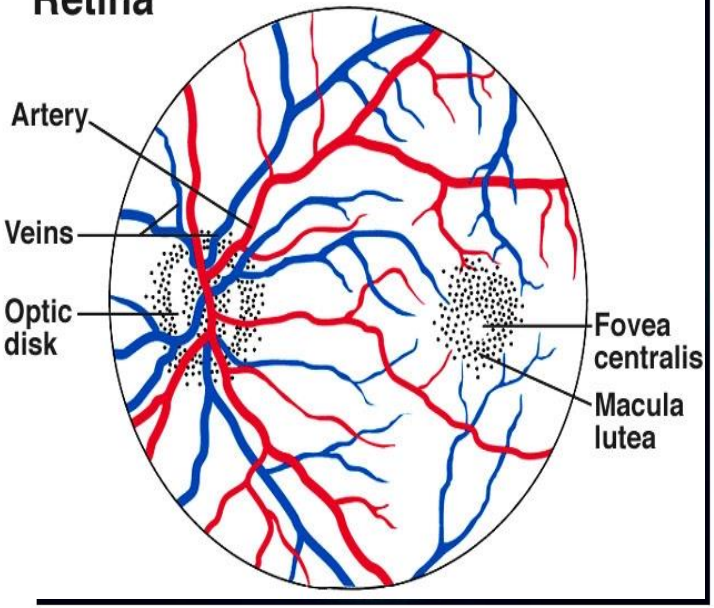
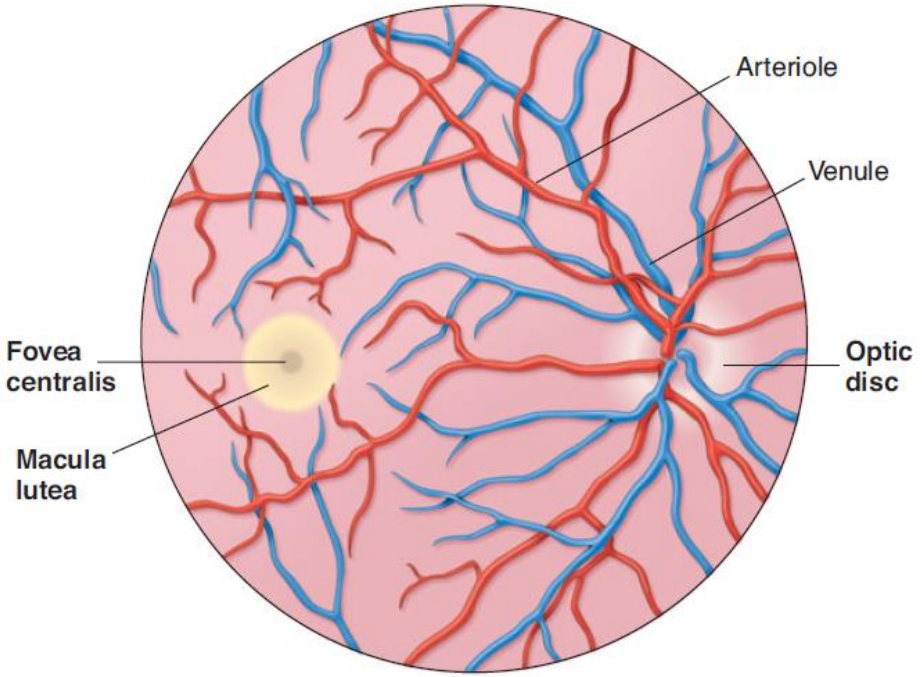
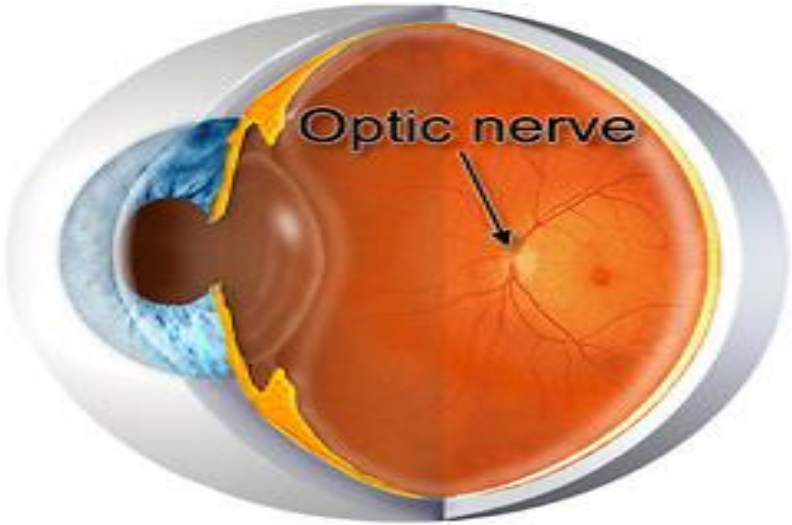
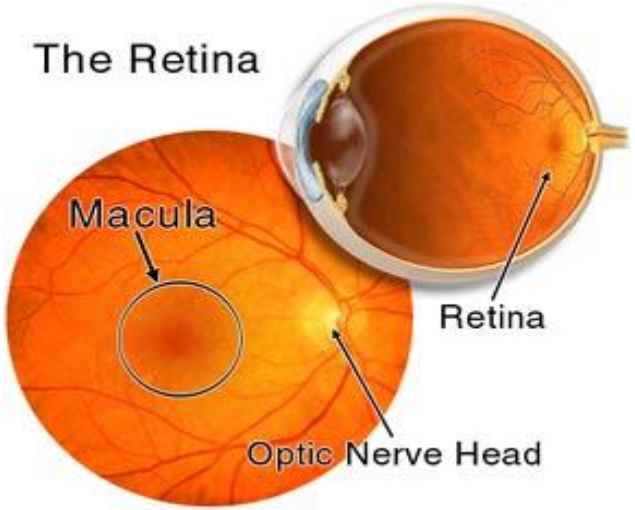


(a)



(b)





BINOCULAR VISION for :-

1- Large visual field

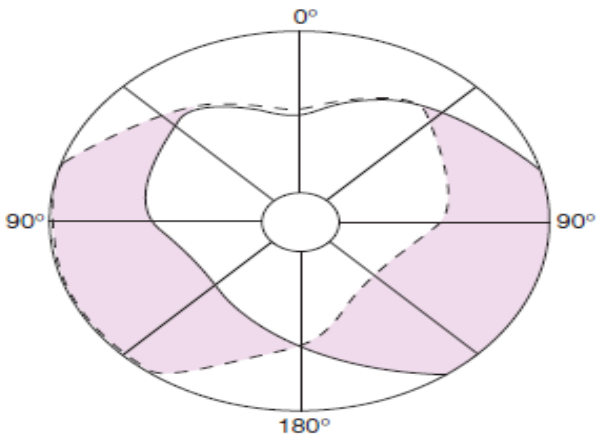
2- cancel the effect of blind spot

3- stereoscopic vision

4- one eye lesion does not affect vision

Monocular and binocular visual fields.
-The dashed line encloses the visual field of the left eye;

- **the solid line, that of the right eye. -The common area (heart-shaped in the center) is viewed with binocular vision.**
- **- The colored areas are viewed with monocular vision.**



Priciples of optics:-

--Biconvex lens(converge) & biconcave lens(diverge)

-Diopter (measure of refractive power
R.P = 1meter / Principal focal distance in meters(The distance beyond a convex lens at which parallel rays converge to a common focal point)

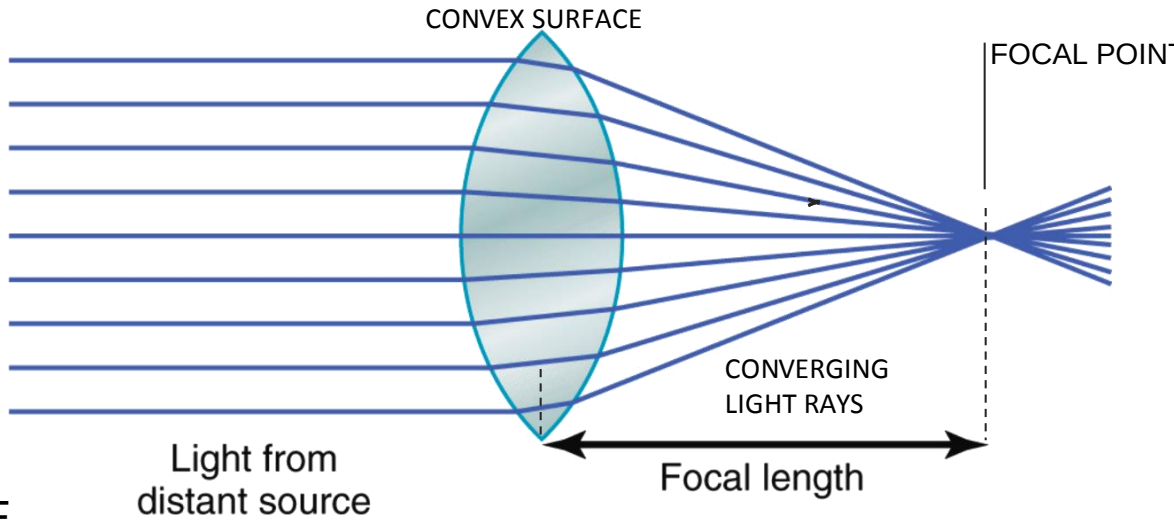
Exp/if Principal focal distance of a lens is 25cm, so its R.P=1/ 0.25 meter = 4D

-

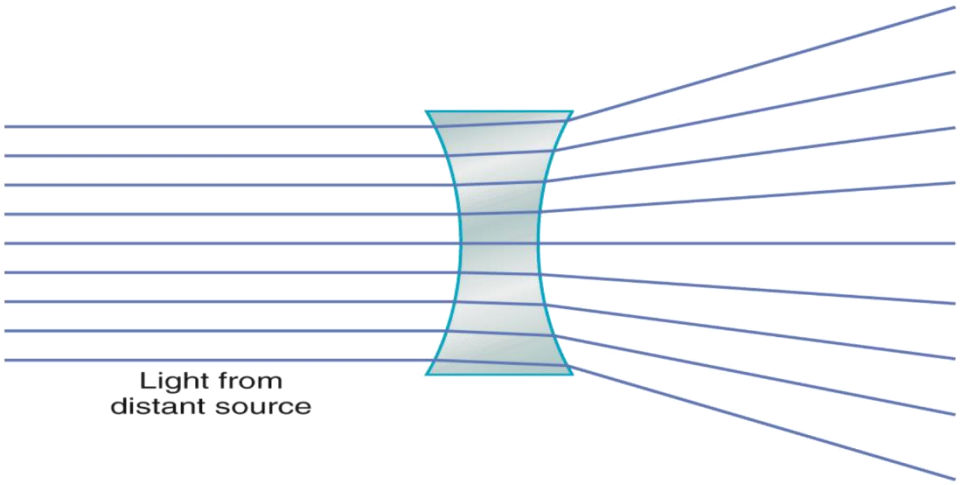
--The greater the curvature of the lens, the greater the refractive power of the eye

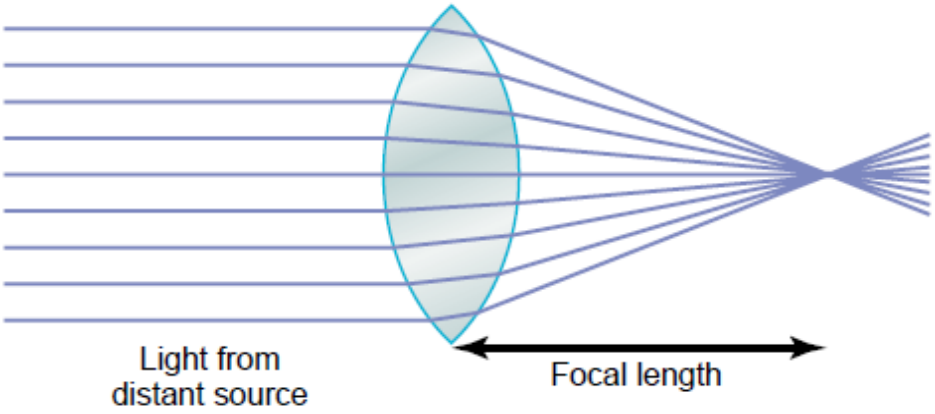
Emmetropic eye;-normal eye has image on retina, has diopteric power 59-60D

•

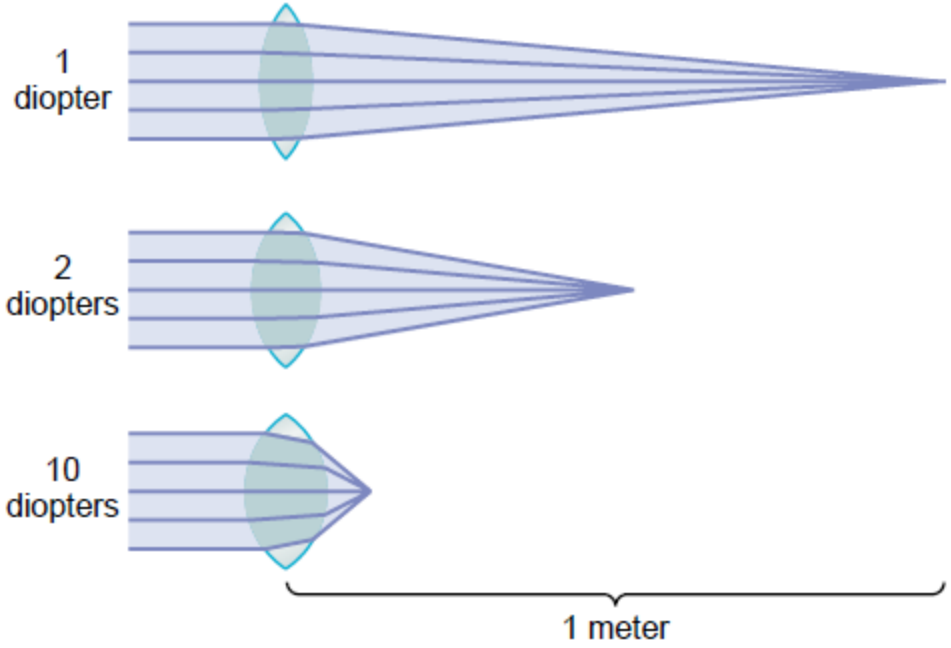


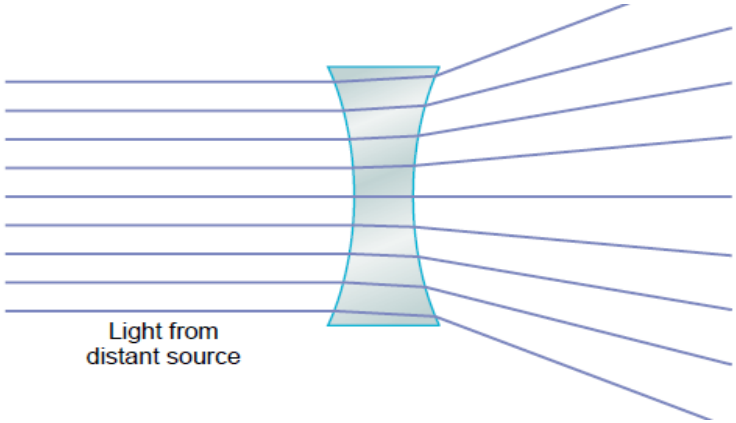
IF THE LENS HAS EXACTLY THE PROPER CURVATURE, PARALLEL LIGHT RAYS PASSING THROUGH EACH PART OF THE LENS WILL BE BENT EXACTLY ENOUGH SO THAT ALL THE RAYS WILL PASS THROUGH A SINGLE POINT, WHICH IS CALLED THE FOCAL POINT





Concave lenses "neutralize" the refractive power of convex lenses. Thus, placing a 1-diopter concave lens immediately in front of a 1-diopter convex lens results in a lens system with zero refractive power





DIOPTERS AND CONCAVE LENSES

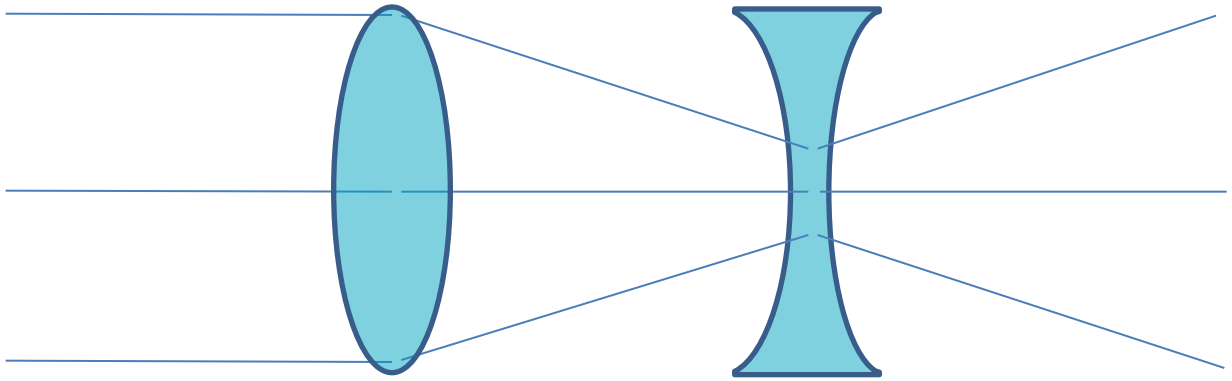
CONCAVE LENSES "NEUTRALIZE" THE REFRACTIVE POWER OF CONVEX LENSES.

THUS, PLACING A 1-DIOPTER CONCAVE LENS IMMEDIATELY IN FRONT OF A 1-DIOPTER CONVEX LENS RESULTS IN A LENS SYSTEM WITH ZERO REFRACTIVE POWER.

THE REFRACTIVE POWER OF CONCAVE LENSES CANNOT BE STATED IN TERMS OF THE FOCAL DISTANCE BEYOND THE LENS BECAUSE THE LIGHT RAYS DIVERGE RATHER THAN FOCUS TO A POINT.

DIOPTERS FOR A CONCAVE LENS ARE MEASURED BY HOW MUCH IT NEUTRALISES THE REFRACTIVE POWER OF A CONVEX LENS

FOR EXAMPLE WHERE A CONCAVE LENS DIVERGES LIGHT RAYS AT THE SAME RATE THAT A 1-DIOPTER CONVEX LENS CONVERGES THEM, THE CONCAVE LENS IS SAID TO HAVE A DIOPTRIC STRENGTH OF −1.



FOCAL LENGTH OF A LENS

THERE IS A DIFFERENCE IN FOCAL LENGTH BETWEEN THESE TWO LENSES – DUE TO THE CURVATURE OF THE LENS

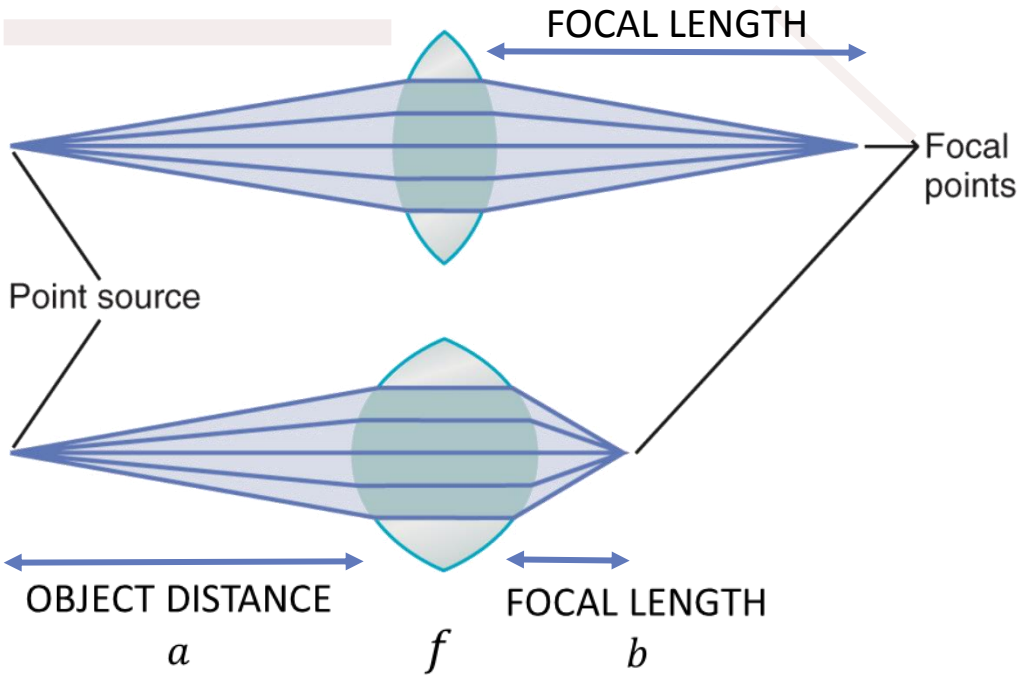
THE FOCAL LENGTH OF THE LENS IS EXPRESSED IN THE FOLLOWING FORMULA:

f is the focal length of the lens for parallel rays,

a is the distance from the point source of light to the lens

b is the focal length on the other side of the lens.

$$\frac{1}{f} = \frac{1}{a} + \frac{1}{b}$$

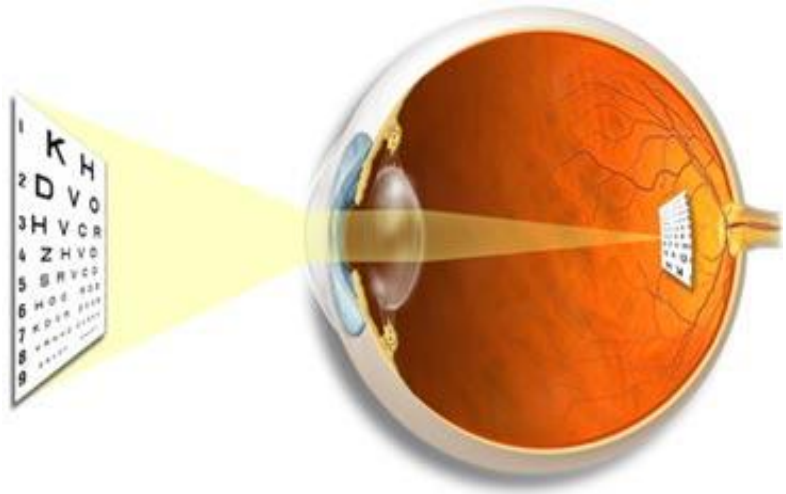


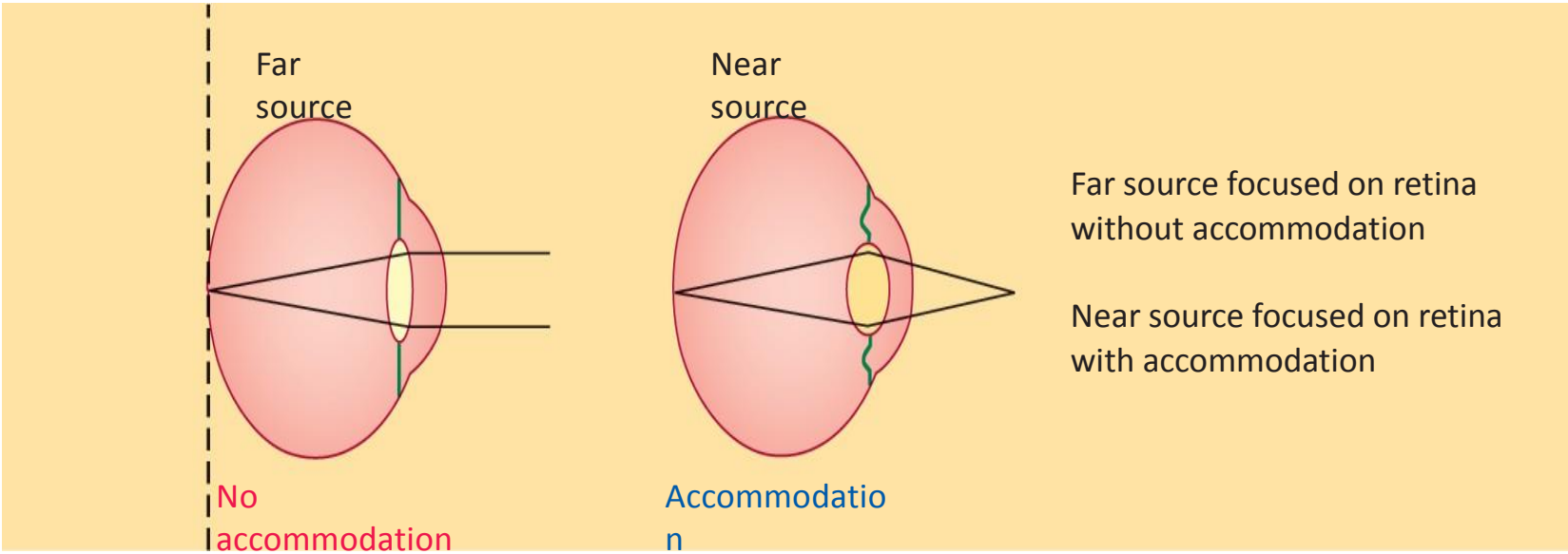
$$\frac{1}{f} = \frac{1}{a} + \frac{1}{b}$$

Emmetropic eye

can see all distant objects clearly with its ciliary muscle relaxed & see close objects clearly with ciliary muscles contracted

Normal eye = Emmetropia





Errors of refraction:-

1-Hypermetropia (hyperopia = farsightedness)

(small eyeball, focus behind retina,

Headache & blurred vision

-continuous accomodation to bring image on retina>>>>>>muscular effort>>>>>cause headache, prolonged covergence by accomodation->>>>squint

correction by biconvex lens

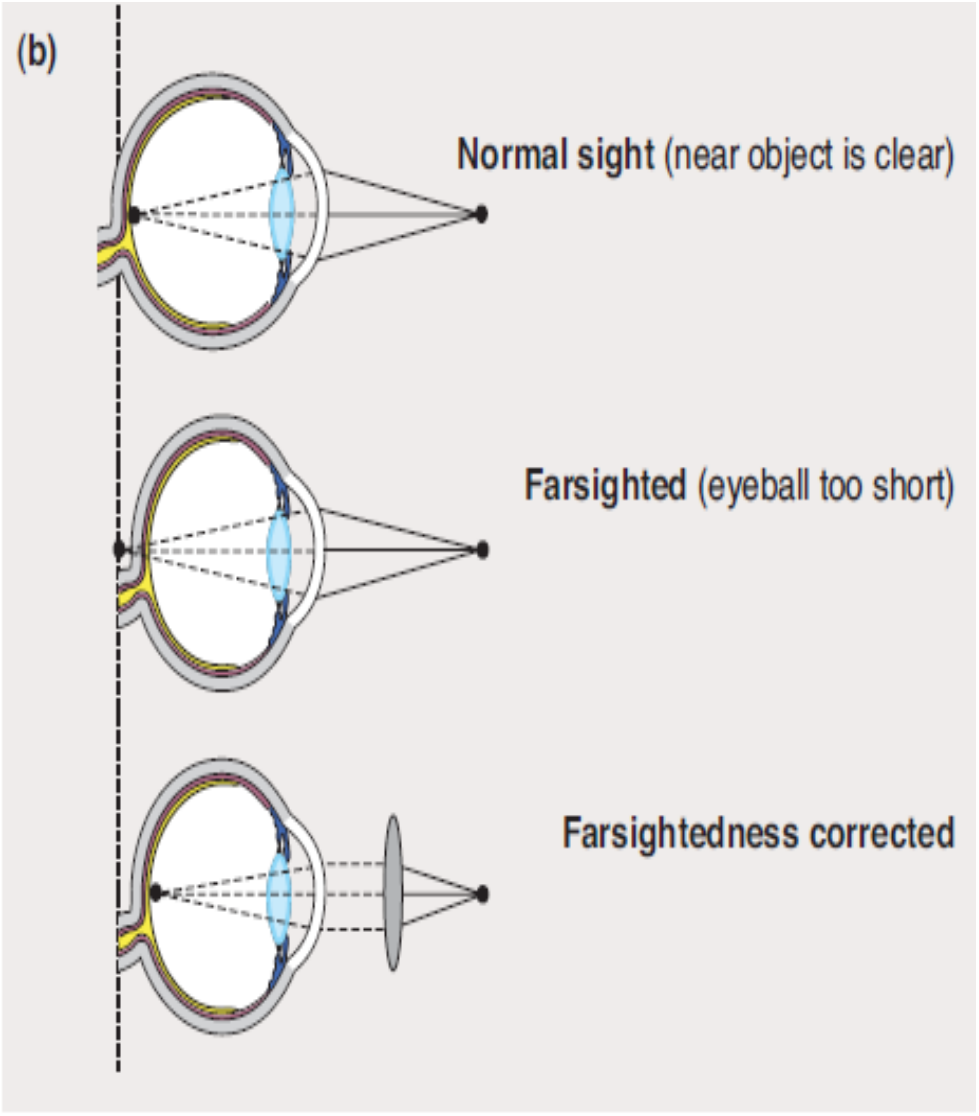
2-Myopia(nearsightedness)

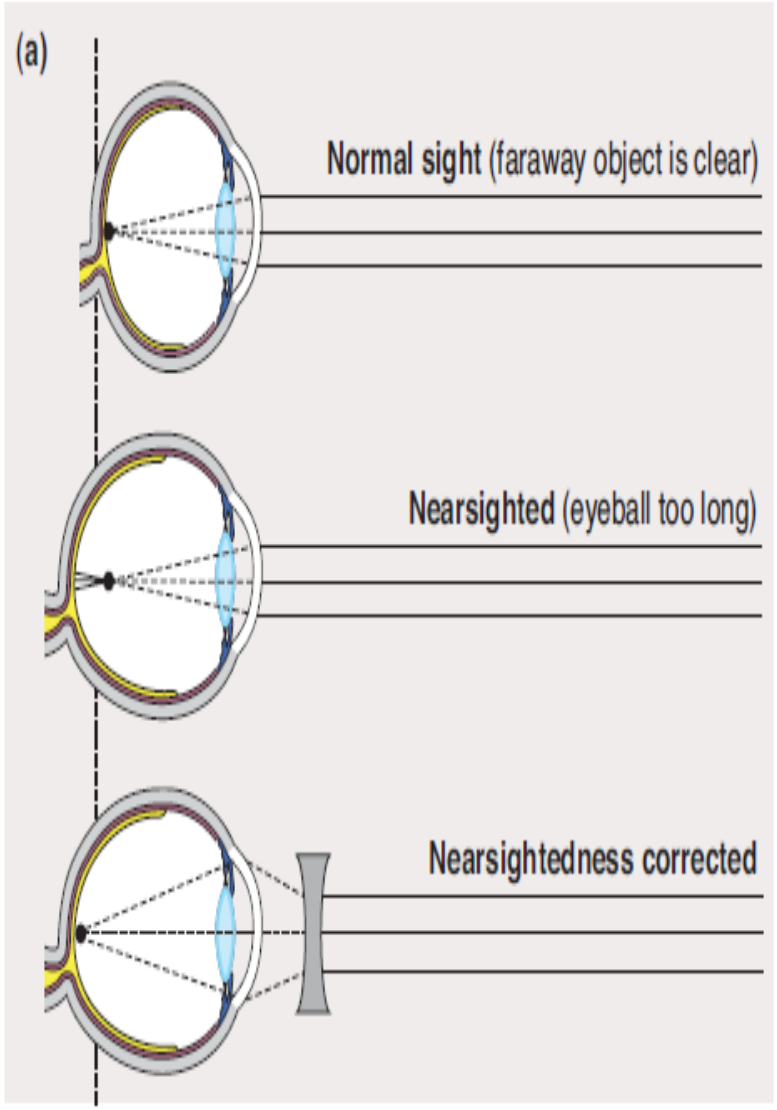
(genetic, large eye ball, long antero-posterior diameter, or extensive close work as in studying>>>>cause focus in front of retina

-- correction by biconcave lens (to diverge rays before strike lens)

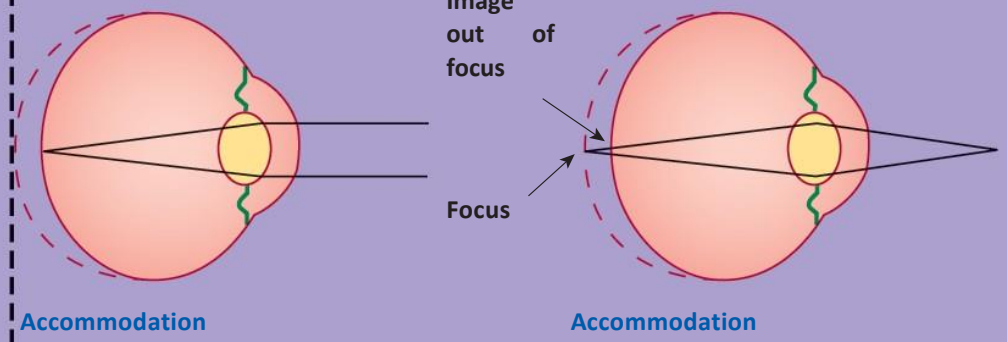
Or due to weak lens system

it can result from too much refractive power in the lens system of the eye or a corneal surface that is too curved


(b)
Normal sight (near object is clear)
Farsighted (eyeball too short)
Farsightedness corrected

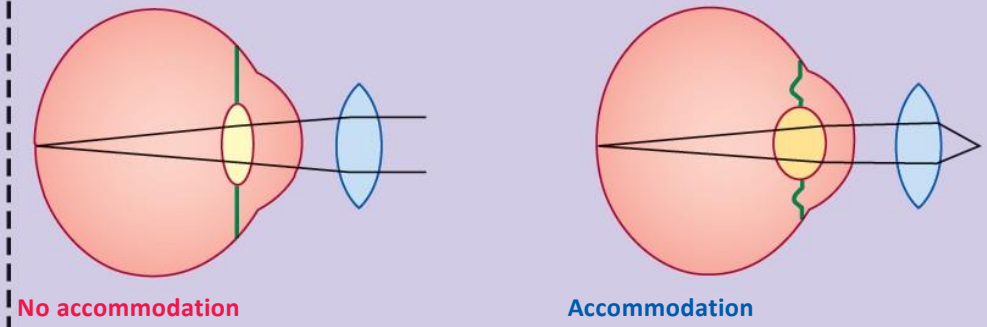

(a)
Normal sight (faraway object is clear)
Nearsighted (eyeball too long)
Nearsightedness corrected

(c) Farsightedness (Hyperopia)



Eyeball too short or lens too weak

1. **Uncorrected**

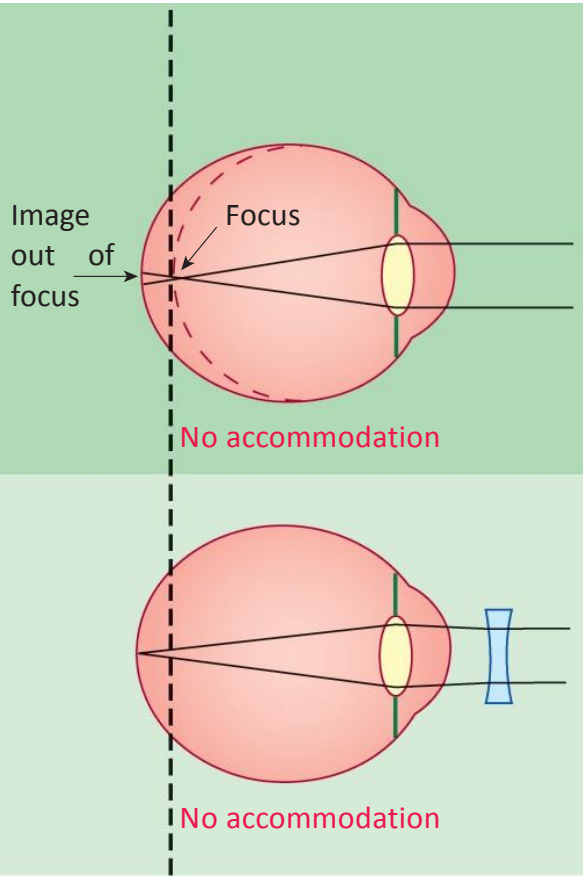


2. **Corrected with convex lens, which converges light rays before they reach the eye**

Far source focused on retina without accommodation

Near source focused on retina with accommodation

- Nearsightedness (Myopia)



Eyeball too long or lens too strong

1. Uncorrected

Far source focused in front of retina (where retina would be in eye of normal length)

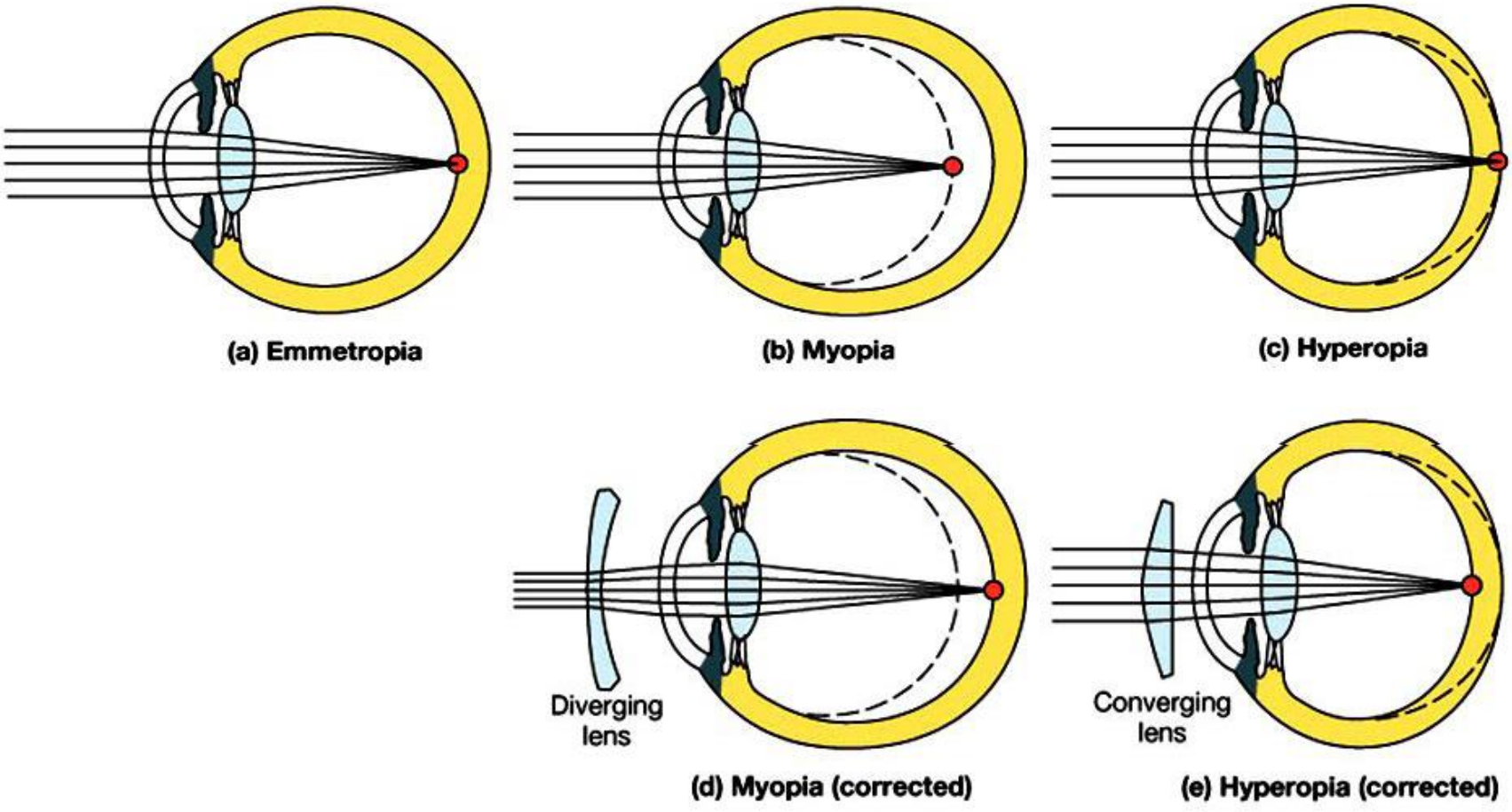
Near source focused on retina without accommodation

2. Corrected with concave lens, which diverges light rays before they reach the eye

Far source focused on retina without accommodation

Near source focused on retina with accommodation

- THE CONCAVE LENS BENDS THE IMAGE OUTWARDS SLIGHTLY – THEN THE EYE LENS CAN REFRACT THE IMAGE INWARDS TO FOCUS ON THE FOCAL POINT OF THE RETINA


(a) Emmetropia
(b) Myopia
(c) Hyperopia
Diverging lens
(d) Myopia (corrected)
Converging lens
(e) Hyperopia (corrected)

3-Presbyopia (eye near point receeds by age due to loss of accomodation

- correction by biconvex lens

4-Astigmatism (mainly uneven & ununiform corneal curvature and very little due to uneven lens curvature

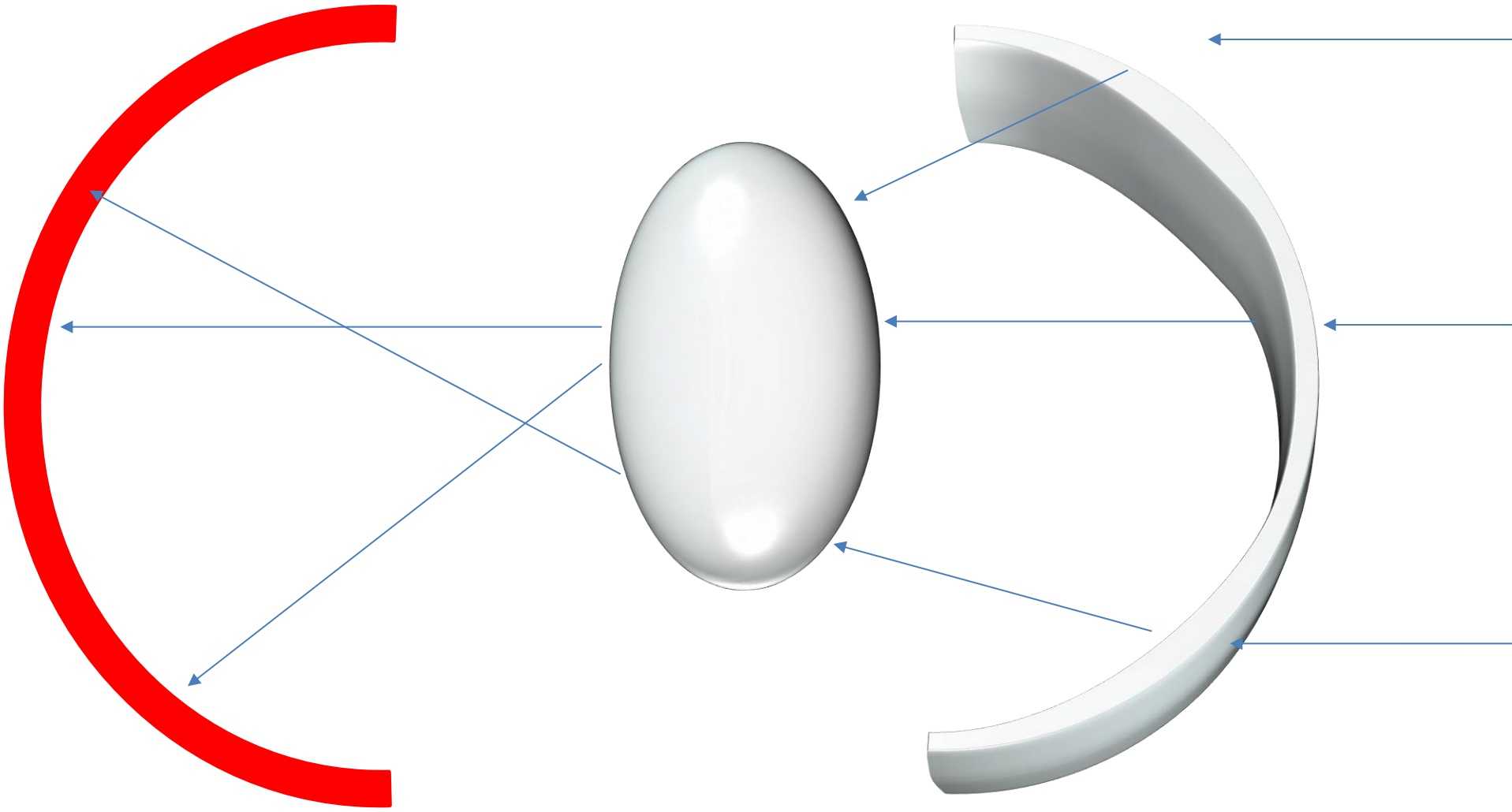
-rays refracted to different foci >>>>>>> blurred vision

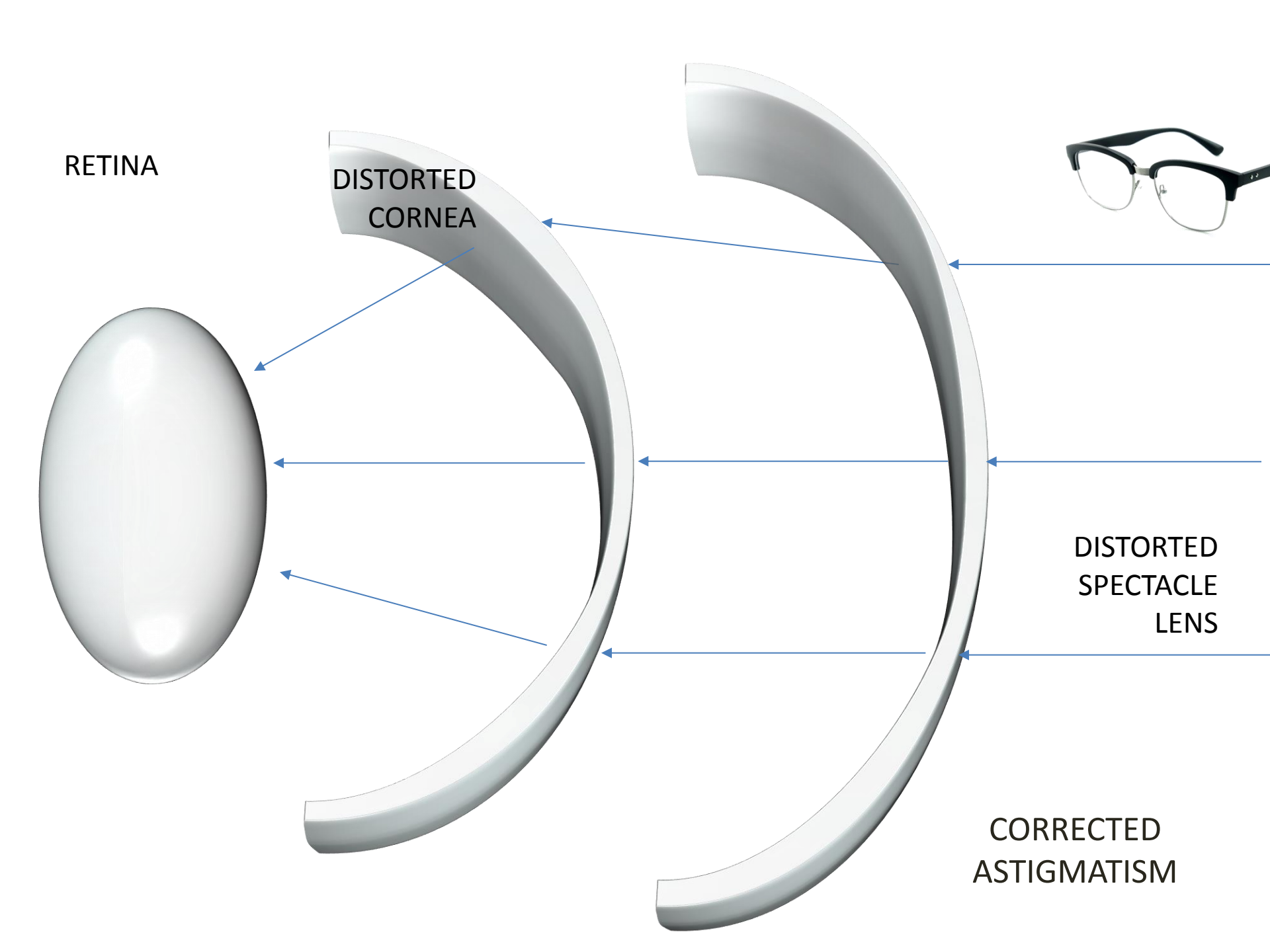
-correction by cylindrical lens which bends light rays in only one plane (a focal line)

ASTIGMATISM

DISTORTED CORNEA

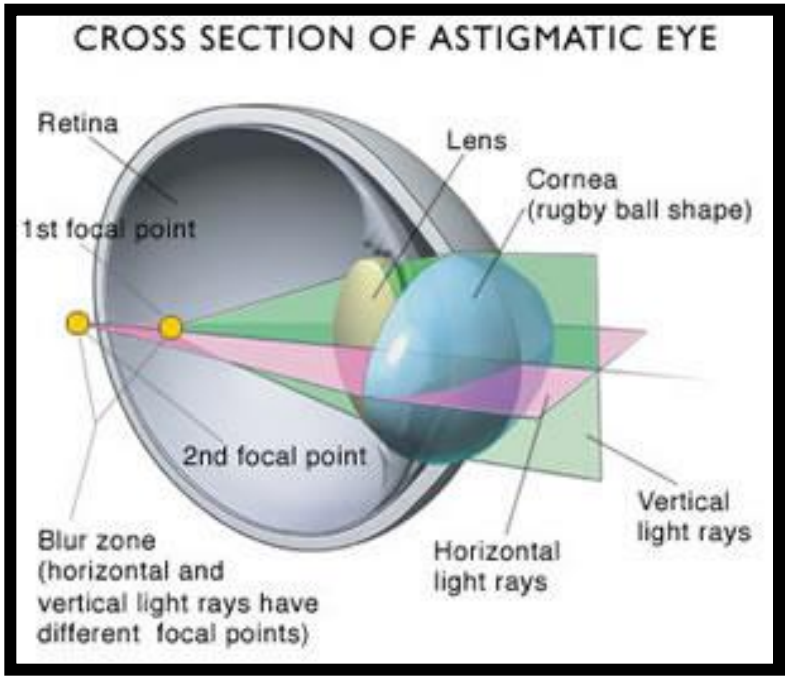
RETINA

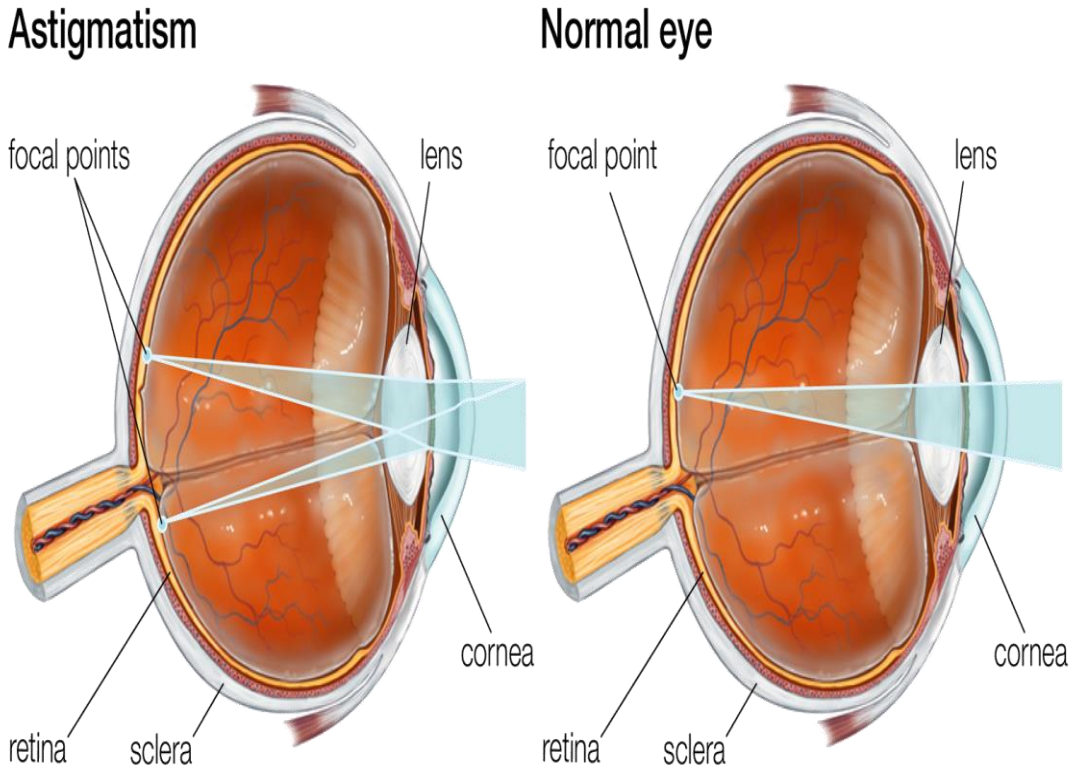


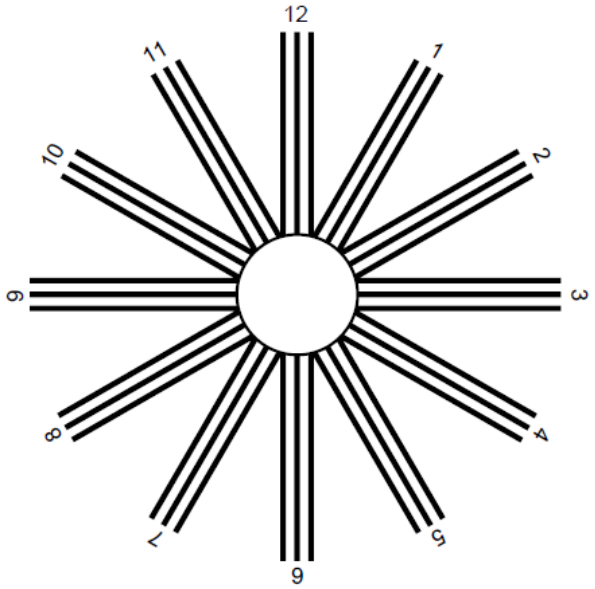

RETINA
DISTORTED CORNEA
DISTORTED SPECTACLE LENS
CORRECTED ASTIGMATISM

Astigmatism

light rays focus at one focal distance in more than one focal plane







- **LAYERS OF RETINA (10 layers), the most important are :-**

1-pigment cell layer (vit A) (outermost layer) .what is its value?

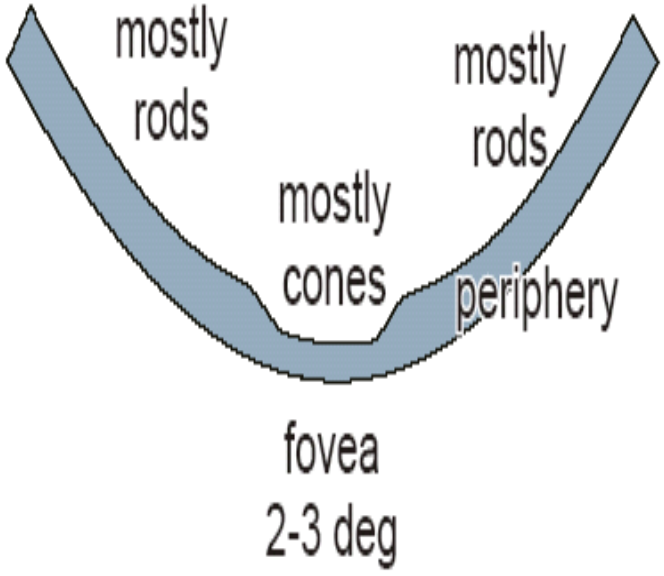
(absorb light & prevent its reflection back)

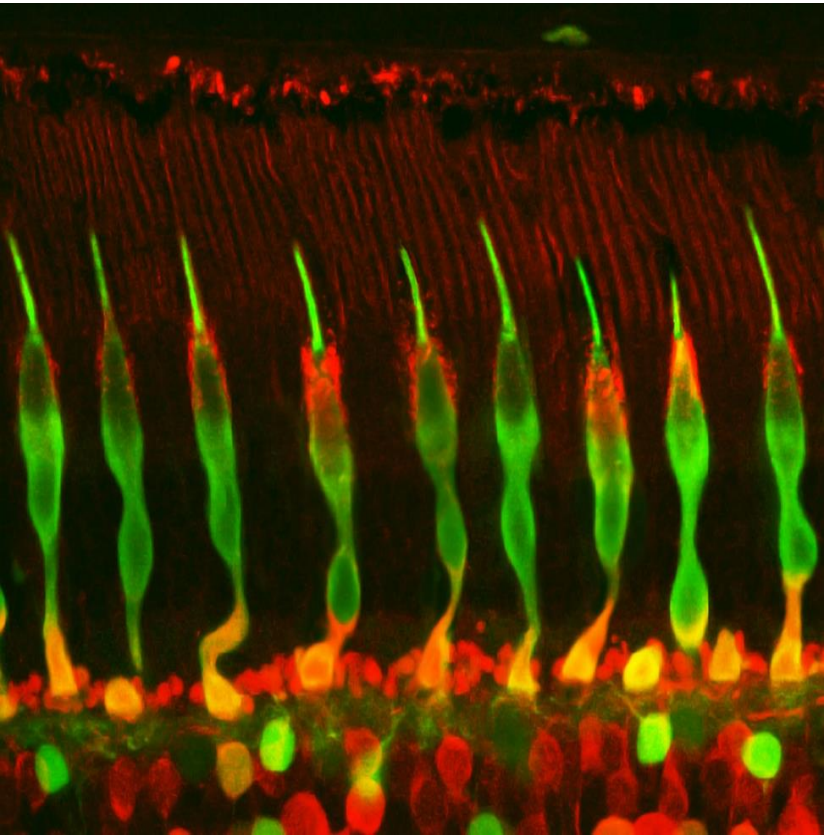
-The pigment layer also stores large quantities of *vitamin A*. This vitamin A is an important precursor of the photosensitive chemicals of the rods and cones.

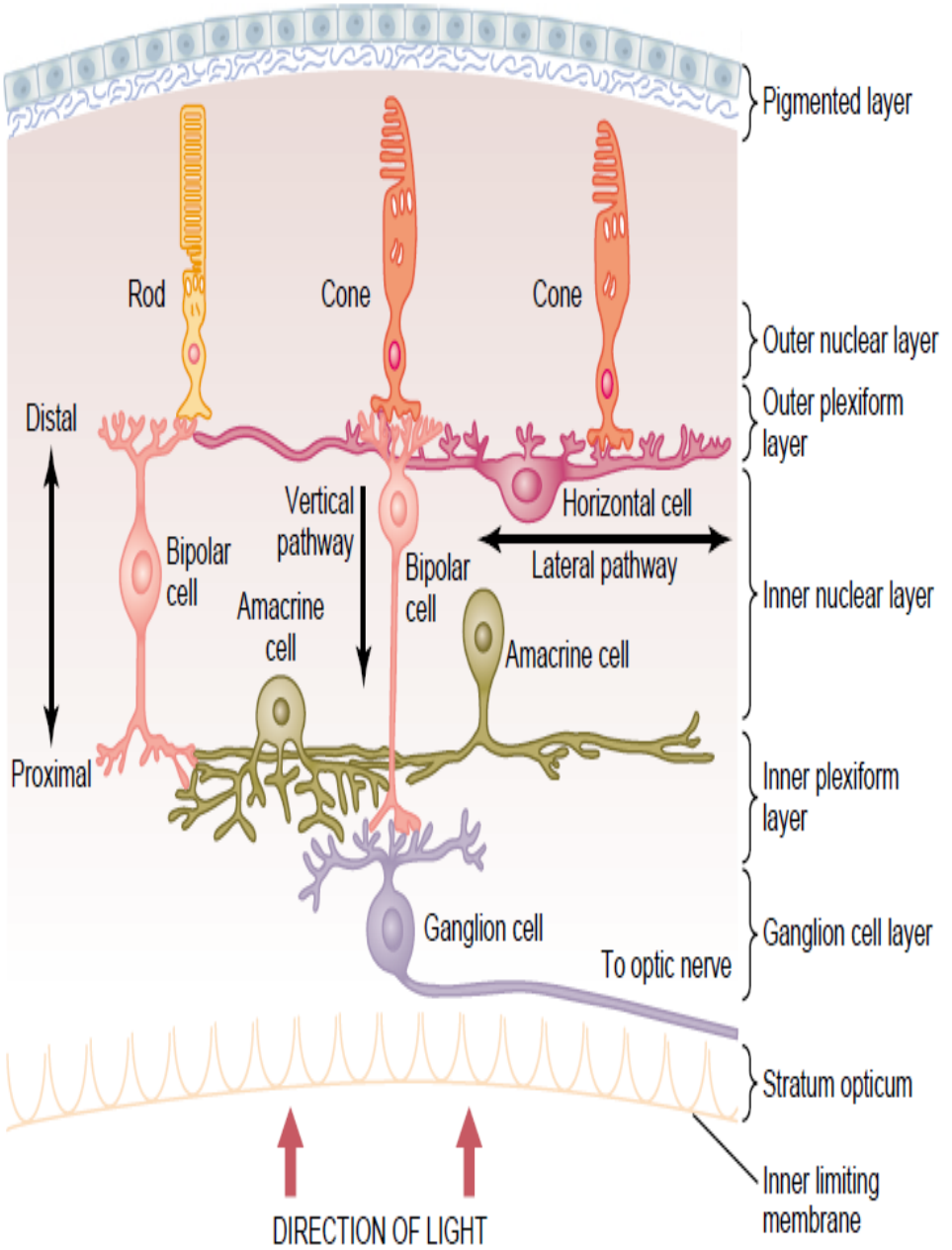
2- rodes & cones (their outer& inner segments), but not cell bodies(rodes 90-120 million & cones 4.5- 6 million) - describe their distribution.

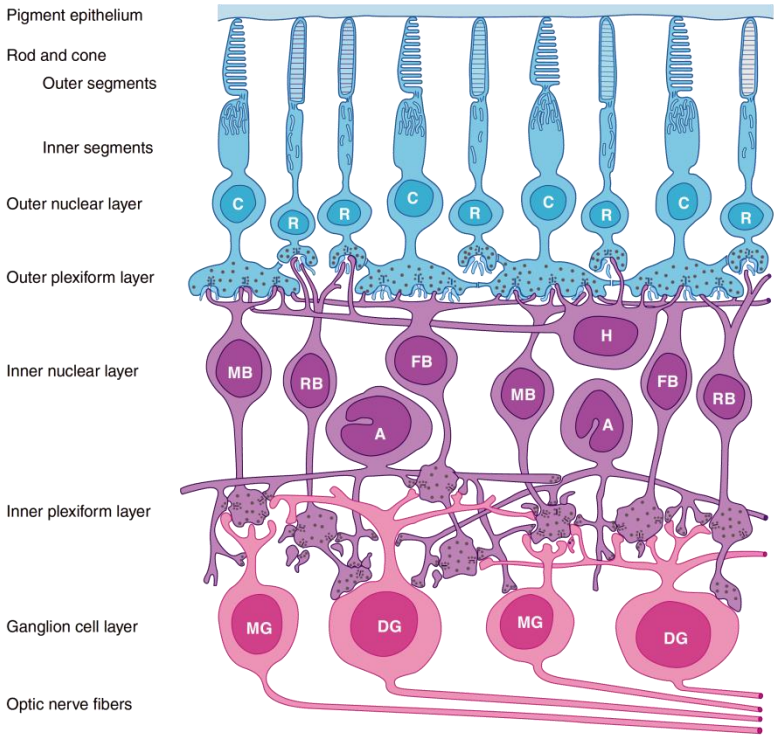
photoreceptor cells are responsible for capturing light and transforming this into generator potential to be used by the nervous system

)



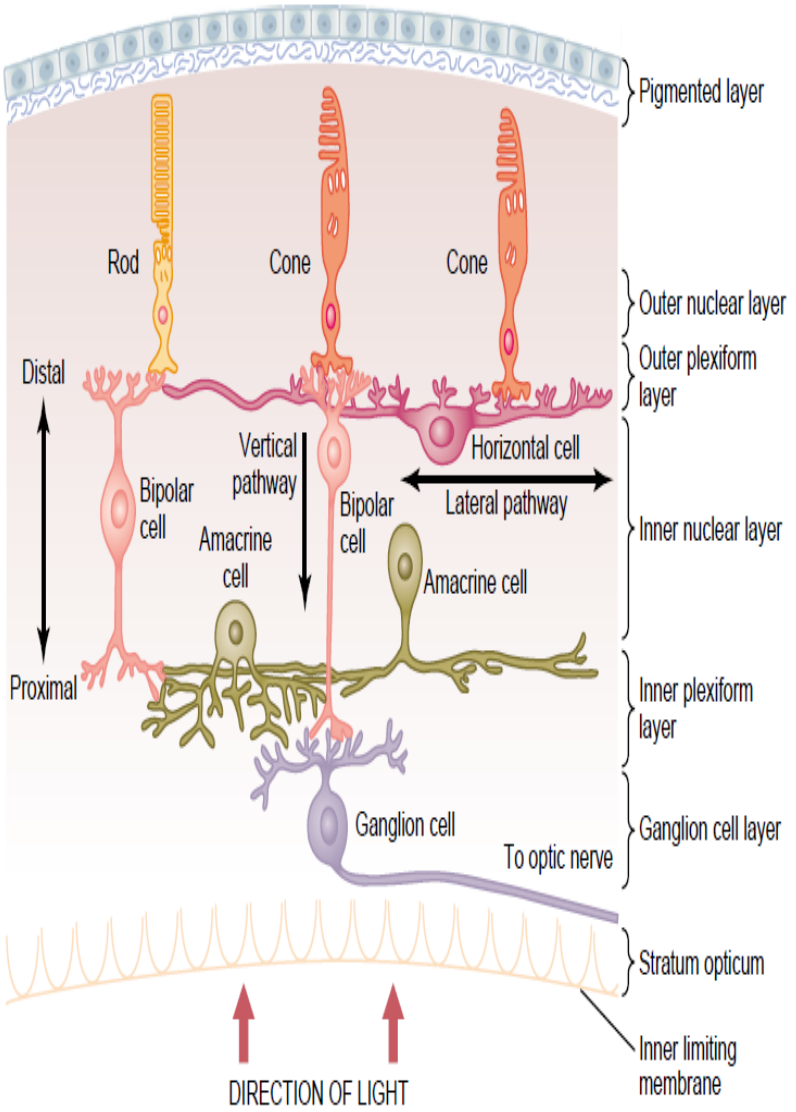



Pigmented layer
Rod
Cone
Cone
Outer nuclear layer
Outer plexiform layer
Distal
Horizontal cell
Vertical pathway
Bipolar cell
Lateral pathway
Amacrine cell
Bipolar cell
Amacrine cell
Inner nuclear layer
Proximal
Inner plexiform layer
Ganglion cell
To optic nerve
Ganglion cell layer
Stratum opticum
Inner limiting membrane
DIRECTION OF LIGHT



RETINAL CELLS

- THE CELL BODIES AND PROCESSES OF THESE NEURONS ARE STACKED IN ALTERNATING LAY
- **there are five basic classes of neurones in th**
  - **photoreceptors,**
  - **bipolar cells,**
  - **ganglion cells,**
  - **horizontal cells,**
  - **amacrine cells.**



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

4-outer plexiform layer mainly of Horizontal cells.

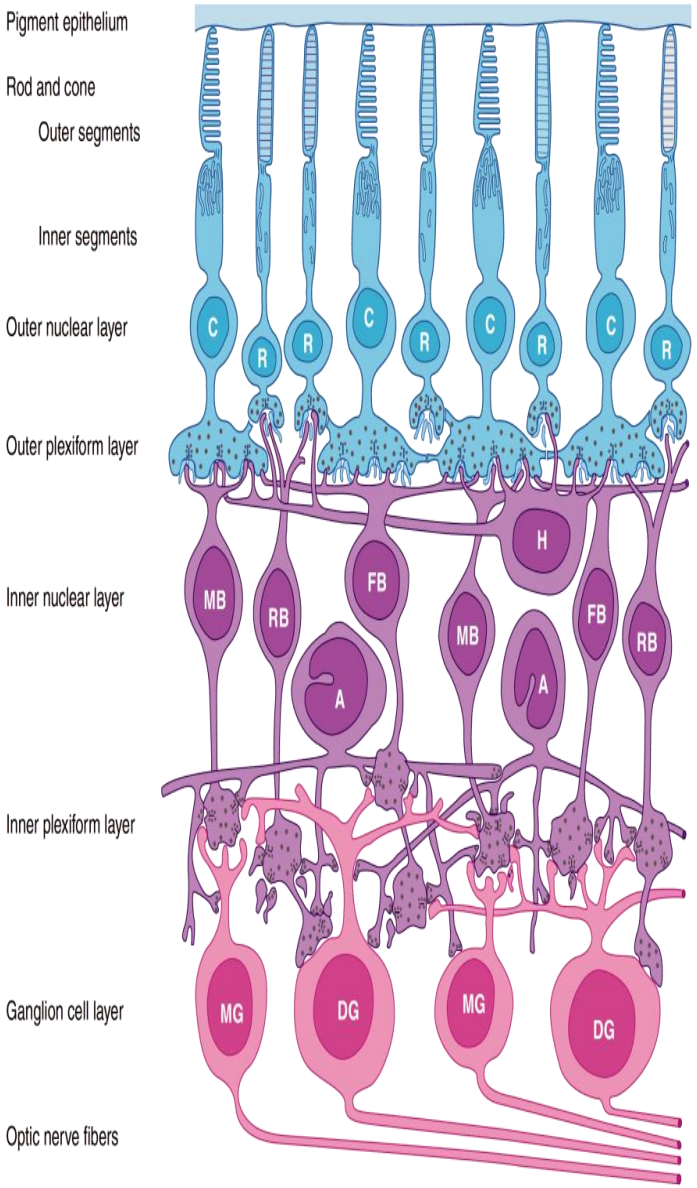
5-Inner nuclear layer (bipolar cells)

6-inner plexiform layer.(amacrine cells) the inner plexiform layer is interposed between the inner nuclear and ganglion cell layers.)

7-Ganglion cell layer

8-Optic nerve fibers (1.2 million fibers)

-# Horizontal cells (outer plexiform layer)
(Make synaptic connections with receptors
Amacrine cells (inner plexiform layer)
(make synaptic connections with ganglion cells)



Müller cells are the major glial element of the retina.

-located in the inner nuclear layer

-form architectural support structure

providing metabolic support to retina

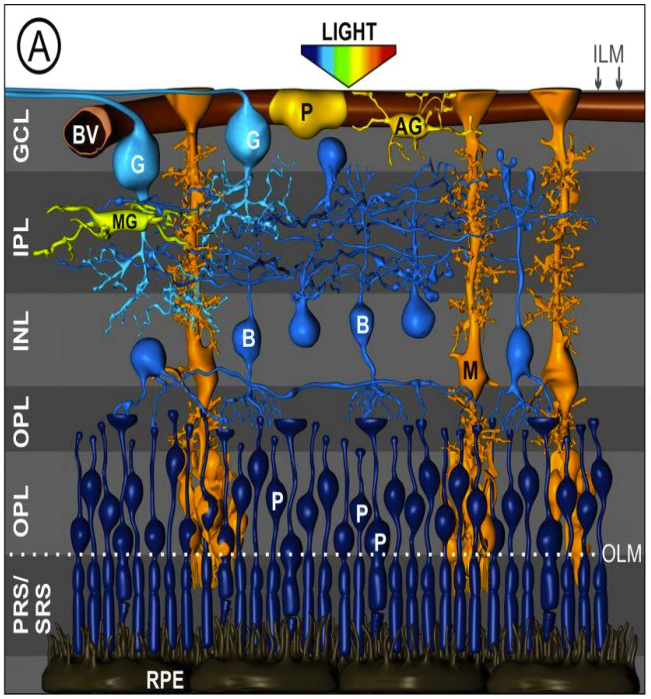
-maintaining synaptic levels of neurotransmitters.

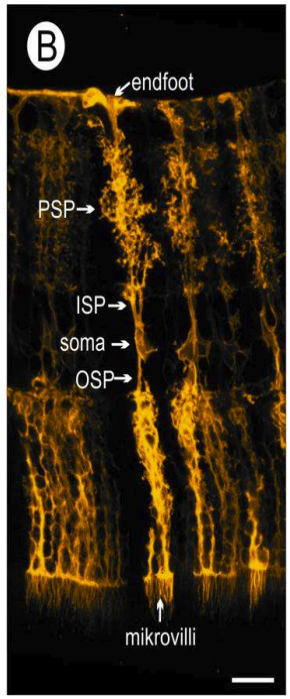
-they can be -

differentiate into a neural progenitor following injury to the retina,

-act as light conductor which funnels light to the rods and cone CELLS.

MÜLLER CELLS ARE SHOWN IN ORANGE





http://www-huge.uni-regensburg.de/Forschung/AG_Grosche/group_Grosche_projects.shtml

Light pathway in the eye:

<u>After light passes through the lens</u> system of the eye and then through the vitreous humor, it *enters the retina from the inside of the eye*

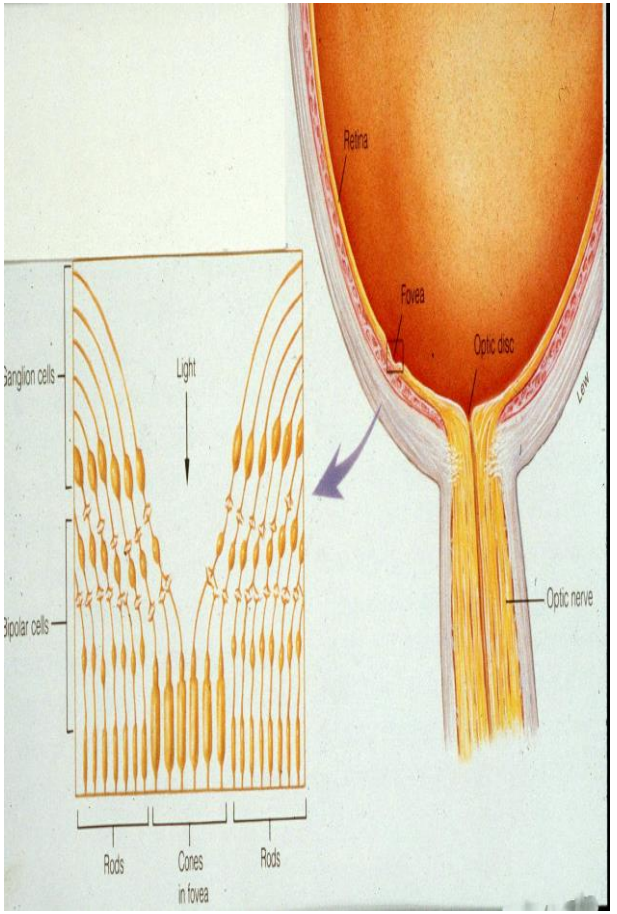
-it passes first through the ganglion cells and then through the plexiform and nuclear layers before it finally reaches the layer of rods and cones located all the way on the outer edge of the retina

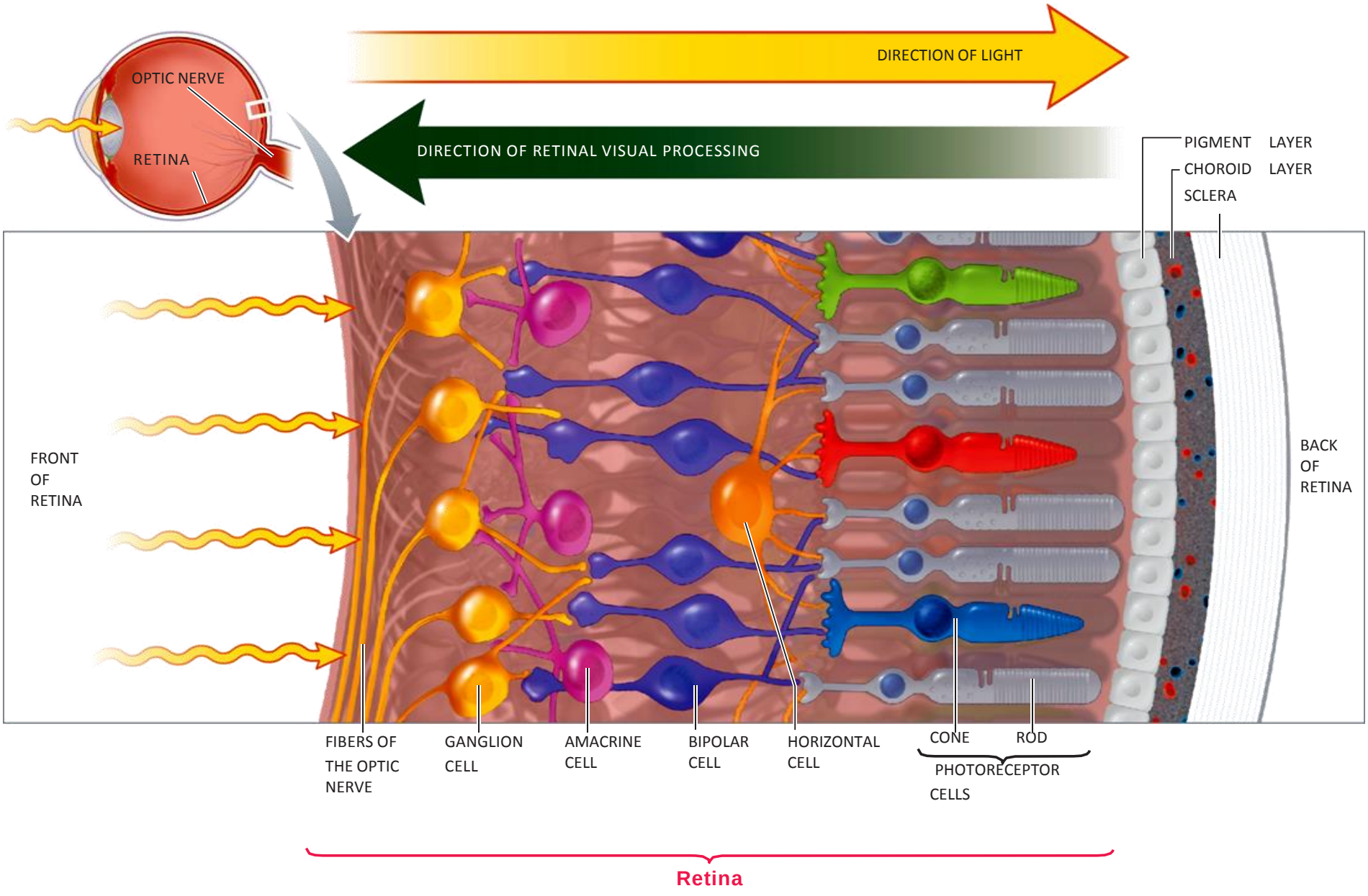
--Light absorbed by pigment cell layer that contain melanin pigment
- impulses pass from rodes & cones to rest of layers finally to ganglion cell layer ------- to optic nerve

.

The visual acuity is decreased by this passage through such non- homogeneous tissue.

-However, in the *central foveal region of the retina,* the inside layers are pulled aside to decrease this loss of acuity.This allows light to pass unimpeded to the cones.




OPTIC NERVE
RETINA
DIRECTION OF LIGHT
DIRECTION OF RETINAL VISUAL PROCESSING
PIGMENT LAYER
CHOROID LAYER
SCLERA
FRONT OF RETINA
BACK OF RETINA
FIBERS OF THE OPTIC NERVE
GANGLION CELL
AMACRINE CELL
BIPOLAR CELL
HORIZONTAL CELL
CONE
ROD
PHOTORECEPTOR CELLS
Retina

Thank you for listening