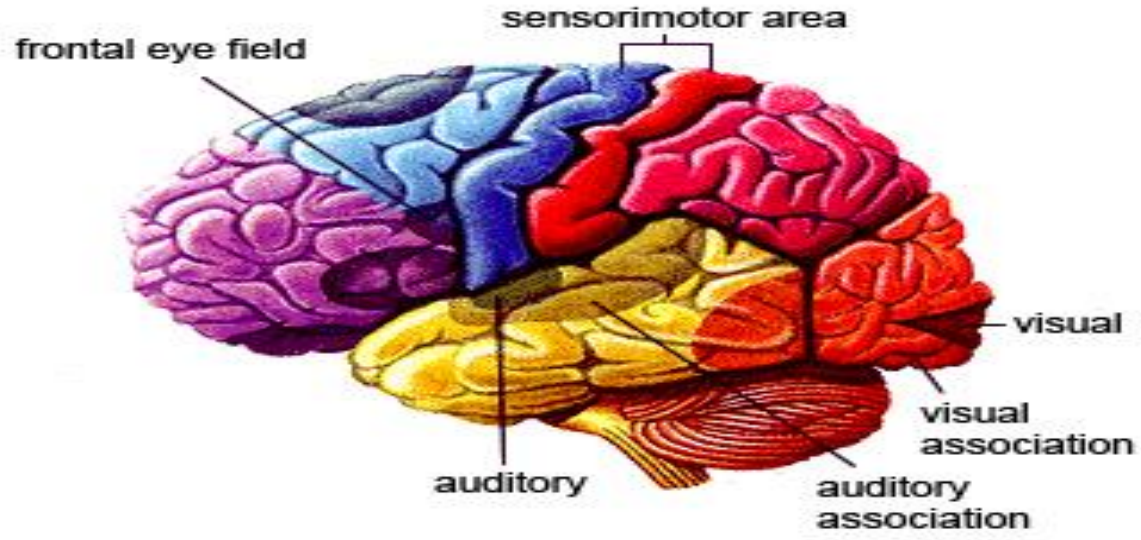
Physiology Team



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(these notes are combination of female and male slides + our notes)

Vision

1-The eye& Refraction

By

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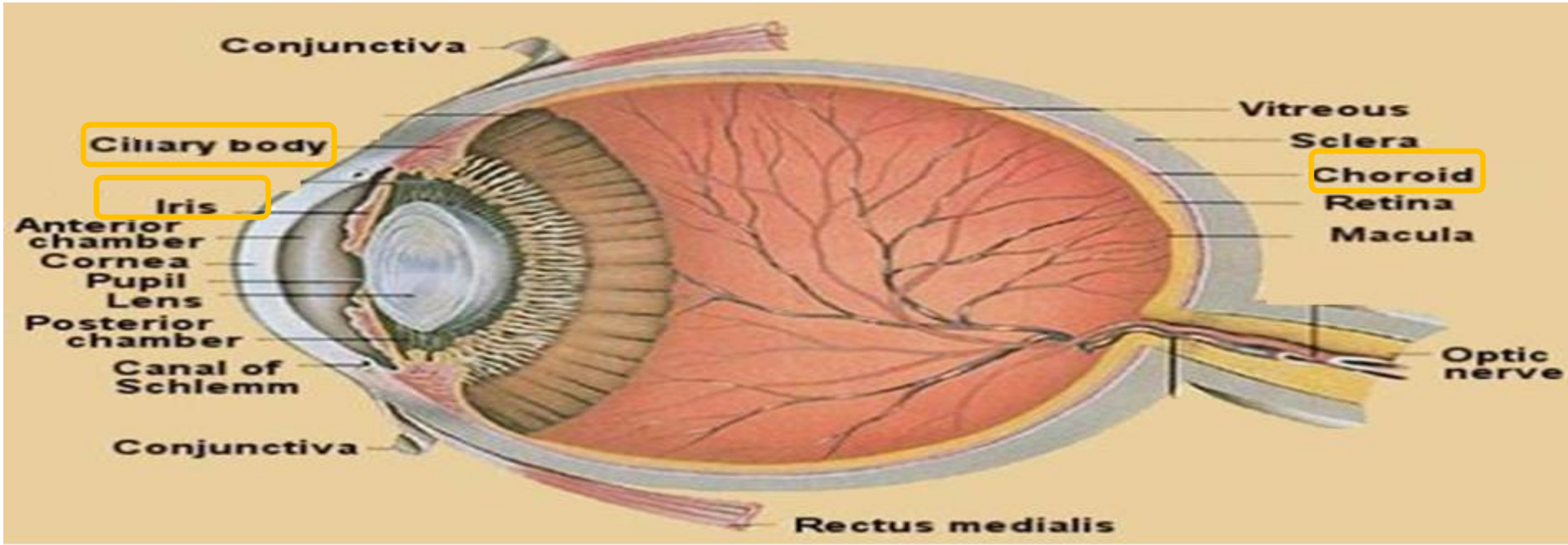
THE EYE

- sclera
- Choroid
- Retina
- Cornea
- conjuctiva
- pupil
- Iris
- Cillary muscle
- Lens

***Choroid + Iris + cilliary Body = UVEA**



Anatomy of the eye

1- Sclera :

Function: **for protection**

- Maintain a spherical appearance of the eye

(it is continuous around the optic nerve and around the eyeball till its modified on the anterior surface to form the cornea)

2- choroid :

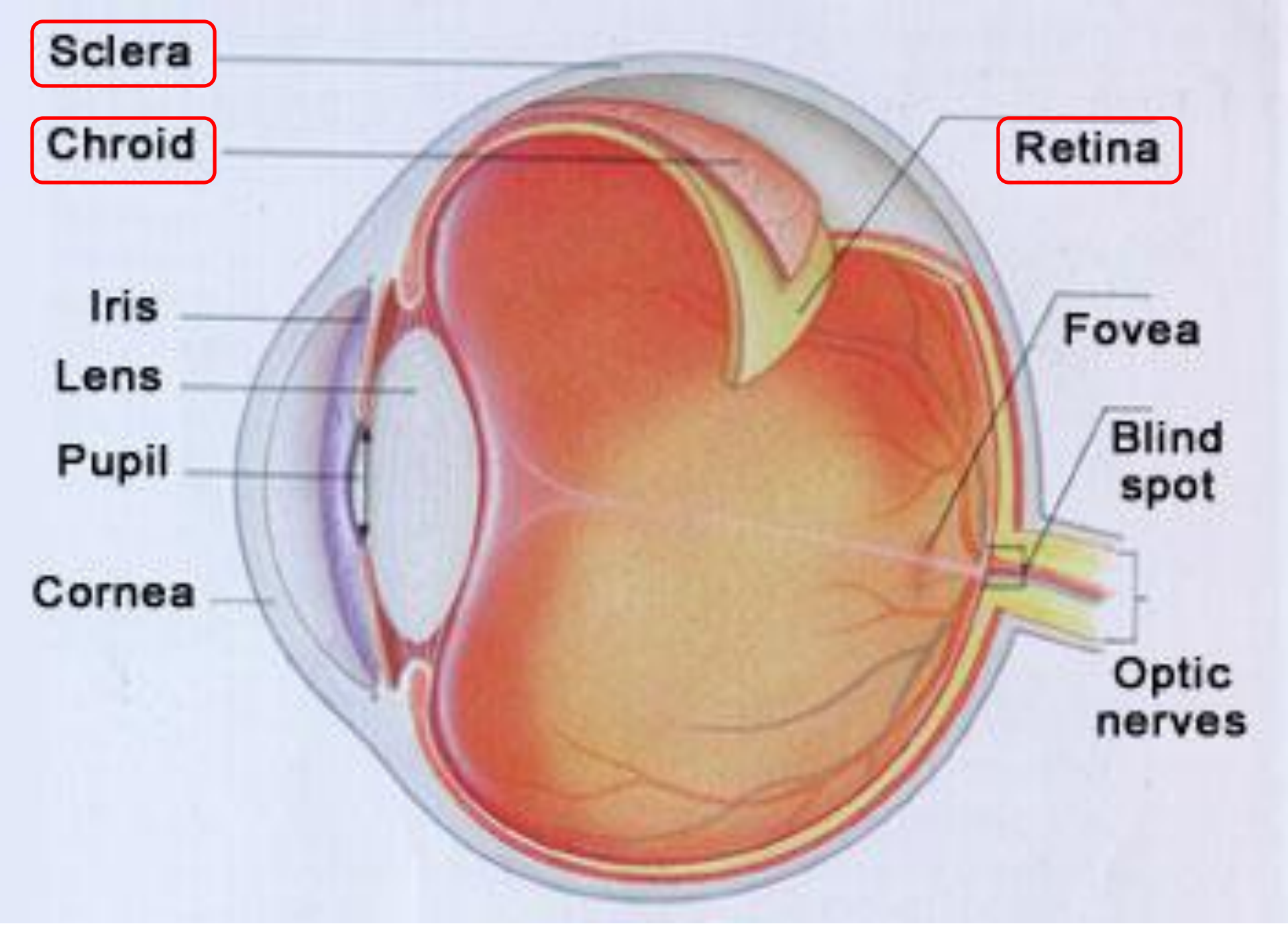
Function: **Blood supply to the retina**

- Inner side of the sclera

(it forms the cilliary bodies (muscles) on the anterior surface of the eye)

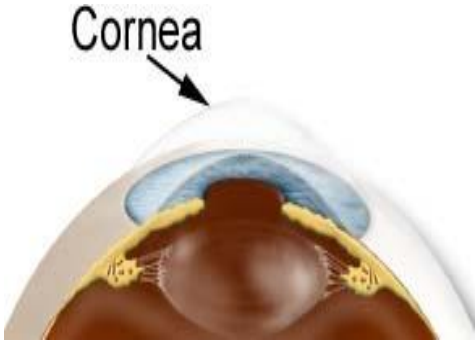
3- Retina : Lining the posterior 2/3 of choroid

- innermost layer


Sclera
Chroid
Retina
Iris
Lens
Pupil
Cornea
Fovea
Blind spot
Optic nerves

4- cornea : (modified anterior 1/6 of sclera)

Function: **allow <u>light to enter</u> the eyes**



Properties :

*transparent .

*avascular (It has NO Blood supply) .

*Refractive or diopteric power *<u>40-45 D</u>* at its ant surface.

5- conjuctiva :

Properties :

*transparent membrane covering anterior surface of eye.

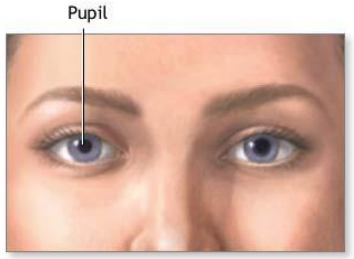
*reflected on inner surface of eye lids

*Covered with thin film of tears ? **(Function)**

protection, wetness, cleaning

6- pupil :

is the opening in the middle of the iris, behind the centre of cornea



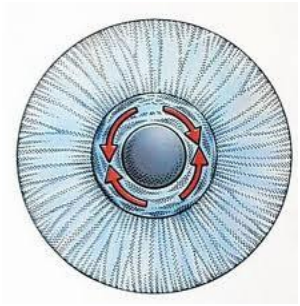
Function:

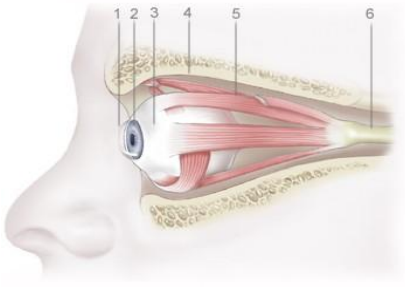
allow light to enter the eye

7- Iris : {colored part}

It has two muscles : (constrictor muscles)

- **RaDial muscle** → Dilates the pupil (by sympathetic)
- **Circular muscles** → Constrict the pupil(by parasympathetic).





8- cilliary muscles \ Body : (thick ant part of choroid)

- Attached to it the suspensory ligaments ((zonule))

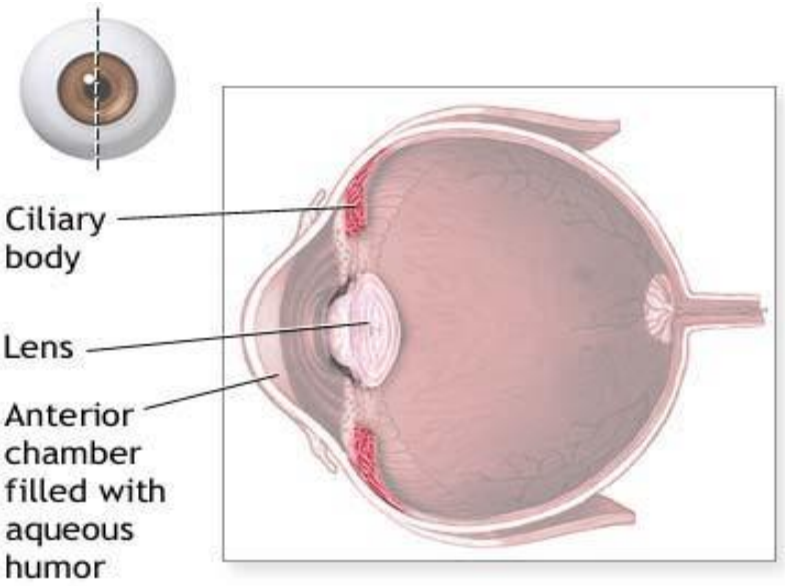
- Has two muscles (different than the iris muscles) :

1- Circular muscles.

2-Longitudinal muscles.

Function of these muscles (just for ur information):

1. controls accomodation
2. regulates the flow of aqueous humour



9- lens : (held in place by zonule)

Properties :

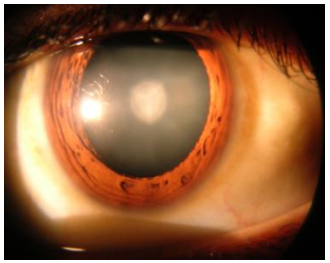
*transparent *biconvex *semisolid

*diopteric power *15-20* D

Q-Lens is more important than the cornea while its lens RP is less than the cornea ?

Because lens can change its RP at anytime but cornea can't

[**remember** :cornea has the 2\3 refractive power of the eye, the lens has 1\3]



Cataract الماء البيضاء

Is the disease when the lens is opaque (معتمة)

- **The eye consists of 3 layers**

1- Outer fibrous coat

sclera

cornea

2- Middle vascular layer

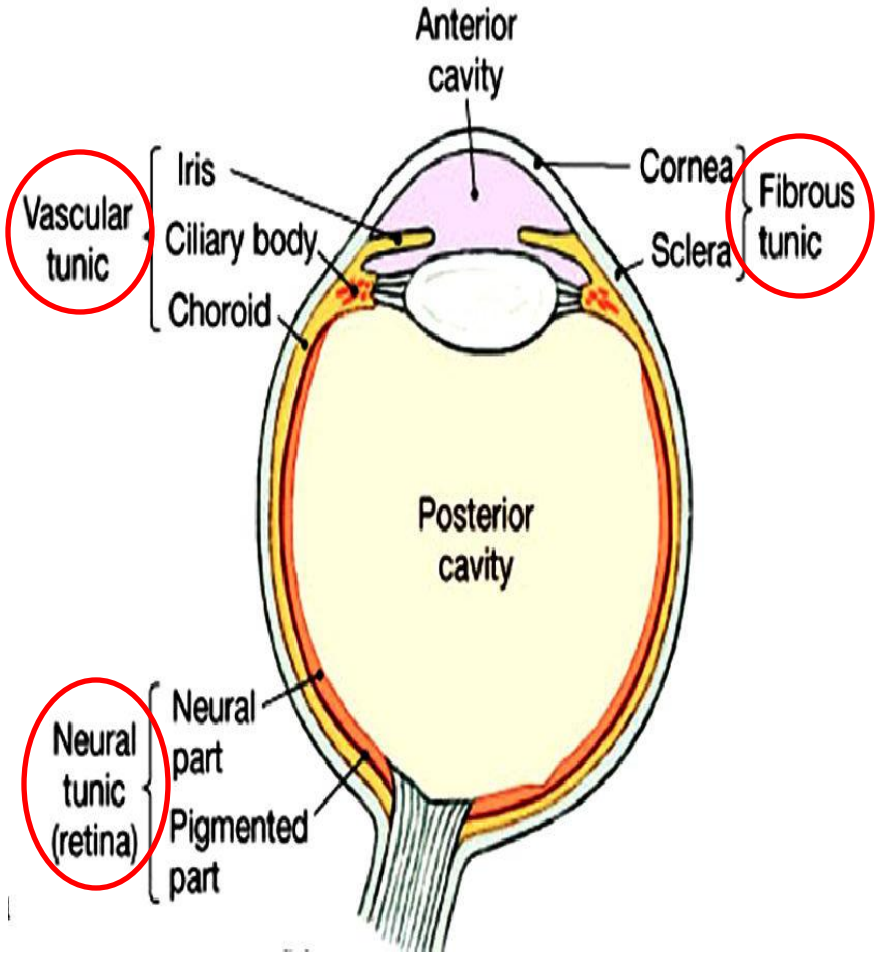
iris

cilliary body (muscle)

choroid

3- Inner neural layer

retina (rods + cones)



- **Anterior and posterior cavities**

The Ciliary Body (and its suspensory ligament) and lens divide the eye into :

(1) Anterior cavity

which contains a fluid called Aqueous Humor

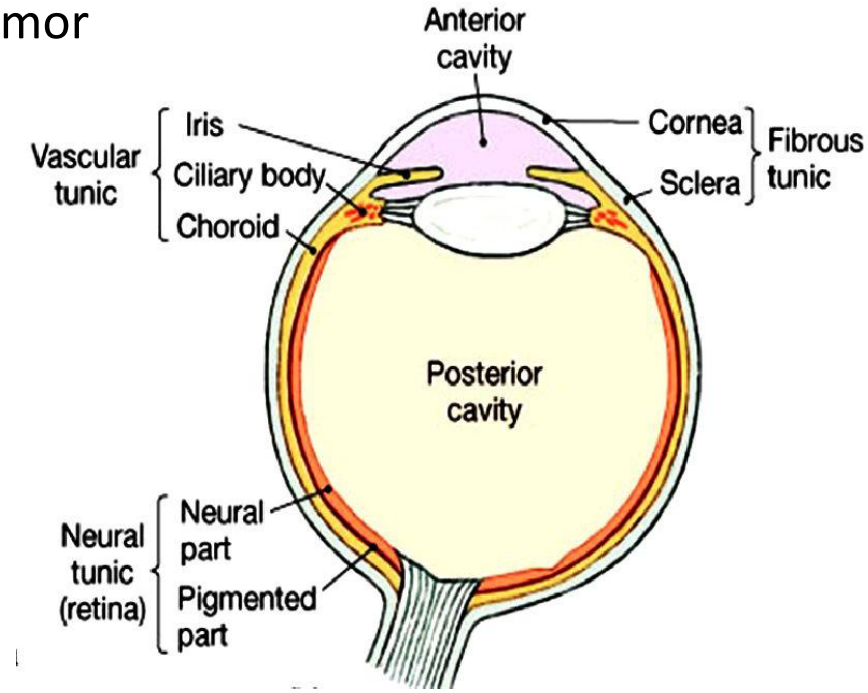
the iris divid the Ant cavity to

1- anterior chamber

2- poterior chamber

(2) Posterior cavity

which contains fluid called Vitreous Humor



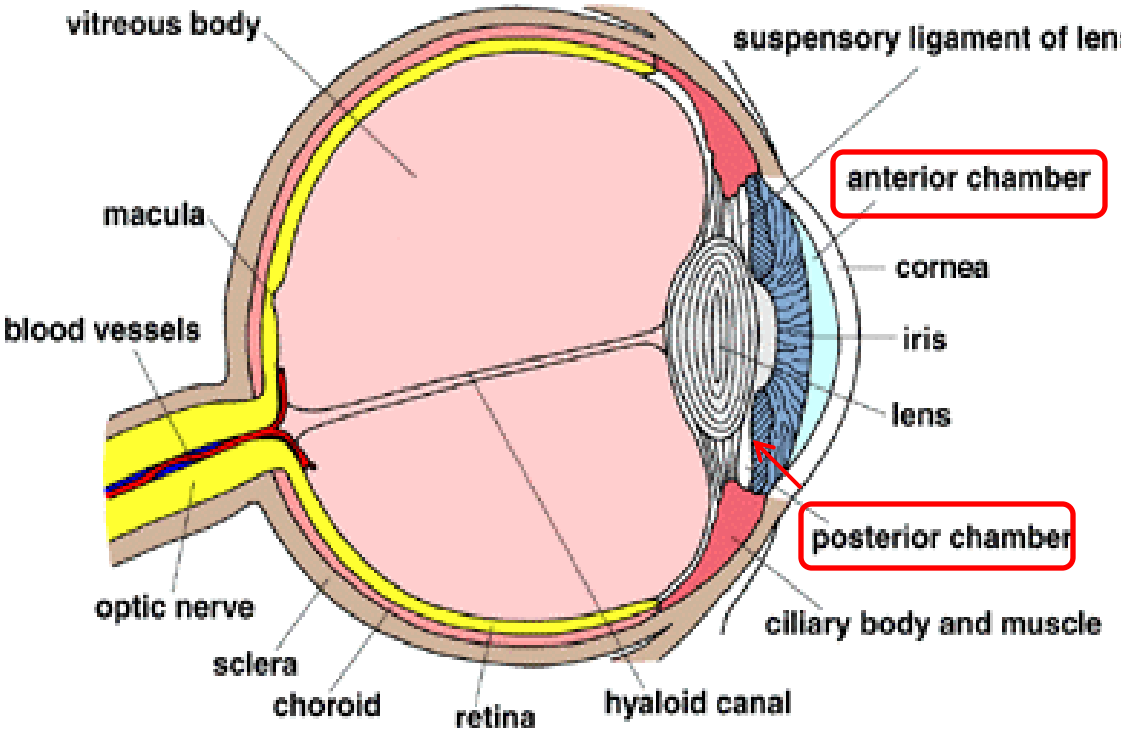
Chambers of the eye

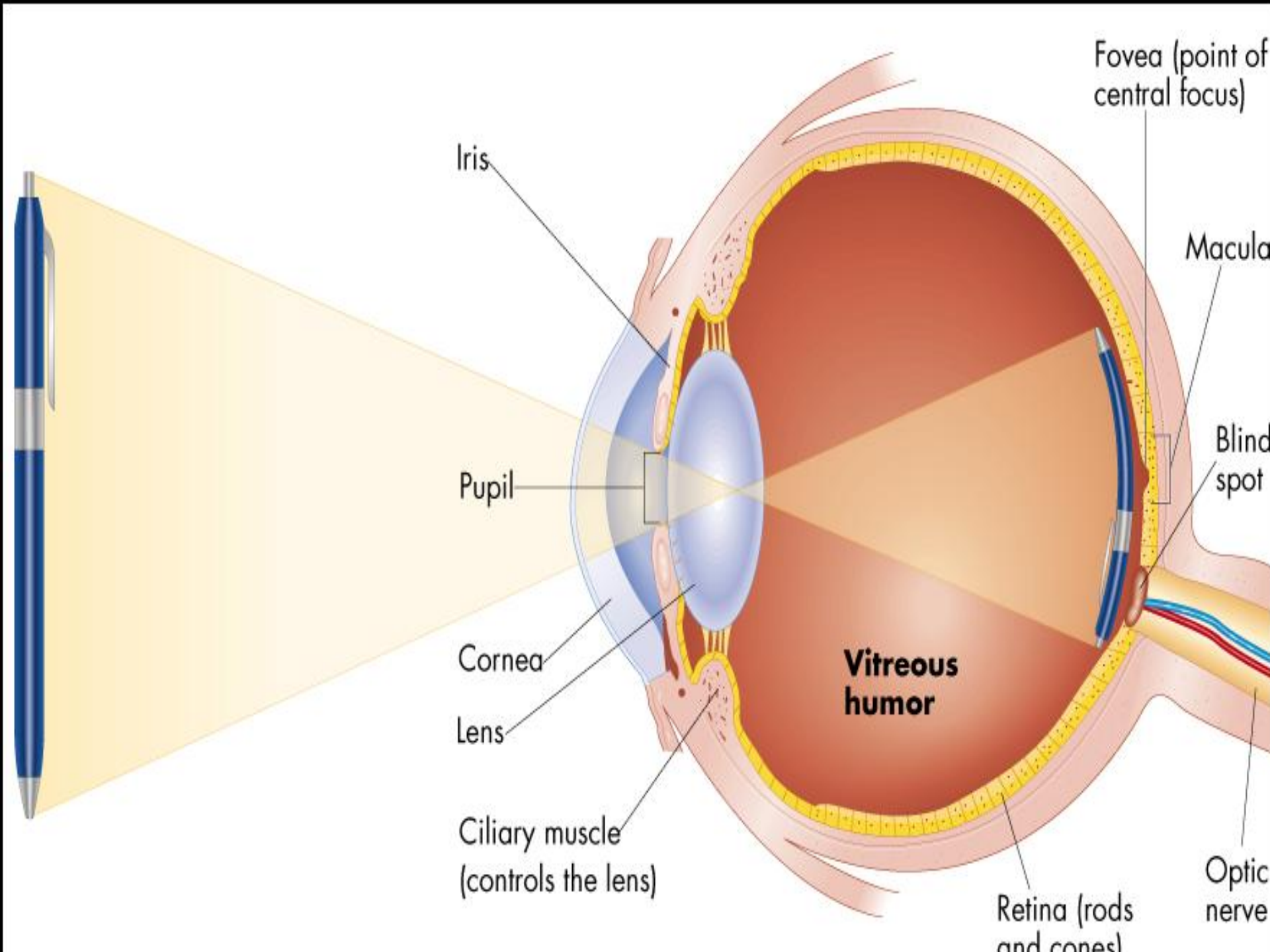
- Anterior chamber

  Between iris & cornea

- Posterior chamber

  Between iris & lens




Fovea (point of central focus)
Iris
Macula
Blind spot
Pupil
Cornea
Lens
Vitreous humor
Ciliary muscle (controls the lens)
Retina (rods and cones)
Optic nerve

Refractive media of the eye

1-Cornea (2\3 RP) .
2-aquous humour .
3-Lens (1\3 RP) .
4-vetrous humour .

1-Cornea : (2/3 refractive power of eye)

- (greatest refraction of light [*40-45* D])

2-Aquous humour :

It is the **fluid** produced by cilliary body → to posterior chamber → to pupil → to anterior chamber → to **canal of schlemm** at angle of ant chamber → to General circulation [veins]

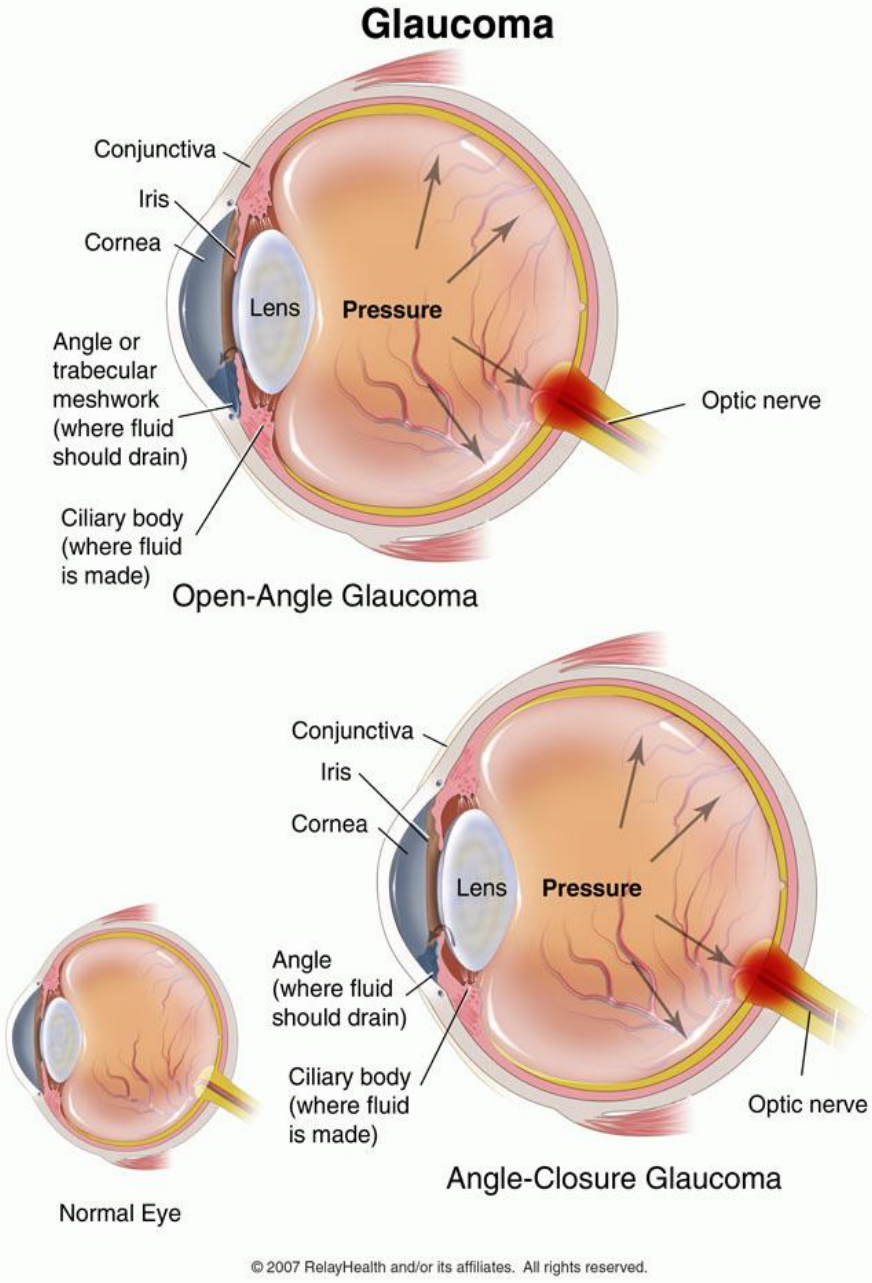
❖ Function of aqueous humour :

- nourishing iris, lens , cilliary body and the retina
- Causes intraocular pressure *10-20* mm Hg , which is **NORMAL**

Glaucoma

[الماء الأزرق]

Atrophy of the *optic nerve* DUE TO increased intraocular pressure more than 20mmHg



3-lens: (1/3 refractive power of eye)

- **(diopteric power *15-20* D)**

Q- more important than cornea. why? Answer is slide 7

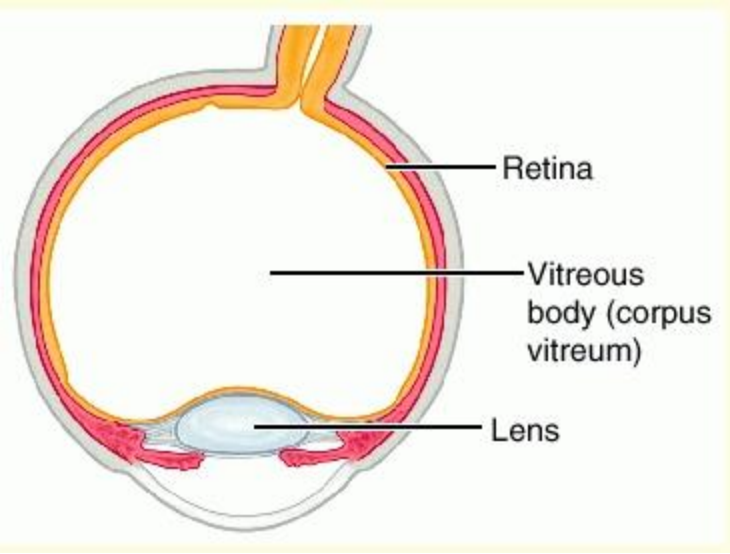
.

4-Vitrous humour :(between retina & lens)

❖ Functions :

1-for nourishing retina

2-keep spheroid shape of the eye



External protection of the eye

1. bony orbit
2. lids blinking keep cornea moist (

   distribute tears over the cornea)
3. conjunctiva
4. tears from lacrimal gland has

   1- Antibacterial
   2- lubricating effect
   3- keep cornea moist & clear ((protect it from dryness))

RETINA

- Components:

1-RECEPTOR CELLS : RODS + CONES .

2-OPTIC DISC = blind spot : (3mm medial & above post pole of eye)

a. Optic nerve **leave** & retinal blood vessels **enter**

b. **no photoreceptors** (the reason why it is called blind spot)

3-FOVEA CENTRALIS : (yellow pigmented spot at post pole of eye)

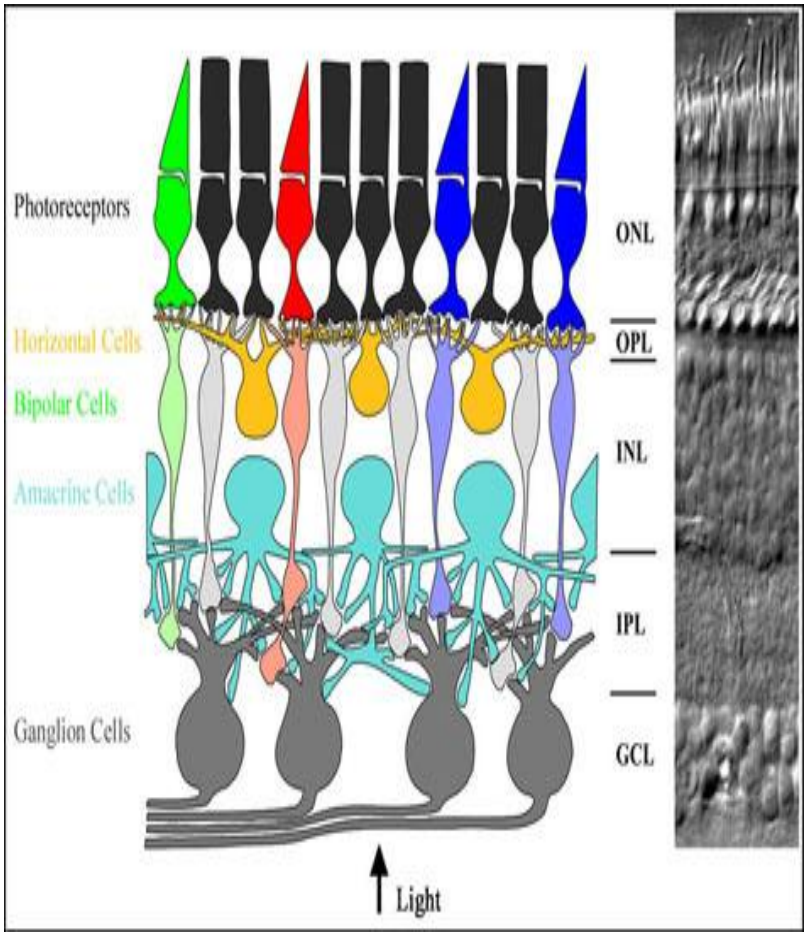
Location : at the centre of Macula lutea

Properties :

* Depression in macula lutea
* Maximum concentration of cons (color vision)
* High (Max) visual acuity
* for details detection (cons are densely packed at fovea)

LAYERS OF RETINA

1-Pigment cell layer .
2-Rodes & cones .
3-Cell bodies of rodes & cones .
4-Horizental cells .
5-Bipolar cells .
6-Amacrine cells .
7-Ganglion cell layer .
8-Optic nerve fibers .



- impulses pass from
- ✓ rodes & cones
- ✓ to rest of layers (horizental + bipolar + amacrine)
- ✓ Ganglion cell layer
- ✓ Action potential
- ✓ to optic nerve

Layers of Retina

1-pigment cell layer : (outermost layer)

what is its value?

Function :

1- Absorb light (because it contains melanin)

2-prevents light reflection back .

3- Involved in the vitamin A cycle where it isomerizes all trans retinol to 11-cis retinal.

2- rodes & cones :(inner neural)

no cell bodies

(rodes 120 million & cones 6 million)

3-cell bodies of rodes & cones (outer nuclear layer)

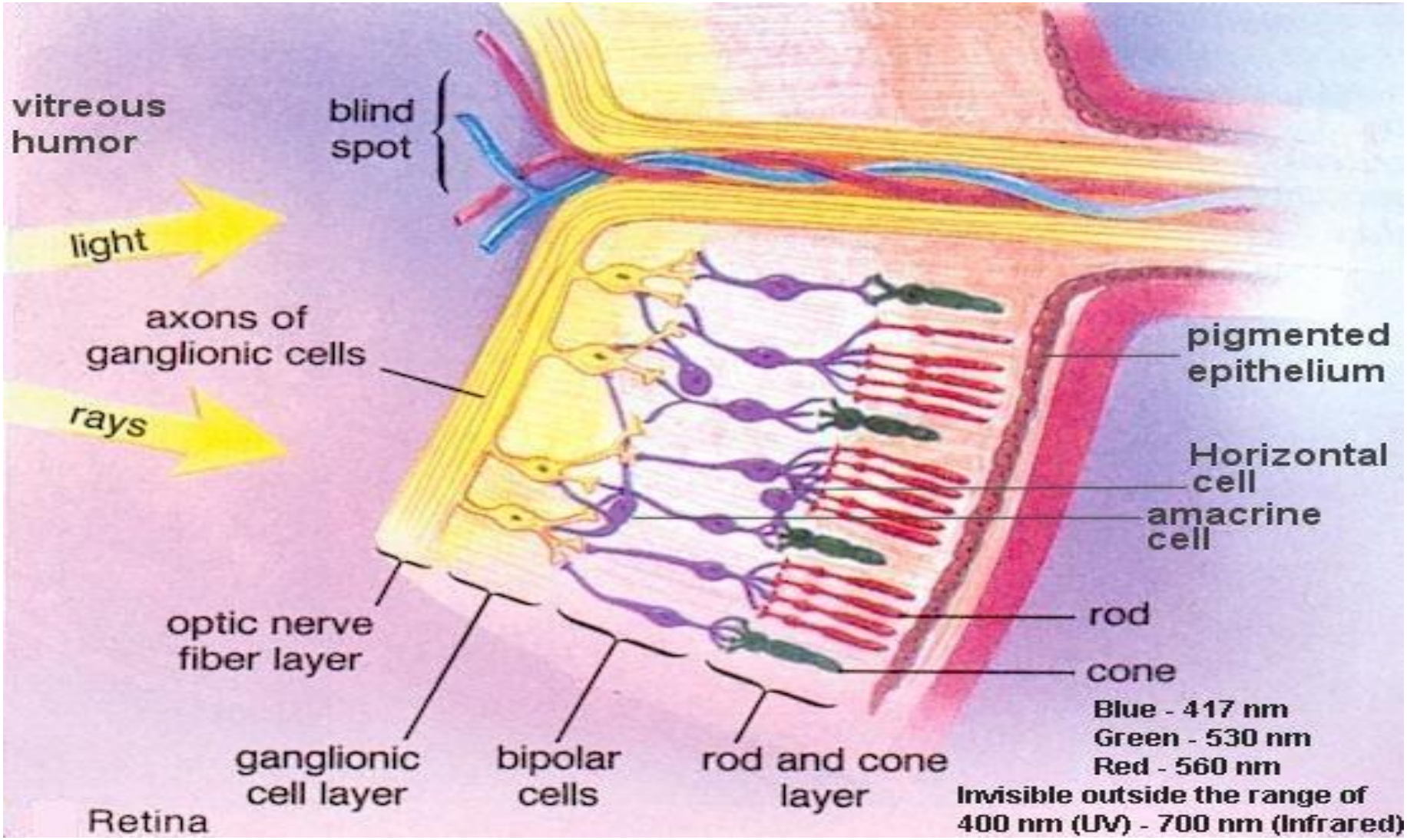
4- Horizontal cells (outer plexiform layer)
Synaptic connection with the receptors

5-bipolar cells (Inner nuclear layer)

6-amacrine cells (inner plexiform layer)
Synaptic connections with the ganglion cells

7-Ganglion cell layer

8-Optic nerve fibers (1.2 million fibers)


vitreous humor
blind spot
light
axons of ganglionic cells
rays
pigmented epithelium
Horizontal cell
amacrine cell
rod
cone
optic nerve fiber layer
ganglionic cell layer
bipolar cells
rod and cone layer
Blue - 417 nm
Green - 530 nm
Red - 560 nm
Invisible outside the range of 400 nm (UV) - 700 nm (Infrared)
Retina

BINOCULAR VISION

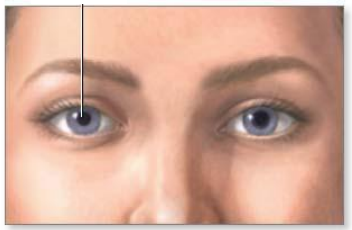
to see with two eyes

1- Large visual field

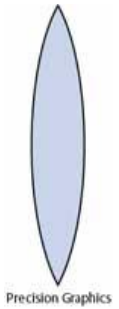
2- cancel effect of blind spot

3- stereoscopic vision (to see objects in a 3D shape)

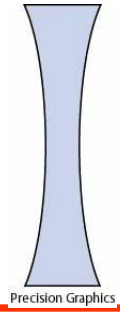
4- one eye lesion does not affect vision



Principles of optics



Biconvex lens(converge) + biconcave lens(diverge)



Diopter (measure of refractive power) =1 / Principal focal distance in meters

Exp/ if Principal focal distance of a lens is 25cm ? (Don't forget to convert Cm to Meters)

R.P= 1/ 0.25 meter = 4D

- **Emmetropic eye** : It's a term indicating a **normal** eye which has the image on retina, has diopteric power 60D

  Why 60D ? Cornea's R.P + Lens R.P = [(40+20)] or [(45+15)] = 60D

- **Lens-retina distance** =15mm

(The greater the curvature of the lens, the greater the refractive power of the eye)

Errors of refraction

1- Hypermetropia (Hyperopia –farsightedness)
2- Myopia (Nearsightedness)
3-Presbyopia (Due to age)
4-Astigmatism

1-Hypermetropia (hyperopia = farsightedness)

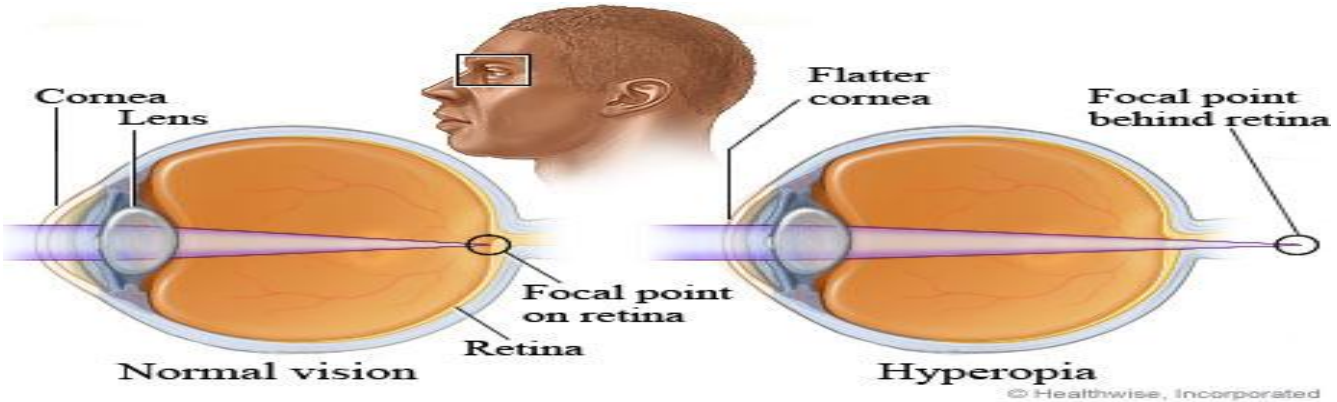
- **Characteristic :** small eyeball → focus behind retina

- **Symptoms :** headache + blurred vision (why?)

  Answer/ continuous accommodation → **muscular effort**

  - prolonged convergence by accommodation → **Squint** (حَوَل)

- correction by : biconvex lens



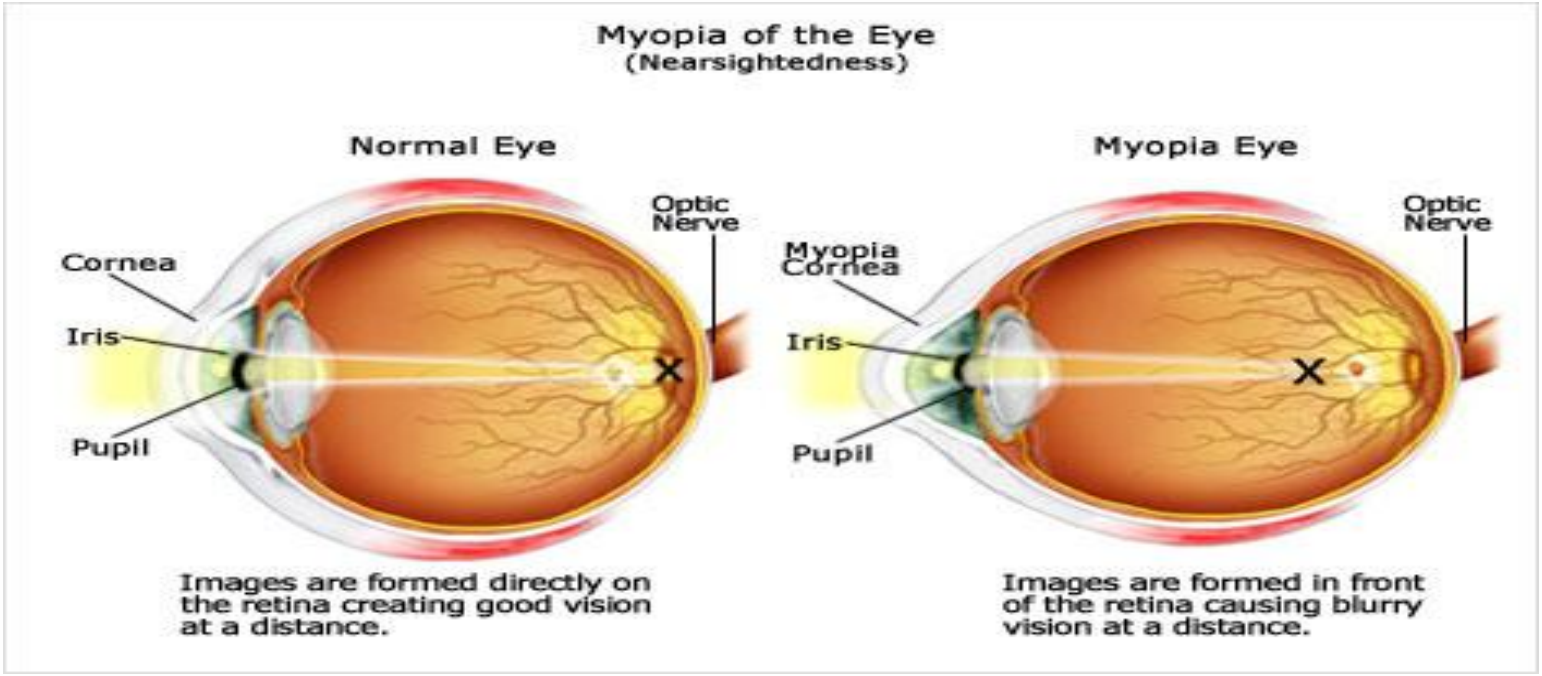
2-Myopia (nearsightedness)

Characteristic :

1. large eye ball (long anteroposterior diameter = increase in space between lens & retina) → focus in front of retina .

2. genetic or acquired (extensive close work as in studying)

correction by : biconcave lens

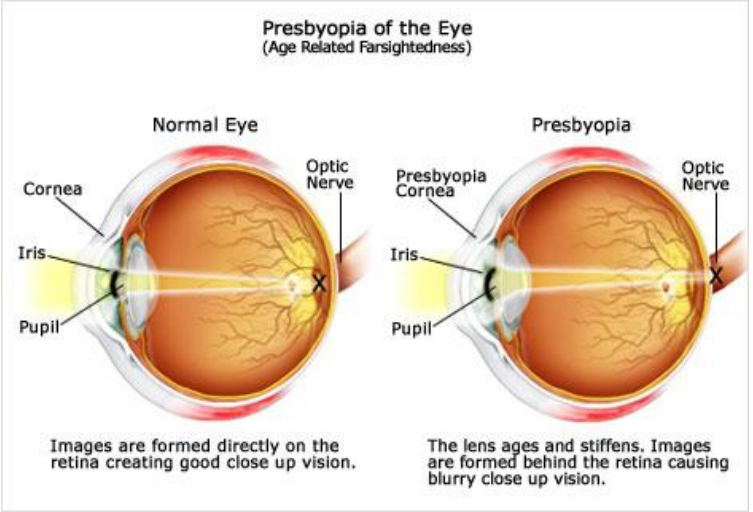


3-Presbyopia : (After 40 years old)

- eye near point receeds

- loss of accommodation → decrease in flexibility of lens → lens becomes solid

- correction by : biconvex lens



4-Astigmatism:(uneven & ununiform corneal curvature)

Blurred vision (why?)

Answer\rays are refracted to different focus (multiple foci)

correction by : cylindrical lens