# PRACHAND NEET

## ONE SHOT

ZOOLOGY

# Neural Control and Coordination

By: Vipin Sharma Sir

# Topics *to be covered*

1. Structure of Neuron
2. Origin and Conduction of Nerve Impulse
3. Central Nervous System: BRAIN
4. Questions and PYQs


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# 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 (Nerves) ; Blood flow (Blood vessel) ; GFR↑ (Kidney) ; Lactic acid↑ (Muscle)

# Neuro-endocrine Control

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

## Neural Control

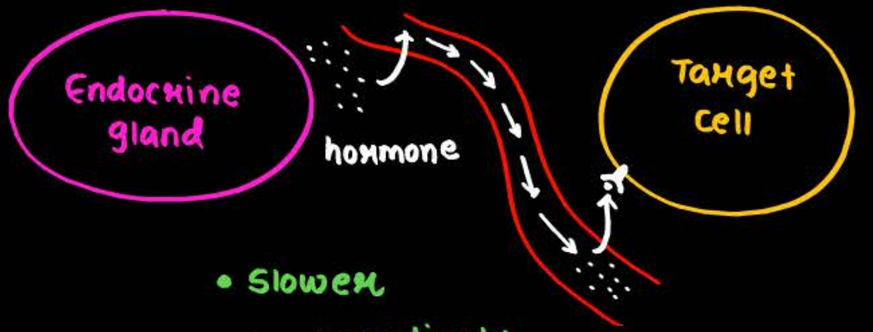
- Point to point connection
- Faster
- Short-term signals

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

- Hormone < Enzyme (mol. wt.)

## Endocrine Control

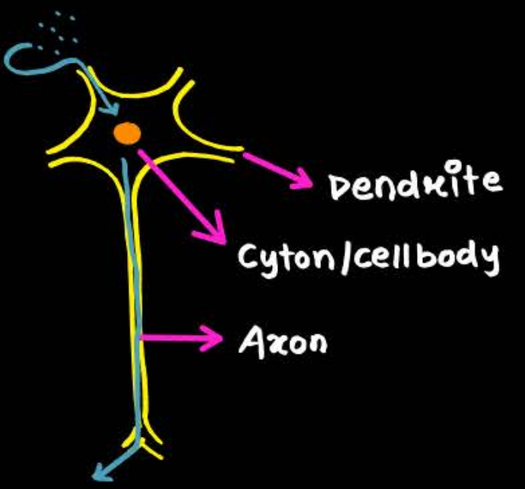
- Hormones are made



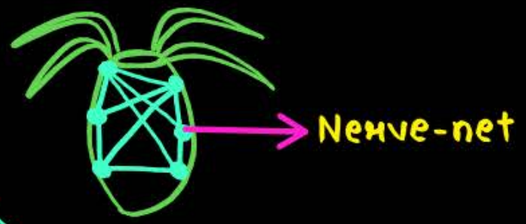

- Slower
- comparatively long term signals

# Neural System

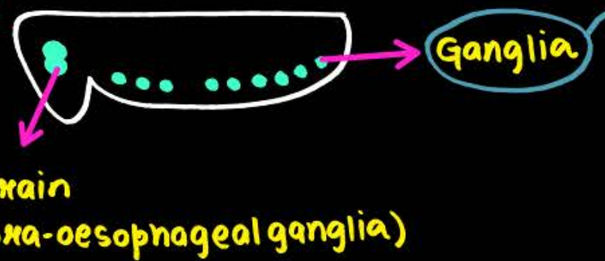
- **Composed of Specialized cells** ⇝ called NEURONS
  - D: Detect stimulus
  - R: Receive stimulus
  - T: Transmits stimulus




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




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

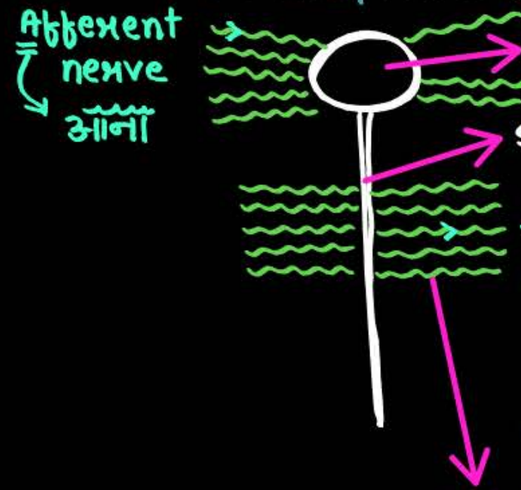


# Human Neural System

- 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

## Peripheral Nervous System (PNS)

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

### 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

# 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

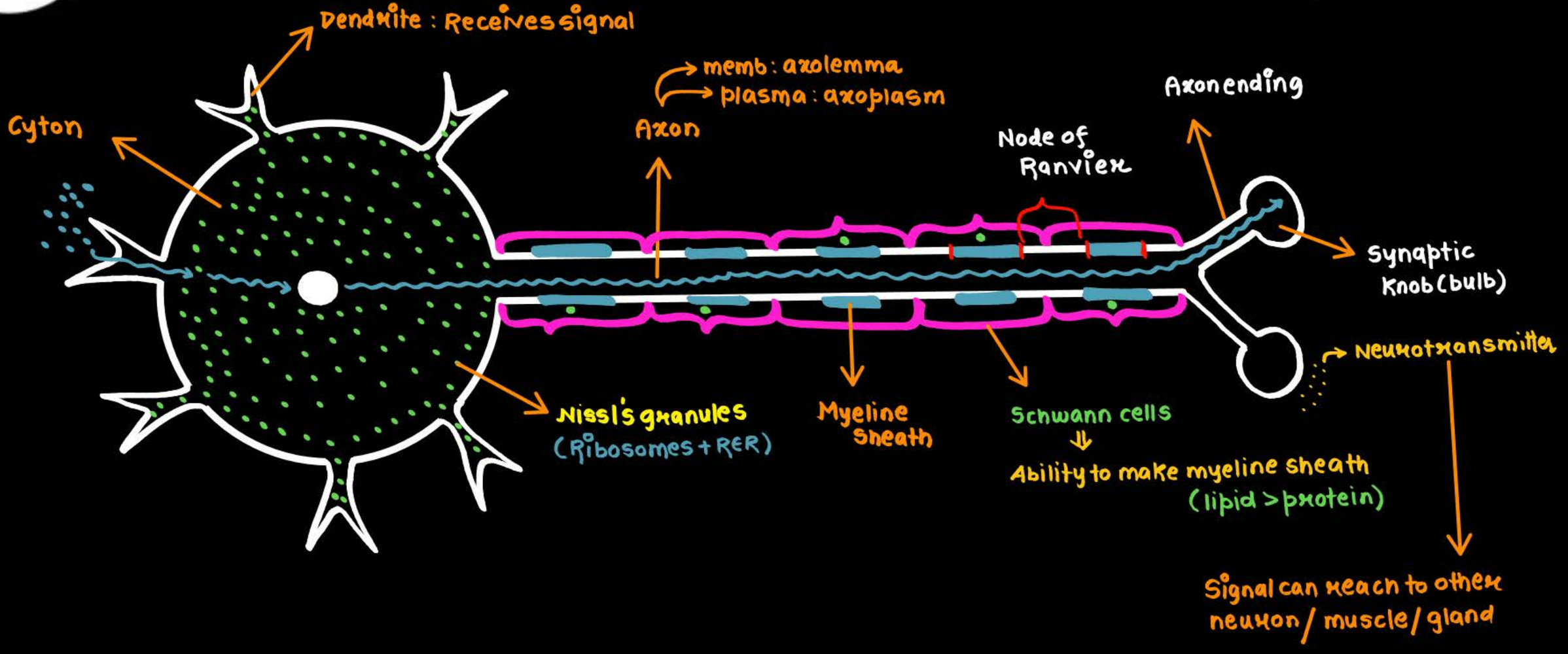
→ in cerebral cortex

2. **Bipolar:** 1 dendrite + 1 axon

→ Retina of eye

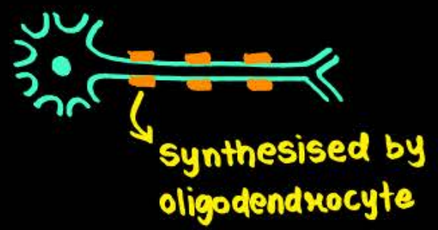
3. **Unipolar:** → 1 axon → Embryonic stage

# Structure of Neuron



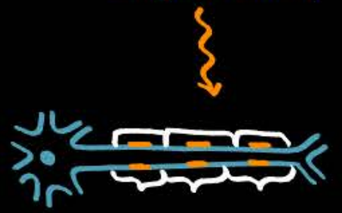
# Neurons in CNS and PNS

**In CNS**
**(Schwann cell: absent)**

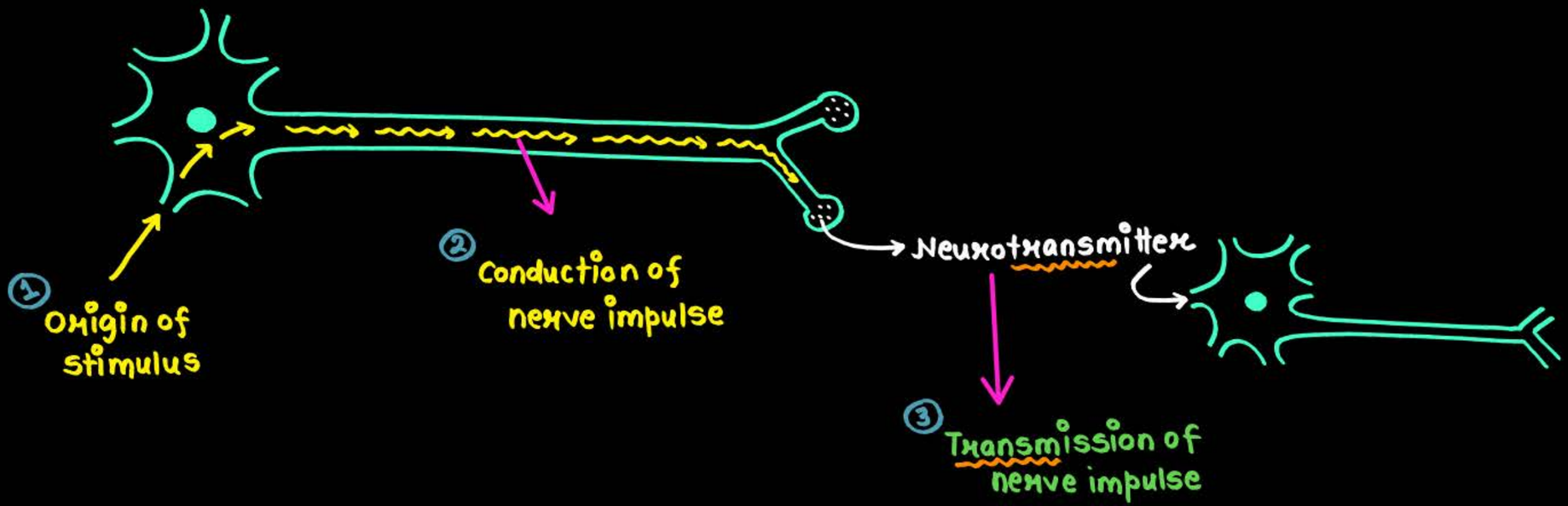
- Myelinated
  - 
  - synthesised by oligodendrocyte
- Non-myelinated
  - 

* 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

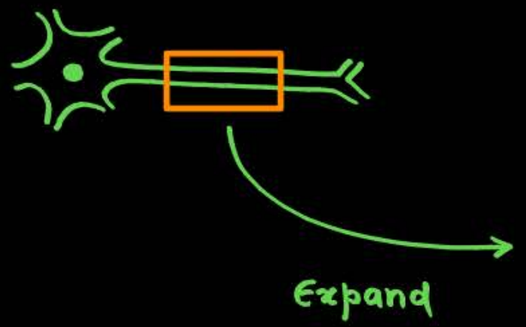


# Neurons are Excitable

∵ their membrane is polarised due to the presence of diff. ion channels

positive : outer
negative : inner

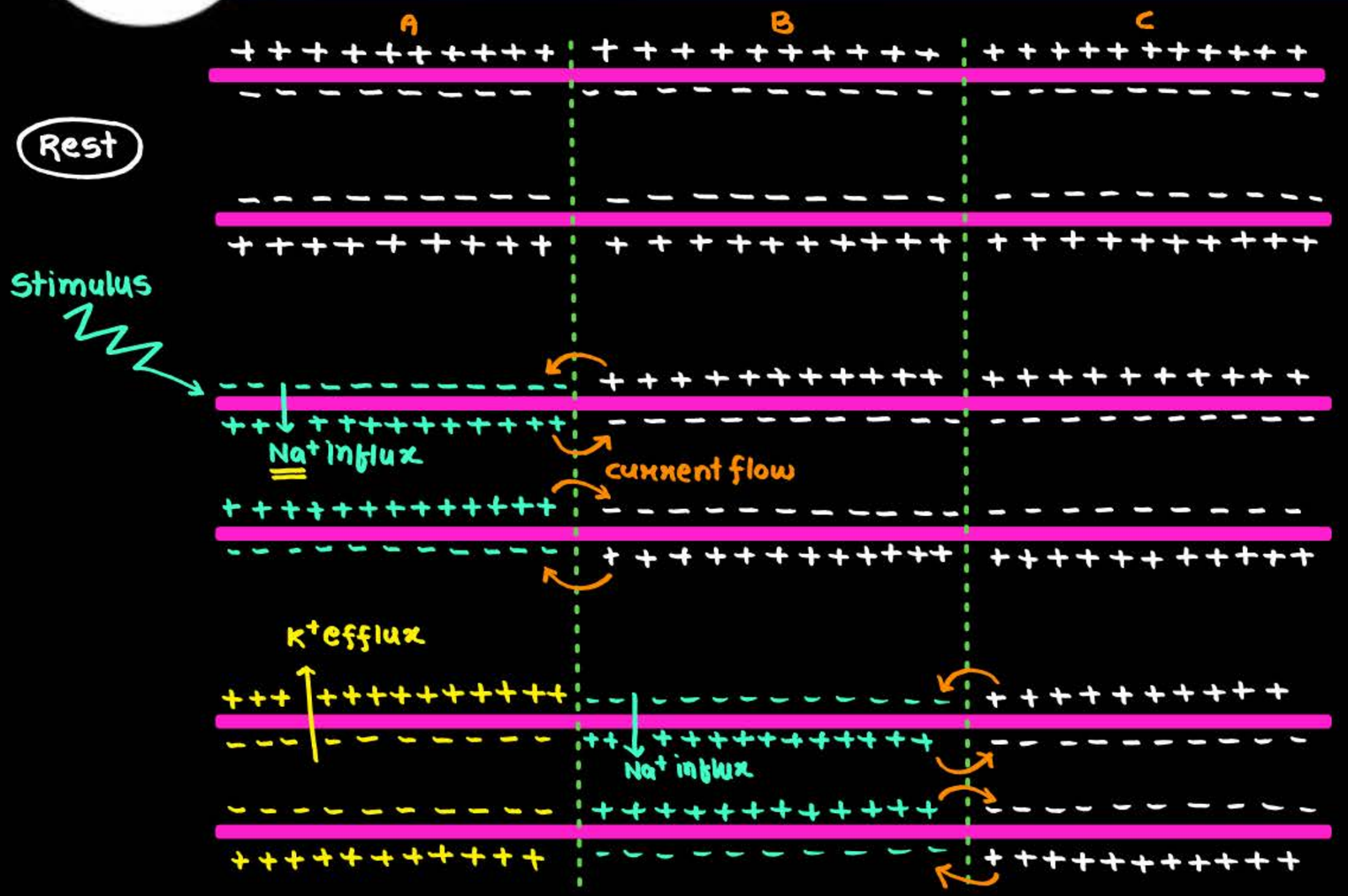
- Neuron in resting state





1. $Na^+$ are ↑ outside & memb. is nearly impermeable to $Na^+$
2. Inside : high amount of $Poy^{3-}$ ions & ⊖vely charged protein : memb. is nearly imper. 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 → Inside, $Na^+$ out, $K^+$

# Origin and Conduction of Nerve Impulse



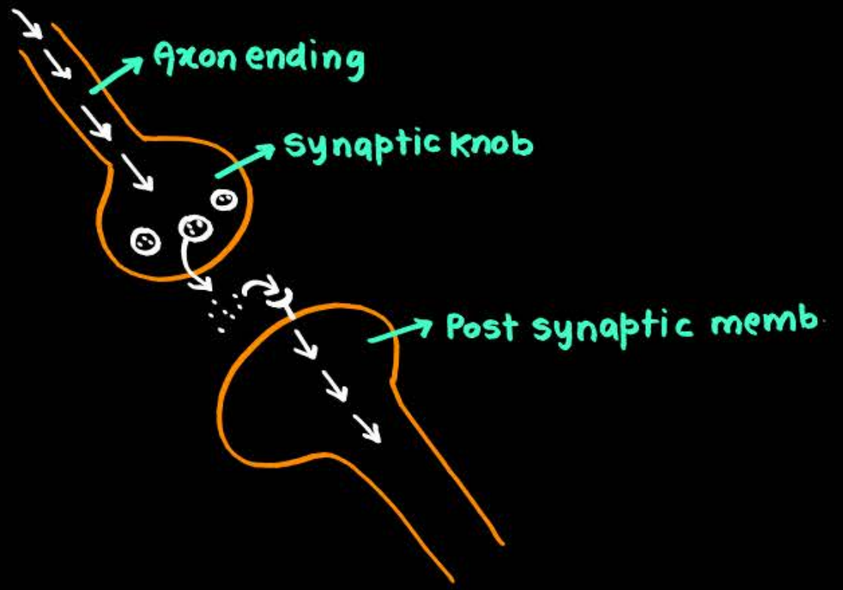

Rest → Rest memb. pot. = -70mV
- A: Polarised
- B: Polarised
- C: Polarised

Action pot. / nerve impulse →
- A: depolarised
- B: polarised
- C: polarised

- A: Repolarise
- B: Depolarise
- C: Polarise

# Transmission of Nerve Impulse

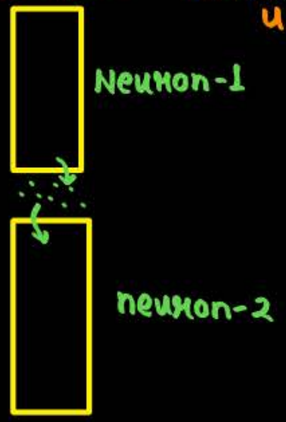
- **Synapse:** Pre-synaptic membrane + synaptic cleft + post synaptic membrane




May or may not be ⊕nt

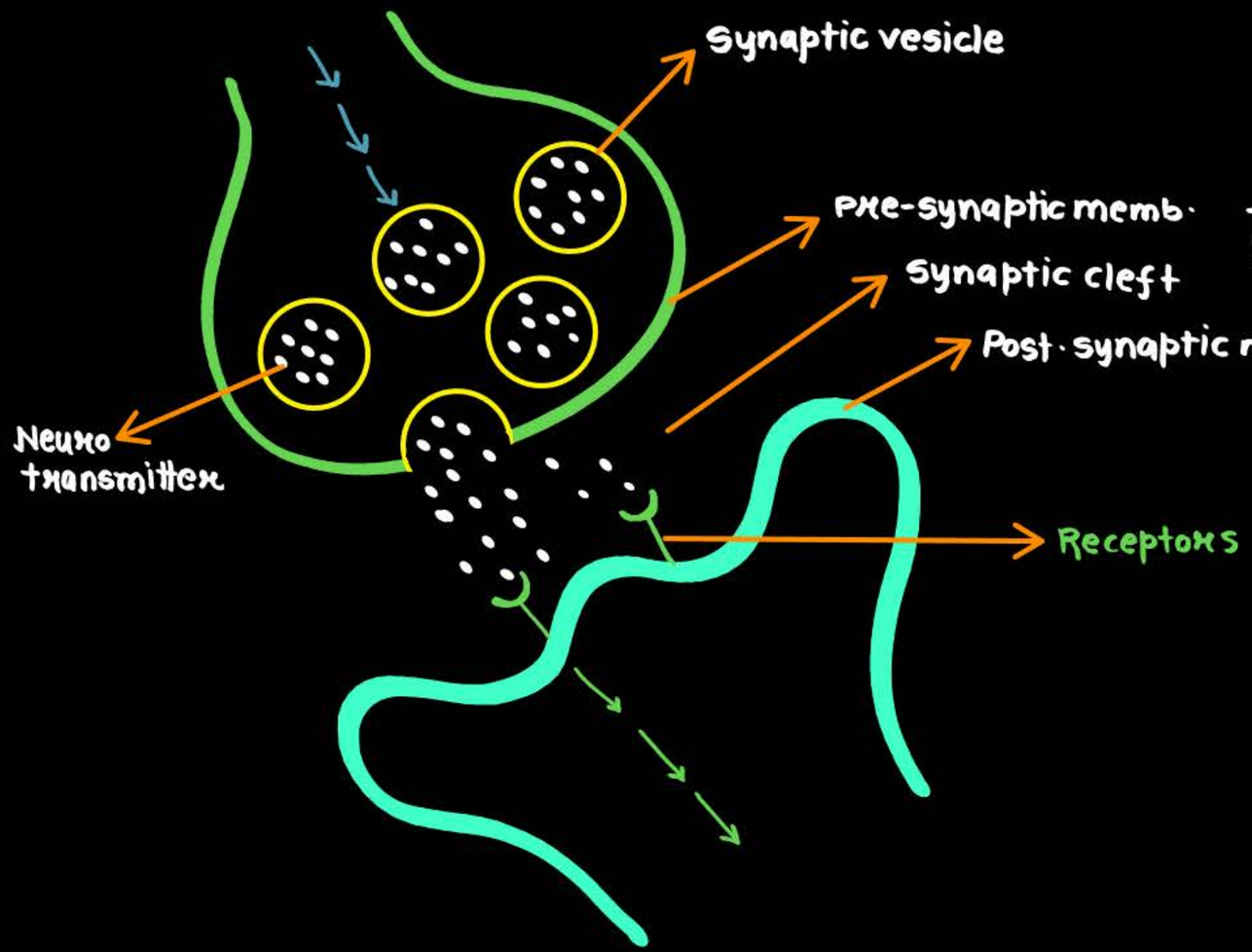
Chemical Synapse → more common in us

Electrical synapse ✗




> Both neurons are in close proximity

# Transmission of Nerve Impulse



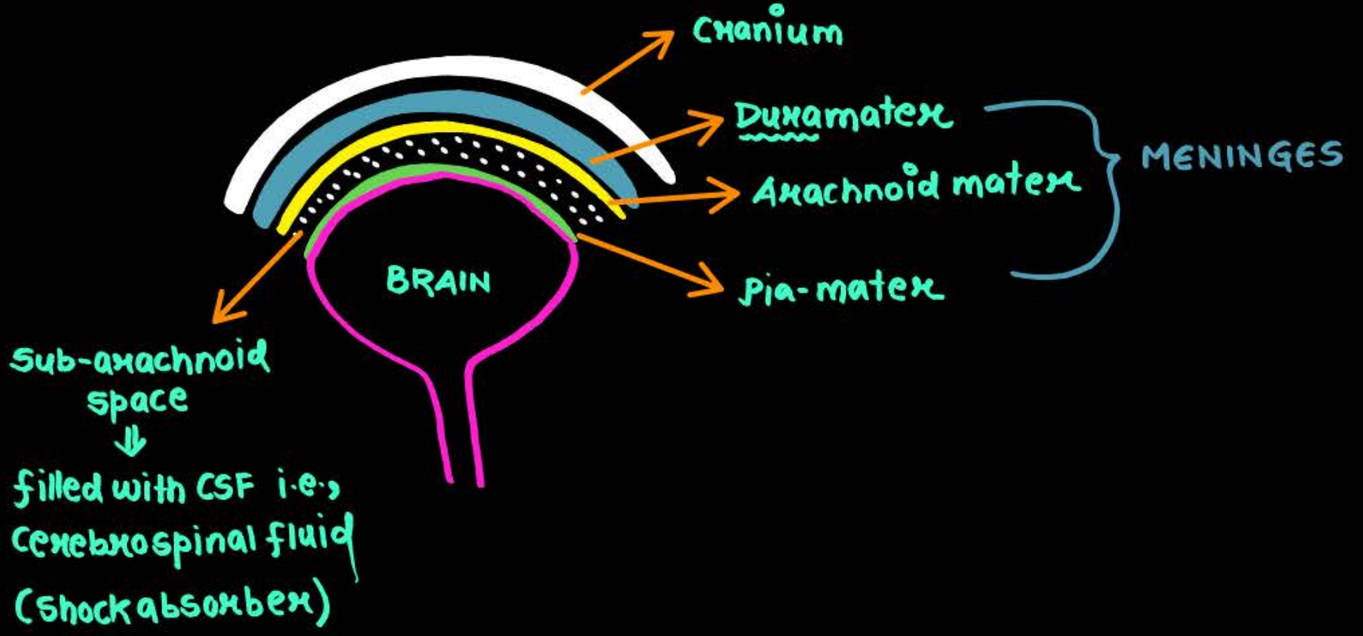

- Signal given can be excitatory or inhibitory

Acetylcholine
Adrenaline

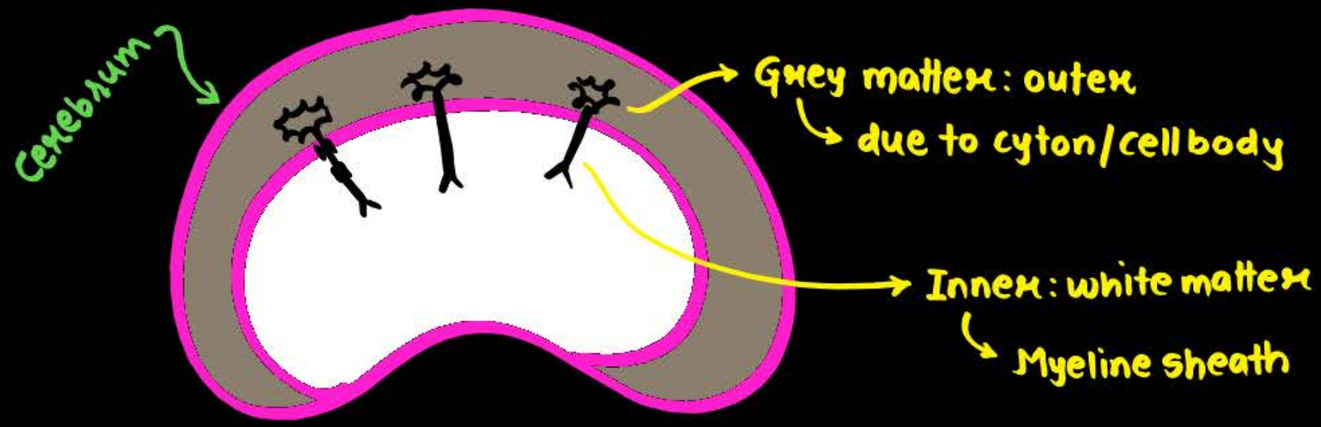
Serotonine
Dopamine
GABA
↓
γ-amino butyric acid

# 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



# 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)

- Cnt 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

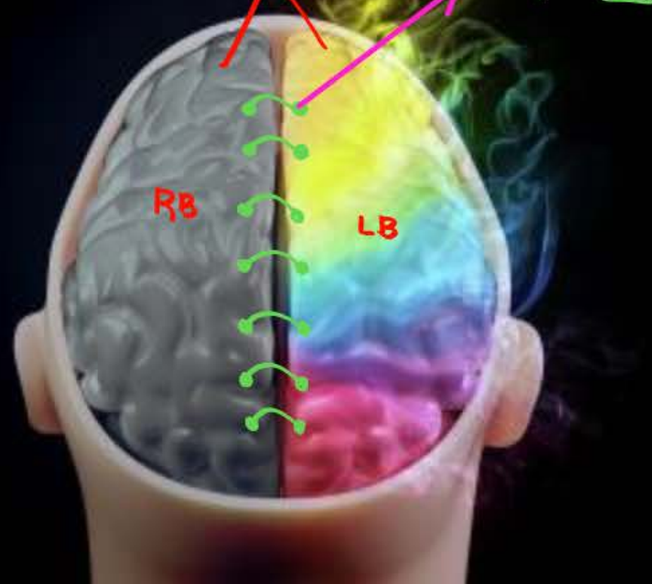
## Hindbrain (Rhombencephalon)

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




Cerebral Hemispheres

Conn. two cerebral hemisp.

↑

Corpus callosum

Cerebrum

Thalamus

Hypothalamus

Amygdala + Hippocampus → limbic system / lobe

Pituitary gland

Midbrain

Pons

Cerebellum

Medulla

⇓

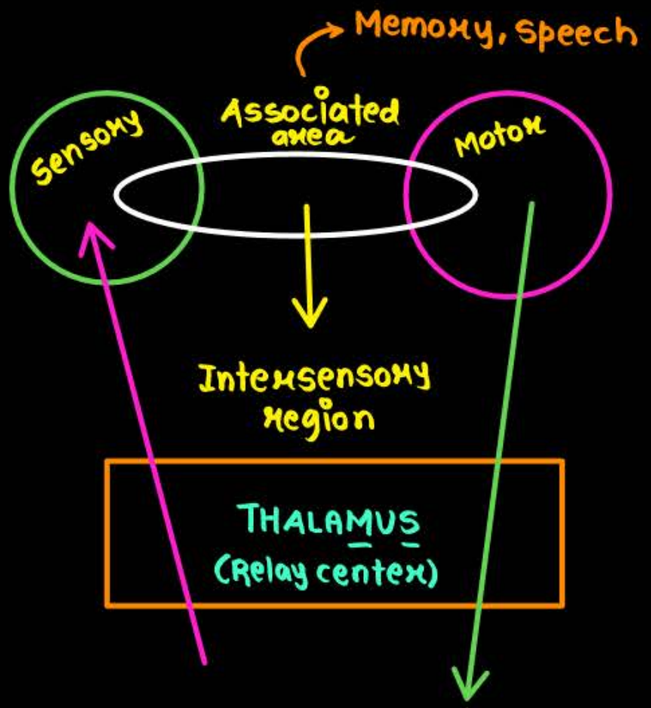
connects to spinal cord

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

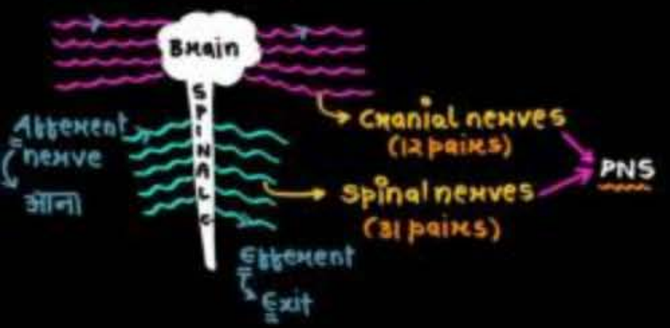
- Functions of organs & organ-systems in our body are coordinated to maintain Homeostasis.
- Coordination: process by which 2- or more organs interact & complement funct. of each other
  e.g., when we exercise: heart, lungs, muscles, nerves, kidney work together

- 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



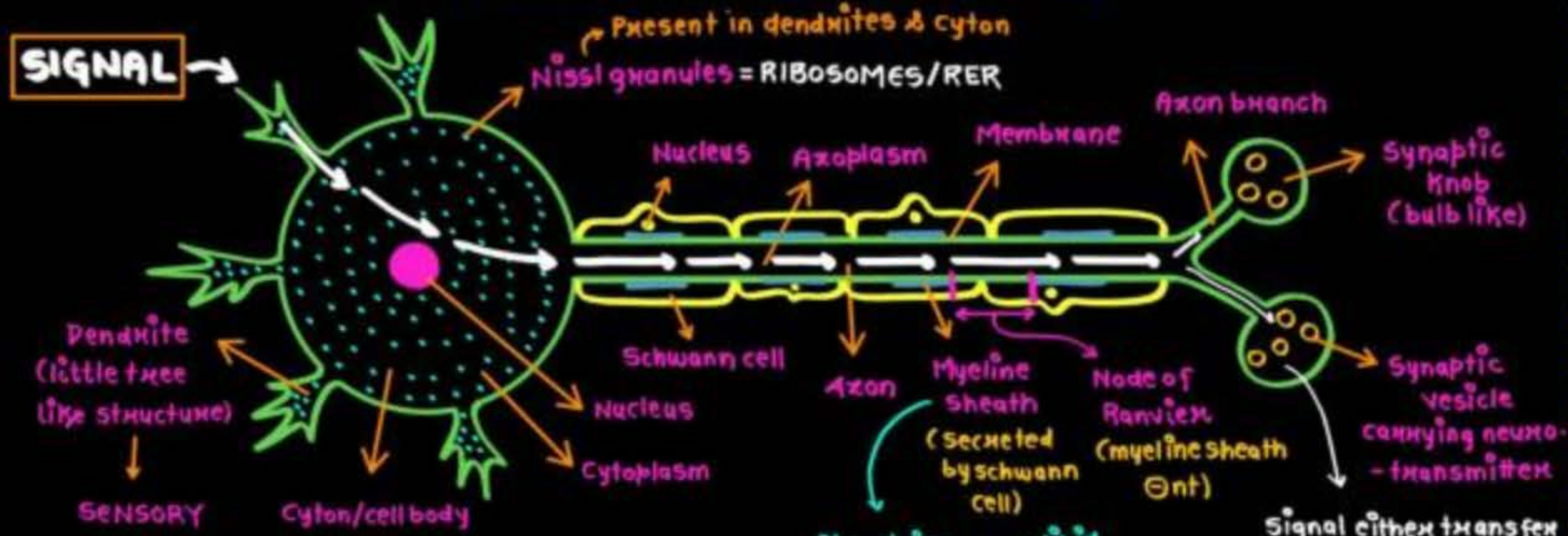

- Visceral N·S includes: neurons, fibers, plexus, ganglion
  - network of neurons

- **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


## Neurons

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

# Structure of Neuron




## Neuron

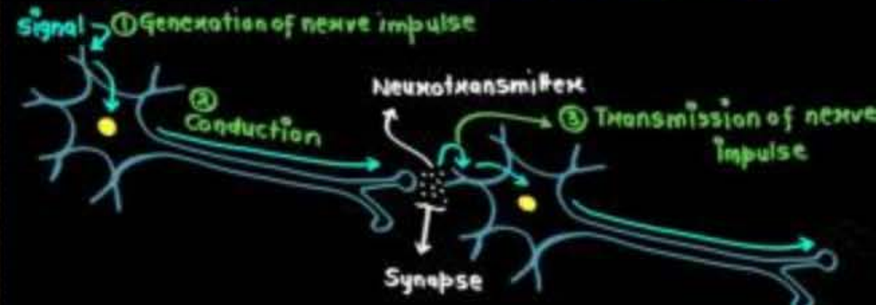
- **In Central Nervous System** → Schwann cells ⊖nt
  - Myelinated neurons (myeline ⊕nt)
  - Non-myelinated neurons

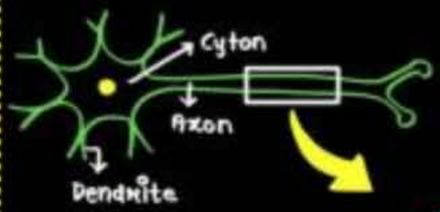
Secreted by oligodendrocyte of neuroglial cells

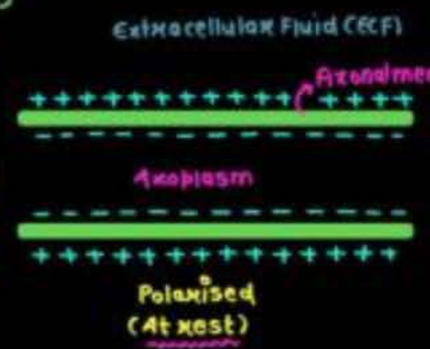
- **In Peripheral Nervous System** → Schwann cells ⊕nt
  - Myelinated
  - Non-myelinated

- Its not mandatory that Schwann cell always produce myeline sheath

# Origin and Conduction of Nerve Impulse



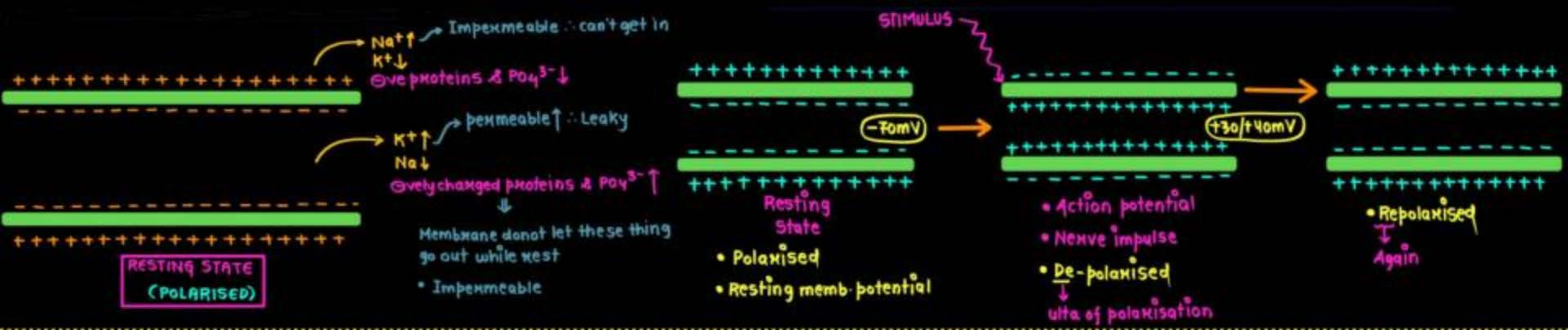



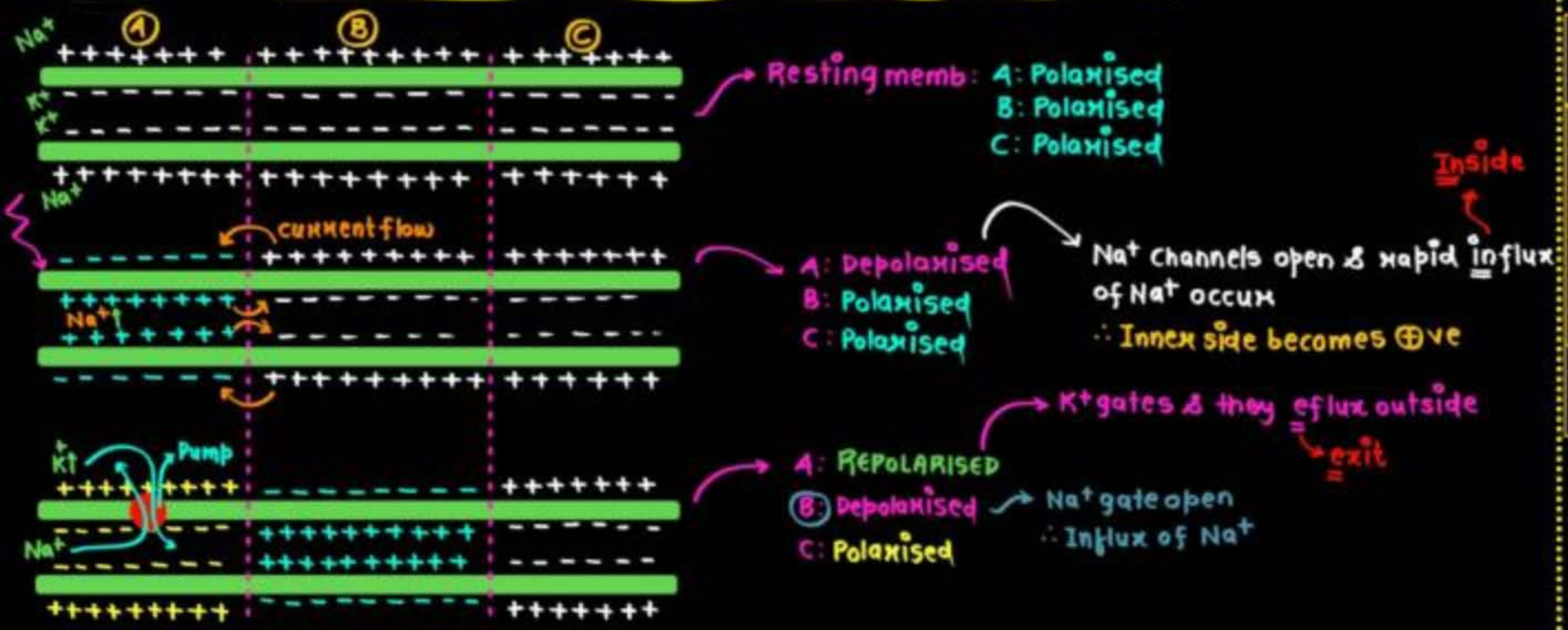

- What is the reason of polarity?

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


2. Inner part of memb. contains ⊖vely charged proteins & $PO_4^{3-}$
   ∴ ⊖ve charge inc. on inner side
3. $K^+$ के Leaky gates opens & some $K^+$ can also go outside

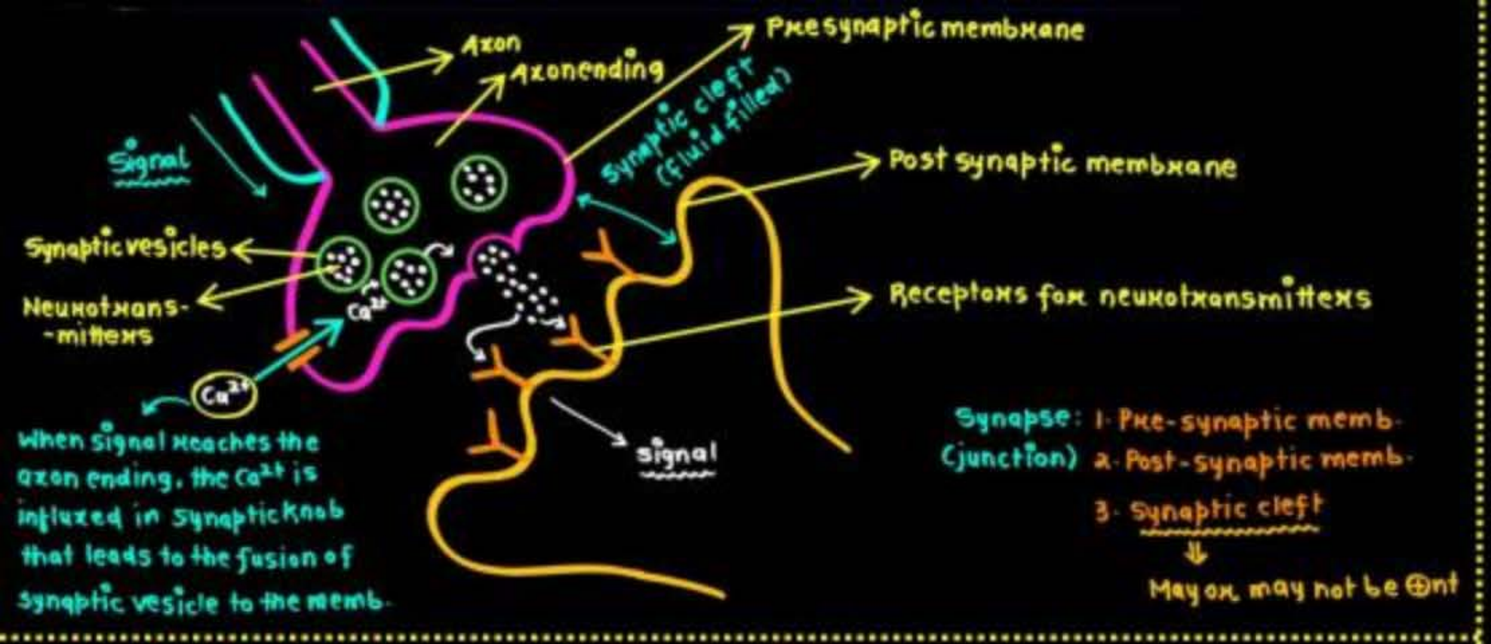



## Generation and Conduction of Impulse




## 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 |

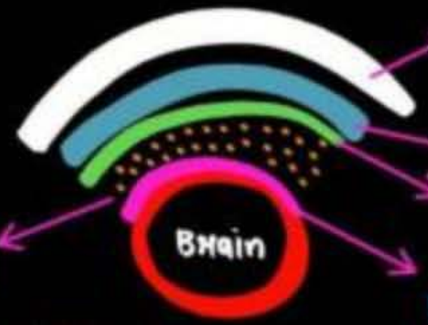



Synapse (junction): 1. Pxe-synaptic memb. 2. Post-synaptic memb. 3. Synaptic cleft ⇓ May ox may not be ⊕nt

# Central Nervous System

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

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




Thick, fibxous Duxamatex

Vexy thin axach-noid matex

Sub-axachnoid Space contain Cexebxospinal fluid (CSF) ⇓ Shock absoxbex

Piamatex (conn. to bxain Tissue)

## Brain

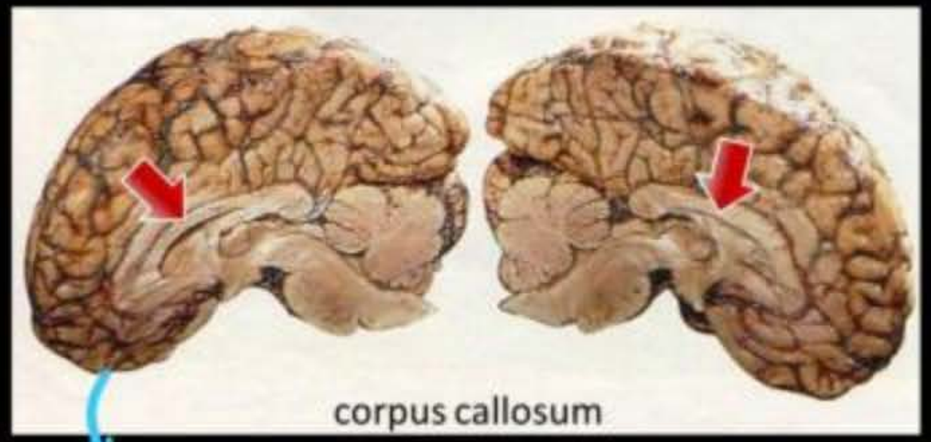
- Prosencephalon (Forebrain)
  - Cexebxum (laxgest) → Cexebxal coxtex → Complex Function
  - Diencephalon
    - Thalamus → Motox & Sensoxy signal
    - Hypothalamus → Heat ① eat/dxink
- Mesencephalon (Midbrain)
  - Coxpoxa quadxigemina ④
  - Cexebxal aqueduct
- Rhombencephalon (Hindbrain)
  - P: Pons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


① Pons: Pneumotaxic centex
- Xost
- connects diff. paxts of bxain

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

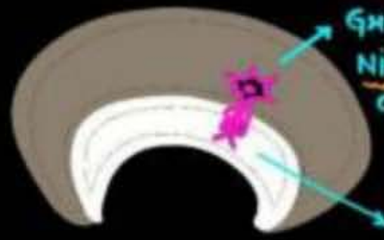
③ Medulla:
- Regulation of xespixation
- Reg. of caxdiovasculax activities
- Vomit centex
- Reg. of gastxic secxetion

Bxainstem connects to Spinal coxd: Midbxain + Pons + medulla



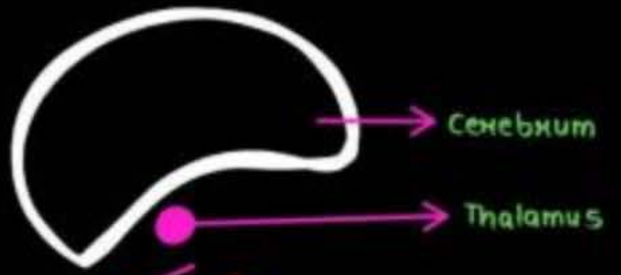

Cerebrum

- outer: cerebral cortex
- Inner cerebrum



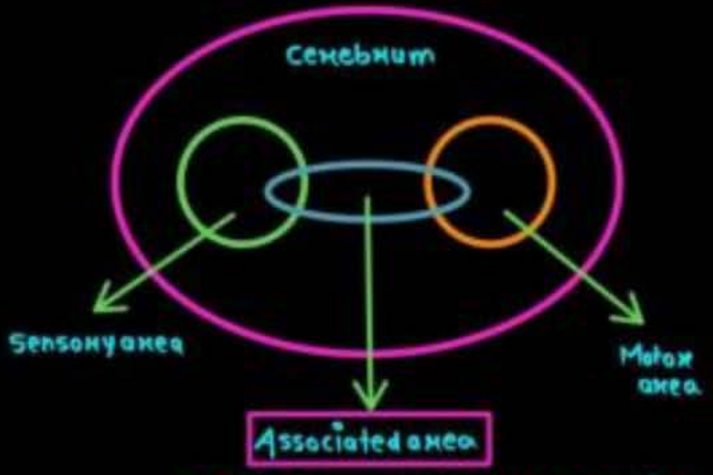
Grey matter due to Nissl granules of cyton

White matter due to myeline sheath of axon

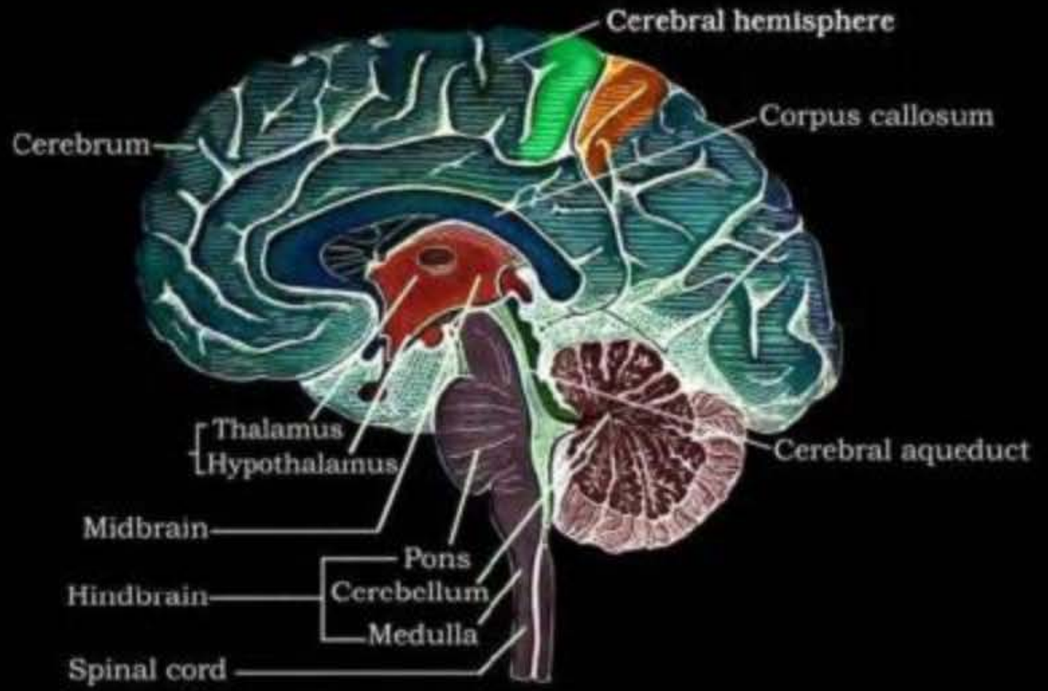



- Sexual desire
- Emotion
- Expression
- Motivation

- 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.


THANK YOU