ANATOMY OF THE EYE

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AP Diagnostic Ophthalmology

- Anatomy of the eye consist of
  - Orbit
  - Adipose tissues
  - Eyelids
  - Eyelashes
  - Eye ball
  - Muscles
  - Nerves and vessels

ORBIT

- Bony cavity which houses the eyeball
- 4 WALLS –
  - ✓ ROOF,
  - ✓ FLOOR,
  - ✓ MEDIAL AND
  - ✓ LATERAL WALL
- 30 mL in volume
- Has an apex where nerves and vessels emerge

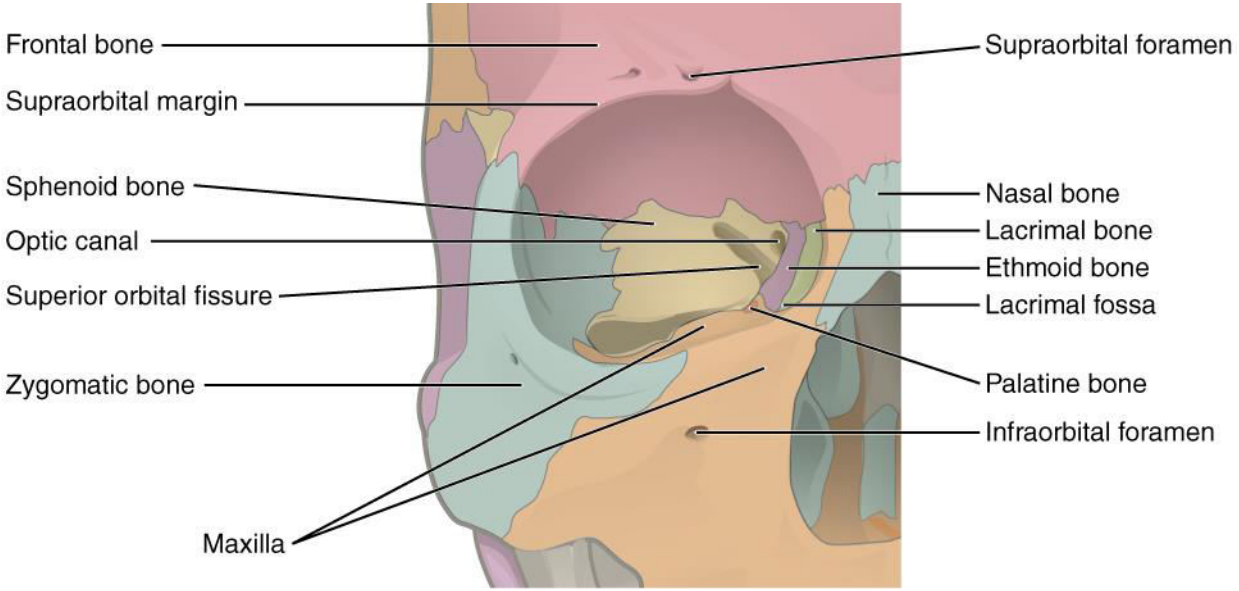
ORBITAL WALLS

- Roof
  - Composed of the lesser wing of the sphenoid, and orbital plate of the frontal bone
  - It is related to the frontal sinus

- Lateral wall
  - Separated from the roof by the superior orbital fissure
  - Composed of the greater wing of the sphenoid, zygomatic bone
- Strongest part of the bony orbit

- Floor
  - Separated from the lateral wall by the inferior orbital fissure
  - Intimately related to the maxillary sinus
  - Composed of maxillary bone, zygomatic bone and palatine bone
  - Orbital contents can herniate into the maxillary sinus in trauma cases

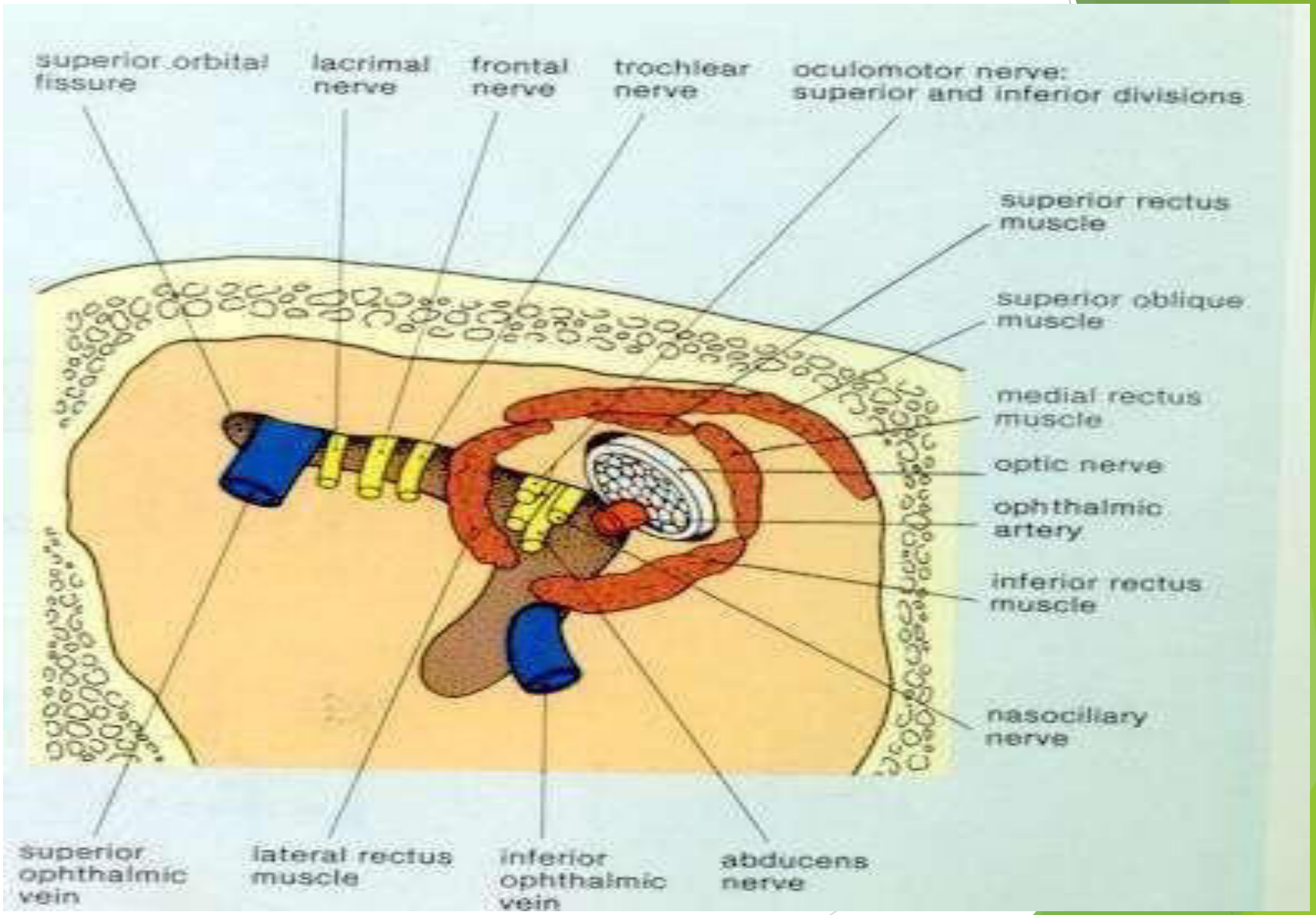
- Medial wall
  - Intimately related to the ethmoid and sphenoid sinuses
  - Composed of the ethmoid bone, sphenoid bone, lacrimal bone and maxilla


Frontal bone
Supraorbital margin
Sphenoid bone
Optic canal
Superior orbital fissure
Zygomatic bone
Maxilla
Supraorbital foramen
Nasal bone
Lacrimal bone
Ethmoid bone
Lacrimal fossa
Palatine bone
Infraorbital foramen

ORBITAL APEX

- Serves as a portal for nerves and vessels

- Site of origin of all extra ocular muscles except inferior oblique


superior orbital fissure
lacrimal nerve
frontal nerve
trochlear nerve
oculomotor nerve: superior and inferior divisions
superior rectus muscle
superior oblique muscle
medial rectus muscle
optic nerve
ophthalmic artery
inferior rectus muscle
nasociliary nerve
superior ophthalmic vein
lateral rectus muscle
inferior ophthalmic vein
abducens nerve

SUPERIOR ORBITAL FISSURE

- Lateral portion
  - Superior ophthalmic vein
  - Lacrimal nerve
  - Frontal nerve
  - Trochlear nerve
- Medial portion
  - Superior and inferior div. Of oculomotor nerve

ORBITAL APEX

- Optic canal
  - Transmits optic nerve and ophthalmic artery
- Superior orbital fissure
  - Also transmits the inferior ophthalmic vein

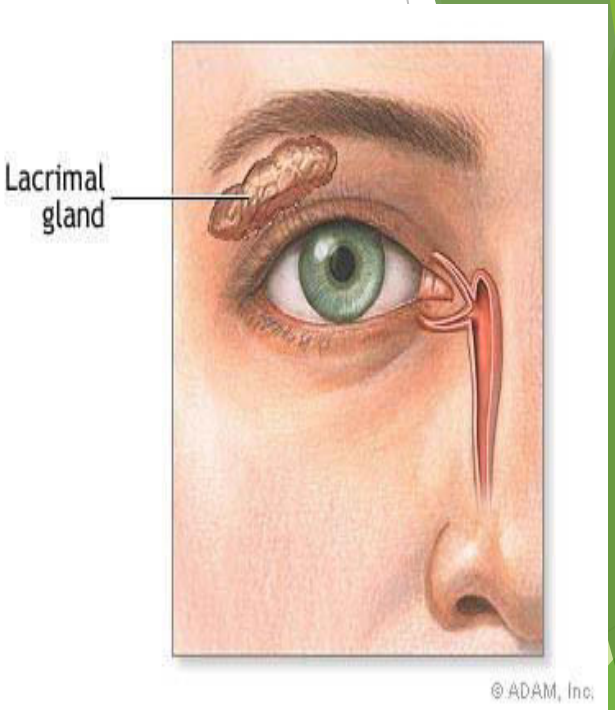
BLOOD SUPPLY OF THE ORBIT

- Ophthalmic artery
  - Central retinal artery
  - Lacrimal artery
  - Muscular branches
  - Long and short posterior ciliary artery
  - Medial palpebral arteries

Venous Drainage of the Orbit

- Superior and Inferior Ophthalmic Veins
- Vortex veins
- Anterior Ciliary Veins
- Central retinal Veins

- Lacrimal glands – produce tears that Lubricate & have a germicidal effect



- Eyebrows – protect against foreign particles, perspiration, & direct rays of light

- Eyelids – folds of skin that cover the
  - Surface of the eye; close by reflex action when an object approaches
- Eyelashes – secrete oils that prevent
  - Lids from sticking together

Eyeball

- Roughly spherical
- approximately 24.5 mm (less than an inch) in length
- About 5mL in total volume

Layers of the eye

- Three layers

1. Outer layer of the eye ball___Consist of
    1. Conjunctiva
    2. Tenon's Capsule
    3. Sclera
    4. Cornea
2. Middle layer of the eye ball--- consist of
    1. Iris
    2. Cillary body
    3. Choroid
3. Inner most layer of the eye ball---consist of
    1. retina

Outer layer of the eye ball

Conjunctiva

- Thin transparent mucous membrane which covers the posterior surface of the eyelid (palpebral conjunctiva) and the anterior surface of the sclera (bulbar conjunctiva)
- composed of two to five layers of stratified columnar epithelial cells
- contains glands which help in ocular lubrication

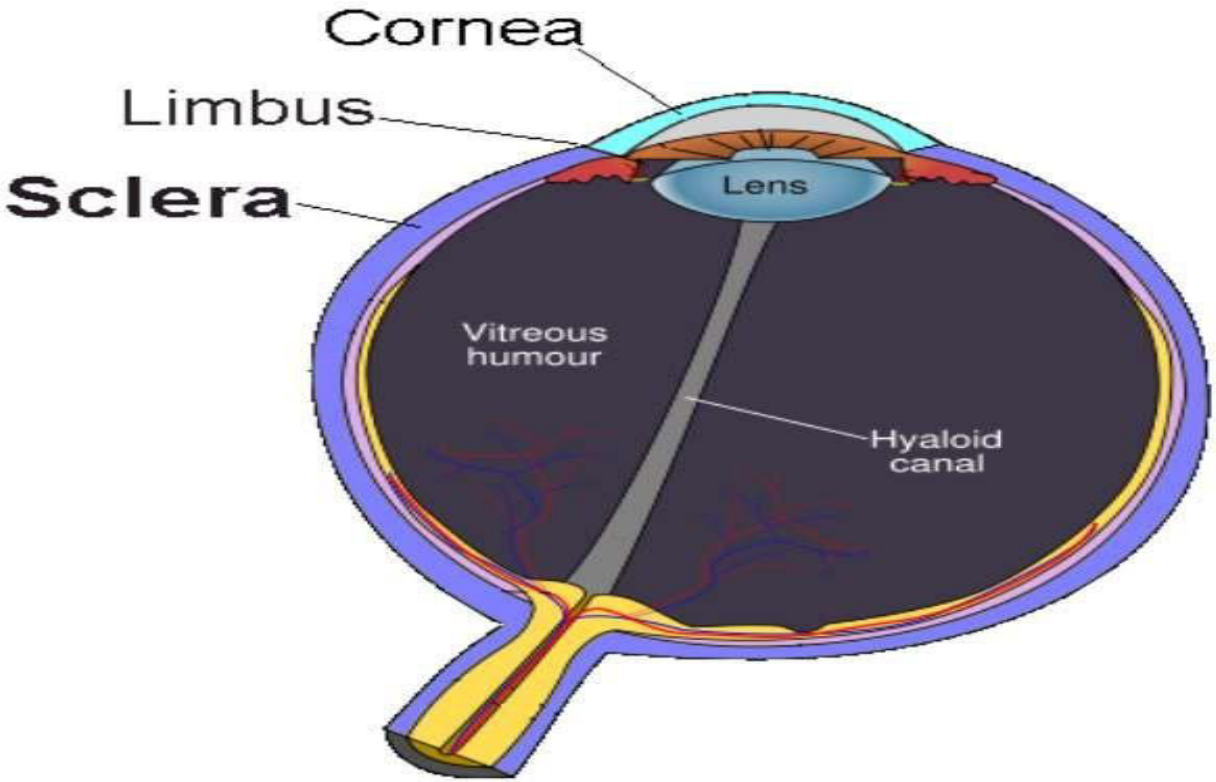
- Blood Supply
  - anterior cilliary artery
  - palpebral arteries
- Nerve Supply
  - first division of the trigeminal nerve

Tenon's Capsule

- Afibrous membrane that envelopes the globe from the limbus to the optic nerve
- continuous with the EOM's
- Thickens to form check ligaments

Sclera

- The sclera forms the posterior opaque 5/6 part of the external fibrous tunic of the eyeball.
- Its whole outer surface is covered by tenon's capsule and also by the bulbar conjunctiva in the anterior part
- Its inner surface lies in contact with the choroid with a potential suprachoroidal space in between.
- Sclera is thickest posteriorly(1mm) and gradually becomes thin when traced anteriorly.


Cornea
Limbus
Sclera
Lens
Vitreous humour
Hyaloid canal

Microscopic structure

Histologically, sclera consist of following three layers

- Epicleral tissue
- Sclera proper
- Lamina fusca

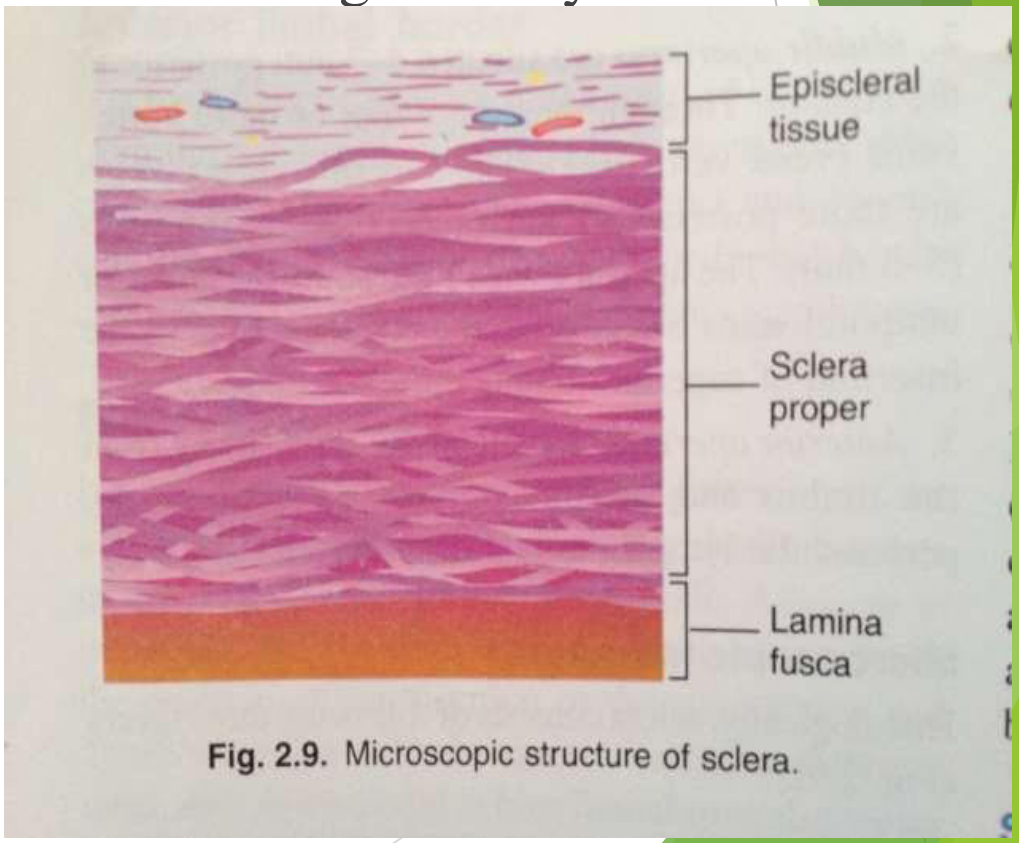


Fig. 2.9. Microscopic structure of sclera.

Blood supply of the sclera

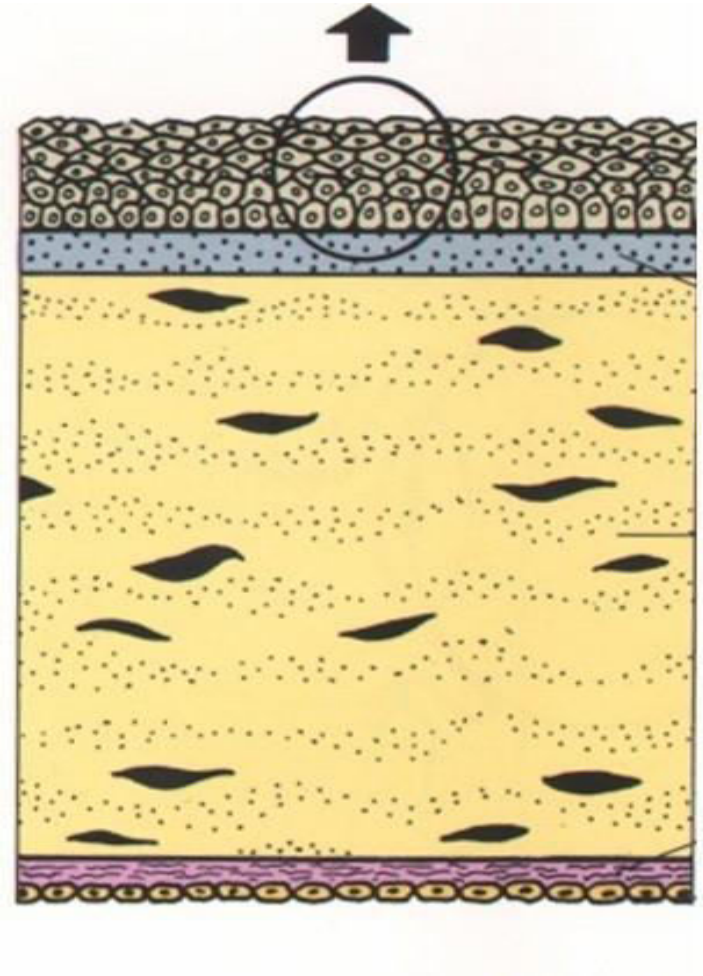
- The episclera receives its blood supply from the anterior ciliary arteries, anterior to the insertions of the rectus muscles and the long and short posterior ciliary arteries.

Nerve supply of the sclera

- The sclera is supplied by the branches from the long ciliary nerves anteriorly and short ciliary nerves behind the equator.

Cornea

- It act as a clear refractive surface and a protective barrier to infection and trauma.
- Its anterior surface is elliptical and posterior surface is circular
- It thinnest centrally and thickest in the periphery



Layers of the cornea

- Epithelium
- Bowman membrane
- Stroma
- Descemet membrane (posterior limiting layer of cornea)
- Endothelium

- The cornea is transparent because of the specialized arrangement of the collagen fibrils within the stroma, which must be kept in a state of relative dehydration.
- Function of the cornea are the
- protection against invasion of microorganisms into the eye,
- and the transmission and focusing (refraction) of light

- Nutrition and nerve supply of the cornea

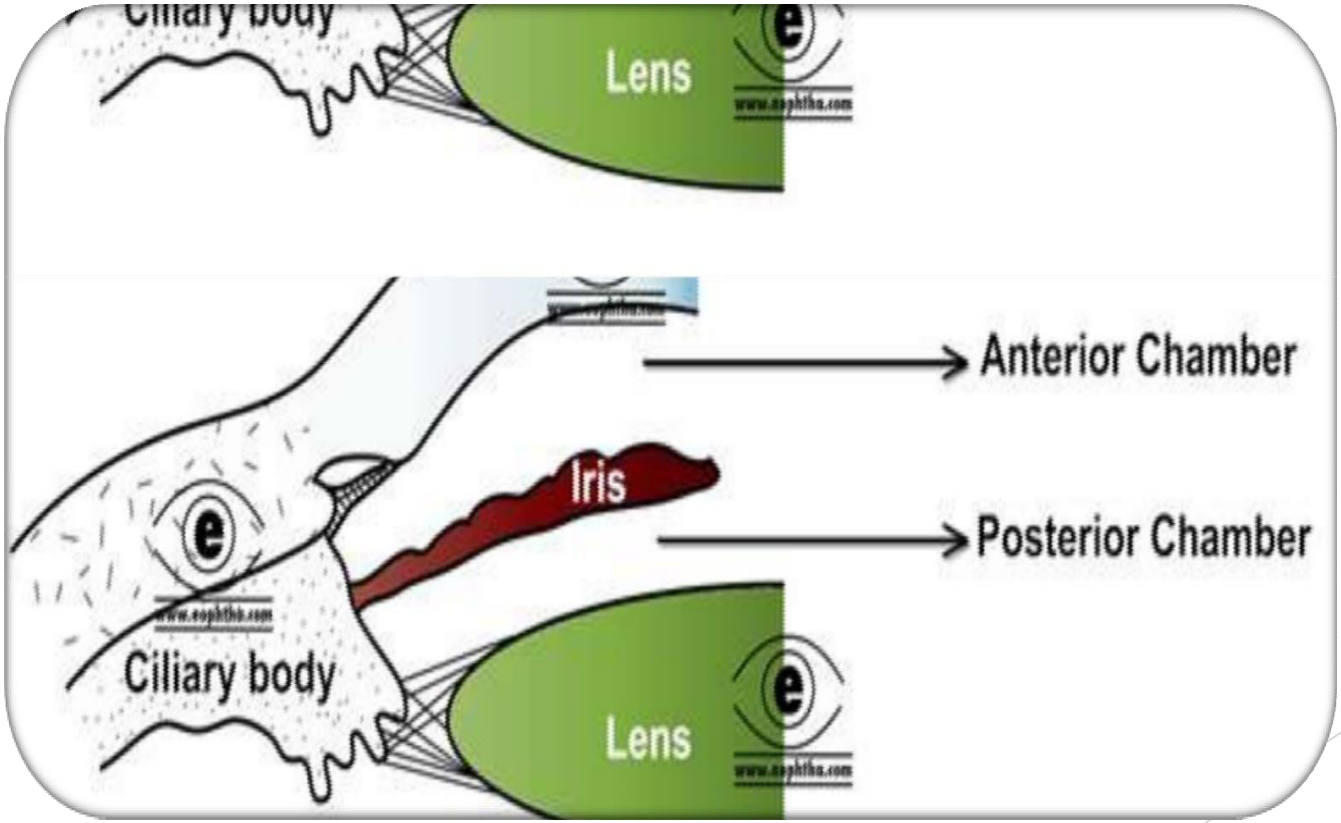
- Cornea is avascular structure

- Relies upon diffusion from limbs and aqueous for nutrion.

- First division of trigeminal nerve forms stromal and sub epithelial plexus responsible for corneal sensation.

Middle layer of the eye ball

- Iris
- It is the anterior part of the uveal tract.
- Forms diaphragm like structure in front of lens.
- Center of iris has an 3-4 mm aperture called Pupil.
- At periphery it is attached to the anterior surface of ciliary body.
- Divides the space between the cornea and lens into anterior and posterior chamber


Lens
Anterior Chamber
Iris
Posterior Chamber
Ciliary body
Lens

MACROSCOPIC APPEARANCE

- **Anterior surface—**

- Divided into cilary and pupillary zone by zigzag line called
- *collarette.*

- It is the thickest region of the iris which lies about 2 mm from the pupil margin.

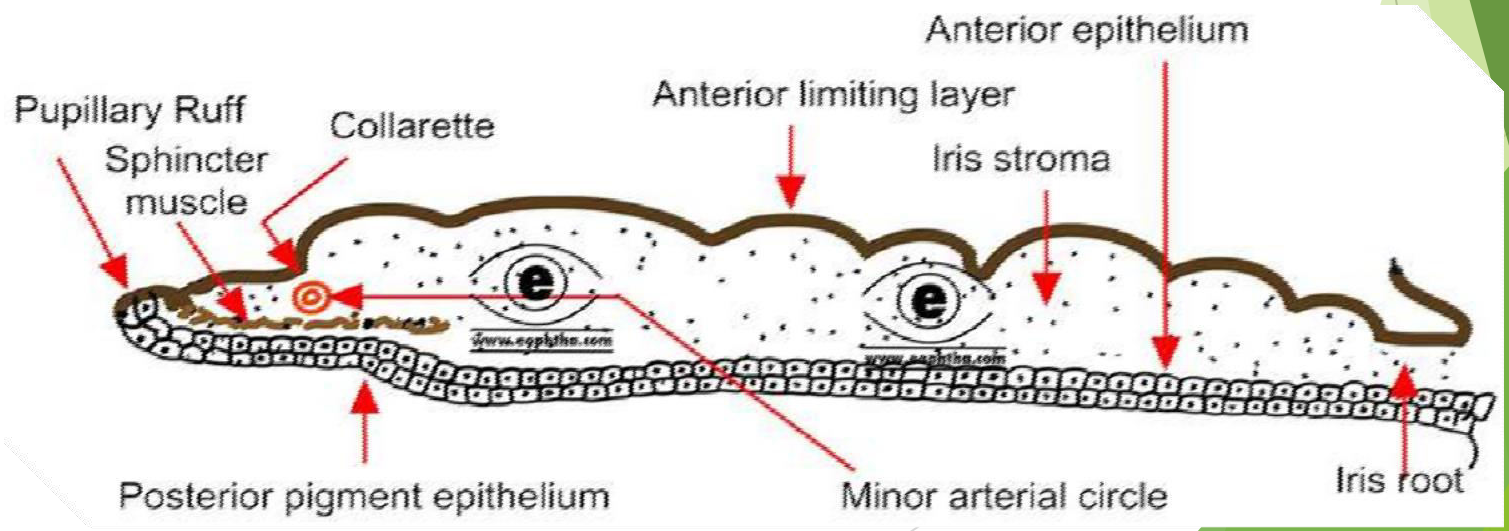
- **POSTERIOR SURFACE**

- Posterior surface of the iris is much more uniform.

- Posterior surface of the iris is darker than the anterior surface and shows numerous radial contraction folds.

MICROSCOPIC STRUCTURE

- Microscopically iris consist of four layers
- Anterior limiting membrane.
- Iris stroma
- Anterior epithelium layer
- Posterior pigmented epithelium layer



CILIARY BODY

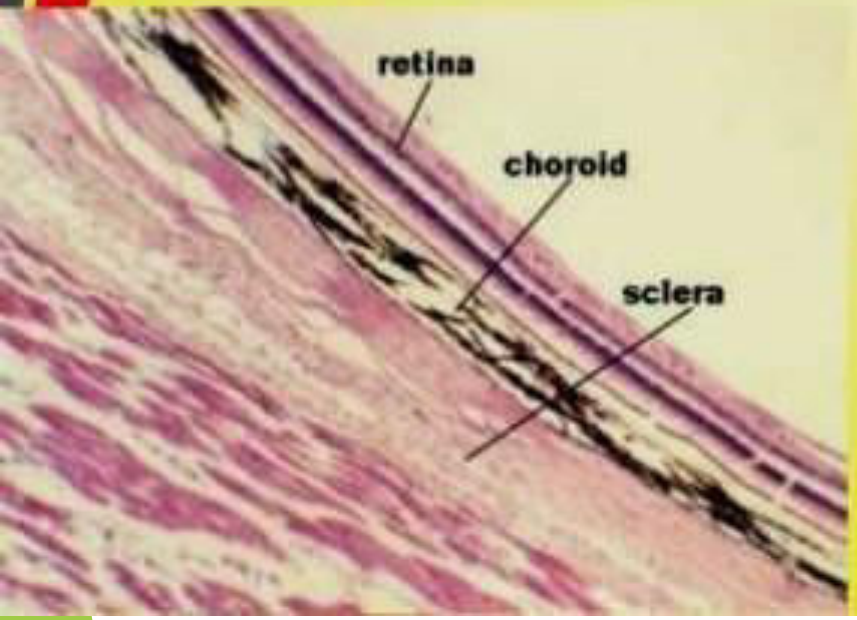
- It is the anterior portion of the uveal tract , which is located b/w the iris and the choroid.
- middle part of vascular coat of eyeball.
- Triangular in shape.
- Inner side of triangle is divided into two parts.
- The anterior portion - ***pars plicata***
- The posterior portion-***pars plana***
- The outer side of triangle lies against the sclera.

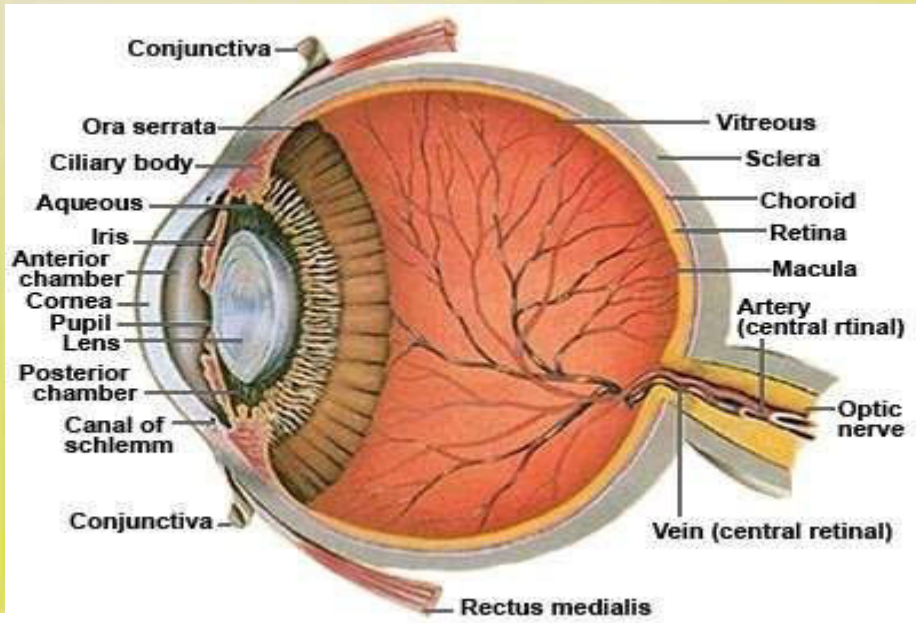
- Microscopically ciliary body consist of five layers.

  - Supraciliary lamina.
  - Stroma.
  - Layer of pigmented epithelium.
  - Layer of non pigmented epithelium.
  - Internal limiting membrane.

3. CHOROID

- Thin, highly pigmented, vascular loose connective tissue
- Rich in melanocytes gives characteristic dark color
- Situated between sclera & retina
- Extends from optic nerve to ciliary body (at ora serrata)
- Thickness decreases from post (0.22mm) to ant (0.1mm)





- **Choroid consist of four layers.**

- Suprachoroidal lamina.
- Stroma.
- Choriocapillaris.
- Bruch's membrane.

Blood supply of the uveal tract

- The **uveal tract** is supplied by three sets of artery.

- Short posterior ciliary artery-Arises as two trunks from the ophthalmic artery .
- ✓ It pierce the sclera around the optic nerve and supply the choroid in a segmental manner.
- Long posterior ciliary artery-- two in number nasal and temporal
- ✓ Pierce the sclera obliquely on medial and lateral side of the optic nerve and supply the ciliary body.

- Anterior ciliary artery– Derived from muscular branches of ophthalmic artery.
- ✓ 7 in numbers– 2 each of superior, medial, inferior rectus muscle and one from lateral rectus muscle
- ✓ these artery gives branches to sclera , limbus and conjunctiva.

NERVE SUPPLY

- The iris receives its sensory and autonomic nerve supply from the long and short ciliary nerves.

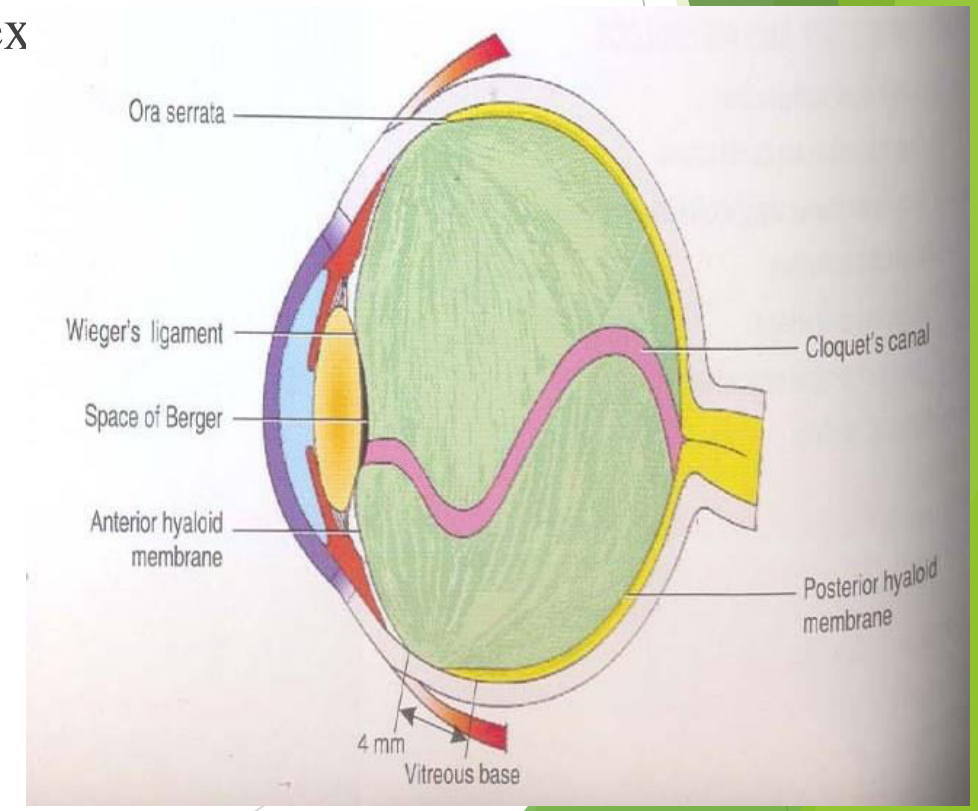
- The choroid is innervated by the long and short ciliary nerves

ANATOMY OF LENS

- **DEFINITION** :

  Lens is a transparent, biconvex structure

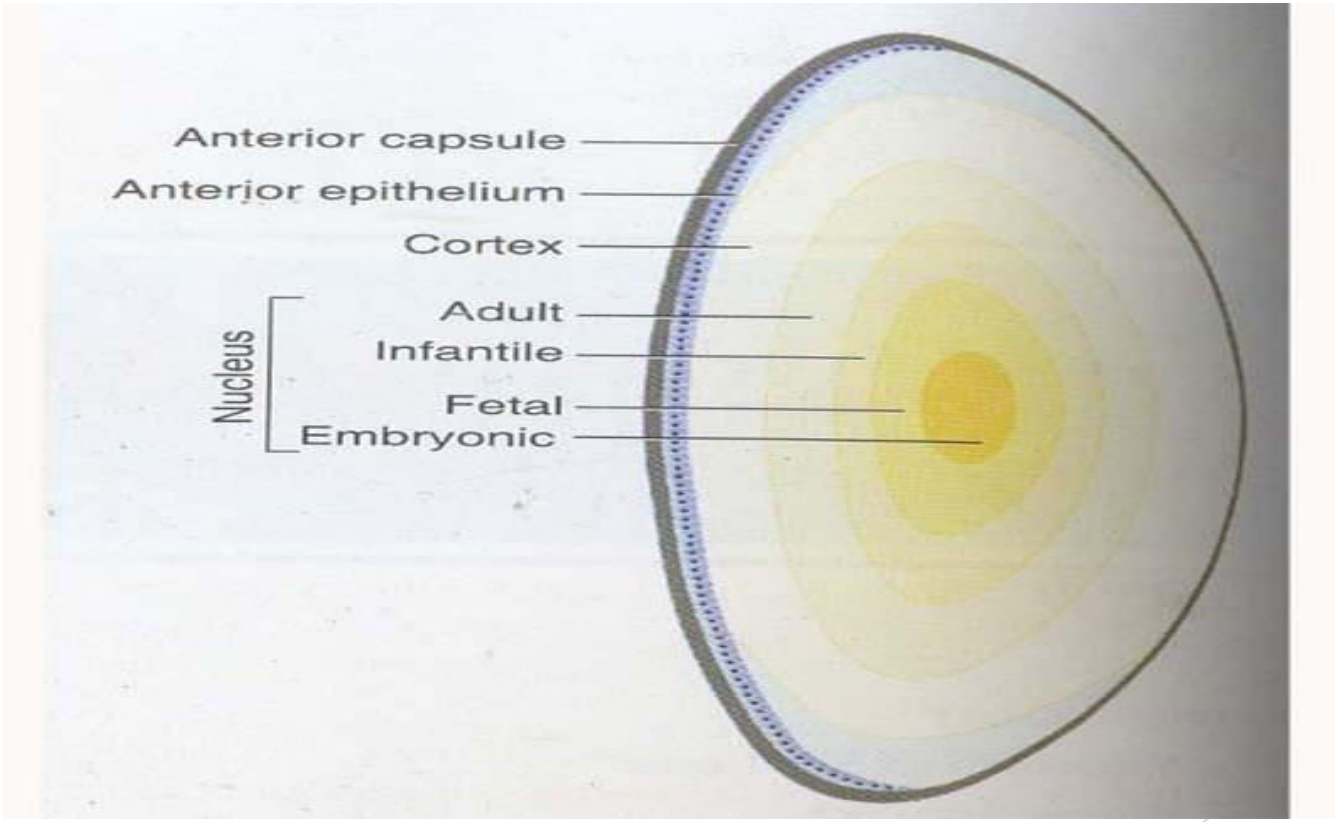
- **Position of Lens in Eye Ball :**
  - Lens lies between post surface of iris & the vitreous



- **Dimension of Lens**
  - Equatorial diameter of lens in adult is 9-10mm.
  - During birth approximately 6.5 mm.
  - Axial diameter (Thickness)
    - A birth about 3.5mm
    - At extreme of Age 5mm

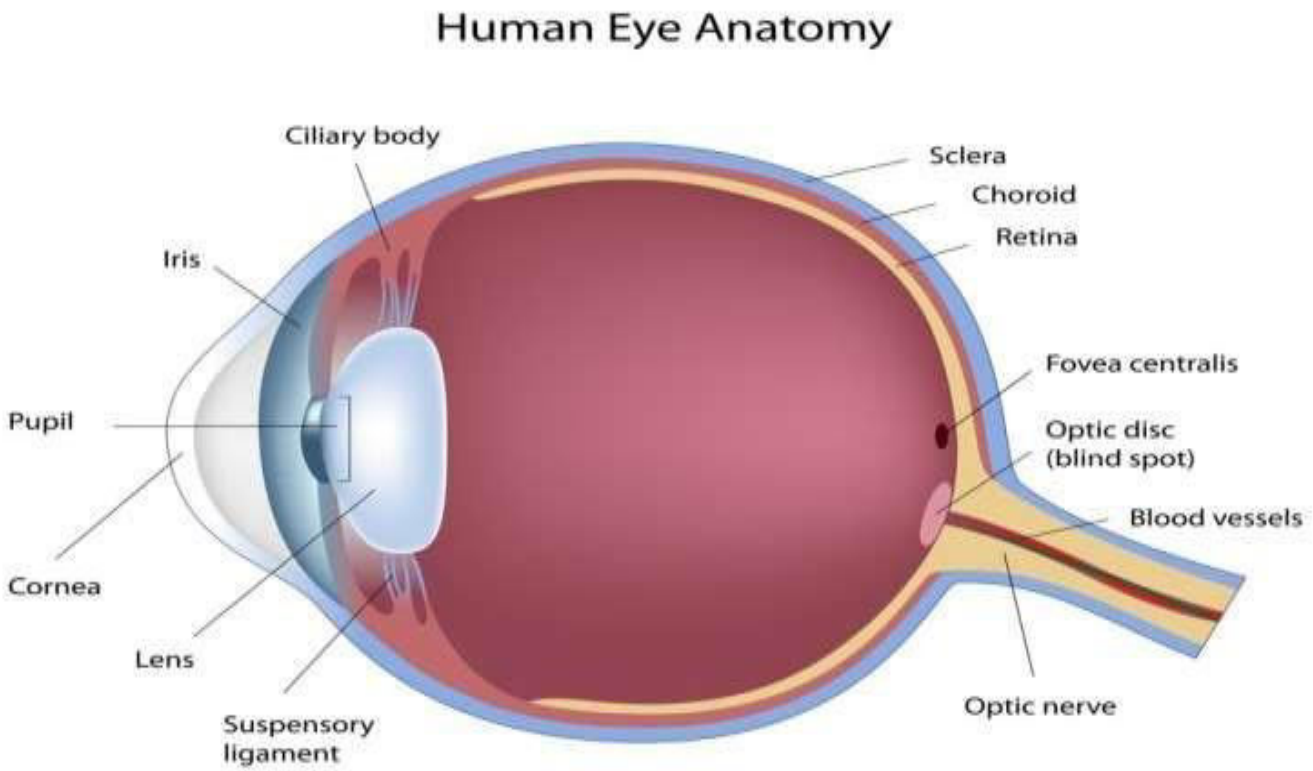
- **Surfaces of Lens**
- Two Surfaces – (i) Anterior (ii) Posterior
- The ant. Surface is less convex & is a part of sphere having radius of 8 to 14mm
- The post surface is more convex & is a part of sphere having radius of 4.5 to 7.5 mm.

- **PARTS OF LENS :**
- The Lens Capsule
- Ant Lens Epithelium and lens fibers
- Nucleus and cortex
- zonules


Anterior capsule
Anterior epithelium
Cortex
Nucleus
Adult
Infantile
Fetal
Embryonic

Inner most layers of eye ball

- Retina
- Retina is the innermost tunic of the eyeball
- Thin, delicate, transparent membrane
- Highly developed tissue of the eye
- Appears purplish red


Human Eye Anatomy
Ciliary body
Sclera
Choroid
Retina
Iris
Fovea centralis
Pupil
Optic disc
(blind spot)
Blood vessels
Cornea
Lens
Suspensory
ligament
Optic nerve

- Three distinct regions of retina:

1.optic disc

2.macula lutea

3.peripheral retina

Optic disc

- Pale pink in colour; well defined circular area
- Diameter: 1.5mm
- All the retina layers terminate here, except the nerve fibre which pass through the lamina cribrosa

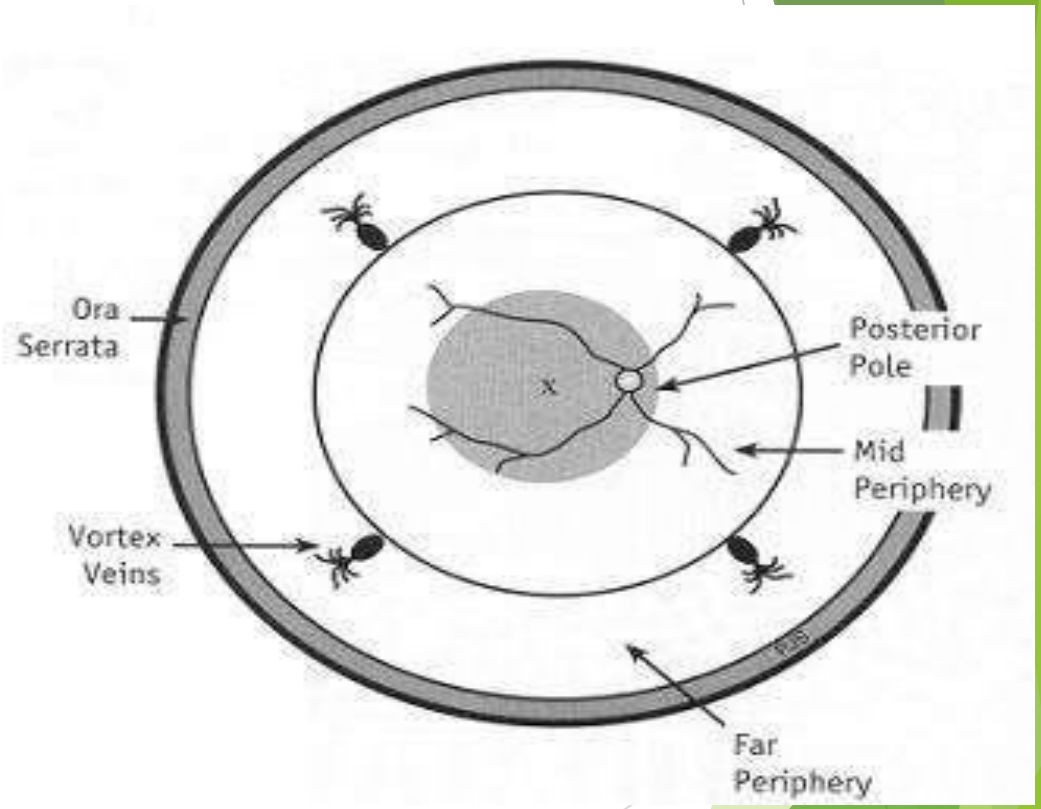
Macula lutea

- The macula lutea is comparatively dark area, 5.5 mm in diameter , situated at the posterior pole of the eyeball , temporal to optic disc , also called as yellow spot or area centralis.
- Primary function :- photoptic vision

- Fovea centralis is central depression in macula; measuring 1.85 mm in diameter & 0.25 thickness
- It is most sensitive part of retina

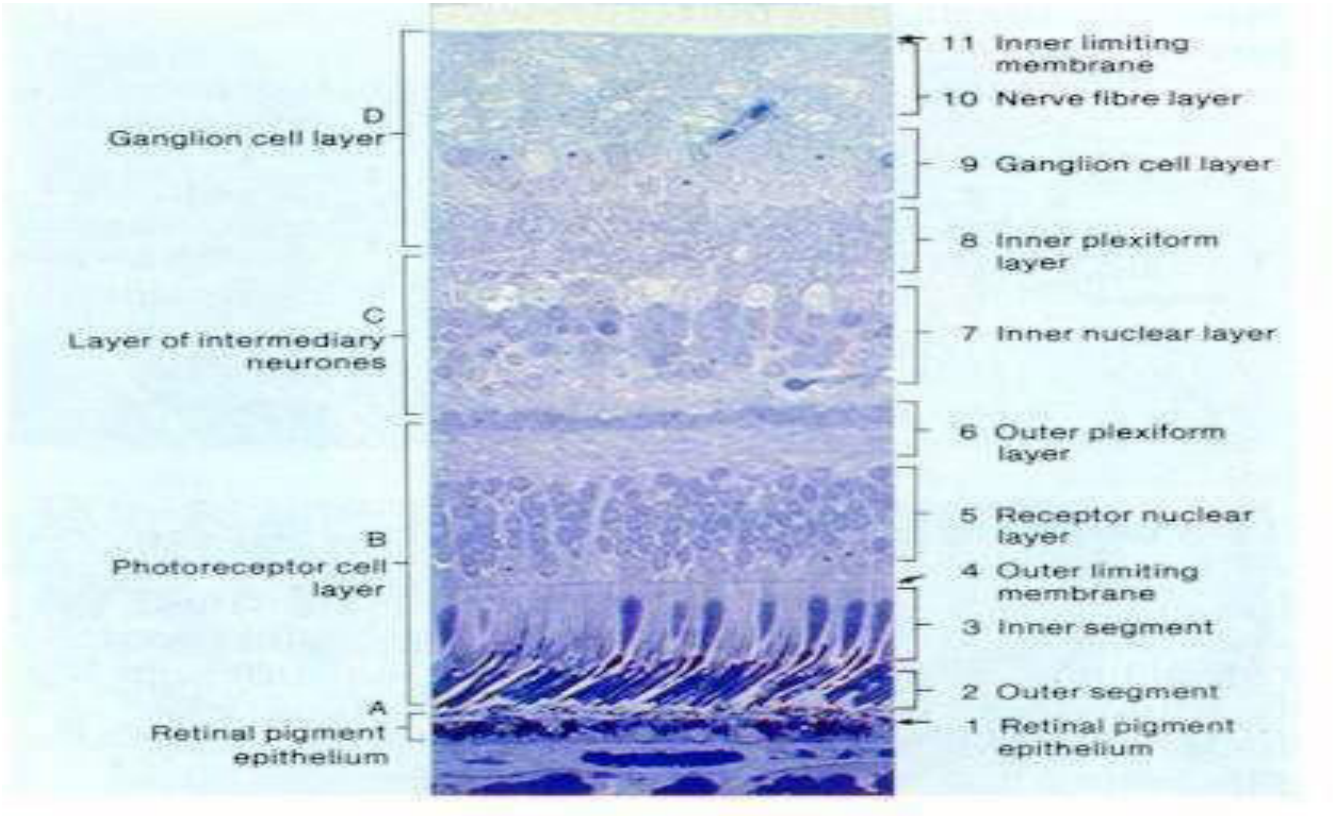
- **Peripheral retina**

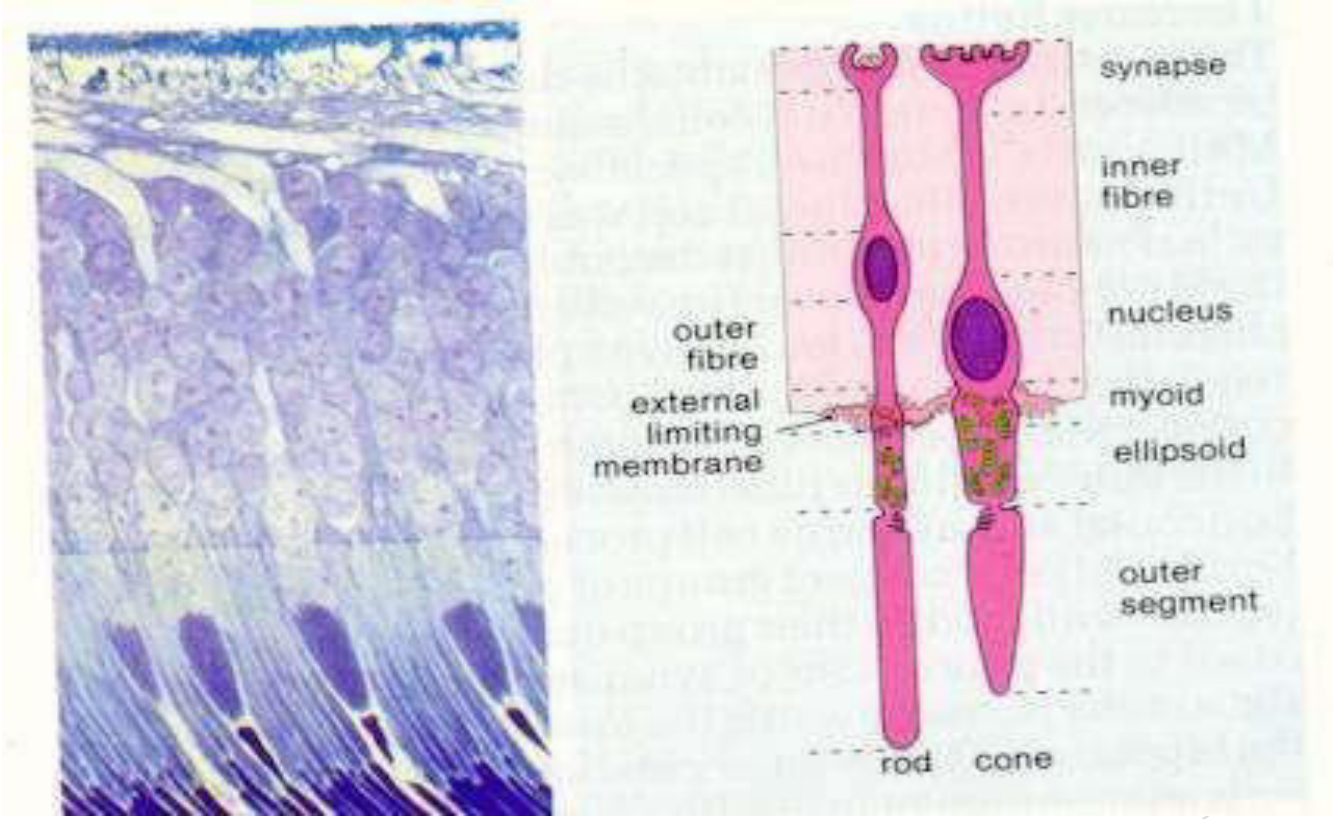
1. Near periphery
2. Mid periphery
3. Far periphery
4. Ora serrata



Microscopic structure of the retina

1. Internal limiting membrane
2. Nerve fiber layer
3. Ganglion cell layer
4. Inner plexiform layer
5. Inner nuclear layer
6. Outer plexiform layer
7. Outer nuclear layer
8. External limiting membrane
9. Photoreceptor layer (rods and cones)
10. Retinal pigment epithelium


D
Ganglion cell layer
C
Layer of intermediary neurones
B
Photoreceptor cell layer
A
Retinal pigment epithelium
11 Inner limiting membrane
10 Nerve fibre layer
9 Ganglion cell layer
8 Inner plexiform layer
7 Inner nuclear layer
6 Outer plexiform layer
5 Receptor nuclear layer
4 Outer limiting membrane
3 Inner segment
2 Outer segment
1 Retinal pigment epithelium


synapse
inner fibre
nucleus
outer fibre
external limiting membrane
myoid
ellipsoid
outer segment
rod
cone

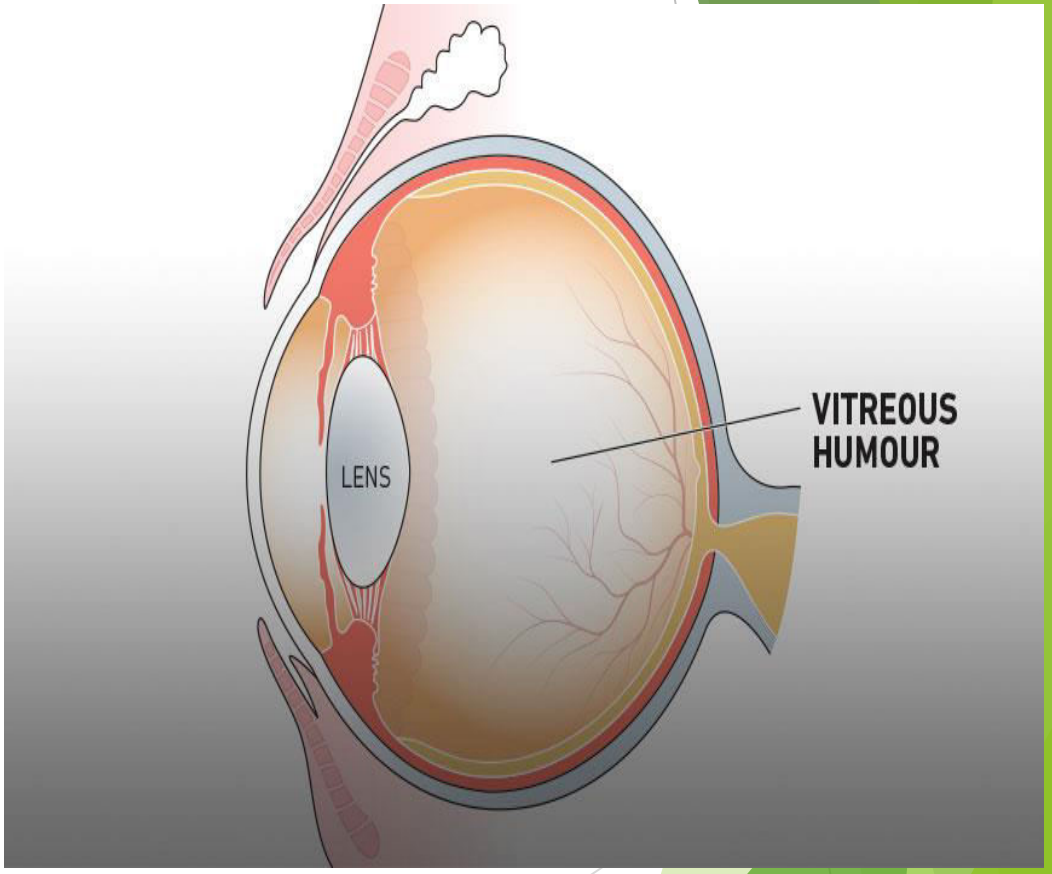
Blood supply of the retina

- The neural retina has a dual blood supply derived from branches of the ophthalmic artery, including the central retinal artery(which provides the retinal circulation) and the posterior ciliary arteries(which provides the choroidal circulation).

- Anatomically, the retinal circulation support the inner two-thirds of the retina, whereas the choroidal circulation supports the outer third of the retina.

Chamber of the eye

- Anterior chamber
- Posterior chamber
- Vitreous chamber



Anterior and Posterior chamber

- Aqueous is a thin, watery fluid located in the anterior and posterior chambers of the eye.
- The anterior chamber lies between the iris (colored part of the eye) and the inner surface of the cornea (the front of the eye).
- The posterior chamber is located behind the iris and in front of the lens.
- In addition to supporting the shape of this area, aqueous supplies nutrients and nourishment to parts of the eye that lack blood supply.

- It also removes waste.
- Improper drainage of the aqueous humor can cause an increase in intraocular pressure (pressure inside the eye).
- This increase can result in loss of vision or contribute to the development of glaucoma

Vitreous chamber

- vitreous humour (also known simply as the vitreous) is a clear, colourless fluid that fills the space between the lens and the retina of eye.
- 99% of it consists of water and the rest is a mixture of collagen, proteins, salts and sugars.
- Despite the water-to-collagen ratio, the vitreous has a firm jelly-like consistency.

Function of the vitreous

- The vitreous performs a vital role in protecting the eye.
- Most importantly, it helps it to hold its ‘spherical’ shape.
- The vitreous also comes in contact with the retina (the light-sensitive tissue at the back of the eye that acts like the film of a camera).
- The pressure of the vitreous humour helps to keep the retina in place.

Thank You