

YAKEEN NEET 2.0

2026

Neural Control and Coordination

Zoology

Lecture - 01

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Struc. Org.
Lec-7

Neural Tissue - 2 types of Cells

I

NEURON

- Structural & functional unit of Neural tissue
- Excitable Cells
- Microscopic structure

II

NEUROGLIA

(= Glue)

- Support, Protect, and Packaging of neurons
- More than One-half of volume of neural tissue

Struc. Org.
Lec-7

Myelin sheath: Phospholipid layer, Act as Insulator

↓
No Exchange of Ions

*NCERT
Neural Control
chapter

NEURON - 3 parts

I DENDRITE

- Short fibres
- Branched repeatedly
- Transmit impulse towards cell body
- Project out of cell body
- Nissl's granules present

II

CELL BODY

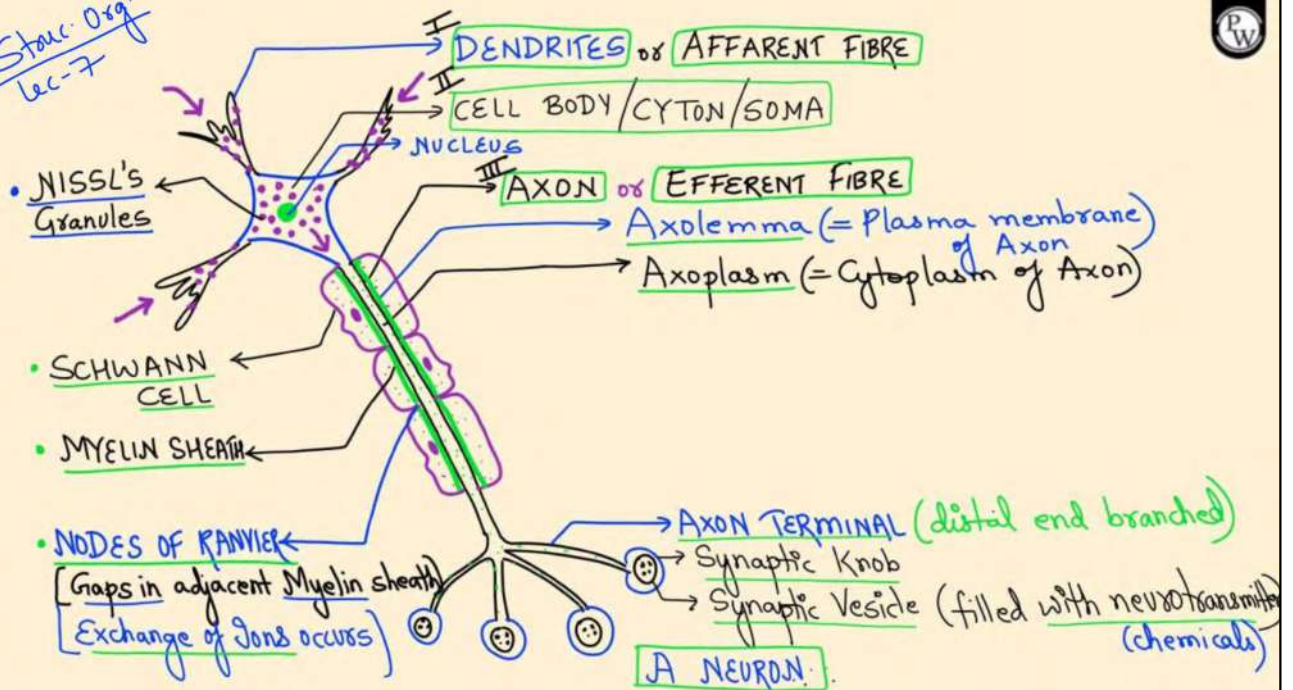
- Contains Nucleus, Cytoplasm, other typical organelles
- Granular structure called "NISSL'S Granules"
 - *made of RER + Ribosomes
 - *Function: PROTEIN SYNTHESIS

III

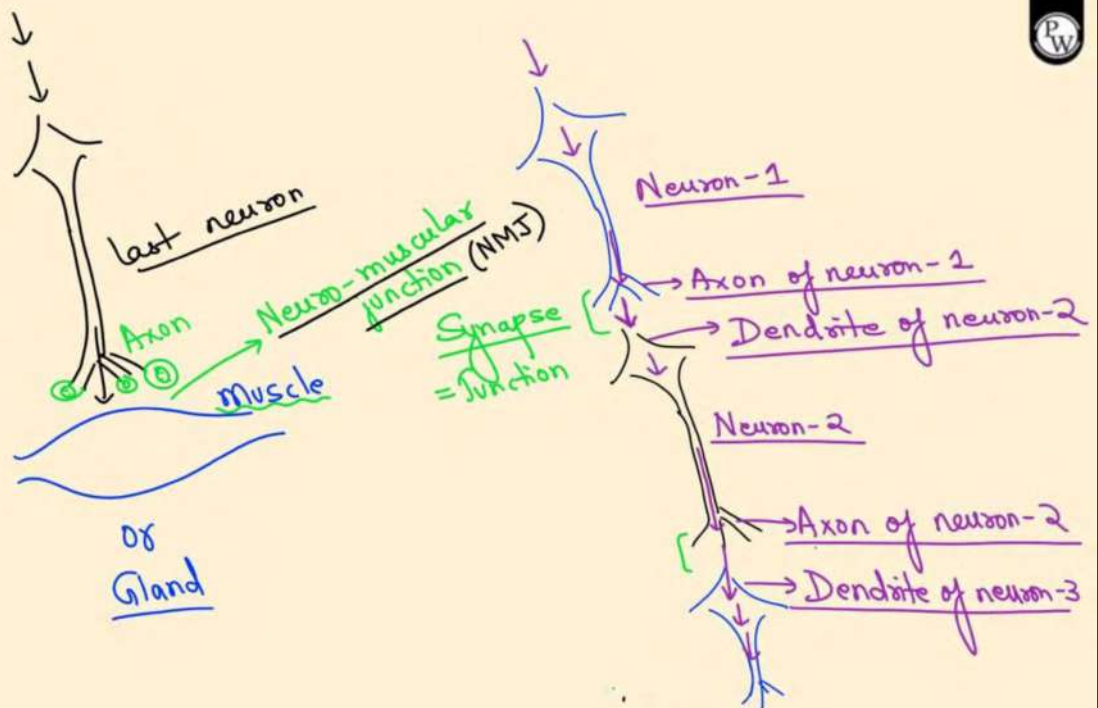
AXON

- long fibre
- distal end is branched
- Transmit impulse away from cell body to Synapse or Neuro-muscular junction

Struc. Org.
Lec-7



Struc. Org.
Lec-7



* Neural Control & Coordination :-

Nervous System

Order Command

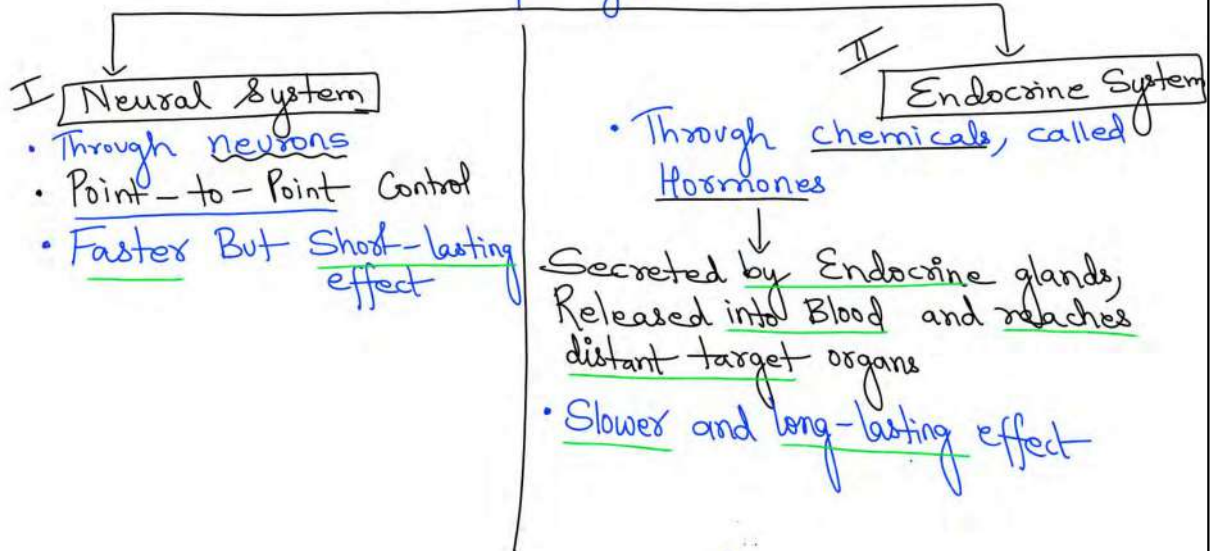
Process through which 2 or more organs interact and complement functions of each other, to maintain homeostasis (constant internal environment)

eg. During exercise, Energy demand ↑

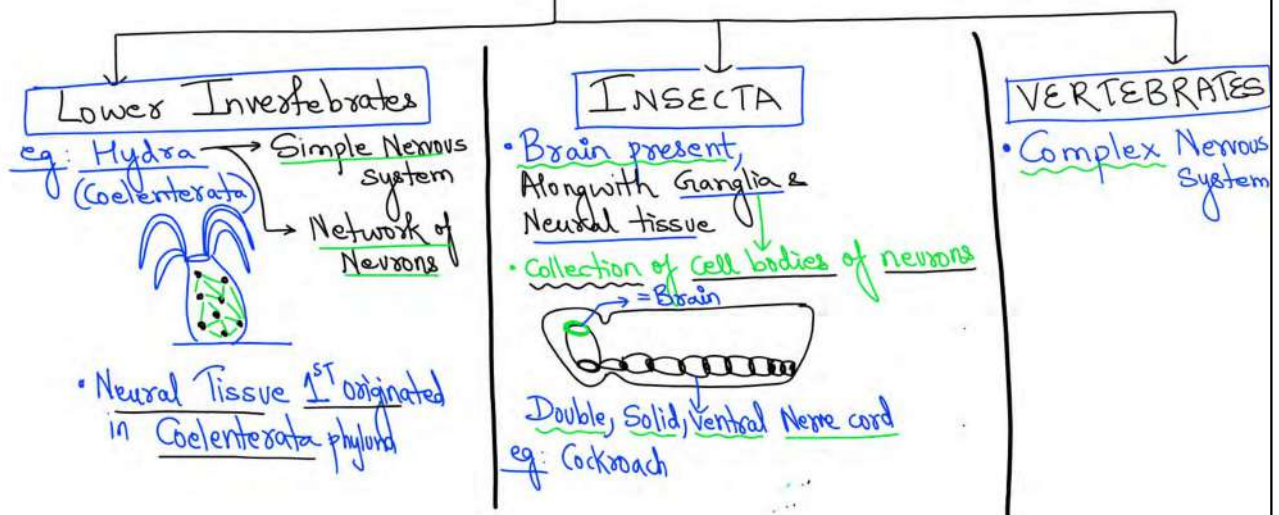
1. Muscular activity ↑
2. More O_2 needed
3. Resp. Rate ↑
4. Heart Rate ↑, C.O ↑
5. Blood flow in vessels ↑
6. Kidney functions ↑

Muscles, Heart, Lungs, Blood vessels, Kidneys coordinate

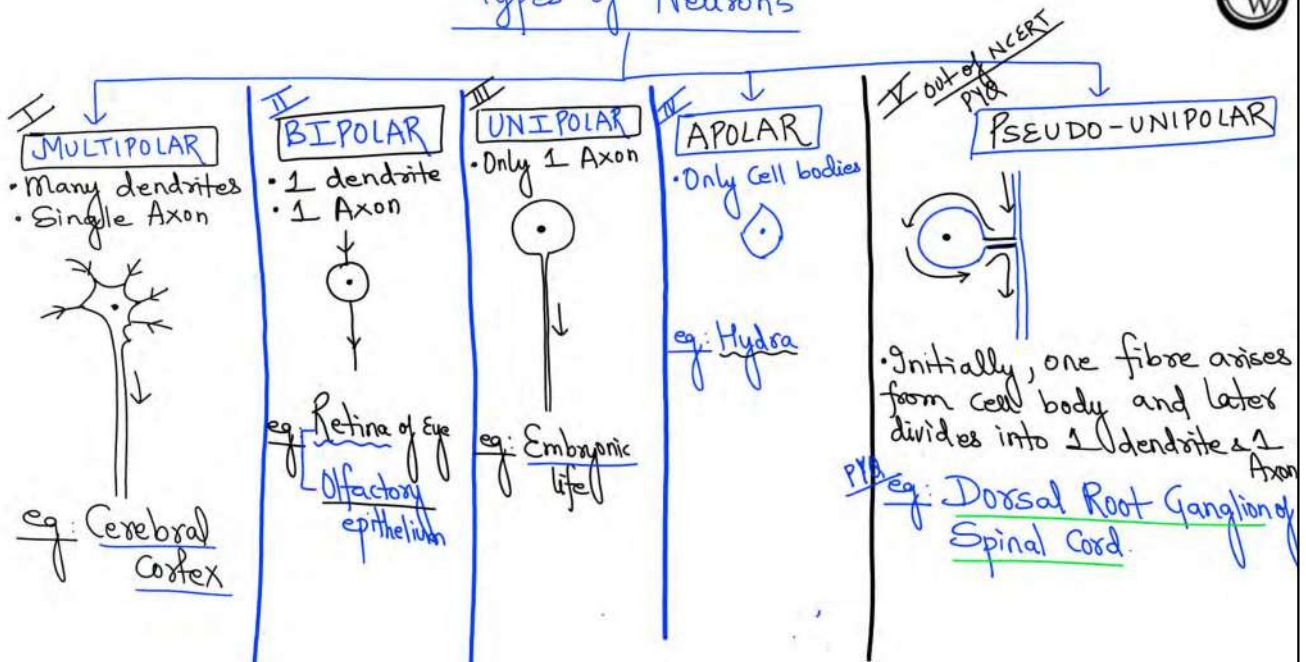
In human body, Coordination occurs through in Synchronised manner



Neural System [Ectodermal, except Microglia (Phagocytic) ↓ Mesodermal]



Types of Neurons

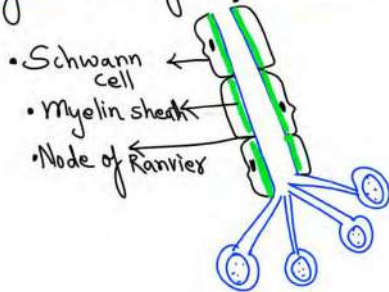


Types of Neurons

I

Myelinated/Medullated

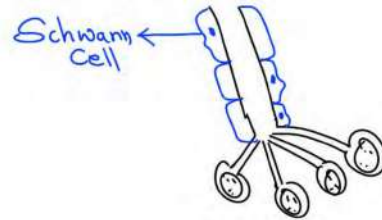
- Myelin sheath formed by (Phospholipid, Insulator)
- Schwann Cells in PNS
- Oligodendrocytes in CNS



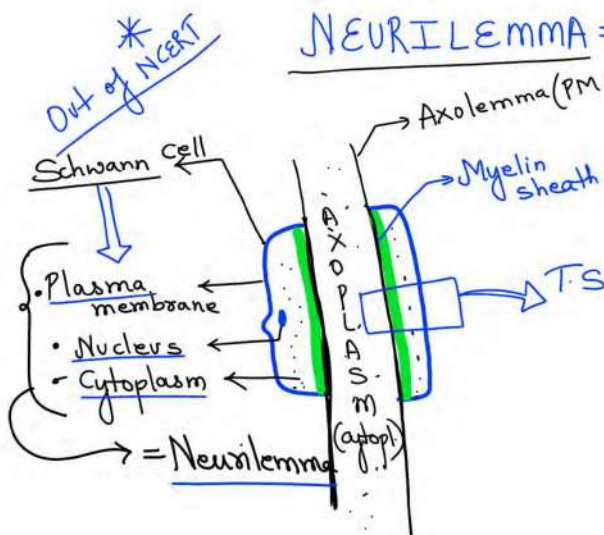
II

Un-myelinated/Non-medullated

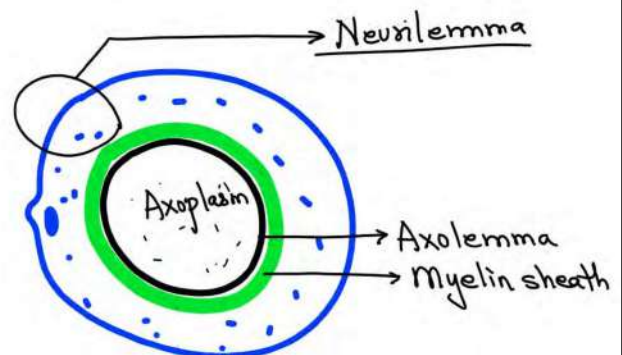
- Schwann cells present But do not secrete Myelin sheath



| Character | Myelinated MSC | Unmyelinated Neuron |
|------------------------------------|---|---------------------------------------|
| 1. Schwann Cell Oligodendrocyte | ⊕ | ⊕ |
| 2. Myelin sheath | ⊕ | ⊖ |
| 3. Node of Ranvier | ⊕ | ⊖ |
| 4. Saltatory Jumping Conduction | ⊕ 20 times faster Conduction of Nerve impulse | ⊖ |
| 5. Occurrence | In Cranial and Spinal Nerves | In Somatic & Autonomic Nervous System |



NEURILEMMA = Sheath of Schwann Cell



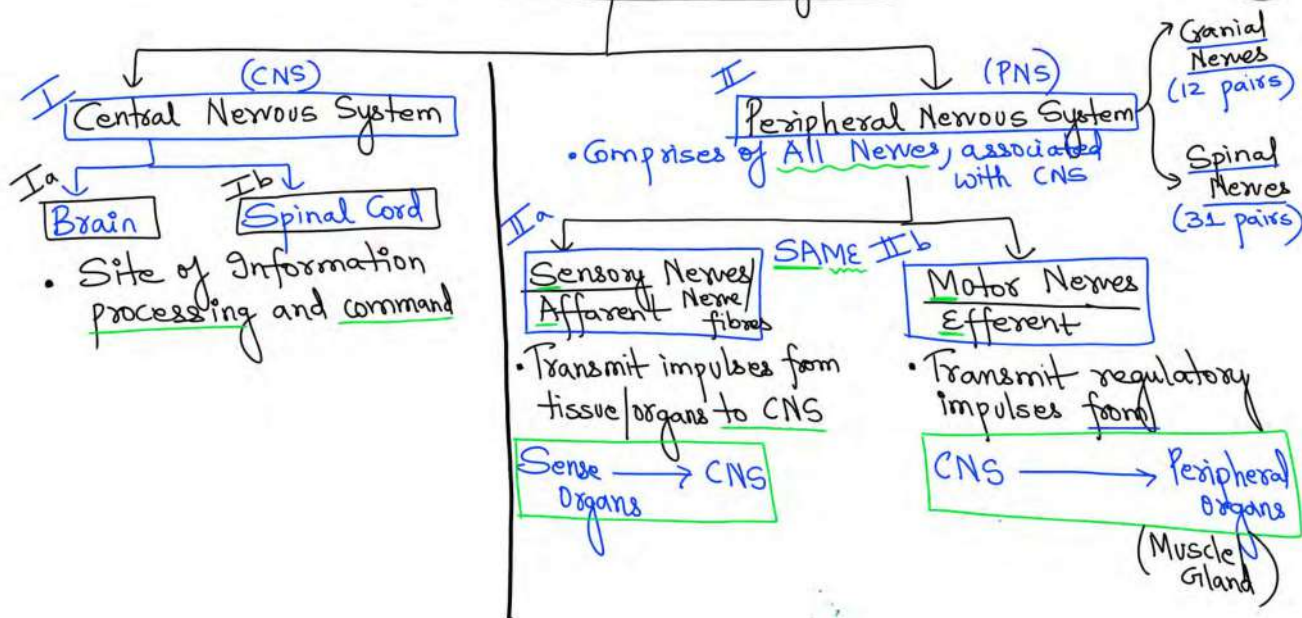
NOTE

* Plexus = Network (जाल)

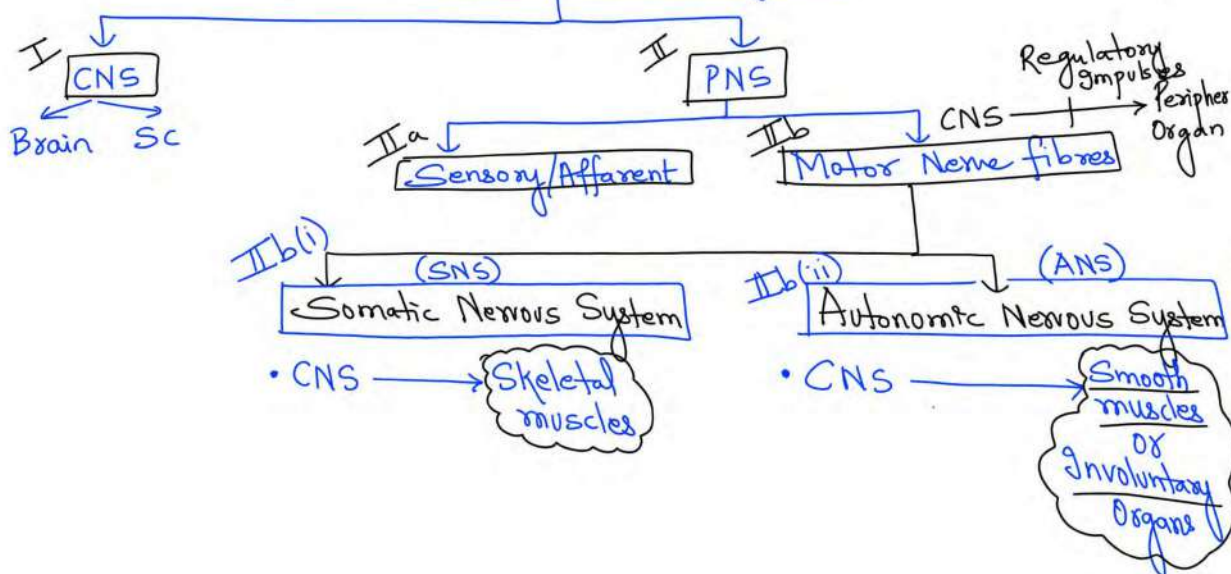
| | CNS | PNS |
|--|---------------|---------------------|
| 1. Group of <u>Cell bodies</u> | <u>Nuclei</u> | <u>Ganglia</u> |
| 2. <u>Group Bundle</u> of <u>Axons</u> | <u>Tract</u> | <u>Nerve fibres</u> |

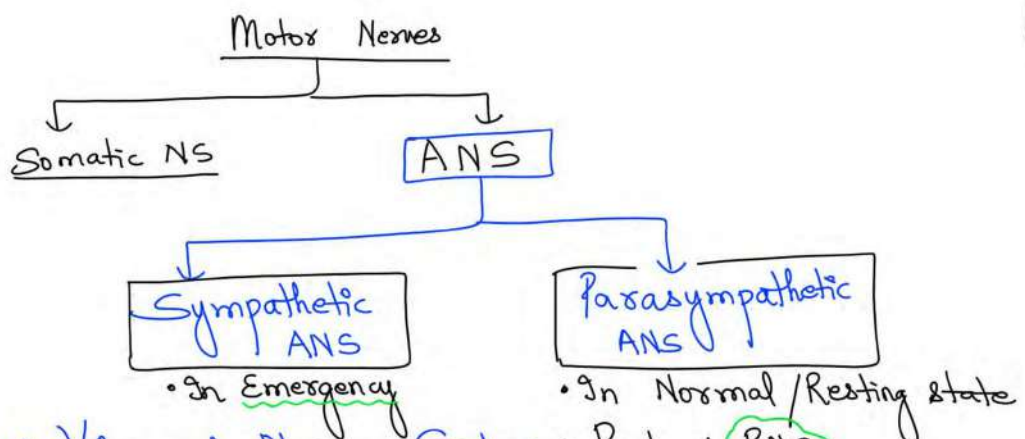
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Human Nervous System

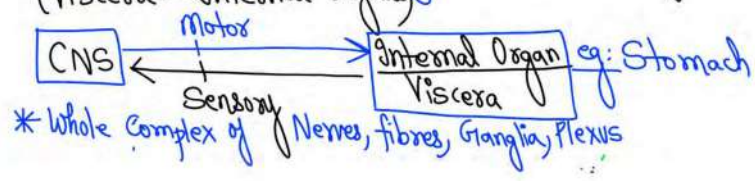


Human Nervous System

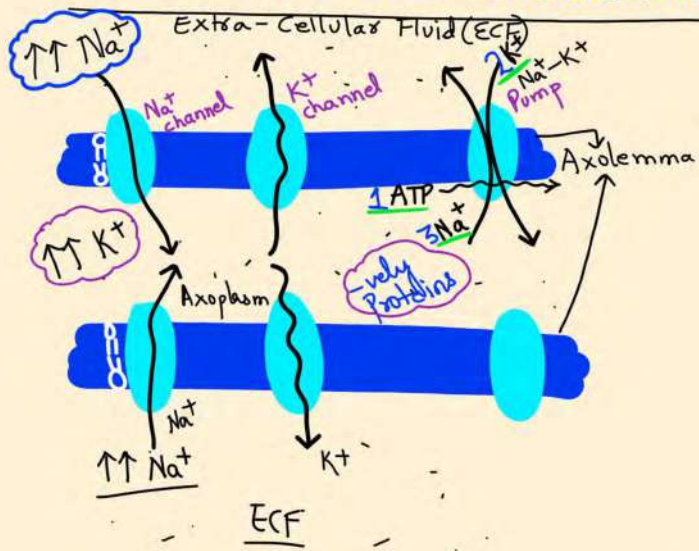




NOTE :- Visceral Nervous System \Rightarrow Part of PNS
 (Viscera = Internal Organs)

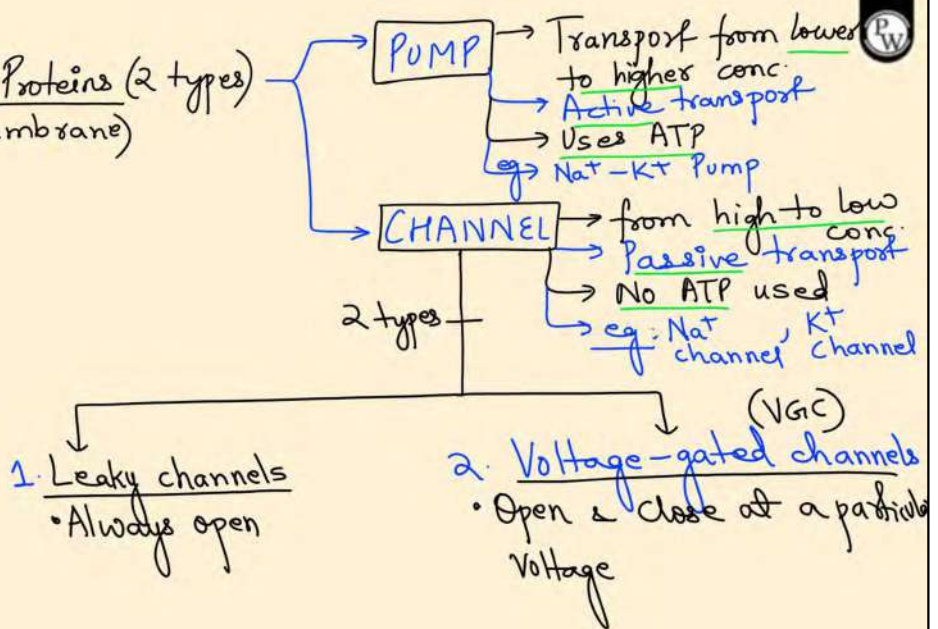


* Generation and Conduction of Nerve Impulse



- ↑ K⁺ (Kudiyā) \rightarrow घर के अंदर (Inside cell)
- K⁺ more inside cell in Axoplasm
- Na⁺ more Outside cell in ECF
- -vely charged proteins present inside Axoplasm

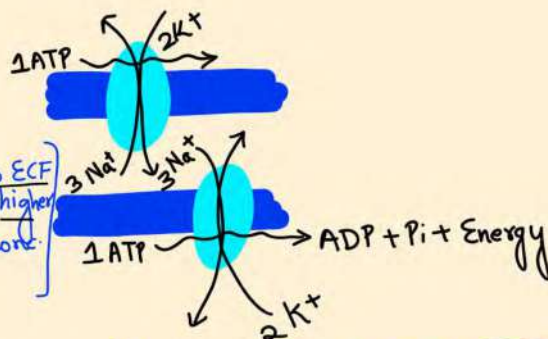
* Membrane Proteins (2 types) (Transmembrane)



* $\text{Na}^+ - \text{K}^+$ Pump

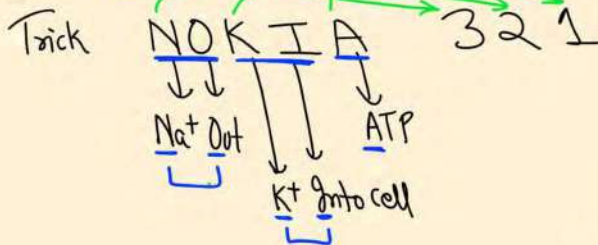
• Na^+ efflux

from Axoplasm to ECF
lower conc. higher conc.



• K^+ Influx

from ECF to Axoplasm
lower conc. higher conc.



• Na^+ channel: Transport Na^+ from higher to lower conc. ECF outside cell Axoplasm into cell

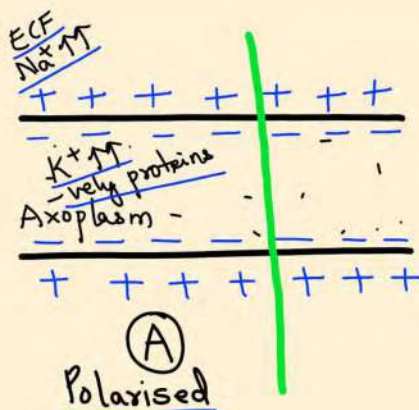
• K^+ channel: Transport K^+ from higher to lower conc. Axoplasm inside cell ECF outside cell

| * VGc | Opens at | Closes at |
|----------------------|----------|-----------|
| 1. Na^+ VGc | -55 mV | +30 mV |
| 2. K^+ VGc | +30 mV | -90 mV |

* STIMULUS

1. light - Eyes
2. Sound - Ears
3. Smell - Nose
4. Taste - Tongue
5. Touch - Skin

I RESTING/POLARISED STAGE: Axolemma



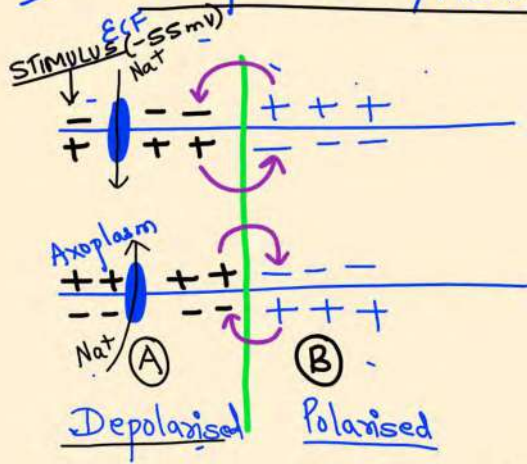
* Resting Membrane Potential (RMP)
RMP = -70 mV

* RMP created due to: Membrane is

- a) almost Impermeable to Na^+ ions
- b) Slightly More permeable to K^+
- c) Impermeable to -vely proteins inside Axoplasm

* RMP Maintained by: Sodium-Potassium Pump

II Depolarised / Active Stage: Axolemma



Inside +ve
Outside -ve

• When stimulus of -55 mV given

Na⁺ VGC Opens

Rapid Influx of Na⁺ into Cell into Axoplasm

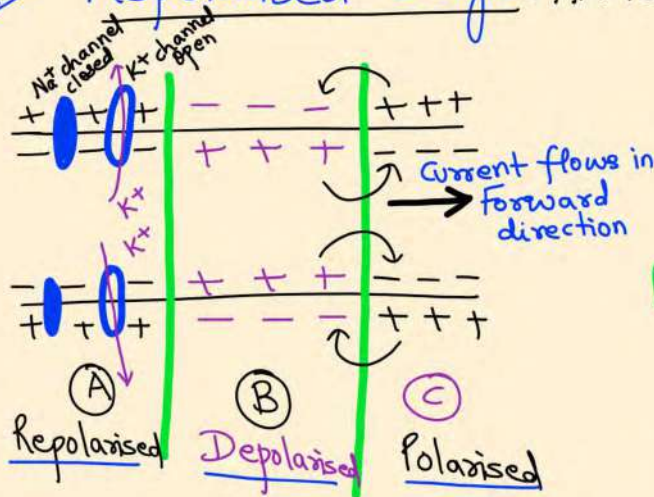
DEPOLARISATION

[Reversal of Polarity at Membrane]

• Current flows from: Inner Side A → B
Outer Side B → A

+30 mV = Action potential
Nerve impulse

III Repolarised Stage: Axolemma



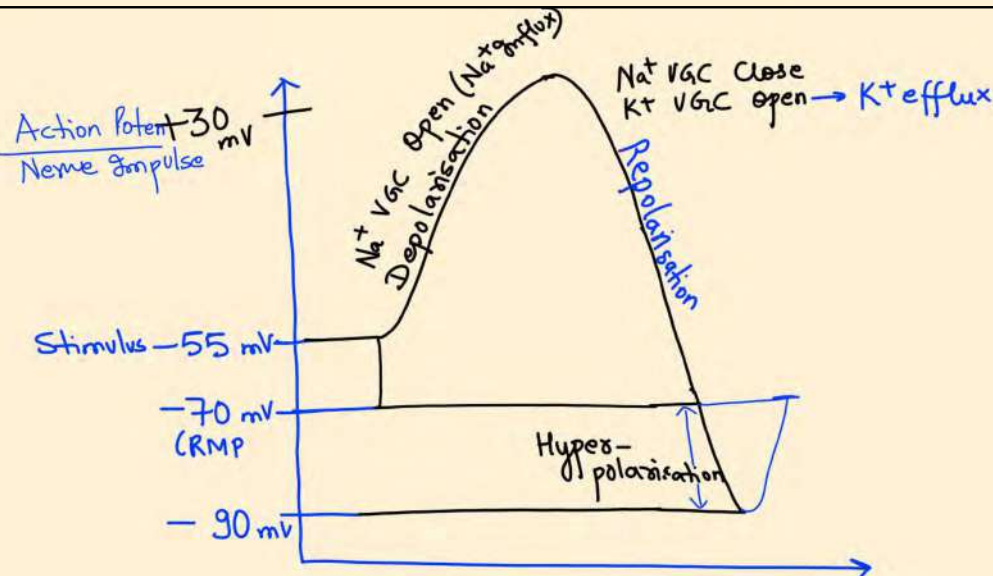
Inner -ve
Outer +ve

* At +30 mV, Na⁺ VGC close (short-lived opening)
and K⁺ VGC Open

Efflux of K⁺ out of Cell into ECF

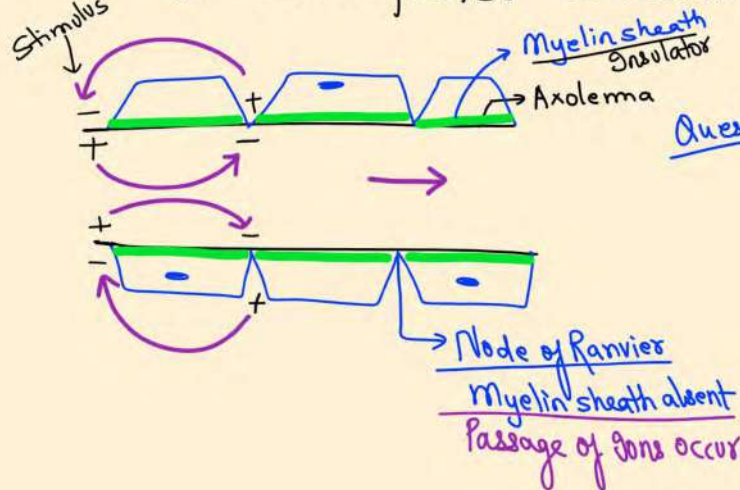
Repolarisation

[Hyperpolarisation -90 mV]



* Saltatory Conduction in Myelinated Neurons

- 20 times faster Conduction of Impulse



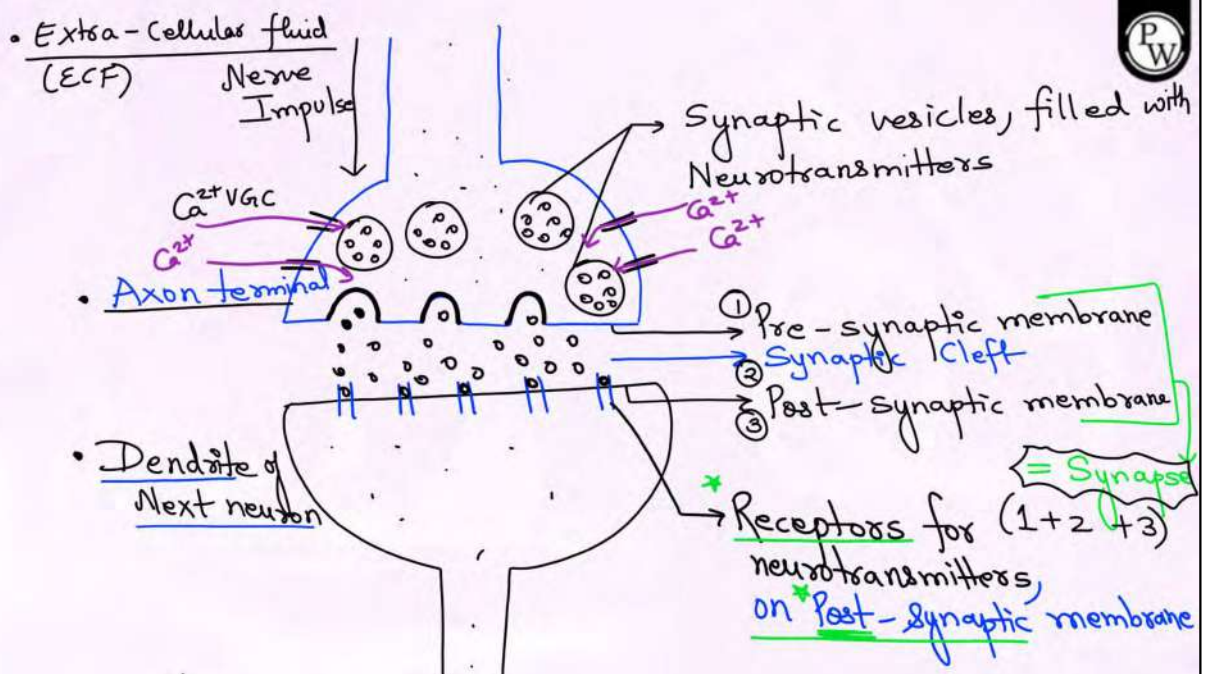
Ques. If Myelin sheath is Continuous / Uniform

OR
If Node of Ranvier absent

No Impulse Conduction

* Transmission of Nerve Impulse :- Through Synapse

Nerve impulse conduction from one neuron to next neuron or from neuron to Muscle occurs through junctions Gland called Synapse.



Types of Synapse - 2 types

I ELECTRICAL - Bidirectional conduction

- Rare in our body
- Pre & Post-synaptic membranes are in close proximity
- Synaptic cleft: Absent
- Electric current flows directly from one neuron to next, similar to conduction along a single axon.
- No role of neurotransmitter
- Faster Conduction

CHEMICAL SYNAPSE

- Most in our body
- In between, Pre & Post synaptic membrane, a fluid-filled cavity, "Synaptic cleft" is present
- Role of neurotransmitter chemical
- Slower Conduction
- Unidirectional Conduction because receptors present ONLY on post-synaptic membrane

* Wave of depolarisation reaches Axon terminal
Nerve impulse

- Ca^{2+} VGC opens and Ca^{2+} diffuses from ECF (higher conc) into Axoplasm (Ca^{2+} influx) (lower conc)
- Ca^{2+} stimulates fusion of synaptic vesicles with pre-synaptic membrane (Plasma membrane) + Bursting of synaptic vesicles
- Release of neurotransmitters, into synaptic cleft, by Exocytosis
- Neurotransmitters Bind with specific receptors, on Post-synaptic membrane

- New potential developed, on Post-synaptic membrane, may be Excitatory or Inhibitory, depends on neurotransmitters

Excitatory Neurotransmitter

eg: Acetylcholine (ACh)

* Na^+ VGC opens (on Post-synaptic membrane)

Rapid Na^+ Influx

Depolarisation (Action Potential)

Inhibitory Neurotransmitter

eg: Glycine, GABA (Gamma Amino Butyric Acid)

* Cl^- VGC opens

Cl^- influx into Neuron, from ECF

Hyperpolarised (No Action Potential)

* Synapse = formed by Pre and Post-synaptic membranes, May or May not be (chemical) (Electrical) separated by a gap, Synaptic cleft

* If receptors are removed from Post-synaptic membrane, in a chemical synapse, Then Conduction of Nerve Impulse STOPS

* Central Nervous System (CNS) :-
• Comprises Brain & Spinal Cord

* BRAIN

• Single, Hollow, Dorsal
Nerve Cord

Neural Tube

Brain

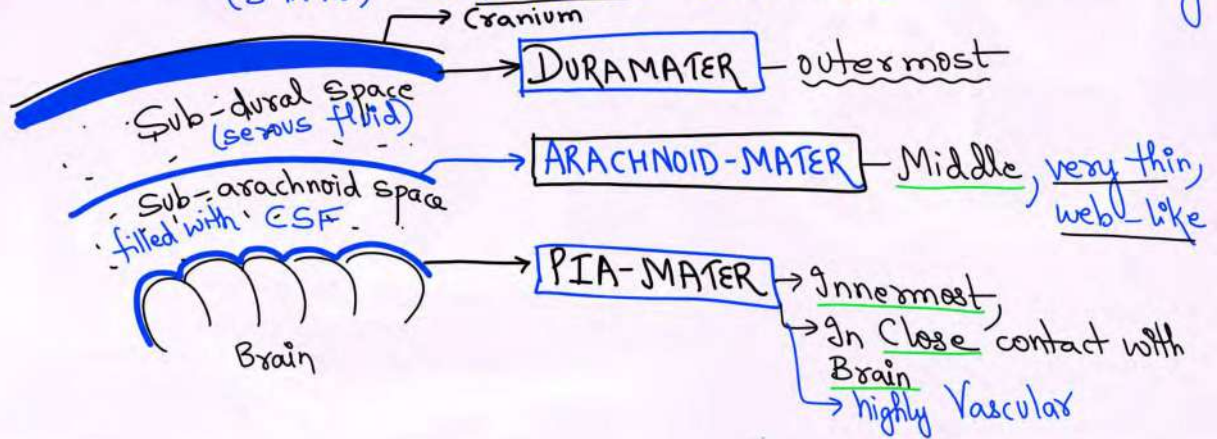
Spinal Cord

• Central Information processing organ of body
• Acts as Control and Command System

- Controls Voluntary movements
- " Balance of body
- " Functioning of Internal organs (Kidneys, Lungs, Heart etc.)
- Thermoregulation
- Hunger
- Thirst
- 24 hour Circadian rhythm / Sleep-awake Cycle.
- Processing of Hearing, Vision, Speech, Memory, Intelligence, Emotions, thoughts etc.
- Controls Human Behaviour
- Controls activities of several Endocrine glands

* Human brain is well-protected by Skull (wt: 1.2-1.4 kg) (Cranium/Brain box)

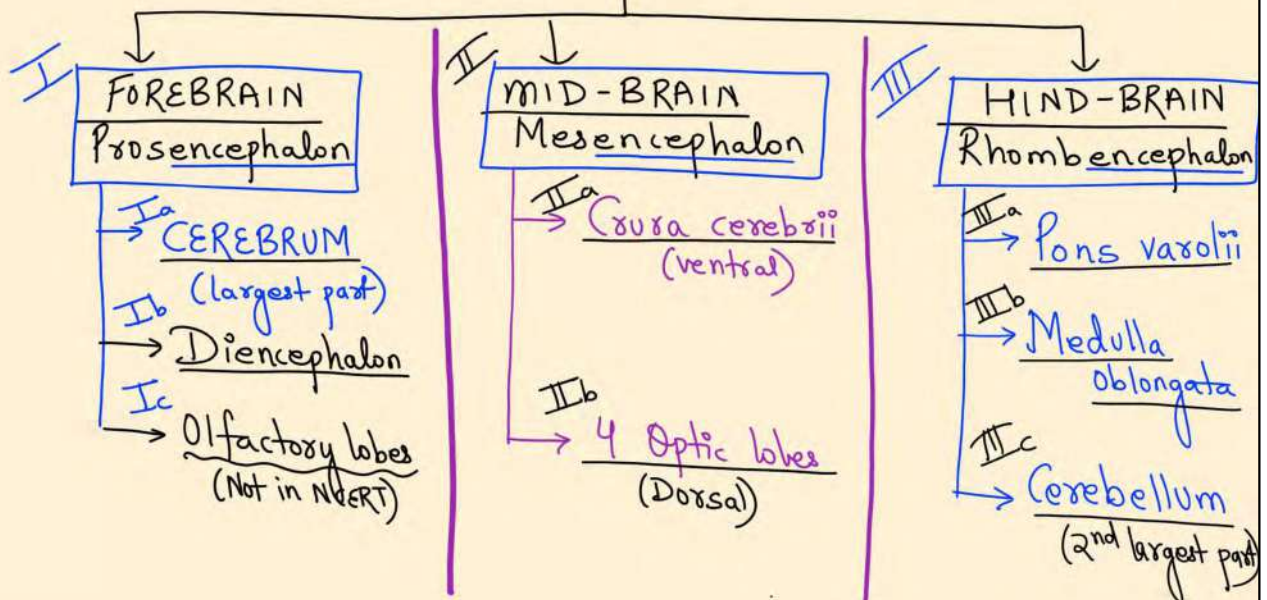
* **MENINGES** (3 in no.) → Between Brain and Cranium
→ Protective Connective tissue covering



* **CSF** = Cerebro-Spinal Fluid

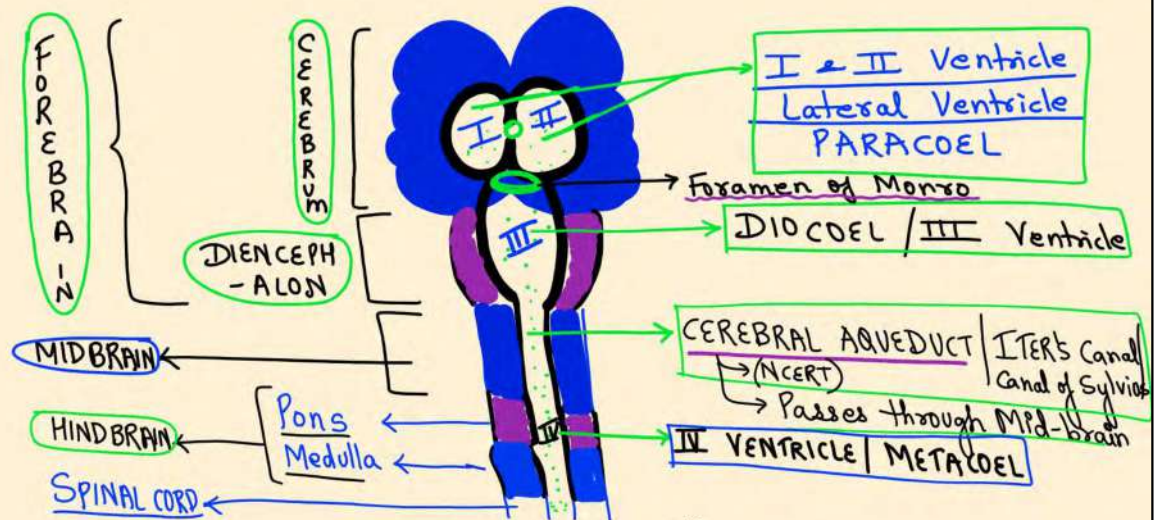
- Supply O₂, nutrients to Brain
- Remove Waste, CO₂ from Brain
- Provides Buoyancy to Brain (weight reduction)
- Act as Shock absorber

Human Brain - 3 Parts

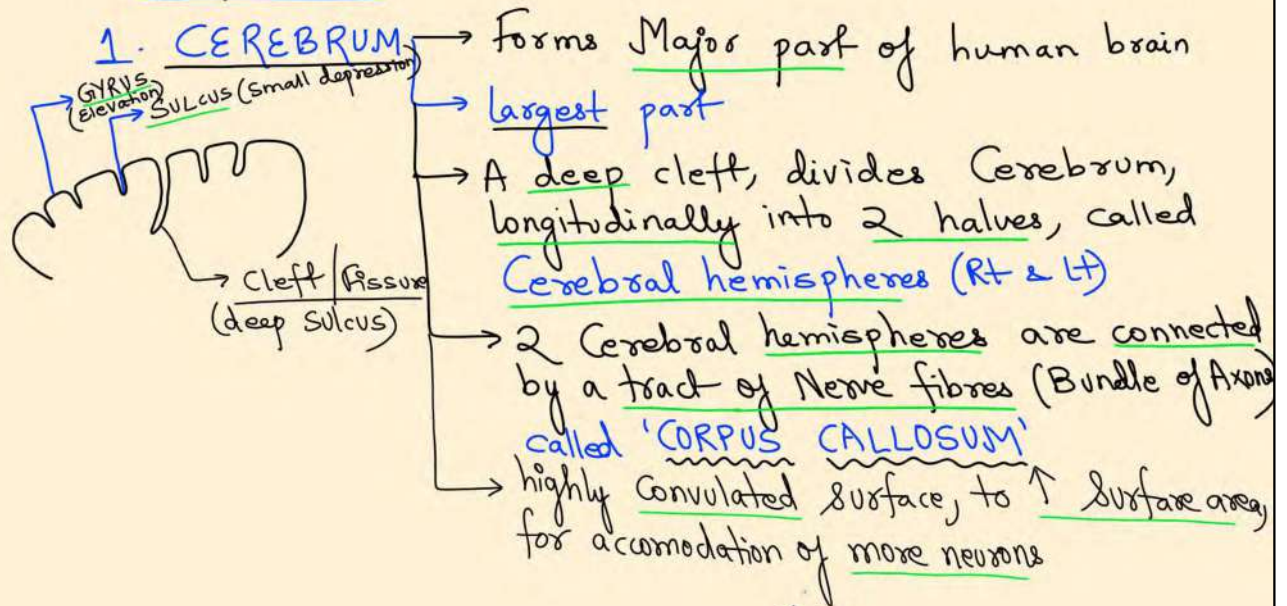


Out of NCERT

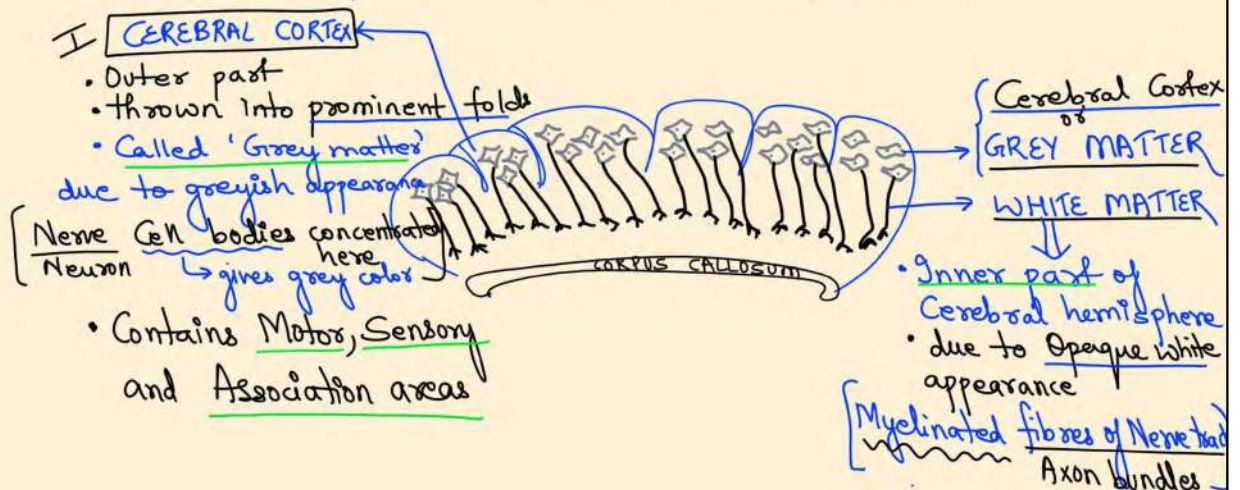
Hollow Neural System, filled with CSF



* FOREBRAIN



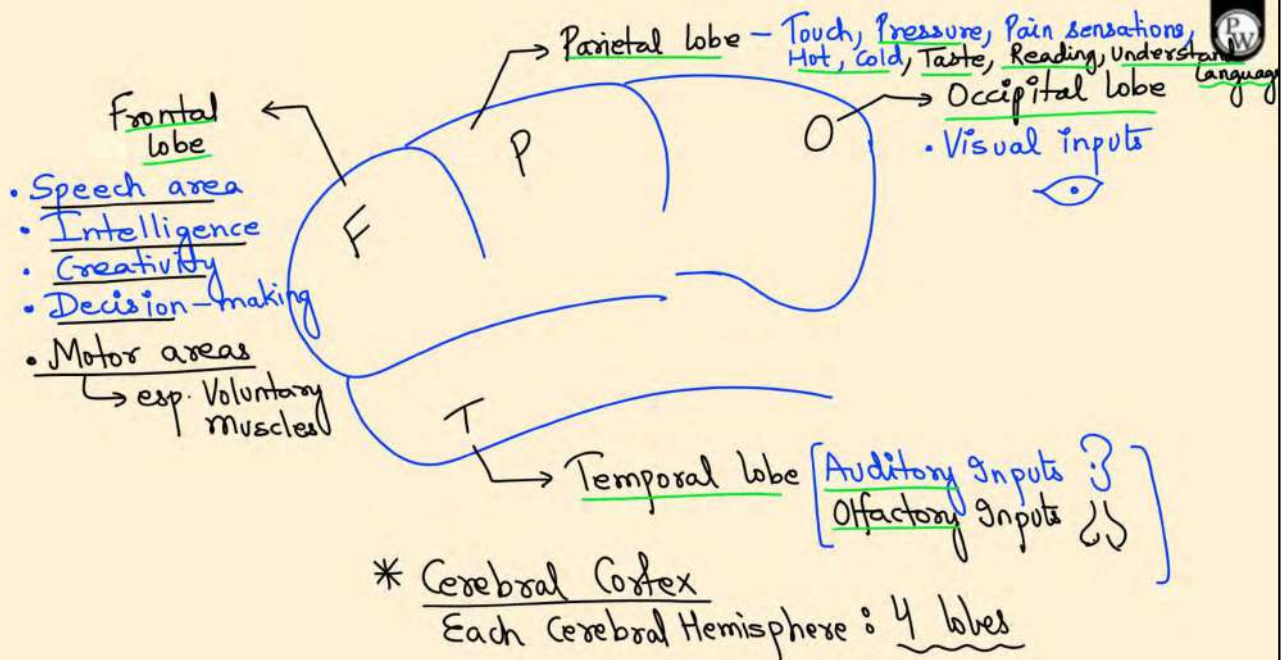
* Cerebrum : 2 parts → I Outer : Grey matter / Cerebral Cortex
2 Cerebral hemispheres → II Inner : White matter



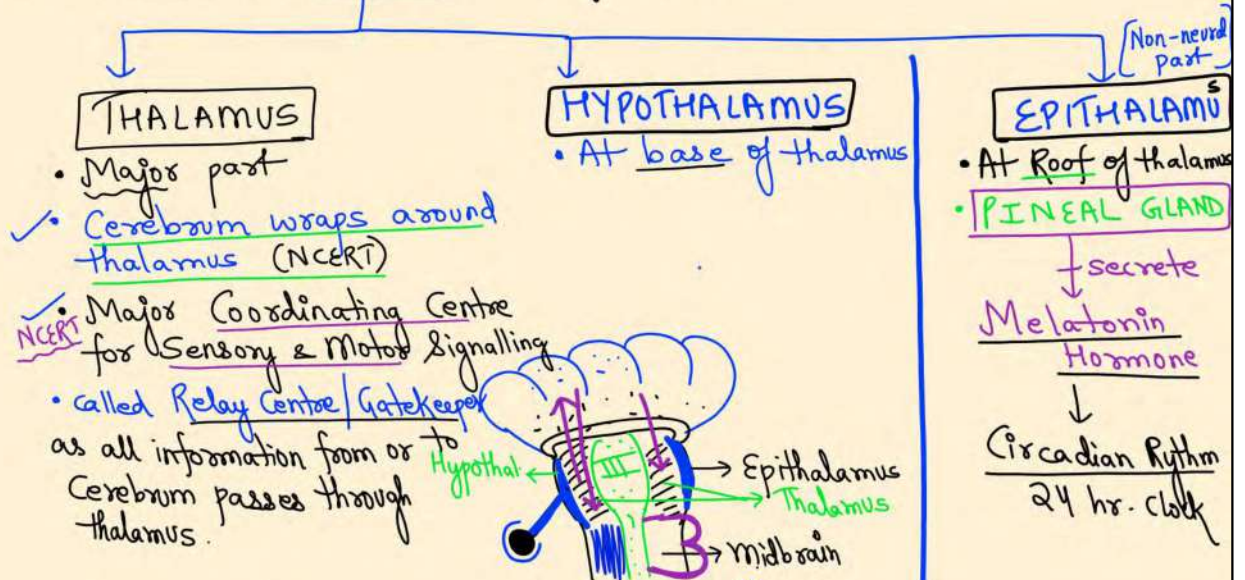
- * Association areas (large areas) → Associated with Complex functions like:
- a) M → Memory
 - b) I → Inter-sensory association (multiple sensory inputs analysis)
 - c) C → Communication
- Neither Sensory, not Motor

* NOTE:

- In Brain, Grey matter Outer
White matter Inner
- In Spinal cord, Grey matter Inner
(out of NCERT) White matter Outer



2. DIENCEPHALON: Part of Forebrain

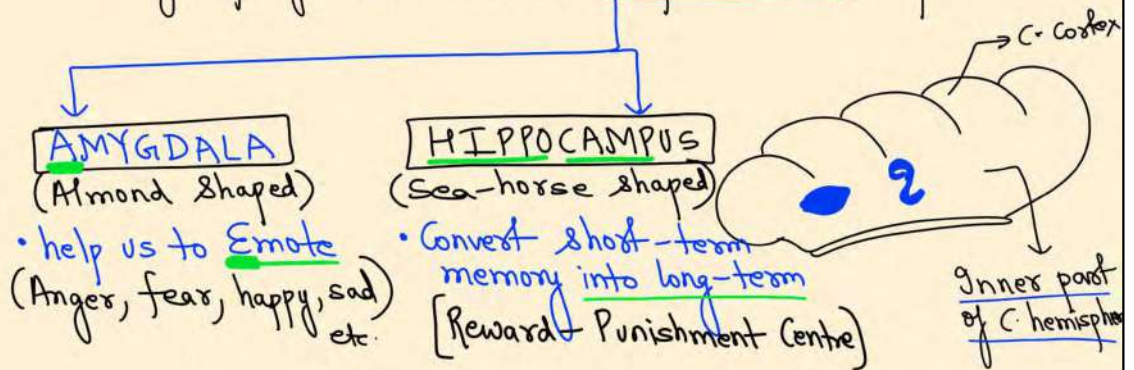


* HYPOTHALAMUS:- At base of thalamus

- * Thermostat of body
- Centres for Urge for Eating, drinking
(Hunger / Thirst / Satiety Centres)
- Contain Neuro-secretory Cells → produce Hypothalamic Hormones
- Connects Neural and Endocrine System
[Connected to Pituitary gland, by a Stalk-Infundibulum]

* LIMBIC SYSTEM or Limbic Lobe

- In Inner parts of Cerebral hemispheres,
- a group of associated deep structures present



* Limbic System along with Hypothalamus
= Emotional Brain

1. Regulation of Sexual behaviour
2. Expression of Emotional reactions (Anger, fear, Sad, happy, excitement)
3. Motivation

* MID-BRAIN

- NCERT
- Cerebral aqueduct passes through mid-brain
 - Located between Thalamus / hypothalamus of Forebrain and Pons of Hindbrain
 - Dorsal side: "4 Optic lobes" (4 Round swellings) known as "Corpora Quadrigemina"
 - 2 Superior Colliculi Control Visual reflex
 - 2 Inferior Colliculi Auditory reflexes
- out of NCERT
- Ventral: Crura Cerebri

* HIND-BRAIN — 3 parts (Pons + Medulla + Cerebellum)

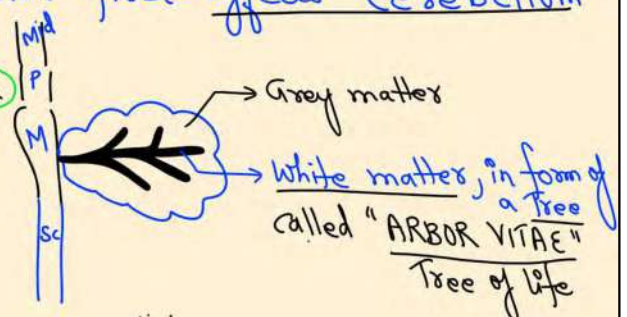
- PONS VAROLII = Bridge
 - Pneumotaxic Centre, which Moderates functions of RRC
 - Consists of fibre tracts that interconnects different regions of Brain
- Medulla Oblongata
 - Connected to Spinal Cord
 - NCERT: Controls Respiration → Respiratory Rhythm Centre (RRC)
 - Gastric Secretions → Gastric Secretions Centre
 - and Cardiovascular reflex → Cardio-Vascular Centre
 - Vomiting / Sneezing / Coughing / Swallowing centre

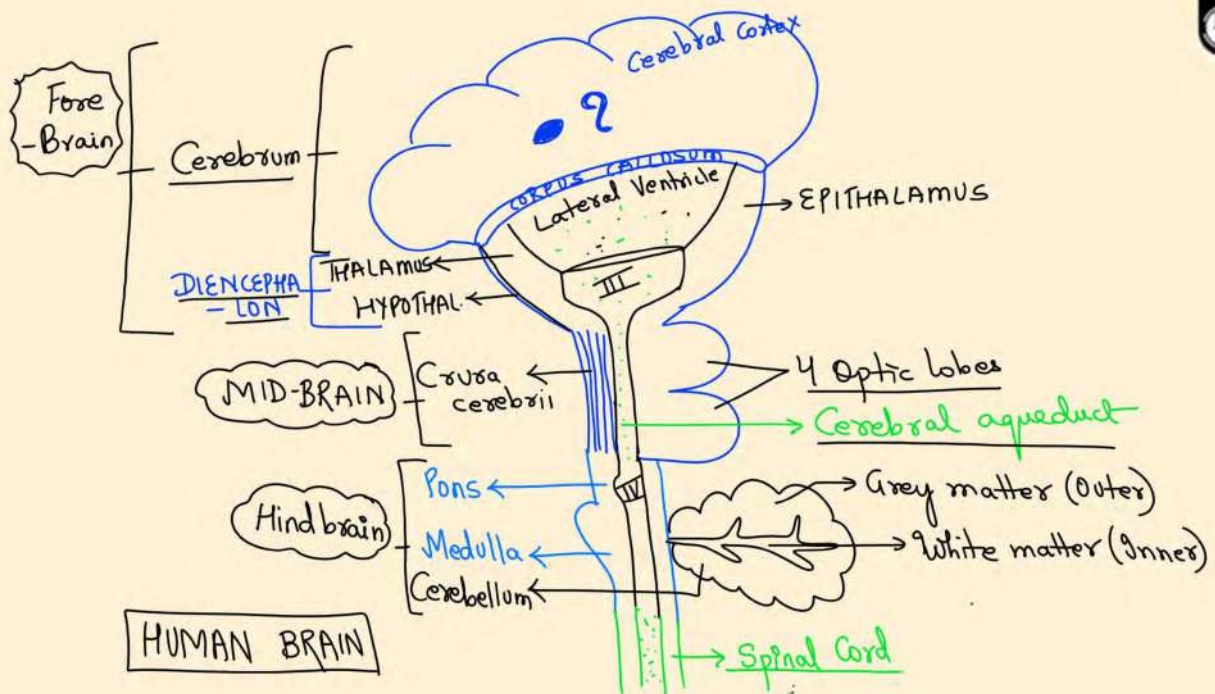
* CEREBELLUM (= little Brain)

- 2nd largest part
- highly convoluted surface to provide additional space for more neurons
- Role in "Balance of Body"
- Alcohol first affects Cerebellum

* Brain Stem

- = Midbrain + Pons + Medulla
- = Midbrain + Hindbrain
- Forms Connection between Brain and Spinal Cord





AUTONOMIC NERVOUS SYSTEM

PNS
Motor Nerves
Involuntary

Character

1. Pupil
2. Sweat
3. Salivation
4. Heart
5. Lungs, Bronchi

(Emergency)

Sympathetic

Dilatation

↑
↓
HR ↑
CO ↑
BP ↑

Artery Constriction (Narrow)

Dilate for Easy breathing, RR ↑

(Relaxed/Normal)

Parasympathetic

Constriction

↓
↑
↓
↓
↓

Dilation

Constriction

AUTONOMIC NERVOUS SYSTEM

PNS
Motor Nerves
Involuntary

Character

6. Alimentary Canal
7. Liver
8. Anal Sphincter
9. Defecation

(Emergency)

Sympathetic

• Peristalsis ↓
• Digestive juices ↓

• Bile Secretion ↓
• GLYCOGENOLYSIS ↑
(Glycogen → Glucose)

Constricted

↓

(Relaxed/Normal)

Parasympathetic

↑
↑

↑

• GLYCOGENESIS (Glucose → Glycogen)

• Dilated

↑

AUTONOMIC NERVOUS SYSTEM

PNS
Motor Nerves
Involuntary



Character

10. Urinary Bladder Muscles

11. Urethral Sphincters

12. Micturination

13. Adrenal Gland Secretions

14. Erector Pili Muscles (Goose flesh)

(Emergency)
Sympathetic

Relaxed

Closed / Constricted

↓

↑

Contract

(Relaxed/Normal)
Parasympathetic

Contract

Dilated

↑

↓

Relaxed



Homework from Yakeen Module

→ Today's topics

* Revise Lec-4

Learn Lec-5

DPP

Read NCERT

* Sunday

Kattar DPP
Summary Lec.
PYQ Lec.

* Mon → Podcast (Neural..)

* Tues → Podcast (Locomotion & Mot.)



THANK YOU

