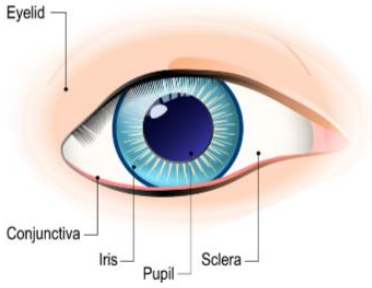
In this topic, are you able to:

- **label and describe** the internal and external structure of the eye?
- **describe** the pupil reflex in response to bright and dim light?
- **describe** the process of accommodation when viewing near and distant object (with reference to components of the eye)?

The external structure of the eye



Structure	Function
Eyelids	• Movable fleshy flap of skin which protects the cornea from excessive damage • Prevents excessive light from entering it when eye is partially closed (squinting) • Spreads tears over the eyes so that dust can be wiped off when blinking
Eyelashes	• Stiff hair that shield the eye from dust particles

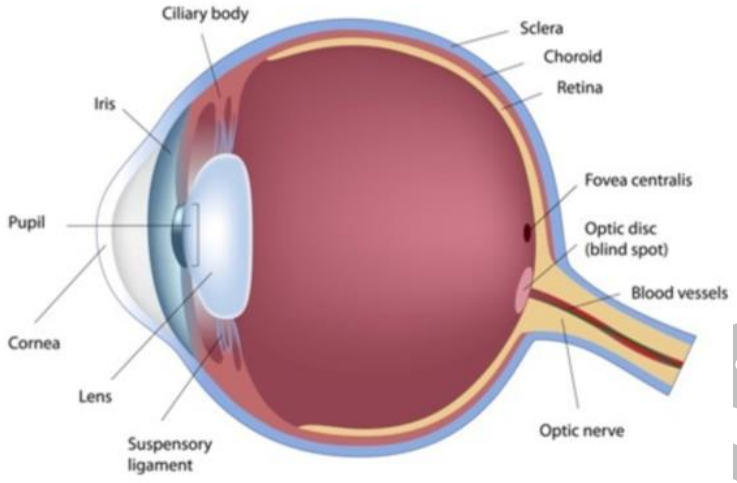
Tear gland	• Gland lying at corner of upper eyelid which secretes tears to:
	  ○ wash away dust particles
	  ○ keep the cornea moist for atmospheric oxygen to dissolve
	  ○ lubricate the conjunctiva which helps to reduce friction when the eyelids move

Conjunctiva	• A thin transparent layer covering the sclera and is continuous with skin of eyelids ○ A mucus membrane which secretes mucus to keep the front of the eyeball moist

Iris	• A circular sheet of muscles, which
	  ○ contains a pigment that gives the eye its colour
	  ○ controls the amount of light entering the eye by two sets of involuntary muscles - **the circular and radial muscles**

Cornea	• A dome-shaped transparent layer which is a specialized form of conjunctiva ○ helps to refract or bend light rays into the eye
Pupil	• A hole in the center of the iris which ○ allows light to enter the eye

The internal structure of the eye



Sclera	• Tough, white <u>outer</u> covering of the eyeball (continuous with the cornea)
	  ○ protects the inner parts of the eye from mechanical damage
	  ○ also supports and maintains the shape of the eye

Choroid	• <u>Middle</u> layer of the eyeball • Pigmented black to prevent the internal reflection of light • Contains blood vessels that carry oxygen and nutrients to the eyeball while removing metabolic waste products
Lens	• Transparent, circular and biconvex structure • Changes its shape or thickness in order to refract light onto the retina
Ciliary body	• Contains ciliary muscles • Control the curvature and thickness of the lens

Suspensory Ligament	• Attaches the edge of the lens to the ciliary body
Aqueous chamber	• Space between the lens and the cornea, which is filled with aqueous humour, a transparent watery fluid • Keeps the front of the eyeball firm • Refracts light into the pupil
Vitreous chamber	• Space behind the lens which is filled with vitreous humour, a transparent jelly-like substance • Keeps eyeball firm • Refracts light onto the retina
Retina	• Innermost layer of the eyeball • Layer on which images are formed • Contains light-sensitive cells known as photoreceptors - **rods and cones** • Photoreceptors connected to nerve ending from optic nerve
Optic Nerve	• Nerve that transmits nerve impulses to the brain upon stimulation of the photoreceptors
Fovea/yellow spot	• A small yellow depression where images are focused • Contains cones but not rods • Enables a person to have detailed colour vision in bright light • Fovea centralis is where vision is the sharpest

NOTE: Cornea, Aqueous Humour, Lens and Vitreous Humour has a common role – refract light rays onto the retina.

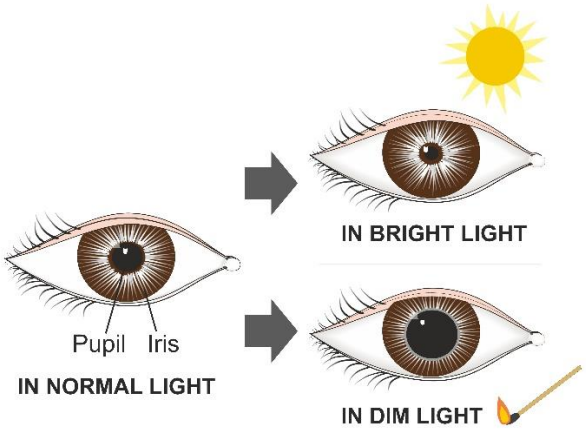
Photoreceptors in the Retina

Cones	Rods
• Three types of cones containing different pigments: **red, blue and green cones** • Each type of cones absorbs light of different wavelengths and together, they enable to see a variety of colours • Cones do not work well in dim light	• Rods are more sensitive to light than cones • They enable us to see in dim light, but only in black or white • Contain a pigment called visual purple

How does the iris control the amount of light entering our eyes?

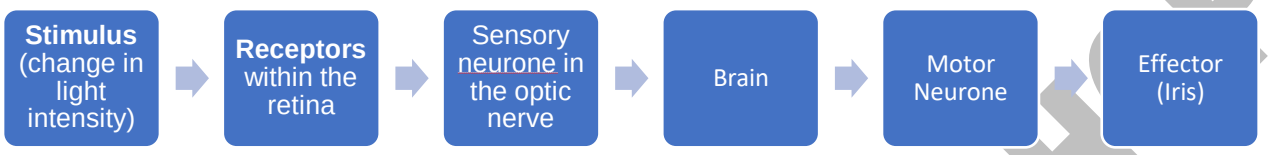
- The iris is controlled by two sets of involuntary muscles – the radial and circular muscles
- The muscles are antagonistic to each other - when one contracts, the other relaxes

In Bright Light	In Dim Light
• Circular muscles contract • Radial muscles relax • Pupil constricts • Reduces the amount of light entering the eye	• Circular muscles relax • Radial muscle contract • Pupil dilates • Increases the amount of light entering the eye

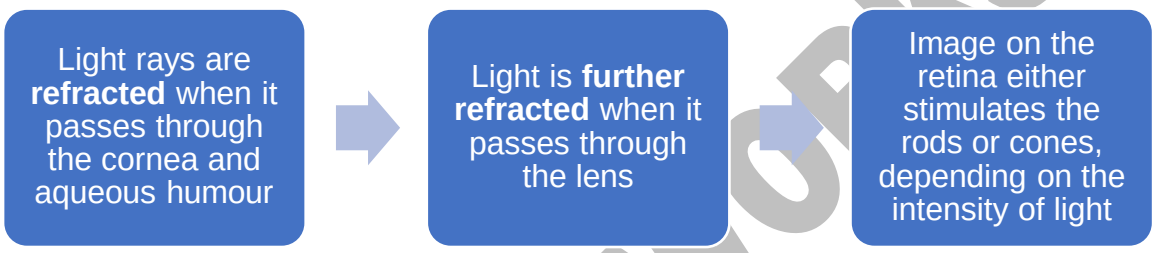


What is a pupil reflex?

- It is a reflex which involves the pupil changes size as result of changes in light intensity
- Involves receptors and effectors



How is an image formed on the retina?

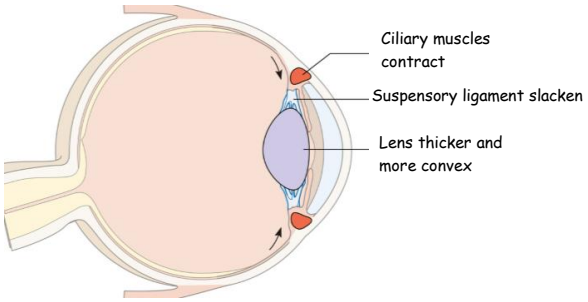
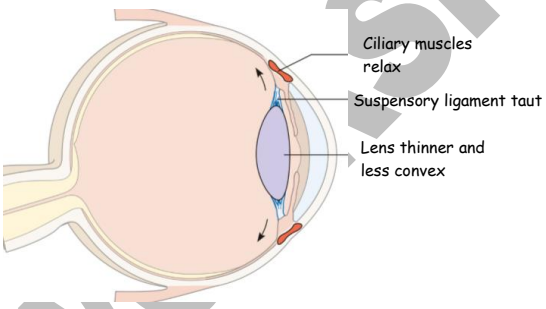


What is the role of the brain in vision?

- Image formed on the retina is inverted, laterally inverted and smaller in size than the real object
  - This means image is upside down within the retina, but the brain makes it upright
- The brain has corrective function
  - In the case of the blind who have their sight restored, objects appear upside down to them at first
  - The brain will learn how to correct the images that fall on the retina

What is focusing?

- Focusing or accommodation is the adjustment of the lens of the eye so that clear images of objects at different distances are formed on the retina
- In focusing, the thickness or curvature of the lens is adjusted
    - This allows the light rays to be focused on the retina, hence enabling a clear image to form on the retina

Viewing NEAR objects	Viewing DISTANT objects
	
• Ciliary muscles **contract**, relaxing their pull on the suspensory ligaments • Suspensory ligaments **slacken**, relaxing their pull on the lens • Lens become **thicker and more convex**, **decreasing** its focal length • Light rays are focused on the retina • Photoreceptors are stimulated • Nerve impulses are transmitted to the brain, which is interpreted by the brain that allows the person to see the object	• Ciliary muscles **relax**, pulling on the suspensory ligaments • Suspensory ligaments become **taut**, pulling on the edge of the lens • Lens become **thinner and less convex**, **increasing** its focal length • Light rays are focused on the retina • Photoreceptors are stimulated • Nerve impulses are transmitted to the brain, which is interpreted by the brain that allows the person to see the object

NOTE: Focal length is the distance between the middle of the lens to the point of focus on the retina.