

# Eye

Bio 40B  
Dr. Kandula

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## External Anatomy of Eye

Site where conjunctiva merges with cornea  
Palpebral fissure  
Lateral commissure (canthus)  
Iris  
Eyelid

— Eyebrow  
— Eyelid  
— Eyelashes  
— Pupil  
— Lacrimal caruncle  
— Medial commissure (canthus)  
— Sclera (covered with conjunctiva)

(a)

Levator palpebrae superioris muscle  
Orbicularis oculi muscle  
Eyebrow  
Tarsal plate  
Palpebral conjunctiva  
Tarsal (Meibomian) glands  
Cornea  
Palpebral fissure  
Eyelashes  
Ocular (bulbar) conjunctiva  
Conjunctival sac  
Orbicularis oculi muscle

(b)

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## Accessory Structures

- Eyebrows
- **Levator Palpebrae Superioris** - opens eye
- Eyelashes
- **Ciliary glands** – modified sweat glands
- Small sebaceous glands
- **Sty** is inflamed ciliary glands or small sebaceous glands

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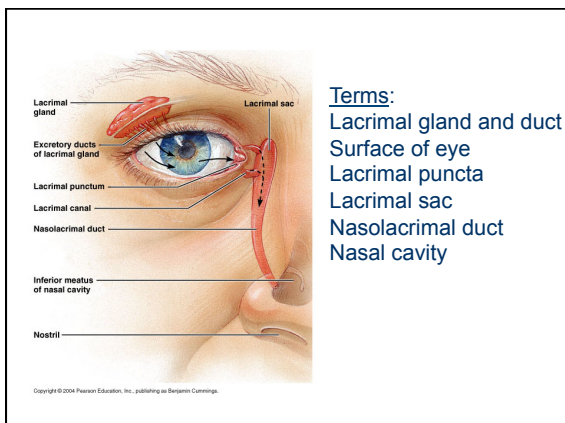
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### Tears / Lacrimal fluid

- a watery physiologic saline, with a plasma-like consistency,
- contains the bactericidal enzyme **lysozyme**;
- it moistens the conjunctiva and cornea,
- provides nutrients and dissolved O<sub>2</sub> to the cornea.

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### Extrinsic Muscles of the Eye:

**Lateral/medial rectus  
 Superior/inferior rectus  
 Superior/inferior oblique** **Important** to know actions and nerve supply in table

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### Extrinsic Eye Muscles

- Eye movements controlled by six extrinsic eye muscles

Four recti muscles

- **Superior rectus** – moves eyeball superiorly supplied by Cranial Nerve III
- **Inferior rectus** - moves eyeball inferiorly supplied by Cranial Nerve III
- **Lateral rectus** - moves eyeball laterally supplied by Cranial Nerve VI
- **Medial rectus** - moves eyeball medially supplied by Cranial Nerve III

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### Extrinsic Eye Muscles

Two oblique muscles

rotate eyeball on its axis

- **Superior oblique** rotates eyeball inferiorly and laterally and is supplied by Cranial Nerve IV
- **Inferior oblique** rotates superiorly and laterally and is supplied by Cranial Nerve III

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### Convergence of the Eyes

- Binocular vision in humans has both eyes looking at the same object
- As you look at an object close to your face, both eyeballs must turn inward.
- **convergence**
- required so that light rays from the object will strike both retinas at the same relative point
- extrinsic eye muscles must coordinate this action

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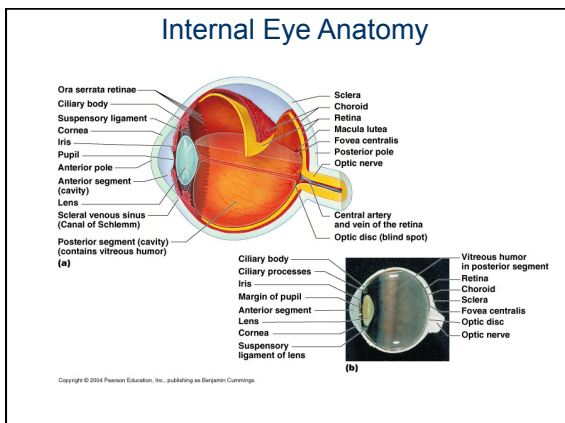
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### Tunics of eye

- Fibrous tunic – outer layer
- Vascular tunic / uvea – middle layer
- Nervous tunic / retina – inner layer

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### Fibrous Tunic

sclera  
cornea

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### Sclera

- “White” of the eye, covers posterior  $\frac{3}{4}$  of the eye
- Dense irregular connective tissue layer -- collagen & fibroblasts
- Provides shape & support
- At the junction of the sclera and cornea is an opening (**scleral venous sinus**)
- Posteriorly pierced by **Optic Nerve** (Cr.N.II)

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### Cornea

- Transparent, avascular
  - Nourished by tears & aqueous humor
  - Helps focus light (refraction)
  - Astigmatism -corneal surface wavy so parts of image out of focus
- 3 layers

Transplants: common & successful; no blood vessels so no antibodies to cause rejection

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### Middle vascular tunic or uvea

- Choroid
- Ciliary body
  - o ciliary muscle & ciliary process
- Iris
  - radial muscle & circular muscle
  - pupil

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### Choroid:

- a network of blood vessels that supply oxygen and nutrients to the tissues of the eye.
- located deep to the sclera
- contains a pigmented layer (melanin) that helps absorb excess light and prevents internal reflection

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### Ciliary Body

- anterior to the choroid is a circular structure called the "**ciliary body.**"
- ciliary body has **ciliary muscles** that act on suspensory ligaments which suspend the lens in the correct position.
- Ciliary body is also made up of a **ciliary process** that makes a fluid called **aqueous humor**

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### Suspensory Ligaments

- The **suspensory ligaments** are either taut or relaxed based on the action of the ciliary muscles.
- The tension on the ligaments changes the shape of the lens, depending on the distance of the object being viewed.
- This process is called "**accommodation**".

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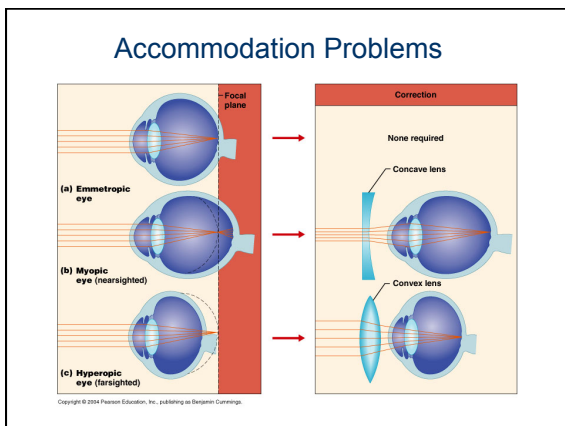
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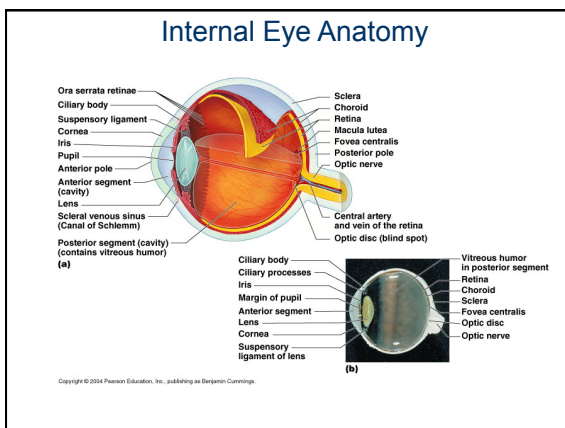
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## Iris

- Colored part of the Eye
- it is the most anterior portion of the vascular tunic
- Made up of **radial muscle & circular muscle (intrinsic muscles of eye)**
- Controls the amount of light entering the eye
- the opening in the middle of the iris is called the **"pupil,"** which appears as the dark center of the eye.

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## Iris

- The iris either dilates or constricts the pupil to regulate the amount of light entering the eye.
- In bright light the pupil will be small, but in dim light the pupil will be very large to let in as much light as possible.
- **Constriction of pupils** - contraction of the circular fibers – **parasympathetic control**
- **Dilation of pupils** - contraction of radial fibers – **sympathetic control**

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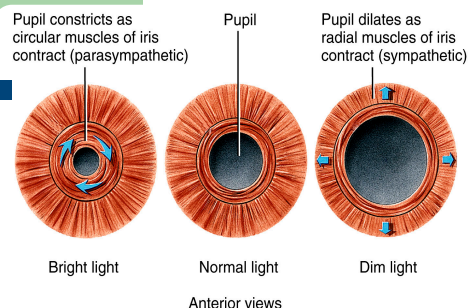


Figure 17.28 Tortora - PAP 12e  
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## Inner sensory tunic/retina

Posterior 3/4 of eye ball only  
 anterior margin – **ora serrata retina** (rods only)  
**optic disc** – attachment of optic nerve / **blind spot**, no photoreceptors  
**fovea centralis** – near the middle of the retina, highest concentration of cones and region of highest visual acuity.

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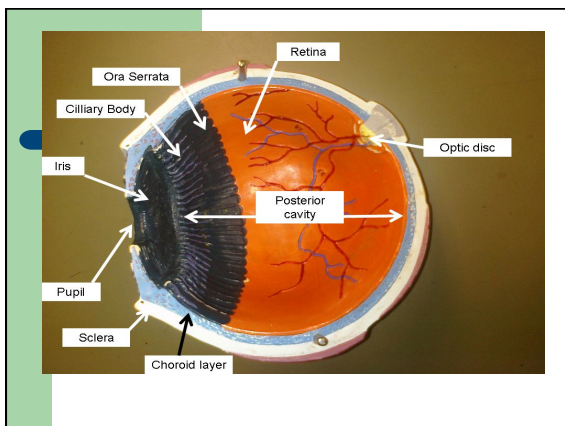
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### Inner sensory tunic/retina

superficial layer of pigment epithelium (melanin):

- non-visual portion
- absorbs stray light & helps keep image clear

deeper layer of neurons

- rods/cones are **photoreceptor layer**
- **bipolar neuron layer**
- **ganglion cell layer**

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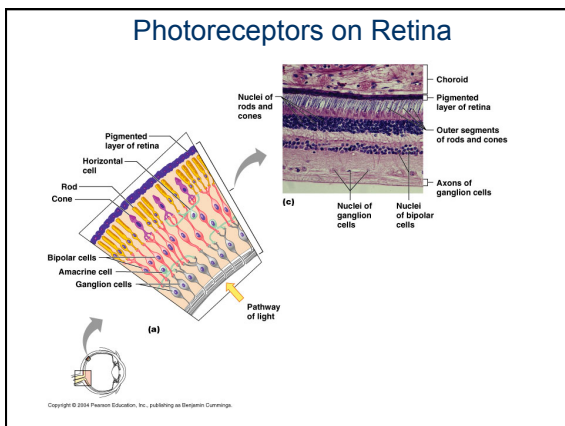
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### Rods and Cones/ Photoreceptors

**Rods**---rod shaped cells

- shades of gray in dim light
- nocturnal vision – black and white vision, great sensitivity in dim light
- 120 million rod cells
- discriminates shapes & movements, distributed along periphery of retina

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### Rods and Cones/ Photoreceptors

**Cones**---cone shaped cells

- sharp, color vision at all higher light intensities
- 6 million
- Fovea centralis – widest distribution at center of retina

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### Lens

- focuses image on retina
- suspensory ligament and ciliary muscles control curvature to focus images on retina
- divides interior of eyeball into anterior cavity and posterior cavity

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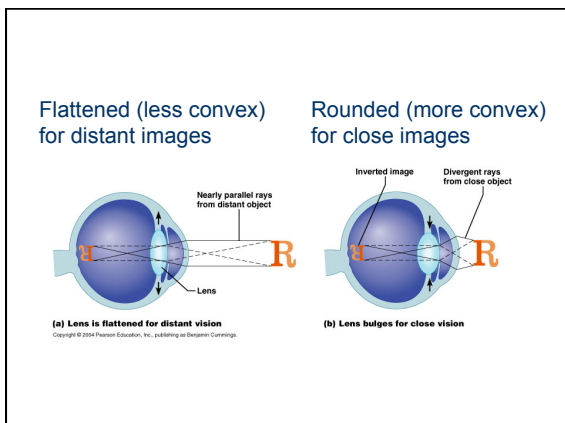
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### Anterior cavity (anterior to lens)

filled with **aqueous humor**

- produced by **ciliary body**
- continually drained by **scleral venous sinus**
- replaced every 90 minutes
- drainage of aqueous humor from eye to bloodstream

**Glaucoma**

- increased intraocular pressure that could produce blindness
- problem with drainage of aqueous humor

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### Posterior cavity (posterior to lens)

- filled with **vitreous humor** (jellylike)
- Holds retina in place
- formed once during embryonic life
- floaters are debris in vitreous of older individuals

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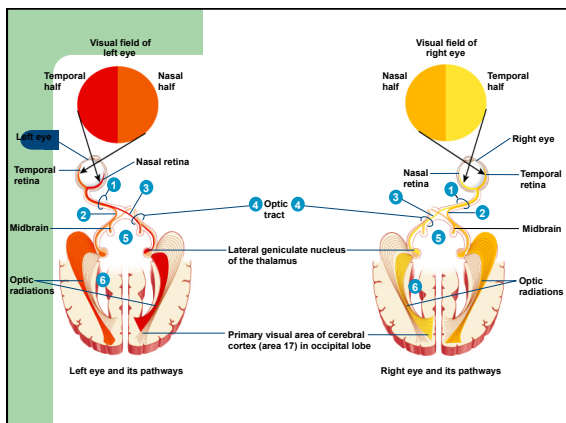
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### Cortex regions responsible for vision

- Left occipital lobe receives visual images from nasal 1/2 of the right eye and temporal 1/2 of the left eye
- Right occipital lobe receives visual images from nasal 1/2 of the left eye and temporal 1/2 of the right eye

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### Internal Structures of Eye

Inner sensory tunic/retina  
 pigment epithelium  
 rods/cones are photoreceptor

Rods: Nocturnal vision – black and white vision, great sensitivity in dim light

Cones: color vision at all higher light intensities

optic disc – attachment of optic nerve / blind spot

fovea centralis – highest concentration of cones

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### Eye terms

- Lens is convex. More convex to see close, less convex to see distant.
- UV light damage to lens = cataract
- Myopia = nearsighted, fix with concave lens
- Hypermetropia = farsighted, fix with convex lens
- Rods detect black/white in dim light, Cones detect color in bright light
- Glaucoma is buildup of fluid pressure in eye

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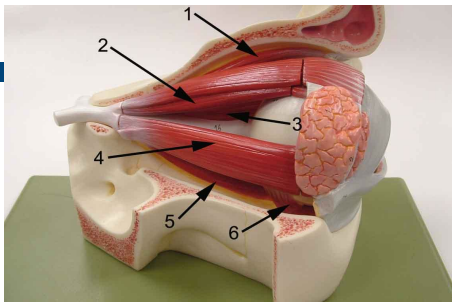
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### Key

- 1. superior oblique
- 2. superior rectus
- 3. medial rectus
- 4. lateral rectus
- 5. lateral rectus
- 6. inferior oblique

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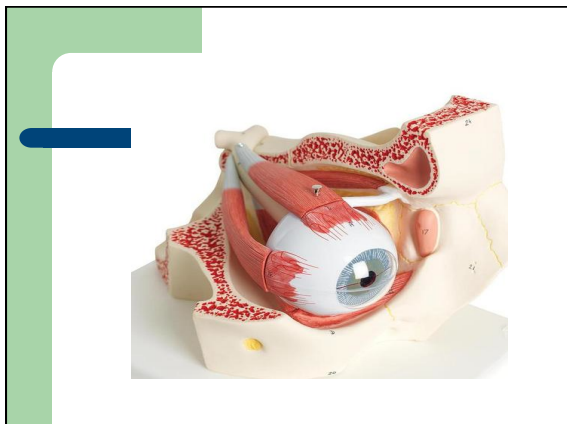
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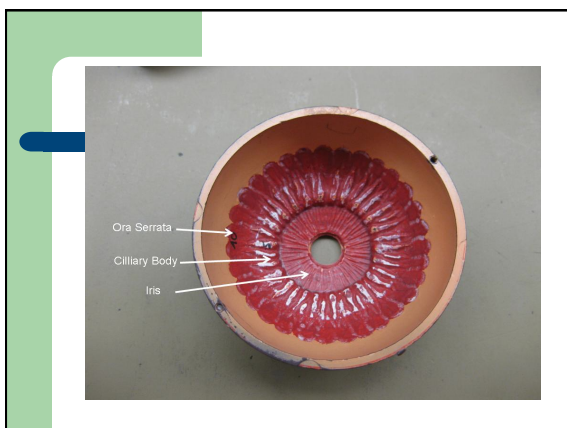
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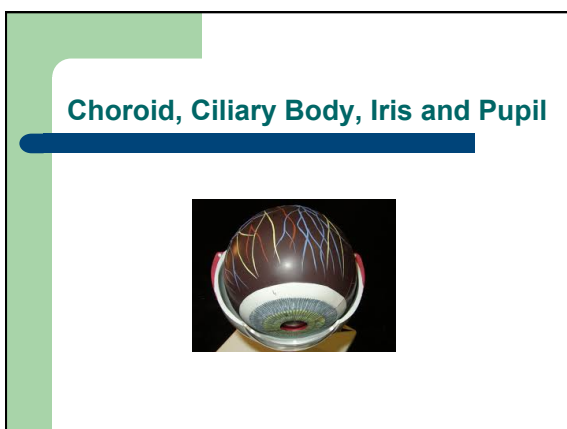
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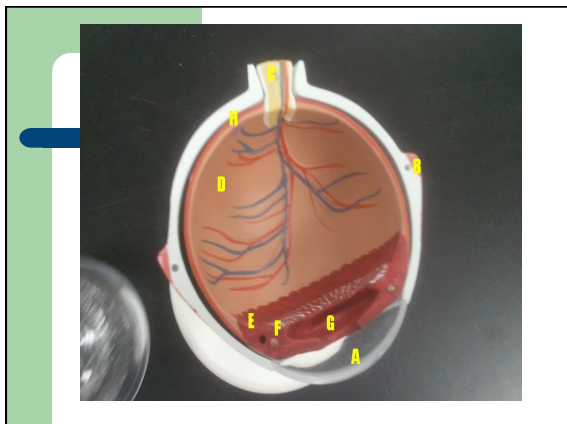
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