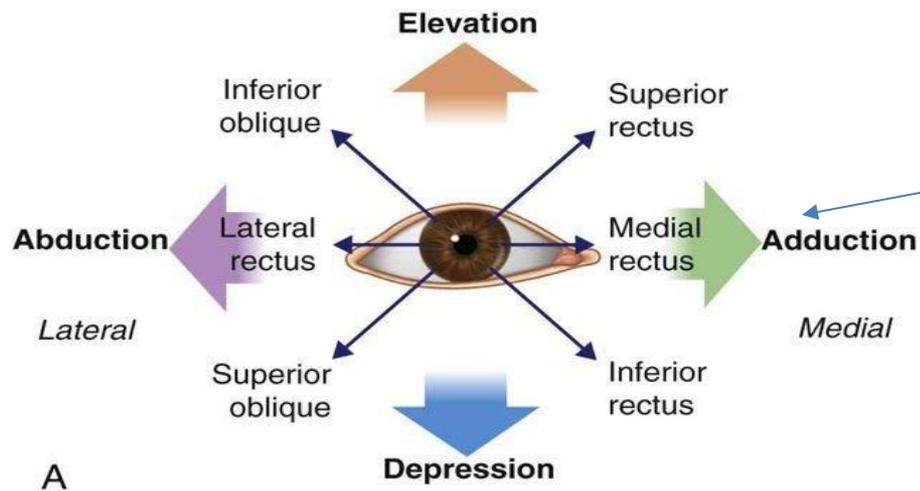
Medial



Axis of eyeball

Axis of orbit

We do the same exact steps here with SO and IO  
IO  
If SO: depress the eyeball  
IO: elevate the eyeball



Function of the extraocular muscles

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>

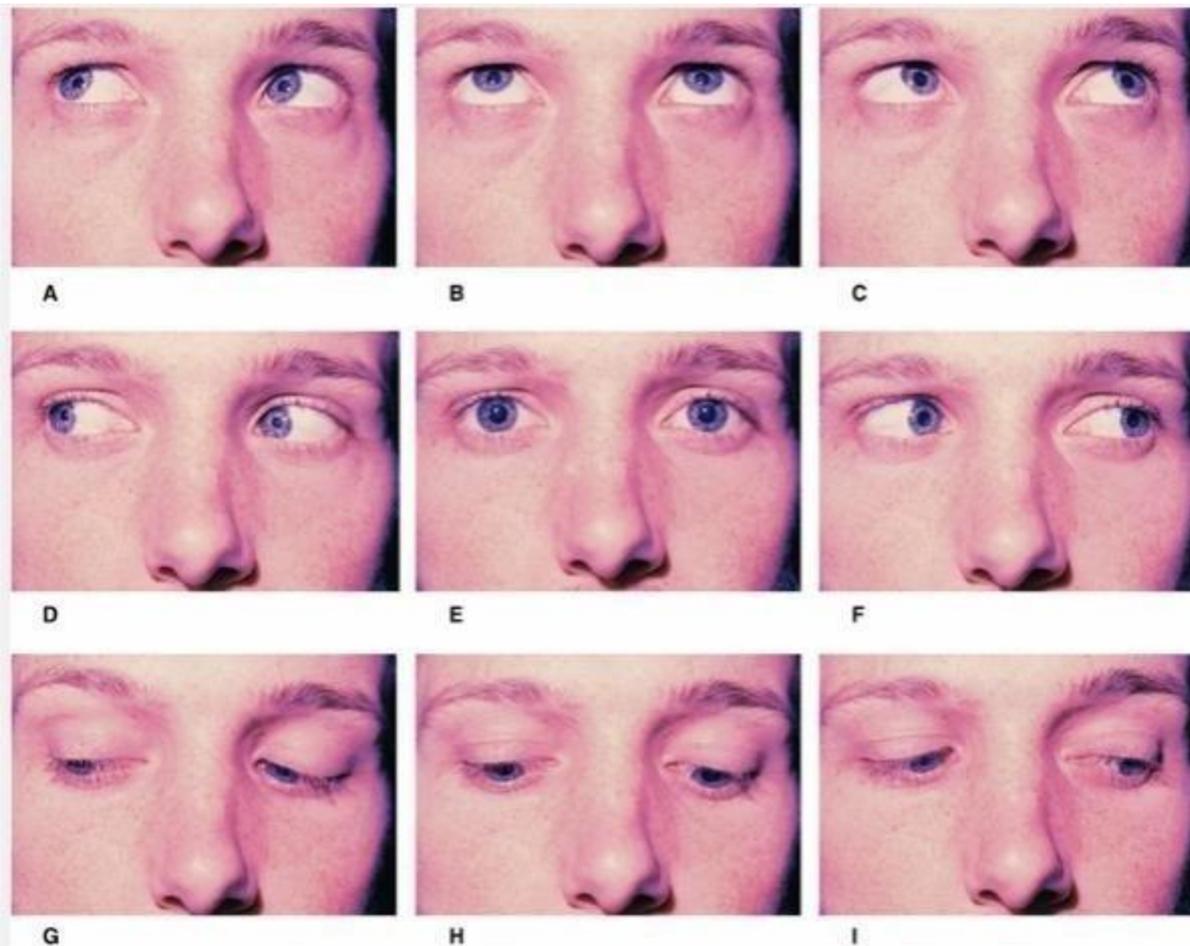
To test muscle

B



For further understanding you can watch this video

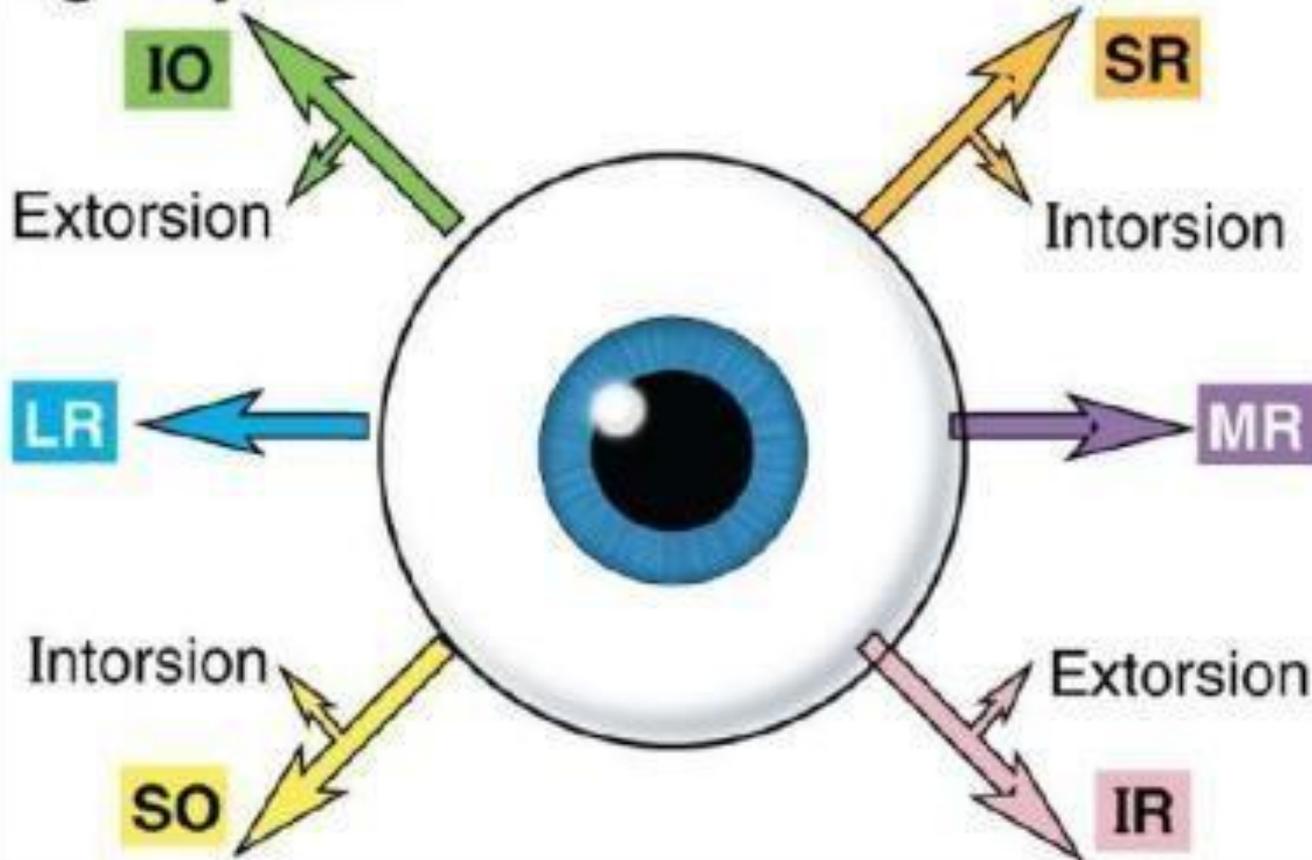
<https://www.youtube.com/watch?v=3J2UZiLVZKA&feature=share>



**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.

The cardinal positions: the optimal position to put the axis of extraocular muscle in alignment with the axis of eyeball. (this is how we testing the muscle)

## Right eyeball:



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

intorsion: moving the superior surface of the eyeball medially (the superior muscles do it)  
Extorsion: moving the superior surface laterally (the inferior muscles do it)

# LEVATOR PALPEBRAE SUPERIORIS

**Origin:** Posterior part of the roof

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

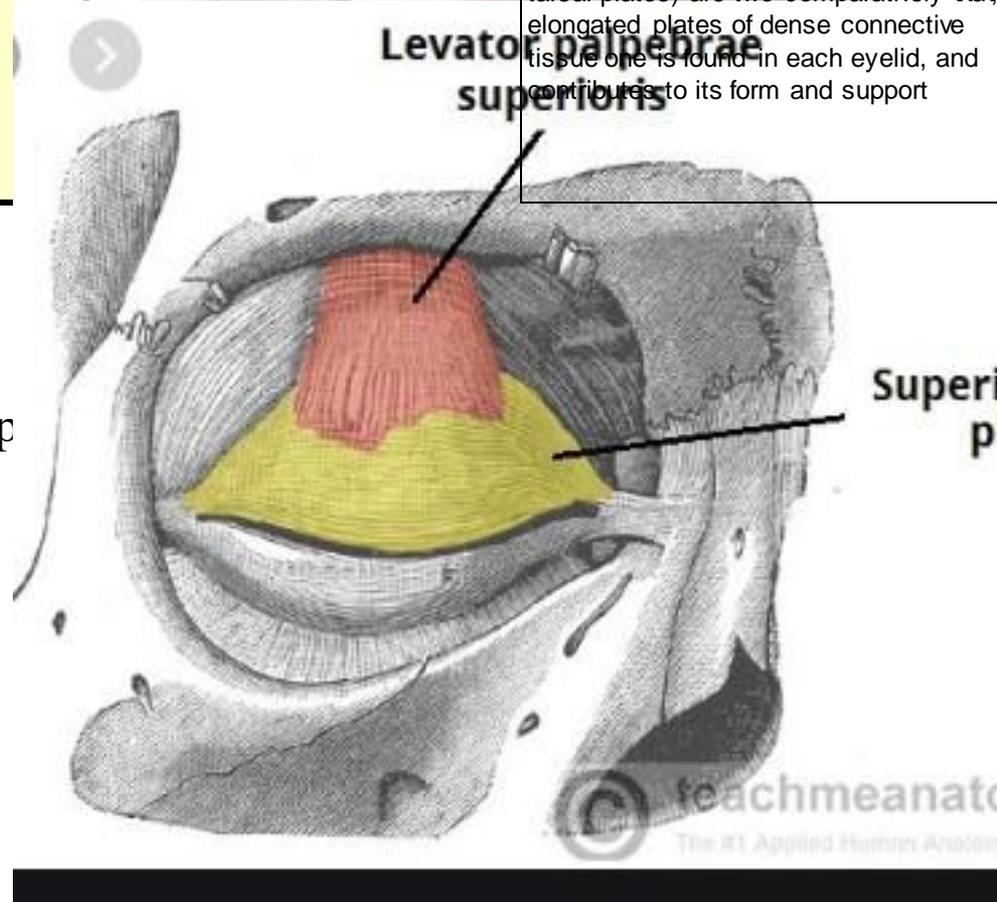
**Nerve supply:** Oculomotor nerve/  
superior branch

**Action:** Elevation of upper eyelid

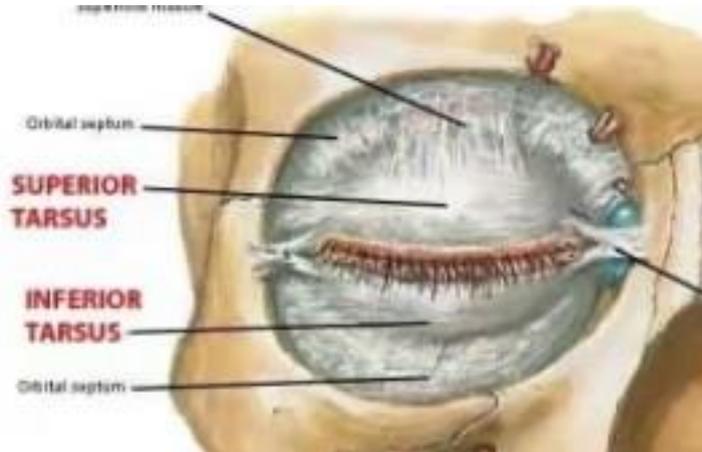


tarsal plates) are two comparatively thick, elongated plates of dense connective tissue one is found in each eyelid, and contributes to its form and support

Levator palpebrae superioris



Into up



# Nerves of orbit

## Motor

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

## Sensory

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

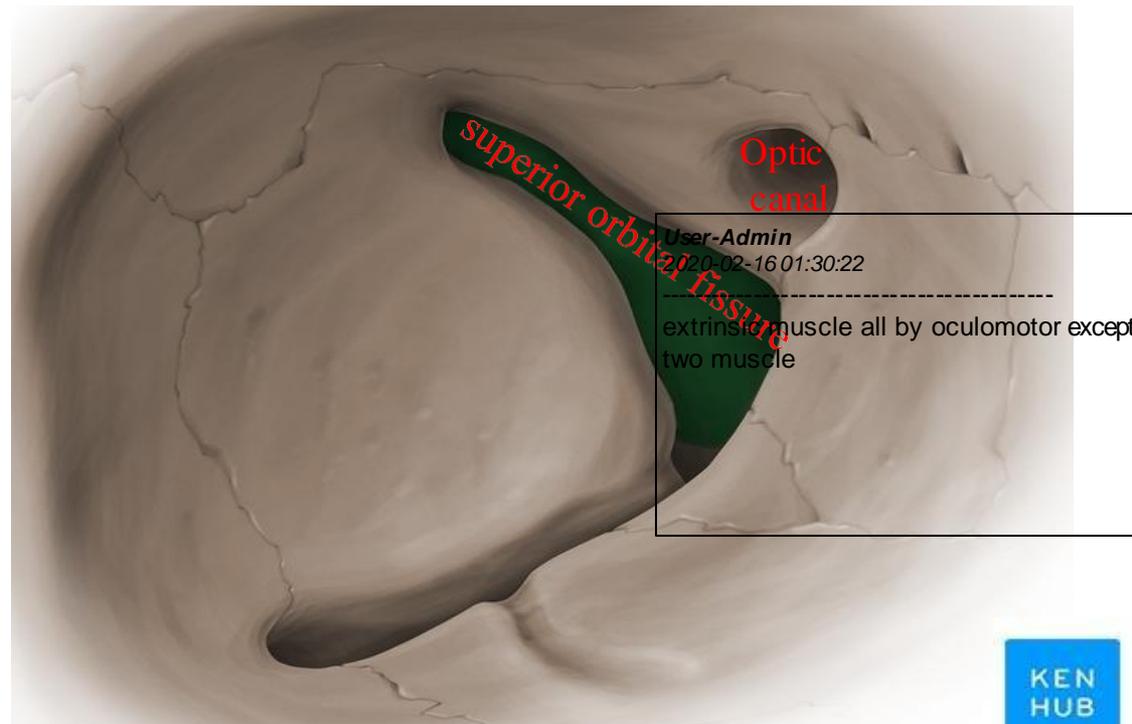
Lacrimal

Frontal

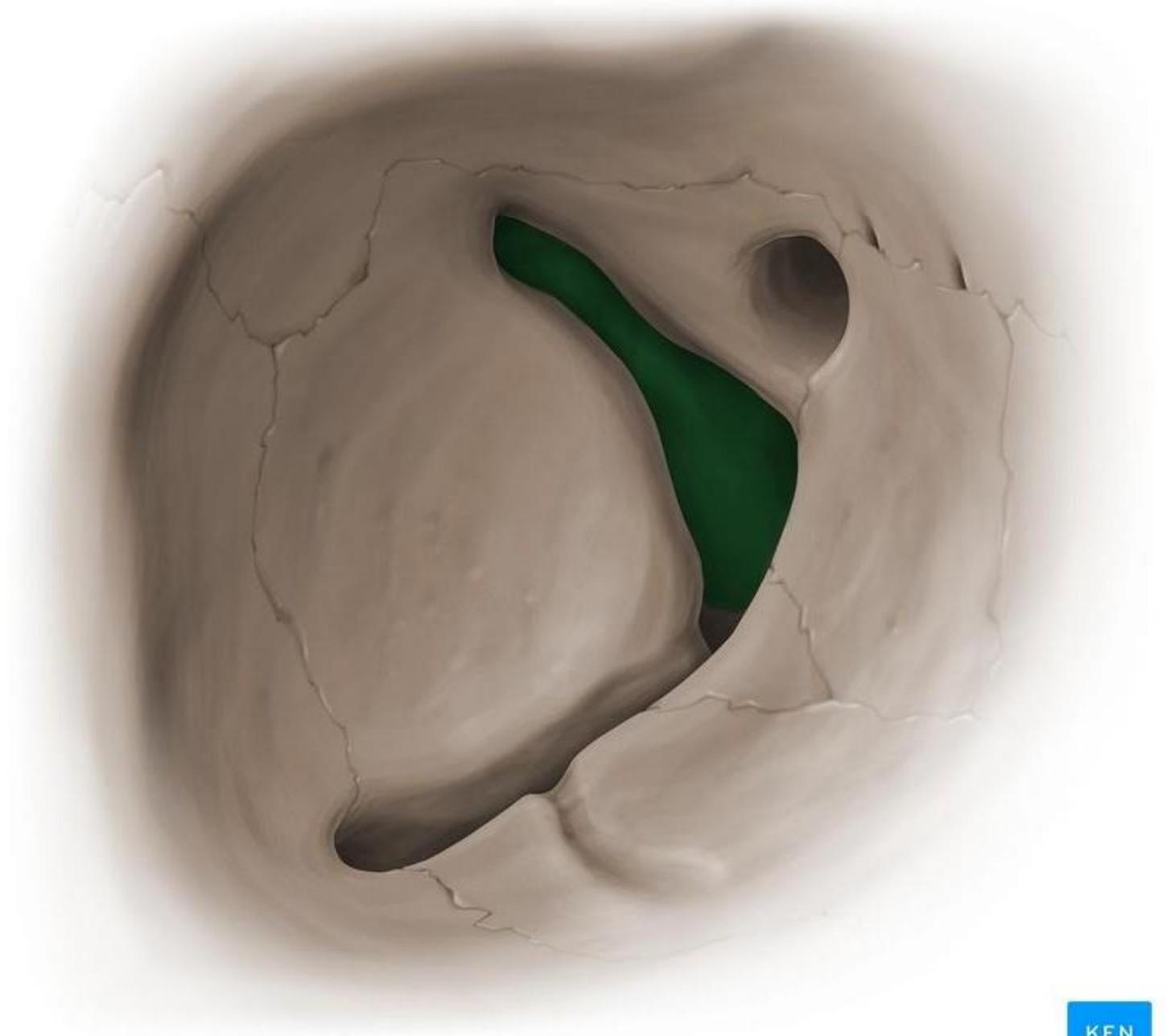
Nasociliary

**SO4LR6**

All the extraocular muscles are supplied by oculomotor nerve except two muscles  
SO: by trochlear nerve  
LR: by abducent nerve



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## LEVATOR PALPEBRAE SUPERIORIS

Superior rectus

Superior oblique

Lateral rectus

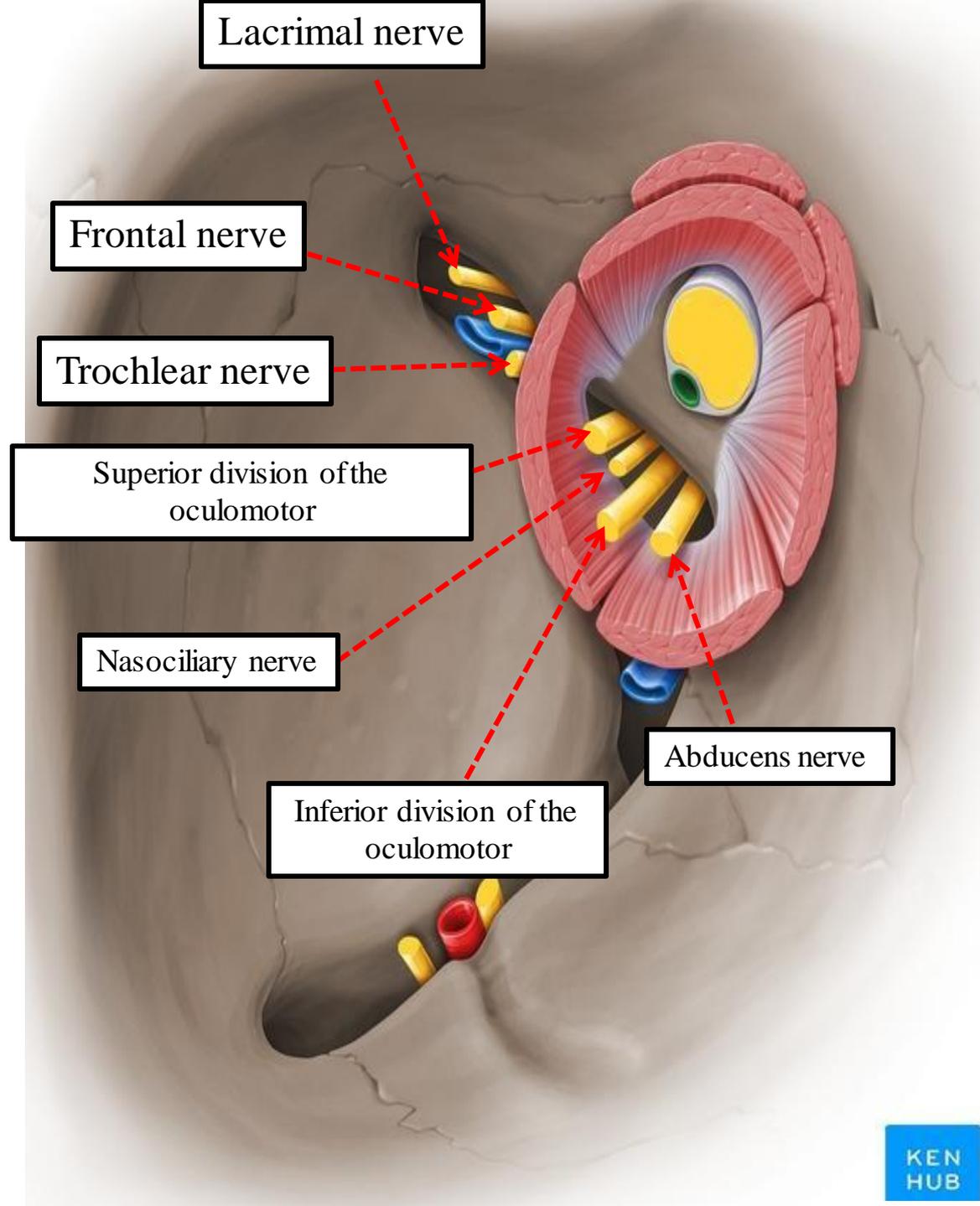
Medial rectus

Inferior rectus

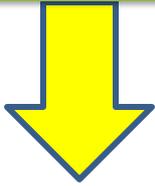
The tendinous ring surrounds the optic canal and the medial margin of superior orbital fissure

# Nerves of orbit

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



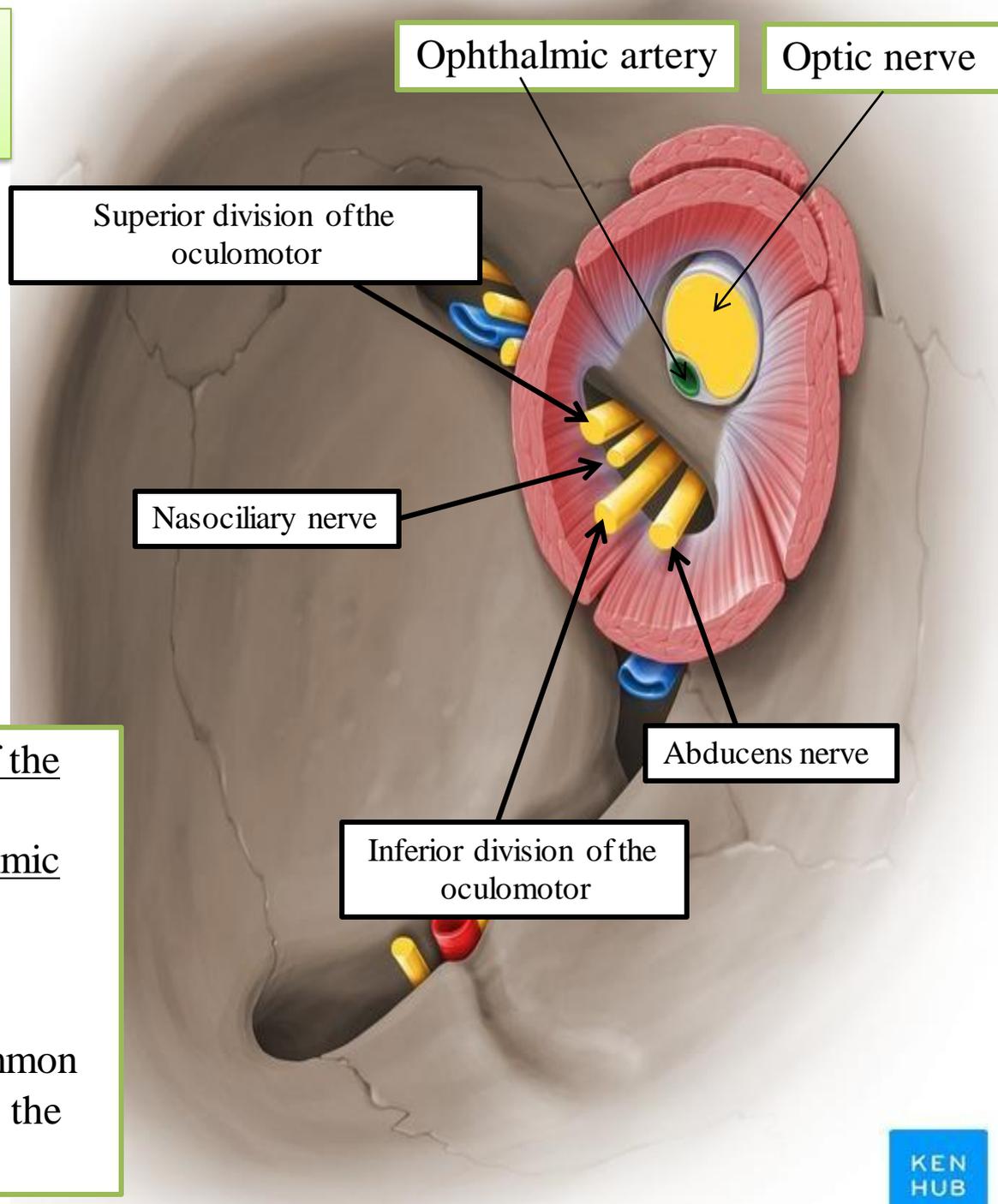
Lie within the common tendinous ring



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**

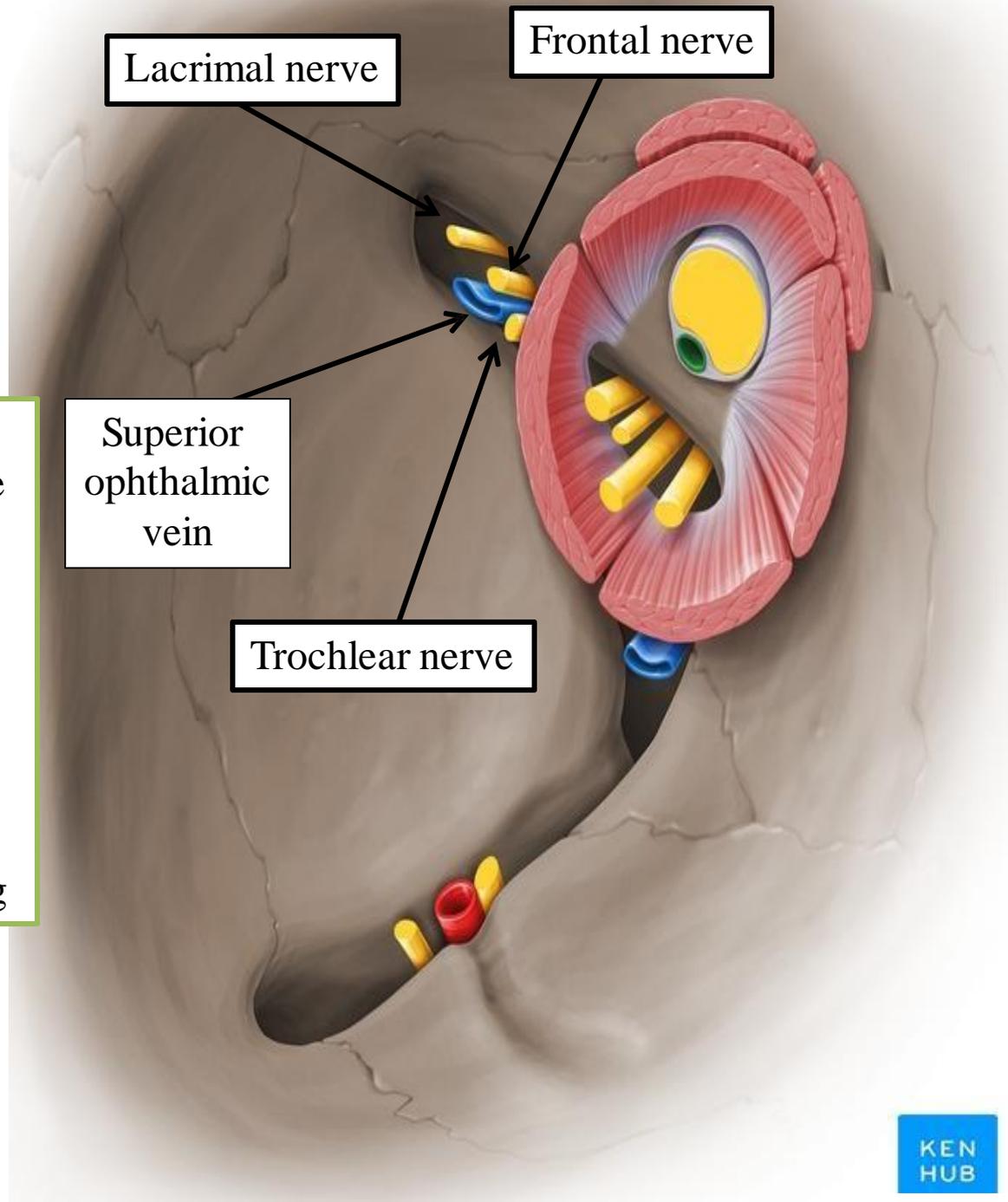


Lie outside the common tendinous ring



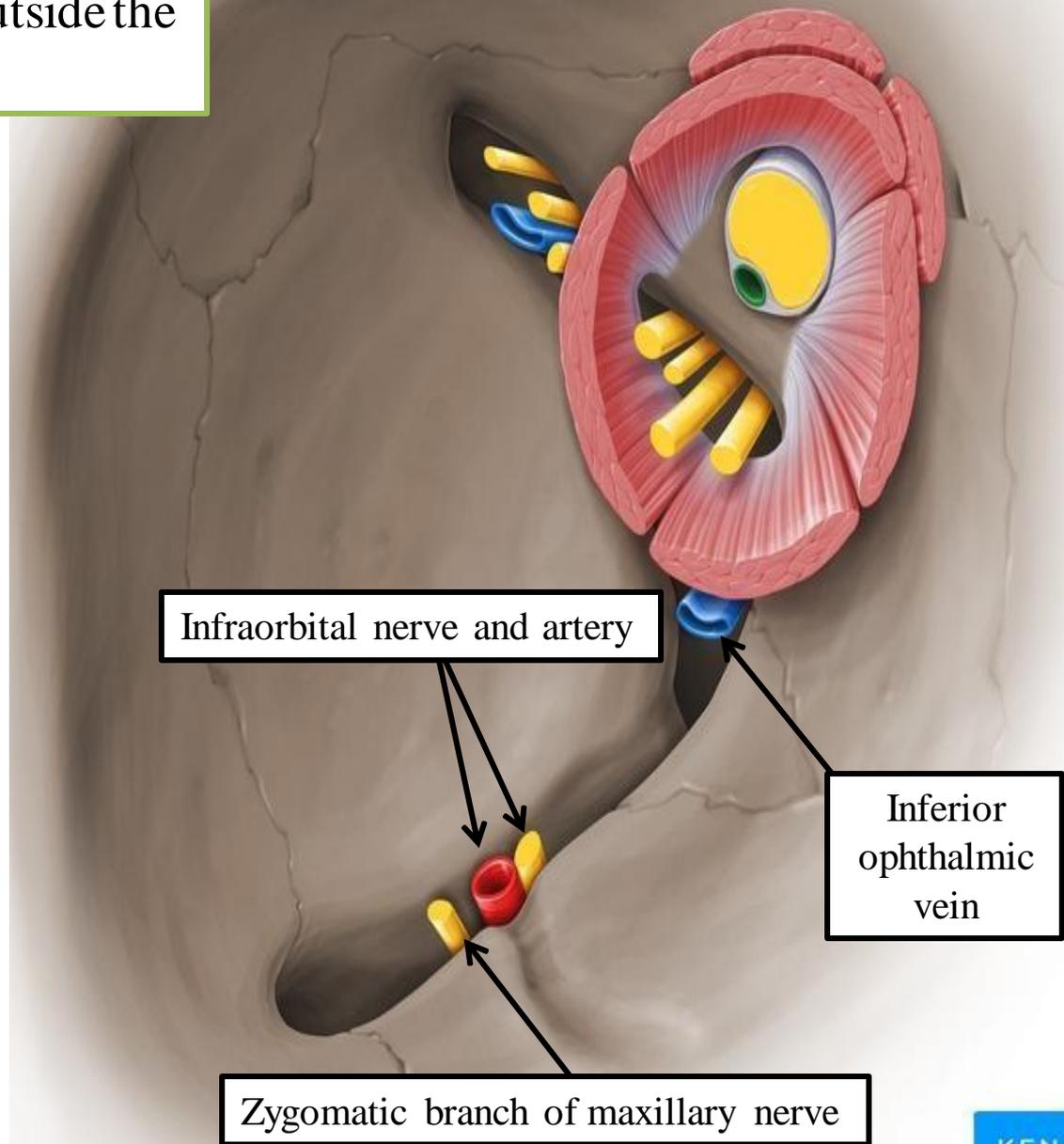
Trochlear nerve  
Frontal branch of ophthalmic nerve  
Lacrimal branch of ophthalmic nerve  
Superior ophthalmic vein

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



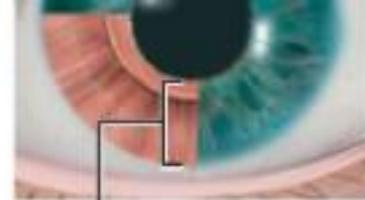
Structures which enter the orbit through the **inferior orbital fissure** lie outside the common tendinous ring.

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**

Sphincter pupillae muscle contraction decreases pupil size.



**Iris (two muscles)**

- Sphincter pupillae
- Dilator pupillae

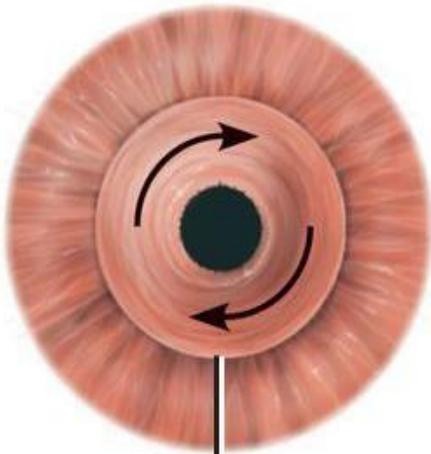
Dilator pupillae muscle contraction increases pupil size.



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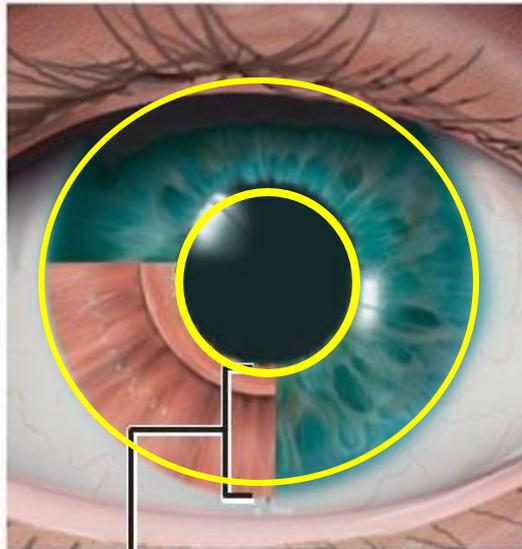
oculomotor nerve

**Parasympathetic +**



**Sphincter pupillae**

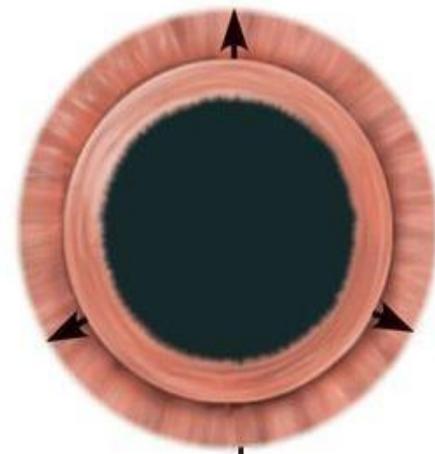
Constricts pupil



**Iris (two muscles)**

- Sphincter pupillae
- Dilator pupillae

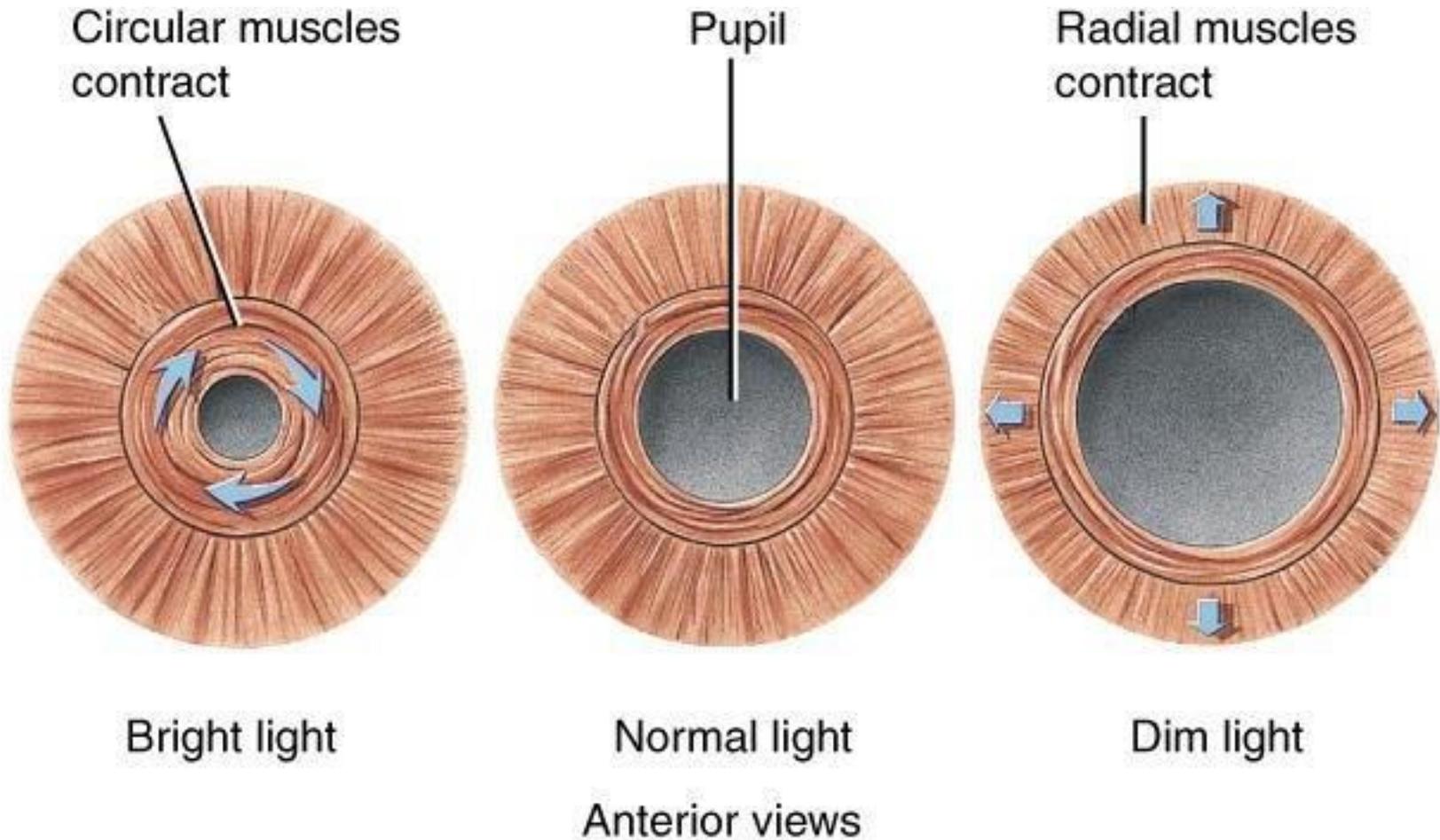
**Sympathetic +**



**Dilator pupillae**

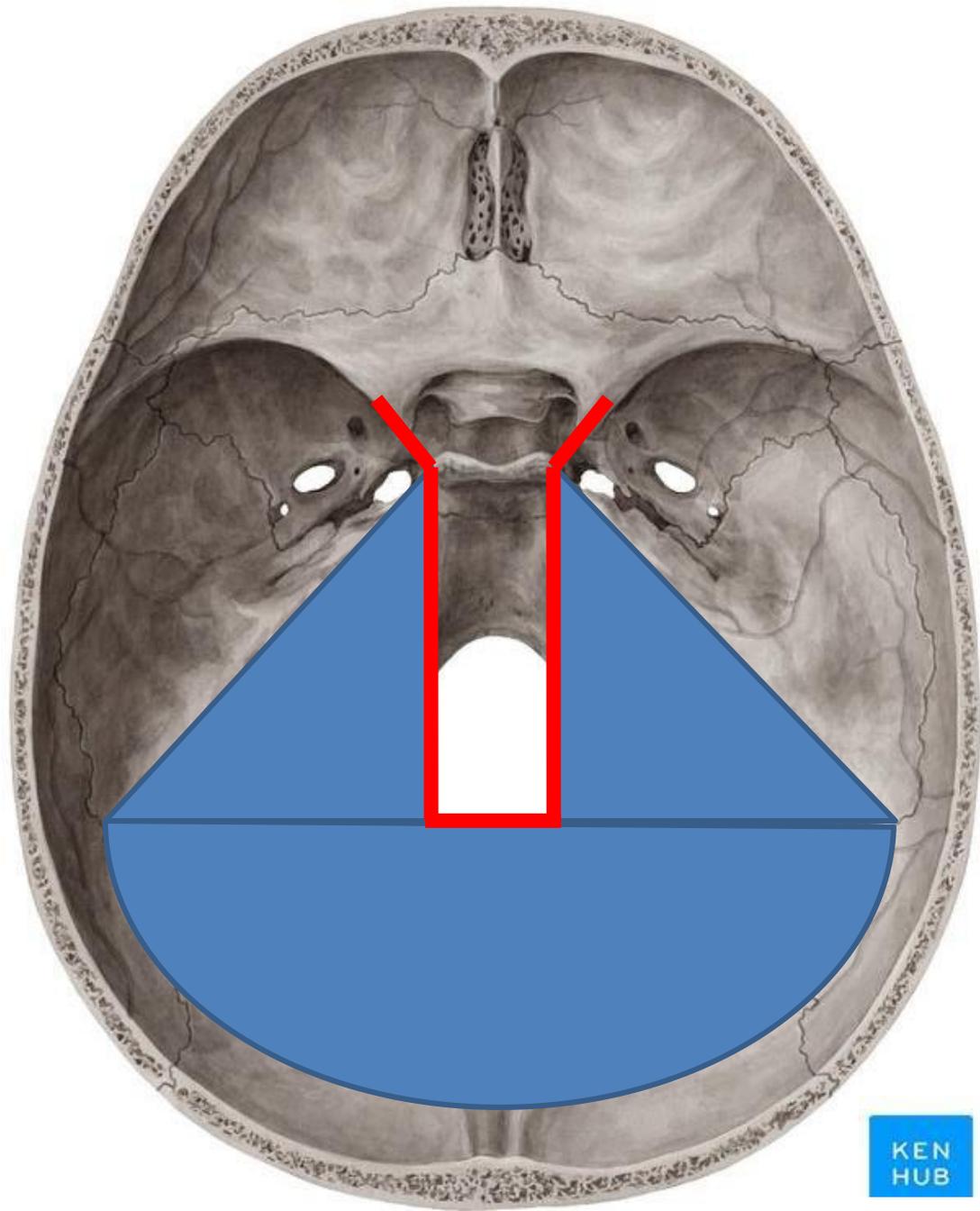
Dilates pupil

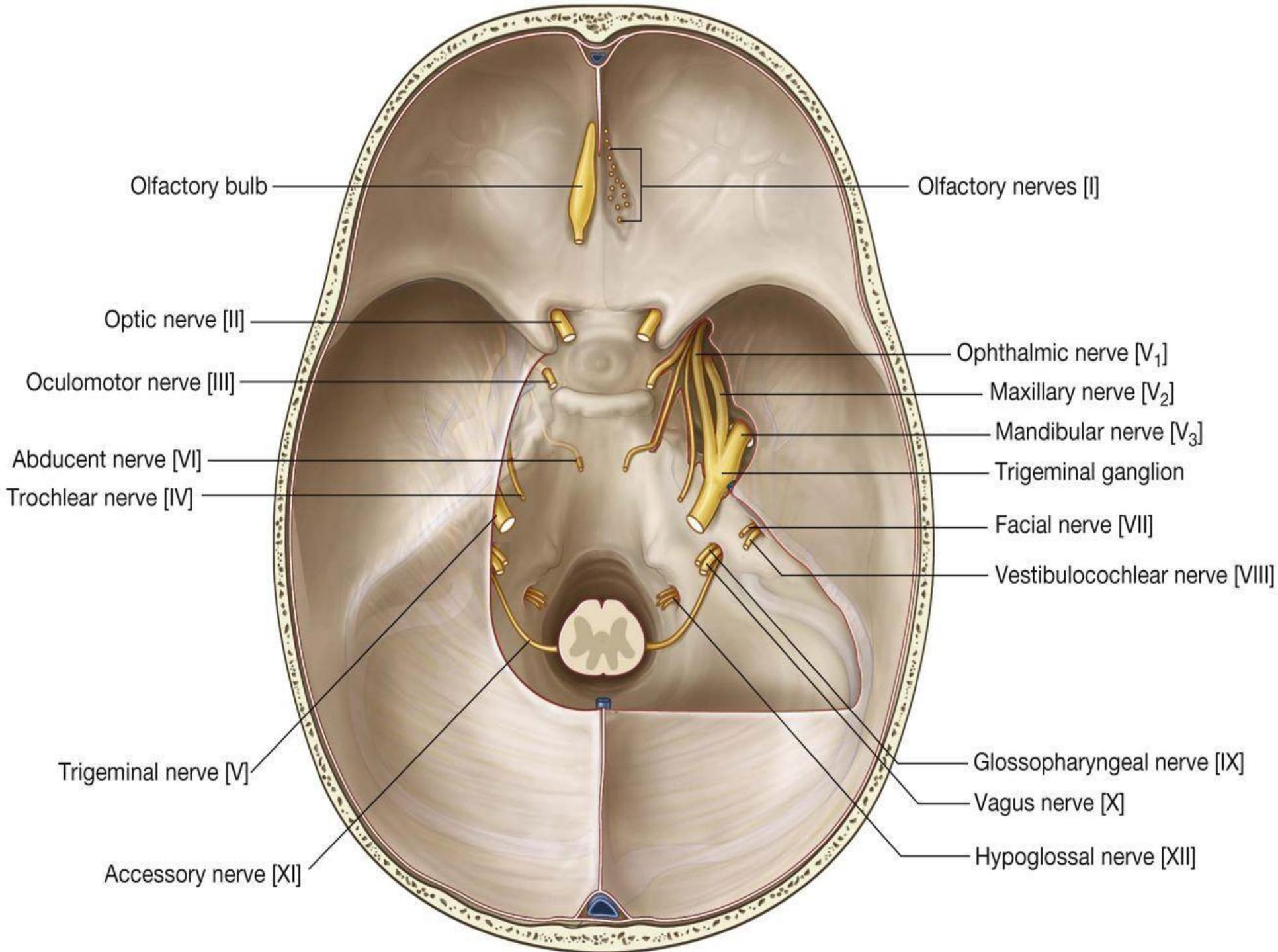
# Intrinsic Eye Muscles and their response to light



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

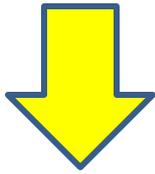
Epidural Hemorrhage  
May  
Cause



**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**

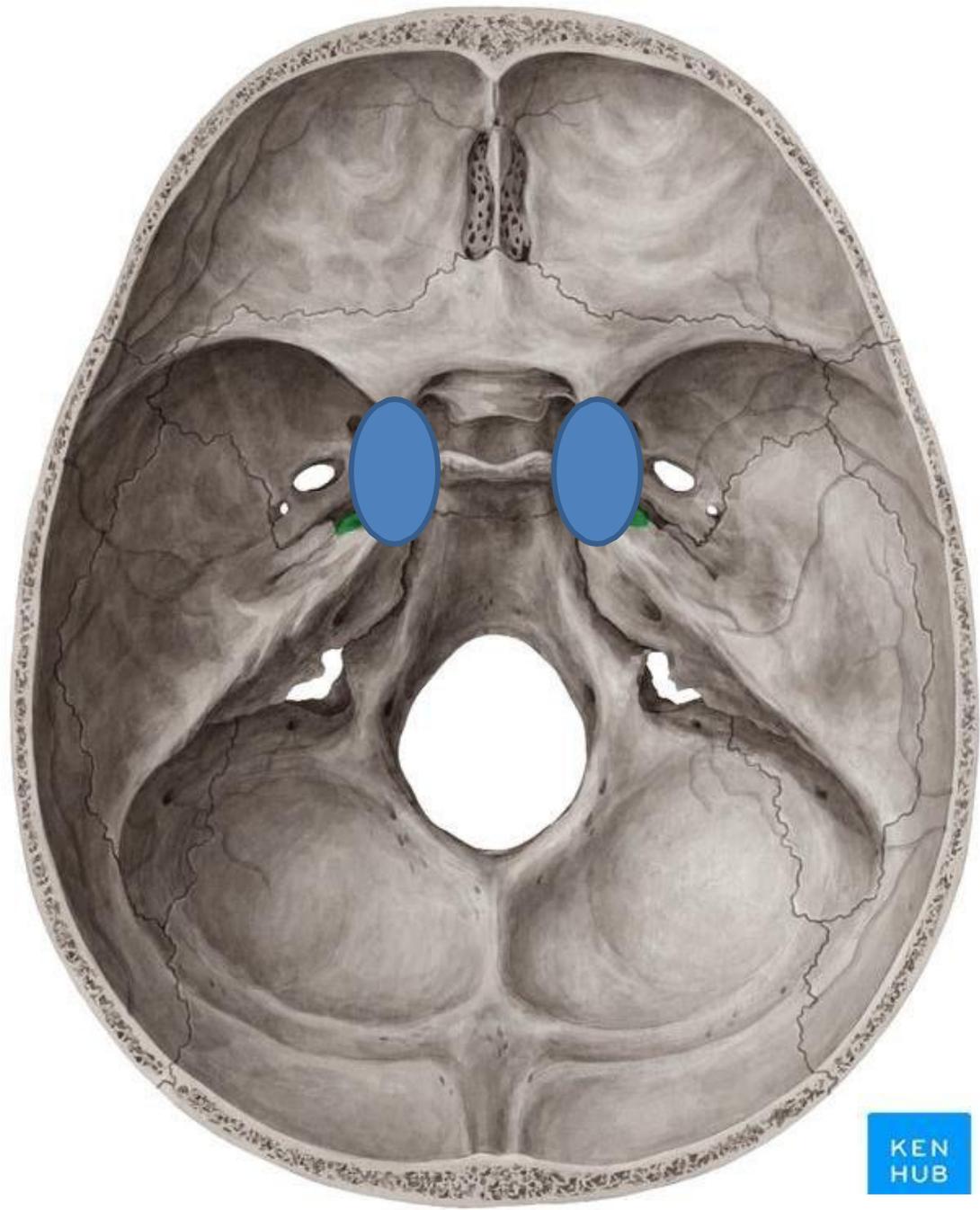
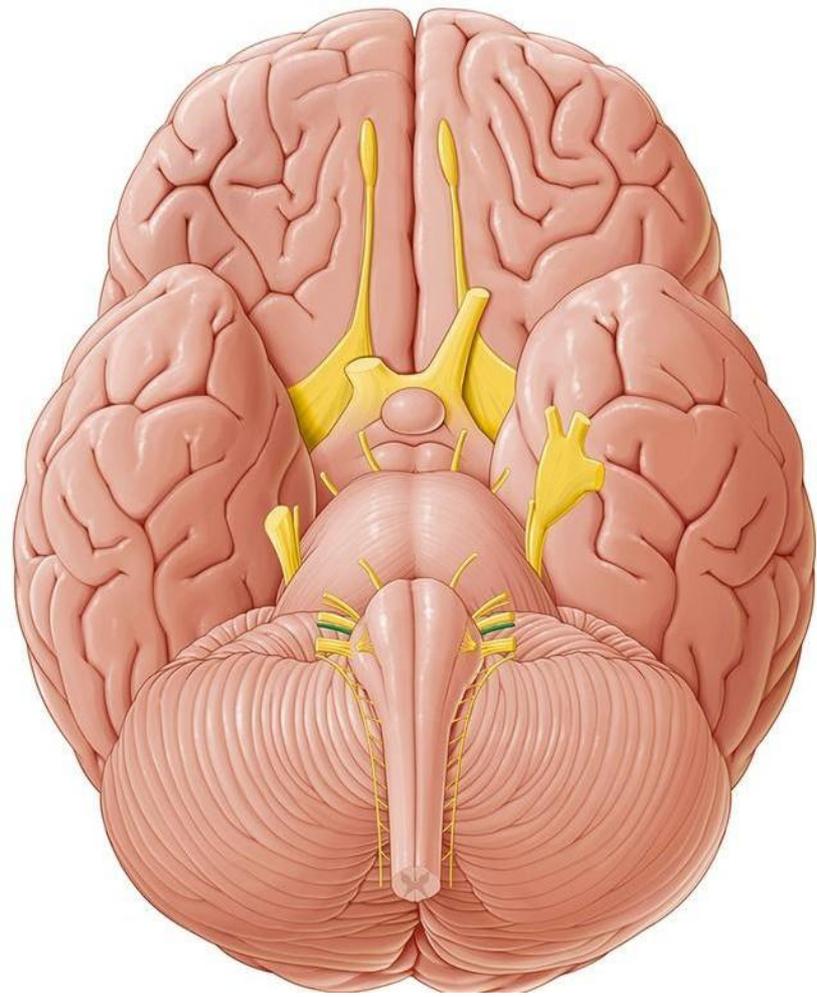
**ipsilateral pupil dilation**

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

On the same side is the initial focal sign



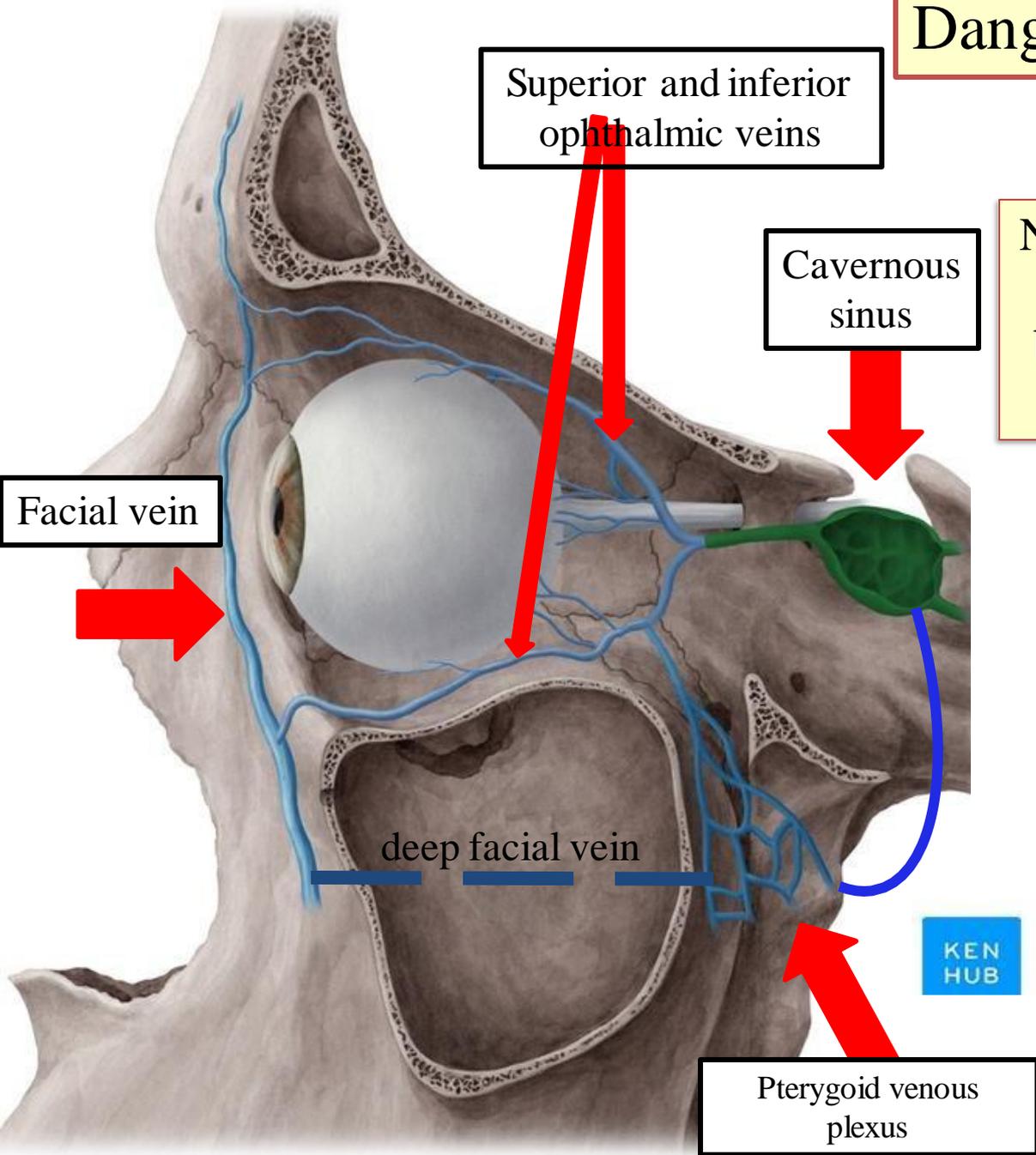


*Dr. Heba Kalbouneh*

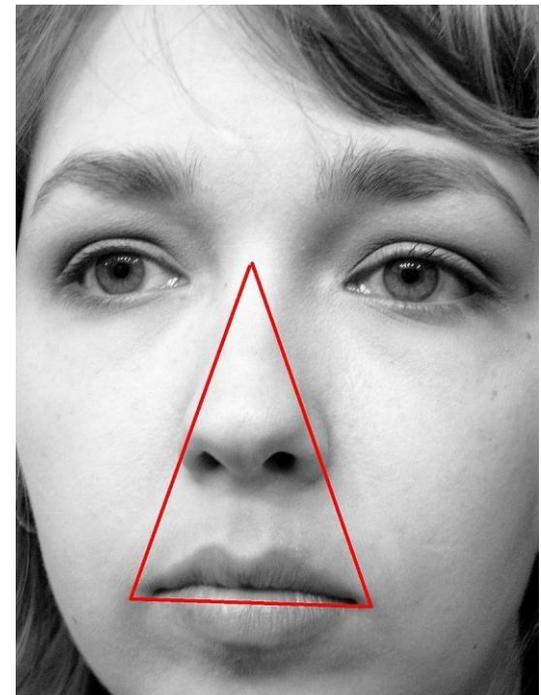
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# Danger triangle of the face



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



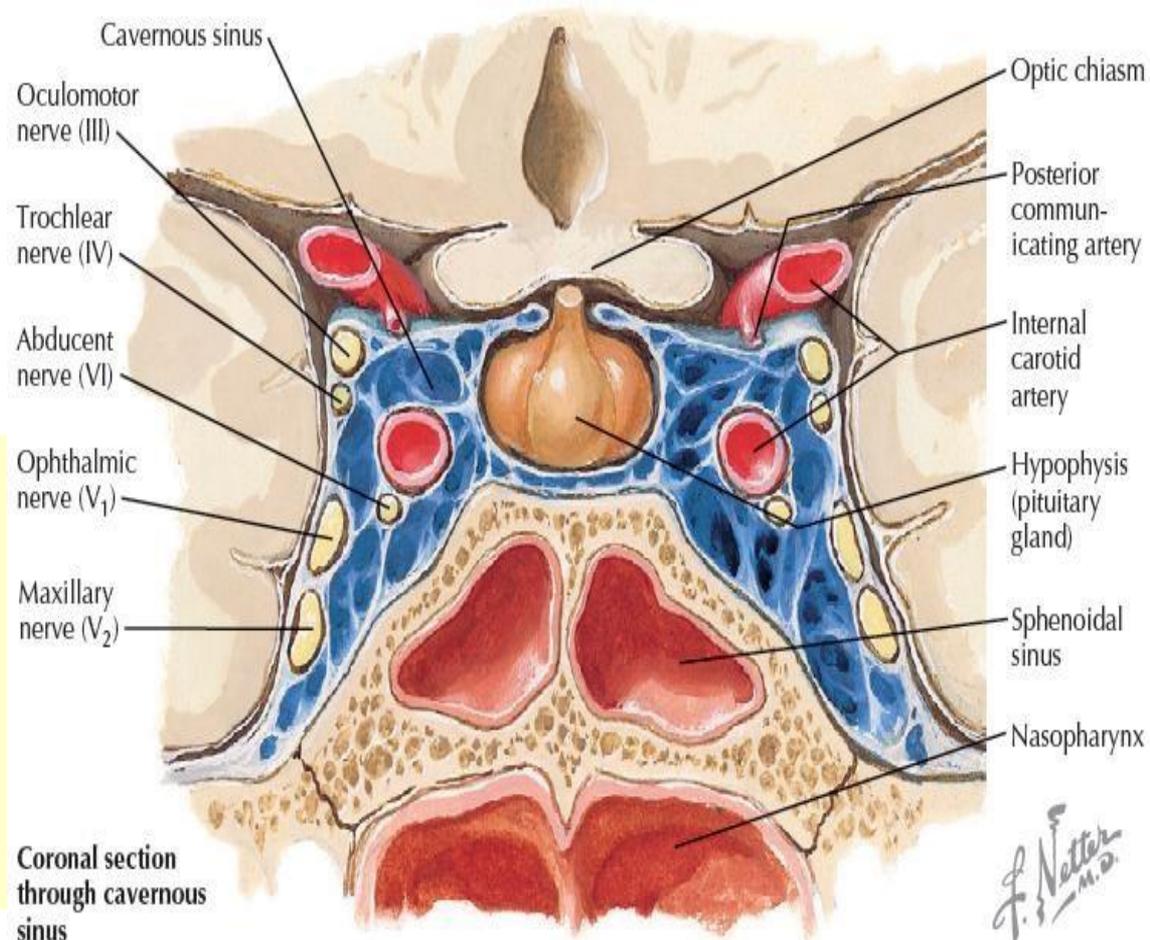
Cavernous sinus syndrome

## 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



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

