

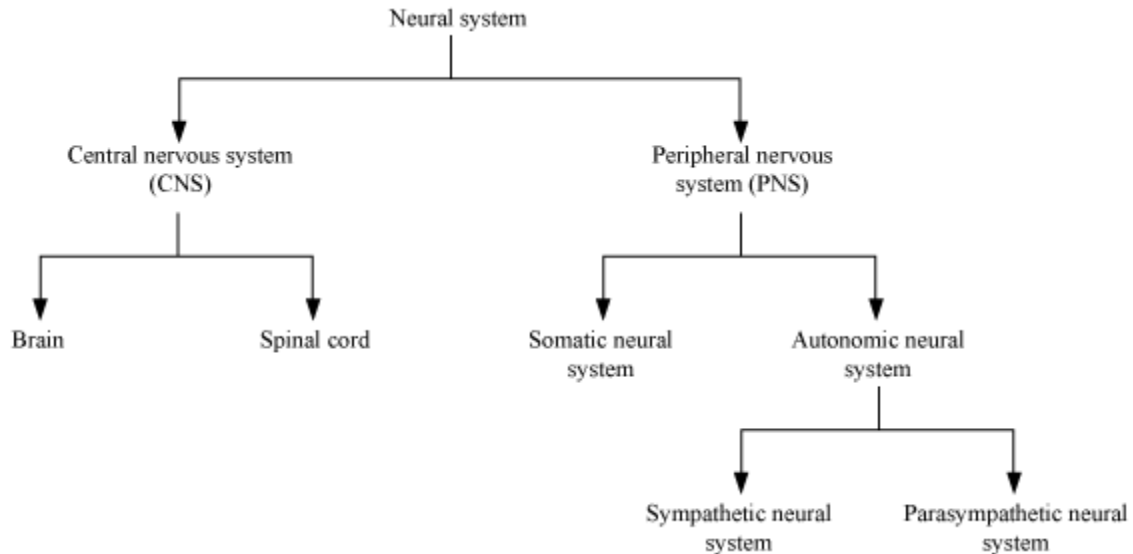
# Neural Control and Coordination

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## Human Neural System

### Neural system

- It provides rapid coordination among the organs of the body.
- The coordination may be in the form of electric impulses, which is quick and short-lived.



## Neurons

- Neurons are structural and functional units of nervous system.
- **Structure of neuron**

1. **Cell body** – Contains Nissl's granules
2. **Dendrite** – Conducts messages towards cell body
3. **Axon** – Conducts messages away from cell body

- **Neurons are of three types:**

1. **Unipolar**
2. **Bipolar**
3. **Multipolar**

- **Axons are of two types:**

2. **Myelinated nerve fibre**

- Fibre is coated with myelin sheath, which is impermeable to ions. Schwann cells enveloped the myelin sheath.
- The place where myelin sheath is not present on the myelinated nerve fibre is called node of Ranvier.
- Conduction of nerve impulse is from node to node in a jumping manner. Hence, the conduction is fast.
- Found in spinal and cranial nerves

### 3. **Non-myelinated nerve fibre**

- Fibres are not coated by myelin sheath.
- Conduction of nerve impulse occurs along the whole length of nerve fibre. Hence, the conduction is slow.
- Found in autonomous and somatic neural systems

### **Conduction of nerve impulse**

- **During resting condition:**

- Concentration of  $K^+$  ions is more inside axoplasm while concentration of  $Na^+$  is more outside axoplasm.
- Ionic gradient is maintained across membrane by transport of 3  $Na^+$  outward and 2 $K^+$  into the cell.
- Membrane becomes positively charged outside and negatively charged inside. Nerve fibre is said to be polarized nerve fibre.

- **When stimulus is given to nerve fibre:**

- Action potential is generated.
- Nerve fibre becomes permeable to  $Na^+$  ions than to  $K^+$  ions.
- Membrane becomes positively charged inside and negatively charged outside the axoplasm. The nerve fibre is said to be depolarized nerve fibre.

- **Synapse**

- It is a small gap found between the last portion of axon of one neuron and dendrite of next neuron.
- There are two types of synapses:
- **Electrical synapse**

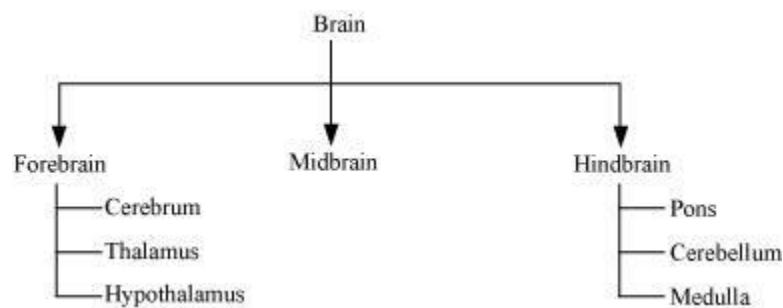
- **Chemical synapse**

**Reflex action –**

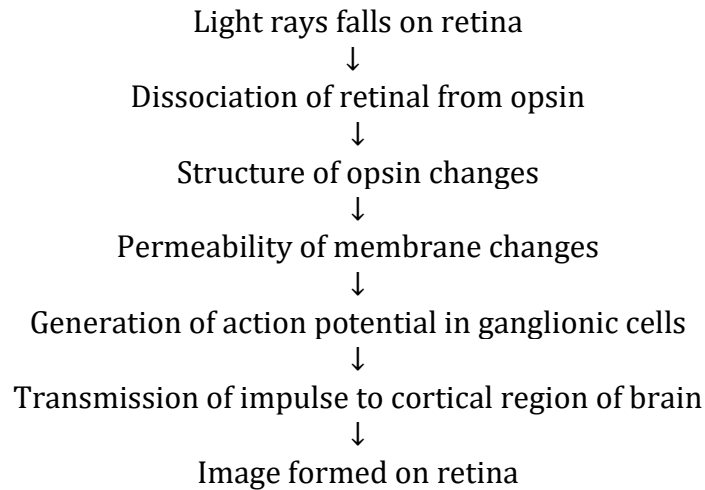
- It is an automatic action or response provoked by a stimulus.
- **Reflex** pathway is comprised of the following.
- **Afferent neuron** – Receives signal from sensory organ and transmits impulse into CNS(spinal cord level).
- **Efferent neuron** – Carries signal from CNS to effectors

**Central nervous system**

- **Brain**
- It is the main coordinating centre of the body.
- Brain is protected by the skull and covered by cranial meninges.
- Cranial meninges consist of three layers - outer dura mater, middle arachnoid, and inner pia mater.



- **Forebrain** is the largest and most developed region of brain.
- **Hypothalamus** region of forebrain regulates body temperature and the urge for eating and drinking.
- **Midbrain** is concerned with the sense of sight and hearing.
- The dorsal portion of the midbrain consists of four round swellings called **corpora quadrigemina**.
- **Cerebellum** maintains posture and equilibrium of the body.
- **Mechanism of vision:**



**Sense Organs:** Organs that helps us to be aware of our surroundings are known as sense organs.

**Receptors:** Any cell or tissue sensitive to a selective stimuli are called receptors.

## Eye

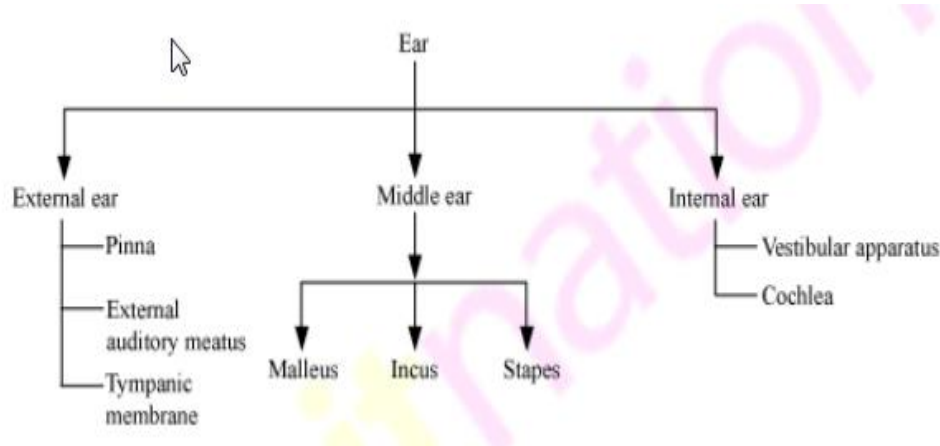
Composed of three layers:

- **Outermost layer-** sclera and cornea
- **Middle layer-** choroid, ciliary body, iris
- **Innermost layer-** retina, with rod cells and cone cells.
- Just behind the iris, a transparent, biconvex, and elastic structure called **lens** is present.
- **Rods** – Contain rhodopsin pigment that is highly sensitive to dim light
- **Cones** – Contain iodopsin pigment that is sensitive to high intensity light. Cones are also responsible for colour vision.
- **Blind spot** – Area where photoreceptors such as rods and cones are absent
- **Fovea** – Area that contains only cones. Vision is finest and sharpest in this zone.
- **Aqueous chamber** – Space between cornea and lens; contains **aqueous humour**.
- **Vitreous chamber** – Space between lens and retina; contains **vitreous humour**  
Pupil regulates the amount of light entering into the eyes.
- **Specific abilities of eyes**
  - Power of Accommodation

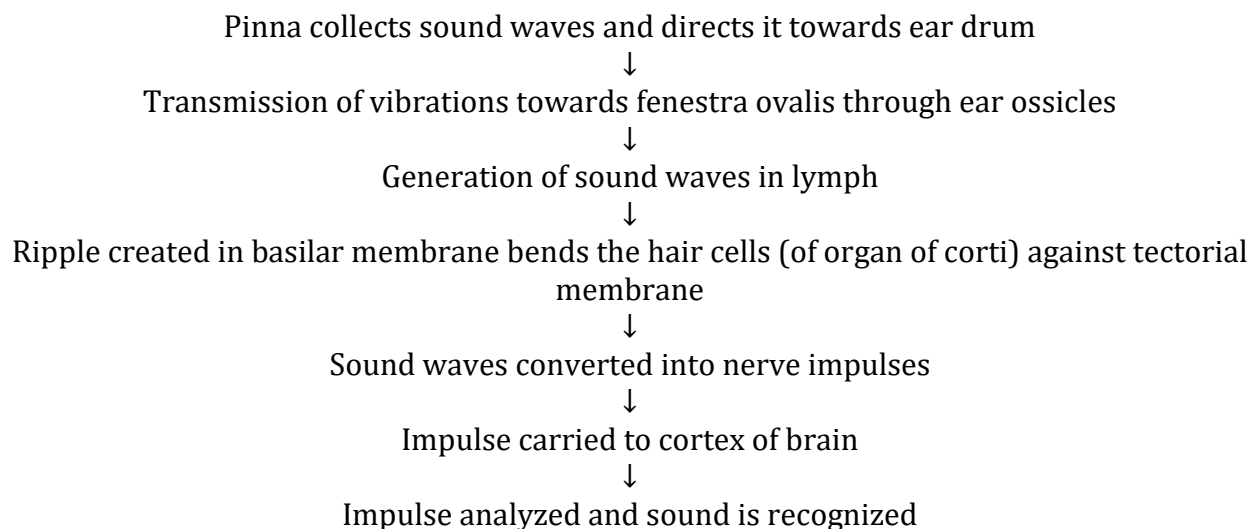
- Stereoscopic Vision

## **Ear**

- Organ for hearing and equilibrium



- **Crista and macula** are receptors of vestibular apparatus that are responsible for maintaining body balance and posture.
- **Organ of corti** is the main hearing structure of internal ear. It is located on basilar membrane that has hair cells. The middle ear contains three small bones – malleus, incus, and stapes (arranged from outside to inside).
- **Mechanism of hearing**



## **Role of Ear in balancing Body**

When we turn our head



fluid inside the semicircular canals moves



pushing against the sensory hair cells



sending nerve impulse to brain -->via auditory nerve



cells present in the semicircular canals are highly sensitive to dynamic equilibrium.



we are able to balance our body.

### **Nose**

- It is the sense organ of smell.
- Sensory receptors are present in the nasal cavity.
- Sends impulses through olfactory nerve.

### **Skin**

- It is the sense organ for the sense of touch and feel.
- Also protects the body.
- Has two layers, epidermis and the dermis.
- Has sweat glands, oil glands and hair follicles.

### **Tongue**

- It is the sense organ of taste.
- Have taste buds to recognize tastes like sweet, sour, bitter and salty.