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# Neural Control And Coordination



## Human Physiology



For pdf, join my telegram channel  
link in description



# NEURAL CONTROL AND COORDINATION

- Neural control and co-ordination
- Chemical control and coordination

Co-ordination → 2 or more organs interact and complement the function of one another

Neural System → Quick coordination point to point contact

→ Neurons →

Very simple organisation in lower invertebrates.

Hydra - Composed of network of neurons.

- Better organised in insects, Brain + ganglia.
- Vertebrates - developed neural system.

Human Neural System →

- divided in 2 parts -

① Central Nervous system →

Brain      Spinal cord  
Site for information, processing and control.

② Peripheral nervous system →

neurons associated with CNS comprises PNS.

Afferent Fibres

and/or sensory neuron [Receptor] → [CNS]

Efferent fibres

exit motor neuron [CNS] → [effector]

Peripheral Nervous System

→ Somatic Nervous System

→ Autonomic Nervous System

Somatic Nervous System

CNS  
↓ impulse

Skeletal muscles

Autonomic Nervous System

CNS  
↓ impulse

Smooth and cardiac muscles.

Sympathetic neural system

mobilise body, energy consume, emergency.

Parasympathetic neural system

Conserve energy non emergency

Nervous Tissue

- ectodermal origin.

Neural Tissue

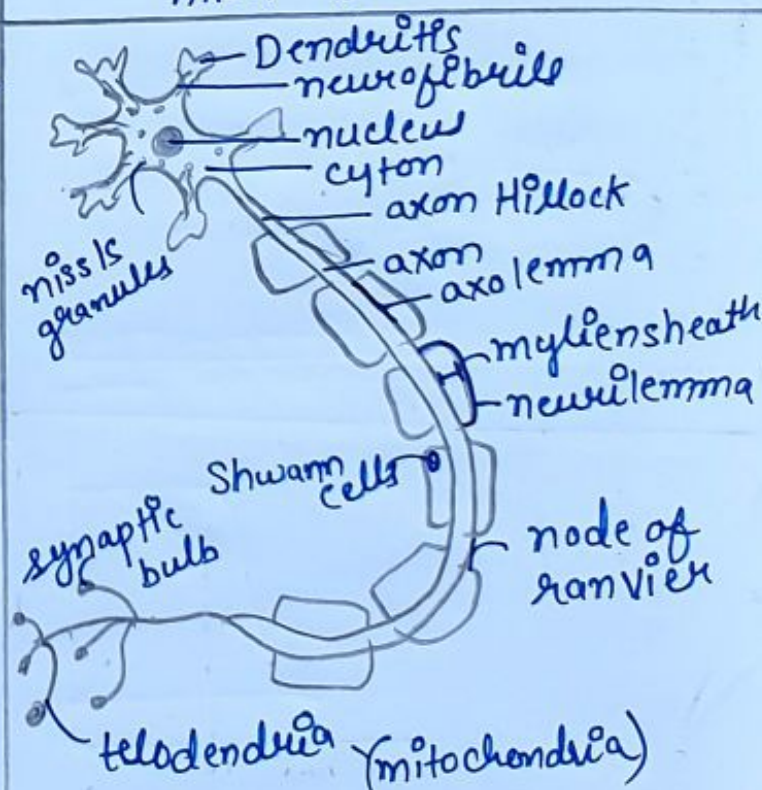
Neurons

Neuroglial Cells

Cyton

process of neuron

Axon Dendrites





neural cells lack centrioles (\*)  
ER + ribosome → Nissl's granules

Structure of Neuron →

- Cell body / Cyton.

→ Cell organelles and nucleus present except centriole.

→ Nissl's granules formed.

(site for protein synthesis)

→ Neurofibrils are present for conduction of impulse from dendron to cyton

→ Dendritile

- small cell process with fine branches to receive stimuli and conduct this stimuli to cyton.

→ Centripetal Conduction

→ Axon - long process - single.

Cyton → axon → axon hillock.

axolemma membrane

Nissl's granules absent

Neurofibrils and mitochondria present

Conduction of impulse.

Cyton → axon

(Centrifugal Conduction).

Telodendria - terminal end.

Synaptic Knob - Conduction of nerve impulse.

→ ↑ mitochondria.

Myelinogenesis - formation of (\*)  
myelin sheath.

Axon → Covered by myelin sheath  
(phospholipid)

Medullated / Myelinated nerve fibres.

→ Myelin sheath - discontinuous around axon.

→ Interruptions - node of ranvier

→ Myelin sheath prevent leakage of ions.

→ CNS → Myelin sheath <sup>grey</sup> absent XX

→ PNS → " present ✓ <sup>white</sup>

Conduction of impulse is quick in myelinated nerve fibres.

# Myelinogenesis in PNS is done by Shwann cells.

\* In CNS Neurolemma and Shwann cells absent, ∴ myelinogenesis by Oligodendrocytes.

\* Myelinated nerve fibres are found in cranial and spinal nerves.

# Collection of cyton - nuclei (CNS)  
ganglia (PNS)

# Collection of nerve fibres  
Tract (CNS) Nerve (PNS)

Types of Neuron →

apolar - Only cyton present  
no dendrites  
no axon

eg - Hydra, amacrine cell of eye.

Pseudo Unipolar - nerve cell has  
1 cyton 1 axon  
eg - Dorsal root ganglia.

Unipolar - 1 cyton, 1 axon  
eg - Nervous system of embryo (\*)

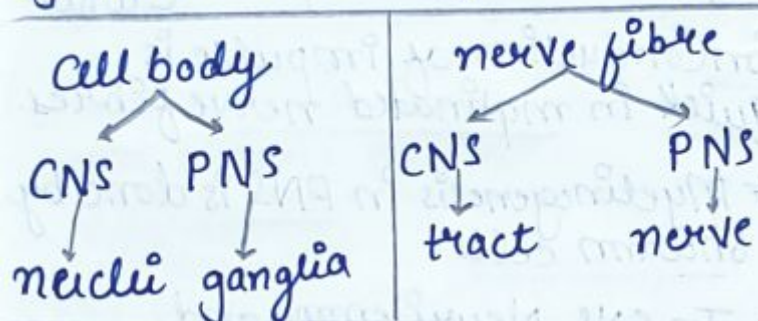


Bipolar - 1 cyton, 1 dendron, 1 axon.

eg- Retina, Olfactory epithelium

Multipolar - 1 cyton, 1 axon, several dendrites.

eg- Most neurons of our body.

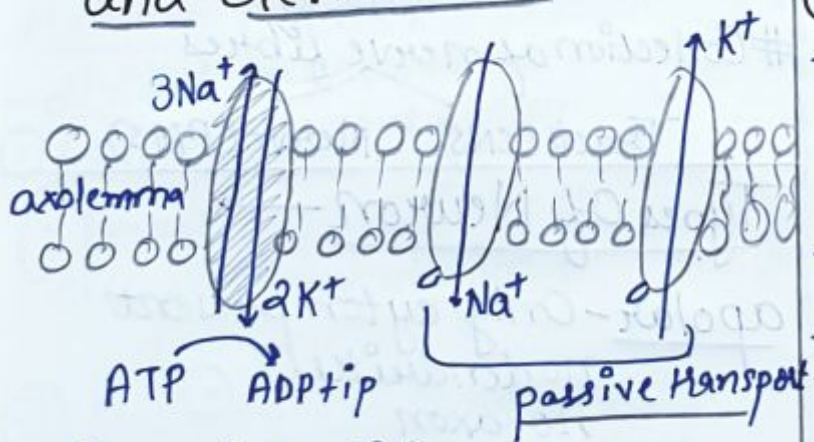


### \* Synapsis

Electrical  
pre and post synaptic neuron are very close.

Chemical  
pre and post synaptic neuron are separated

## Nerve Impulse Conduction and Generation →



- Normal Condition - axolemma is permeable to K<sup>+</sup> and impermeable to Na<sup>+</sup>.

### ① Resting / Polarised phase →

- Na<sup>+</sup> K<sup>+</sup> pump open.
- Voltage gated channel for K<sup>+</sup> and Na<sup>+</sup> closed.

3Na<sup>+</sup> out, 2K<sup>+</sup> in. Potential diff at resting phase = -70mV

- most abundant intercellular cation = Na<sup>+</sup>

- intracellular cation = K<sup>+</sup>

### ② Excited State / Depolarisation Action potential →

- Stimuli → +10Vm (V.d., threshold stimulus)
- Voltage gated channel for Na<sup>+</sup> opens → Rapid influx of Na<sup>+</sup> ions into the axolemma.

action potential / Depolarisation.

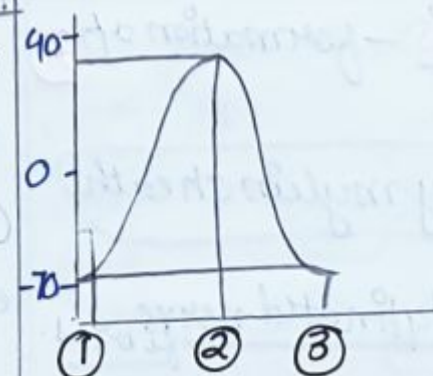
P.D. = +30 - +45mV

Conduction of impulse, ∴ P.D. → +

### ③ Repolarisation -

- after seconds - Na<sup>+</sup> gated channel - close, K<sup>+</sup> gated channel - open.
- Rapid efflux of K<sup>+</sup> ions occurs
- During repolarisation, P.D. returns to -70mV

++++ --- +++++ Refractory period 0.01s

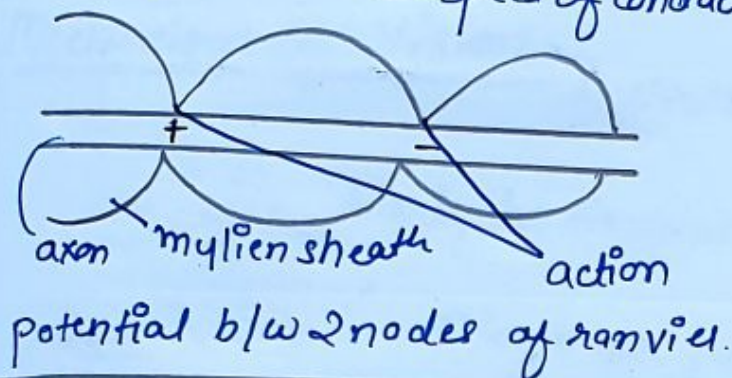




- Speed of conduction of nerve impulse - 100 m/s.

## Saltatory Conduction of Nerve Impulse →

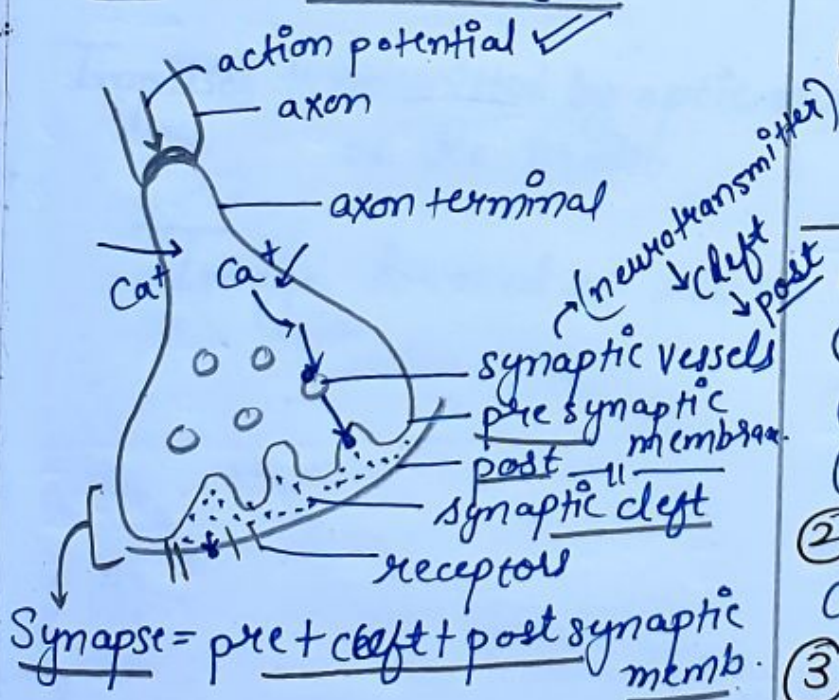
myelinated nerve fibre > unmyelinated nerve fibre  
 ↳ speed of conduct?



## Synapsis → Junc.<sup>n</sup> b/w 2

neuron where info. is transferred from one neuron to other.

Term - Charles Sherrington.



Synapse = pre + cleft + post synaptic memb.

## Central Nervous System (CNS)

- Brain
- Spinal Cord.

### Human Brain →

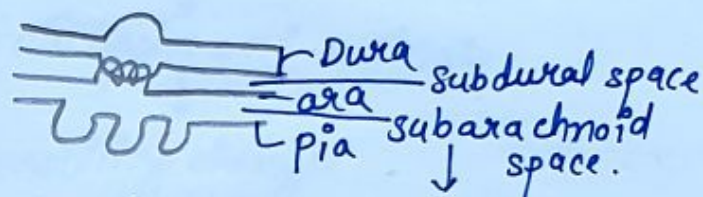
Cranium → 8 bones

Outer Covering of Brain - Meninges

Outer most — ① Dura Matter

Inner most — ② Arachnoid

③ Pia Matter



\* filled with cerebrospinal fluid (CSF)

\* CSF originates from choroid plexus.

\* present in ventricles of brain, subarachnoid space, spinal cord.

function - Transport, shock absorber, buoyancy to brain

effective weight - 180 gm

### ① Fore Brain —

① Olfactory lobe

② Cerebrum

③ Diencephalon.

### ② Mid Brain —

Cells of corpora quadregia.

### ③ Hind Brain —

① Pons

② Medulla Oblongata

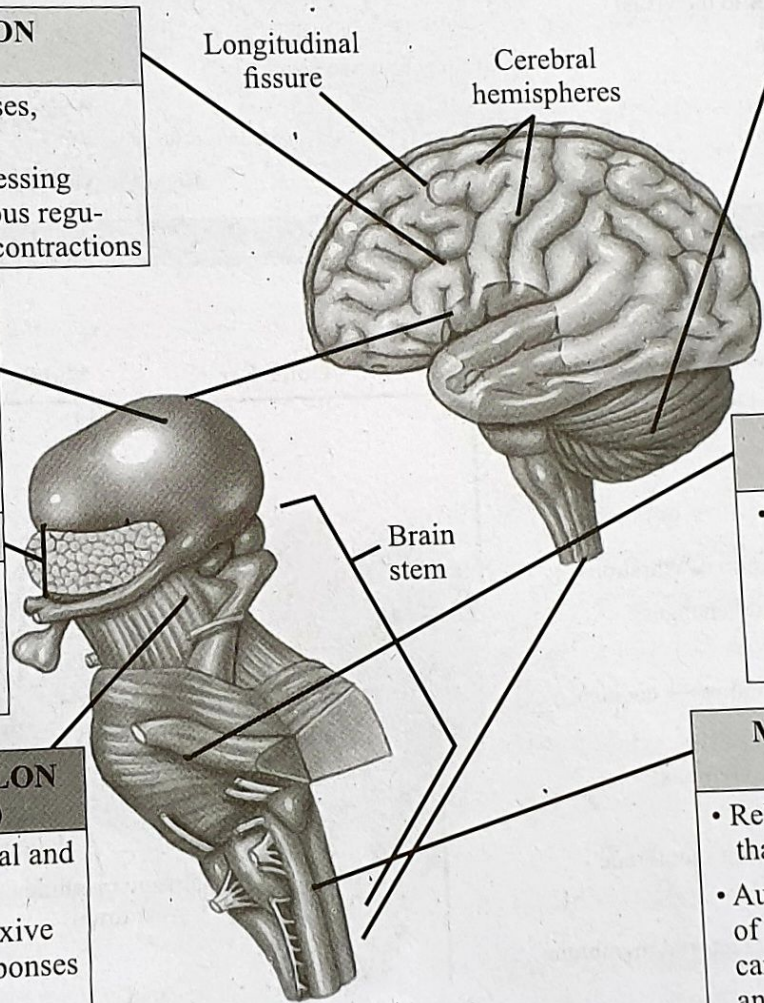
③ Cerebellum



TELENCEPHALON (CEREBRUM)
<ul style="list-style-type: none"> <li>• Conscious thought processes, intellectual functions</li> <li>• Memory storage and processing</li> <li>• Conscious and subconscious regulation of skeletal muscle contractions</li> </ul>

DIENCEPHALON
<b>THALAMUS</b> Relay and processing centers for sensory information
<b>HYPOTHALAMUS</b> Centers controlling emotions, autonomic functions, and hormone production

MESENCEPHALON (MIDBRAIN)
<ul style="list-style-type: none"> <li>• Processing of visual and auditory data</li> <li>• Generation of reflexive somatic motor responses</li> <li>• Maintenance of consciousness</li> </ul>



METENCEPHALON (CEREBELLUM)
<ul style="list-style-type: none"> <li>• Coordinates complex somatic motor patterns</li> <li>• Adjusts output of other somatic motor centers in brain and spinal cord</li> </ul>

METENCEPHALON (PONS)
<ul style="list-style-type: none"> <li>• Relays sensory information to cerebellum and thalamus</li> <li>• Subconscious somatic and visceral motor centers</li> </ul>

MEDULLA OBLONGATA (MYELENCEPHALON)
<ul style="list-style-type: none"> <li>• Relays sensory information to thalamus</li> <li>• Autonomic centers for regulation of visceral functions such as cardiovascular, respiratory, and digestive activities</li> </ul>



B) Spinal Cord :- Enclosed within the spinal canal of vertebral column.

Functions :-

- Conduction of impulses to and from the brain.
- Centre of spinal reflexes.

## Eye

### Mechanism Of Vision

Light rays focussed on retina through cornea and lens.

↓ Impulses

Activates rods and cones

↓  
Rhodopsin dissociates into opsin and retinal.

↓  
Membrane permeability changes

↓  
potential differences generated in the photoreceptor cells.

↓ Through bipolar cells

Action potential generated in ganglion cells.

↓  
Impulses transmitted by optic nerves to the visual cortex area of the brain.

Image formed on retina.

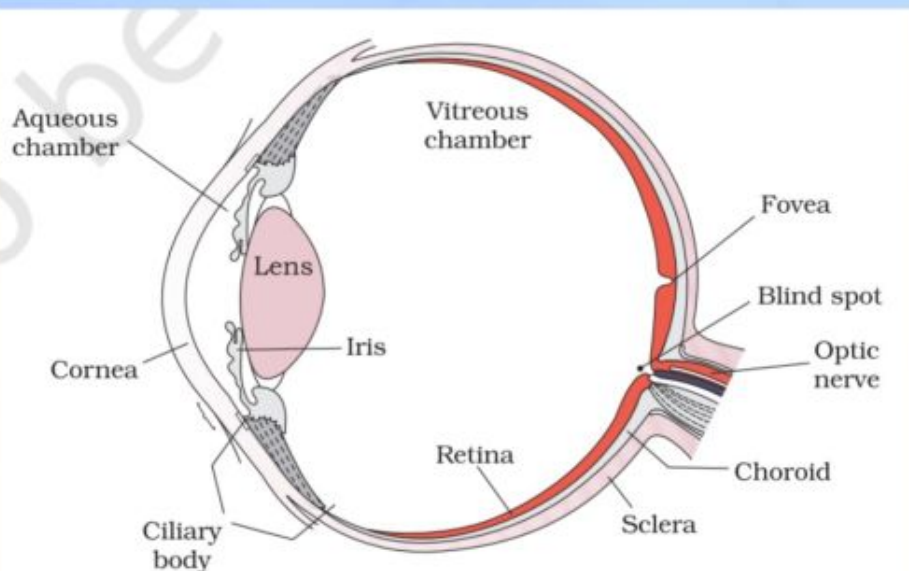


Figure 21.6 Diagram showing parts of an eye



# Ear - Mechanism Of Hearing

Sound waves  
↓ *Received by*  
External ear  
↓ *Vibrates*  
Ear drum  
↓ *Transmission of vibrations*  
Membrane permeability changes.  
↓  
From ear ossicles → Oval window → cochlea  
↓  
Waves generated in lymph  
↓  
Ripple is induced in basilar membrane.  
↓ *Results in*  
Hair cells bend and pressed against tectorial membrane.  
↓  
Nerve impulse generated in the associated afferent neurons.  
↓  
Transmission of impulse to auditory cortex of the brain  
via auditory nerves.  
↓  
Sound is Recognised.

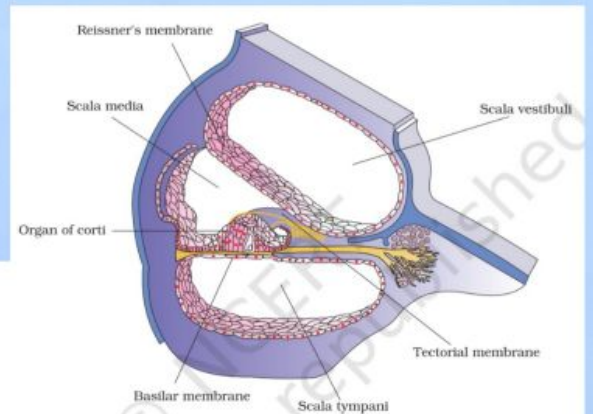


Figure 21.8 Diagrammatic representation of the sectional view of cochlea

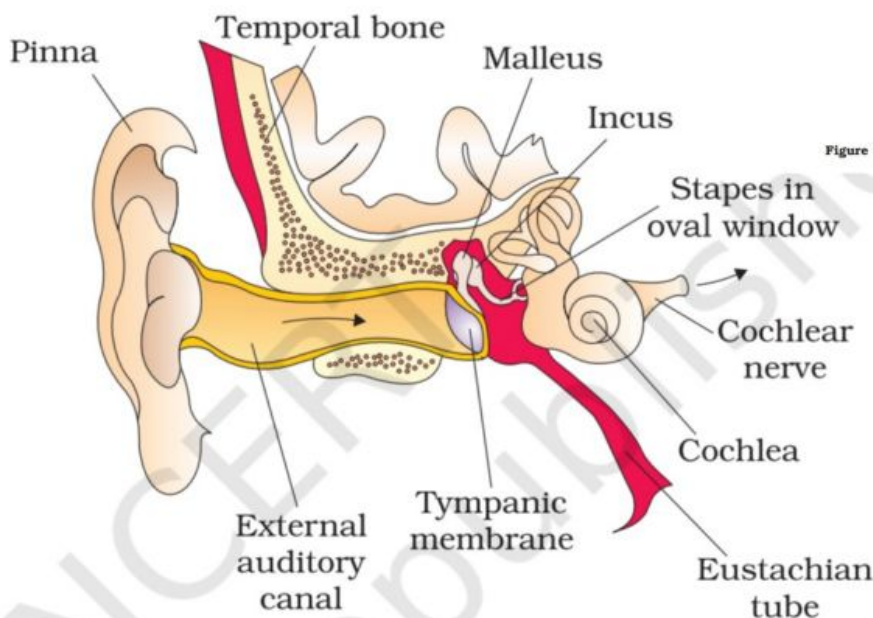


Figure 21.7 Diagrammatic view of ear

