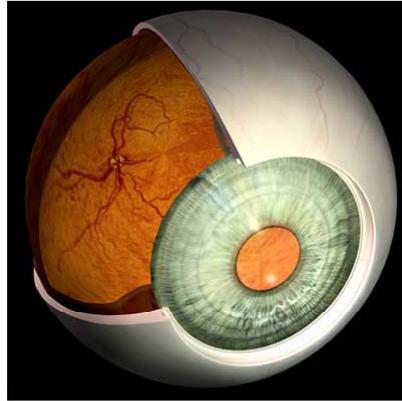
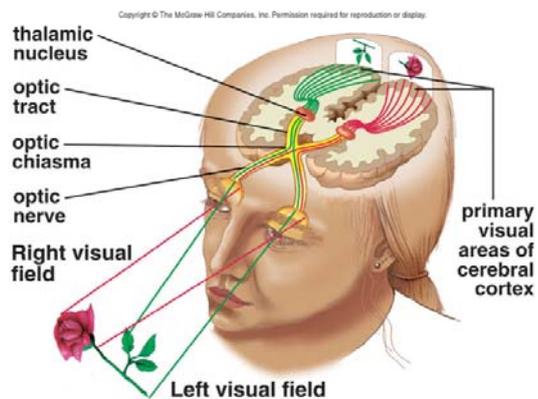


Anatomy of the human eye

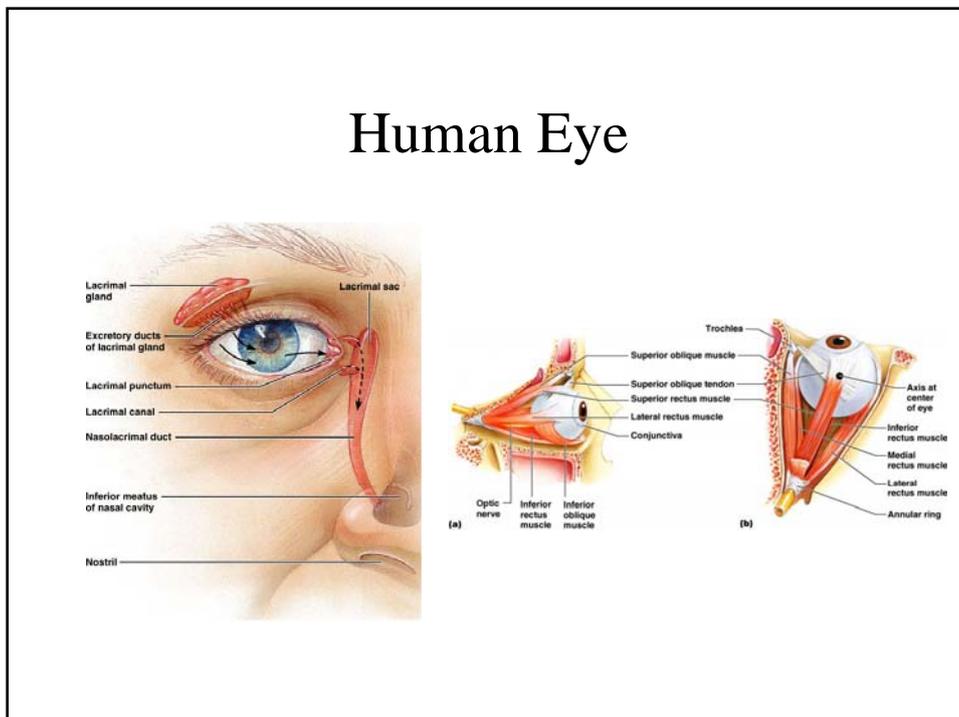
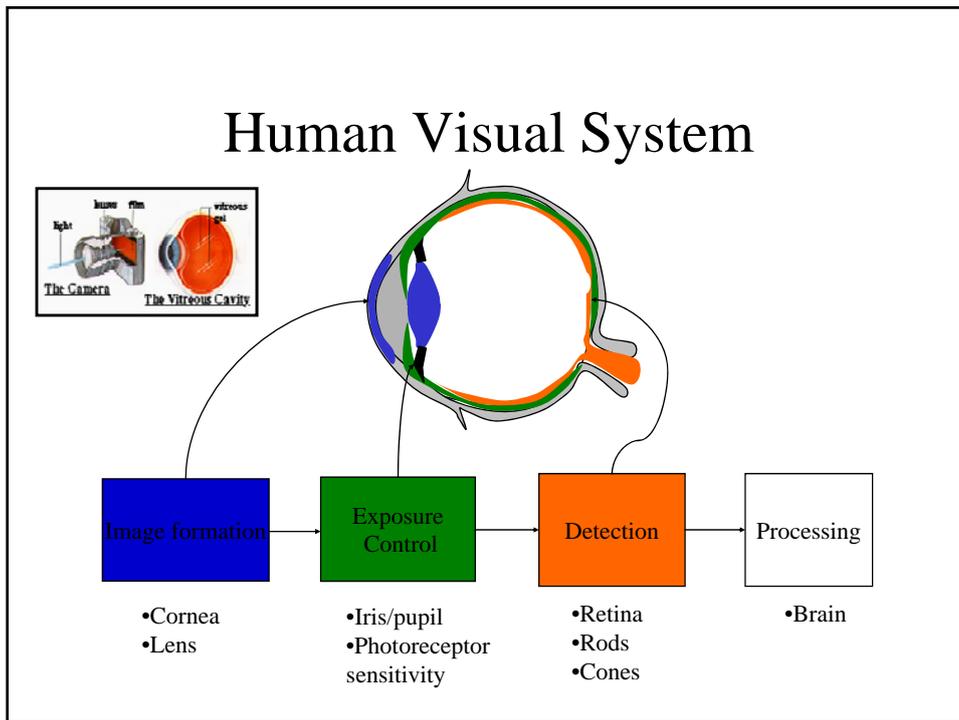
M. K. Tsilimbaris, MD
University of Crete Medical School



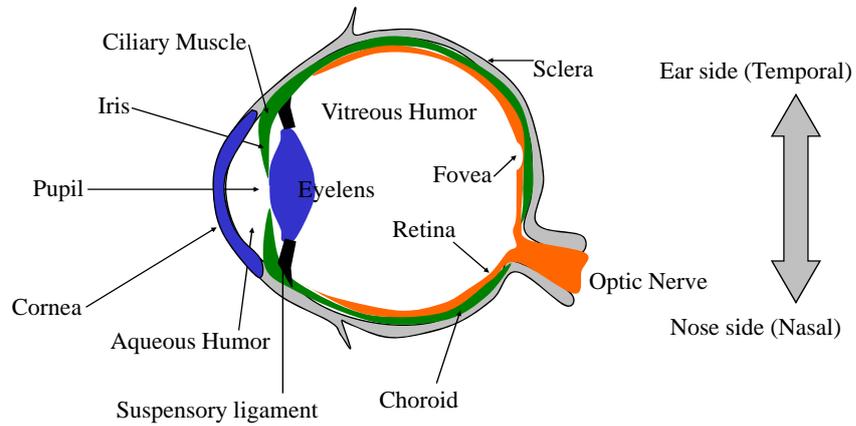
Human Visual System



- Sensation—The process of receiving, translating, and transmitting raw sensory data from the external and internal environments to the brain
- *Sensation* occurs when nerve impulses reach the cerebral cortex. The sensation that results depends on the part of the brain receiving the impulses.
- *Perception* is an interpretation of the meaning of sensations.
- It is the process of selecting, organizing, and interpreting sensory data into useful mental representations of the world

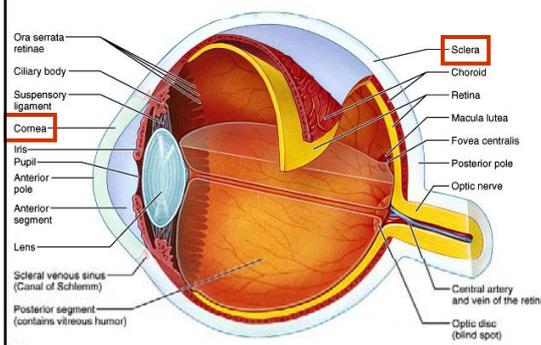


Human Eye



- Human eye is a complete imaging system.

Fibrous Tunic



- **Sclera Functions:**
- Protects eye
- Shapes eye
- Anchors eye muscles
- **Cornea Functions:**
- Transparent window for light entry
- Refracts light

Vascular Tunic

(a)
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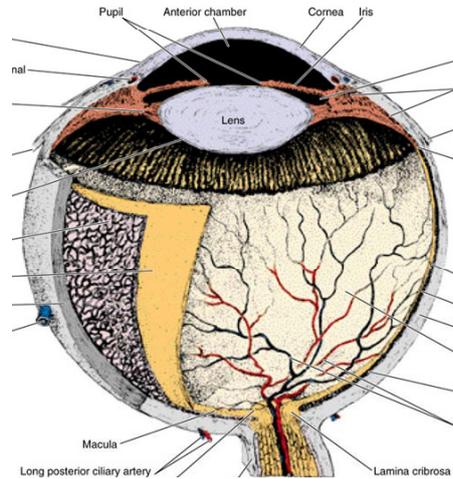
- **Choroid Functions:**
- Provides nutrients to all eye tunics.
- Absorbs light preventing reflecting & scattering of light within the eye.
- **Ciliary Body Functions:**
- Ciliary processes secrete aqueous humor.
- Suspensory ligaments hold lens in place.
- Ciliary muscles pull on the ligaments to change the thickness of the lens.

Sensory Tunic

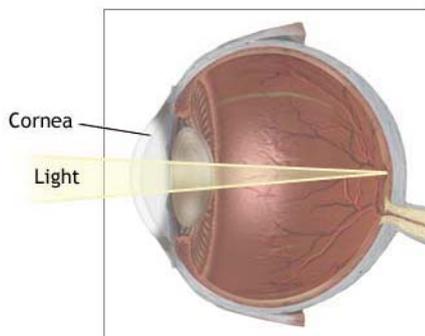
(a)
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- **Pigmented Layer**
- Absorbs light
- Carries out phagocytosis
- Stores Vitamin A
- **Neural Layer**
- Contains photoreceptors (rods and cones)
- Contains bipolar cells & ganglion cells for visual impulse processing and transmission

The eye globe: The layers



The eye globe: The segments

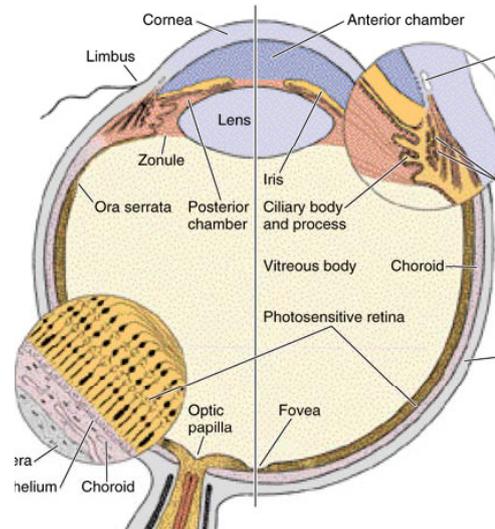


- In simple terms the **anterior segment** of the eye serves as the lens (cornea and crystalline) and the diaphragm of the camera.
- The aim of the anterior part is to focus a clear image onto the retina.

Refractive Bodies

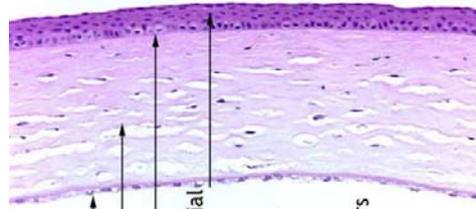
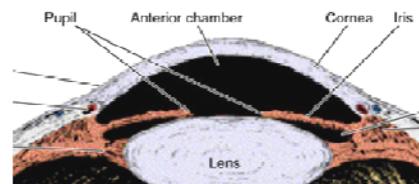
A. Cornea

B. Lens



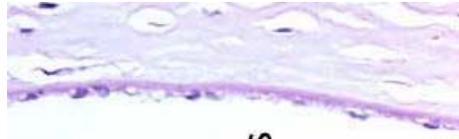
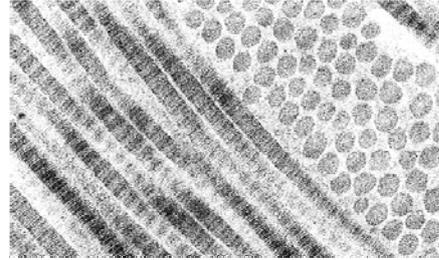
Cornea

- Composed of 5 layers, from the front to the back:
 - Epithelium.
 - Bowman's (anterior limiting) membrane.
 - Stroma (substantia propria).
 - Descemet's (posterior limiting) membrane.
 - Endothelium (posterior epithelium).



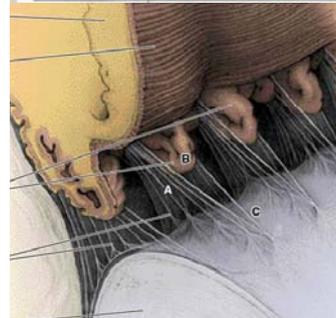
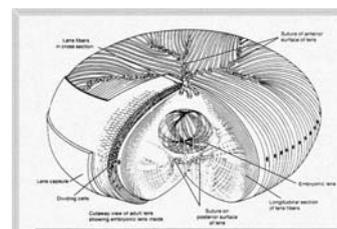
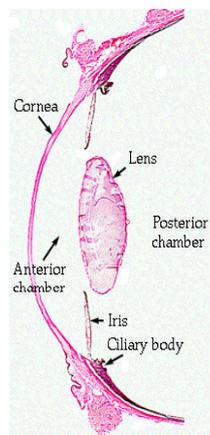
How does the cornea stay transparent?

- No blood vessels.
- Transparent stroma with low level of fluids.
 - Collagen fibrils
 - Endothelium cells serves as a pump that supply oxygen and remove fluids.
- Tear film also supplies oxygen and keep corneal surface smooth and clean.



Lens

- The lens is a naturally elastic structure
- Biconvex, avascular, transparent structure.
- Suspends behind the iris by the zonules which are connected to the ciliary body.
- Serves to converge light onto the retina.



The iris diaphragm

Parasympathetic stimulation causes circular muscles to contract

Sympathetic stimulation causes radial muscles to contract

(a) Constricted pupil (b) Normal pupil (c) Dilated pupil

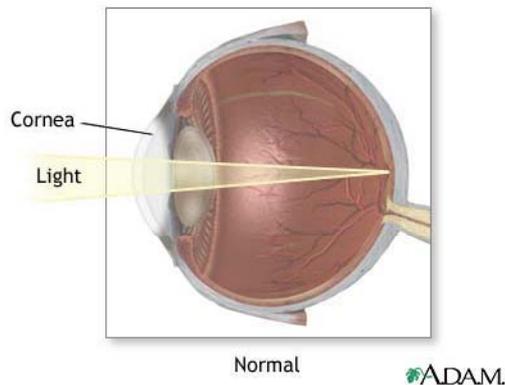
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The iris constricts or dilates to adjust size of the pupil.
The pupil allows light to enter the posterior segment of the eye.

The anterior segment internal circulation: The Aqueous Humor

- Helps support the eye internally due to the intraocular pressure it produces inside the eye.
- Supplies nutrients & oxygen to the cornea, lens and portions of the retina.
- Carries away metabolic wastes from the cornea, lens and portions of the retina.
- Glaucoma – any disturbance in AH circulation that increases IOP

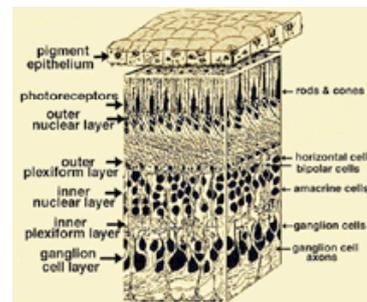
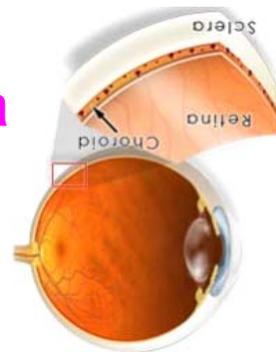
The eye globe: The segments



- In simple terms the **posterior segment** of the eye serves as the dark box and the film of the camera.
- The aim of the posterior segment is to transform the light into neural signal and send it to the brain.

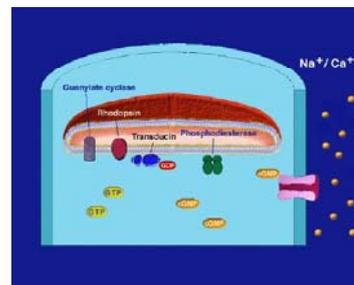
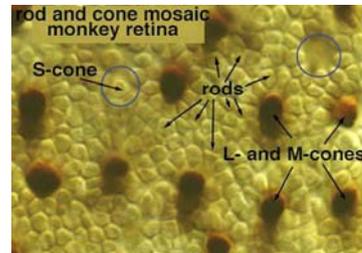
The retina

- The retina is approximately 0.5 mm thick and lines the back of the eye and is involved in signal transduction
- All vertebrate retinas are composed of three layers of nerve cell bodies and two layers of synapses.
- In general, dark "nuclear" or "cell" layers contain cell bodies, while pale "plexiform" layers contain axons and dendrites.



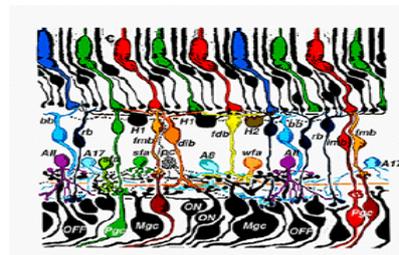
The photoreceptors

- Rods and cones (the names reflect their respective shapes) contain light sensitive pigments. Each photoreceptor consists of an outer segment which contains hundreds of thin plates of membrane (lamellae). The outer segment is connected by a cilium to an inner segment which contains a nucleus. [Rods](#) are about 500 times more sensitive to light than [cones](#), but cones give us colour vision



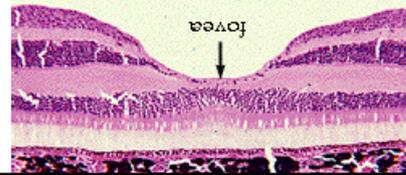
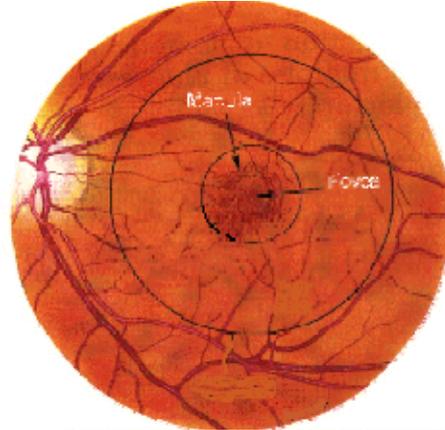
The ganglion cells

- Rather than a simple mosaic arrangement, neighbouring ganglion cells receive their inputs from overlapping arrays of receptors, thus a single spot of light can stimulate very many ganglion cells simultaneously.



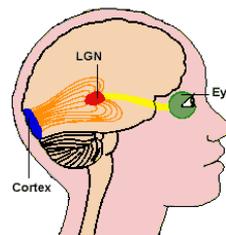
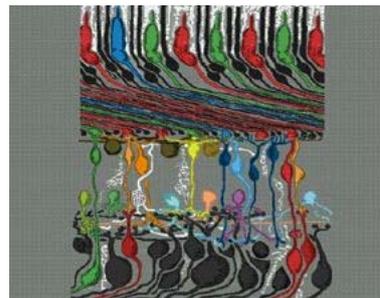
Retina

- **Fovea Centralis**
- Contains only closely packed cones
- Provides acute color vision in bright light
- **Macula Lutea**
- Contains more widely spaced cones
- **Other areas of Retina**
- Contain mainly rods
- Provide night, dim light & peripheral vision
- **Optic Disc**
- Contains no receptors
- Blind spot

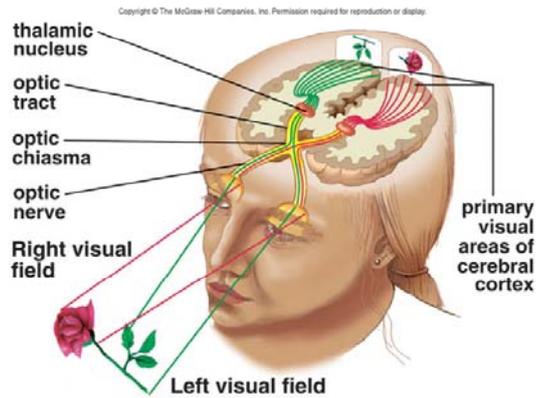


Trace the signal through the retina

- - Light enters from the GCL side first, and must penetrate all cell types before reaching the rods and cones.
- - The outer segments of the rods and cones transduce the light and send the signal through the cell bodies of the ONL and out to their axons.
- - In the OPL photoreceptor axons contact the dendrites of bipolar cells and horizontal cells. Horizontal cells are interneurons which aid in signal processing.
- - The bipolar cells in the INL process input from photoreceptors and horizontal cells, and transmit the signal to their axons.
- - In the IPL, bipolar axons contact ganglion cell dendrites and amacrine cells, another class of interneurons.
- - The ganglion cells of the GCL send their axons through the OFL to the optic disk to make up the optic nerve. They travel all the way to the lateral geniculate nucleus.



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