

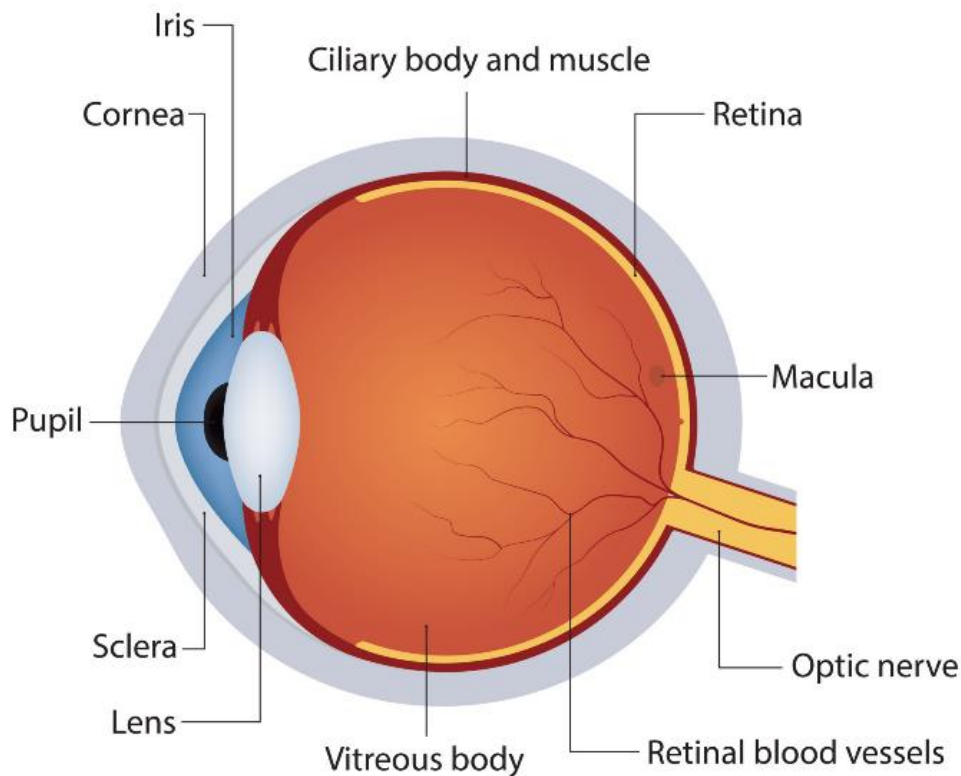
Sense organs

Eye – Anatomy And Physiology

- The **eye** is the primary organ of vision. It functions by detecting light and converting it into electrochemical signals, which are interpreted by the brain to form images.
- Its structure is specialized to capture light efficiently and support visual processing.

Structure of the Eye

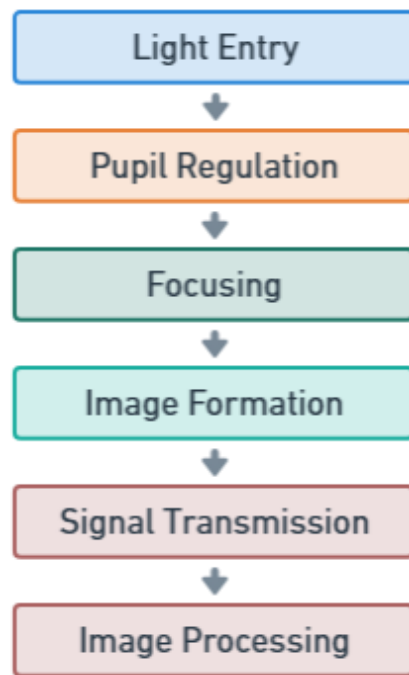
- The human eye is a complex organ responsible for vision, made up of several parts:



1. **Cornea:** The transparent outermost layer that refracts light entering the eye.
2. **Sclera:** The white part of the eye that provides structural support and protection.
3. **Iris:** The colored part of the eye that controls the size of the pupil, regulating the amount of light that enters.
4. **Pupil:** The black circular opening in the center of the iris that allows light to pass through.
5. **Lens:** A transparent, flexible structure that focuses light onto the retina.
6. **Retina:** The innermost layer that contains photoreceptor cells (rods and cones) responsible for detecting light.
 - a. **Rods:** Photoreceptors that are sensitive to low light levels, crucial for night vision.
 - b. **Cones:** Photoreceptors responsible for color vision and sharpness of vision in well-lit conditions.
7. **Optic Nerve:** Transmits visual information from the retina to the brain.

8. **Choroid:** The vascular layer of the eye that supplies blood to the retina.
9. **Macula:** The central part of the retina responsible for detailed central vision.
10. **Fovea:** A small depression in the macula that contains a high concentration of cones and is the area of sharpest vision.
11. **Aqueous Humor:** A clear fluid that fills the space between the cornea and the lens, providing nutrients and maintaining intraocular pressure.
12. **Vitreous Humor:** A gel-like substance that fills the space between the lens and the retina, maintaining the shape of the eye.

Mechanism of Vision



1. **Light Entry:** Light enters through the cornea and is refracted.
2. **Pupil Regulation:** The iris adjusts the pupil size to control light intake.
3. **Focusing:** The lens changes shape (with help from ciliary muscles) to focus light onto the retina.
4. **Image Formation:** Light is focused on the retina, where rods and cones detect it and convert it to electrical signals.
5. **Signal Transmission:** These signals travel to the brain via the optic nerve.
6. **Image Processing:** The brain interprets the signals into images.

Accommodation of the Eye

- Accommodation is the process by which the eye adjusts the lens shape to focus on objects at different distances:
 - **Distant Objects:** Ciliary muscles relax → lens becomes flatter.
 - **Near Objects:** Ciliary muscles contract → lens becomes thicker.
- This ensures a clear image is focused on the retina, whether the object is near or far.

Diseases of the Eye

1. **Cataracts:** Clouding of the lens, causing blurred vision; common with aging.
2. **Glaucoma:** Increased intraocular pressure damaging the optic nerve; leads to vision loss.
3. **Macular Degeneration:** Deterioration of the macula; affects central vision, especially in older adults.
4. **Myopia (Nearsightedness):** Distant objects appear blurry; light focuses in front of the retina.
5. **Hyperopia (Farsightedness):** Near objects appear blurry; light focuses behind the retina.
6. **Astigmatism:** Irregular curvature of the cornea or lens; causes distorted or blurred vision.
7. **Conjunctivitis (Pink Eye):** Inflammation of the conjunctiva; usually from infection or allergy.
8. **Retinal Detachment:** Separation of the retina from underlying tissue; can cause blindness if untreated.

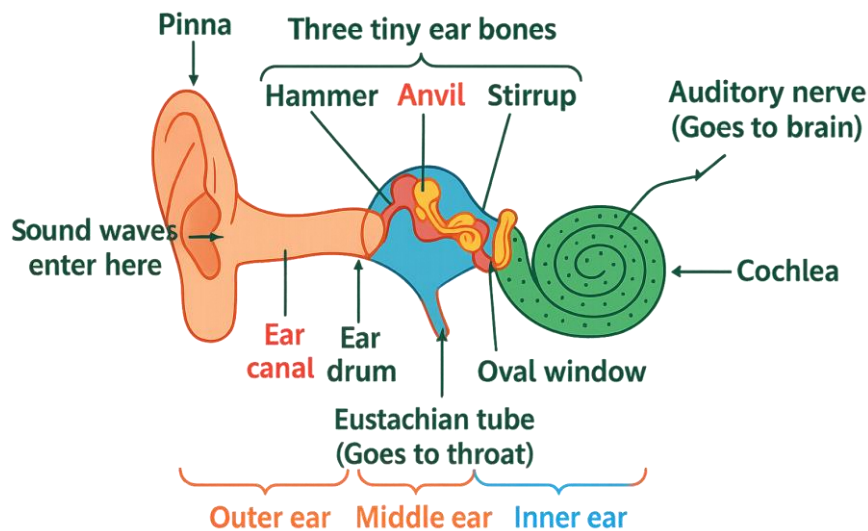
Functions of the Eye

1. **Vision:** Detects light and converts it into neural signals for image formation in the brain.
2. **Color Perception:** **Cone cells** in the retina enable the detection of different colors.
3. **Light Regulation:** The **iris** adjusts pupil size to control light entry and protect the retina.
4. **Focus Adjustment (Accommodation):** The **lens** changes shape to keep objects at various distances in clear focus.
5. **Depth Perception:** **Binocular vision** (both eyes working together) allows for depth and distance judgment.

Ear – Anatomy And Physiology

- The **ear** is responsible for two main sensory functions: **hearing** and **balance**.
- It is structurally divided into three parts:
 1. External ear
 2. Middle ear
 3. Inner ear

Structure of the Ear



1. Outer Ear

- Pinna (Auricle):** The visible external part that collects sound waves and funnels them into the ear.
- Ear Canal (External Auditory Meatus):** The passage through which sound waves travel toward the eardrum.
- Tympanic Membrane (Eardrum):** Vibrates in response to sound waves, transmitting vibrations to the middle ear.

2. Middle Ear

- Ossicles:** Three small bones that amplify sound vibrations:
 - **Malleus (Hammer):** Connected to the eardrum.
 - **Incus (Anvil):** Middle bone between the malleus and stapes.
 - **Stapes (Stirrup):** Connects to the oval window of the cochlea.
- Eustachian Tube:** Connects the middle ear to the throat, equalizes air pressure on both sides of the eardrum.

3. Inner Ear

- Cochlea:** Spiral-shaped organ that converts sound vibrations into electrical signals using sensory hair cells.

- B. **Vestibular System:** Maintains balance and includes:
 - **Semicircular Canals:** Detect rotational movements.
 - **Utricle and Saccule:** Detect linear movements and head position relative to gravity.
- C. **Auditory (Cochlear) Nerve:** Transmits electrical signals from the cochlea to the brain.
- D. **Oval Window:** Membrane through which the stapes transmits sound vibrations into the cochlea.
- E. **Round Window:** Allows movement of cochlear fluid for sound transmission.

Mechanism of Hearing

1. **Sound Wave Collection:** Pinna collects sound and channels it through the ear canal.
2. **Vibration of Eardrum:** Sound waves vibrate the tympanic membrane.
3. **Amplification by Ossicles:** Vibrations pass through the malleus, incus, and stapes to the oval window.
4. **Fluid Movement in Cochlea:** Vibrations create pressure waves in the cochlear fluid.
5. **Activation of Hair Cells:** Hair cells in the cochlea respond to specific frequencies.
6. **Conversion to Electrical Signals:** Hair cells generate signals sent via the auditory nerve.
7. **Sound Interpretation:** The brain processes the signals as recognizable sounds.

Mechanism of Balance

1. **Detection of Movement:** Semicircular canals detect rotation; utricle and saccule detect linear movement and gravity.
2. **Fluid Movement:** Head movement causes fluid in canals to shift, bending hair cells.
3. **Signal Transmission:** Nerve signals from hair cells are sent via the vestibular nerve to the brain for balance control.

Functions of the Ear

1. Hearing

- Detects **sound waves** and converts them into **electrical impulses**, which are interpreted by the brain (e.g., speech, music).

2. Balance

- The **vestibular system** helps maintain **equilibrium** and **spatial orientation**.

3. Pressure Regulation

- The **Eustachian tube** equalizes air pressure in the **middle ear**, ensuring proper **eardrum function** and comfort.

Diseases of the Ear



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