

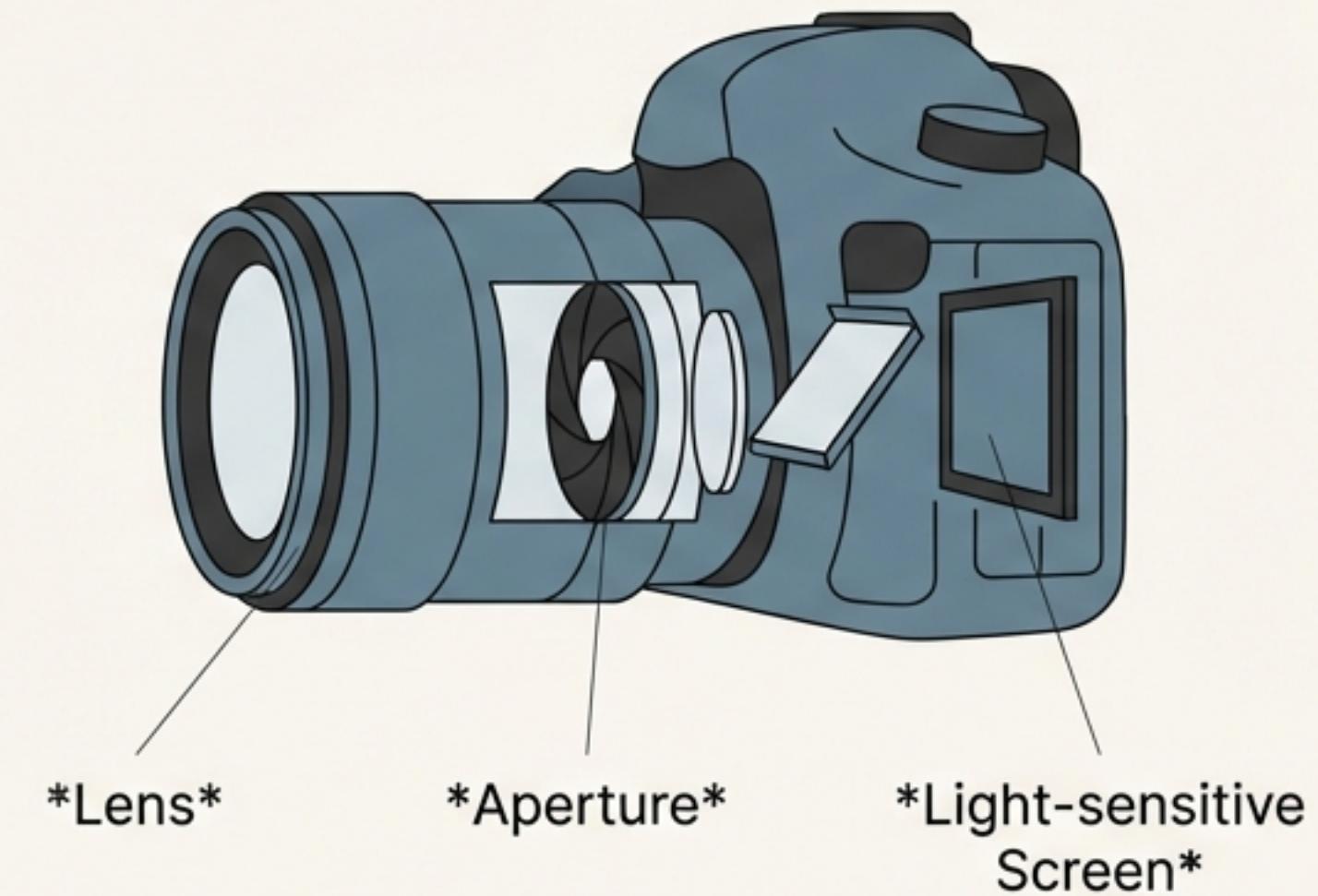
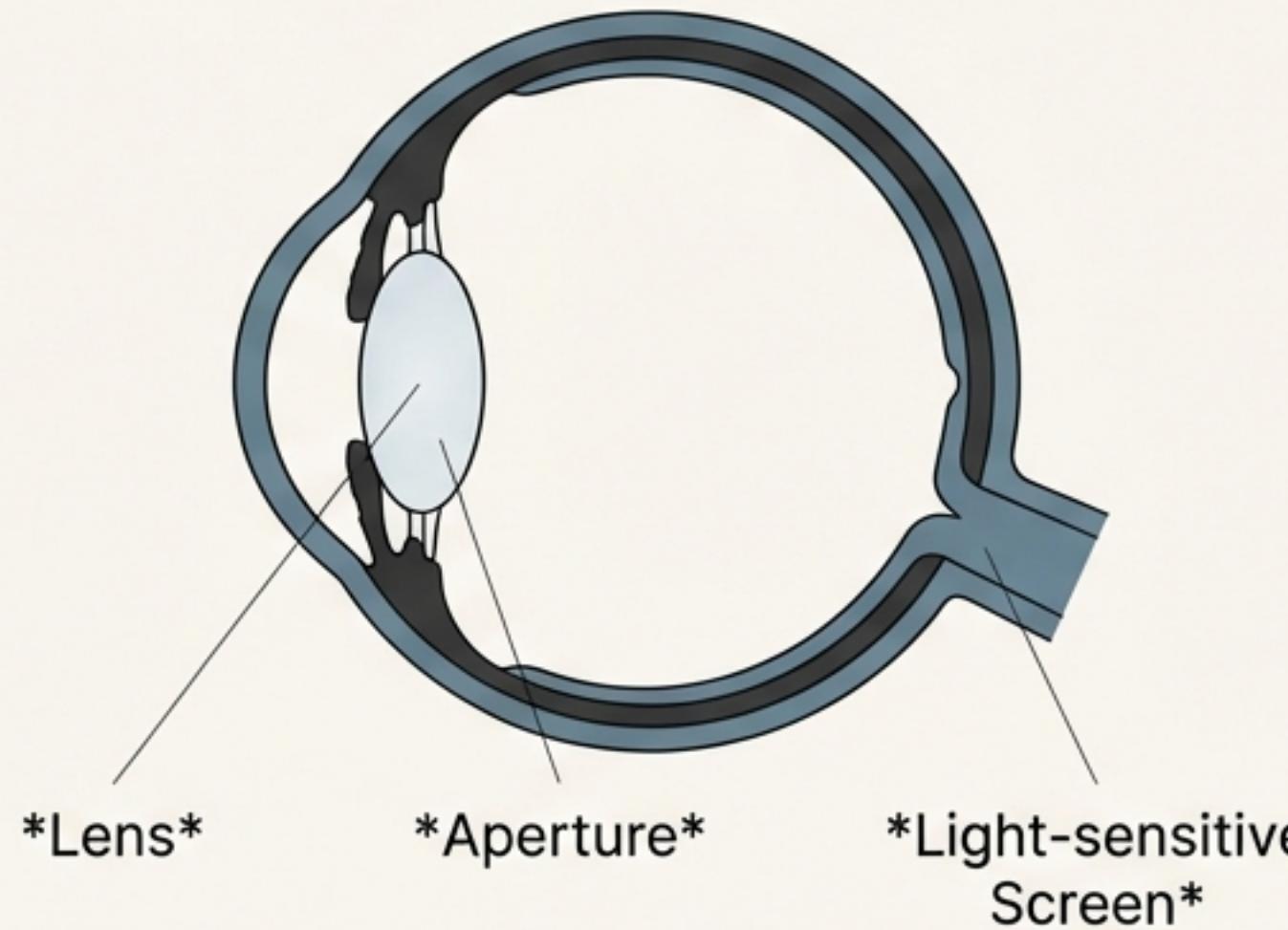


# The Optics of Sight

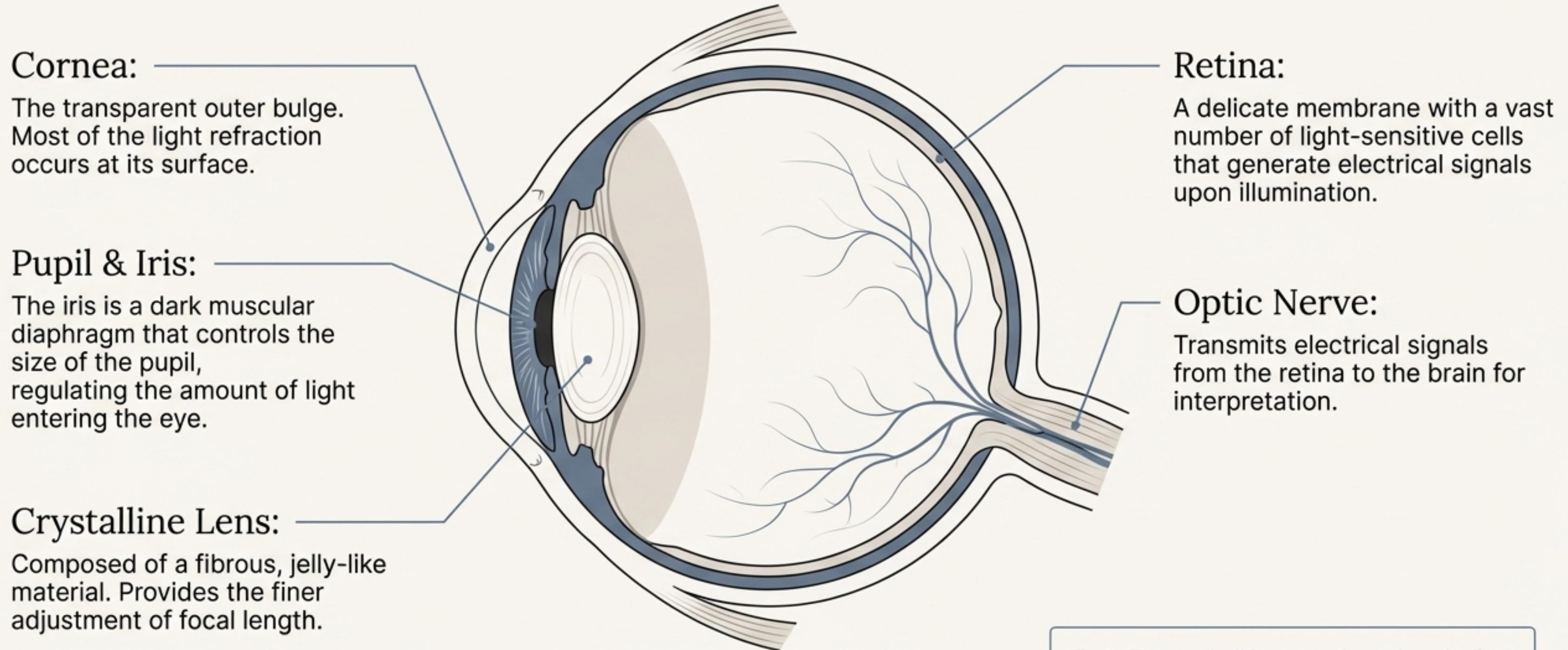
An Inside Look at the Human Eye and Its Imperfections

# Nature's Ultimate Optical Instrument

The human eye is like a camera. Its lens system forms an image on a light-sensitive screen called the retina.



# Anatomy of Vision

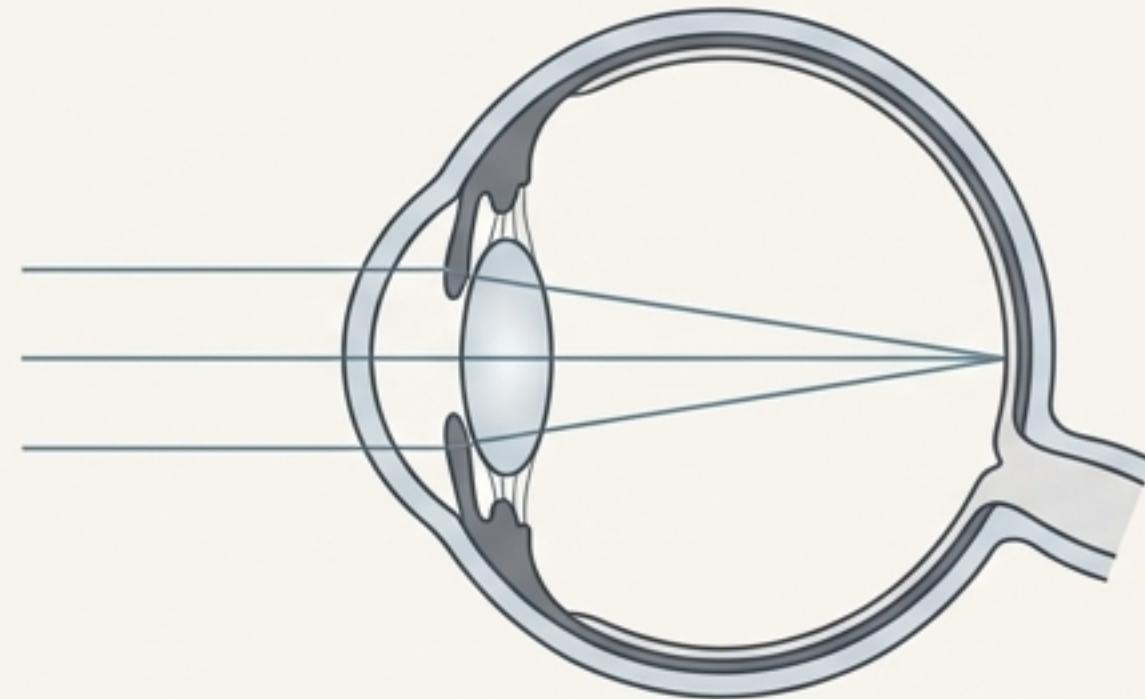


Fact: The eyeball is approximately spherical in shape with a diameter of about 2.3 cm.

# The Power of Accommodation: The Eye's Autofocus

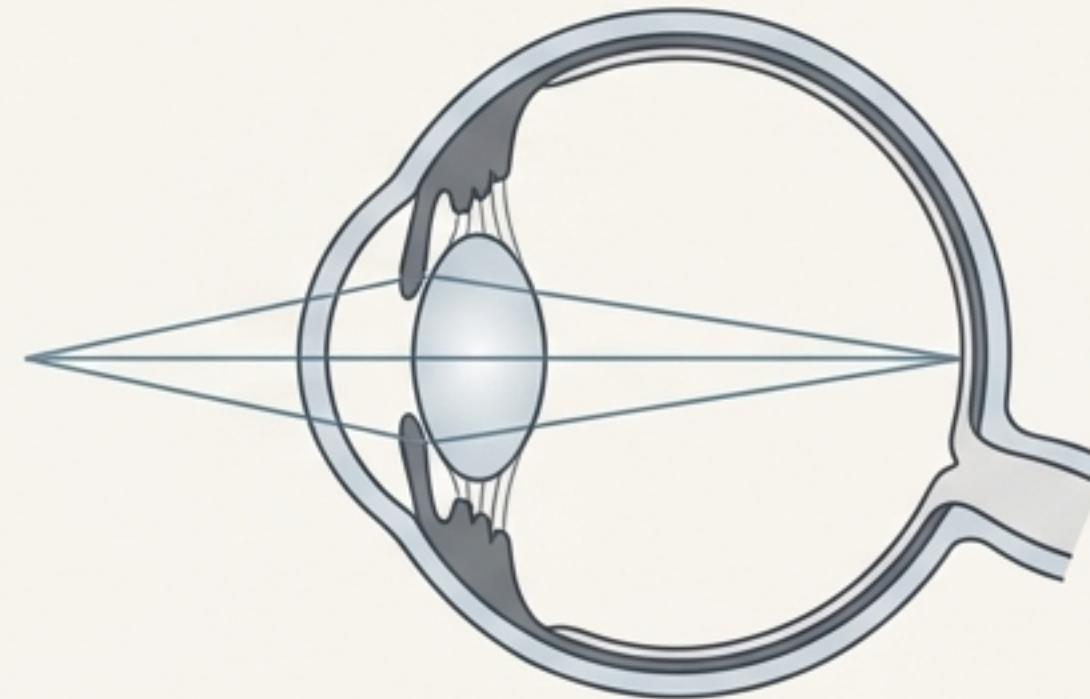
The ability of the eye lens to adjust its focal length is called accommodation.

Viewing Distant Objects



Muscles Relaxed -> Lens Thinner -> Focal Length Increases.

Viewing Near Objects



Muscles Contract -> Lens Thicker -> Focal Length Decreases.

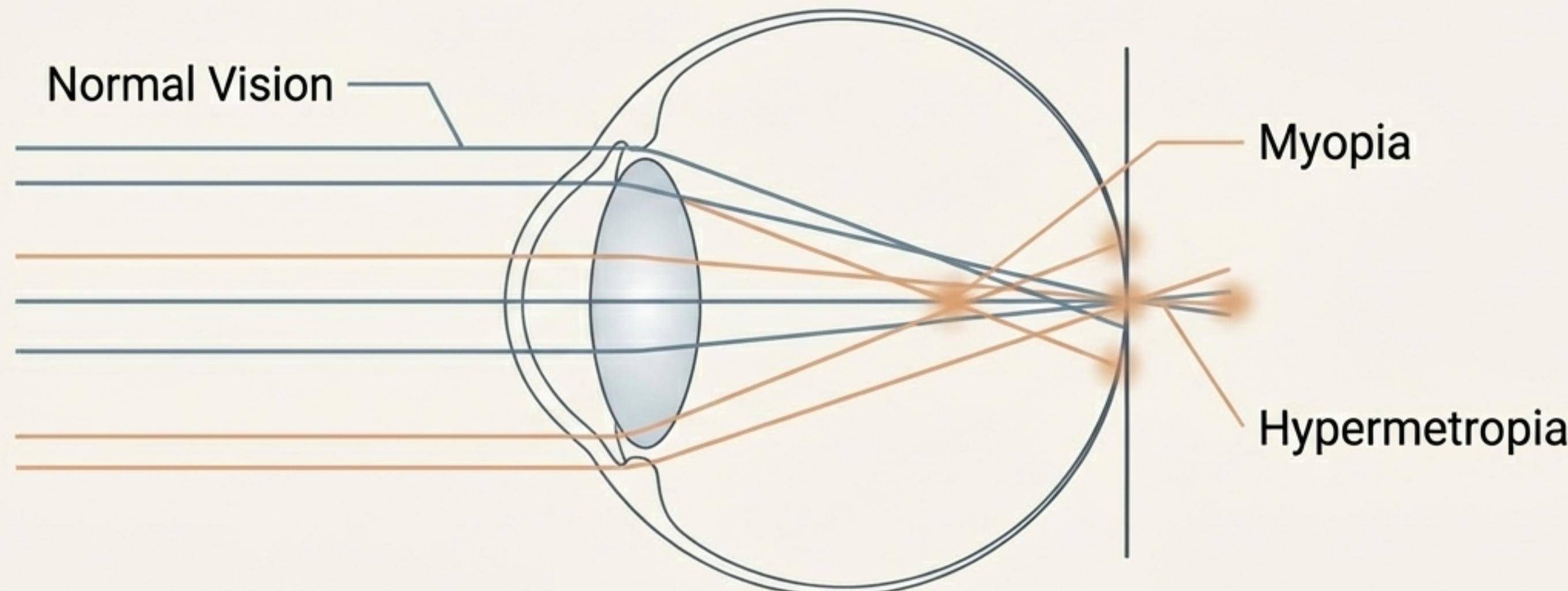
## Key Terms

**Far Point:** The farthest point the eye can see clearly. For a normal eye, this is **infinity**.

**Near Point:** The minimum distance at which objects can be seen distinctly without strain. For a young adult with normal vision, this is about **25 cm**.

# When the Focal Point Misses Its Mark

Sometimes, the eye may gradually lose its power of accommodation.  
The vision becomes blurred due to refractive defects of the eye.



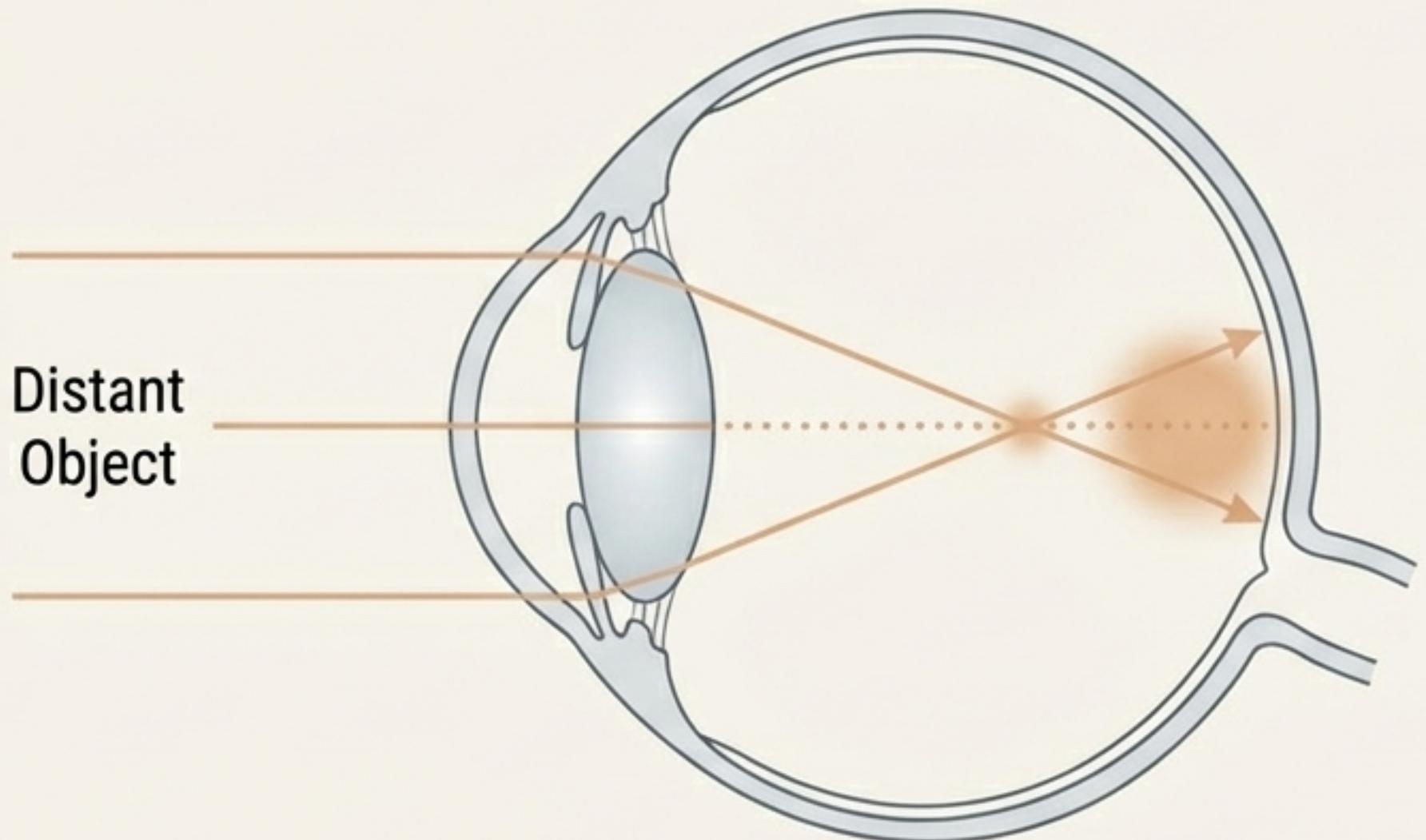
We will explore the three common refractive defects: Myopia, Hypermetropia, and Presbyopia.

# Defect 1: Myopia (Near-sightedness)

**Symptom:** A person with myopia can see nearby objects clearly but cannot see distant objects distinctly. The far point is nearer than infinity.

## Causes:

1. Excessive curvature of the eye lens.
2. Elongation of the eyeball.

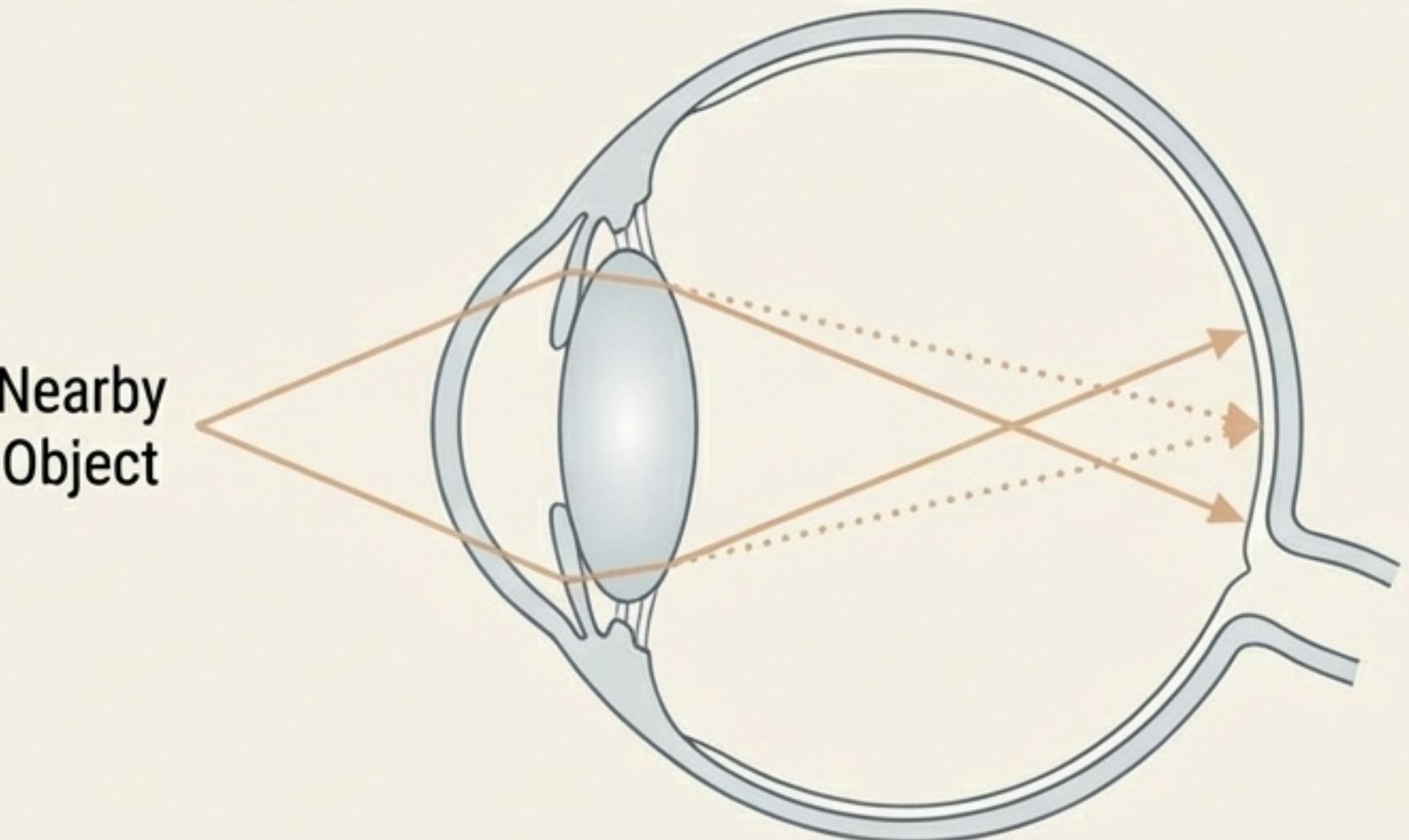


## Defect 2: Hypermetropia (Far-sightedness)

**Symptom:** A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly. The near point is farther away from the normal 25 cm.

### Causes:

1. The focal length of the eye lens is too long.
2. The eyeball has become too small.



# Defect 3: Presbyopia (The Aging Eye)

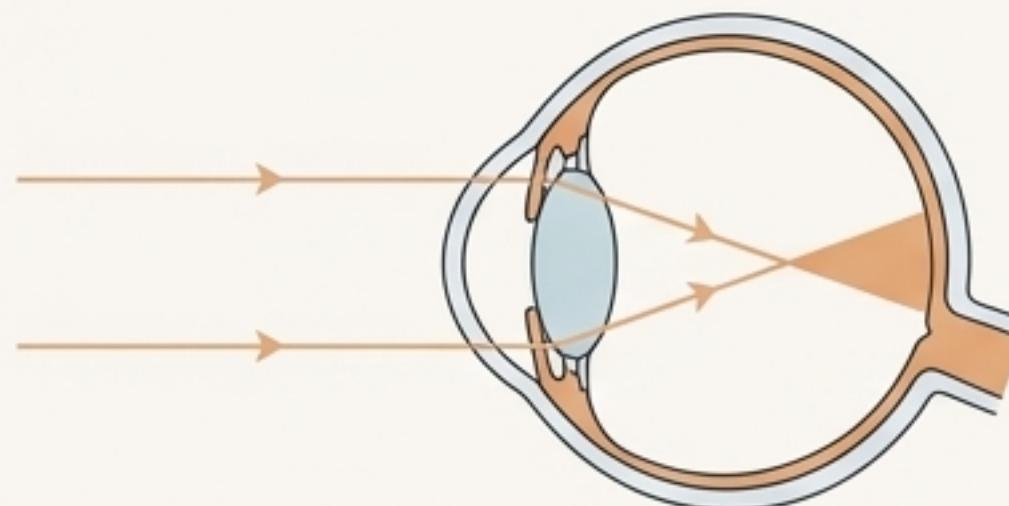
**Symptom:** The power of accommodation of the eye usually decreases with ageing. For most people, the near point gradually recedes away, making it difficult to see nearby objects comfortably.

**Core Mechanism:** This is a direct loss of accommodation power.

## Causes:

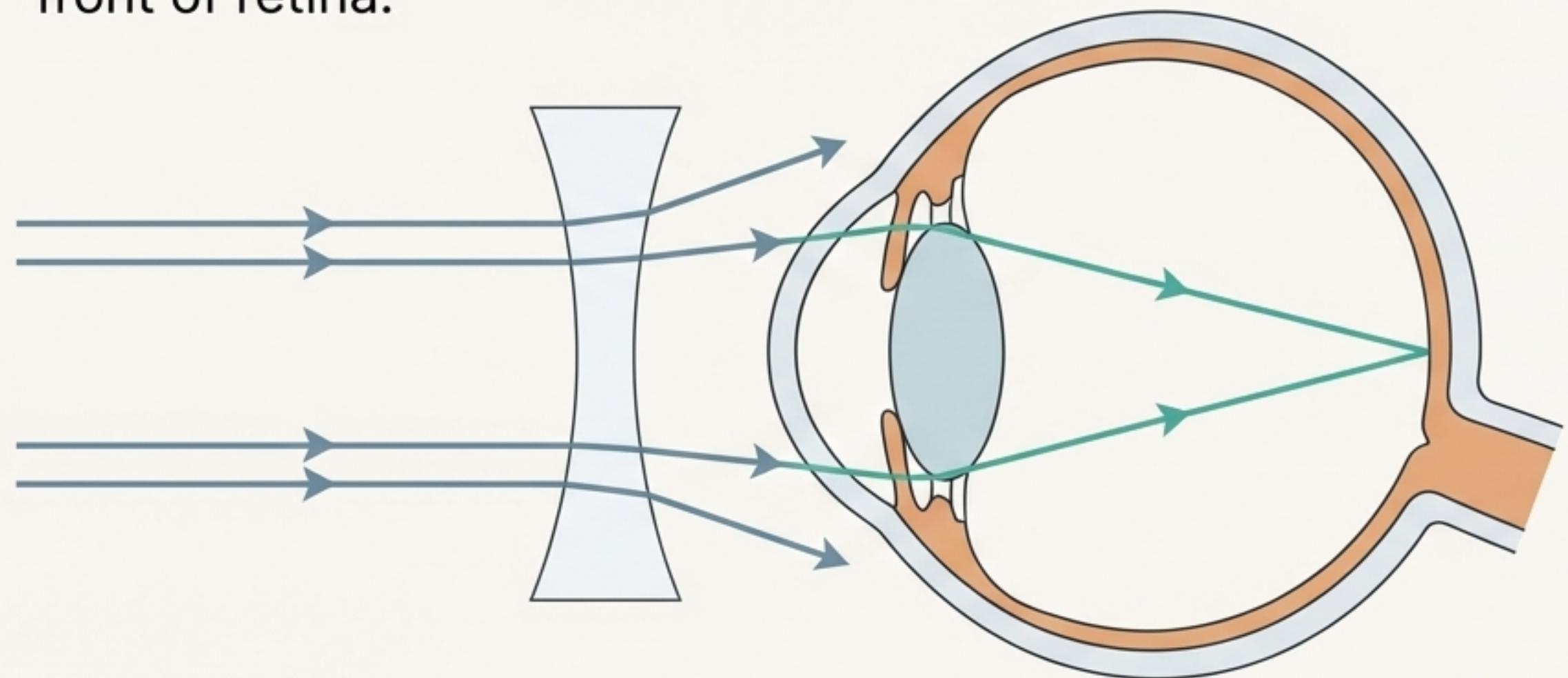
1. Gradual weakening of the ciliary muscles.
2. Diminishing flexibility of the eye lens.

# Correction for Myopia: The Diverging Lens



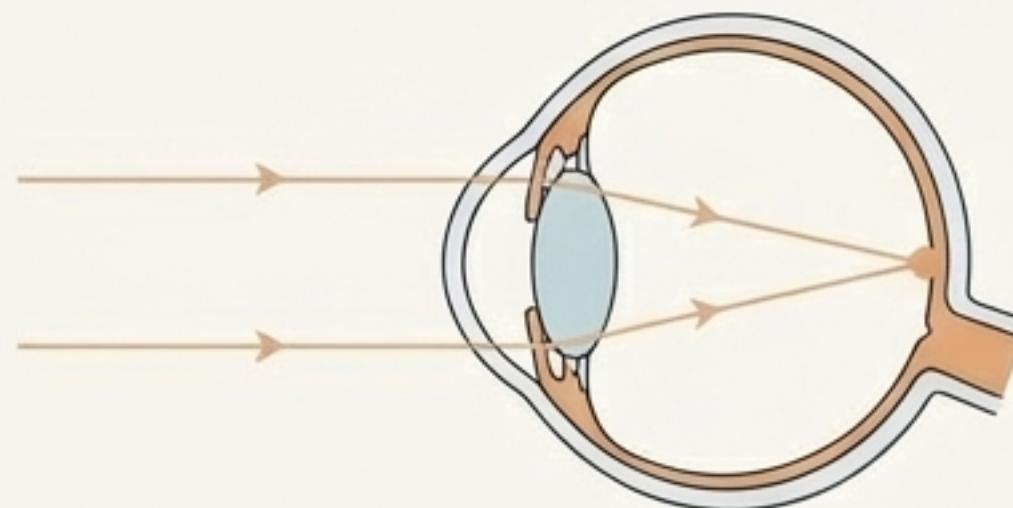
**Problem:** Focus is in front of retina.

**Solution:** Concave lens corrects the focus.



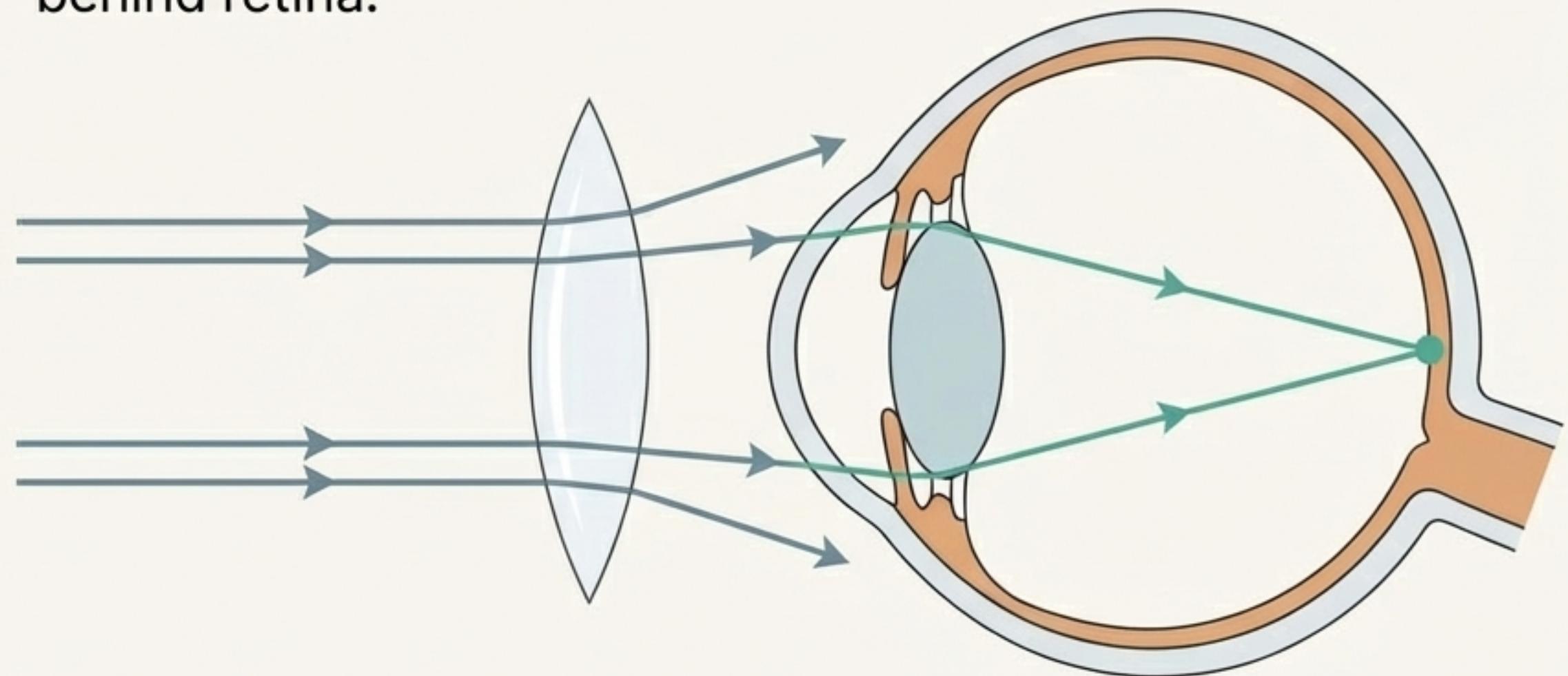
**\*\*Mechanism\*\*:** This defect can be corrected by using a concave lens of suitable power. The lens brings the image back on to the retina, and thus the defect is corrected.

# Correction for Hypermetropia: The Converging Lens



**Problem:** Focus is behind retina.

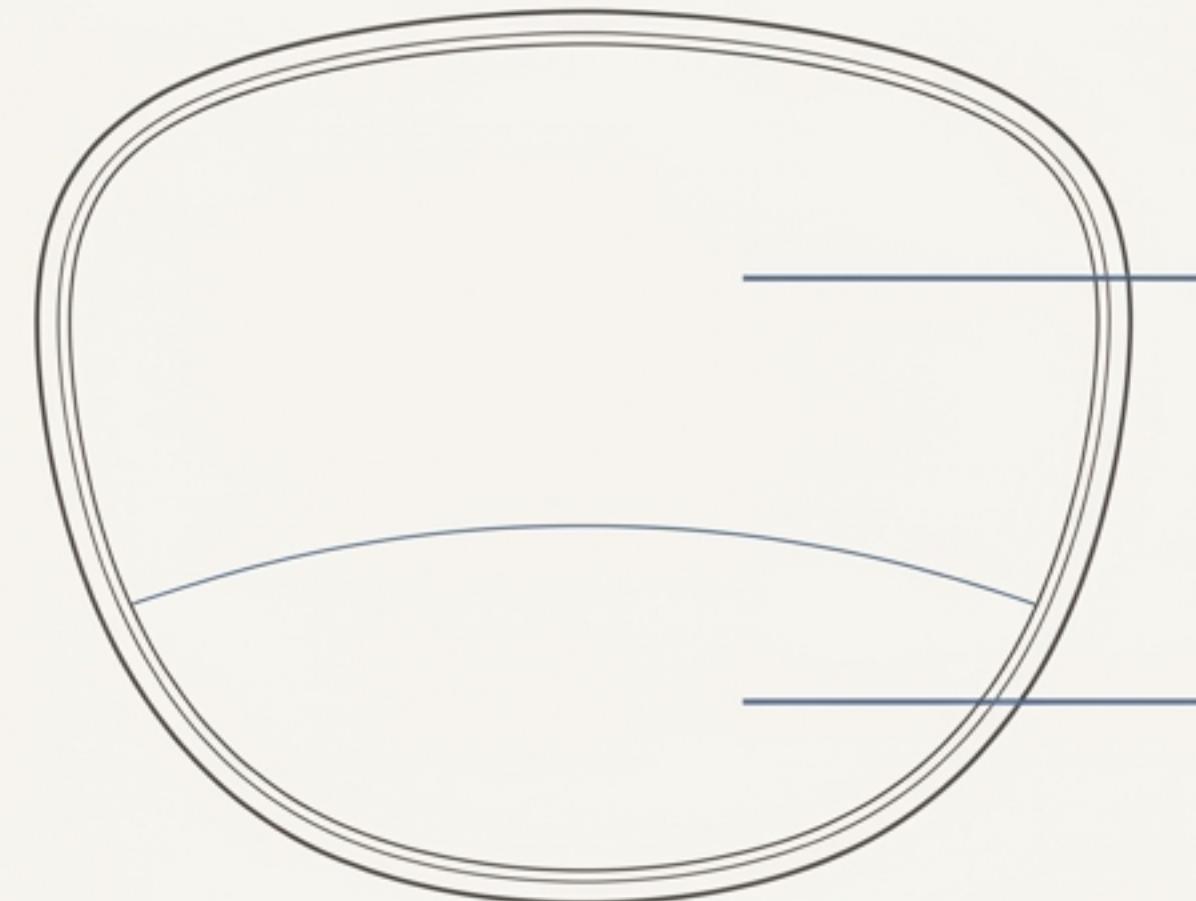
**Solution:** Convex lens corrects the focus.



**\*\*Mechanism\*\*:** This defect can be corrected by using a convex (converging) lens of appropriate power. The lens provides the additional focussing power required for forming the image on the retina.

# A Multifocal Solution for Complex Needs

Sometimes, a person may suffer from both myopia and hypermetropia.  
Such people often require bi-focal lenses.



Upper Portion: Concave Lens  
- Facilitates distant vision.

Lower Portion: Convex Lens  
- Facilitates near vision.

**\*\*Modern Alternatives\*\*:** It is now possible to correct refractive defects with contact lenses or through surgical interventions.

# Beyond Refraction: When the Lens Itself Is the Obstacle

**\*\*Condition\*\*: Cataract**

**\*\*Description\*\*: Sometimes, the crystalline lens of people at old age becomes milky and cloudy. This condition is called cataract and causes partial or complete loss of vision.**



Normal Vision



View with Cataract

**\*\*Solution\*\*: It is possible to restore vision through a cataract surgery.**

# Vision: A System in Balance

Refractive Defect	The Cause	The Correction
<b>Myopia</b> (Near-sightedness)	Image forms <i>in front of</i> the retina	<b>Concave Lens</b> (Diverges light)
<b>Hypermetropia</b> (Far-sightedness)	Image forms <i>behind</i> the retina	<b>Convex Lens</b> (Converges light)
<b>Presbyopia</b>	Loss of accommodation power with age	<b>Convex or Bifocal Lens</b>

# The Gift of Sight

Our eyes can live on even after our death.

About 4.5 million people with corneal blindness can be cured through  
**corneal transplantation of donated eyes.**

One pair of eyes gives vision to up to **FOUR CORNEAL BLIND PEOPLE.**

**So, if we have got the gift of vision, why not pass it on to  
somebody who does not have it?**