

# **SPECIAL SENSES**

## **Eye & Vision**



**Reading: Chapter 10**

# What are the 5 Special Senses?

## INTRODUCTION

**nose (olfaction/smell)**

**ears (hearing & equilibrium)**

**eyes (vision)**

**tongue (taste)**

**skin (touch)**

# The Eye & Vision

**1) External Structures:** eyebrows, eyelids, eyelashes

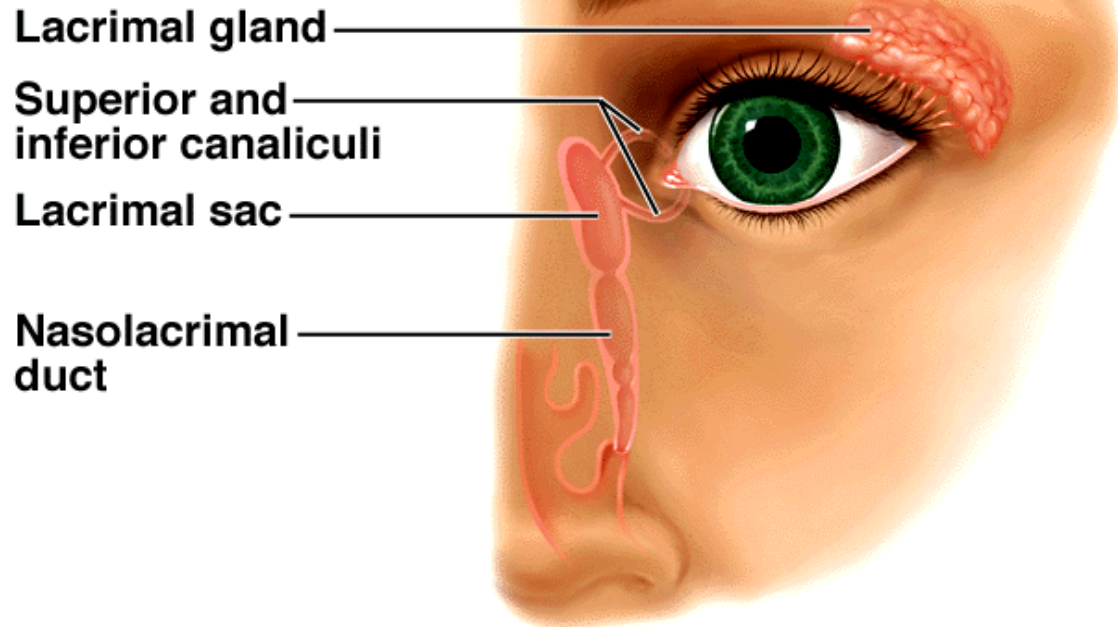
**a) conjunctiva** -lines eyelid & covers white of the eye  
-protects and decreases friction

**Conjunctivitis: many different causative agents**

- pinkeye = acute & contagious
- bacterial
- viral
- foreign bodies
- allergens

- b) lacrimal glands** -superior and lateral to eye
- produce tears
  - why are tears important?*
  - tears wash over the eye
  - drain into nasolacrimal duct

## Lacrimal Apparatus



**c) Extrinsic eye muscles** - 6 that control eye movements (Table 10.2)

Superior Rectus - CIII → look up & in

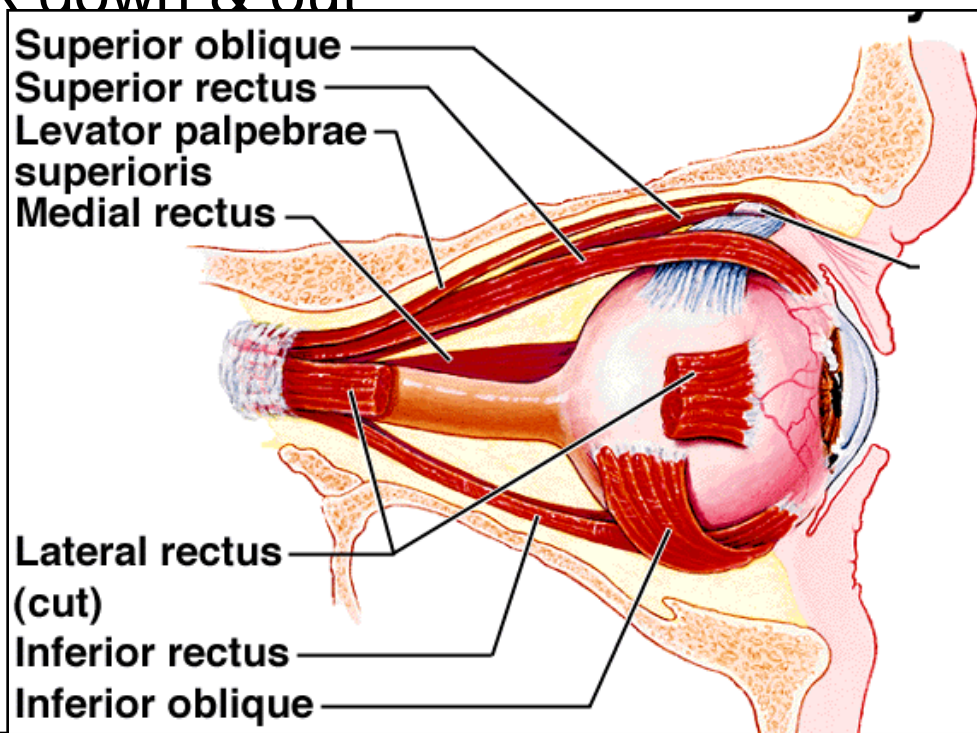
Inferior Rectus – CIII → look down & in

Medial Rectus – CIII → look toward midline

Lateral Rectus – CVI → look away from midline (*another word?*)

Superior Oblique – CIV → look down & out

Inferior Oblique – CIII → look



*Strabismus* = -“lazy eye”

-b/c muscles are not properly aligned or  
of unequal strength

-confusing messages sent to brain

-eye will shut down → amblyopia

-need to correct before age 5-7 to prevent

blindness

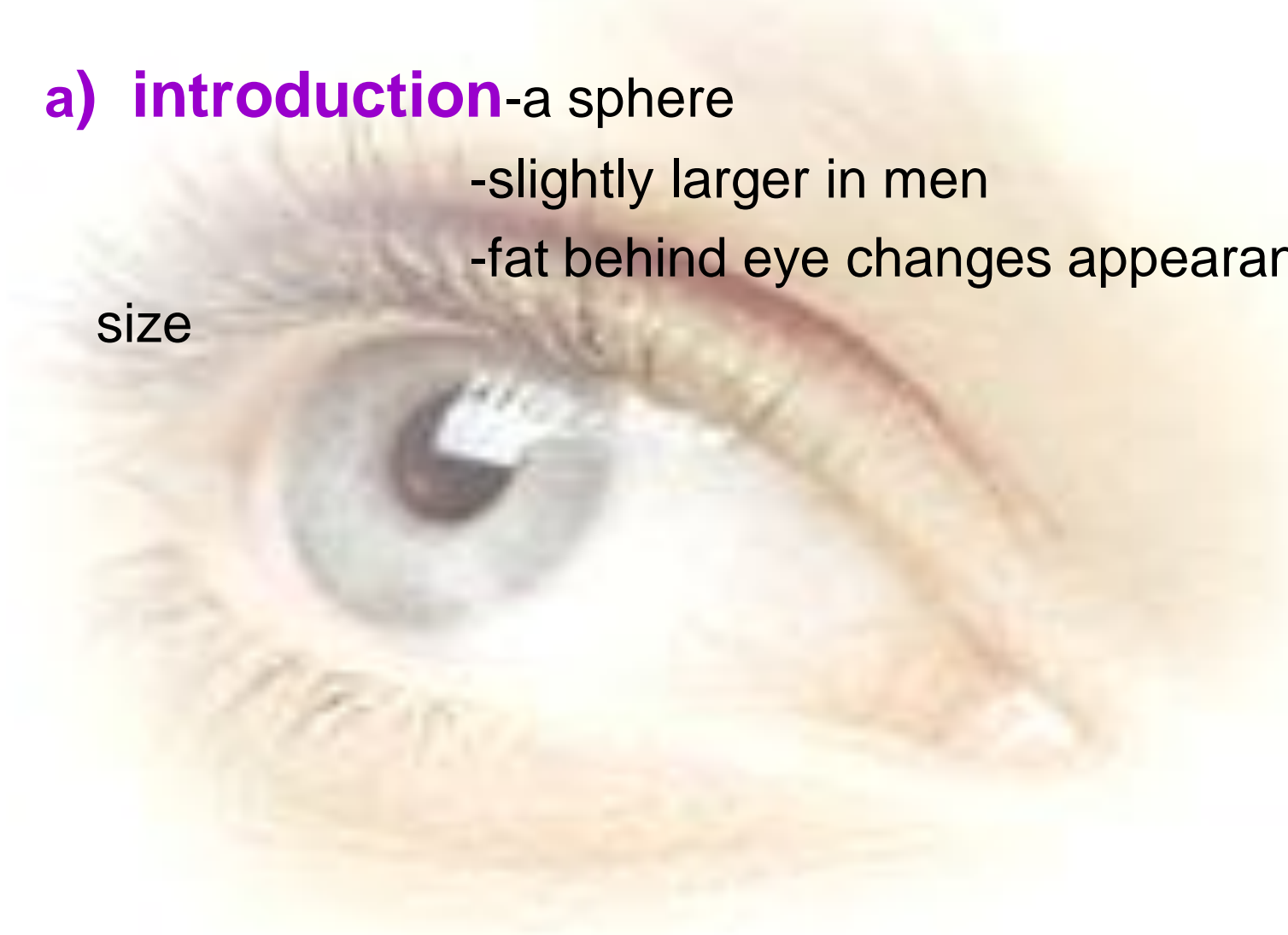


## 2) Internal Eye Structures

### a) introduction-a sphere

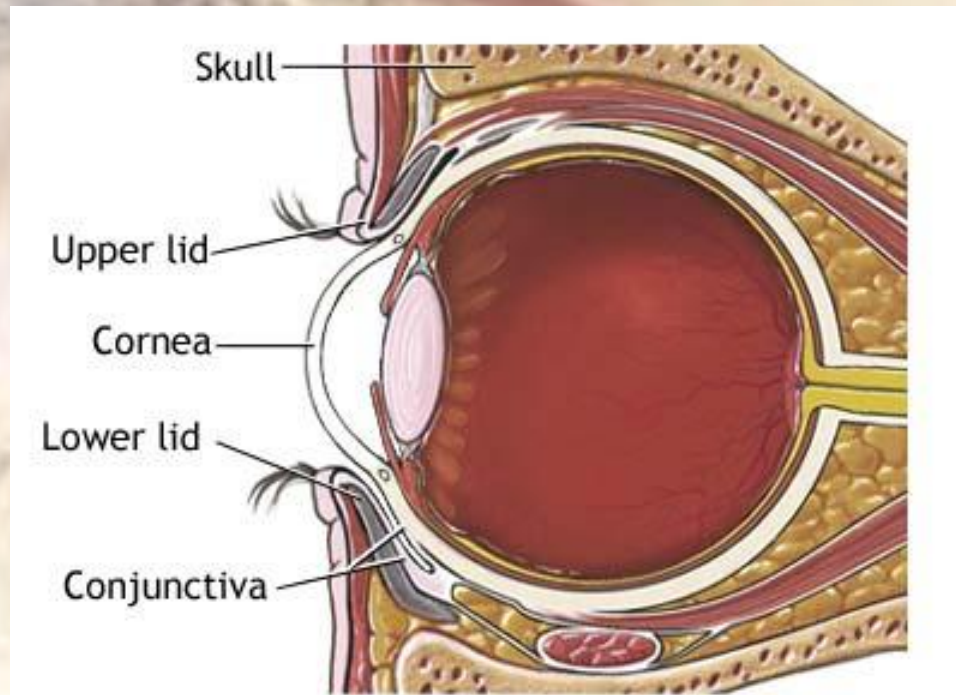
-slightly larger in men

-fat behind eye changes appearance of size



## 2) Internal Eye Structures

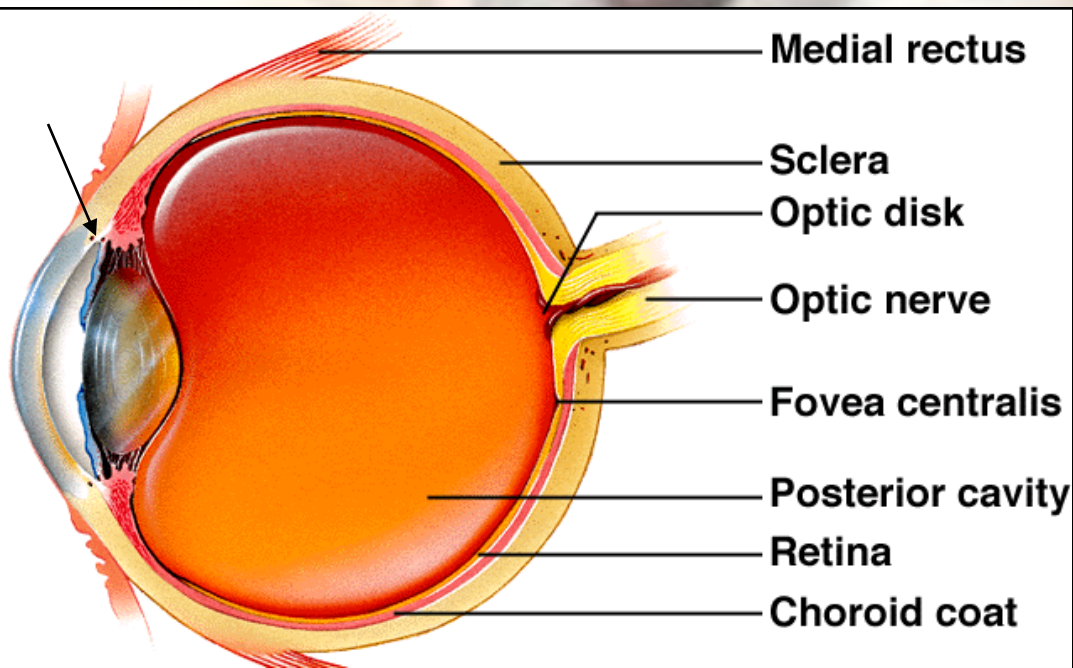
- b) Outer layer = protective layer
- c) Middle layer = vascular layer = uvea
- d) Inner layer = photoreceptors



## 2) Internal Eye Structures

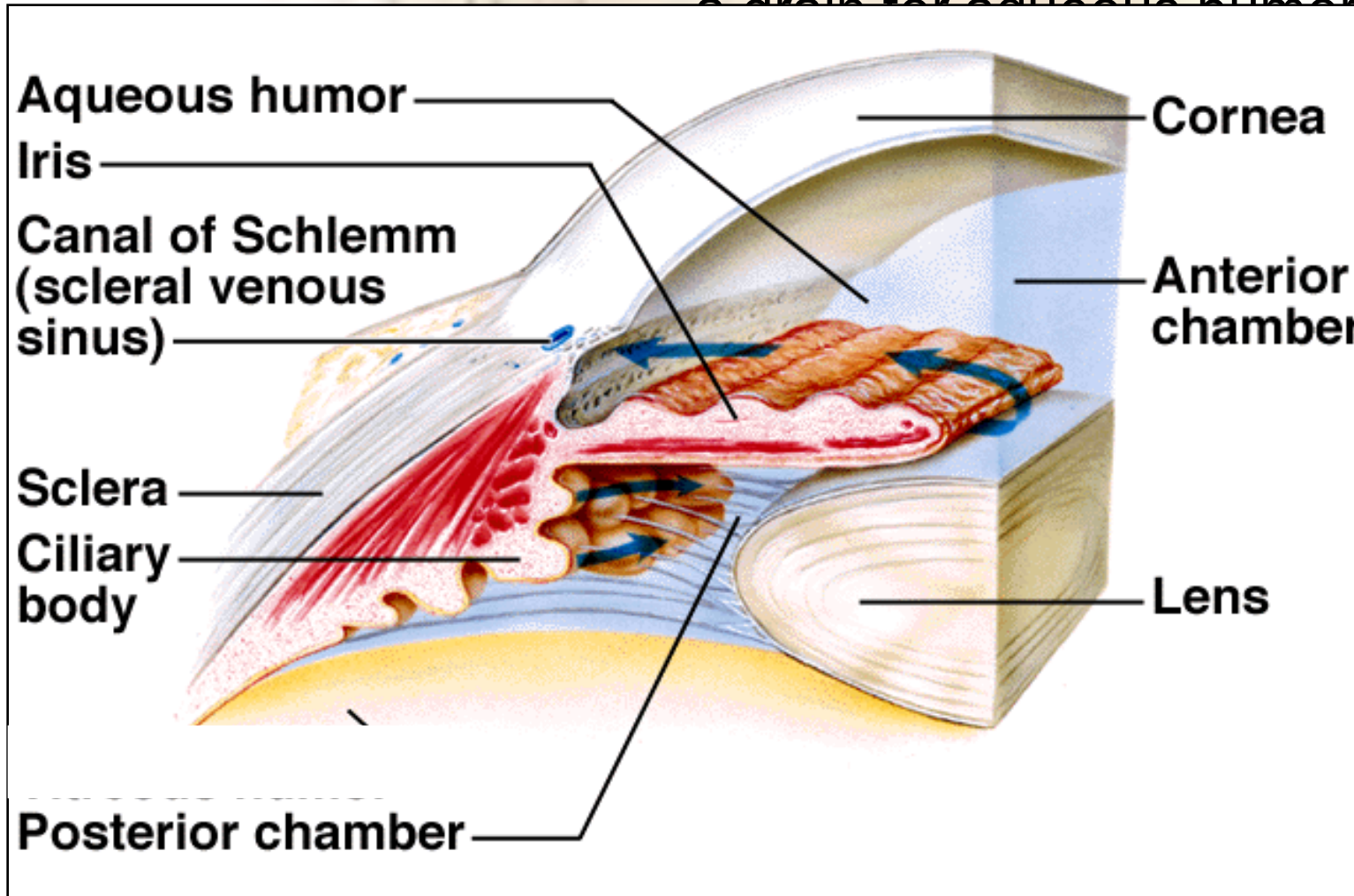
### b) Outer layer of eye

- 1) sclera -white of the eye, tough fibrous layer for shape.
- 2) cornea -clear layer at front of eye
  - bends light rays
  - no blood vessels... *where does O<sub>2</sub> come from?*
- 3) anterior cavity -b/w cornea & iris
  - filled w/ aqueous humor
  - fluid nourishes cornea

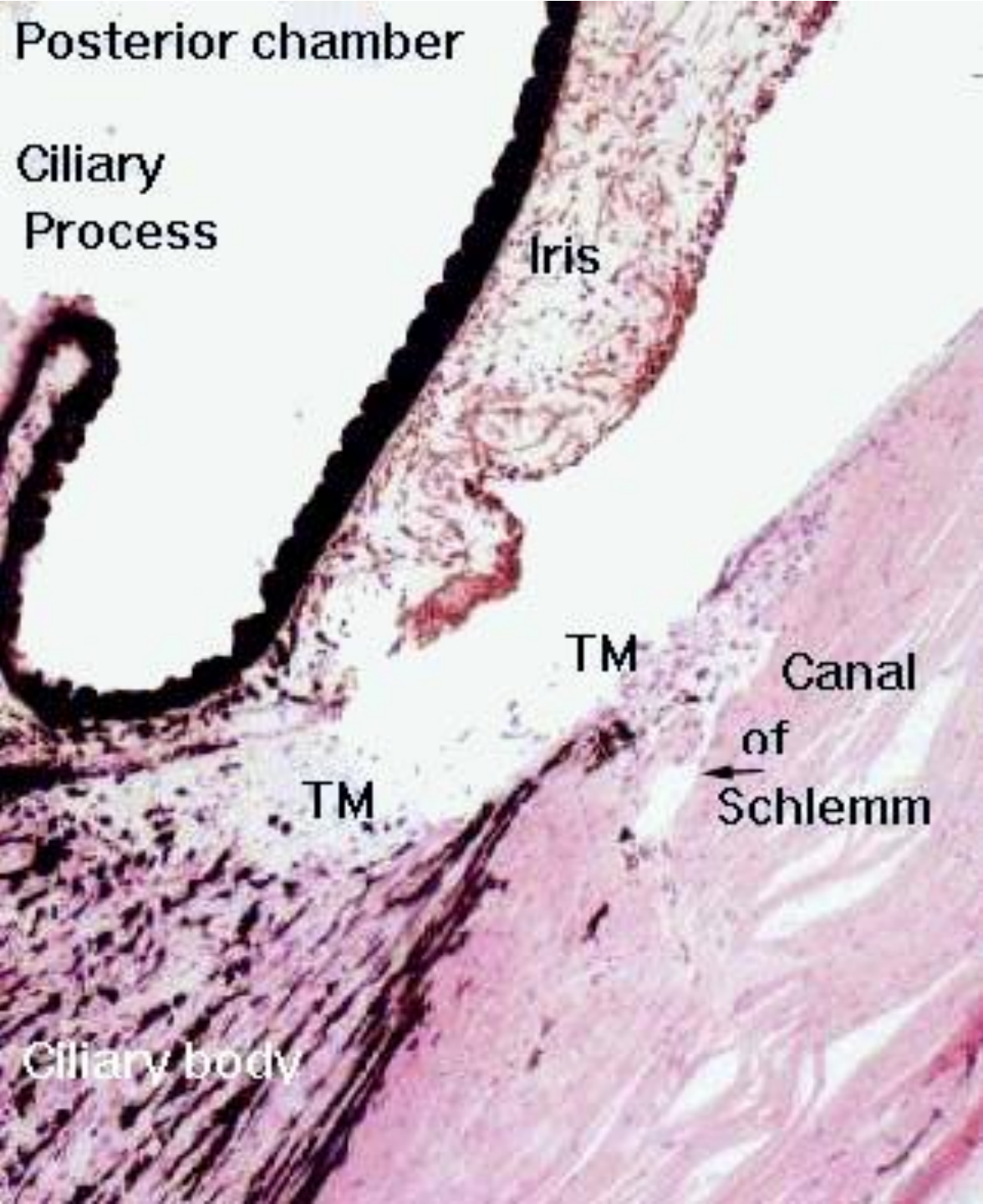


## b) Outer layer of eye (con't)

- 4) canal of Schlemm -at the junction of cornea and sclera



**NOTE:**  
Ant. Cavity  
Divided  
Into  
Ant. & Post.  
Chambers



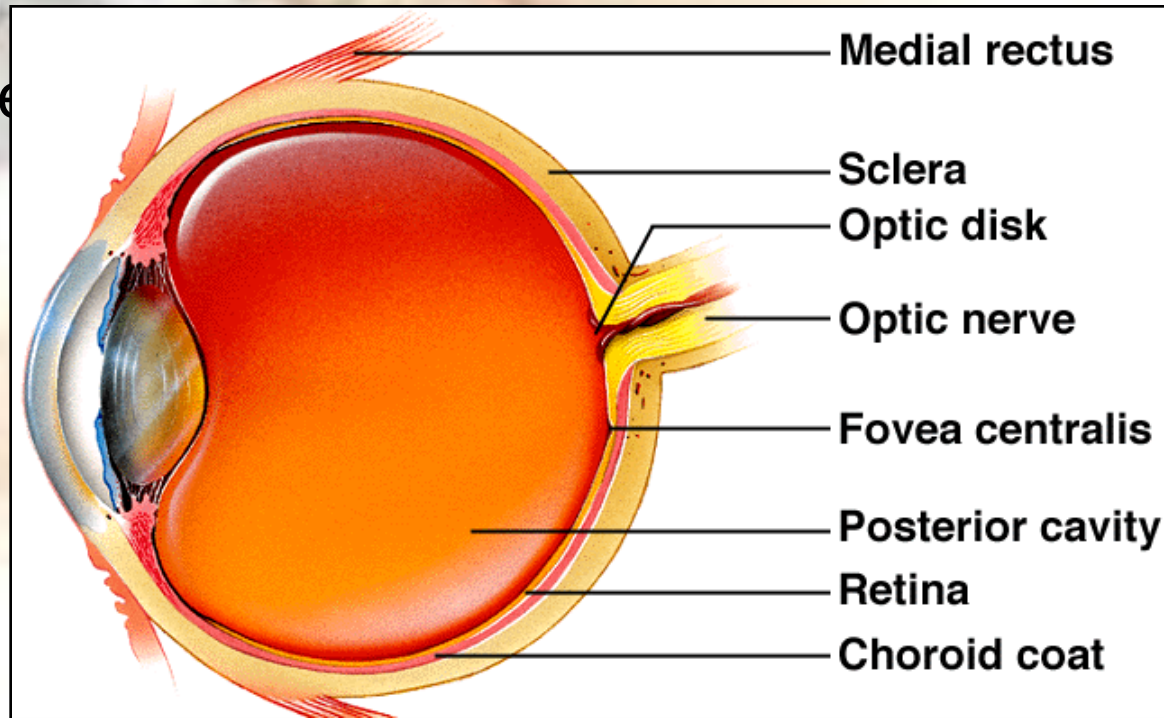
## c) Middle layer of eye

**1) choroid coat** -thin dark layer (melanin and blood vessels)

- nutrient delivery to retina
- absorbs light (limits reflection)

**2) ciliary body** -focuses lens (smooth muscle)  
(glandular)  
-produces aqueous humor

**3) pupil** - the hole



#### 4) Iris

-colored portion of eye

-changes size to adjust amount of light entering eye

\*radial muscles constrict = pupil dilation ( \_\_\_\_\_ stimulation)

\*circular muscles constrict = constriction ( \_\_\_\_\_ stimulation)

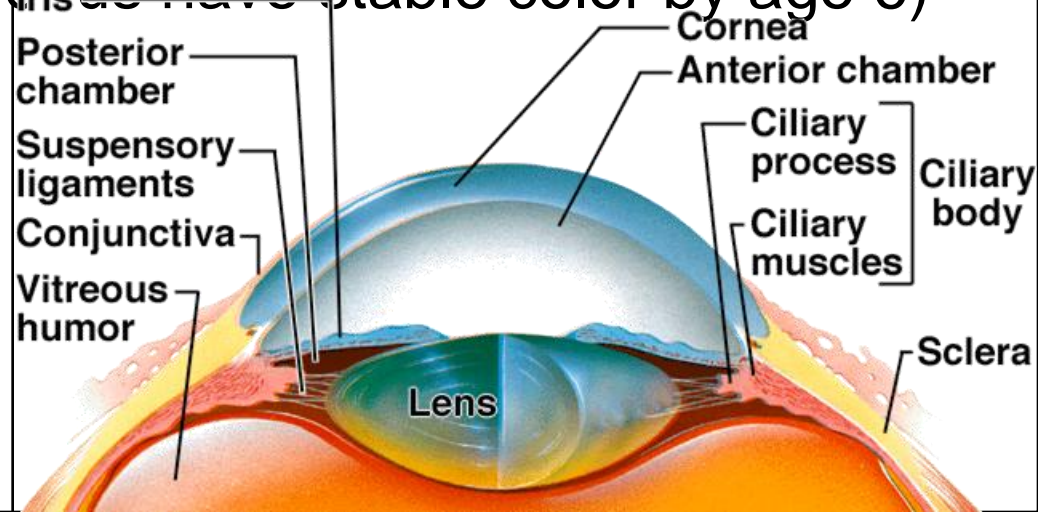
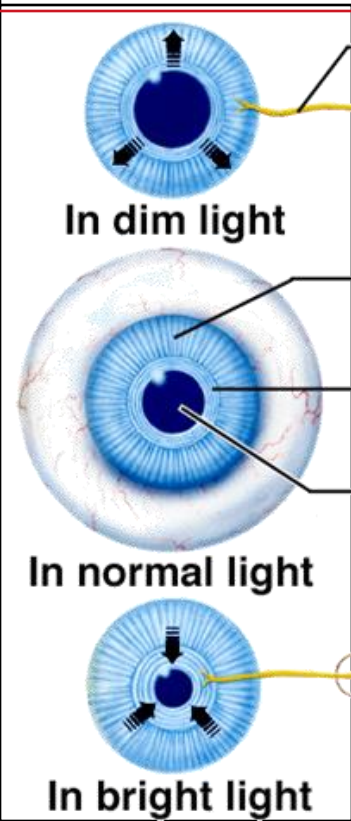
#### *\*Pupillary Light Reflex*

-2 layers of pigment for color

\*posterior layer is blue

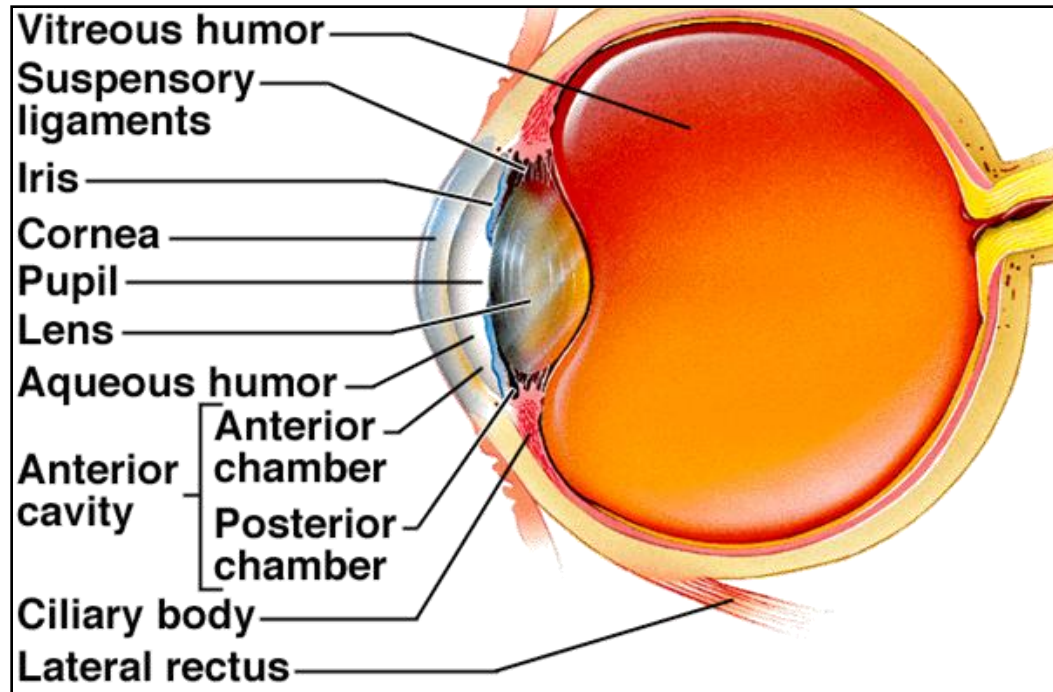
\*color of anterior layer controlled by genes

(85 to 90% of us have stable color by age 6)



## 5) lens

- biconvex ( ) shape
- important for bending light rays
- anchored by suspensory ligaments



Review convex and concave

**6) anterior cavity** -space anterior to lens

-filled w/ aqueous humor

-divided into: a) anterior chamber – anterior to

iris

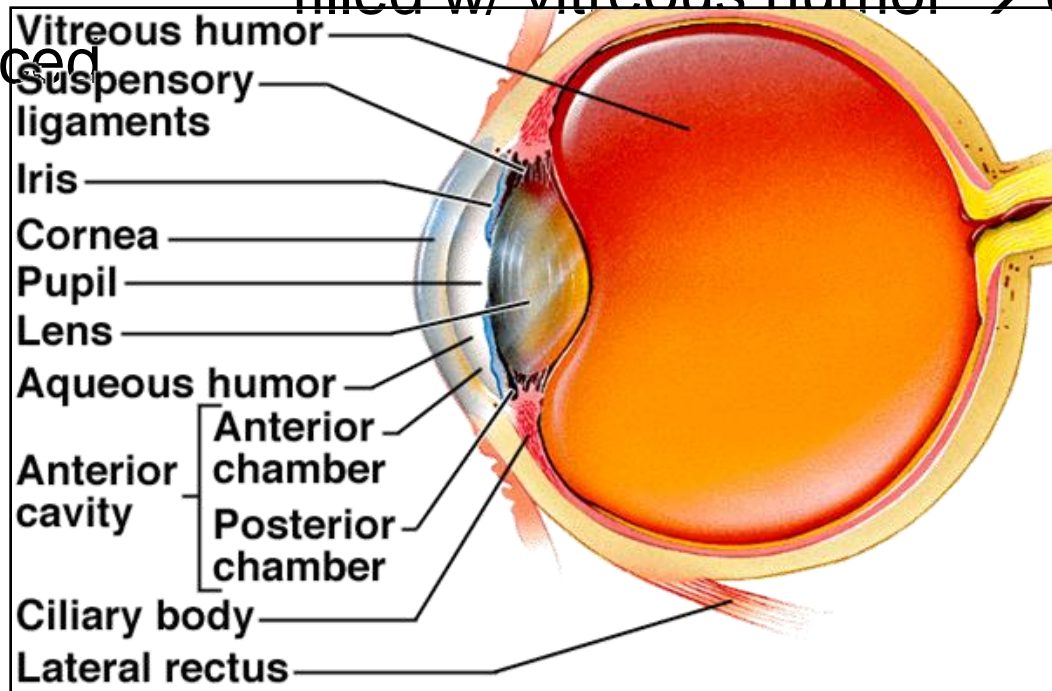
b) posterior chamber – posterior to

iris

**7) posterior cavity** -behind lens

-filled w/ vitreous humor → cannot be

replaced



## a) Inner layer of eye

1) **retina** -inner most layer, very delicate, nutrients from choroid

-has *transducers* for vision (**light energy** → **AP**)

a) rods: Long thin receptors, for night vision.

Found throughout retina.

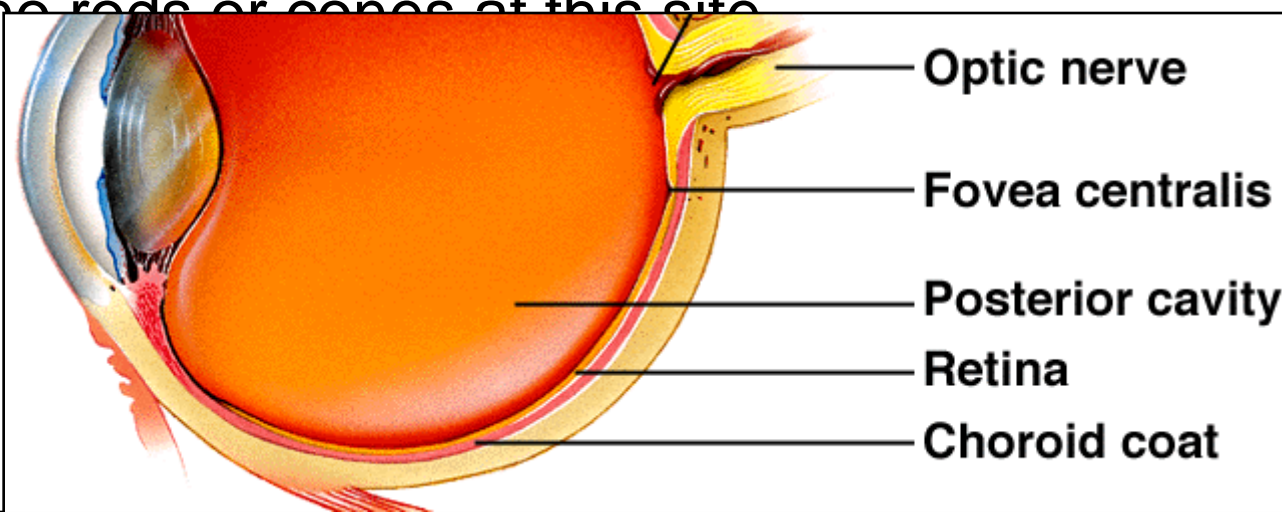
b) cones: Conical shape, for color vision.

Concentrated in fovea centralis.

-nerve connections pass through optic disk → brain

\*“blind spot” at optic disk

\* no rods or cones at this site



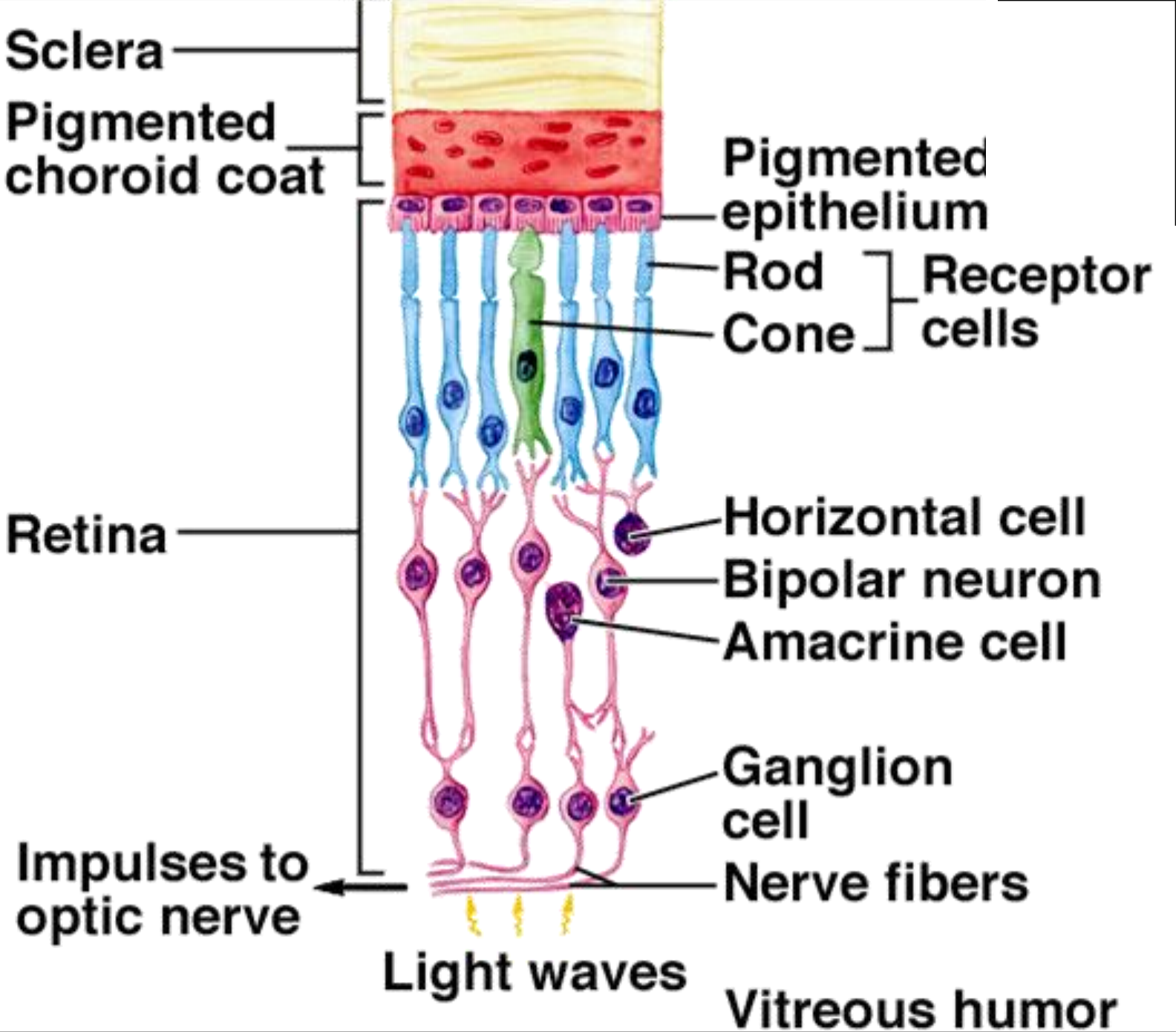
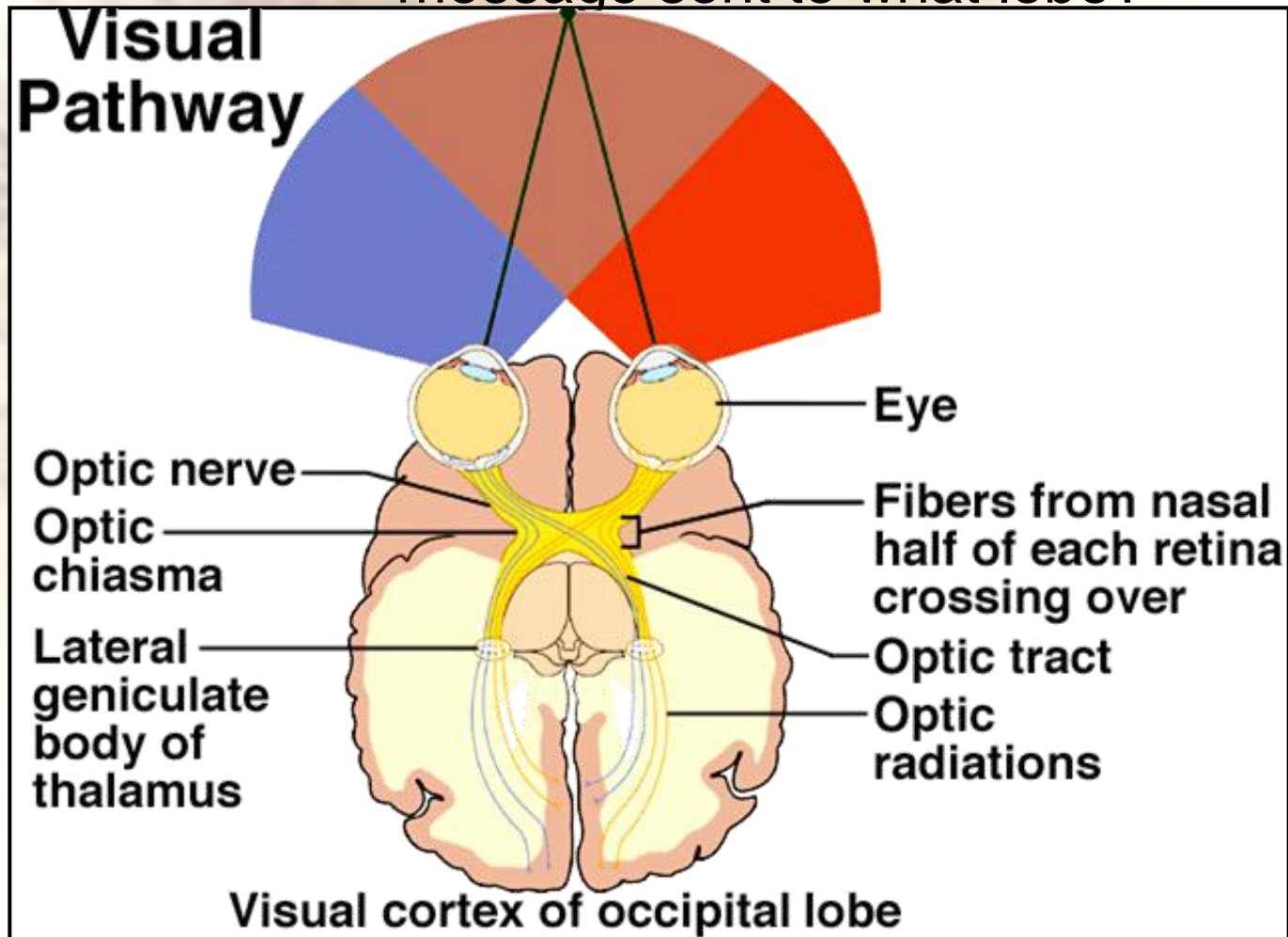


Fig 10.22

## d. Inner Layer (con't)

2) **optic chiasm** -optic nerves partially cross near sella turcica

-message sent to what lobe?



### 3) Physiology of vision

#### a) transducers - rods & cones

##### 1) rods -for night vision

- 20x more abundant than cones
- peripherally located

-contains rhodopsin (need vit. A to make this)

-light inactivates rhodopsin

-in the dark, rhodopsin changes to active form

\*takes time to re-activate

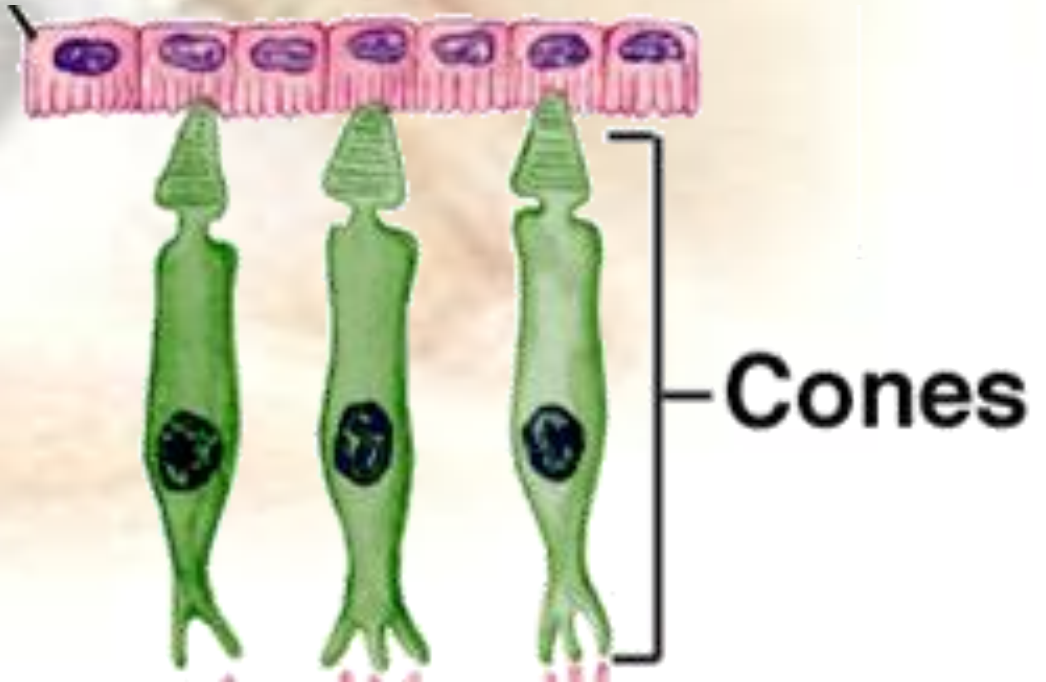
\*about 30 min. for all rods to be activated

\*movie theater example

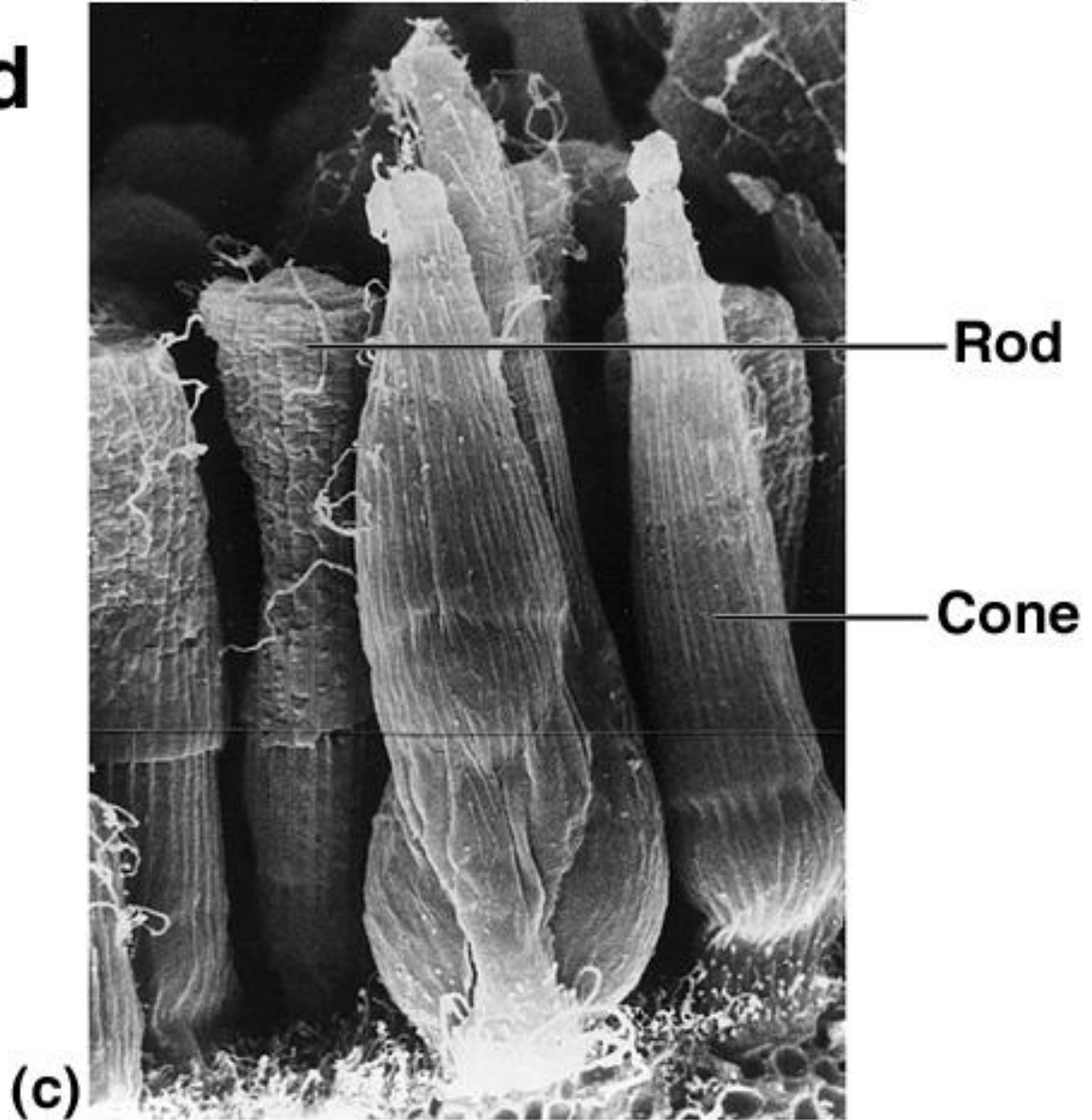


## 2) Cones -for color vision

- a) concentrated in fovea centralis
- b) specialized pigments similar to rhodopsin
- c) 3 types: red, green, blue
- d) always active
- e) produce a sharp image



# Rods and Cones

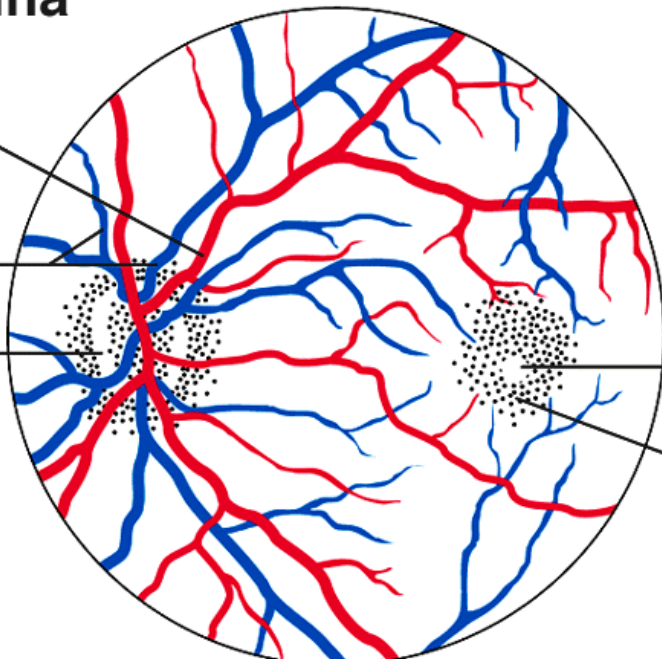


# Retina

Artery

Veins

Optic disk

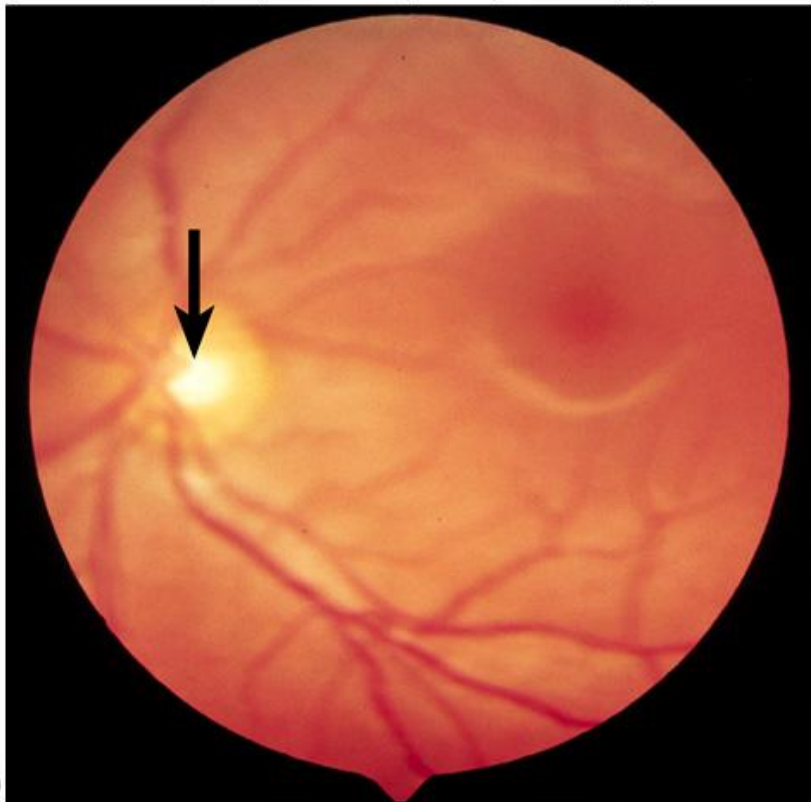


Fovea centralis  
Macula lutea



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

# Optic Disk



(a)

Copyright Per H. Kjeldsen

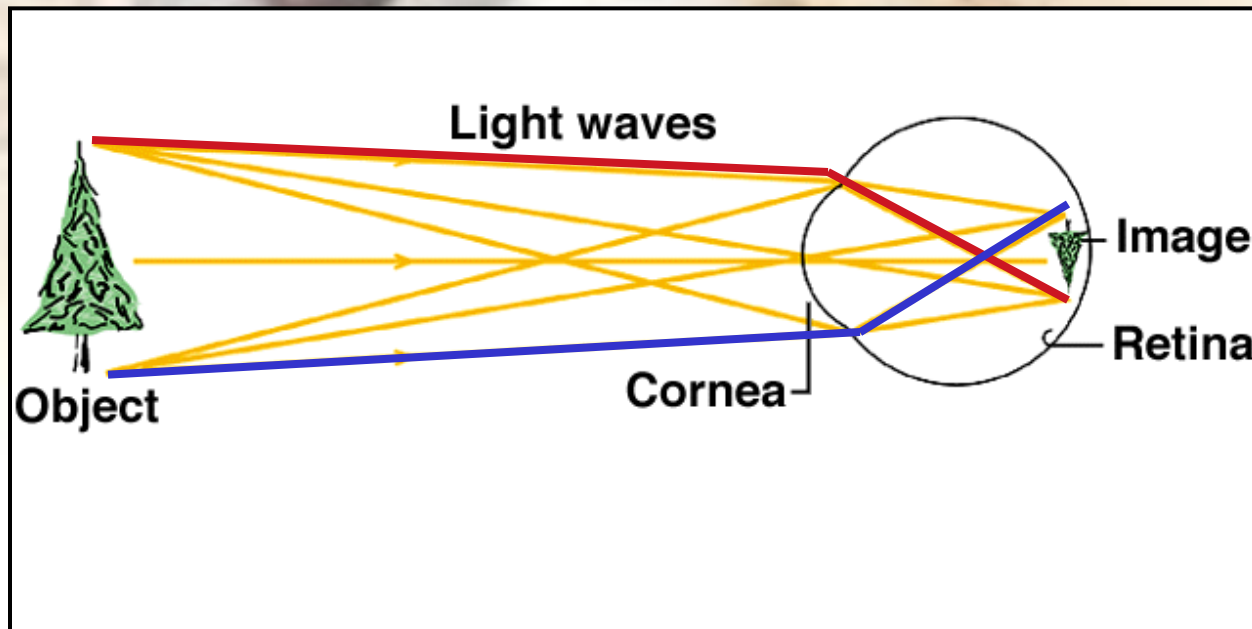
## b) Lens function

-cornea & lens bend light rays (cornea can't focus)

a) lens can be focused

b) rays bend inward... *why is this important?*

c) image is inverted on retina... *brain interprets as "right side up"*



## b) Lens function (con't)

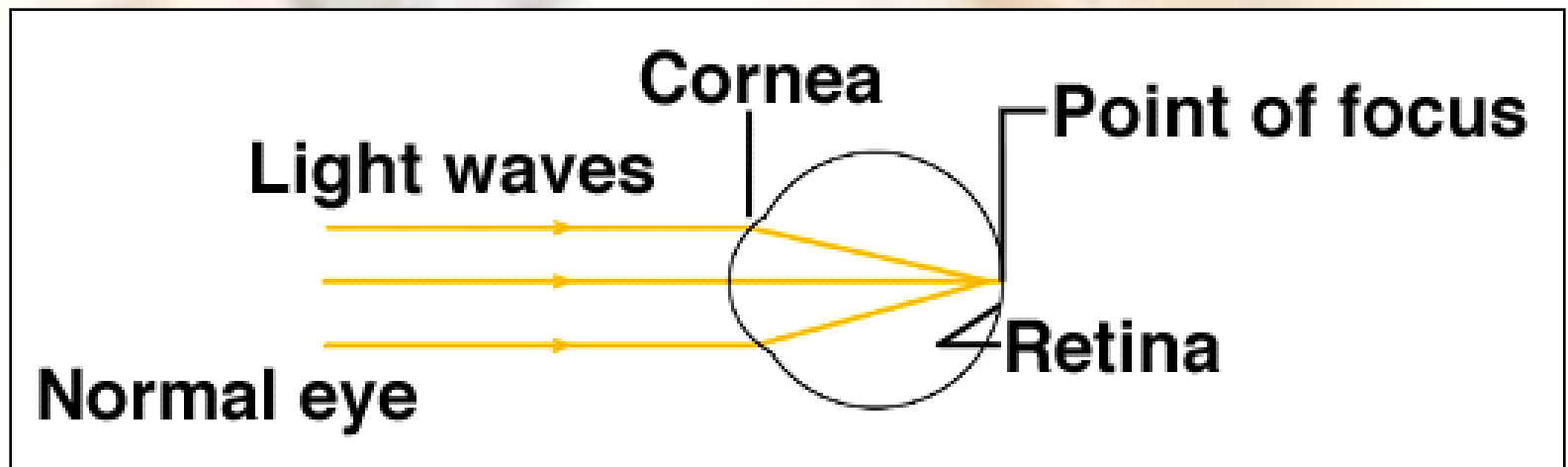
**Ciliary Body (smooth muscle), responsible for focusing lens**

d) Thin lens = distance vision

e) Thick lens = near vision...ciliary body contracts

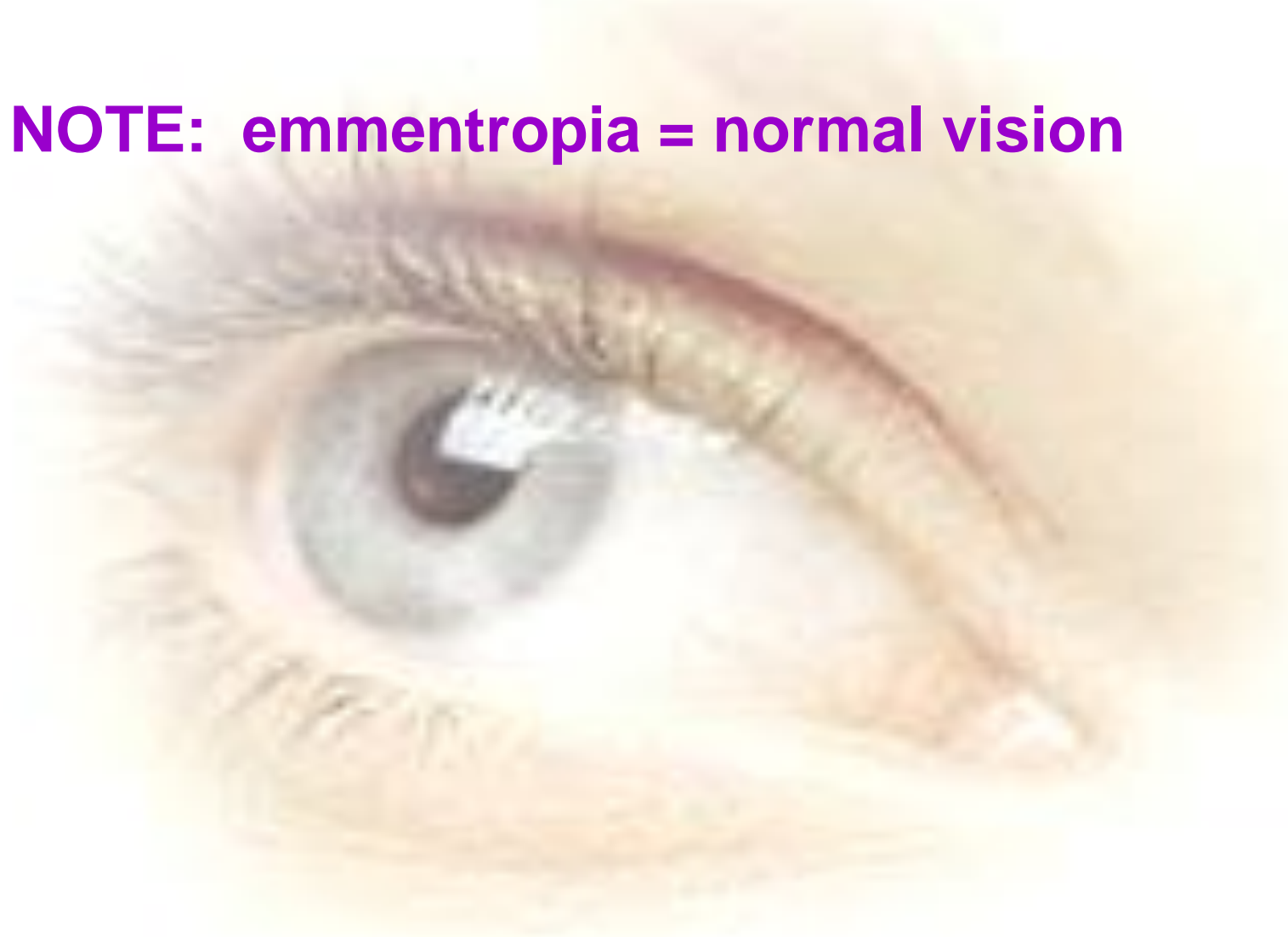
f) Near point = closest point eye can focus on

g) Far point = in a normal eye is infinity



## 4) Vision abnormalities

**NOTE: emmetropia = normal vision**



## 4) Vision abnormalities

### a) myopia - near sightedness

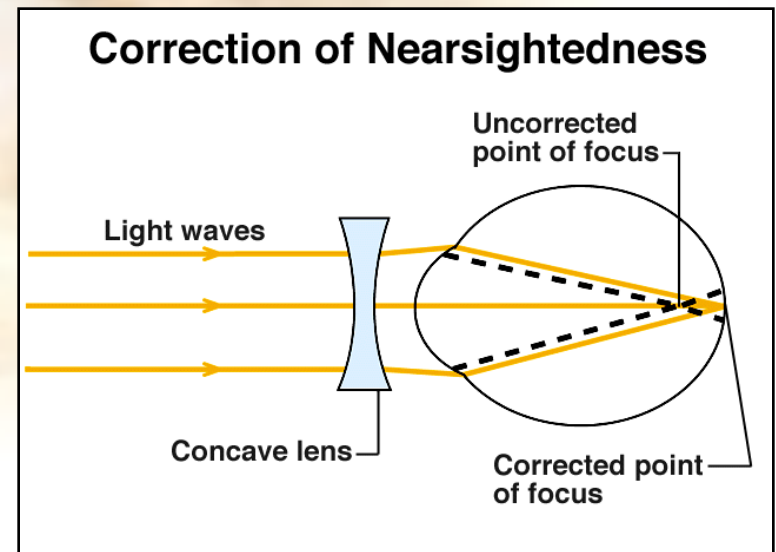
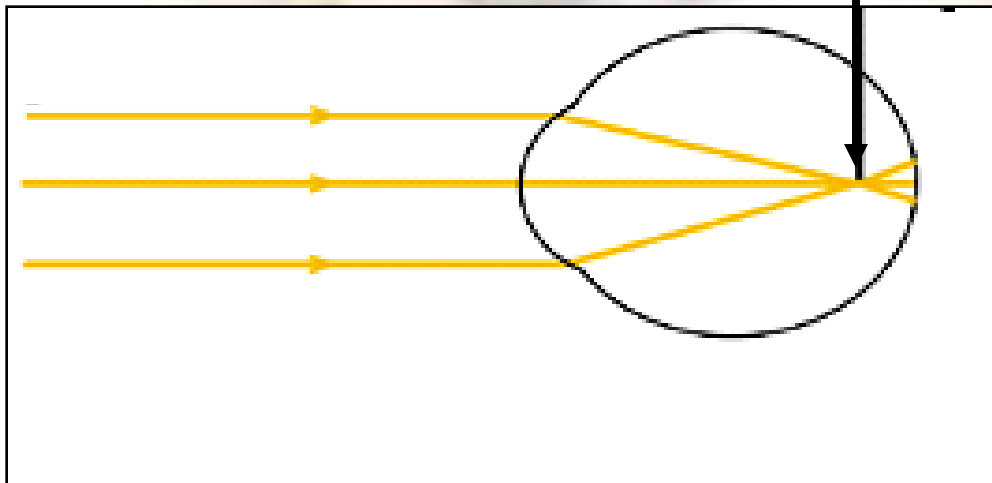
- 1) can see up close, but not far away
- 2) “eye too long or lens too strong”



## 4) Vision abnormalities

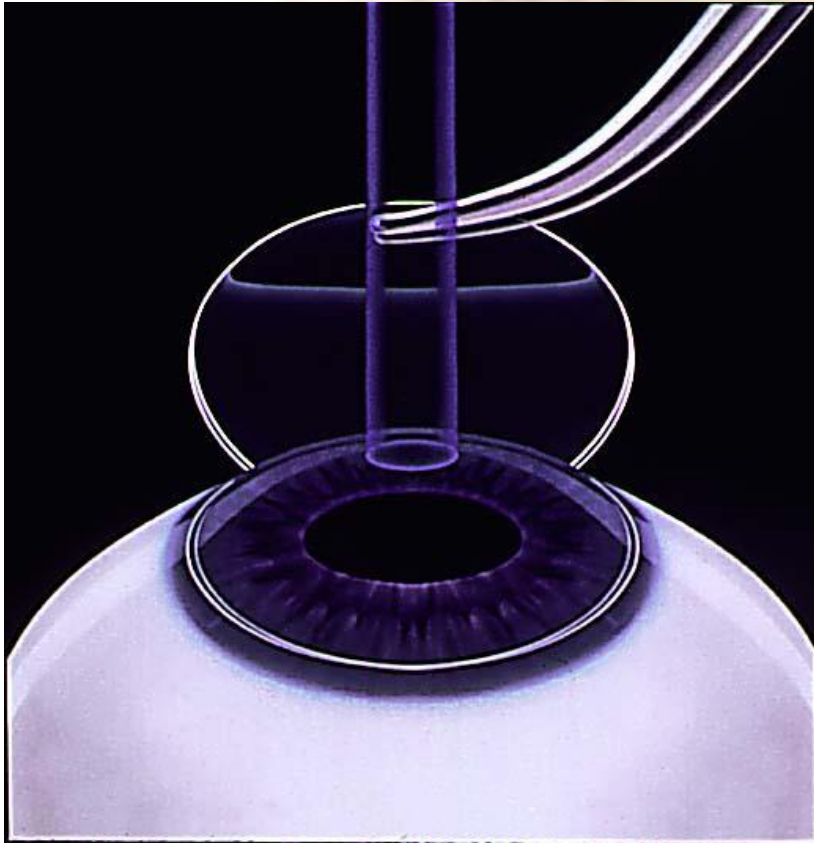
### a) myopia - near sightedness

- 2) “eye too long or lens too strong”
- 3) image focuses in front of retina
- 3) concave lens to correct – bend light rays out
- 4) surgery for some



## LASIK (Laser Assisted *in situ* Keratomileusis)

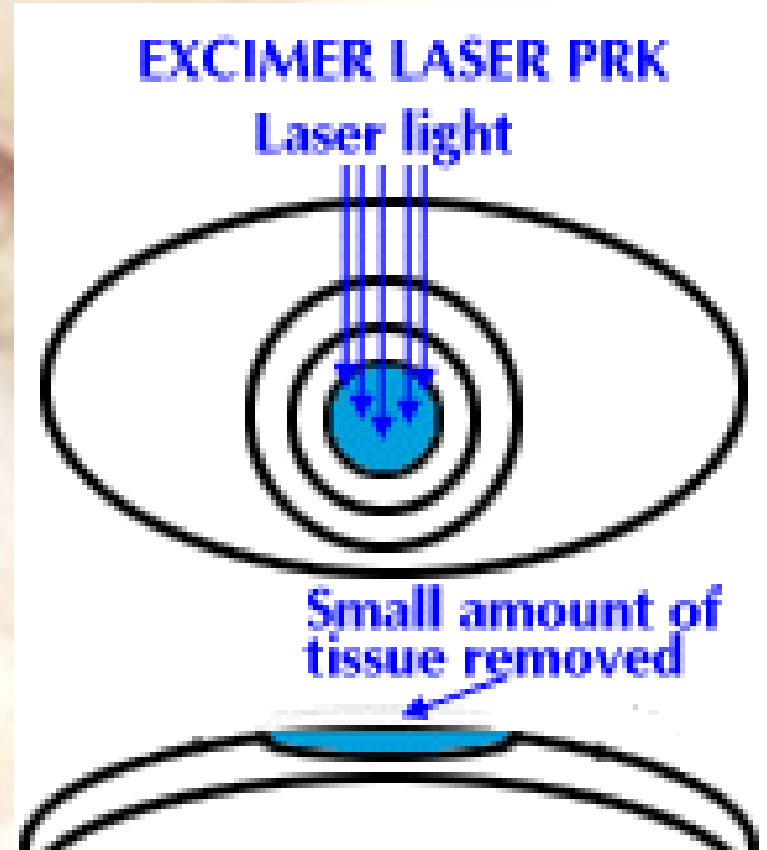
- A thin layer of cornea is lifted creating a protective flap.
- A laser re-shapes the cornea
- The flap is then returned to speed recovery.



## PRK

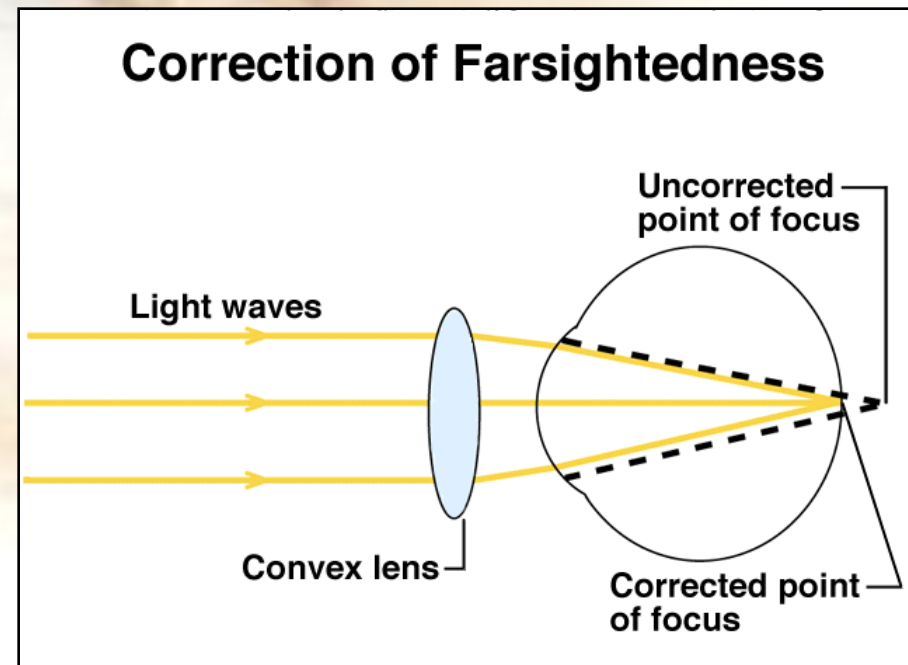
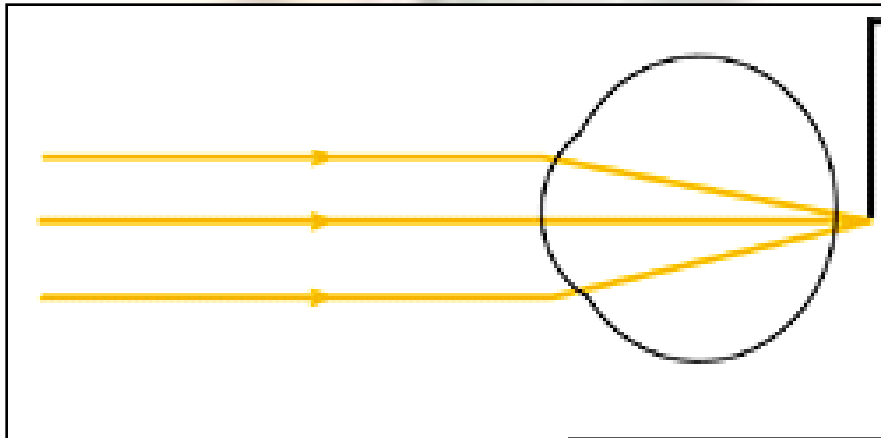
### (PhotoRefractive Keratectomy)

- cornea is re-shaped with a laser



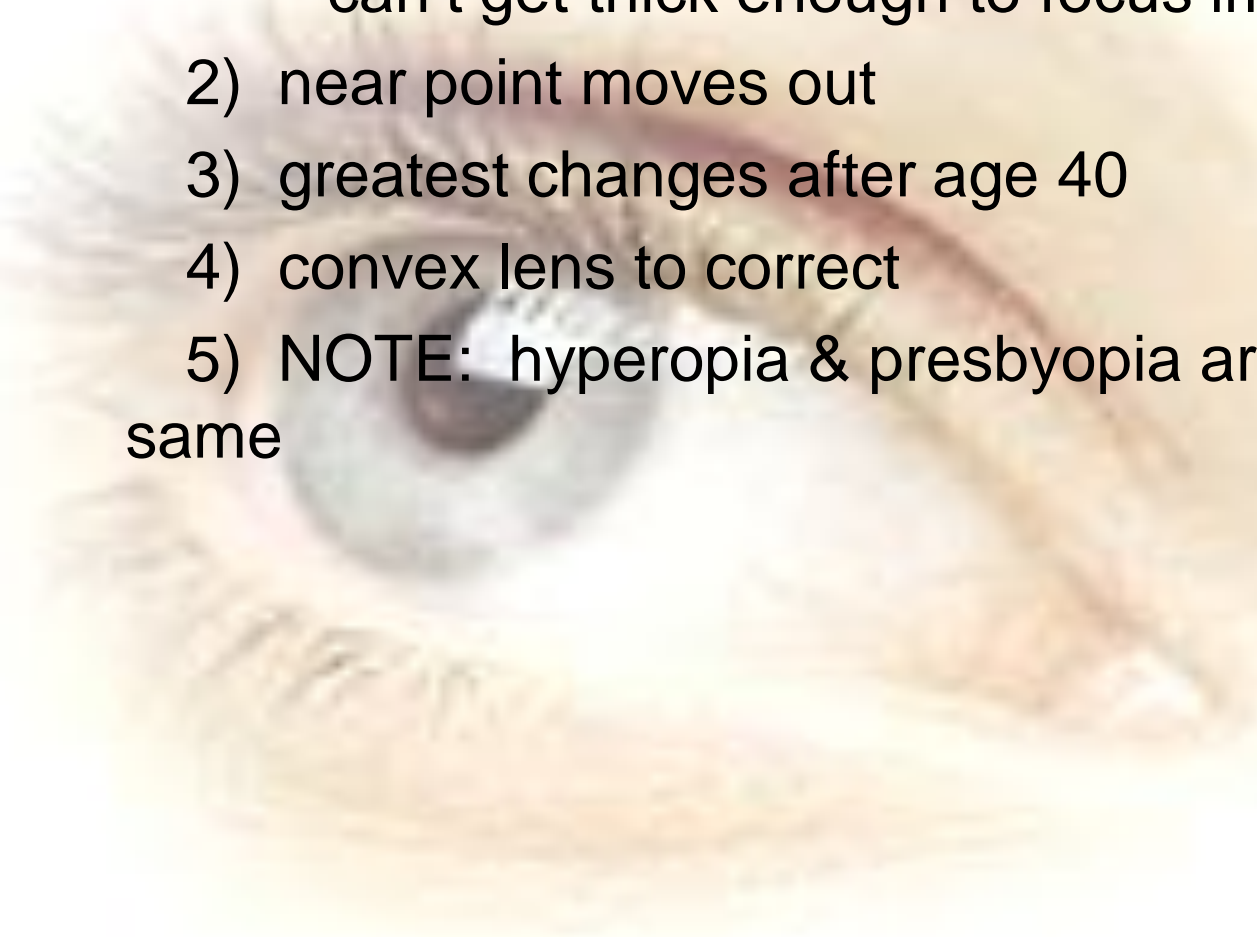
## b) Far sightedness

- 1) can see far but not near
- 2) eye is too short or lens not strong enough
- 3) image focuses behind retina
- 4) convex lens to correct, bend rays in more
- 5) LASIK surgery for some



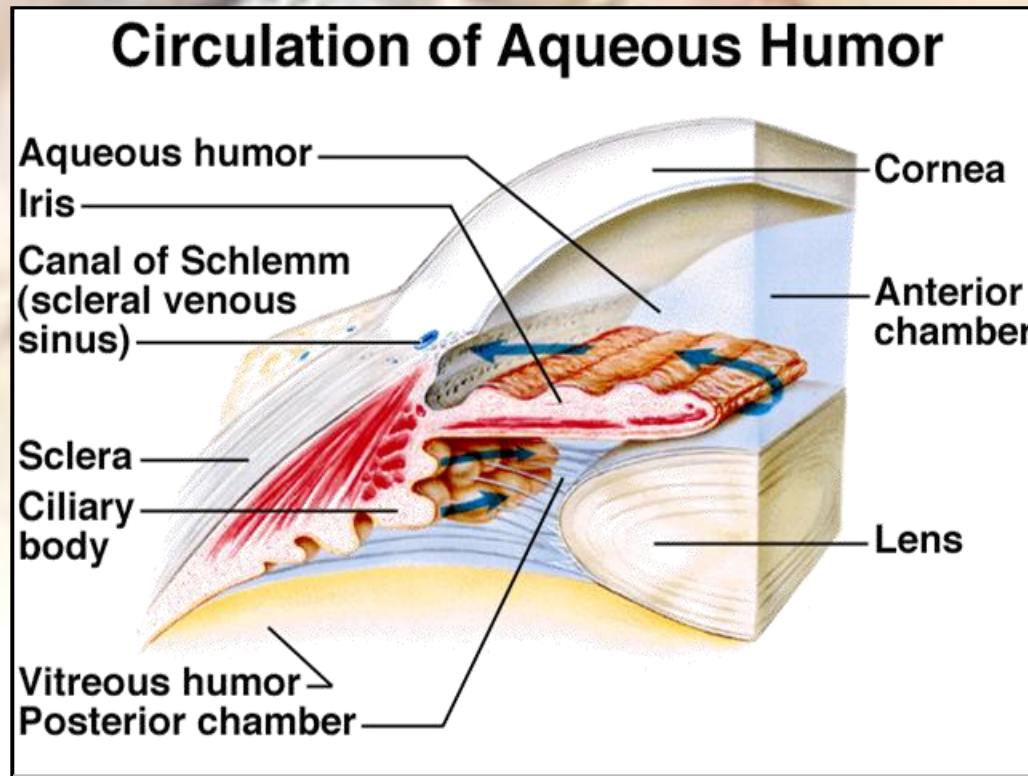
## c) presbyopia - “old man’s eye”

- 1) lens loses flexibility with age
  - can’t get thick enough to focus image
- 2) near point moves out
- 3) greatest changes after age 40
- 4) convex lens to correct
- 5) NOTE: hyperopia & presbyopia are NOT the same



## d) glaucoma - excessive pressure in eye

- 1) Aqueous humor not draining sufficiently
- 2) Pressure on optic disk (nerves and blood vessels here)
- 3) Over time, vision can be lost
- 4) Loss of peripheral vision first
- 5) Treatment - drops that opens C of S  
- surgery





Normal Vision

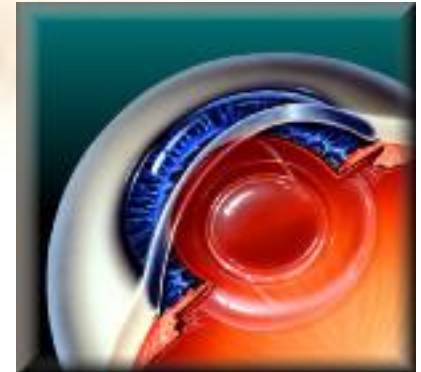
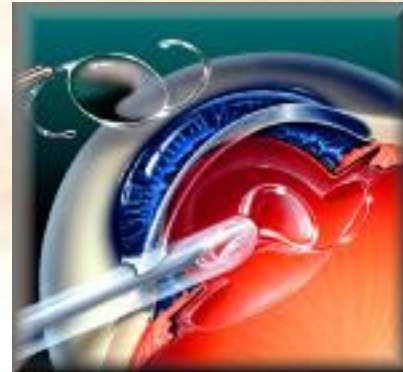
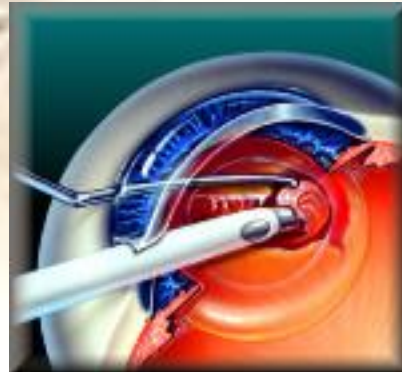
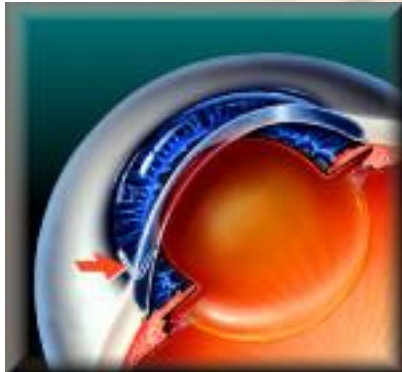


Glaucoma

# e) cataracts - clouding of the lens (protein changes)

- 1) Vision slowly lost
- 2) Surgery to replace lens

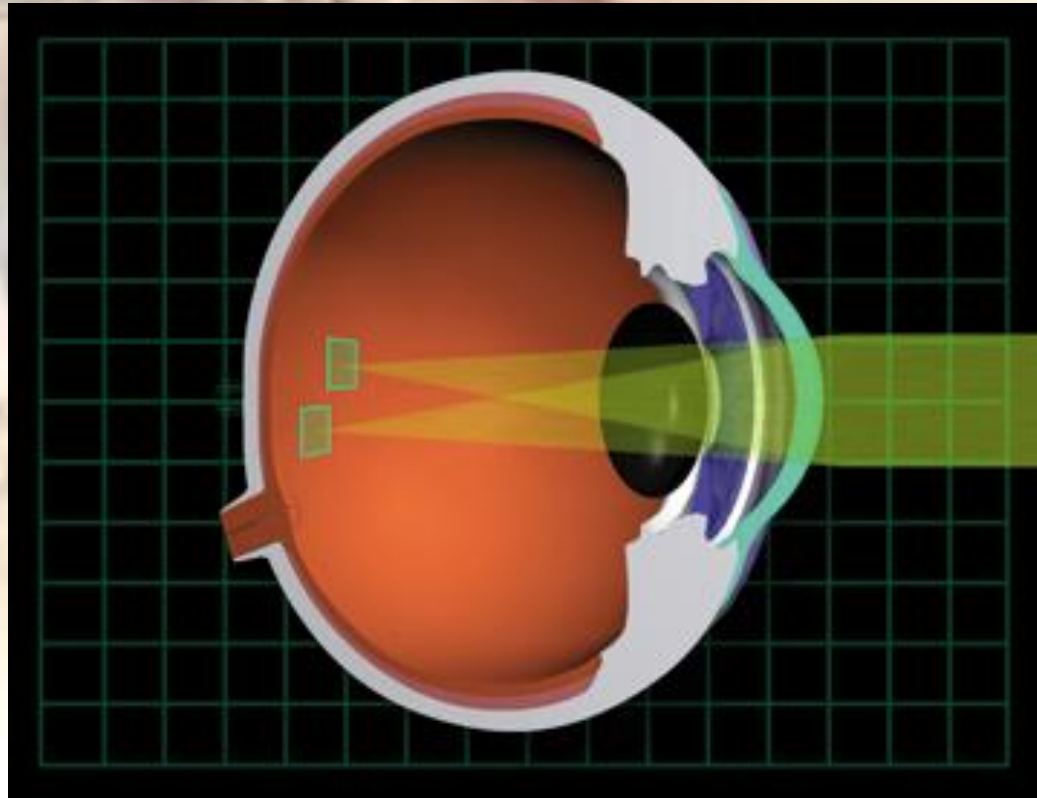
Causes: age, UV light, diabetes, genetics, steroid use, smoking...





**f) astigmatism** - cornea or lens is warped.

- 1) Lenses to correct for the warping in your cornea/lens
- 2) Glasses or Toric Contact Lenses
- 3) Surgery for some





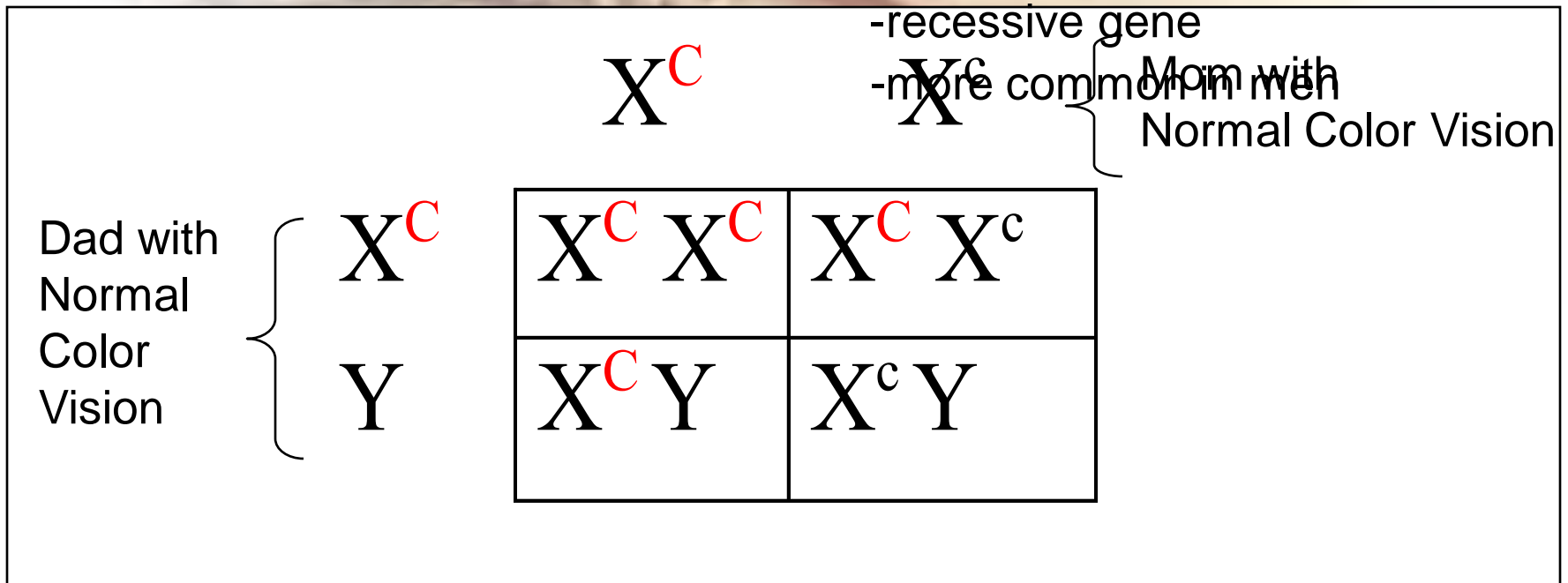
Normal Vision



Astigmatism

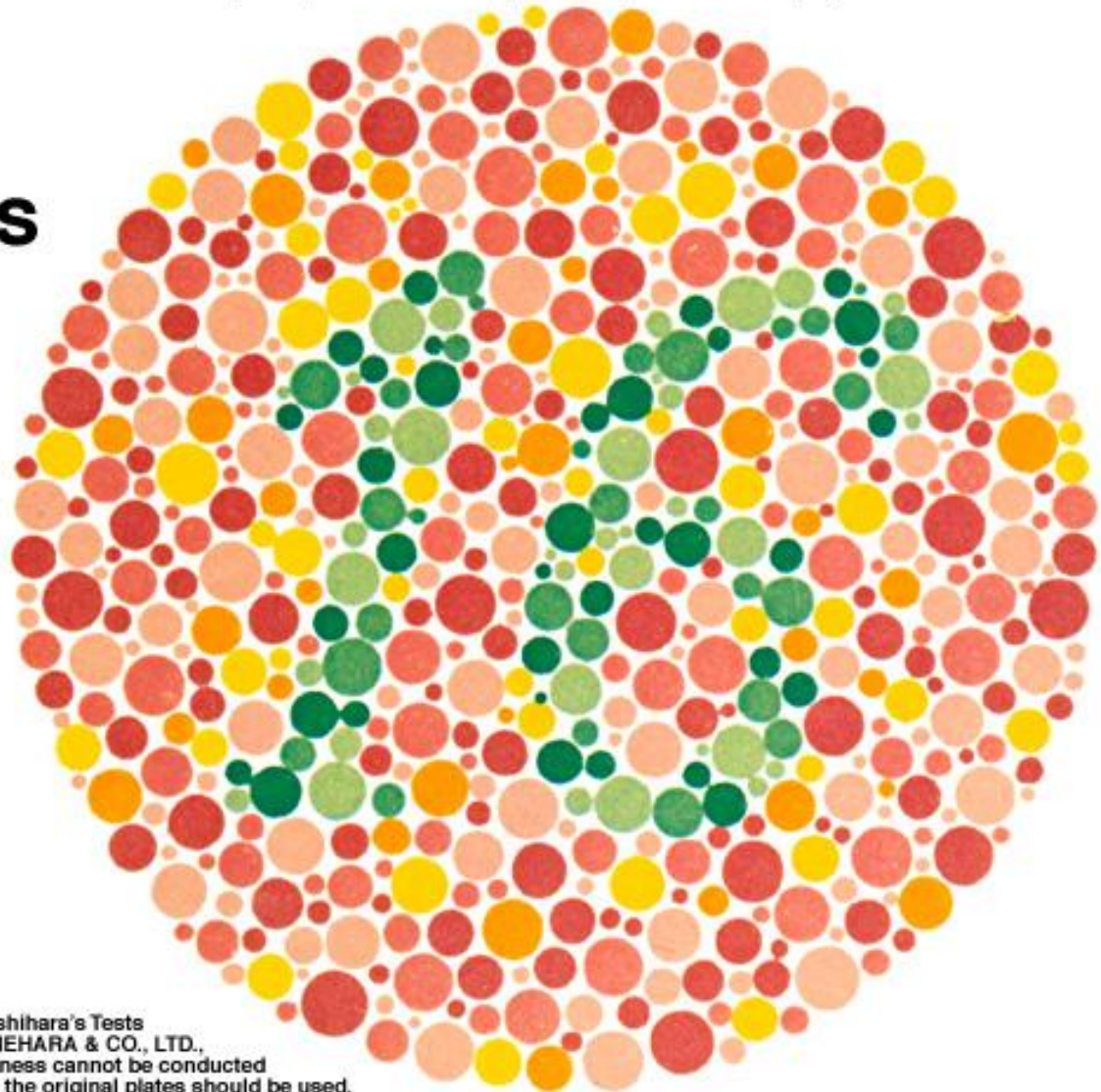
# g) color blindness - an inherited disorder of the eye.

- 1) red-green CB is most common, though blue CB does exist
- 2) red-green color blindness = -sex linked trait, on X chromosome



Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.

# Test for Color Blindness



The above has been reproduced from Ishihara's Tests for Colour Blindness published by KANEHARA & CO., LTD., Tokyo, Japan, but tests for colour blindness cannot be conducted with this material. For accurate testing, the original plates should be used.

**END**

