Control and Coordination

Neural control
Chemical control

- Is important among diff. organs & organ systems to maintain HOMEOSTASIS
- coordination is basically the interaction & complementation of diff. organs

- E.g., Exercise → Breathing rate↑ (Lungs) ; heart rate↑ (Heart) ; Nerve Stimulation ; Blood flow ; GFR↑ ; Lactic acid↑

Sonu

Nerves
Blood vessel
Kidney
Muscle

Neuro-endocrine Control

- All our body functions are controlled either by neural system or endocrine system (↷ makes hormones)

Neural Control

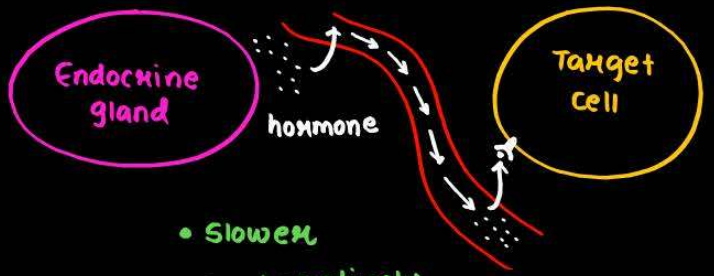
- Point to point connection
- Faster
- Short-term signals

* Combined study of Neural & endocrine system is called : Neuro-endocrino-logy

- Hormone < Enzyme (mol wt.)

Endocrine Control

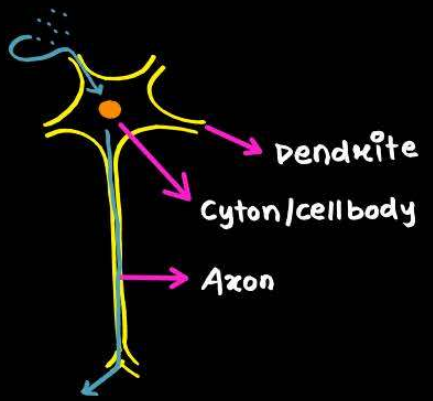
- Hormones are made



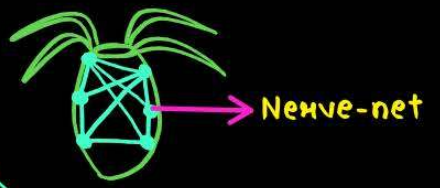
- Slower
- comparatively long term signals

Neural System

- **Composed of Specialized cells** ⇝ called NEURONS
  - D: Detect stimulus
  - R: Receive stimulus
  - T: Transmits stimulus



- **Simple in:** Invertebrates (lower animals)
- **In Hydra:** Nerve net



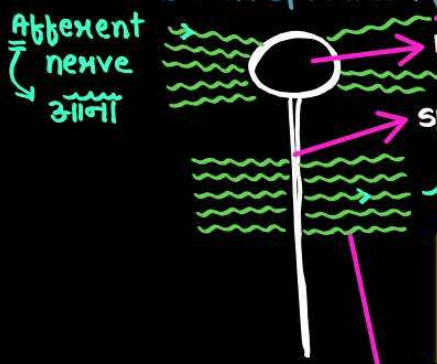
- **In insects:** Brain + ganglia
- **In complex vertebrates:** Complex nervous system is found e.g., Humans

Human Neural System

- Ganglia : gp. of neuronal cyton
- Plexus : gp. of neurons

Central Nervous System (CNS)

Brain + Spinal cord



- Cranial nerves (12-pairs)
- Spinal nerves (31 pairs)

Somatic Neural System

- Voluntary signals
- Skeletal muscles

Autonomic Neural System (ANS)

- Smooth / involuntary muscles

Sympathetic-ANS
- Flight & Fight

Parasymp-ANS
- Eat & Sleep

Visceral Nervous System

- Connects CNS to visceral / enteric organs like stomach & intestine (gut)
- Consisted of neurons, fibers, ganglia, plexus

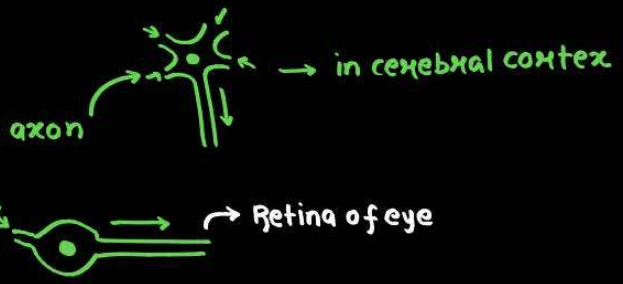
Peripheral Nervous System (PNS)

Consisting of all nerves conn. to CNS i.e., Spinal & cranial nerves

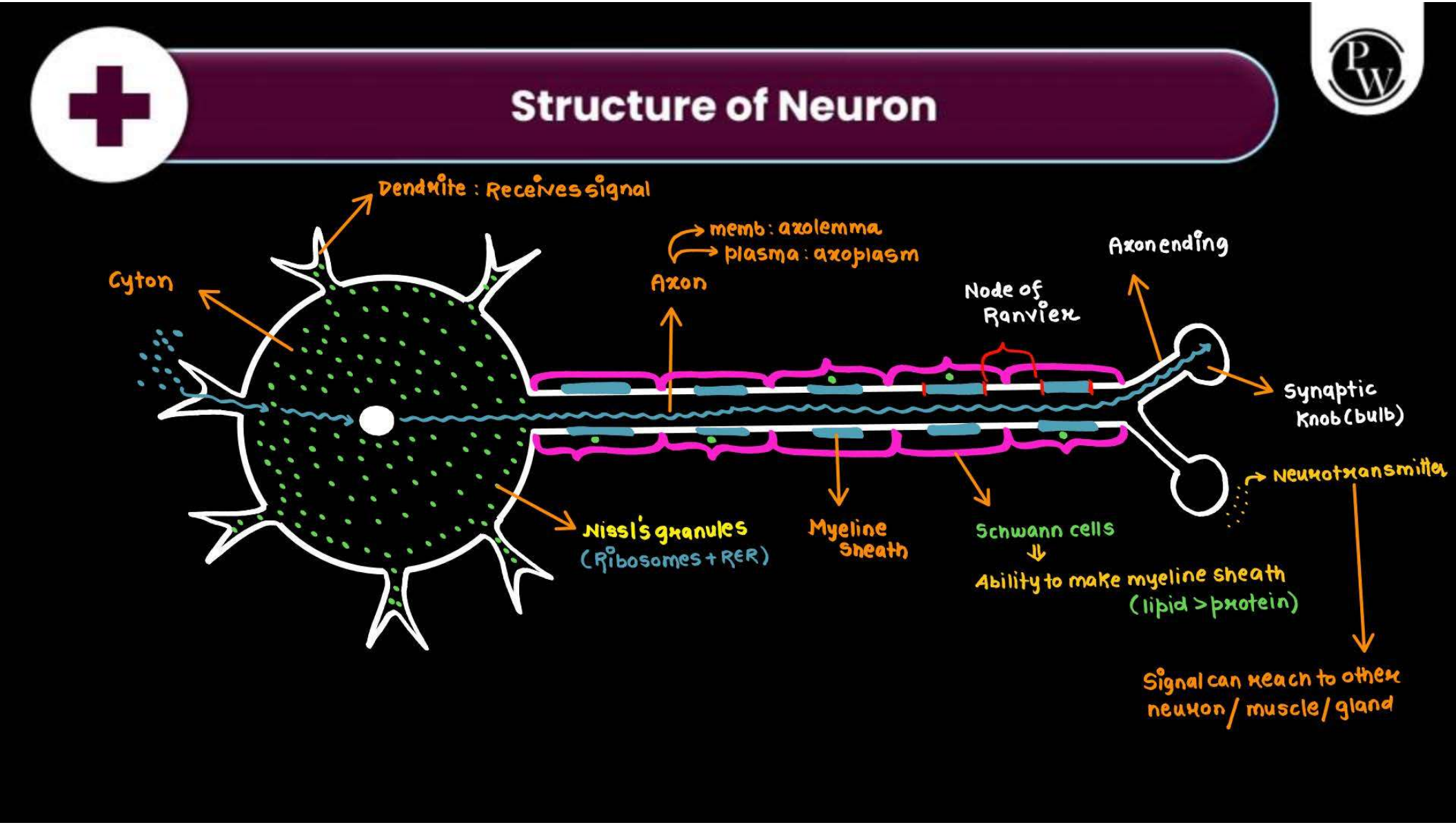
Structure of Neuron

- **Neuron:** Str. & functional unit of nervous system
  - Excitable cells (polarised)
- **Parts of Neuron:** 1. Dendrite
  2. Cyton / cell body
  3. Axon
- **Types of Neurons:**

1. **Multipolar:** Many dendrites & 1 axon → in cerebral cortex
2. **Bipolar:** 1 dendrite + 1 axon → Retina of eye
3. **Unipolar:**
   - 1 axon → Embryonic stage



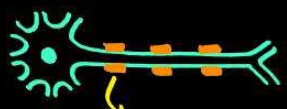
Structure of Neuron



Neurons in CNS and PNS

In CNS
(Schwann cell: absent)

- Myelinated
  - synthesised by oligodendrocyte

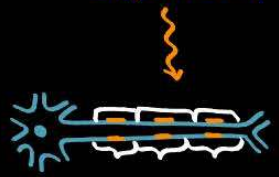


- Non-myelinated

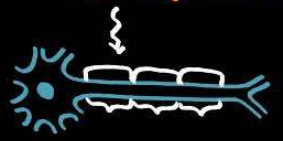
* It is not mandatory that schwann cell will make myeline sheath ; it is also not mandatory that myeline sheath is always formed from schwann cell

In PNS
(Schwann cell: present)

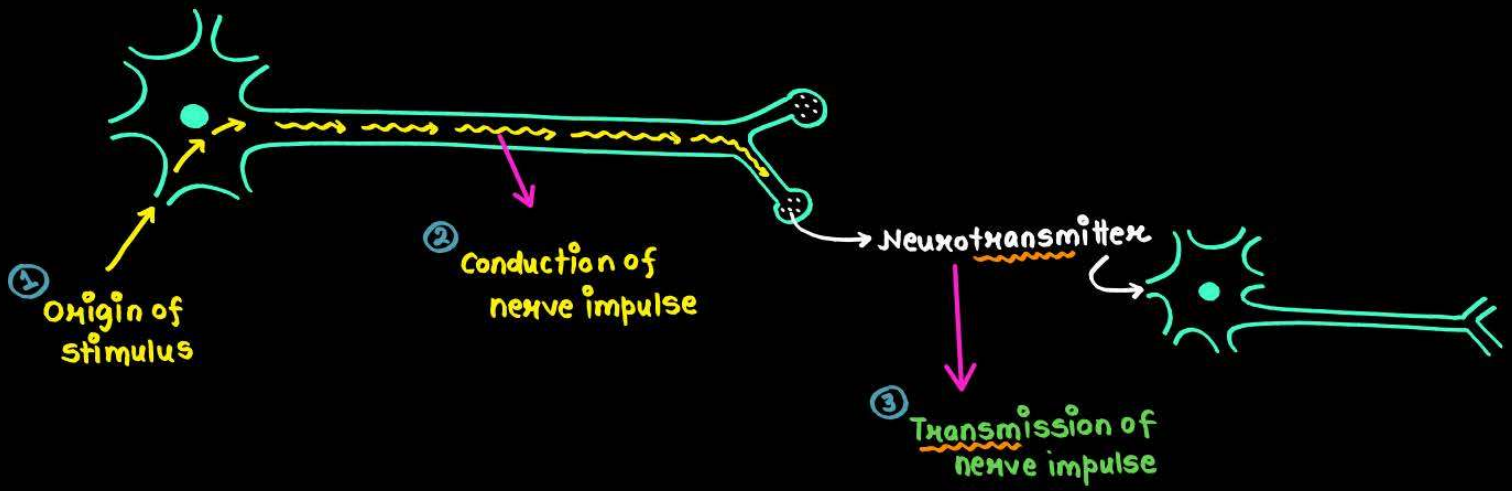
- Myelinated



- Non-myelinated



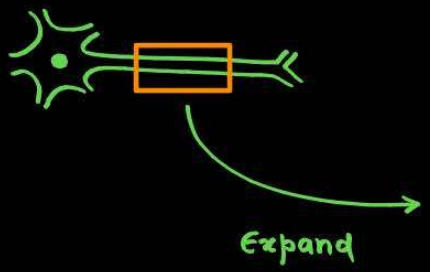
Origin, Conduction and Transmission of Nerve Impulse



Neurons are Excitable

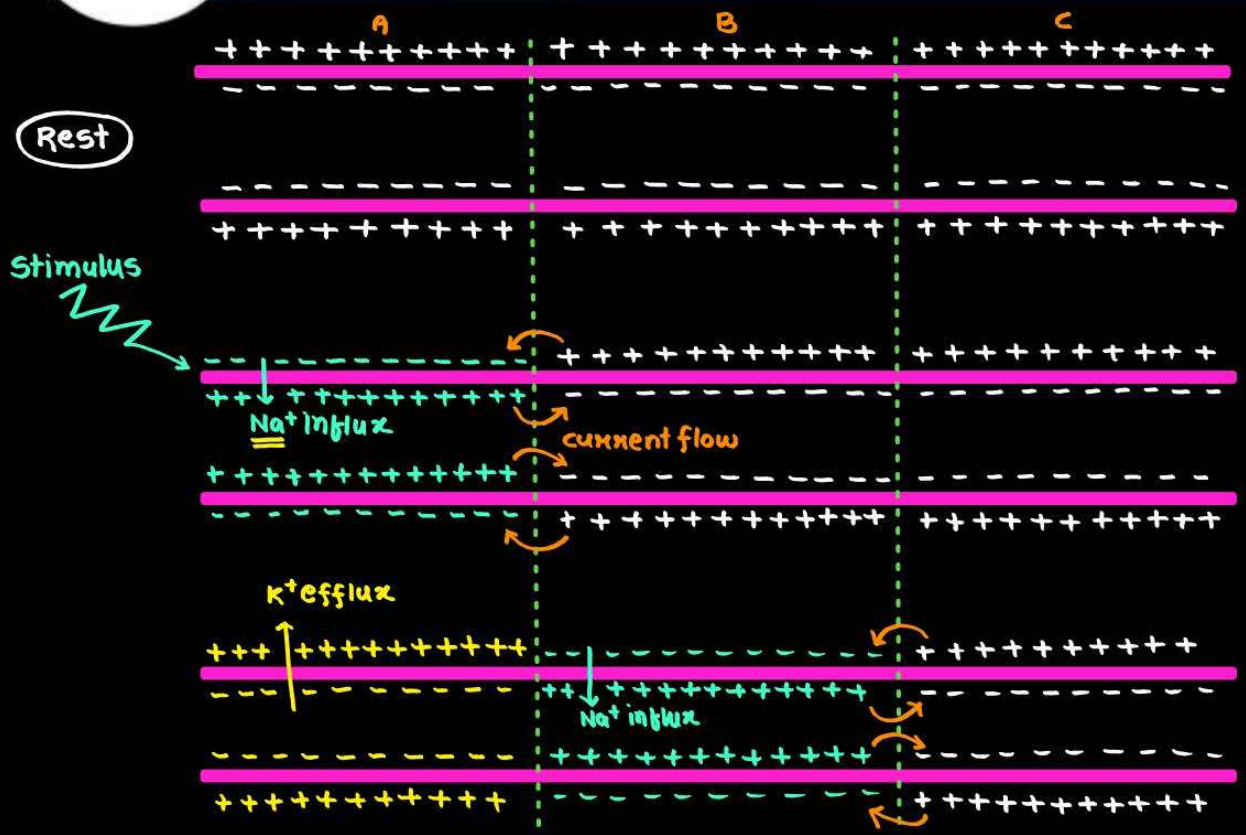
∵ their membrane is polarised due to the presence of diff. ion channels
→ positive : outer
negative : inner

- Neuron in resting state



1. Na^+ are ↑ outside & memb. is nearly impermeable to Na^+
2. Inside : high amount of PO_4^{3-} ions & ⊖vely charged protein : memb. is nearly impermeable for them ∴ they can't go out
3. K^+ is high inside but memb. is permeable to it ∴ Leaky gates use करके it can go out
4. Na^+/K^+ ATPase (pump) : NOKIA → Na^+ out, K^+ Inside

Origin and Conduction of Nerve Impulse



Rest

Rest · memb · pot. = -70mV
A: Polarised
B: Polarised
C: Polarised

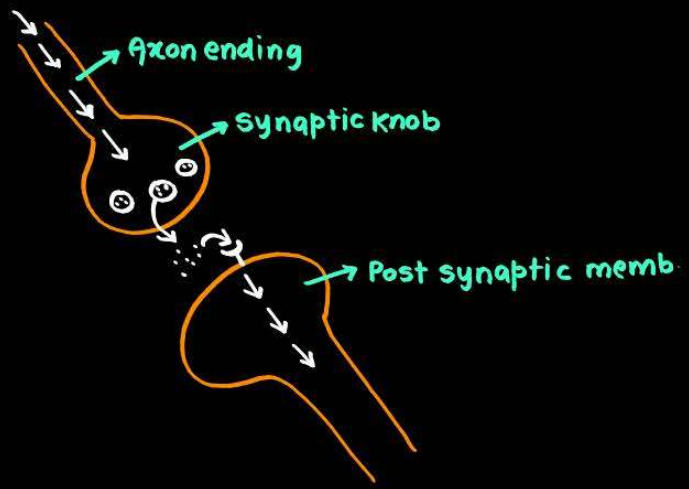
Action pot. / nerve impulse

A: depolarised
B: polarised
C: polarised

A: Repolarise
B: Depolarise
C: Polarise

Transmission of Nerve Impulse

- **Synapse:** Pre-synaptic membrane + synaptic cleft + post synaptic membrane



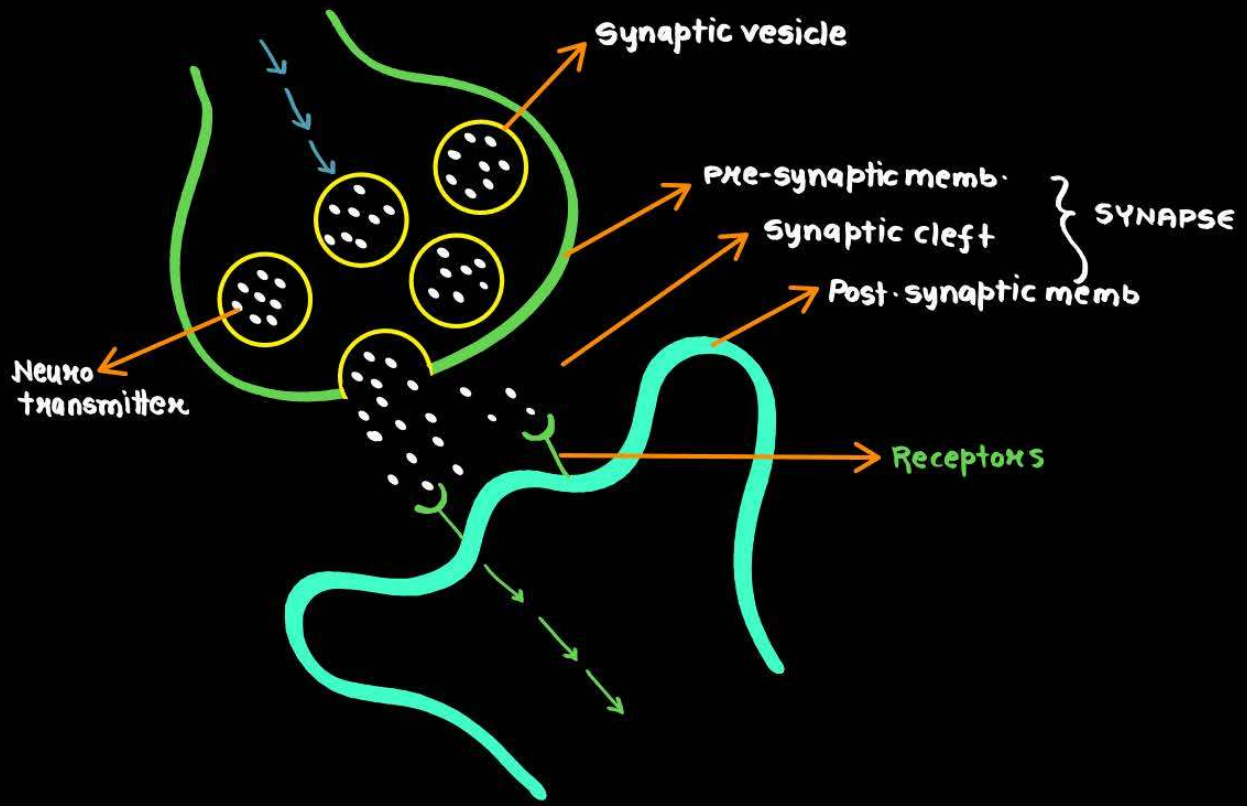
May or may not be ⊕nt

Chemical Synapse → more common in us

Electrical synapse ✗

> Both neurons are in close proximity

Transmission of Nerve Impulse



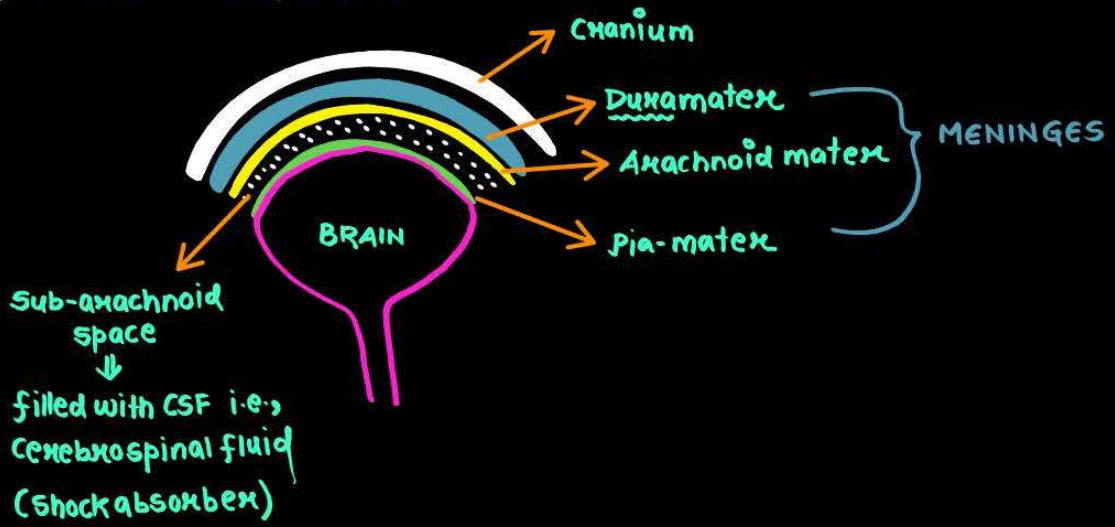
- Signal given can be excitatory or inhibitory

Acetylcholine
Adrenaline

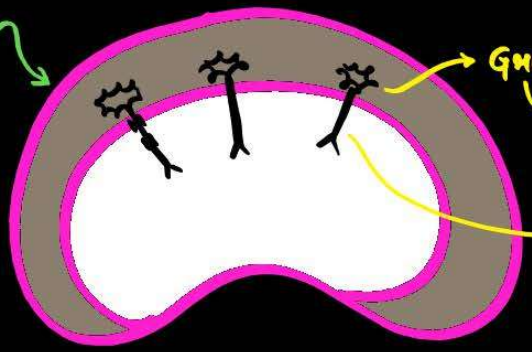
Serotonine
Dopamine
GABA
↓
γ-amino butyric acid

Central Nervous System

- Consist of: Brain & spinal cord
- Brain is: central information processing centre : our CPU → control & command centre
- Meninges: protection is importance



Grey and White Matter



Grey matter: outer
due to cyton/cell body

Inner: white matter
Myeline sheath

Parts of Brain

Forebrain (Prosencephalon)

1. Cerebrum : largest part
   - outer : cortex (complex funct.)
   - Inner cerebrum
2. Diencephalon
   - Thalamus → Motor & Sensory relay center
   - Hypothalamus → Heat → Eating, drink; Temp. regulation
   - Neurosecretory cells : secrete hormones : ADH, oxytocin

Midbrain (Mesencephalon)

- Ant b/w diencephalon & hindbrain
- 4-small lobes found in dorsal side called corpora quadrigemina
  - optic colliculi
  - Auditory colliculi
- Cerebral aqueduct pass from here → CSF flow

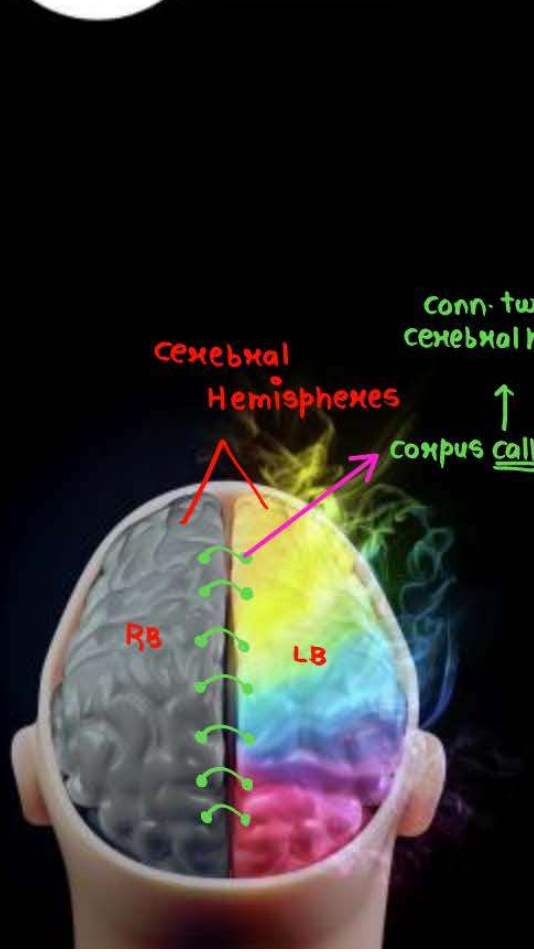
Hindbrain (Rhombencephalon)

P : Pons : fibers : connects to diff. parts of brain
- Sleep/rest : regulates

C : Cerebellum : here space to accomodate many neurons is provided → balance/posture

M : Medulla
- Resp. regul.
- Cardio-vasc. reflex
- Vomiting centre

Structure of Brain



Conn. two cerebral hemisp.

Corpus callosum

Cerebrum

Thalamus

Hypothalamus

Amygdala + Hippocampus

limbic system / lobe

Pituitary gland

Midbrain

Pons

Cerebellum

Medulla

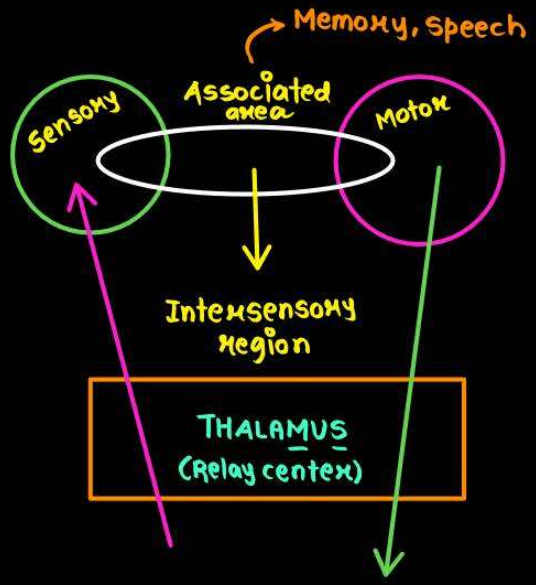
Connects to spinal cord

Spinal cord

Brain stem : Pons + medulla + Midbrain *

Associated Area and Limbic Lobe

In cerebral cortex: some part is clearly sensory & some part is clearly motor



- Deep part of cerebrum + Amygdala + Hippocampus
  ⇓
  Limbic lobe / Limbic system (LL)
- (LL) + Hypothalamus: Sexual beh.
  Excitement
  Emotions: anger, rage, etc.

Neural Control and Coordination

- Functions of organs & organ-systems in our body are coordinated to maintain Homeostasis.
- **Coordination:** process by which 2- or more organs interact & complement funct. of each other
  e.g.; when we exercise: heart, lungs, muscles, nerves, kidney work together
- Our body is controlled by our **Neuro-endocrine** system
  - Neuro: Point to point; rapid
  - endocrine: through hormones
- Neural system comprised of specialised cells called **neurons**: they receive, detect & transmit stimuli
- Invertebrates have simple & vertebrates have complex neural system; e.g., Hydra has nerve net; insects have ganglia & humans have brain.

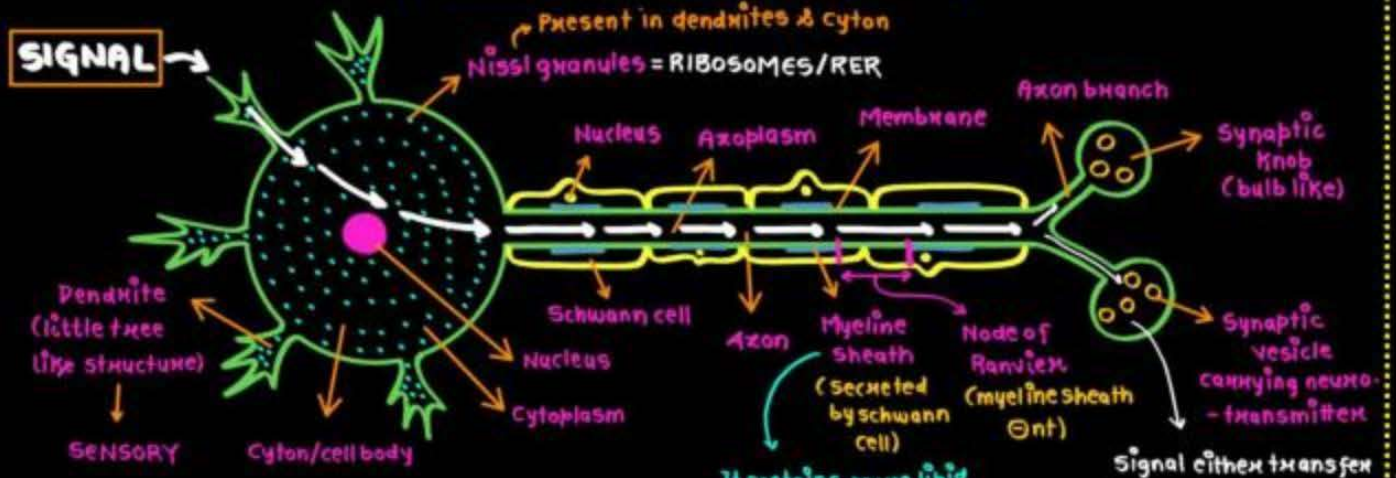
Nervous System

- **Central Nervous System**
  - contain Brain + Spinal cord
  - Brain
  - Spinal cord
  - Afferent nerve (आना)
  - Efferent (Exit)
  - Cranial nerves (12 pairs)
  - Spinal nerves (31 pairs)
  - → PNS
- **Visceral N.S** includes: neurons, fibers, plexus, ganglion
  - network of neurons
- **Peripheral Nervous System**
  - Nerves attached to CNS
  - **Somatic nerv. sys.**
    - control skeletal muscles
  - **Autonomic N.S (ANS)**
    - control the involuntary muscles
    - Sympathetic ANS → Fight & Flight response
    - Parasympathetic ANS → Eat & sleep
  - **Visceral N.S** also called Enteric N.S
    - Present in some visceral organs like Stomach & lungs
    - Plexus

Neurons

Neuron	Characters
Multipolar	Have 1 axon and 2 or more dendrites e.g., cerebral cortex
Bipolar	Have 1 axon and 1 dendrite e.g., retina of eye
Unipolar	Have cell body with one axon only e.g., in embryonic stage

Structure of Neuron



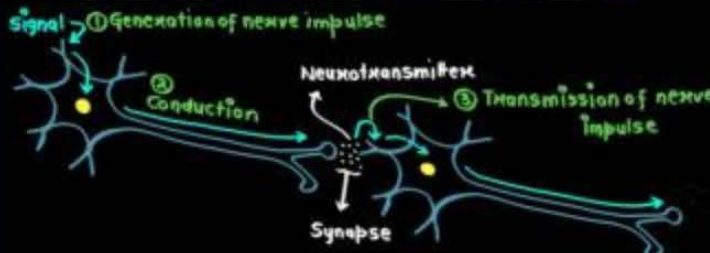
Neuron

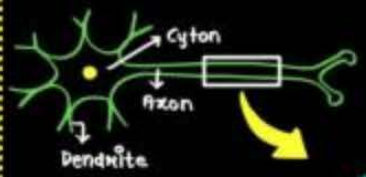
- In Central Nervous System → Schwann cells ⊖nt
  - Myelinated neurons (myeline ⊕nt)
  - Non-myelinated neurons
- In Peripheral Nervous System → Schwann cells ⊕nt
  - Myelinated
  - Non-myelinated

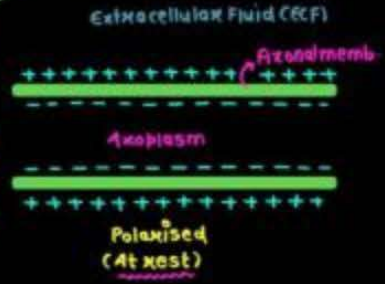
Secreted by oligodendrocyte of neuroglial cells

- It's not mandatory that Schwann cell always produce myeline sheath

Origin and Conduction of Nerve Impulse

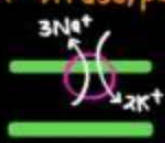






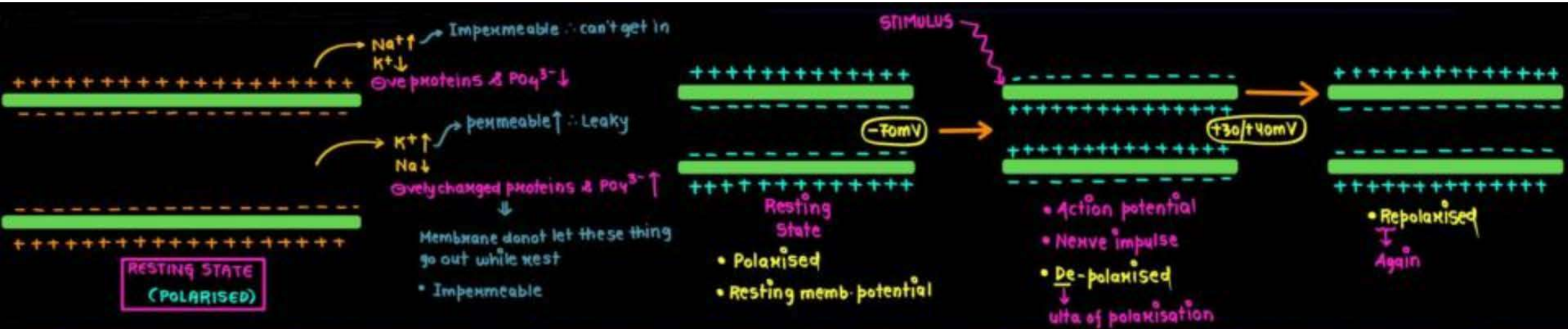
- What is the reason of polarity?

1. Na^+/K^+ ATPase/pump: NoKia

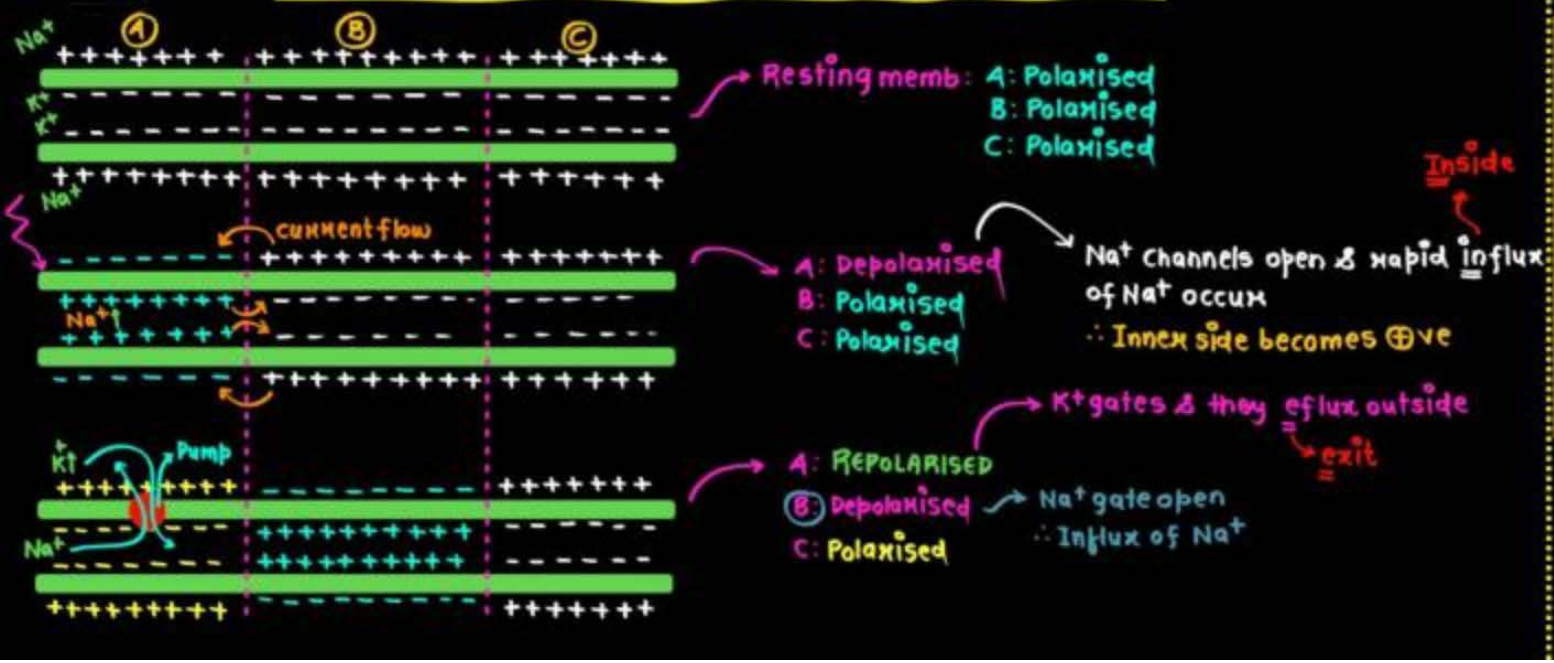


Na+ out, K+ In

2. Inner part of memb. contains ⊖vely charged proteins & Poy^{3-}
   ∴ ⊖ve charge inc. on inner side
3. K^+ ↑ Leaky gates opens & some K^+ can also go outside

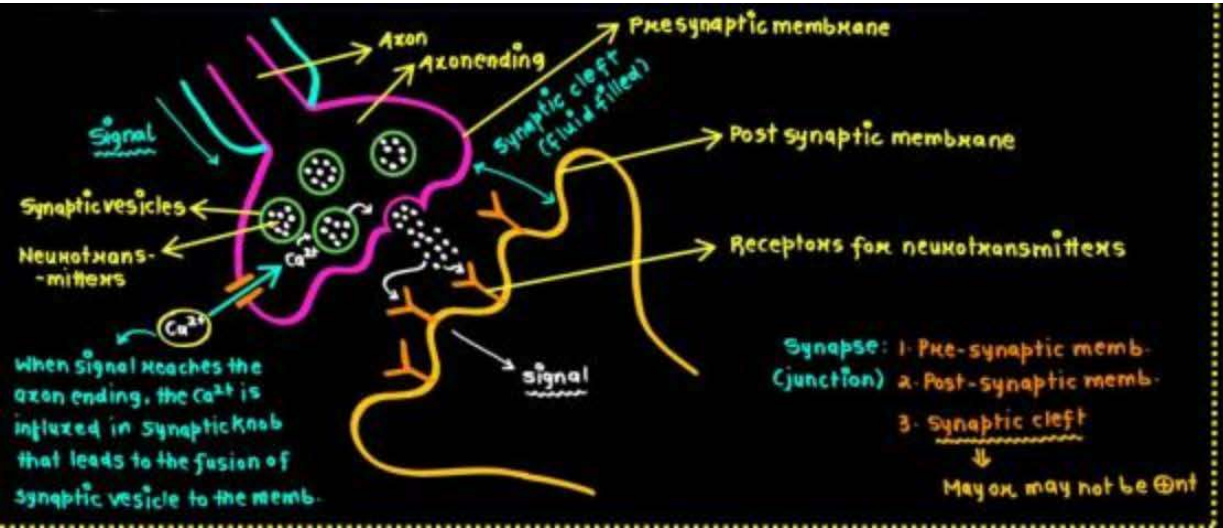


Generation and Conduction of Impulse



Transmission of Impulse

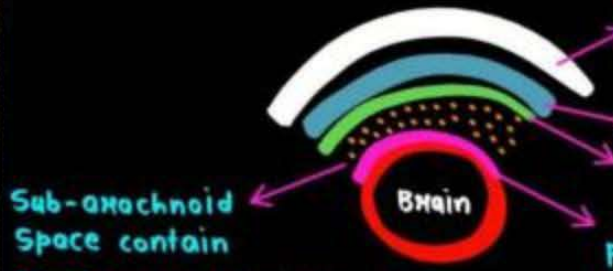
Electrical Synapse	Chemical Synapse
Pre and post synaptic membranes are in close proximity	Fluid filled synaptic cleft is present between pre and post synaptic membrane
Transmission is faster	Transmission is slower



Central Nervous System

- Bxain is centxal infoxmation pxocessing oxgan & act as command & contxol system of body.

Covexings of Bxain (outex to innex: DAP)
- duxable ∴ outex
1. Duxamatex
2. Axachnoid matex
3. Piamatex



Brain

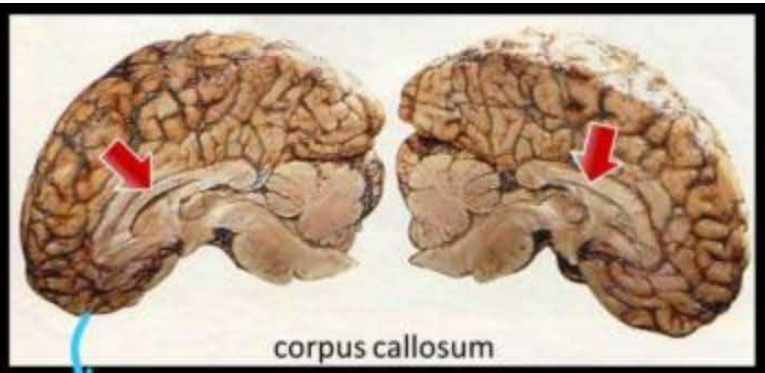
- **Prosencephalon (Forebrain)**
  - Cexebxum (laxgest) → Cexebxal coxtex → Complex Function
  - Diencephalon
    - Thalamus → Motox & Sensoxy signal
    - Hypothalamus → Heat (1) eat/dxink
- **Mesencephalon (Midbrain)**
  - Coxpoxa quadxigemina (4)
  - Cexebxal aqueduct
- **Rhombencephalon (Hindbrain)**
  - P: Pons
  - C: Cexebellum
  - M: Medulla

(1) Pons: Pneumotaxic centex
- xest
- connects diff. pxts of bxain

(2) Cexebellum:
- Balance/equilibxium
- Convolutions ↑ ∴ Neuxons can accumulate ↑

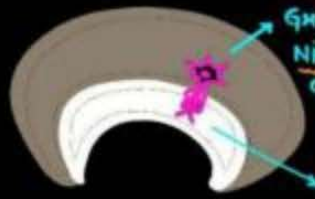
(3) Medulla:
- Xegulation of xespixation
- Xeg. of cxdiovasculax activities
- Vxmit centex
- Xeg. of gastxic secxetion

Bxainstem connects to Spinal coxd: Midbxain + Pons + medulla



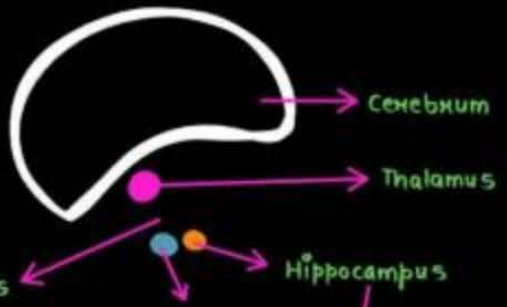
Cerebrum

- outer: cerebral cortex
- Inner cerebrum



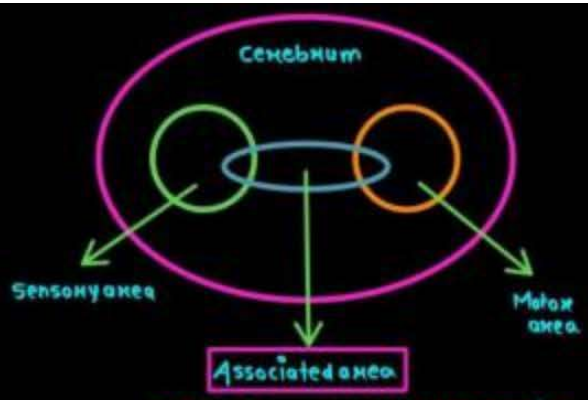
Grey matter due to Nissl granules of cyton

White matter due to myeline sheath of axon

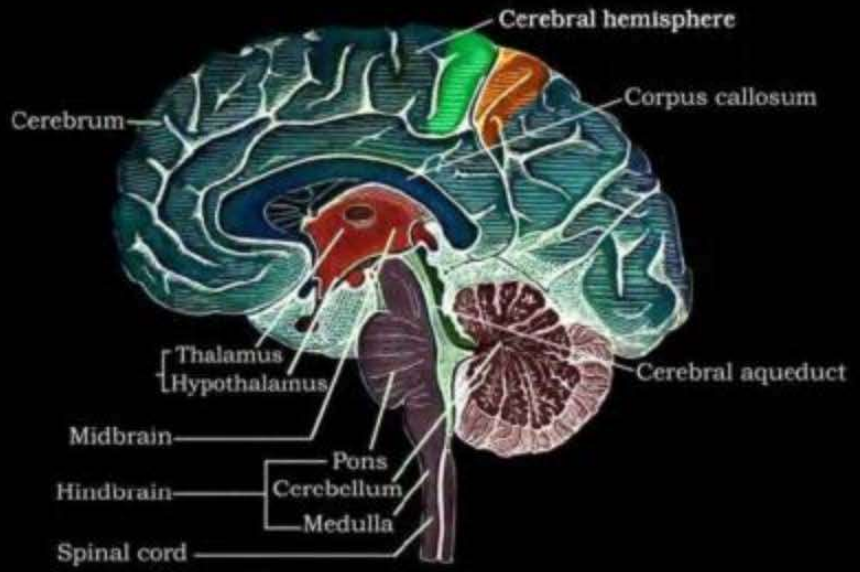


- Sexual desire
- Emotion
- Expression
- Motivation

- Deeply in Forebrain
- Lymbic system & lymbic lobe



- Neither completely sensory or motor
- Intersensory area (linked senses)
- Memory & communication



QUESTION (NEET PYQ EXAM 2024)

Match List I with List II :

	List I		List II
A.	Pons	I.	Provides additional space for Neurons, regulates posture and balance.
B.	Hypothalamus	II.	Controls respiration and gastric secretions.
C.	Medulla	III.	Connects different regions of the brain.
D.	Cerebellum	IV.	Neuro secretory cells

Choose the correct answer from the options given below :

(1) A-II, B-III, C-I, D-IV

(2) A-III, B-IV, C-II, D-I

(3) A-I, B-III, C-II, D-IV

(4) A-II, B-I, C-III, D-IV

QUESTION (NEET PYQ EXAM 2024)

Given below are two statements:

Statement I: The cerebral hemispheres are connected by nerve tract known as corpus callosum.

Statement II: The brain stem consists of the medulla oblongata, pons and cerebrum.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both Statement I and Statement II are correct.

(2) Both Statement I and Statement II are incorrect.

(3) Statement I is correct but Statement II is incorrect

(4) Statement I is incorrect but Statement II is correct.

QUESTION (NEET PYQ EXAM 2024)

Match **List-I** with **List -II**

	List-I		List-II
A.	Schwann cells	I.	Neurotransmitter
B.	Synaptic knob	II.	Cerebral cortex
C.	Bipolar neurons	III.	Myelin sheath
D.	Multipolar neurons	IV.	Retina

Choose the correct answer from the options given below:

(1) A-III, B-I, C-IV, D-II

(2) A-I, B-IV, C-II, D-III

(3) A-IV, B-III, C-II, D-I

(4) A-II, B-III, C-I, D-IV

QUESTION (NEET PYQ EXAM 2023)

Brainstem of human brain consists of; **(Manipur 2023)**

(1) mid-brain, pons and medulla oblongata

(2) forebrain, cerebellum and pons

(3) thalamus, quadrigemina hypothalamus and corpora

(4) amygdala, hippocampus and corpus callosum

QUESTION (NEET PYQ EXAM 2023)

The parts of human brain that helps in regulation of sexual behaviour, expression of excitement, pleasure, rage, fear etc. are; **(2023)**

(1) corpus callosum and thalamus

(2) limbic system & hypothalamus

(3) corpora quadrigemina & hippocampus

(4) brain stem & epithalamus

QUESTION (NEET PYQ EXAM 2022)

Match **list-I** with **list-II**. **(2022 II)**

List-I		List-II	
A.	Multipolar neuron	P.	Somatic neural system
B.	Bipolar neuron	Q.	Cerebral cortex
C.	Myelinated nerve fibre	R.	Retina of eye
D.	Unmyelinated nerve fibre	S.	Spinal nerves

Choose the **correct** answer from the options given below.

(1) (A)-(Q); (B)-(R); (C)-(S); (D)-(P)

(2) (A)-(R); (B)-(P); (C)-(S); (D)-(Q)

(3) (A)-(Q); (B)-(S); (C)-(R); (D)-(P)

(4) (A)-(Q); (B)-(R); (C)-(P); (D)-(S)

QUESTION (NEET PYQ EXAM 2022)

Select the **incorrect** statement regarding synapses. **(2022 I)**

(1) Impulse transmission across a chemical synapse is always faster than that across an electrical synapse

(2) The membranes of presynaptic and postsynaptic neurons are in close proximity in an electrical synapse

(3) Electrical current can flow directly from one neuron into the other across the electrical synapse

(4) Chemical synapses use neurotransmitters

QUESTION (NEET PYQ EXAM 2019)

Which part of the brain is responsible for thermoregulation?

(2019)

(1) Cerebrum
(2) Hypothalamus
(3) Corpus callosum
(4) Medulla oblongata

QUESTION (NEET PYQ EXAM 2018)

Which of the following structures or regions is **incorrectly** paired with its function? **(2018)**

(1) Medulla oblongata: Controls respiration and cardiovascular reflexes

(2) Limbic system: Consists of fibre tracts that interconnect different regions of brain; controls movement

(3) Hypothalamus: Production of releasing hormones and regulation of temperature, hunger and thirst

(4) Corpus callosum: Band of fibres connecting left and right cerebral hemispheres

QUESTION (NEET PYQ EXAM 2018)

Nissl bodies are mainly composed of; **(2018)**

(1) proteins and lipids

(2) free ribosomes and RER

(3) nucleic acids and SER

(4) DNA and RNA

QUESTION (NEET PYQ EXAM 2017)

Receptor sites for neurotransmitters are present on; **(2017)**

(1) tips of axons

(2) post-synaptic membrane

(3) membranes of synaptic vesicles

(4) pre-synaptic membrane

QUESTION (NEET PYQ EXAM 2017)

Myelin sheath is produced by; **(2017-Delhi)**

(1) schwann cells and oligodendrocytes
↳ PNS ↳ CNS
(2) astrocytes and schwann cells
(3) oligodendrocytes and osteoclasts
(4) osteoclasts and astrocytes.