The Sense Organs

The eye:

It is the organ of vision, one of the most highly specialized forms of sense.

Each eye comprises:

I- Eye ball (Globe)
Ocular bulb
(bulbus occuli)

II- Optic n.

III-Accessory structures
1- periorbita & orbital fascia
2- Eye lids (palpebra)
3- Conjunctiva.
4- Ocular muscles
5- Lacrimal apparatus

THE ORBIT:

- In macerated skull, is a funnel shaped cavity, its apex at the optic foramen and its base at a rim of bone formed by; frontal, Lacrimal, maxillary, zygomatic, palatine and temporal bones.

The depth of the orbit determines the appearance of the eye, while the shape of the orbit determines the extent of the visual field.

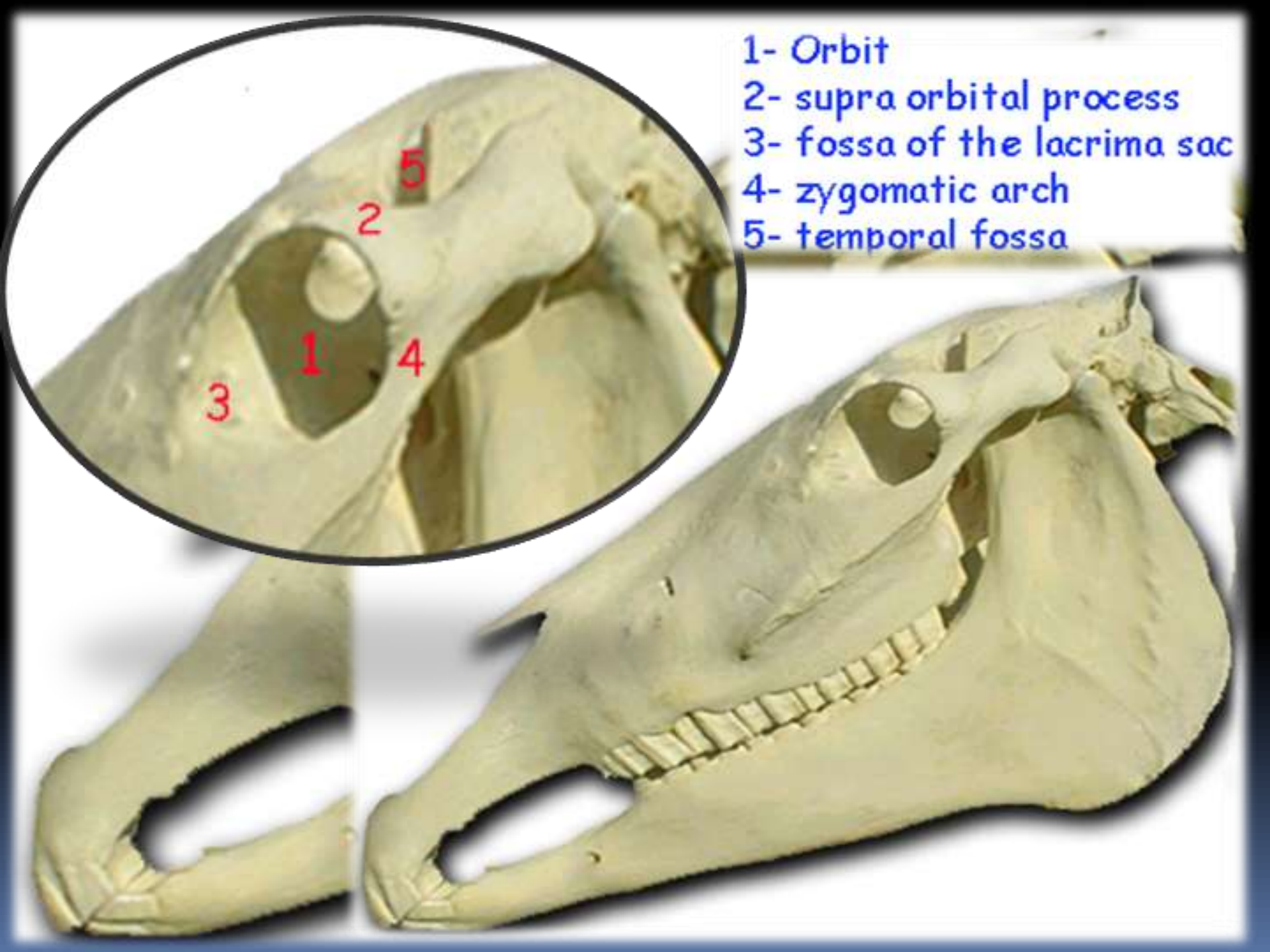
Each eye is found in a bony socket "Orbit".

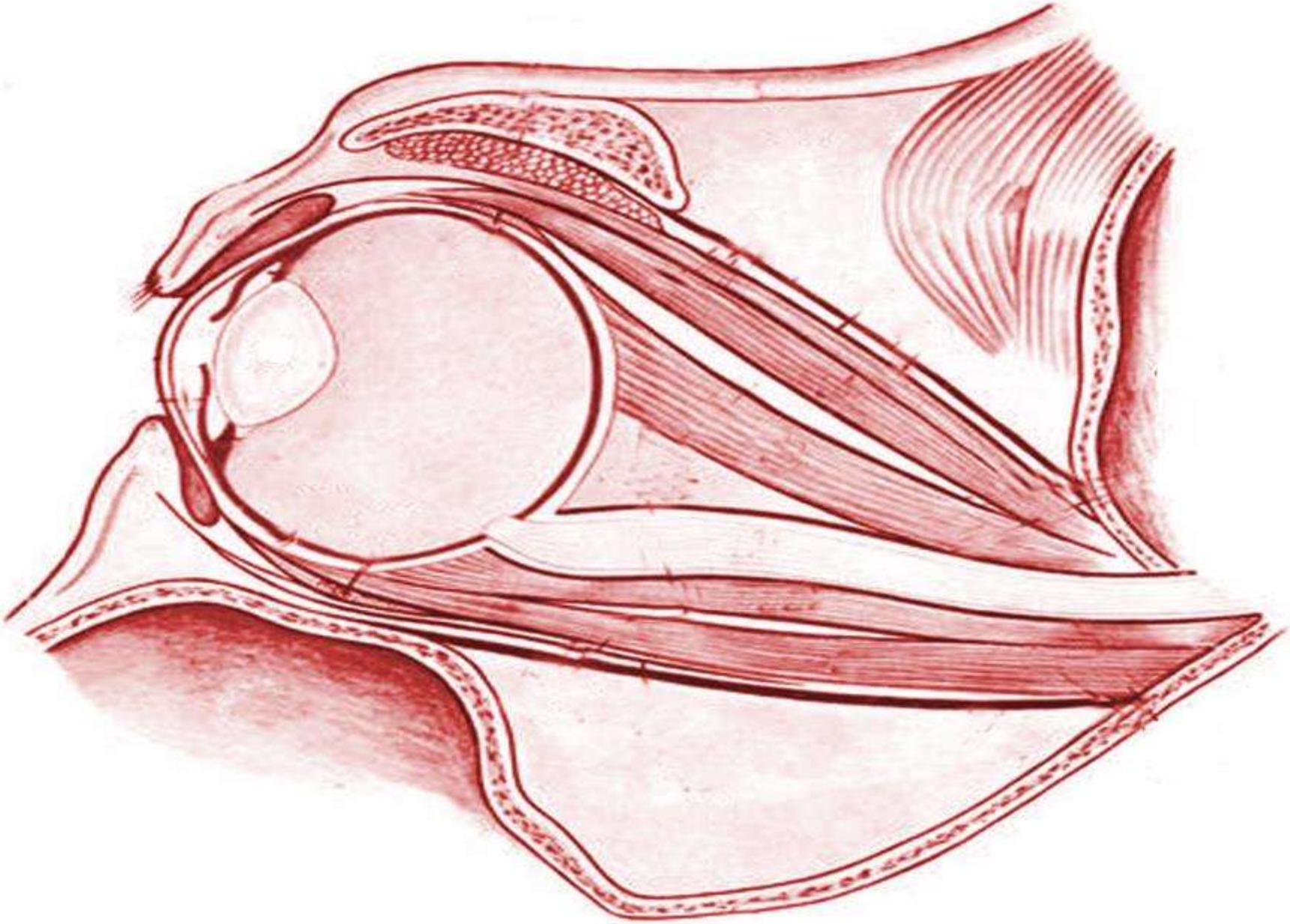
The orbital axis:

- It is the distance between the apex of the orbit and the center of its base.

Position of the eye in the skull:

- At the junction between the cranial bones and the bone of the face, may be laterally located *(in Ruminants)* or rostro-laterally located *(in Carnivora)*.


1- Orbit
2- supra orbital process
3- fossa of the lacrima sac
4- zygomatic arch
5- temporal fossa
5
2
1
4
3

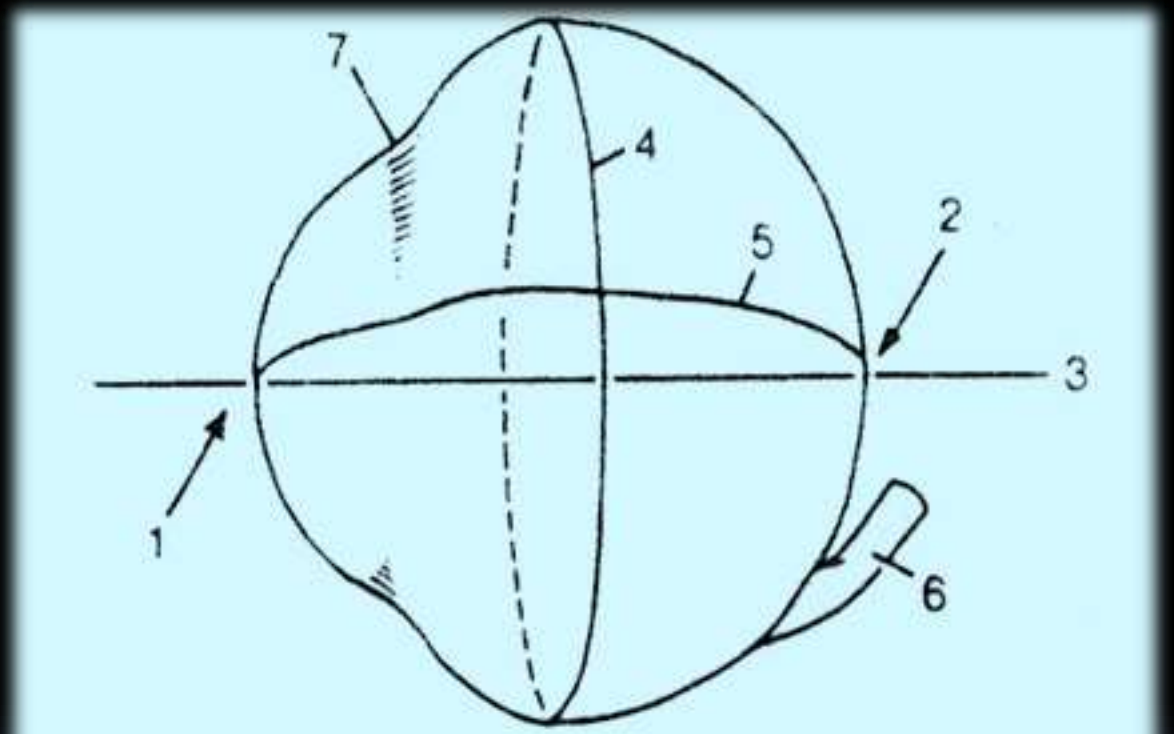


Axises of the eye:

1- Visual axis: the line between the center of the retina and the object viewed.

2- Orbital axis: the line between the apex of the orbit and the center of the orbital inlet.

3- Optic axis: the line between the anterior and the posterior poles of the eye ball.



Medial view of right eyeball.

1. Anterior pole; 2. posterior pole; 3. optic axis; 4. equator; 5. a meridian; 6. optic nerve; 7. limbus.

THE ACCESSORY OCULAR ORGANS:

1- Eye lids.
2- Conjunctiva.
3- Orbital fascia.
4- Orbital muscles.
5- Lacrimal apparatus.

Eyelids

1- EYELIDS "Palpebrae":

Two flaps of skin, serve to close or cover the eye.

Functions of the eyelids:

1- Protection of the eye ball.

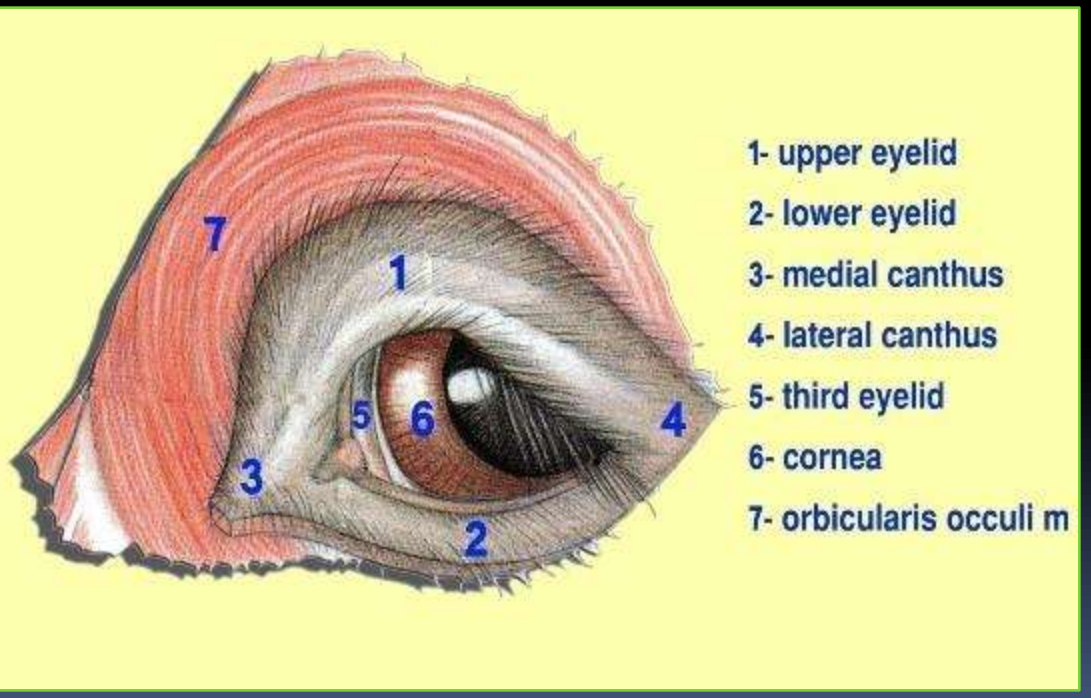
2- Lubrication of the cornea through their glandular secretion.

3- Distribution of tears.

4- Direction of tears toward the medial canthus.

Eyelids are:

1- Upper eye lid
(Palpebrae superior).
2- Lower eye lid
(Palpebrae inferior).
3- Third eye lid
(Palpebrae tertia).



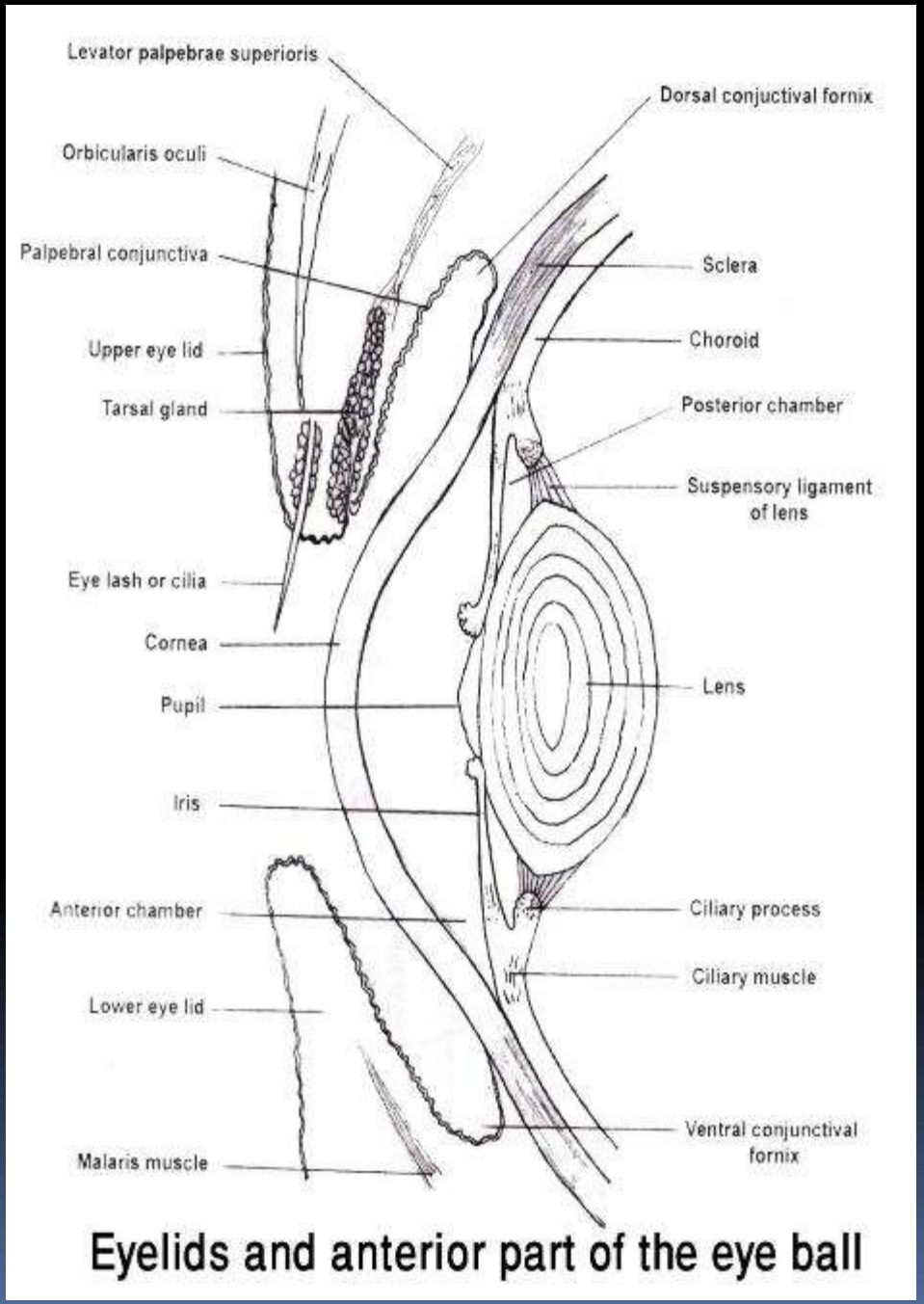
1- The upper and lower eyelids:

The free margin of the lids bears stiff hairs or cilia *"eye lashes"* and tactile hairs.

The cilia on the lower eyelid are short and smaller in diameter, while those on the upper eyelid are numerous, long and dense.

The tactile hairs are numerous on the lower eyelid than that on the upper eyelid.

The space between the two eyelids is the palpebral fissure *"rima palpebrum"*, which is biconvex *(in opened eye)* and a slit like *(in the closed one)*.



Eyelids and anterior part of the eye ball

The two ends of the fissure *"angles"* are termed *"medial and lateral canthi";*

The lateral angle is rounded, while the medial angle is narrow and forms the nasal recess of the eye lids *"lacrimal lake".*

The medial and lateral palpebral ligaments extend from the vicinity of the commissures to the medial and lateral margin of the orbit.

These ligaments prevent the palpebral aperture from making a circular structure.

Layers of the eye lid:

1- Outer layer: skin covered by hairs.

2-Middle layer: represents orbicularis occuli and corrugator super sellae ms in the upper eyelid and malaris m in the lower eyelid.

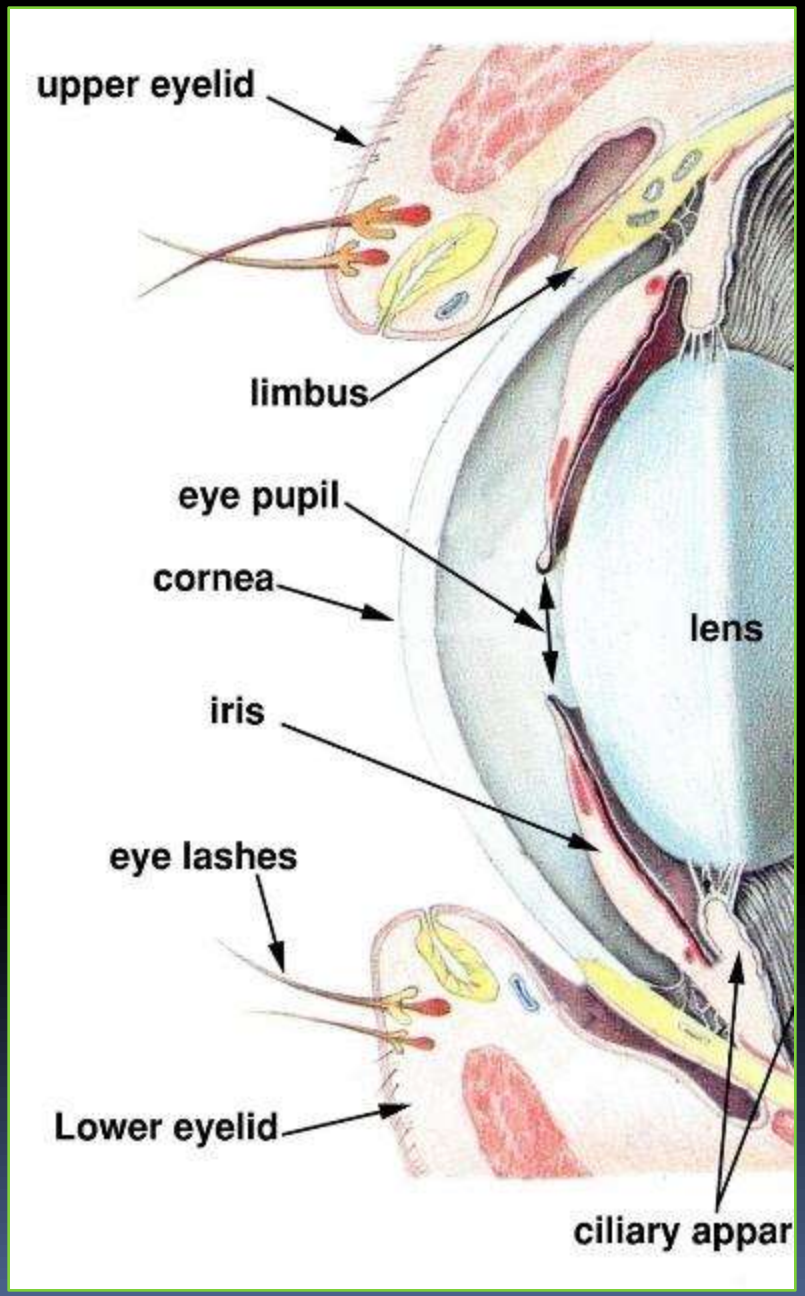
3- Deep layer: between orbicularis m & conjunctiva,

it includes:

A- Tarsus: a dense fibrous connective tissue, a long the free edge of the eyelid.

B- Tarsal glands: open at the palpebral margin of the eyelids, and they give a fatty secretion, which prevents the tears from spilling over the margins of the eye.

C- Sebaceous glands and mall glands "glandulae ciliaris".



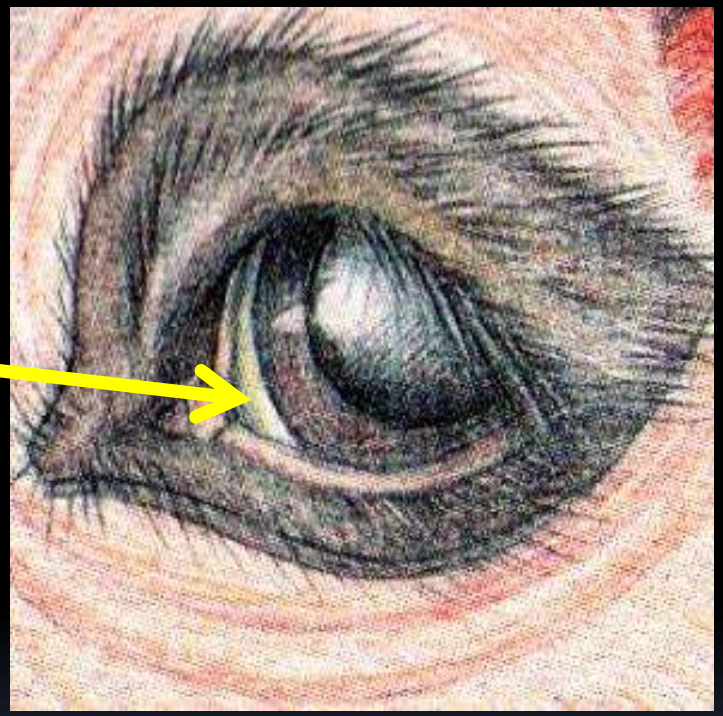
2- The third eyelid:

- A transverse sheet of thin translucent semilunar fold of conjunctiva *"nictitating membrane"* supported by a curved plate of hyaline cartilage and situated at the medial canthus.

- The shape of the hyaline cartilage determines the shape of the third eyelid.

- The free margin of the third eyelid is pigmented and bears an aggregation of lymphoid tissue which functions to reduce the incidence of the ocular infection.

- The third eyelid is protruded when the muscles of the eye ball are contacted as in tetanus, strychnine poisoning and death.



Muscles of the eyelid:

1- Muscles, that close the palpebral fissure:

a- Orbicularis occuli m.

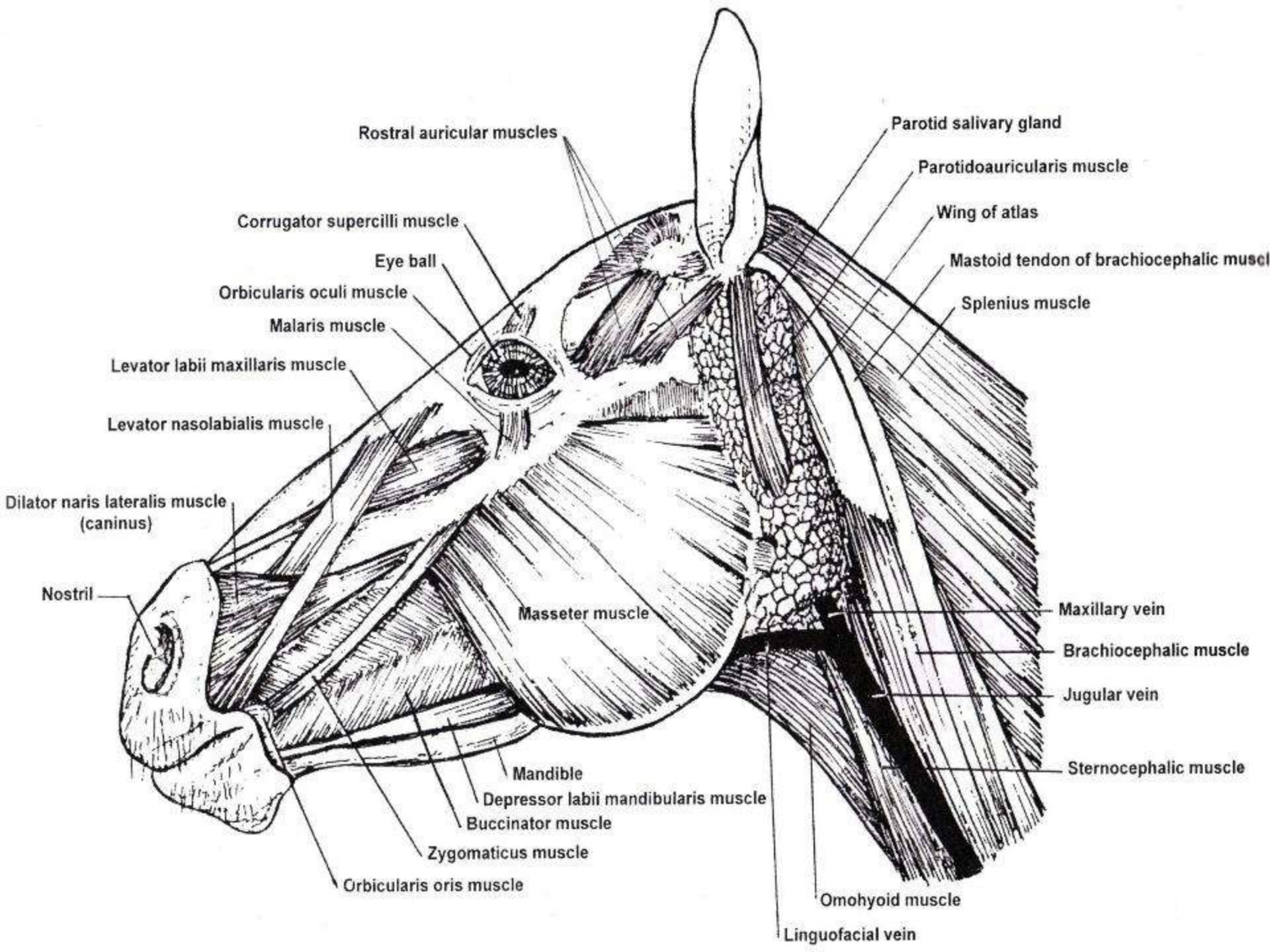
b- Horner's m.

2- Muscles, that open the palpebral fissure:

a- Levator palpebrae superioris propria m.
(Within the upper eyelid).

b- Malaris m.
(Within the lower eyelid).

c- Corrugator supersellae m.
(From the supra orbital process to the eyelid).


Rostral auricular muscles
Parotid salivary gland
Parotidoauricularis muscle
Wing of atlas
Mastoid tendon of brachiocephalic muscl
Splenius muscle
Corrugator supercilli muscle
Eye ball
Orbicularis oculi muscle
Malaris muscle
Levator labii maxillaris muscle
Levator nasolabialis muscle
Dilator naris lateralis muscle (caninus)
Nostril
Masseter muscle
Maxillary vein
Brachiocephalic muscle
Jugular vein
Sternocephalic muscle
Mandible
Depressor labii mandibularis muscle
Buccinator muscle
Zygomaticus muscle
Orbicularis oris muscle
Omohyoid muscle
Linguofacial vein

Conjunctiva

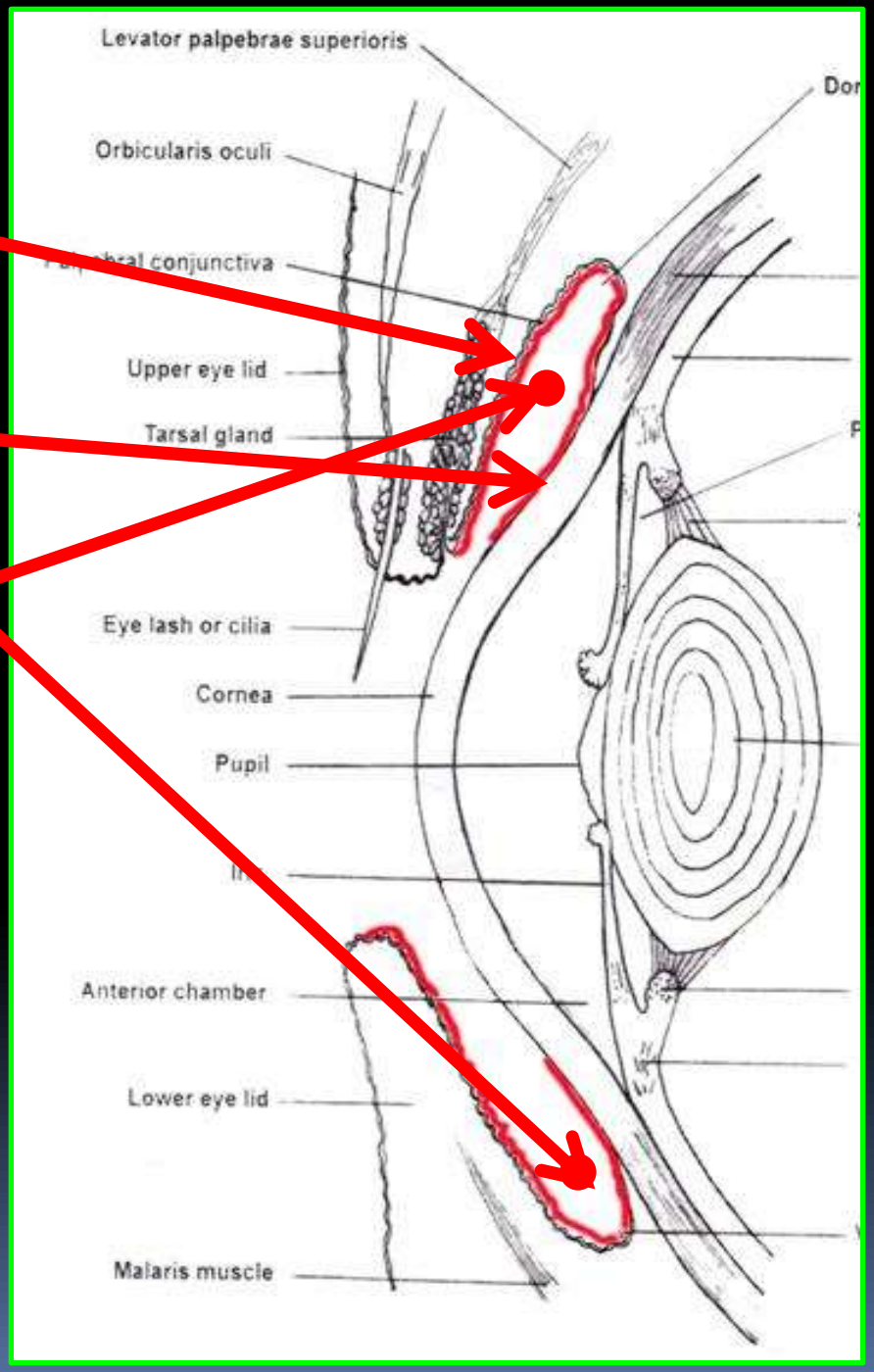
2- CONJUNCTIVA:

1- Stratified squamous epithelial mm, lines the eyelids *"palpebral conjunctiva"* and then reflects upon the anterior part of the eye ball *"bulbar conjunctiva"*.

2- The lines of reflection are the conjunctival fornices *(upper fornix and lower fornix)*.

3- The palpebral conjunctiva is rich in blood vessels; while the bulbar one is avascular *(i.e it obtains its nutrition through the aqueous humor)*.

4- Color of the conjunctiva and state of the blood vessels give an idea about the general condition of the animal and taken as an indication for diagnosis of some diseases. *e.g.* Jaundice, fever, ... etc.



Orbital fascia

3- ORBITAL FASCIA:

it represents;

1- Outer layer "superficial orbital fascia"
encloses the contents of the orbit and sends septa between the orbital ms.

2- Intermediate layer:
A- Outer layer → encloses the orbital ms.
B- Inner layer → covers the inner surface of the orbital ms.

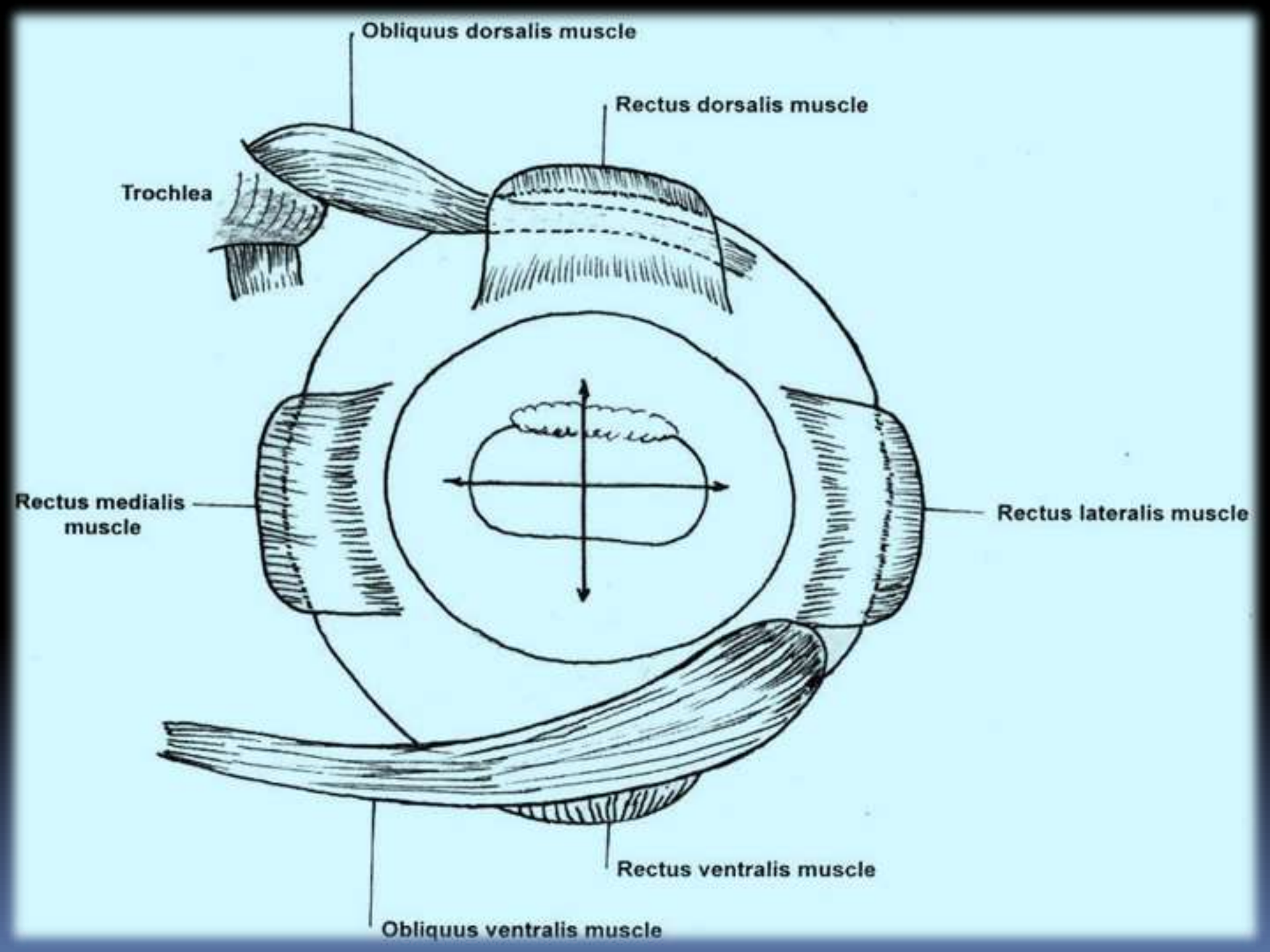
3- *Deep layer "Tenon's capsule"*:
extends from the limbus *"corneo-scleral junction"* and encloses the retractor bulbi m.

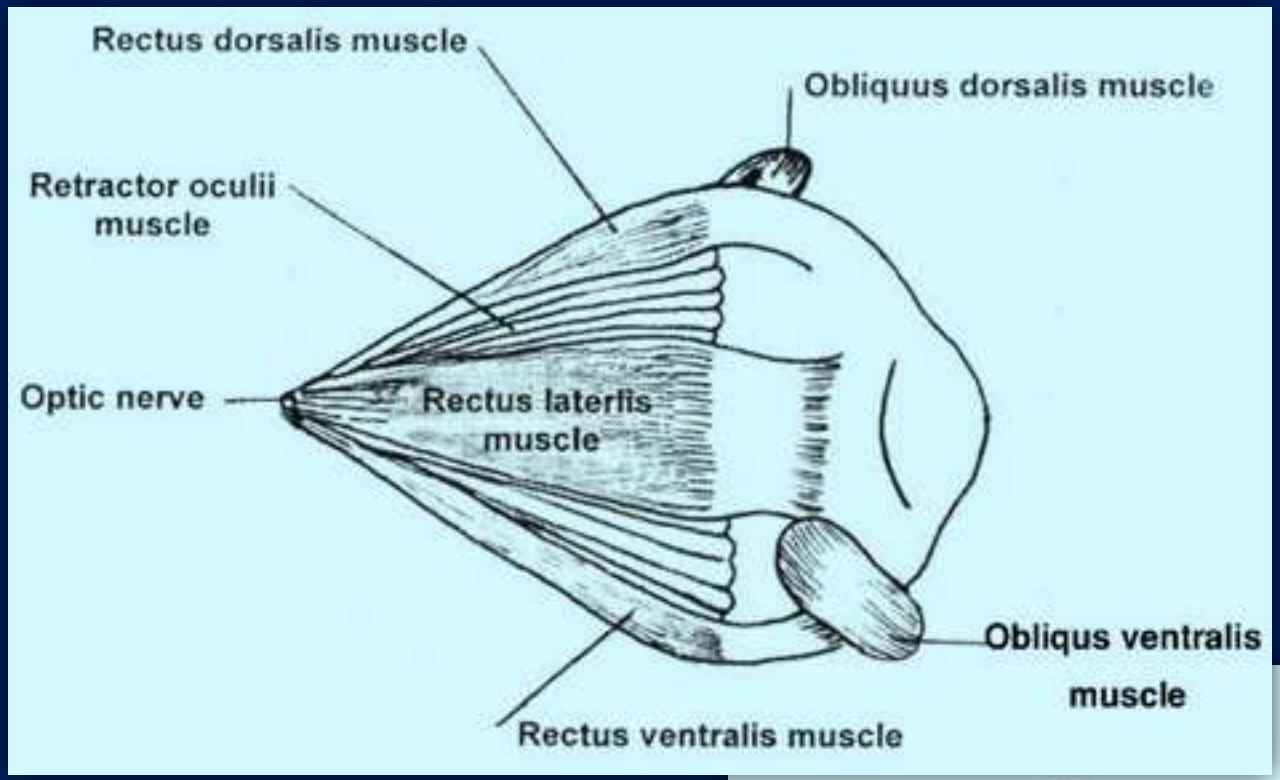
Orbital muscles

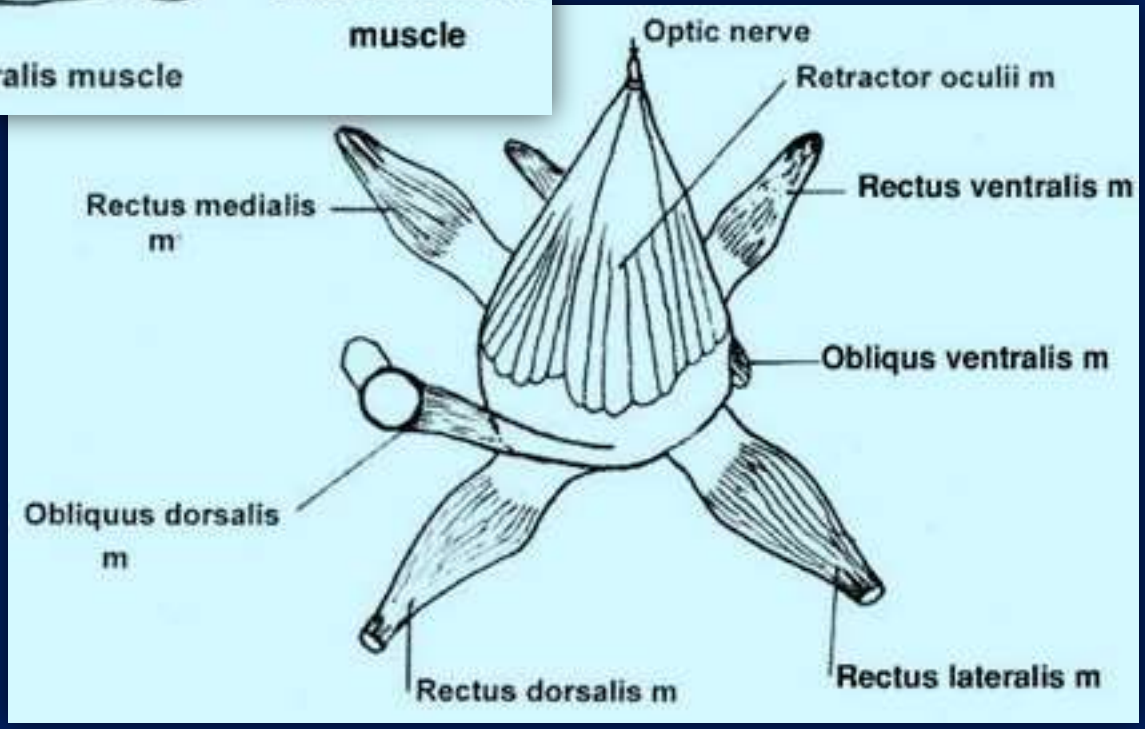
4- ORBITAL MUSCLES: 1- Ocular muscles (eye muscles):

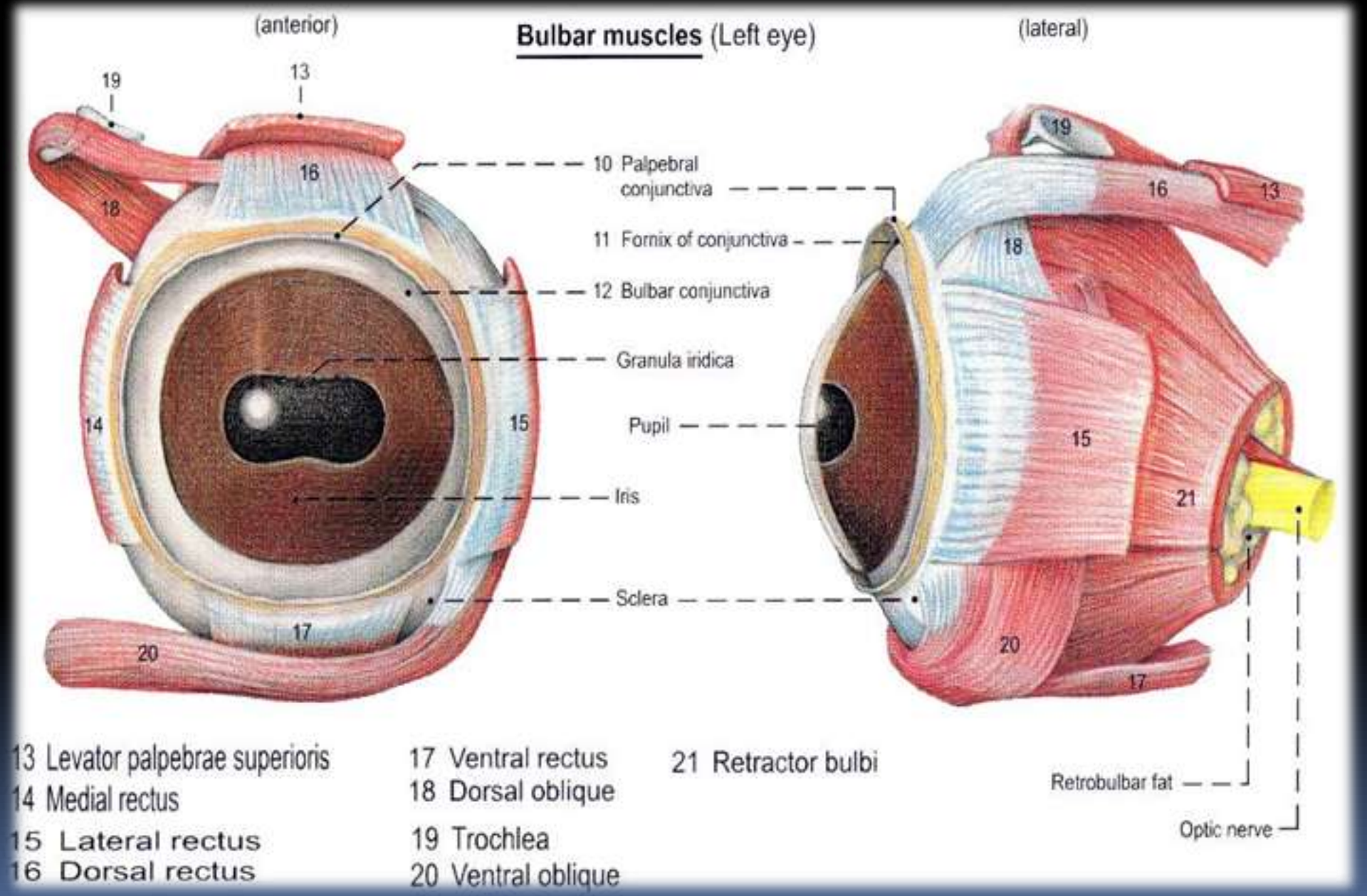
Muscles	Origin	Insertion	Action	N. supply
		In the sclera	Rotate the visual axis	Cranial Nn.
1- dorsal rectus	Sphenoid bone around the optic foramen	Dorsal surface of the globe	Dorsally	III
2- ventral rectus		Ventral surface of the globe	Ventrally	III
3- lateral rectus		Lateral surface of the globe	Medially	VI
4- medial rectus		Medial surface of the globe	Laterally	III
	Medial wall of the orbit			
5- dorsal oblique	Adjacent to ethmoidal fossa	Sclera between dorsal rectus and lateral rectus muscles.	Rotate lateral papillary margin upward	IV
6- ventral oblique	Caudal to Lacrimal fossa	Sclera between ventral rectus and lateral rectus muscles	Rotate lateral papillary margin downward	III
6- Retractor bulbi	Sphenoid bone around the optic foramen	Sclera beyond the insertion of the recti muscles	Retract (pull) the eye ball around the orbit.	VI

The formula of the ocular muscles nerve supply is: (LRR6 – SO4 – Rest3)


Obliquus dorsalis muscle
Rectus dorsalis muscle
Trochlea
Rectus medialis muscle
Rectus lateralis muscle
Rectus ventralis muscle
Obliquus ventralis muscle


Rectus dorsalis muscle
Obliquus dorsalis muscle
Retractor oculii muscle
Optic nerve
Rectus laterlis muscle
Obliqus ventralis muscle
Rectus ventralis muscle


Optic nerve
Retractor oculii m
Rectus ventralis m
Rectus medialis m
Obliqus ventralis m
Obliquus dorsalis m
Rectus dorsalis m
Rectus lateralis m


Bulbar muscles (Left eye)
(anterior)
(lateral)
19
13
16
18
10 Palpebral conjunctiva
11 Fornix of conjunctiva
12 Bulbar conjunctiva
Granula iridica
Pupil
Iris
Sclera
14
15
17
20
21
Retrobulbar fat
Optic nerve
13 Levator palpebrae superioris
14 Medial rectus
15 Lateral rectus
16 Dorsal rectus
17 Ventral rectus
18 Dorsal oblique
19 Trochlea
20 Ventral oblique
21 Retractor bulbi

Lacrimal apparatus

5- LACRIMAL APPARATUS:

It is represented for the secretion and excretion of tears and includes;

- Lacrimal gland
- Excretory ducts
- Lacrimal ducts
- Lacrimal sac
- Nasolacrimal duct

LACRIMAL GLAND:

Flattened, oval, lobulated and light pink colored gland,

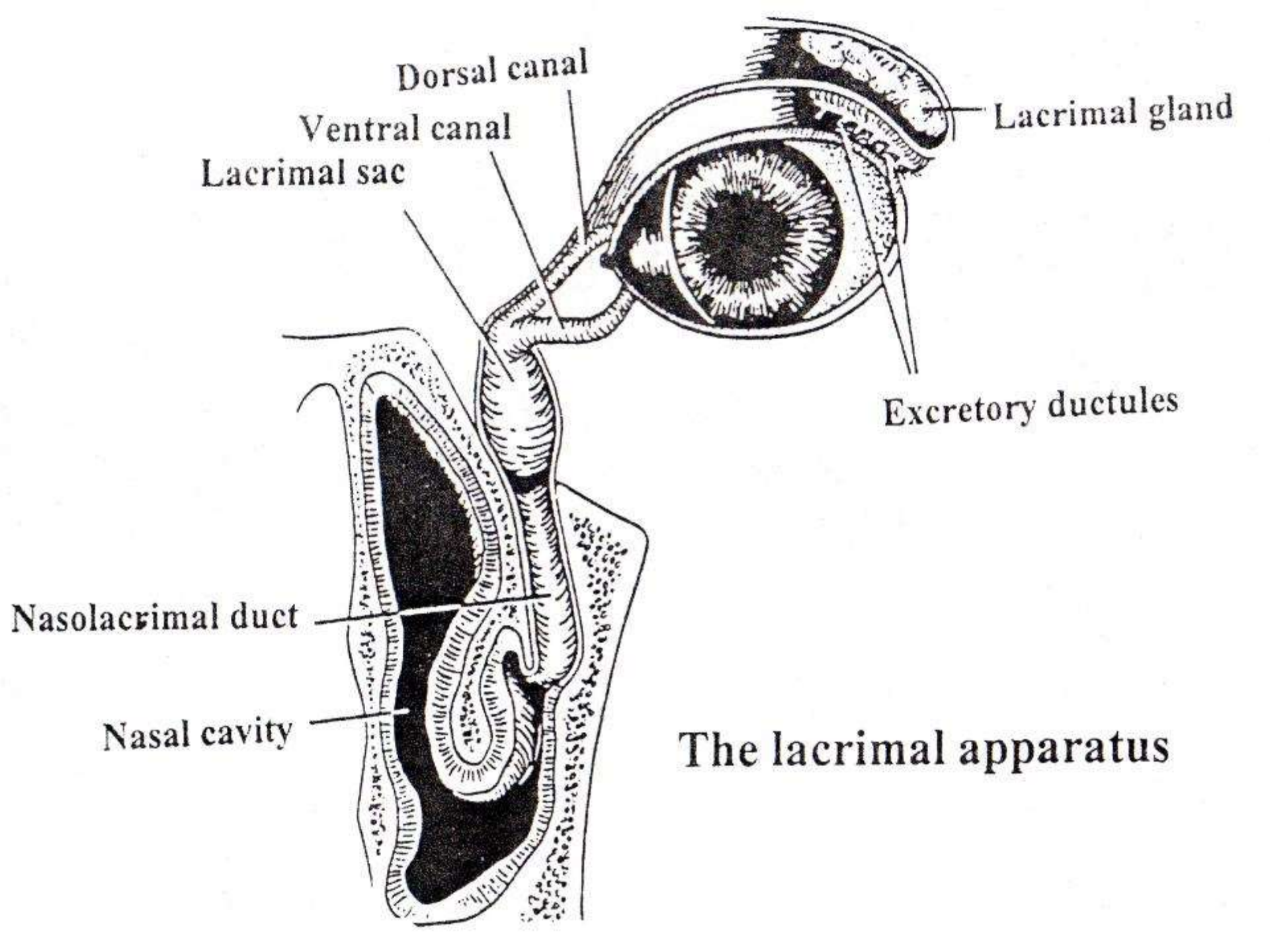
located on the dorsolateral aspect of the orbit, dorsal to the lateral canthus.

It opens in 12-16 excretory ducts to the upper fornix.

The lacrimal secretion is directed toward the medial canthus where it passes through the lacrimal ducts to the lacrimal sac

Finally the tears pass to the nasal cavity through the nasolacrimal duct.

N.B. The puncta lacrimales are the entrance to the lacrimal ducts.



The lacrimal apparatus

Lacrimal apparatus

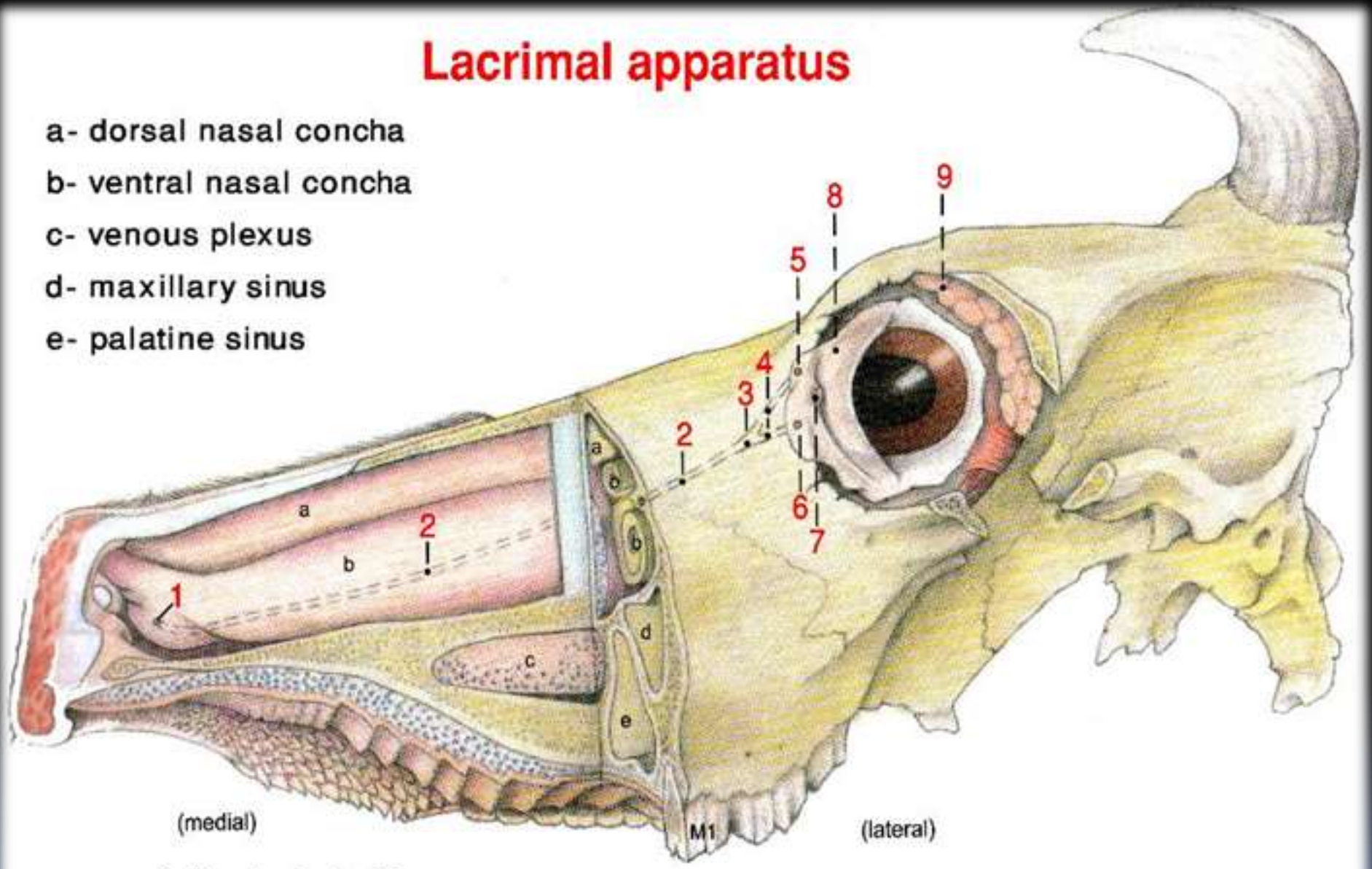
a- dorsal nasal concha

b- ventral nasal concha

c- venous plexus

d- maxillary sinus

e- palatine sinus



1- Nasolacrimal orifice

2- Nasolacrimal duct

3- lacrimal sac

4- lacrimal canaliculi

5-superior lacrimal punctum

6-inferior lacrimal punctum

7- lacrimal caruncle

8- third eyelid

9- lacrimal gland

Periorbita

6- PERIORBITA:

- A strong fibrous, non elastic, conical shaped sheath encloses the structure of the eye.

- It extends from the round of the optic foramen and orbital foramen to the bony boundaries of the orbital inlet.

- It continues partly with the periosteum and partly with the fibrous tissue of the eyelids.

Eye ball

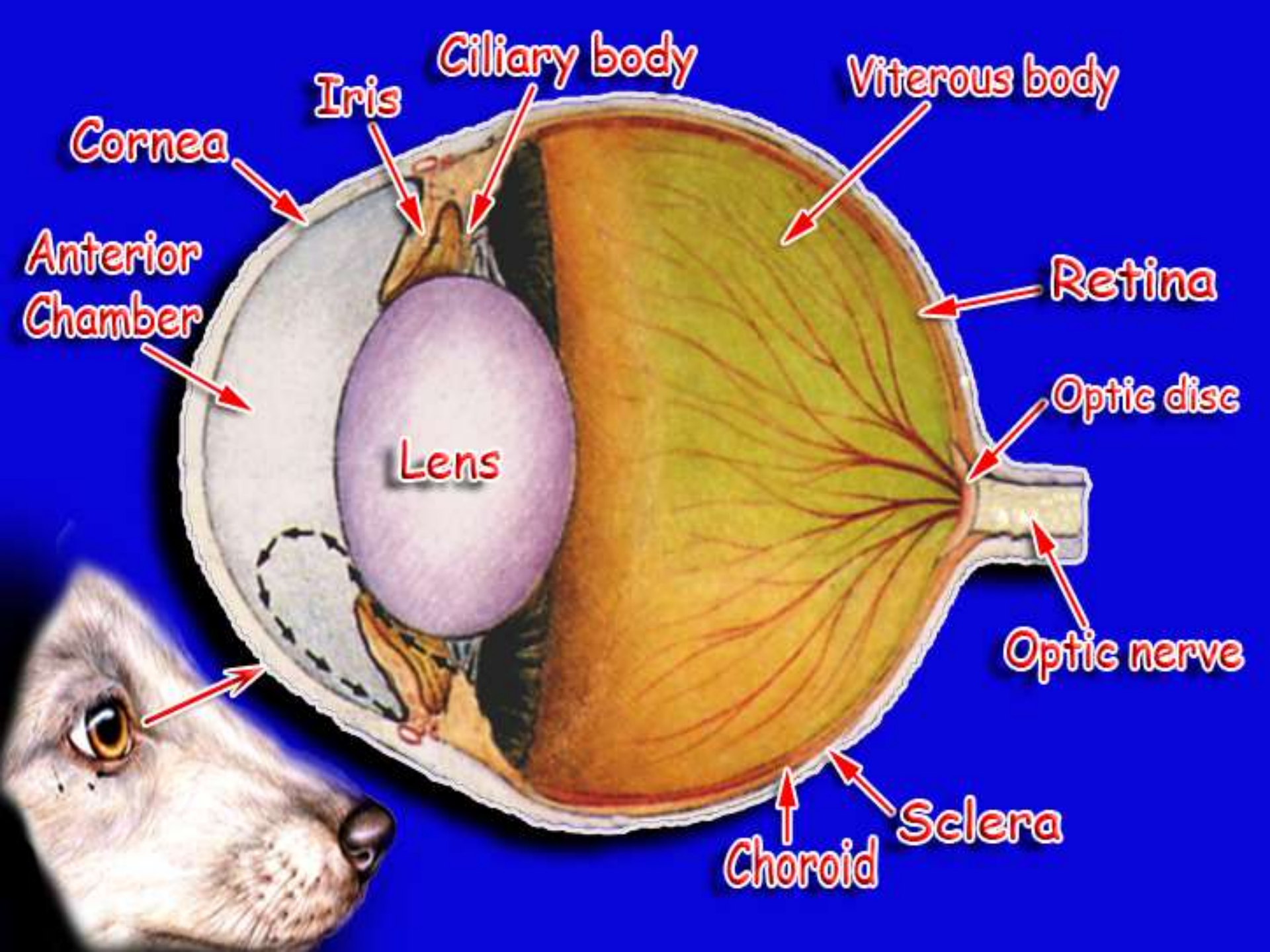
THE EYE BALL:

- Situated in the rostral part of the orbital cavity.

- It is protected infront by the eyelids and conjunctiva, in the middle by complete orbital ring and related behind to the bulbar fascia, occular muscles and fat.

The eye ball composed of three tunics:

1- Fibrous tunic.
2- Vascular tunic.
3- Nervous tunic.


Ciliary body
Iris
Viterous body
Cornea
Anterior Chamber
Retina
Optic disc
Lens
Optic nerve
Sclera
Choroid

I- THE FIBROUS TUNIC:

-The external coat of the eye ball,

- Composed of opaque posterior part;

The sclera

(form 4/5 of the fibrous tunic) and transparent anterior part,

The cornea

(form the other remain 1/5 of the tunic).

Sclera

1- THE SCLERA:

-A dense fibrous membrane which form about $^4/_5$ of the fibrous tunic.

- It is thick posteriorly *"2 mm"* and thin at the equator *"0.4 mm"* and increase in thickness toward the junction with the cornea *"1.3 mm"*.

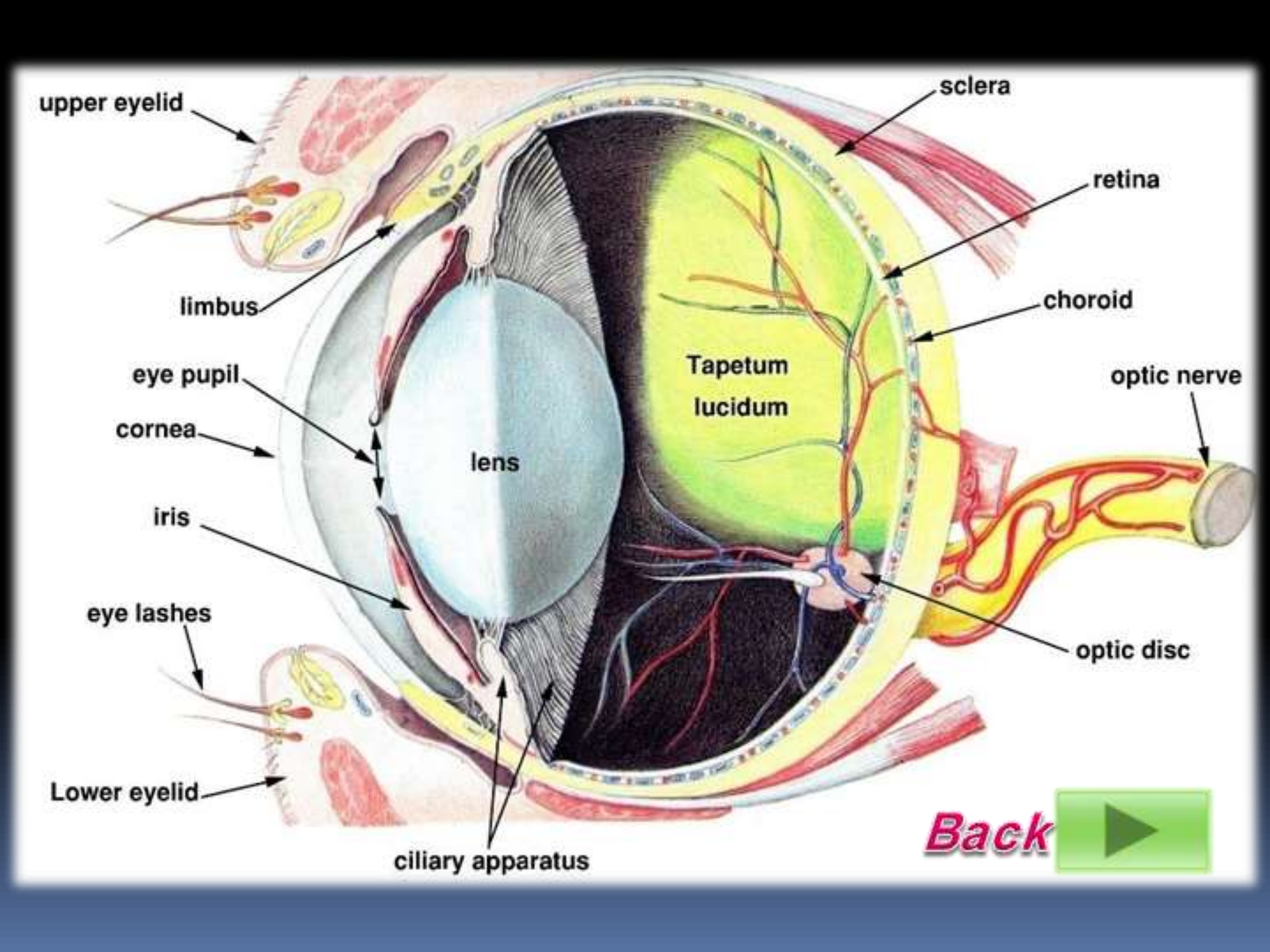
- It is white tinged with bluish at its thinnest part, its external surface represents the insertion to the ocular muscles.

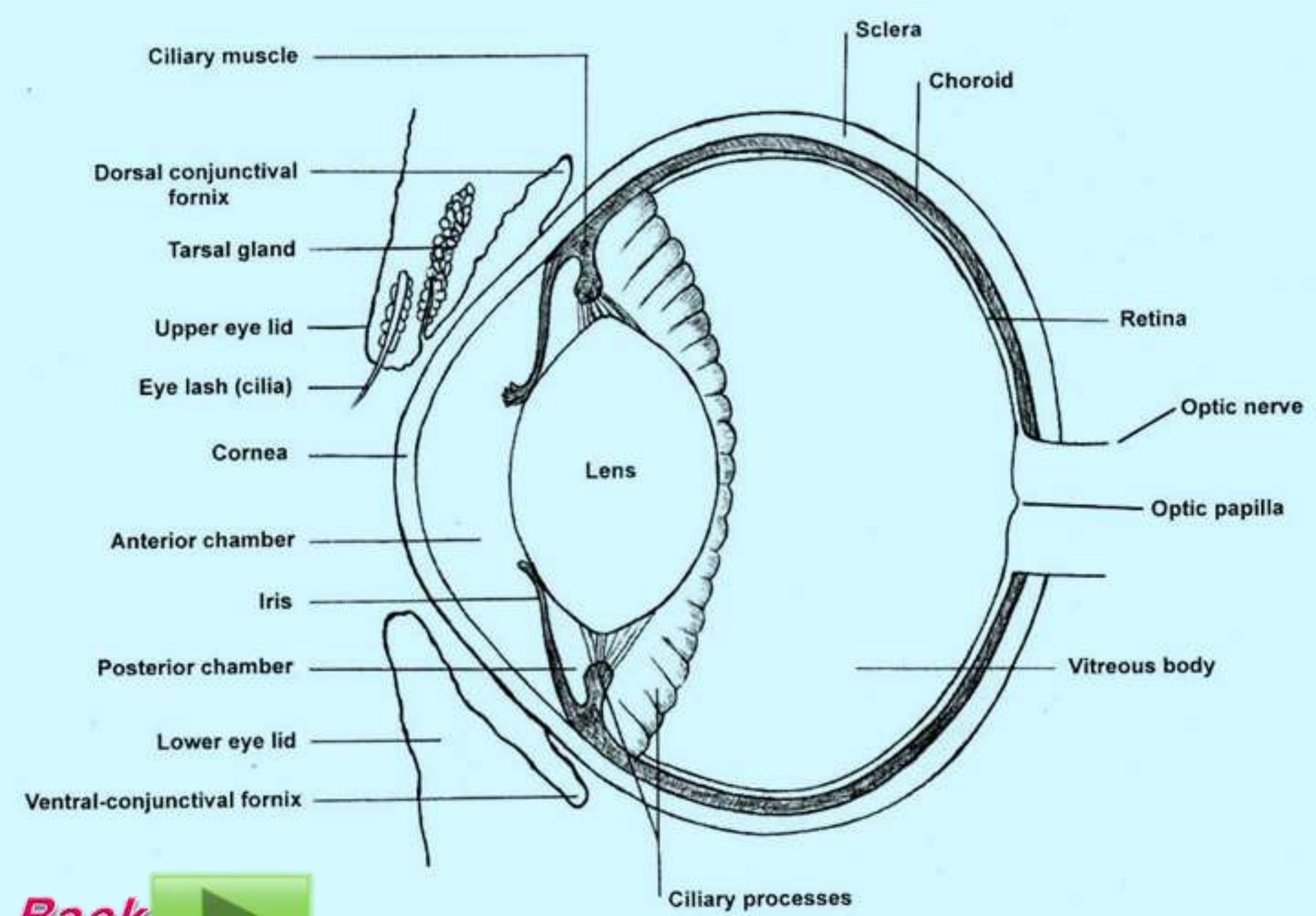
-The episcleral tissue attaches the conjunctiva to the sclera. It is loosely meshed except, at the junction with the cornea.

-The inner surface is attached to the choroid's coat by a layer of delicate pigmented connective tissue, the transition from the opaque scleral tissue to the transparent cornea occur by the sclera, appears to form a groove into which the cornea fits as a watch crystal fits into the case.

-Near the corneo-scleral junction (Limbus) there is a circular venous plexus, drains fluid of the anterior chamber of the eye.

-The optic nerve passes through the posterior part of the sclera, a little below and lateral to the posterior pole.


upper eyelid
sclera
retina
limbus
choroid
eye pupil
Tapetum
lucidum
optic nerve
cornea
lens
iris
eye lashes
optic disc
Lower eyelid
ciliary apparatus
Back



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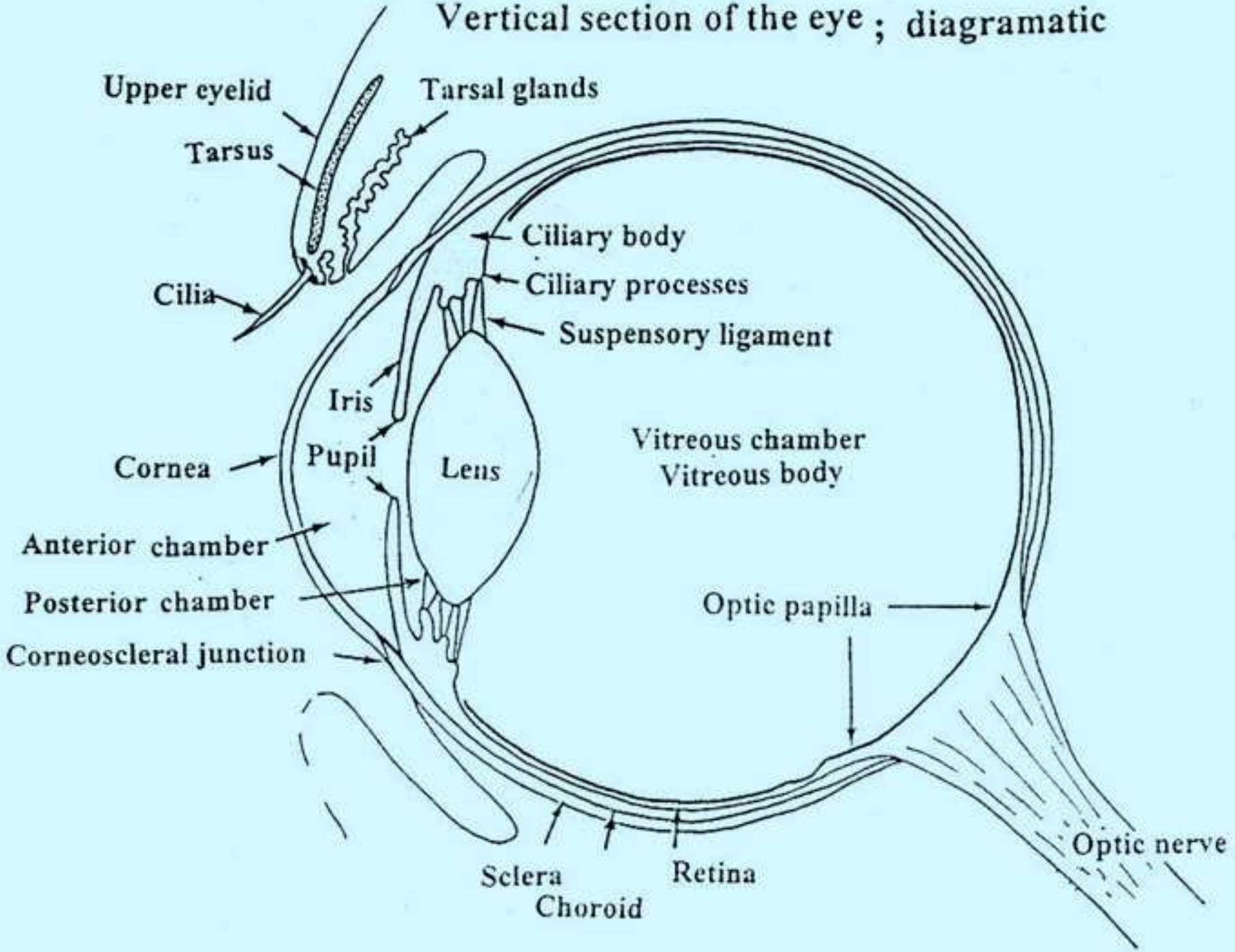
Vertical section in eye ball


Vertical section of the eye ; diagramatic
Upper eyelid
Tarsal glands
Tarsus
Ciliary body
Ciliary processes
Cilia
Suspensory ligament
Iris
Pupil
Cornea
Lens
Vitreous chamber
Vitreous body
Anterior chamber
Posterior chamber
Optic papilla
Corneoscleral junction
Optic nerve
Sclera
Retina
Choroid

Cornea

2- THE CORNEA:

- Forms the anterior 1/5 of the fibrous tunic.

-Transparent, colorless and non vascular.

-Its anterior surface is convex and is more strongly curved.

-Covered by epithelium which is continuous with that of the scleral conjunctiva and it is stratified squamous epithelium.

-It forms the anterior boundary of anterior chamber, lined by epithelium consists of a layer of flattened polygonal cells.

image

II- THE VASCULAR TUNIC:

lies internal to the fibrous coat,
it is composed of three parts:

A- Choroid
B- Ciliary body
C- Iris

Choroid

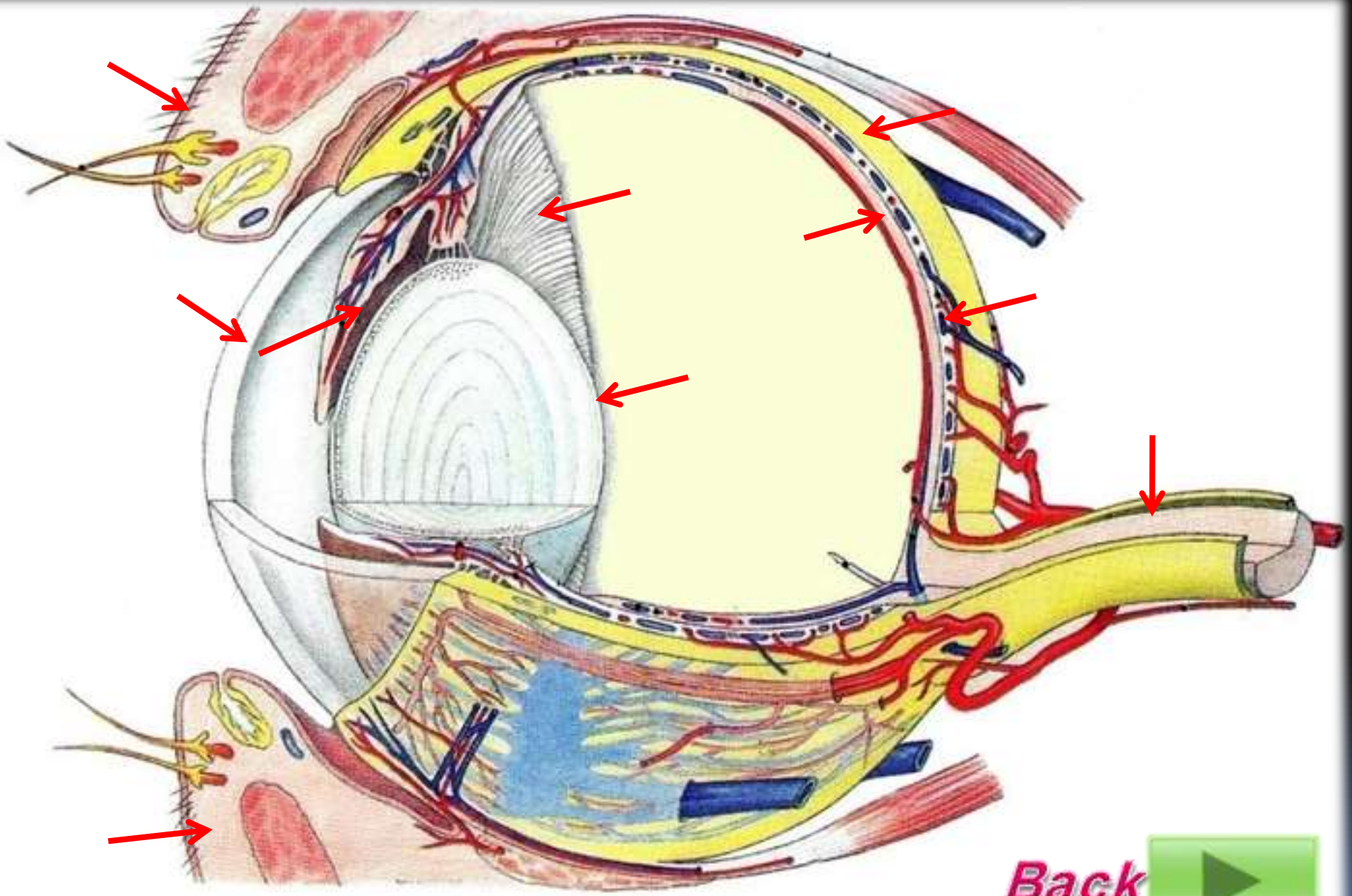
A- THE CHOROID:

- A thin membrane lies between sclera and retina.

- loosely attached to the sclera by the supra-choroid lamina (connective tissue layer).

-Its inner surface is in contact with the layer of pigmented cells of retina.

- color of choroids is dark brown, and extensive semilunar area a little above the level of optic papilla has a metallic luster and termed *"tapetum of the choroid"*



Back

Tapetum of the choroid:

- A light reflecting area, lies above the optic papilla.

- A vascular, fibrous layer containing crystalline rods that causes light to be fractioned into a yellowish or bluish-green iridescence.

image

The Choroid composed of four laminae:

1- Supra Choroid lamina.

2- Vascular lamina, contain large blood vessels.

3- Choroid capillary lamina, network of capillary.

4- Basal lamina is very thin transparent, it is composed of an inner homogenous part and outer elastic part.

B- Ciliary body

B- THE CILIARY BODY:

- middle part of the vascular coat; composed of ciliary ring, ciliary process and ciliary muscle.

- **Ciliary ring:** posterior zone which is distinguished from the choroid by its greater thickness.

- **Ciliary process:** more than 100 in number form a circle of radial form which surrounded the lens.

-**Ciliary muscles:** constitute the outer part of the ciliary body lies between sclera and ciliary process. Form a circular band of smooth muscle fibers, its fibers arise from the inner surface of the sclera and insert in the ciliary processes and ring.

- Play an important role in the mechanism of eye accommodation.

image

C- Iris

C- THE IRIS: (the pigmented part of the eye)

The third and the smallest part of the vascular tunic. lies between the lens and the cornea.

a flat ring of tissue attached with its periphery to the sclera by *"pectinate ligament"*, the opening in the center is *"the eye Pupil"*.

size of the eye pupil and the amount of light reaches the retina are regulated by smooth sphincter and dilator muscles in the iris.

image

The sphincter lies near the papillary margin, while the fibers of the dilator muscles are arranged radially.

The iris divides the space between the lens and the cornea into anterior and posterior chambers which are communicated by the eye pupil;

both are filled by *"aqueous humor"*.

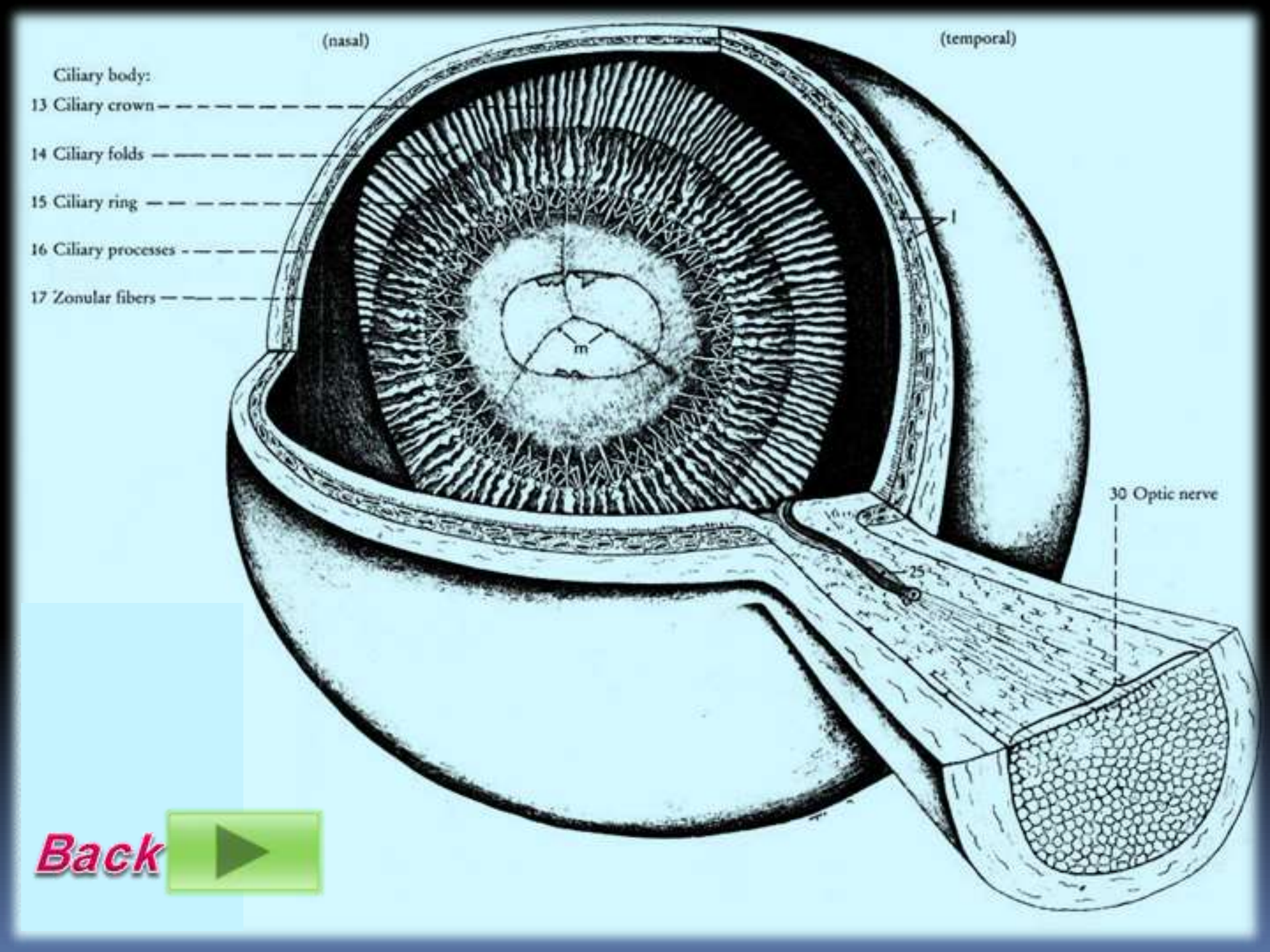
The iris composed of three layers:

1-Anterior epithelial layer.

2-Middle connective tissue stroma
contains smooth muscles.

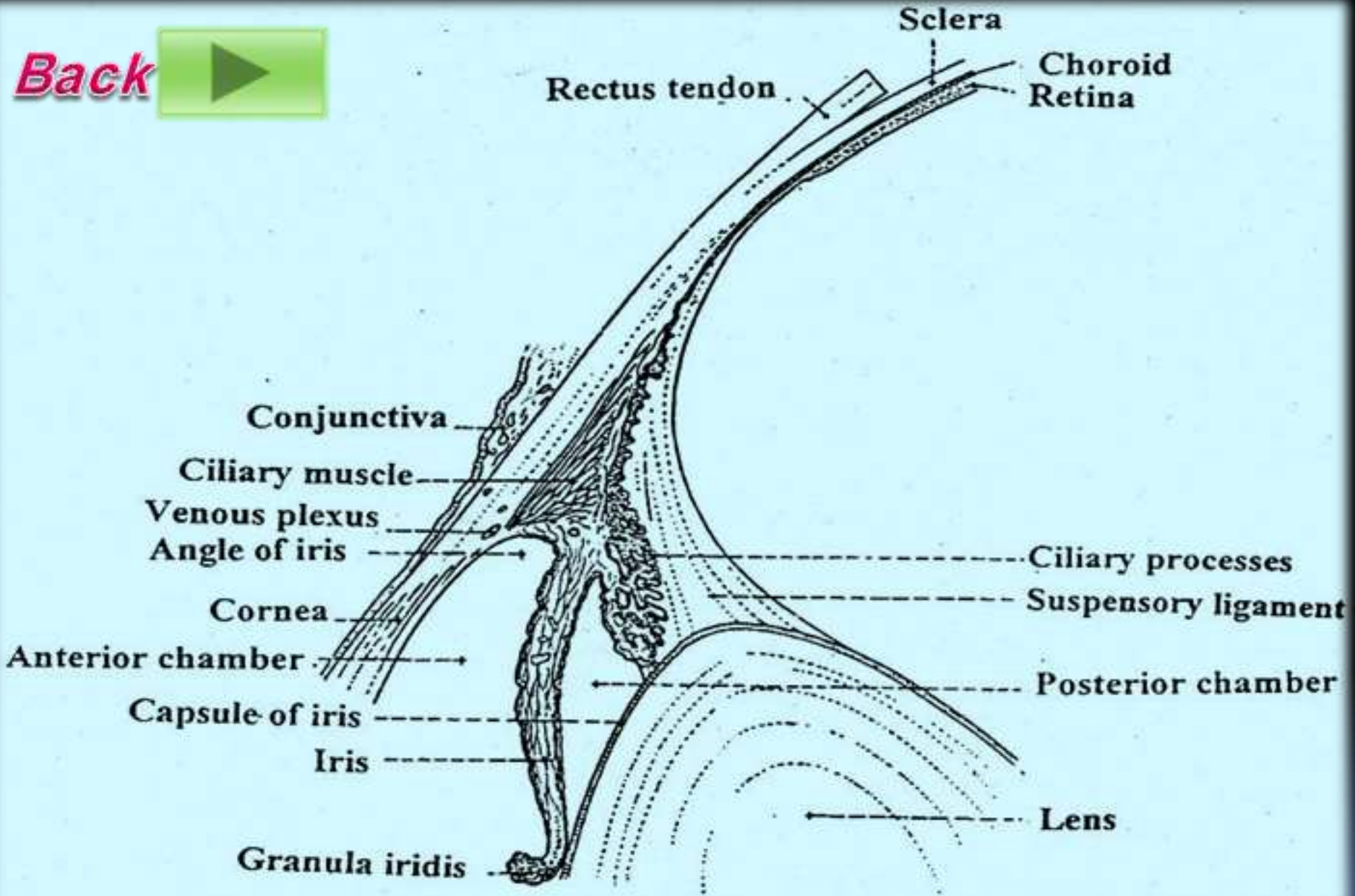
3-Posterior layer of pigmented epithelium,
continuation of the pigmented layer of the retina.

Note that: The color of the eye depends on the color of the iris.


(nasal)
(temporal)
Ciliary body:
13 Ciliary crown
14 Ciliary folds
15 Ciliary ring
16 Ciliary processes
17 Zonular fibers
m
l
25
30 Optic nerve

Back

Back



Section of the ciliary body and iris of the eye

Lens

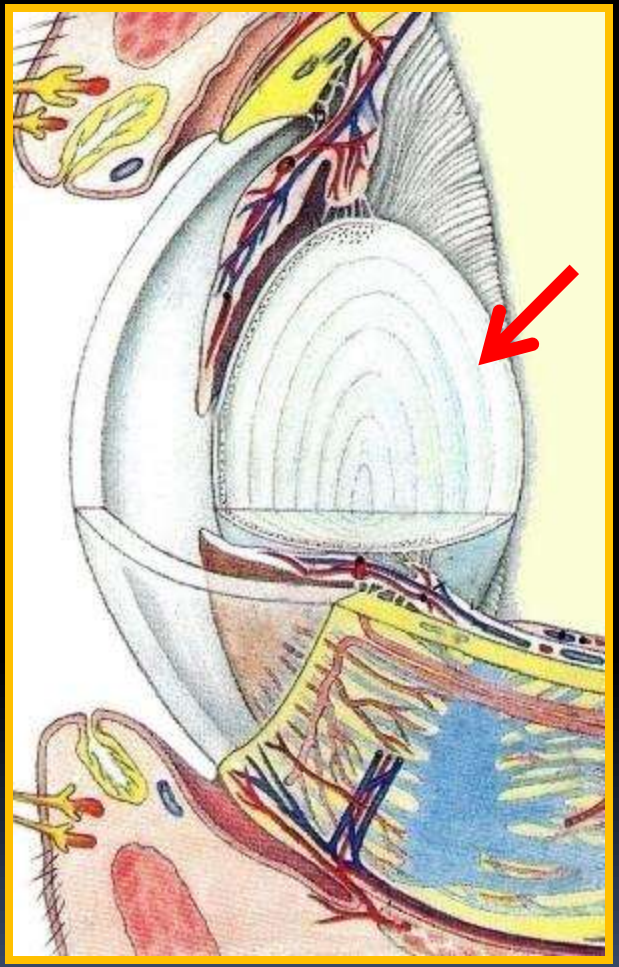
THE CRYSTALLINE LENS:

-A biconvex transparent body, surrounded by a transparent elastic membrane (lens capsule) and suspended in the eye by the zonular fibers to the ciliary processes.

- It consists of a softer outer substance, a dense central part and the muscles of the lens, and when the lens is hardened, it is seen consisted of concentrated laminae arranged somewhat like the layers of an onion and united by an amorphous cement substance.

- The lens has neither vessels nor nerves.

- The change of the shape of the lens is dependant on the action of the ciliary muscle which, in turn transmits its action to the lens capsule by means of the zonular fibers.



Retina

III- THE NERVOUS TUNIC:

It is called *"retina"*

a delicate membrane extends from the entrance of the optic nerve to the margin of the eye pupil.

Consists of 3 parts:

A- large posterior part contains a special neuro-epithelium and termed *"pars optica retinae (1)"*, which extends forward till the ciliary body, then losses its nervous element.

B- it continues over the ciliary body and iris by two parts; inner non pigmented layer called *"pars ciliaris retinae (2)"* and outer pigmented layer covers the posterior surface of the iris called *"pars iridis retinae (3)"*.

Chambers of the eye:

1- **Anterior chamber:**

encloses infront by the cornea and posteriorly by the iris, communicates with the posterior chamber by the eye pupil.

2- **Posterior chamber:**

a small annular space, triangular in cross section, bounded infront by the iris, behind by the peripheral part of the lens and its ligament and externally by ciliary processes.

- They are filled by aqueous humor fluid, which is a clear fluid composed of *(98% water, 2% sodium chloride + glucose + protein "traces of albumen").*

image

-**The aqueous humor:**

derived from the vessels within the ciliary processes; it fills the anterior and posterior champers of the eye

3- ***Vitreous chamber:***

The space between the lens and retinacontains the vitreous body *(gelatinous mass contain protein + great amount of water)* surrounded by a vitreous (hyaloid) membrane, its cranial surface form a fossa for the posterior surface of lens and filled by vitrous humor.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Thanks