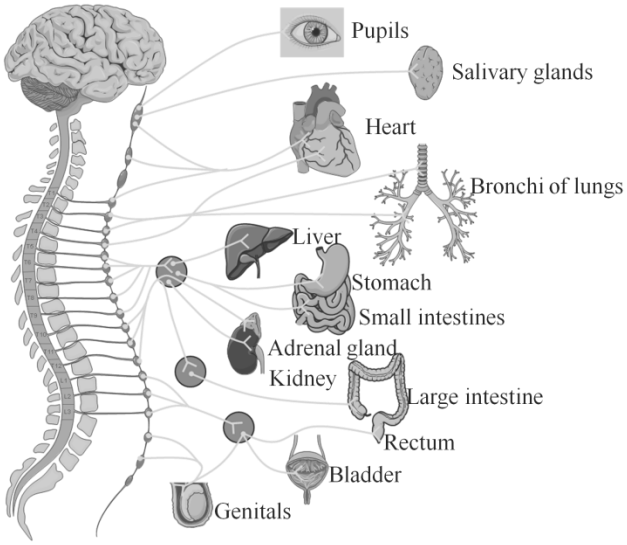
Day - 6

Autonomic (Visceral) Nervous System.

Controls the visceral functions by controlling the smooth muscles, cardiac muscles and certain glands maintains homeostasis inside the body.

- **Sympathetic nervous system**;
- ANS is not autonomous (independent of CNS). Though sympathetic and parasympathetic nervous systems of ANS control the involuntary visceral organs. But both are controlled by higher nerve centres of brain. These centres send the impulses to ANS through preganglionic nerve fibres, which transmit them to visceral organs. So autonomic ganglia act as only relay centres neither is exclusively excitatory or inhibitory.

Sympathetic nervous system:



Nerve Impulse

Properties of nervous tissue

Electrical excitability

Conductivity

Resting potential and action potential

Resting potential: The potential difference across the membrane at rest is called the **resting membrane potential** and this is about – 70mV (the negative sign indicates that inside the cell is negative with respect to the outside).

(Range $\rightarrow$ – 60 to – 85 mV)

$\Rightarrow$ The resting potential is maintained by active transport and passive diffusion of ions.

$\Rightarrow$ Resting membrane potential is maintained by the active transport of ions against their electrochemical gradient by **sodium potassium pump**.

Action potential

Threshold stimulus: A change of –10mV in potential difference from RMP through influx is sufficiently significant to trigger a rapid influx of Na+ ions leading to generation of action potential.

This change of –10 mV is called as threshold stimulus.

Summation

All-or-none principle: Conduction of nerve impulse is unidirectional. It follow all or none law. Magnitude of response will always be same irrespective of strength of stimulus above threshold stimulus.

Membrane or ionic theory of nerve impulse

Sodium-potassium-exchange pump

Generation of nerve impulse

Depolarization: Once the event of depolarization has occured, a nerve impulse or spike is initiated. Action potential is another name of nerve impulse. This is generated by a change in the sodium ion channels. These channels, and some of the potassium ion channels, are known as voltage gated channel, meaning they can be opened or closed with change in voltage. In resting state these channels are closed due to binding of Ca^{++}.

An action potential is generated by sudden opening of the sodium gates. Opening of gates increases the permeability of the axon membrane to sodium ions which enter by diffusion. This increases the number of positive ions inside the axon. A change of –10mV in potential difference from RMP through influx is sufficiently significant to trigger a rapid influx of Na+ ions leading to generation of action potential. This change of –10 mV is called as threshold stimulus.

Repolarization: After a fraction of second i.e., 0.5 m.sec, the sodium gates closed, Depolarisation of the axon membrane causes potassium gates to open, potassium therefore diffuse out of cell.

⇒ Since potassium is positively charged, this makes the inside of cell less positive, or more negative and the process of repolarization or return to the original resting potential begins.

⇒ The repolarization period returns the cell to its resting potential (–70 mV). The neuron is now prepared to receive another stimulus and conduct it in the same manner.

⇒ At this point membrane show hyper polarization.

⇒ Sodium pump starts working to maintain the normal resting membrane potential by expelling Na+ and in take of K+. The time taken for restoration of resting potential is caled **refractory period**, because during this periods the membrane is incapable of receiving & conduicting another impulse.

⇒ Nerve impulse travels as action potential which passes along axon as a wave of depolarization.

⇒ The whole process of depolarisation and repolarisation is very fast. It takes only about **1 to 5 milli second (ms)**.

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Transmission (propagation) of nerve impulse along the nerve fibre

Saltatory conduction: This type of conduction occur in myelinated fibre. Myelin is fatty material with a high electrical resistance and act as electrical insulator in the same way as the

rubber and plastic covering of electrical wiring. This means, in effect that the action potential jump from node to node and passes along the myelinated axon faster as compared to the series of small local circuits in a non-myelinated axon. This type of conduction is called saltatory conduction.

– Leakage of ions takes place only in nodes of Ranvier and less energy is required for salutatory conduction.

Transmission of impulse at a synapse: Telodenria of one neutron form synapse with dendron of next neuron. It is the junction between two neurons where information is transferred from one neutron to another neuron but no protoplasmic connection. Synapse = Pre synaptic knob + synaptic cleft + post synaptic membrane – Telodendria membrane is called pre synaptic membrane & membrane of dendron of other neuron called as post synaptic membrane. Space between pre and post synaptic membranes is called synaptic cleft.

– When the AP develop in pre synaptic membrane. it becomes permeable for Ca^{++}.

– Ca^{++} enter in pre synaptic membrane & vesicles burst due to the stimulation by Ca^{++} and causes release of neurotransmitters (Ach) in synaptic cleft.

– Ach reaches the post synaptic membrane via synaptic cleft & bind to receptors. It develops excitatory post synaptic potential (EPSP). EPSP develop due to opening of Na+ gatted channnels.

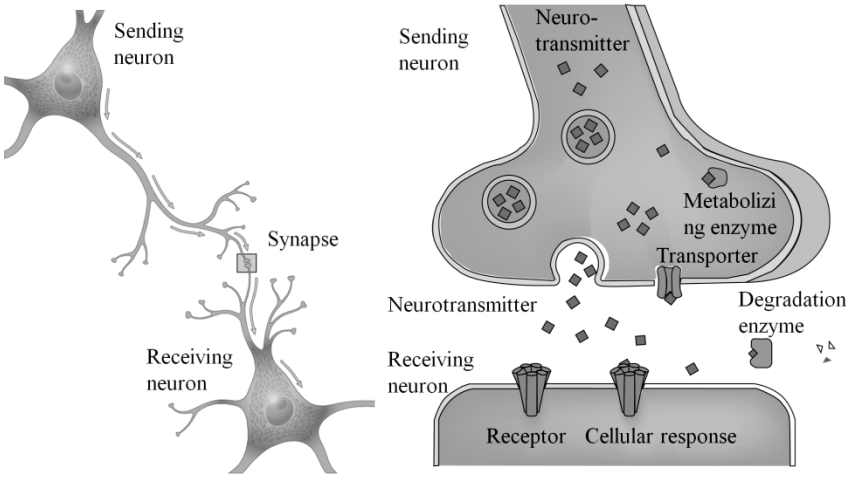
Cholinesterase enzyme is found in the synaptic fluid of synapse.

– This enzyme decomposes the Ach into choline & Acetate.

– Neuro inhibitory transmitter (GABA) binds with post synaptic membrane to open the Cl^- gated channels and hyperpolarization of neuron occurs. Now the potential is called inhibitory post synaptic potential (IPSP) & further nerve conduction is blocked.

Neurotransmitters Neurotransmitters or Neurohormone

1. Stimulatory – Stimulates impulse at synapse eg: Acetyl choline (Ach), Nor-epinephrine or noradrenaline or sympathetin
2. Inhibitory- Inhibit impulse at synapse eg: GABA (gamma amino butyric acid), serotonin,dopamine, glycine



Disorders of Nervous System

Poliomyelitis

Meningitis: It arises due to infection or inflammation or injury in the meninges. Infection may be due to virus or bacteria or both.

Sciatica

Neuritis

Synaptic delay

Synaptic fatigue

Practice Question Online