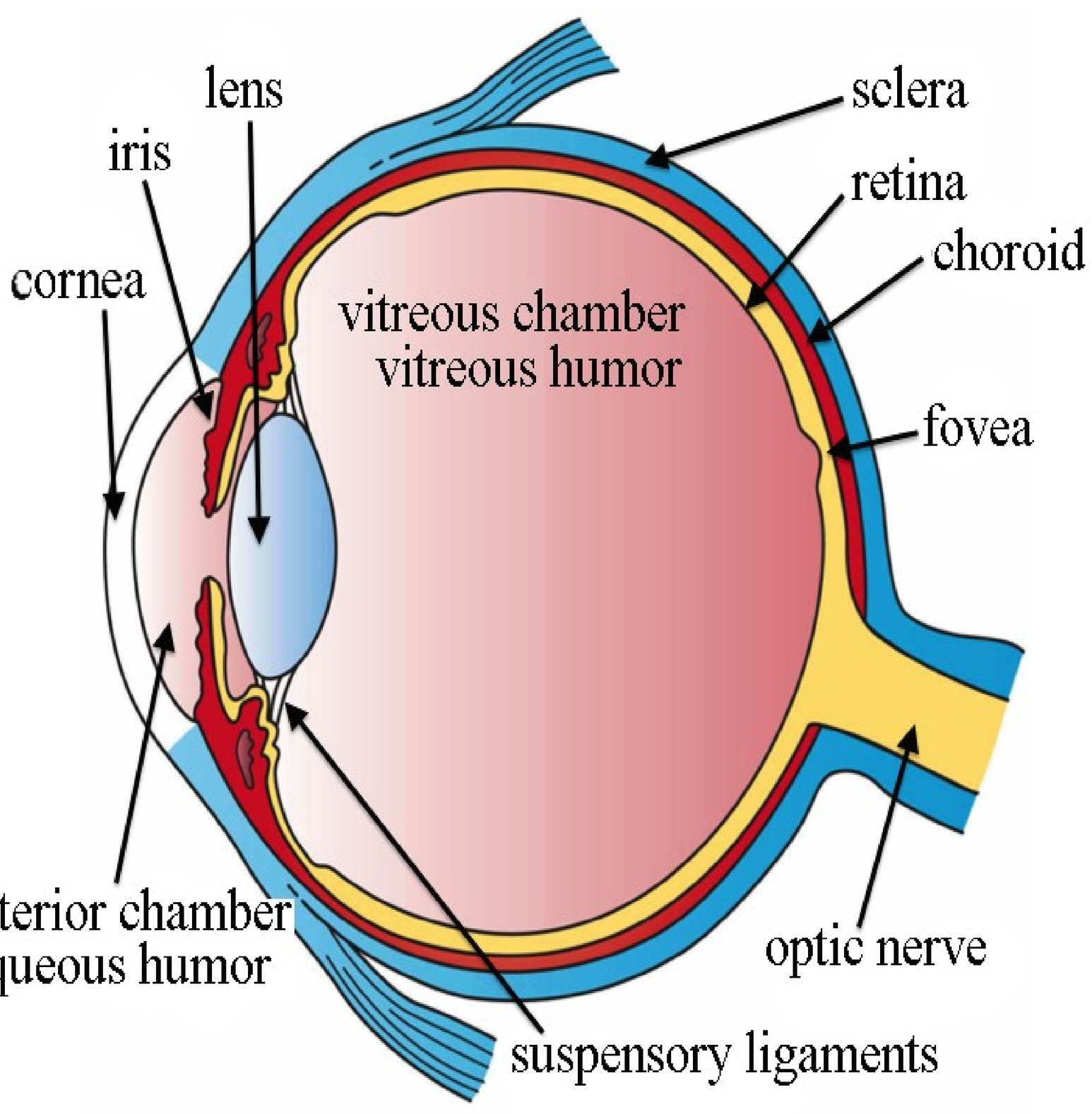
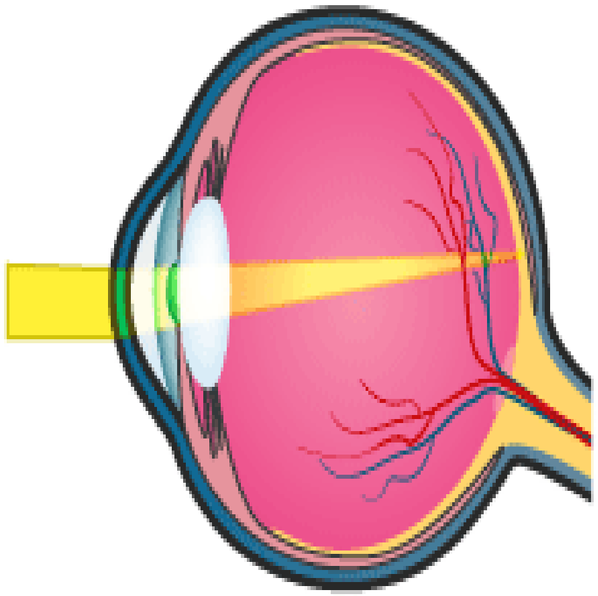
PRESENTATION BY

SANTHIT
CINTHIA C


lens
sclera
iris
retina
choroid
cornea
vitreous chamber
vitreous humor
fovea
anterior chamber
aqueous humor
optic nerve
suspensory ligaments

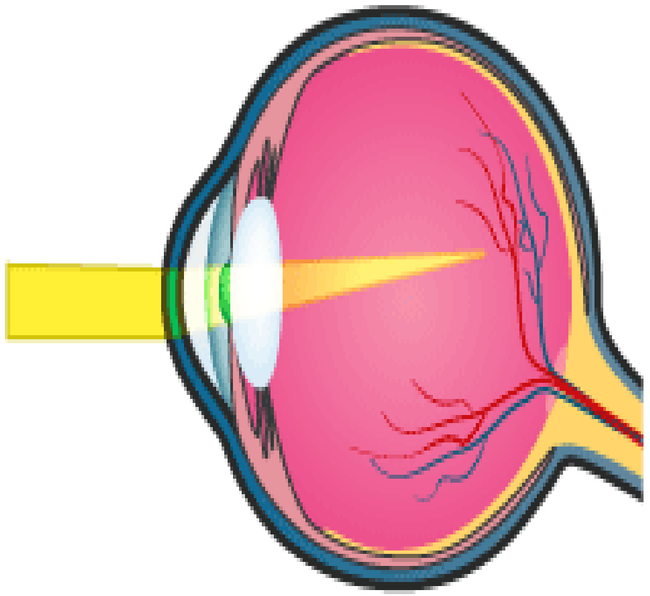
NORMAL VISION AND MYOPIA

BYJU'S The Learning App



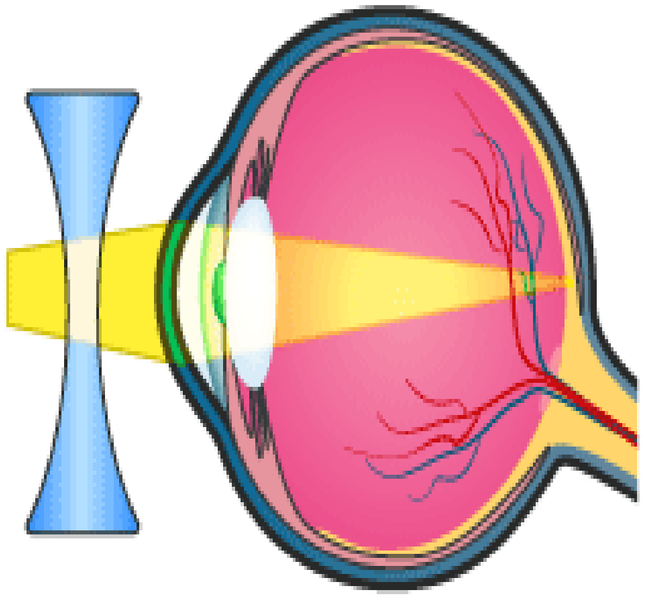
Normal vision

Faraway object is clear



Myopia

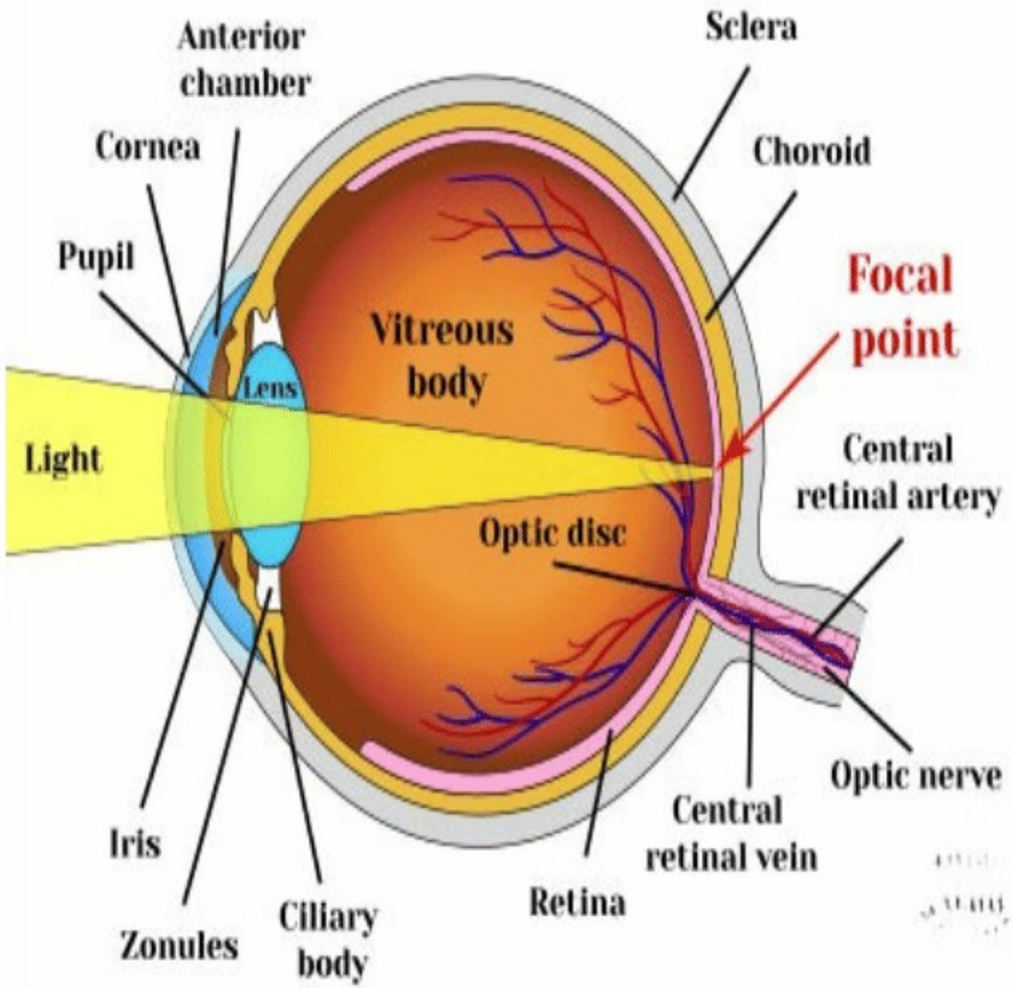
Nearsighted eye the eyeball is too long faraway object is blurry



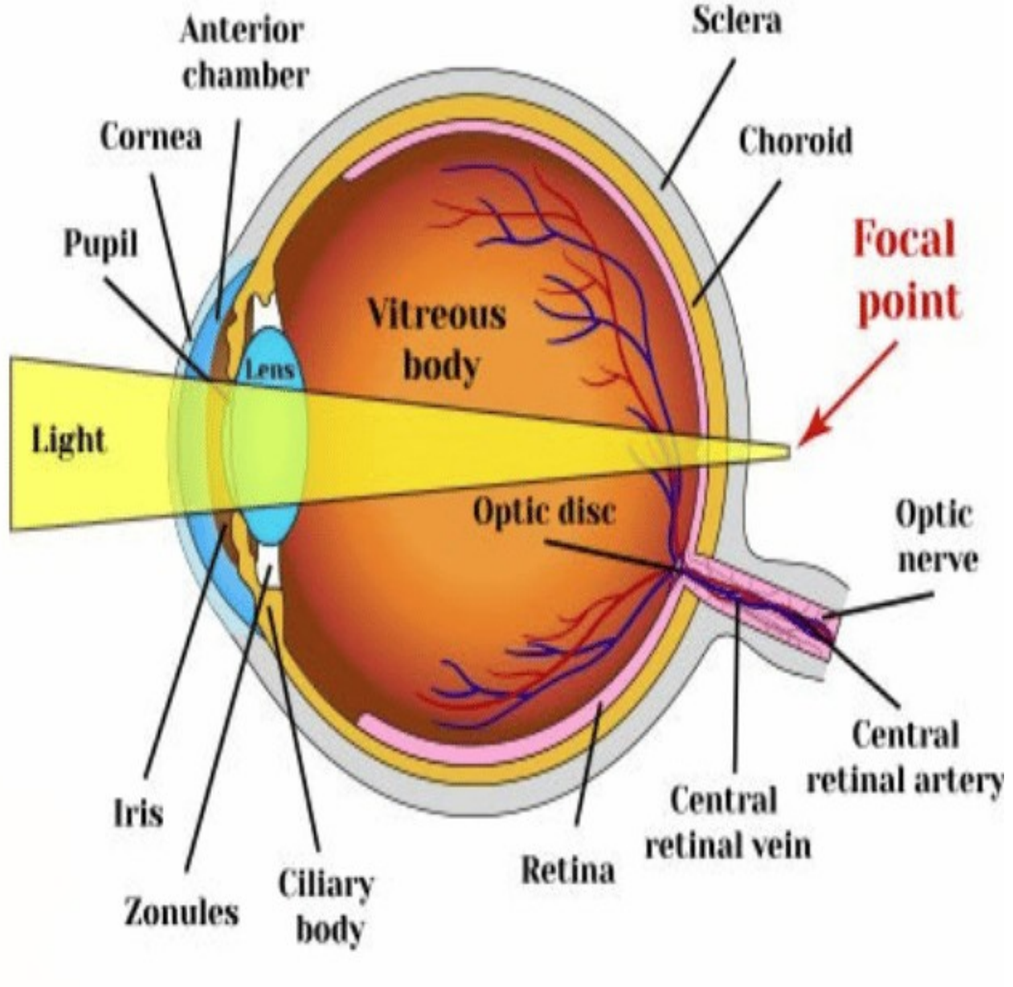
Myopia corrected

Correction with a minus lens

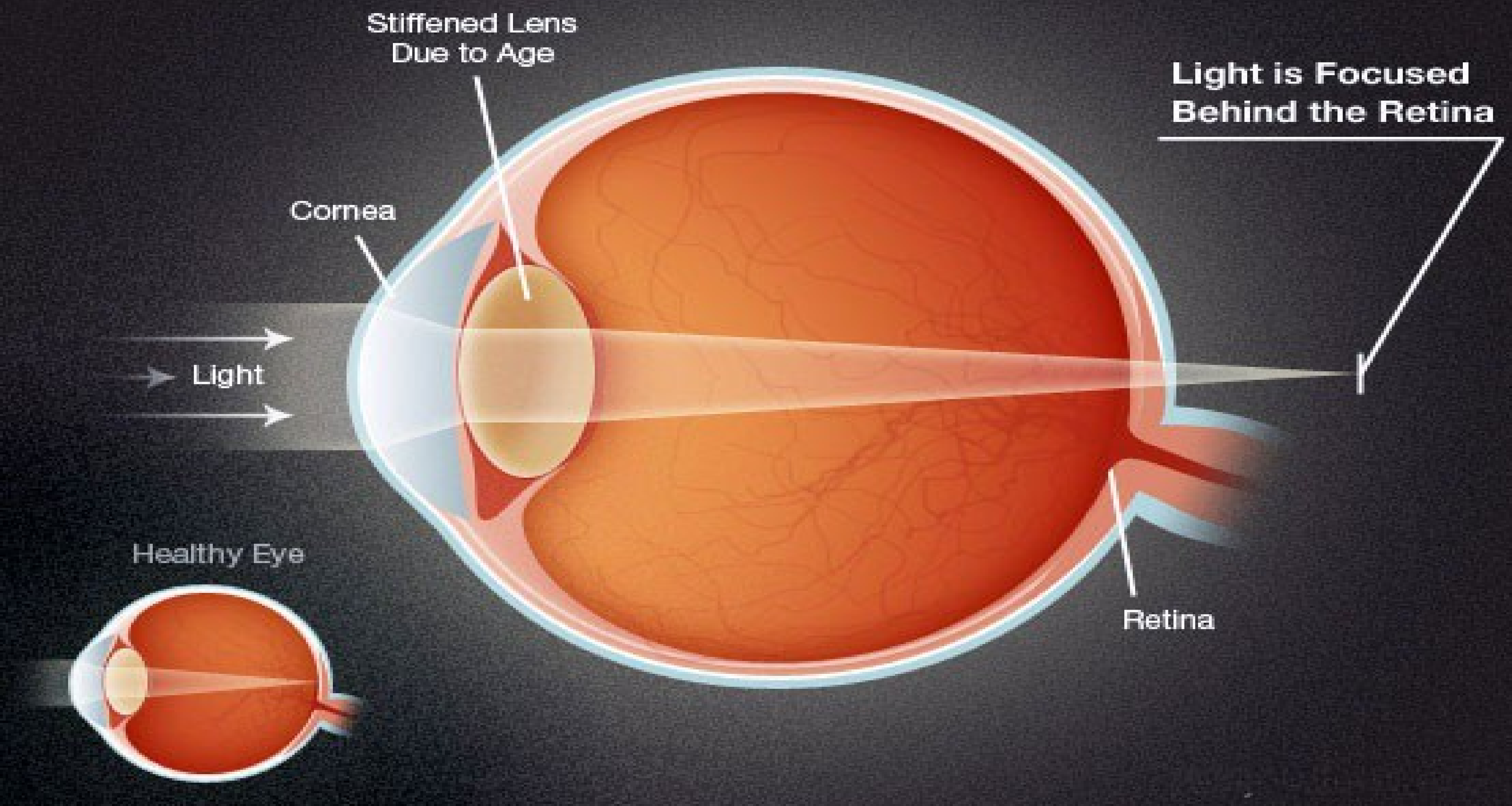
Normal vision



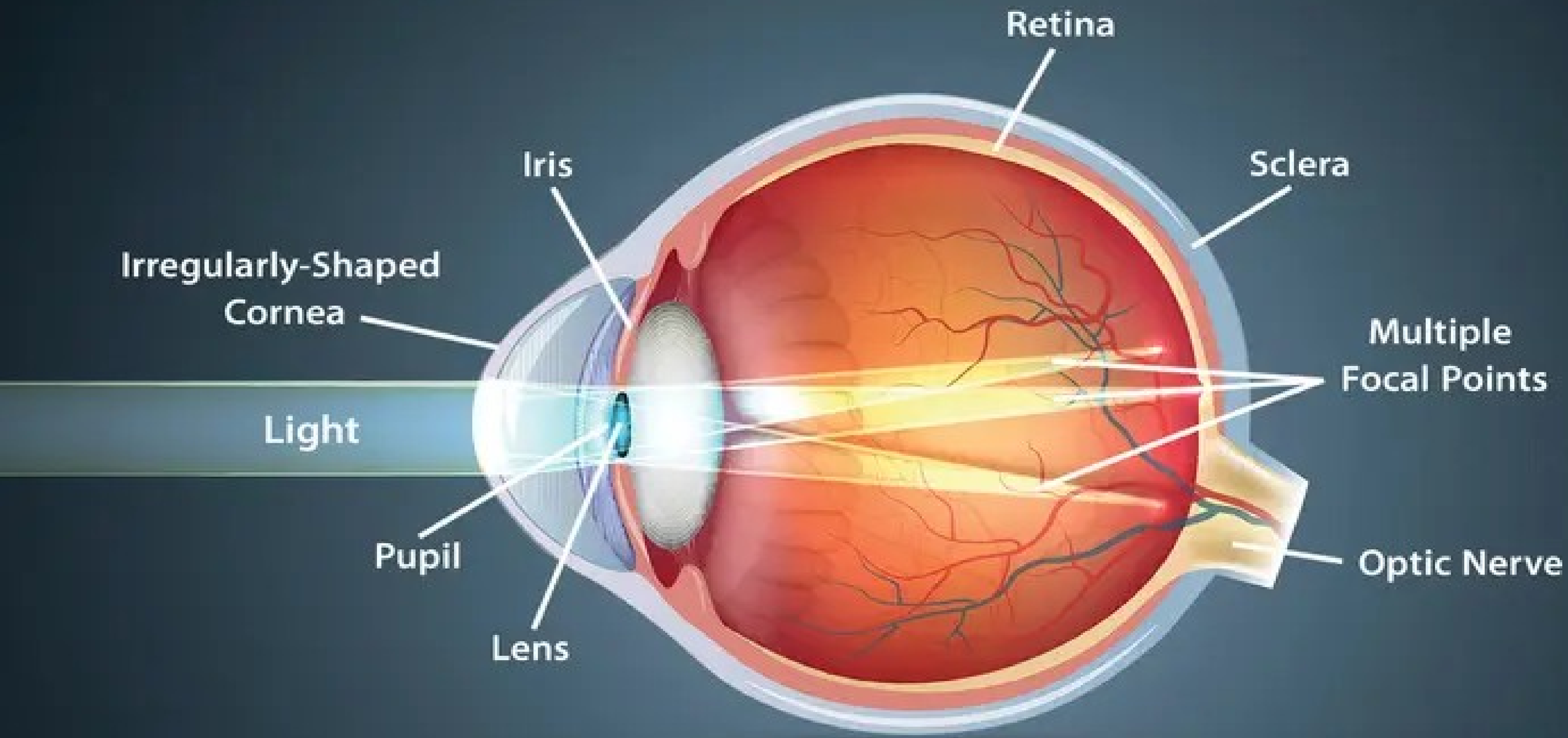
Hyperopia



Presbyopia


Stiffened Lens
Due to Age
Light is Focused
Behind the Retina
Cornea
Light
Retina
Healthy Eye

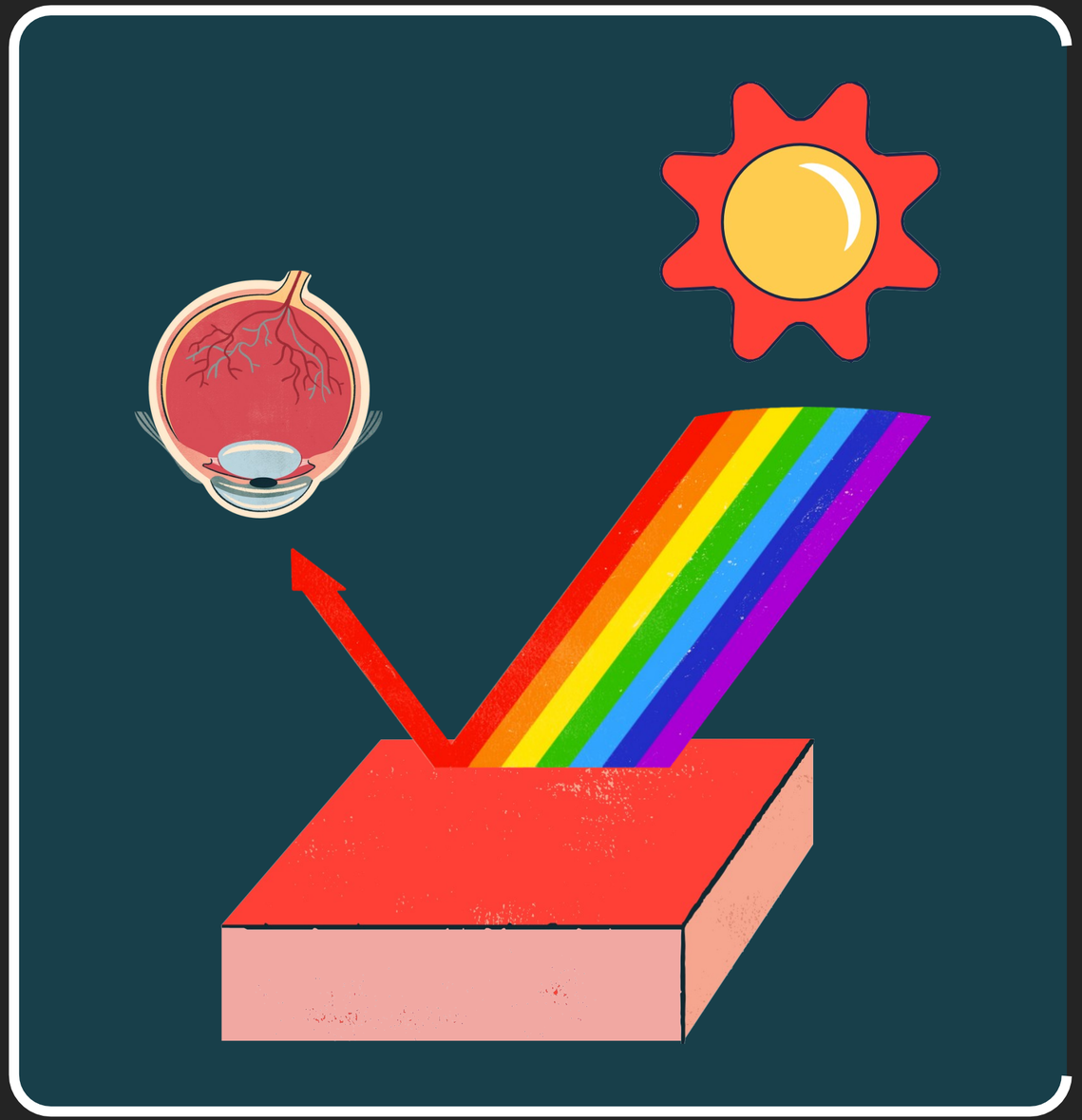
Astigmatism

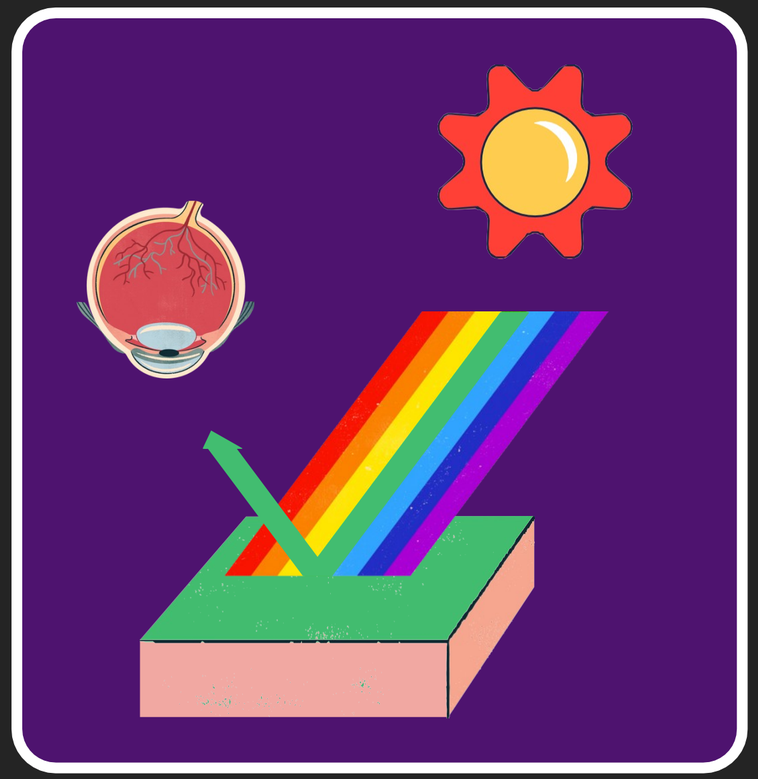


How the Eye Perceives Color

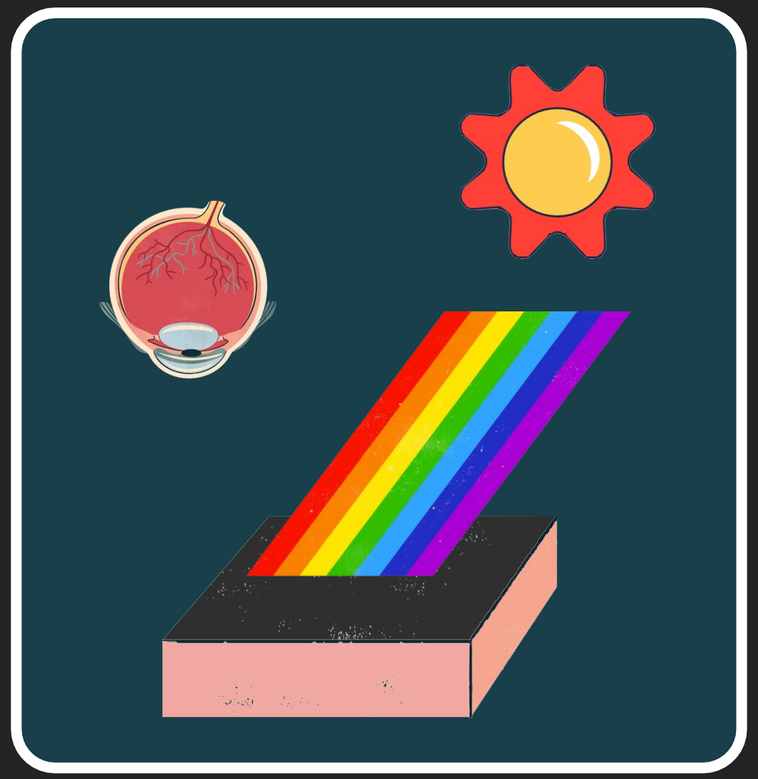
CoLor

Color is the way our eyes perceive different wavelengths of light. It's what makes objects look different from one another. When light shines on an object, some of the light is absorbed, and some is reflected back to our eyes. The colors we see are the result of the reflected light.

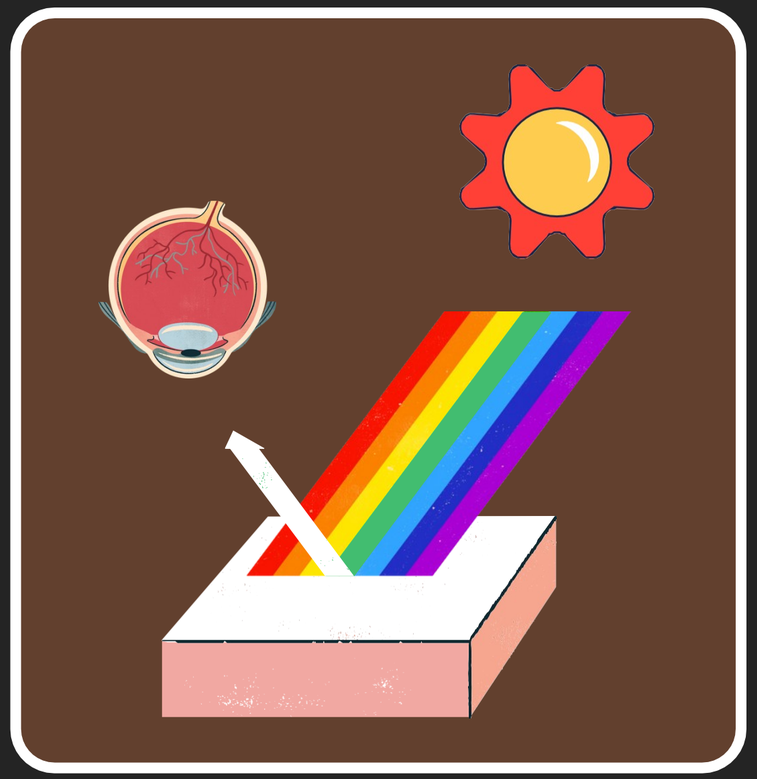




If the wavelength reflected by the object is green, the color perceived by the human eye is green.



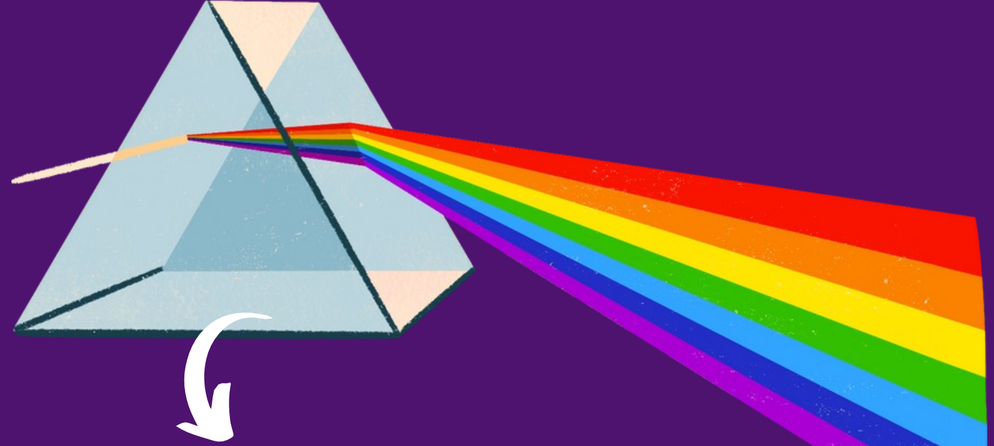
If the wavelength reflected by the object is black, the object absorbs all wavelengths.



If the wavelength reflected by the object is white, the object reflects all wavelengths.

Mixing colors

Did you know that white light is actually made up of many colors? When you shine white light, like sunlight or light from a flashlight, through a prism, it splits into different colors and creates a beautiful band of colors. This is called a spectrum.

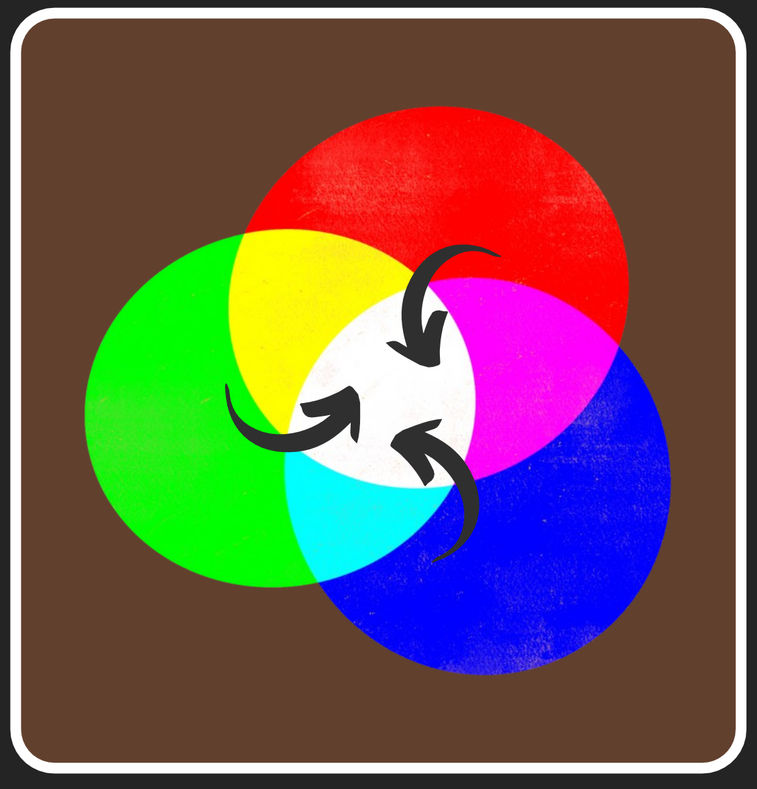


A prism is a special glass or plastic object that can bend, or refract, light.

Unlike pigments, the primary colors of light are red, green, and blue.

The secondary colors are: green + blue = cyan blue + red = magenta red + green = yellow

When you combine the primary colors of light: red, green, and blue, they will reflect white light.

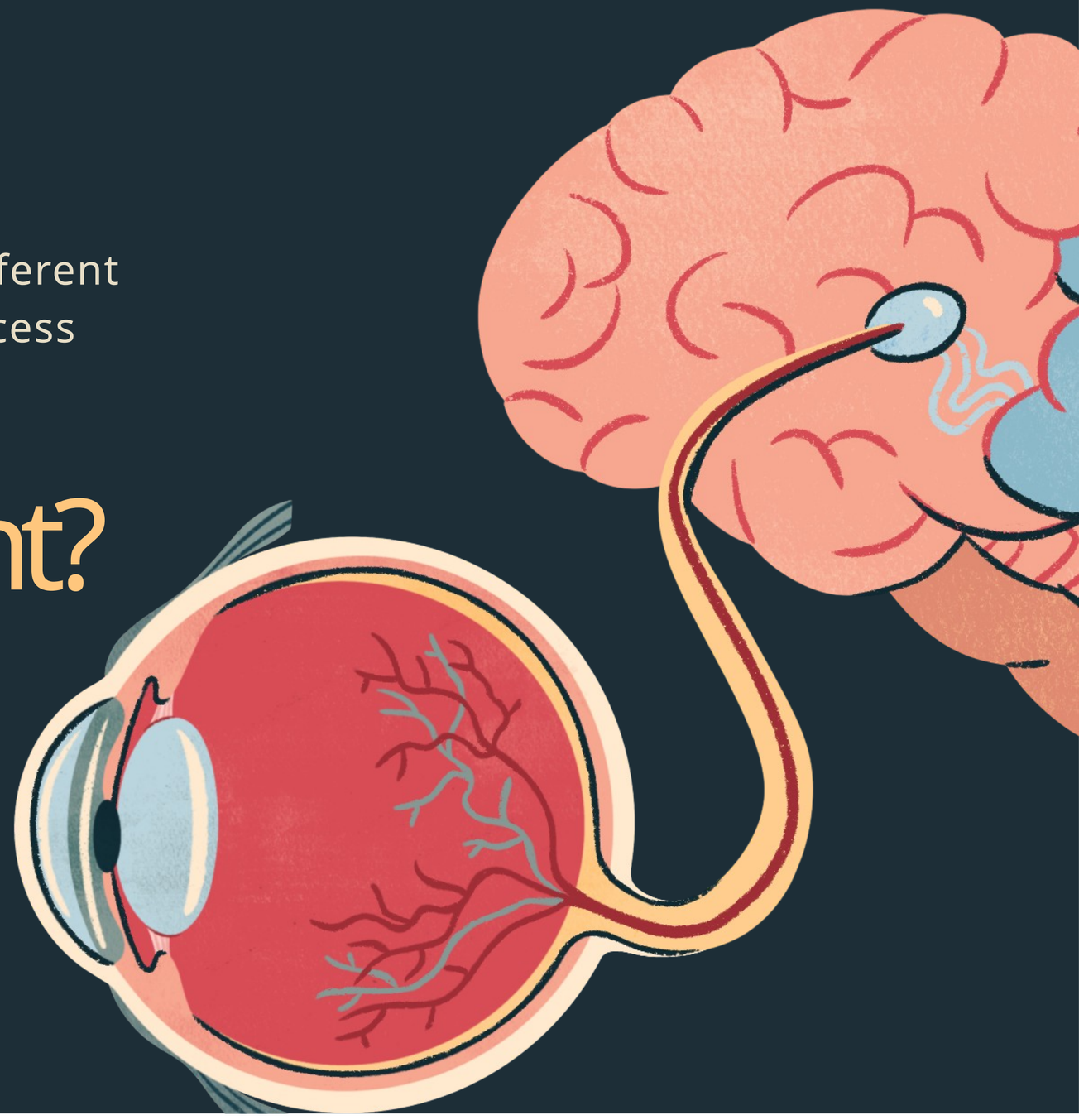


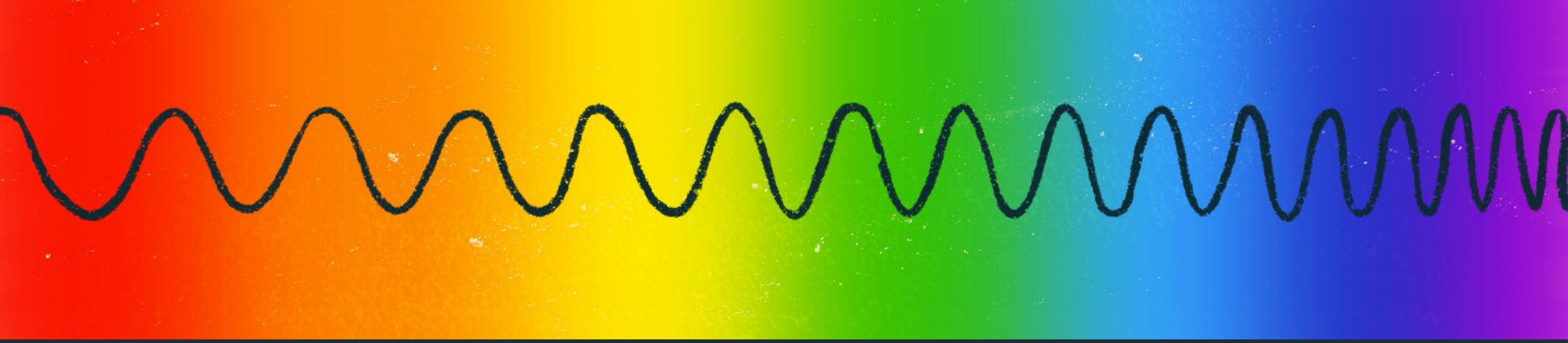
What is Color Perception?

The ability of the human eye to distinguish different wavelengths of light as colors. A complex process involving the eyes, brain, and light.

Why is it Important?

Helps us interpret the world around us. Essential for art, design, safety, and daily life.





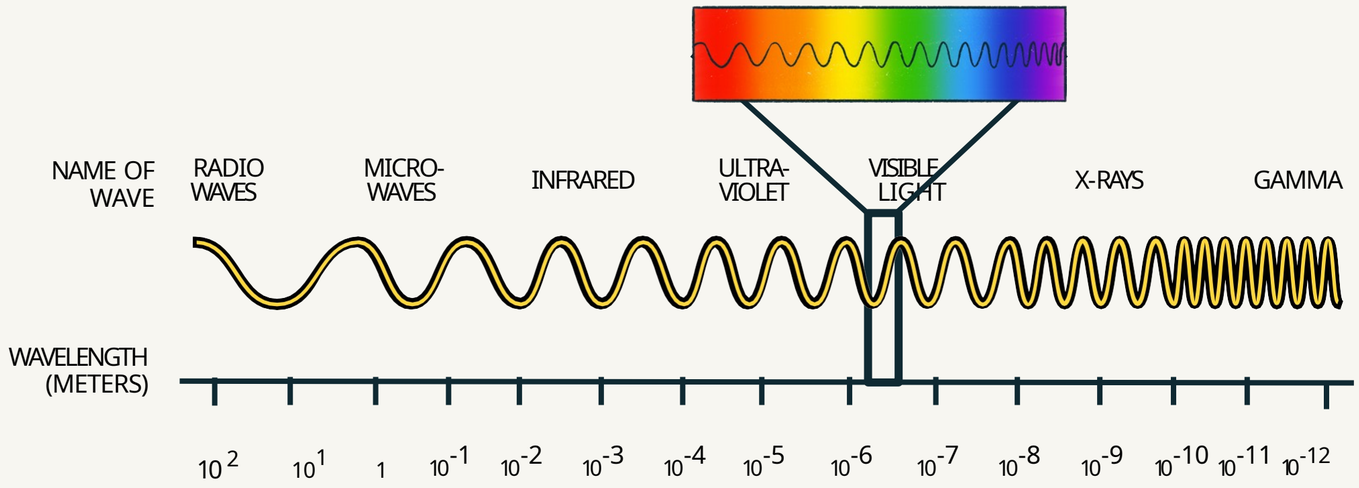
Light and Wavelength

Visible light is part of the electromagnetic spectrum. Wavelengths range from ~380 nm (violet) to ~750 nm (red).

Color and Light

Objects absorb and reflect specific wavelengths. The reflected wavelengths determine the color we perceive.

VISIBLE



a narrow portion of the electromagnetic spectrum that humans can see

FREQUENC

Its frequency falls between 400 to 750 terahertz (THz).

WAVELENGTH

Its wavelength ranges between 400-700 nanometers.

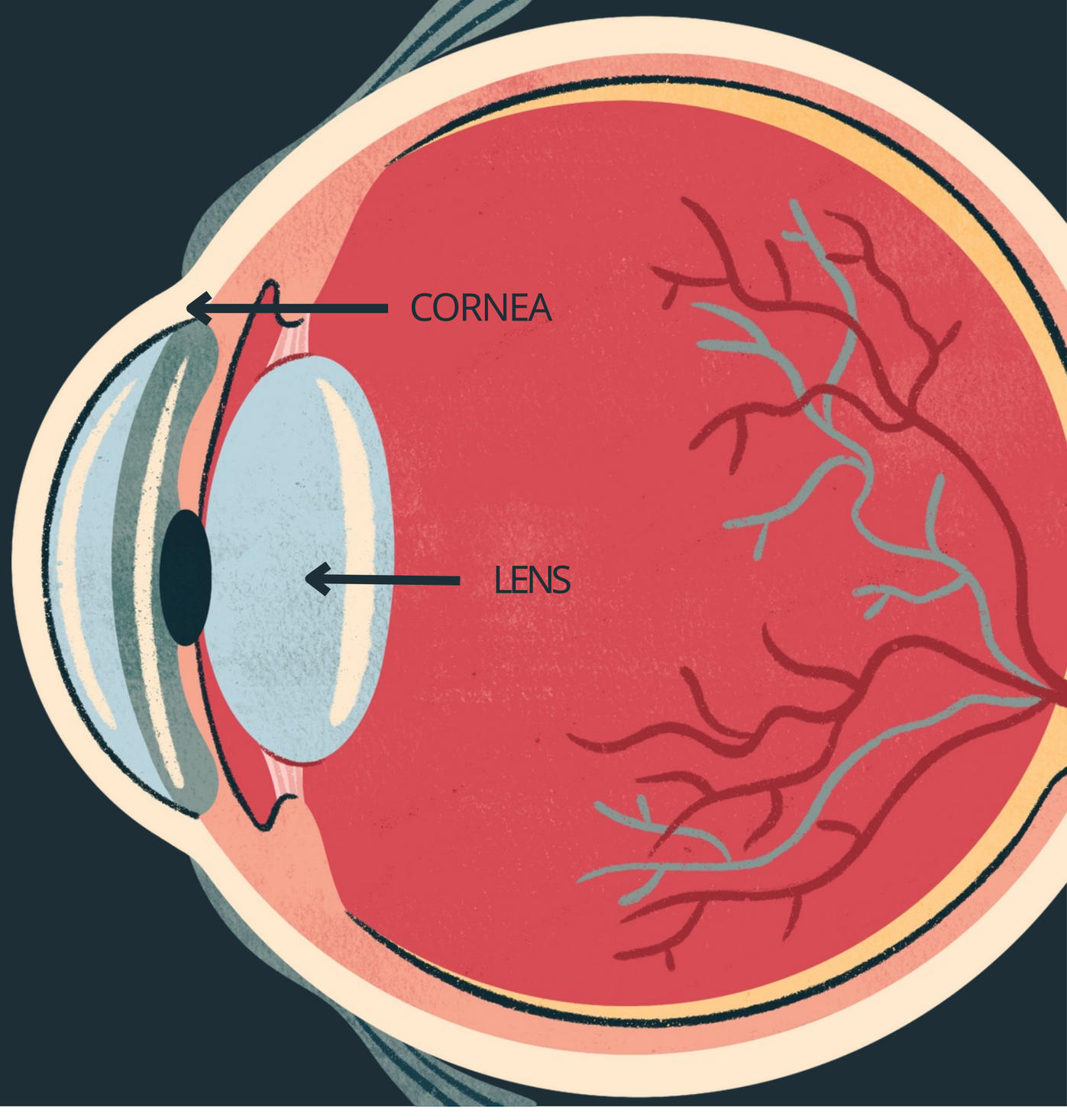
Key Structures Involved in Color Perception

Cornea

- It acts as the eye's first lens, bending (refracting) incoming light to help focus it onto the retina.

Lens

- It fine-tunes the focus of light onto the retina by changing its shape, a process called accommodation.



Key Structures Involved in Color Perception

RODS

Detecting Light Intensity

Rods are photoreceptor cells responsible for scotopic vision (vision in low-light conditions). They are highly sensitive to light and allow us to see in dim environments, such as at night.

CONES

Detecting Color

Cones are photoreceptor cells responsible for photopic vision (vision in bright light). They detect color and provide high-resolution, detailed vision.

The Marvel of Colour Perception: Rods and Cones

The retina contains two types of light-sensitive cells, known as photoreceptors, which manage our ability to see in different light conditions.

Rods (Light Sensitivity)

- Approximately 120 million.
- Highly sensitive to light, responsible for vision at low light levels (scotopic vision).
- They do not mediate colour vision.

Three Types of Cones

S-Cones (Short Wavelength)

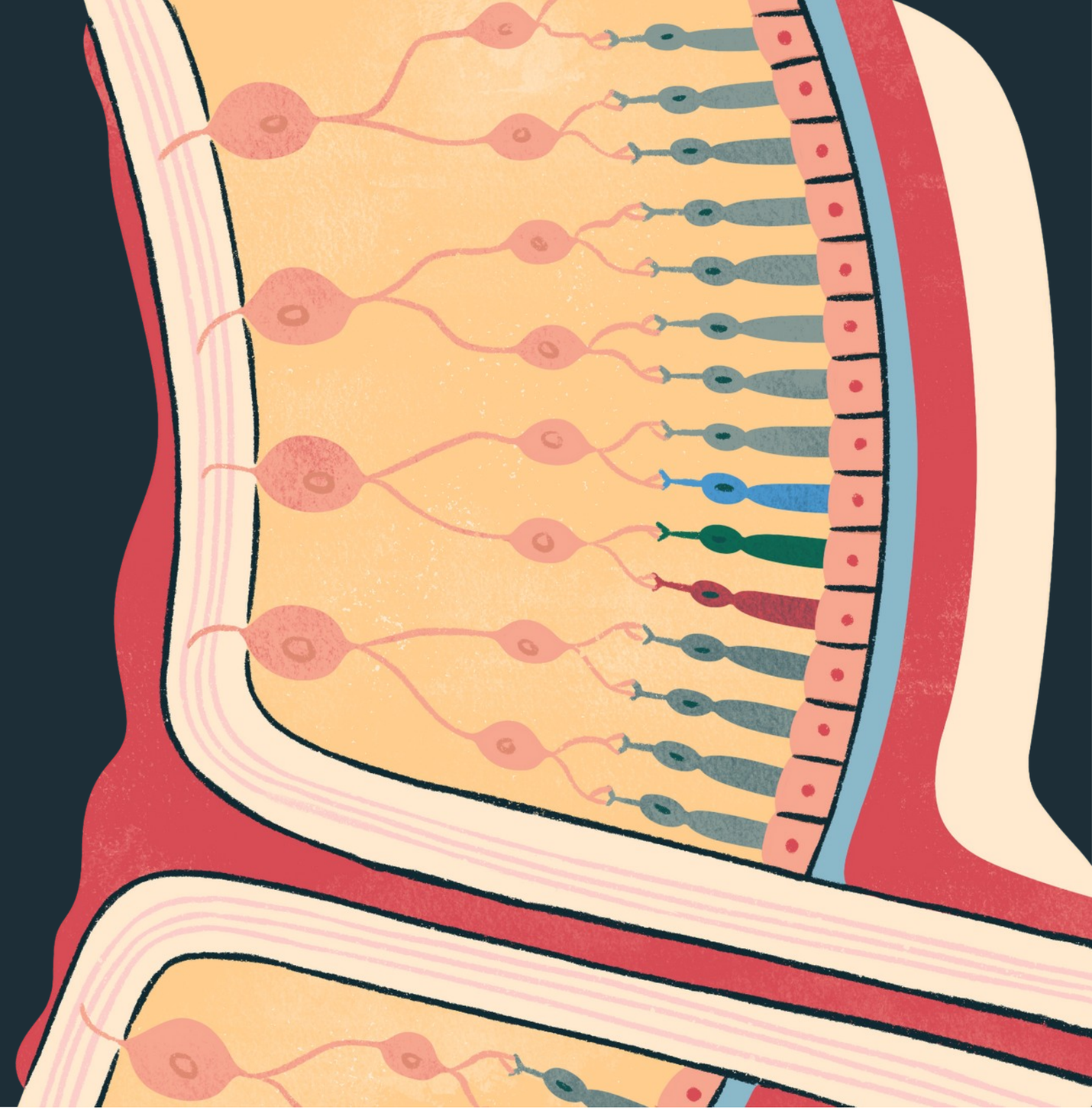
Sensitive to short wavelengths (blue).
Peak sensitivity around 420-440 nm.

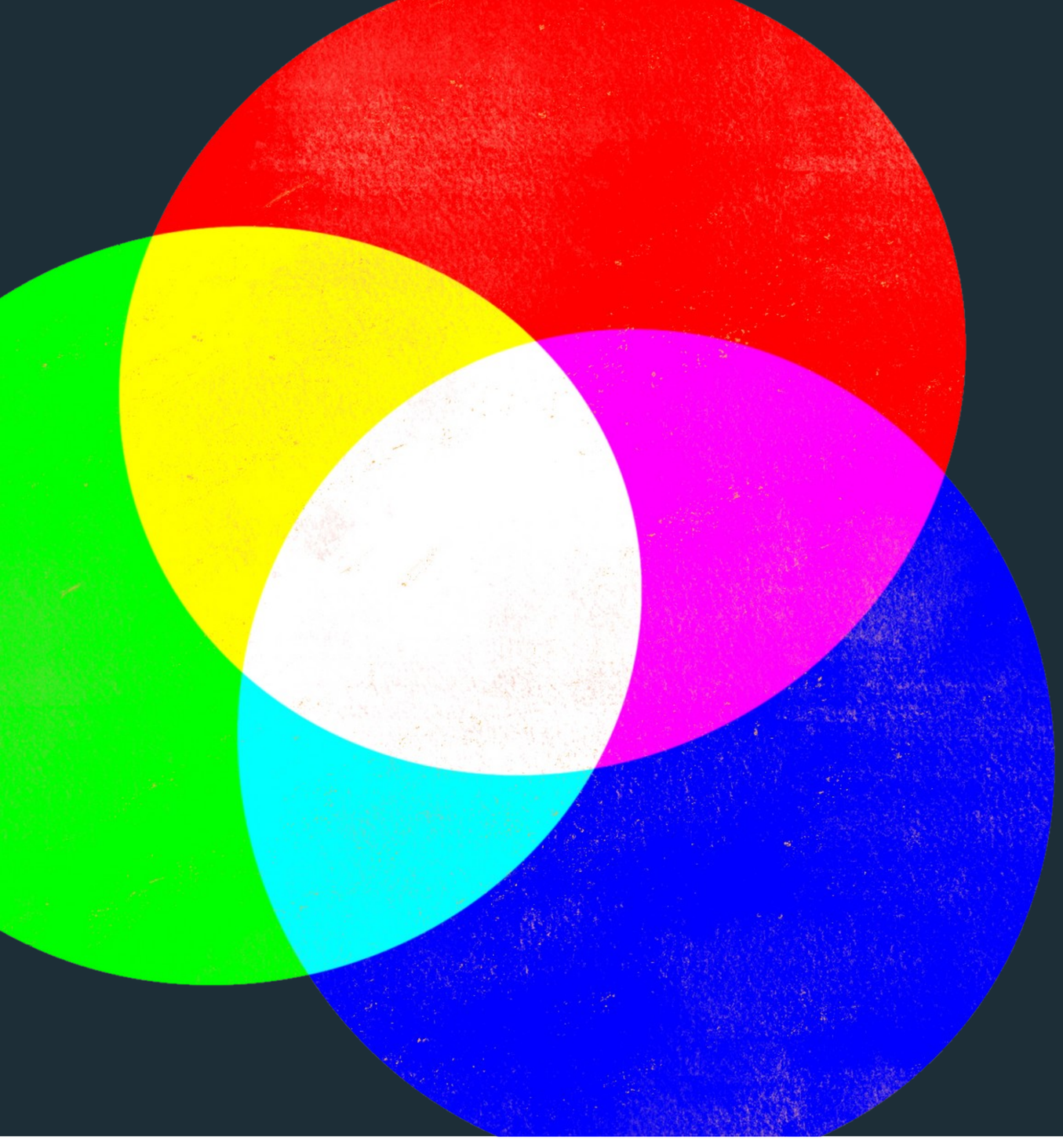
M-Cones (Medium Wavelength)

Sensitive to medium wavelengths (green).
Peak sensitivity around 530-540 nm.

L-Cones (Long Wavelength)

Sensitive to long wavelengths (red).
peak sensitivity around 560-580 nm





How Cones Work Together

Each cone type responds to a range of wavelengths, not just one specific color.

These cones work together to detect and differentiate colors.

Yellow light

Stimulates both L-cones (red) and M-cones (green), but not S-cones (blue).

White light

Stimulates all three cone types equally.

What is Color Blindness?

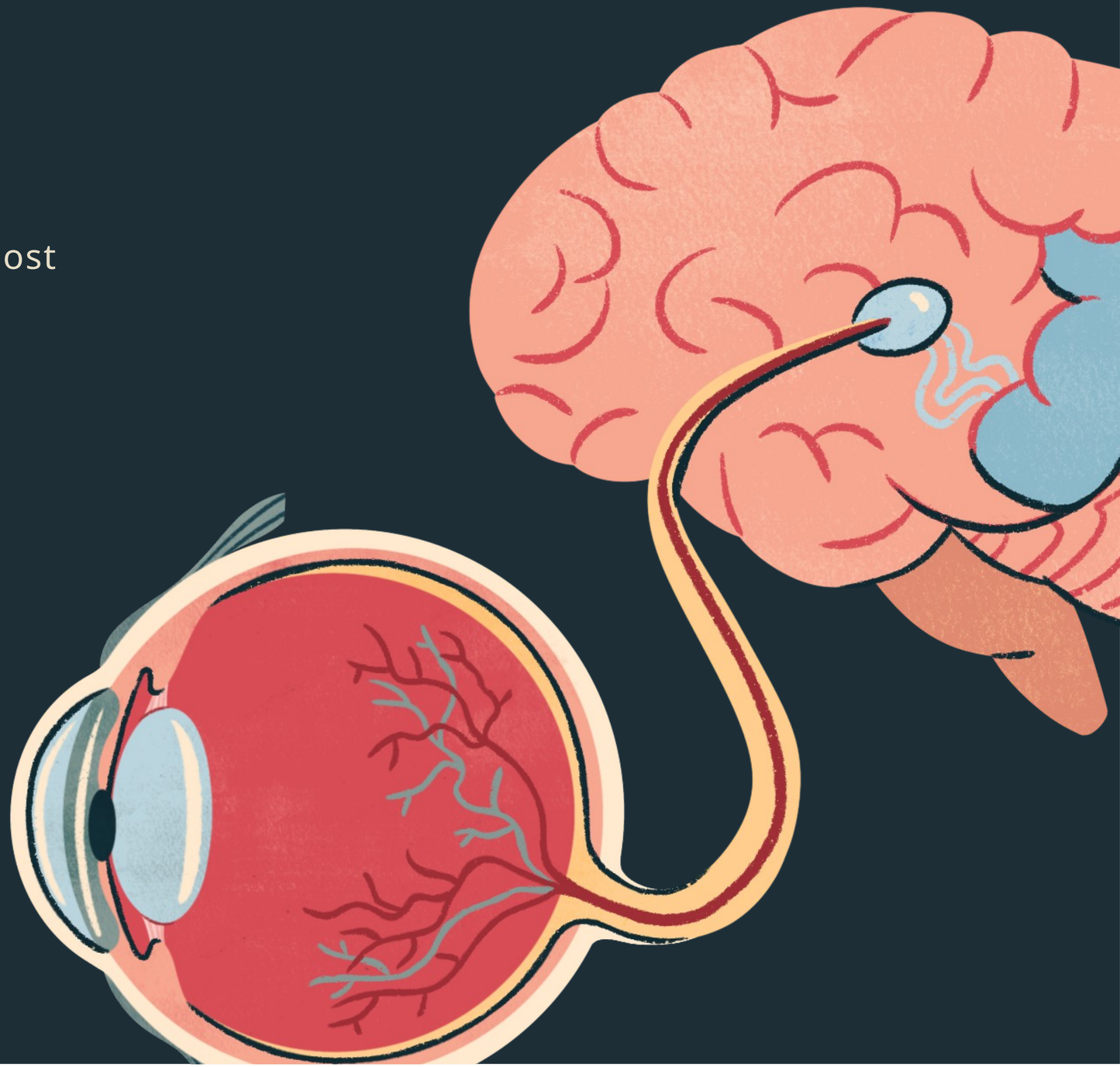
A deficiency in one or more types of cones. Most common type: red-green color blindness.

Causes

- Genetic factors.
- Damage to the retina or optic nerve.

Impact

- Difficulty distinguishing certain colors.
- Does not mean seeing in black and white.



The Basic Biology of the Eye: A Universal Design

Core Components

Despite vast external differences, all complex eyes share fundamental components like the lens (for focusing light) and the retina (for light detection).

Photoreception

The primary function remains consistent: translating photons into neural signals that the brain can interpret as images. This is the bedrock of vision.

Shared Ancestry

The evolutionary development of the camera-type eye (found in vertebrates and cephalopods) suggests a single, ancient origin, highlighting its efficiency.

Divers e Habitats , Divers e E yes : Adaptation to E nvironment

The shape, size, and internal structure of an eye are finely tuned evolutionary responses to the specific environment an organism inhabits. Vision is a dialogue between the organism and its surroundings.

Des ert Dwellers

Animals in bright, harsh environments often have small pupils and deep sockets to protect against intense sunlight and dust, optimising for high contrast.

Deep-Sea Life

Creatures in low-light, high-pressure aquatic zones develop extremely large lenses and spherical eyes to capture every stray photon, often sacrificing color vision for sensitivity.

Fores t Canopies

Primates and birds that navigate dense foliage require excellent depth perception (stereopsis) and sharp colour vision to identify ripe fruit and judge distances.

Nocturnal vs. Diurnal Vision: The Role of Light

Night Hunters (Nocturnal)

- Eyes are often large and spherical to maximise light collection (e.g., Owls, Tarsiers).
- Retinas are dominated by **Rods**, which are highly light-sensitive but cannot perceive colour.
)
- Many possess a **Tapetum Lucidum**, a reflective layer that bounces light back through the retina, enhancing night vision.
- Retinas contain numerous **Cones**, which enable high visual acuity and colour perception.
- Adapted for sharp, focused detail in high-light conditions.

Avian Vision: Sharpshooters of the Sky

A Hawk's Eye: Seeing the Unseen

Birds of prey, like eagles and falcons, possess visual acuity up to eight times greater than humans. Their eyes are true marvels of evolutionary engineering.

- **Foveal Density:** Birds often have two foveae (areas of highest concentration of cones) per eye, enabling extreme high-resolution central vision and peripheral tracking simultaneously.

Tube-Shaped Eyes: The shape of their eyes is sometimes tubular, enabling a much larger image to be cast on the retina, functioning like a built-in telephoto lens.

Ultraviolet Perception: Many birds can perceive UV light, crucial for finding specific food sources or identifying other birds' plumage patterns invisible to humans.

Human E yes : From Hunter-Gatherers to S martphone Us ers

Our eyes evolved for a life spent outdoors: focusing on distant horizons, tracking movement, and benefiting from natural, full-spectrum light.

Evolved for Dis tance

Human eyes are naturally optimized for viewing objects beyond six meters, promoting relaxation of the ciliary muscles.

Shift to Near Work

The invention of print and widespread education introduced prolonged, close-up reading, beginning the shift towards constant visual accommodation.

The Digital Explos ion

Mobile devices have intensified near-work exponentially, forcing the eyes to focus at extremely short distances for prolonged, unbroken periods.

Understanding the Anatomy of the Eye

The eye is a complex sensory organ responsible for sight. Understanding its primary components is crucial to grasping how vision defects occur.

- **Cornea:** The transparent outer layer that focuses most of the light entering the eye.
- **Lens:** Changes shape to fine-tune focus for near and far objects (accommodation).
- **Retina:** Light-sensitive tissue at the back of the eye, converting light into neural signals.
- **Optic Nerve:** Transmits these electrical signals to the brain for interpretation.

Common Refractive Errors

Refractive errors occur when the eye cannot focus light correctly on the retina, leading to blurred vision. These are the most prevalent vision issues globally.

Myopia (Nearsightedness)

Distant objects appear blurred. Occurs when the eyeball is too long or the cornea is too curved.

Hyperopia (Farsightedness)

Near objects appear blurred. Occurs when the eyeball is too short or the cornea/lens curvature is too flat.

Astigmatism

Blurred vision at any distance due to an irregularly shaped cornea (like a football, not a sphere).

Presbyopia (Age-Related)

Difficulty focusing on near objects due to the natural hardening and loss of flexibility of the lens, typically after age 40.

Rectification Methods: Correcting Vision Defects

Modern optometry offers effective solutions to restore clear vision for millions.

Spectacles (Glasses)

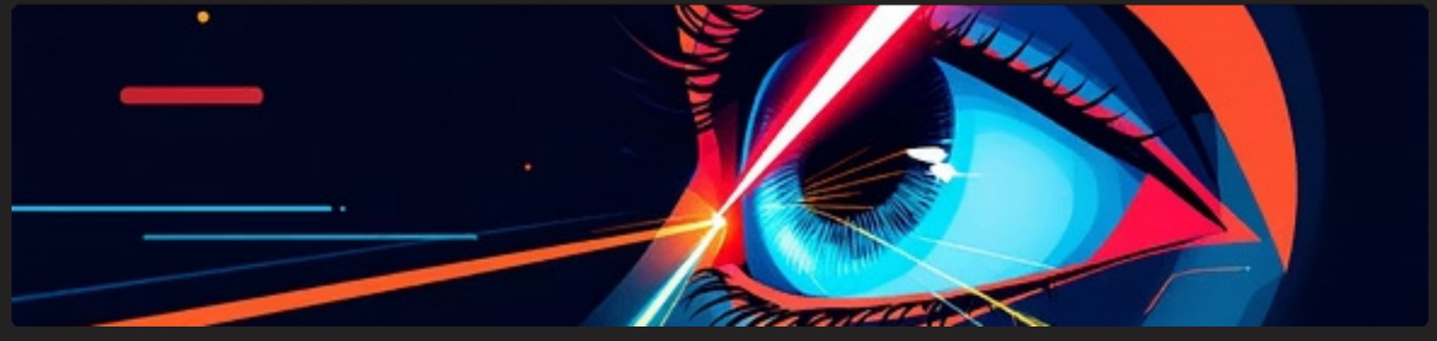
The simplest and safest correction method, using external lenses to redirect light onto the retina's focal point.

Contact Lenses

Thin plastic lenses worn directly on the cornea. They offer a wider field of vision and cosmetic appeal.

Surgical Interventions

LASIK/PRK: Procedures that permanently reshape the cornea using a laser to correct refractive errors, reducing dependency on corrective lenses.



Beyond Refractive Errors: Critical Eye Conditions

These serious conditions can cause irreversible vision loss if not detected and treated early.

1. **Cataracts**

   Clouding of the natural lens, leading to blurred or dull vision. Treated via surgical replacement of the cloudy lens.

2. **Glaucoma**

   Damage to the optic nerve, often linked to high intraocular pressure. Known as the 'silent thief of sight'.

3. **Diabetic Retinopathy**

   Caused by damage to the blood vessels of the light- sensitive tissue at the back of the eye (retina) due to high blood sugar.


Thank
you