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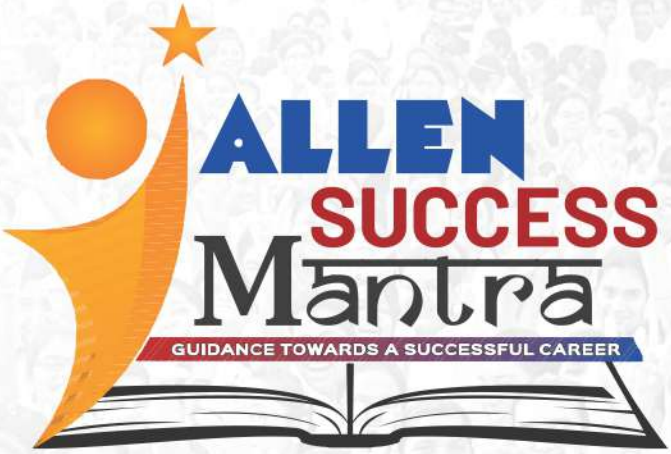

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NEURAL CONTROL AND CO-ORDINATION

Co-ordination : It's the process through which two or more organs interact and complement the functions of one another.

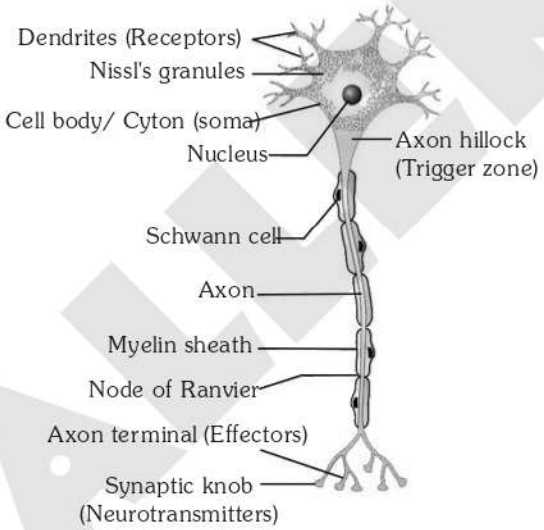
Integrated system : In Human's body the neural system and the endocrine system jointly coordinate and integrate all the activities of the organs so that they function in a synchronised fashion and interdependent to each other combinely called integrated system.

Distinction in neural system and endocrine systems.

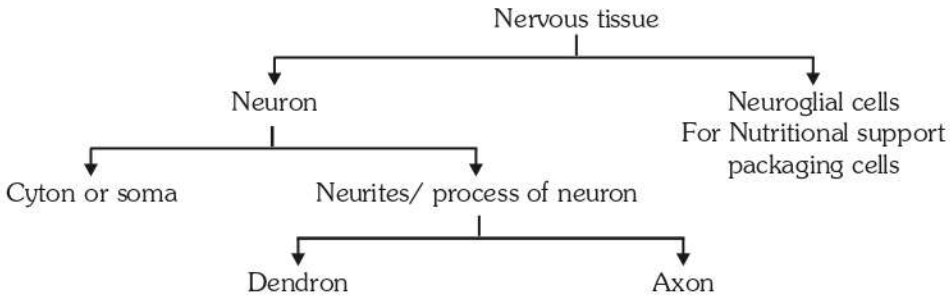
The neural system provides an organised network of **point to point** connections for a quick response (Fast speed) and short span of coordination where as the endocrine system provides chemical integration, slow speed and long lasting effect.

Neural system :

Neurons : The neural system of all animals is composed of highly specialised cells called neurons also known as structural and functional unit of nervous system.



Structure of a neuron (Multipolar)



- Three major parts of neuron, are dendron, cyton and axon.

Nissl's granules : The cell body contains cytoplasm with typical cell organelles and certain granular bodies called Nissl's granules which is also present in dendrites.

Types of Neuron
(Based on number of axon and dendrites)

Multipolar
Cell body with two or more short dendrites and one long axon
Ex. Cerebral cortex

Bipolar
Cell body with one axon and one dendrite
Ex. Retina, Schneidarian epithelium (olfactory epithelium)
Gustatory epithelium (Tongue)
Membranous labyrinth (Internal ear)

Unipolar
cell body with one axon only
Ex. Embryonic stage (Foetus)

Types of axon
(On the basis of Myelin)

Myelinated Nerve Fibres
Enveloped by Schwann cells which form myelin sheath
The gaps between two adjacent myelin sheath are called **Nodes of Ranvier**
Ex. Cranial nerves and S**pinal nerves**

Unmyelinated Nerve Fibres
It's enclosed by a Schwann cell that does not form a myelin sheath around the axon and is commonly found in **Autonomous** and the **Somatic neural system**

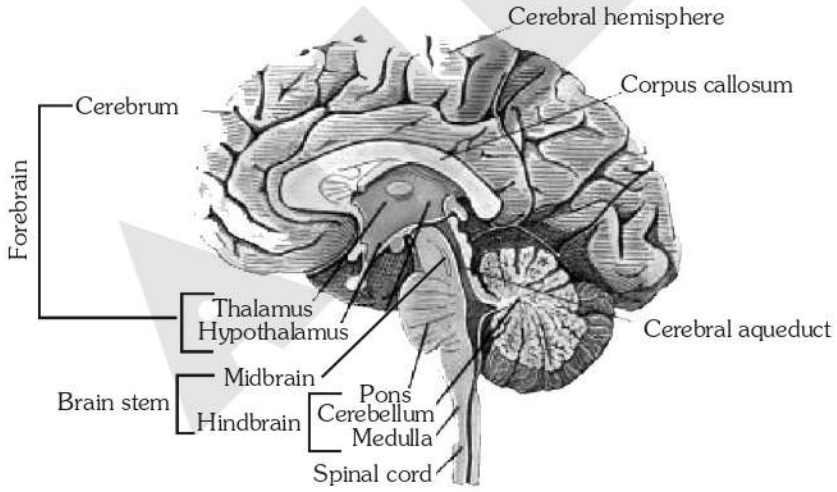
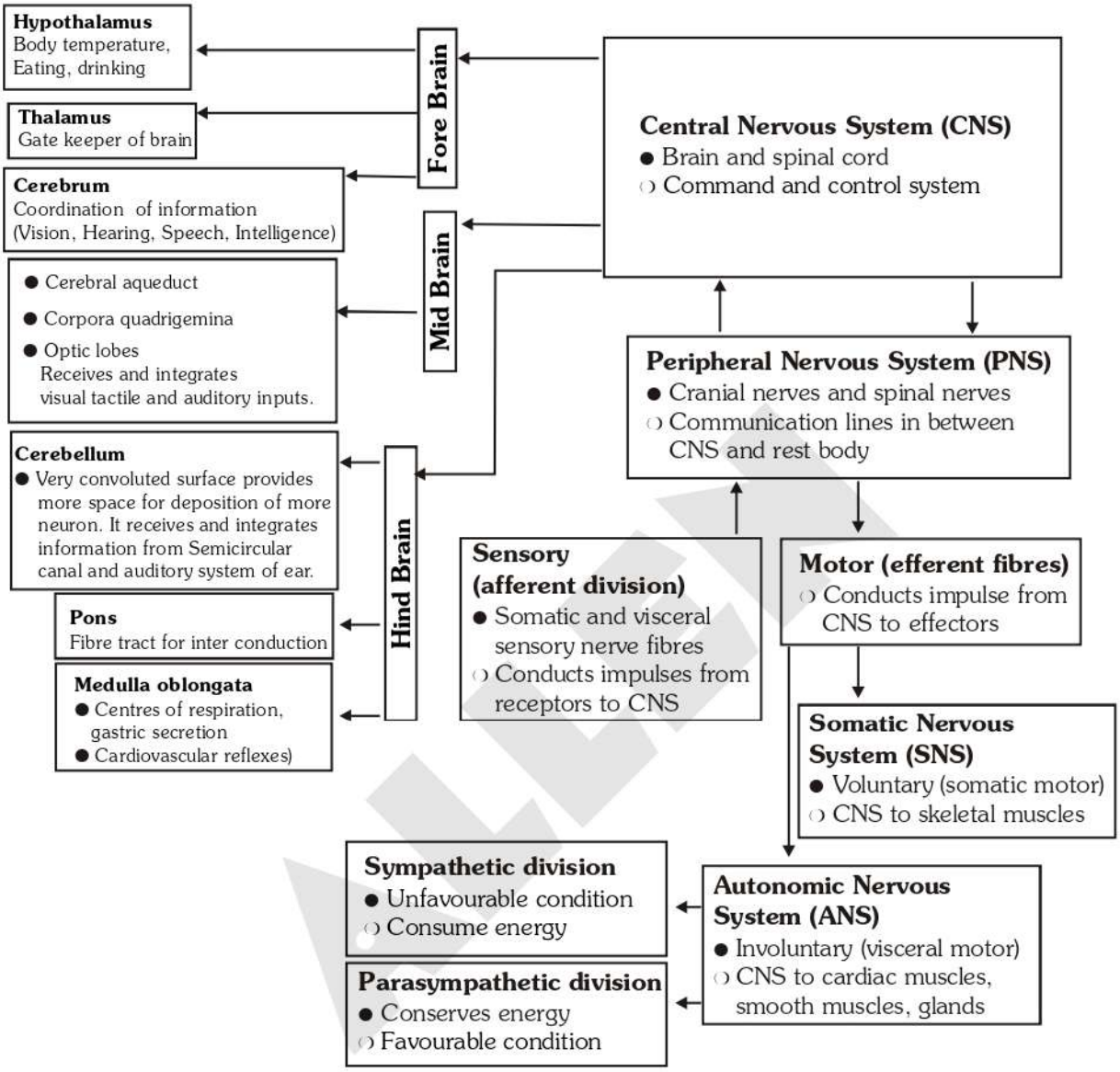


Diagram showing sagital section of the human brain

Human Neural System (Memory map)



Limbic system

It is a complex structure which includes inner parts of cerebral hemisphere and associated deep structures like amygdala, hippocampus. Along with hypothalamus, it is involved in olfaction autonomous response, regulation of sexual behaviour, expression of emotional reaction (Excitement, pleasure, rage and fear) and motivation.

Cranial meninges : Inside skull the brain is covered by cranial meninges, consisting of outer duramater, middle arachnoid, and inner piamater.

Cerebral hemispheres : A deep cleft divides the cerebrum longitudinally into two halves, termed as the left and right cerebral hemisphere.

Corpus callosum : The cerebral hemispheres are connected by a tract of nerve fibres called corpus callosum.

Cerebral cortex : The layer of cells which covers the cerebral hemisphere is called cerebral cortex, thrown in to prominent folds.

Gray matter : The cerebral certex is referred as the gray matter due to grayish appearance and it is due to highly concentrated neuron cell bodies.

White matter : Fibres of the tract are covered with myelin sheath which constitute the inner part of cerebral hemispheres and gives the opaque white appearance to the layer hence called the white matter.

Association area : The cerebral cortex contains motor area, sensory area and large regions called association areas responsible for complex functions like intersensory association, memory and communication.

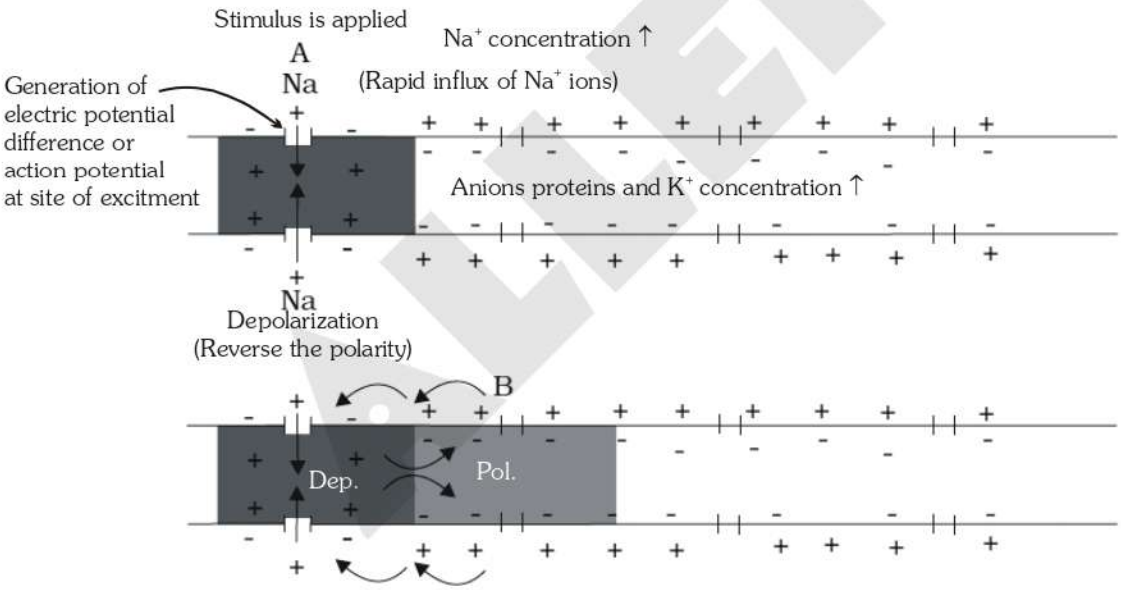
The neural system coordinate and integrates function as well as metabolic and homeostatic activities of all the organs.

Generation and conduction of nerve impulse

Excitable cells : Neurons are excitable cells because their membranes are in a polarized state due to differential concentration gradient of ions across the membrane. Different types of ion channels are present on neuronal membrane for which this membrane is selectively permeable.

Resting stage : When neuron is not conducting any impulse in that stage axonal membrane is more permeable for K^+ ions and nearly impermeable for Na^+ ions .Ionic gradient across the resting membrane is maintained by active transport of ions by **Na^+-K^+ pump.**

Polarized stage : By the presence of high concentration of Na^+ in fluid out side of axon, K^+ ions & negativety charged proteins in axoplasm and due to Na^+ – K^+ pump axonal membrane possesses a positive charge on outer surface and negative charge on its inner surface therefore its called **polarized.**



Diagrammatic reprsentation of impulse conduction thourgh an axon
Inner surface current flow A to B and outer surface from B to A

Resting potential : The electric potential difference across the resting plasma membrane is called as the resting potential.

Nerve impulse : Nerve impulse is conducted along the axon membrane in the form of depolarization and repolarization.

Transmission of impulses :

Synapse : A nerve impulse is transmitted from one neuron to another through junction called synapse one synapse is formed by the membrane of a presynaptic neuron and post synaptic neuron which may be or may not be separated by a gap called synaptic cleft.

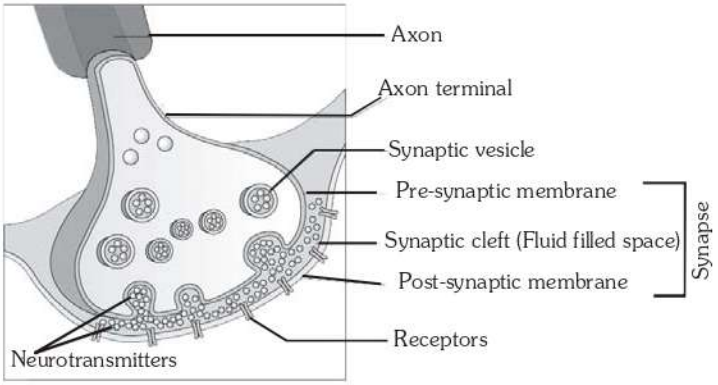


Diagram showing axon terminal and synapse

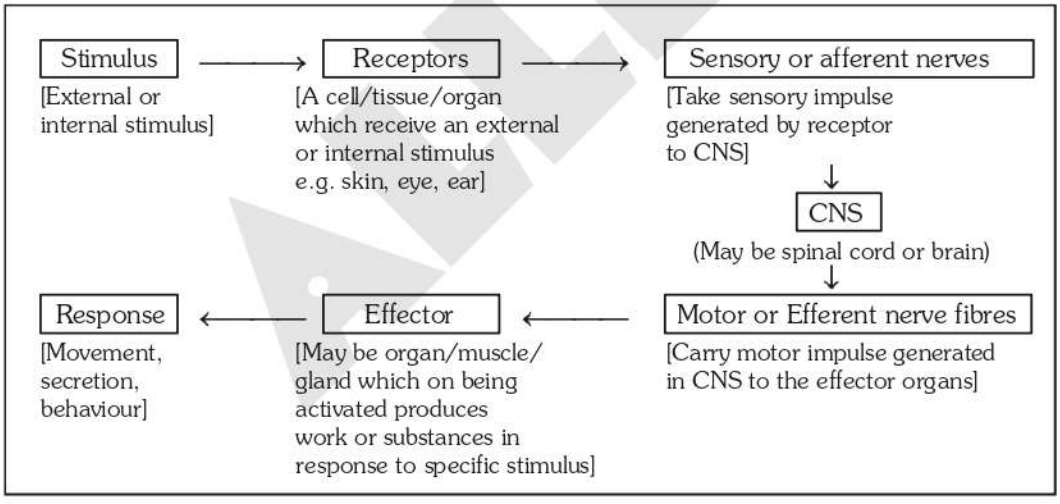
Types and difference in synapses : Two types of synapses are present namely electrical synapses and chemical synapses.

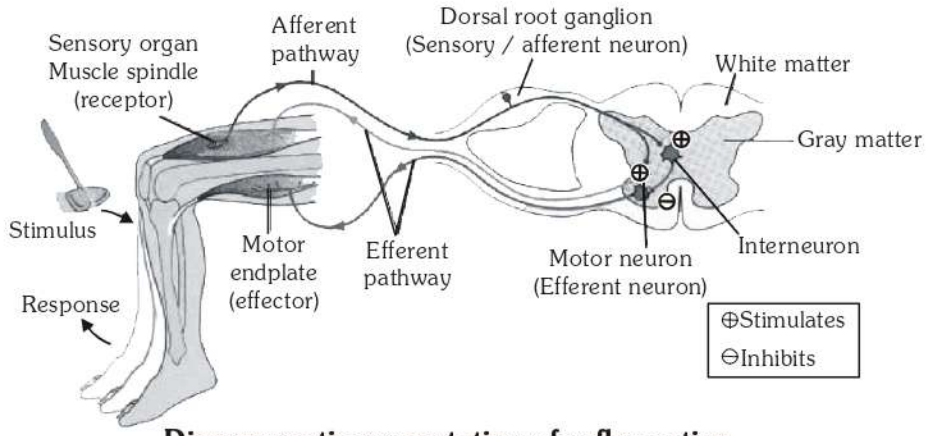
At electrical synapses the membranes of pre and post synaptic neurons are in very close proximity. Electric current flow directly from one neuron to other which is very similar to impulse conduction along a single axon. Impulse transmission across an electrical synapse is always faster than across a chemical synapse.

In chemical synapses when an impulse (action potential) arrives at the axon terminal, it stimulates the movement of the synaptic vesicles towards the membrane where they fuse with plasma membrane and release their neurotransmitter in the synaptic cleft. The released neurotransmitter binds to their specific receptors present on post synaptic membrane this binding opens ion channels allowing the entry of ions which can generate new potential may be either excitatory or inhibitory.

Reflex action and reflex arc : Sudden withdrawl of a body part which comes in contact with hot, cold, pointed object this entire process is involuntary response to a peripheral nervous stimulation called reflex action.

The reflex pathway comprises at least one afferent and efferent neuron appropriately arranged in series.





Diagrammatic presentation of reflex action (showing knee jerk reflex)

SENSORY ORGAN

Sensory receptor and processing :

The sensory organs detect all types of changes in the enviroment and send appropriate signals to the C.N.S. where all the inputs are processed and analysed. Signals are then sent to different parts / centres of the brain. thus you can sense changes in the environment.

EYE

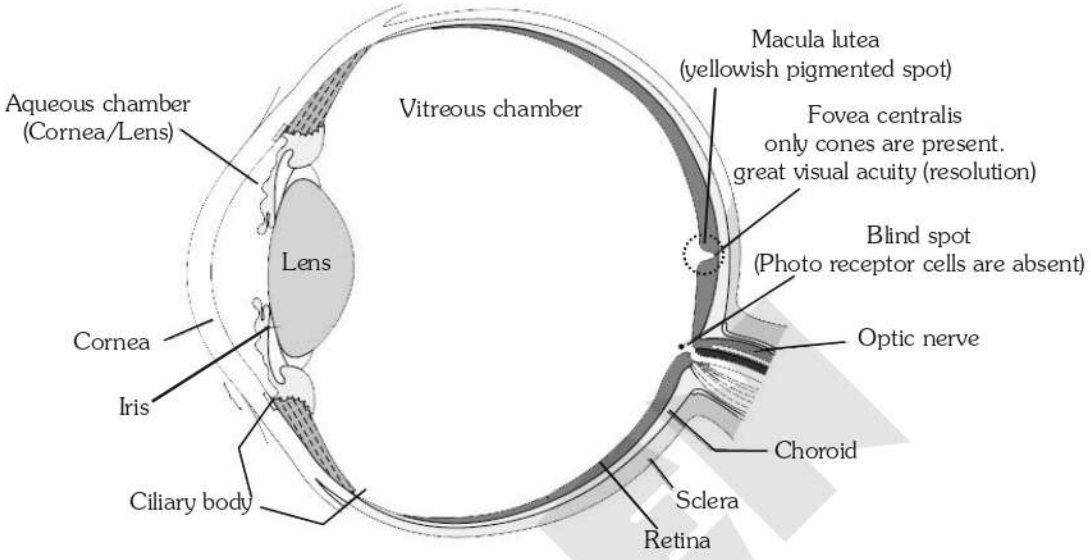
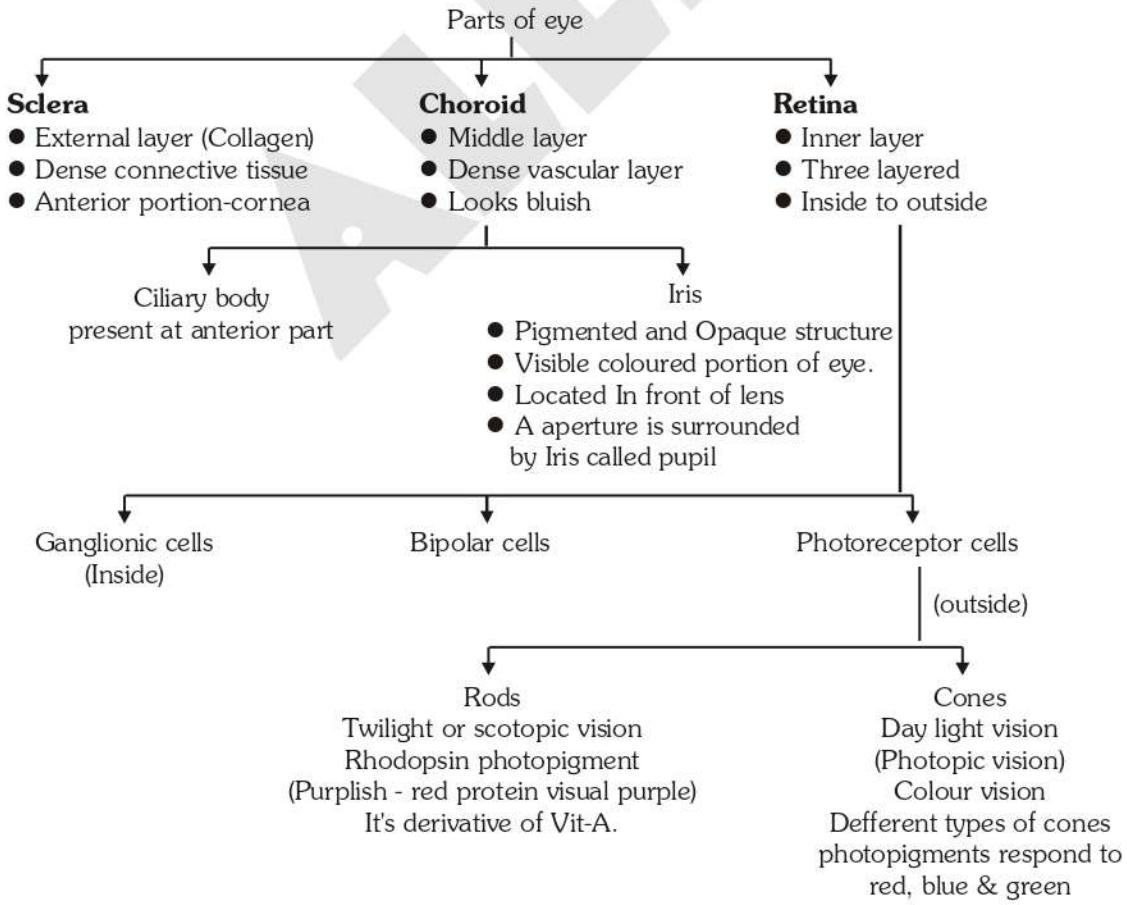


Diagram showing part of an eye



Light rays in visible wave length focus on

↓

Cornea

↓

Lens

↓

Retina

↓

Rods (Rhodopsin)
Light induces dissociation (Bleaching)

↓

Opsin (Protein)

Retinal (Vitamin-A)
Causes membrane permeability
Creates potential difference

Cones (Iodopsin)
(Colour differentiation)

↓

Bipolar cells

↓

Ganglionic cells (Action potential)

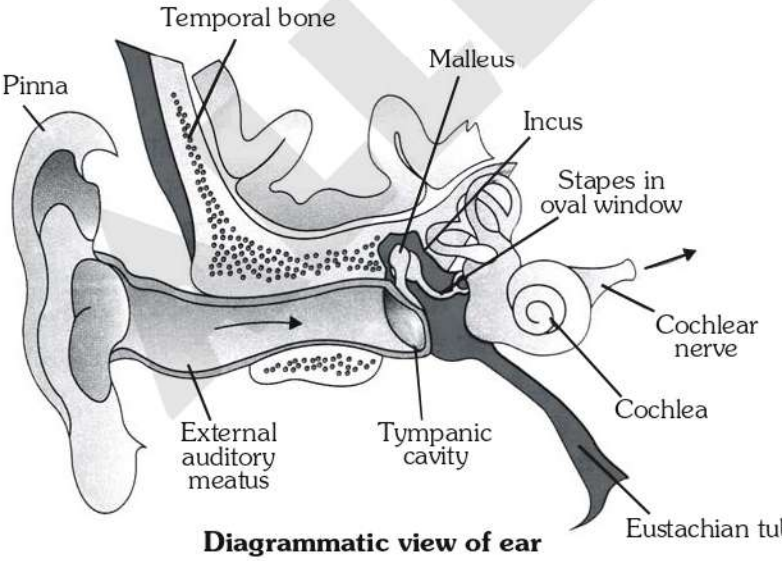
↓

Optic nerve

↓

Visual cortex of brain
(Analysis and formation of image based on earlier memory and experience)

THE EAR Perform two sensory functions hearing and maintenance of body balance.



Diagrammatic view of ear

Ear

↓

Outer Ear

↓

Pinna

External auditory meatus

Middle Ear

↓

Malleus

↓

Attached to tympanic membrane

Incus

Stapes

↓

Attached to oval window and opens in cochlea

Inner Ear
(Fluid filled called labyrinth)

↓

Bony labyrinth

↓

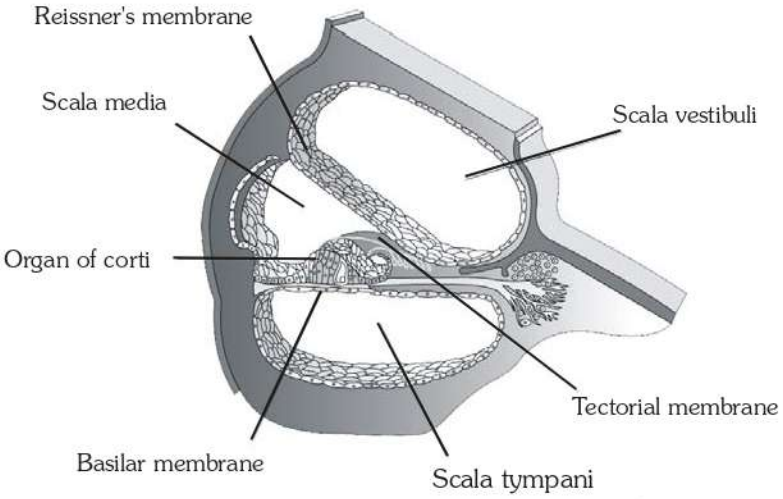
Perilymph

Membranous labyrinth

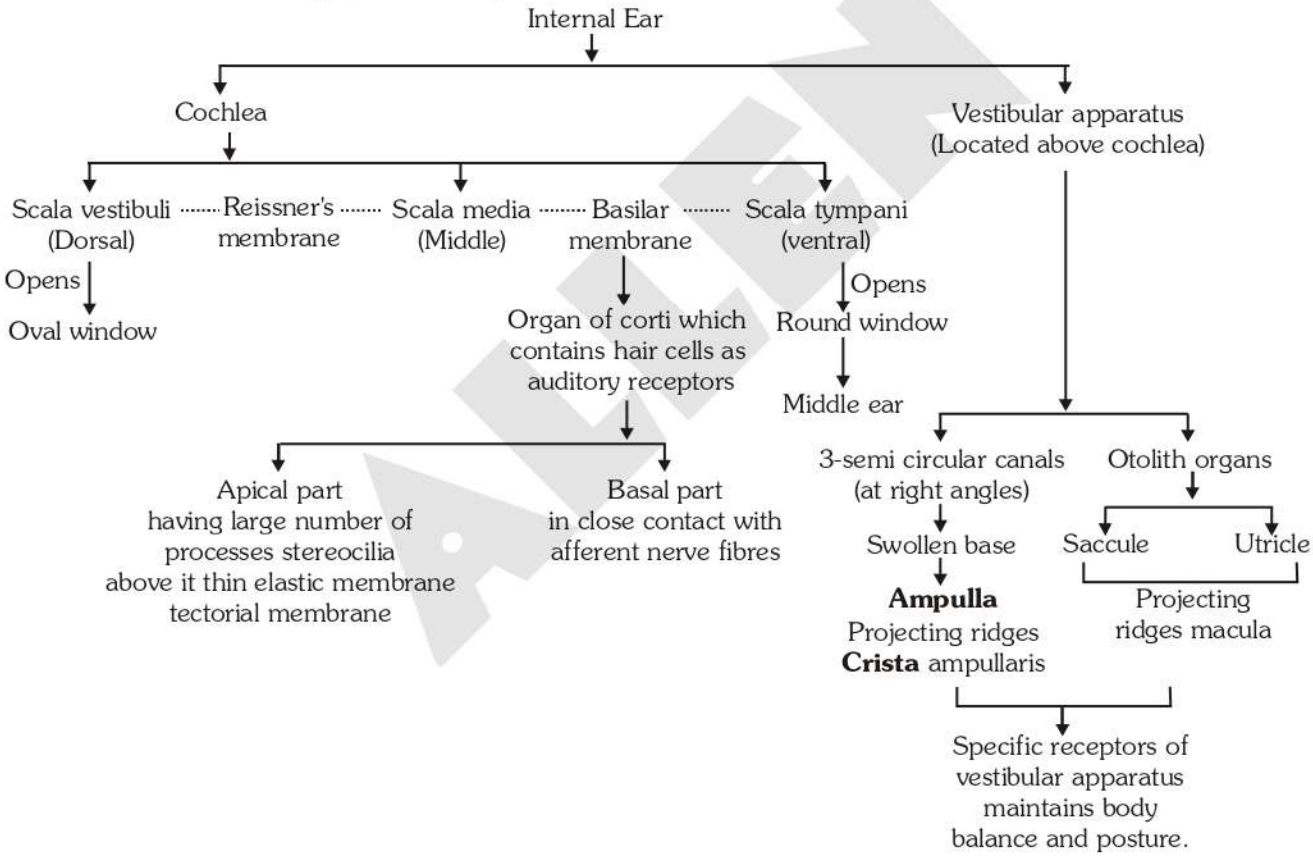
↓

Endolymph

- An eustachian tube connects the middle ear cavity with the pharynx and helps in equalising pressure on either side of eardrum



Diagrammatic representation of the sectional view of cochlea



Mechanism of hearing