

NEURAL CONTROL AND COORDINATION

Coordination:- Process through which 2 or more organ interact & compliment to each other & complete a particular function.

Neural system:-
an organised network of point to point connection from quick coordination.
→ neural system of animal composed of specialised cell called **Neuron**.

Neurons:-
It can detect, receive & transmit diff kind of stimuli
or information.
• Mammals have highly developed neural system.

NOTES:-

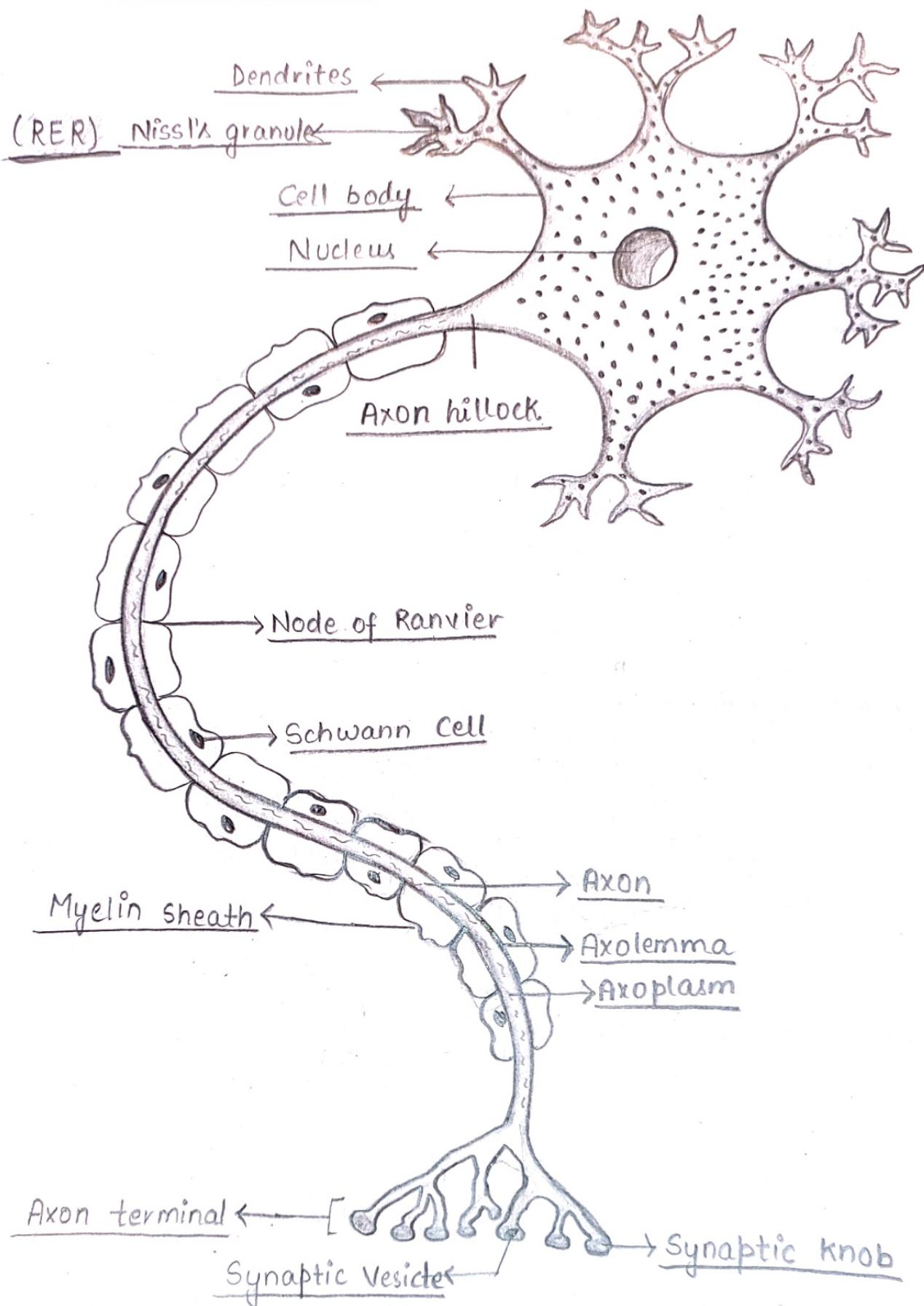
Hydra = Network of Neurons

Insect = Brain & no of ganglia

Ganglia:-

- Parts of PNS.
- They work as relay & response station of neuron/nerve signal in which one nerve enters & another nerve exits from each ganglion.
- It is of 2 types:-
 - Secondary ganglia
→ receive signal from periphery & send them to brain.
 - Automatic ganglia
→ sends signal to periphery to brain

Endocrine system provide chemical integration through hormones.



NEURON

- * Cell body is also called soma of neuron or cyton or perikaryon
- * It is the site where information received & transmit further in the form of impulse to other neurons or muscle cells or gland.
- * Cell body contains cytoplasm, nucleus & some granular structures called Nissle's granules.

Nissle granule:-

- also called Nissle body or triggering body.
- Rough endoplasmic reticulum with free ribosomes.
- Since ribosomes are present that means protein synthesis occurs.
- When Nissle granules comes in functional state of neuron their number, size & arrangement varies.
- helpful in chromatolysis in injured neuron i.e. after injured axon injuries due to toxic infections & other affect, it segregate the dissolved part on their cyton.
- also used as Reserve for food materials.
- histologically it can dye through cresyl violet or toluidine blue.

Dendrites:-

- also contain Nissle granules.

Nucleus:-

- Oval structure & bounded by nuclear membrane.
- found in cell or neuron cell.
- It contains nucleolus & chromosome i.e. necessary for coded production of protein in the cell.
- Nucleolus of the nucleus produces ribosomes.

Dendrites:- (dendron-tree)

- It is the part of neurons that receives stimulation from outside the real world through receptor.
- It is entry site of neural signals into neurons.
- Highly complex & often beautiful structures that are very characteristic for different types of neurons.
- Basically it is information receiving site of neuron.
- 2 micrometer in length & appear 5 to 7 in number & they project directly from the soma & branch extrinsically.
- It contains little amount of Nissle granule, ribosomes, SER, Golgi body, & cytoskeletal structures.
- It shows high degree of protein synthesis activity in dendrites during signal transmission.

Receptor :- a cell or unit cell or group of cell that receive stimulus for sense organ.

sense organ	receptors
Eye	Photo receptor
Nose	Olfactory
Tongue	Gustatory
Ear	Phono receptor
Skin	Thermo receptor

Ex:- to see something information goes to our brain determines the name of seen object

* experiencing heat through skin

AXON :-

Axon or nerve fibre is long spindle (thin lining) of a nerve cell or neuron.

- It transmit impulse information the form of impulse to diff neuron, muscle, gland.
- in vertebrates its typically conducts electrical impulse known as action potential away from the nerve cell body.
- axons are the primary transmission lines of nervous system.
- neuron can't divide due to absence of centriole
- group of axon form nerves
- Nissl's granule absent in axon.
- neurons are longest cell of human body.
eg:- sciatic nerve which run from base of spine to the big toe of each foot approx 1m or more.
- There is 2 types of axon
 - 1. Myelinated axon
 - 2. Non Myelinated axon.

Myelinated axon:-

layer of fatty covered ie insulating substance these fatty cover substances made up of 2 diff types of neuroglial cell.

~~essential cell~~ Oligodendrocyte

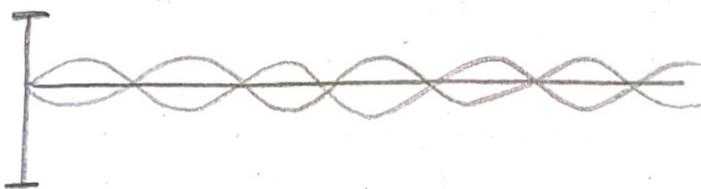
- Schwann cell part of PNS & Oligodendrocytes is CNS.
- in myelinated axon there is a layer of covered upon axon that we called myelinated sheath.
- myelinated sheath having function protecting covering of axon due to this axon enhance transmission of electrical impulse.
- It regulates fast transmission
- myelin is consider as electrical cell since it speed up the transmission.
- In mother womb myelinated sheath form during end of 14 week 3 months.
- M.S help in communication b/w CNS & other body part in Agile (Quick response).
- M.S axon allow saltatory conduction.

Unmyelinated sheath:-

axon are not cover with M.S , consider as Non m. axon.

→ These are often found in PNS & also occur in CNS.

→ UM Axon electrical impulses travelled as continuous wave.



→ UM axon are commonly found in autonomic & somatic & autonomic & somatic nerves system.

→ Schwann cell also present in non myelinated axon. but they did not form myelin sheath.

Axon hillock:-

- It is starting of axon.
- also called trigger zone
- site where action potential generate.
- in axon hillock little amount of nissl granules are also found but in axon nissl granules are present.

Node of Ranvier:- MS absent & it form node of Ranvier.

→ NOR useful for saltatory conduction.

→ at NOR nerve impulse propagate by jumping saltatory conduction.

Synaptic Knob:-

in every axon at their distal end there are branches, which terminates in bulb like structure called Synaptic knob.

→ each synaptic knob contains a vesicle ie called Synaptic Vesicle.

→ SK responsible for release of Neurotransmitter ie acetylcholine. it synthesis due to present of enzyme acetylcholine transferase.

→ When axon get branch at its terminal then they form terminal / telodendria. or bottom end / axon terminal.

Types of neurons

1. Unipolar:-

→ only 1 axon present

→ ex:- in embryonic stage



2. Bipolar:-

→ in bipolar neuron 1 axon + 1 dendron is present.

→ ex retina of eye ie Rods + cones.



3. Multipolar:-

→ many dendron, 1 axon is present.

ex- vertebrates (human).



4. A polar:-

→ axon + dendron is absent.

ex:- hydra (cnidarian)

(Camacrine cell retina)



5. Pseudoneurons:-

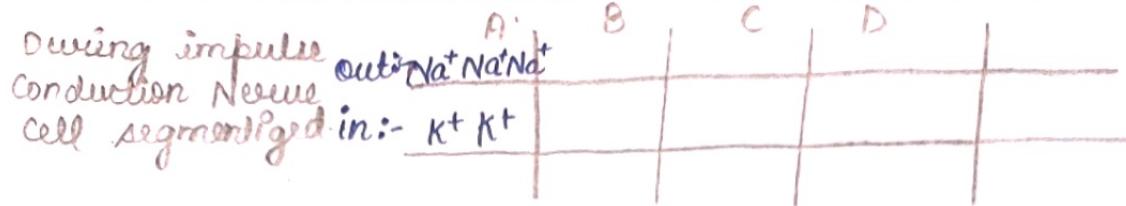
→ from cyton a axon form.

→ from axon a dendrone form.

ex dorsal root of ganglia of spinal cord.



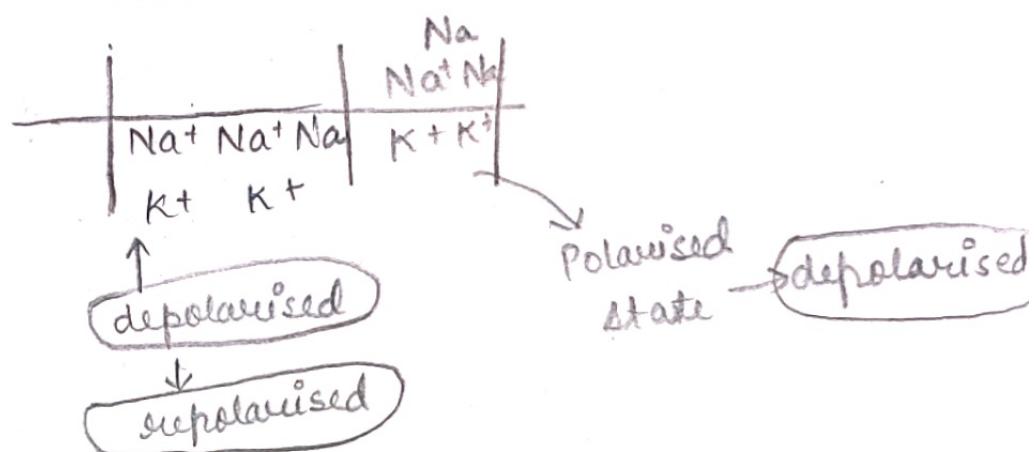
Generation and conduction of Nerve impulse



at resting phase = Polarised state
 $\rightarrow \text{Na}^+ - \text{K}^+$ pump

action potential = -70mV (inside)
 \rightarrow impermeable for Na^+
 permeable for $= \text{K}^+$

Depolarised = Na^+ ion / Na^+ gated channel open
 K^+ ion is always permeable so it is released.



- neurons are excitable since, their membranes are polarised
- in this scenario inner surface of axon membrane are -vely charged compare to out side
- that means neurons are in resting state & No nerve impulse conduction.
- membranes are polarised since $\text{Na}^+ \text{K}^+$ pump transported 3 sodium ion out & K^+ inside.
- potassium most abundant intracellular ion & it is always permeable.
- membrane is comparatively more permeable to K^+ ion & almost impermeable to Na^+ ion.
- at this action potential would be $[-70\text{mV}]$ = polarised state.
- * when nerve impulse generated then is called depolarised.
 - Stimulus apply at site \rightarrow A
 - Due to this A become freely permeable to sodium ions.

- This is active transportation process, so will ATP is used.
- Since Na^+ passes through influx on rapid influx.
- due to this inner site become fully positively charged & their action potential would be $+30 \text{ mV}$ that mean site A is depolarised. Action potential.
- If the same impulse movement process takes further 4 site B become depolarised and the same from site A move into their repolarised state & reach at polarised.

* Synapse:-
Bridge b/w two neurons.

* Synapse is of 2 types.

Electrical

* The membranes of pre & post synaptic neuron very close to each other so current flow directly from one to another neuron.

* fast.

*

chemical

* Membrane of pre & post synaptic neuron are separated by synaptic cleft. At their cleft from their synaptic knob a chemical secreted i.e. called neurotransmitter in the influence of enzyme neurotransmitter transpeptidase.

* slow

* synaptic knobs are present in synaptic vesicle.

flow of nerve impulse

Axonal terminal

↓ (stimulates)

Synaptic vesicle move toward next membrane of neuron



fuse with P.M



releases neurotransmitter from synaptic cleft.



open ion channels.



generate new potential (post synaptic neurons)

CNS

→ Brain is central part associated with spinal cord

Brain:-

- command & control system
- brain is covered by 3 layers i.e. called meninges.
- CM composed of 3 layers.

1. duramata :-

outermost & thick

2. arachnoid :- middle layer is thin.

3. pia mater :- inner most layer & get contact in brain tissue

→ weight of brain 1200 to 1400 gm.

→ Brain is divided in 3 diff location.

1. Forebrain

2. Mid brain

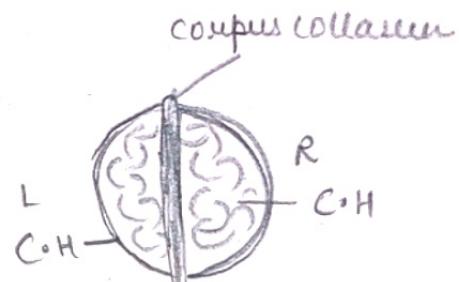
3. Hind brain

* Forebrain :- consist of 3 location

1. CEREBRUM :-

2. THALAMUS :-

3. HYPOTHALAMUS :-



→ cerebrum form major part of human brain.

→ R & L cerebrum hemisphere are attach with the help of corpus callosum.

→ Cerebral hemisphere are deep cleft of divide cerebrum longitudinally in two halves.

→ Corpus callosum having network of nerve fibre through which both hemisphere attach.

→ C.H. covered by layer of cells ie called cerebral cortex & it occur in various fold like St.

- Cerebral cortex is also called grey matter because of greyish appearance & it is due to core of nerve fibre.
- * → When these fibres are covered by myelin sheath then appear white & it is also called white matter
- Cerebral cortex have:
 1. Motor area :- Voluntary movement.
 2. Sensory area :-
 3. Neither sensory nor motor association area :- memory, inter-sensory association, communication
- inner part of cerebral hemisphere with few deep str.
amygdala & hippocampus form limbic lobe system
responsible for sexual behaviour, expression of emotional reaction. like excitement, pleasure, raised fear.

THALAMUS :-

- Cerebrum wrapped around mid brain. thalamus
- Co-ordination center for sensory & motor signal.

HYPOTHALAMUS :-

- Present at base of thalamus.
- control & co-ordination center of body tempera
urge of drinking & eating.
- It having various nerve secretory cells & this
hormones are called hypothalamic hormones.

Mid brain :-

located between thalamus & hypothalamus of fore brain & pons of hind brain

- through mid brain pipe like str. is pass.
called cerebral aqueduct
- dorsal portion of mid brain consist of 4
swelled lobe str. called corpora quadrigemina

Hind Brain :-

- 3 location.
1. Pons
2. cerebellum
3. medulla

- Pons consist of fibre tracts that interconnect & diff regions of brain
- Cerebellum is convoluted surface that provide additional space of many neurons.
- medulla connect to spinal cord contains centers for
 - 1. Respiration
 - 2. Cardiovascular reflexes
 - 3. gastric secretion.
- 3 diff regions like mid brain, pons & medulla oblongata collectively form brain stem.

PNS

- cranial nerve + spinal nerve.
- it includes all the nerves other than CNS.
- PNS nerves are associated with CNS for coordination
- PNS coordinated with CNS through 2 diff nerve fibres
- (1) → afferent fibres - means inward (to brain from tissue)
(2) → efferent fibres - means outward (exit) transmit regulatory impulse from CNS to the concerned peripheral tissue or organ.

MCQ Question:-

1. In which animal, nerve cell is present but brain is absent?
→ hydra.
2. Read the statement & select wrong
→ in eutherians, nervous system consist of a dorsal nerve cord, paired ganglia
3. Nerves in sponges.
→ absent.
4. Visceral nervous system part of:
→ PNS
5. Afferent nerve fibre carries impulse from receptor to CNS.
6. Skeletal muscles controlled by.
→ Somatic nerves.
7. In a human being the number of cranial nerves is 12.
→ 12 pairs
8. Select the correct:-
→ Sensory.
9. In a man abducens injured. WOTF will be affected?
→ Movement of eyeball.
10. WOTF transmit impulse the N.s
→ auditory
11. Sympathetic nervous system.
→ both b & c.
12. WOTF is pure motor nerve?
→ Abducens.
13. WOTF cranial nerve is purely a motor nerve & sensory nerve
→ Vagus.
14. Vagus nerve effects
→ all of these
15. Injury of Vagus in human is not likely
→ Tongue movement.
16. WOTF following nerve has the highest number of branches?
→ Vagus nerve
17. How many pairs of cranial nerve are mixed nerve.
→ 4
8. Hypoglossal nerve control the movement of.
→ hypoglossal
9. In human how many spinal nerves
→ 31 pairs.

20. Complete the flow chart.
→ C
21. One of the example of action of autonomous n.s is
→ all of these.
22. Sympathetic nervous system induces
→ heartbeat is correctly matched
23. WOTF pairs is correctly matched
→ b.
24. WOTF pairs is correctly matched
→ a.
25. Visceral nervous system comprises of
→ all of these
26. Match the following:-
→ b
27. Myelin sheath formed by.
→ Schwann cell.
28. In medullated nerve fibre the conduction of impulse is
→ myelin's sheath & nodes of Ranvier.
29. Read paragraph.
→ d
30. Nerve fibre during resting stage
→ more permeable to K⁺
31. WOTF options illustrations of Na⁺, K⁺ ions in a sectional
→ (a)
32. Sodium potassium pump transports
→ K⁺ into the neuron & Na⁺ out of neuron.
33. In resting state of the neural membrane, diffusion due to concentration gradients, if allowed would drive.
→ Na⁺ out of the cell.
34. WOTF statement correct regarding Na⁺-K⁺ pump?
→ all of these
35. The electrical potential difference b/w outside and inside of a nerve even before excitation is known as.
→ resting potential
36. complete ...
→ Na⁺, Na⁺ depolarization.