Unit: 3. Nervous System Date: 17/12/2020

Structure of Neuron:-

A neuron is a nerve cell with its branches and is functional unit of nervous system. It may be elongated over 100 cm to conduct the nerve impulses to various body parts. A neuron is formed of two parts.

(a) Cyton (cell body or soma or perikaryon):

It is of variable shape. Its size varies from 4 μm to 135 μm in diameter. It granular cytoplasm is called ~~neuroplasm~~ neuroplasm. In the neuroplasm a large, spherical, centrally located nucleus with nucleolus, endoplasmic reticulum, lysosome and neurofilaments present which are responsible for metabolism, growth, and repair of neuron. Numerous fine thread called neurofibrils for the conduction of nerve impulses are also found in them.

Neurofilaments and neurotubuls are threads like protein, runs parallel to long process. Neurofilament is semisolid structure that provides skeletal framwork to the axon. ~~Nutro~~ ~~Neuro~~ Neurotubules transport intracellular

proteins between the cell body and the processes. Several small, basophilic granules of varying shapes called Nissil's granules, originated from rough endoplasmic reticulum (RER) with ribosomes present in the neuroplasm which provides sites for the protein synthesis. Neuroplasm has large number of mitochondria to provide high energy for conduction of impulse.

(b) Nerve processes:- There are one or more proplasmic processes arising from the cytons. These are of two types —

(i) Dendrites or Dendrons:- These are one or more small sized tapering processes. Several thread like cytoplasmic extension arises from cell body called dendrites. Each is highly branched to form the terminal arborization. It conducts nerve impulse toward the cell body, hence afferent in nature. These are myelinated and have both Nissl's granule and neurofibril.

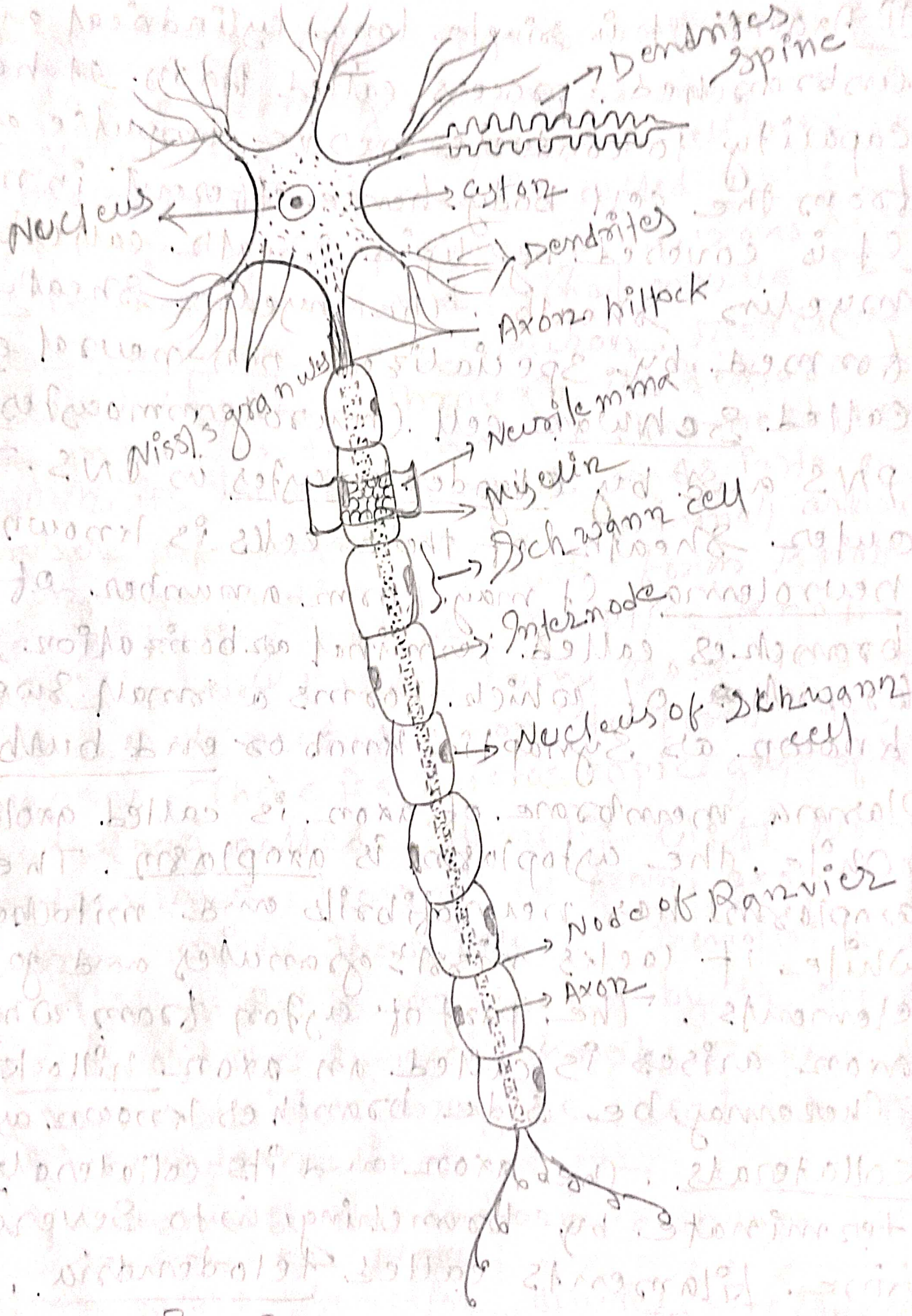


Fig: Structure of Neuron.

(ii) Axon:- It is single long, cylindrical and unbranched process called Axon. It has capacity to conducts nerve impulse away from the cell body hence efferent in nature. It is covered by lipid sheath called myelin sheath. The myelin sheath is formed by specialized non-neural cell called Schwan cell (neurolemmocytes) in PNS and by Oligodendrocytes in CNS. The outer sheath of these cells is known as neurolema. It may form a number of branches called terminal arborization, each branch of which forms a small swelling known as synaptic knob or end bulb. The plasma membrane of axon is called axolemma while the cytoplasm is axoplasm. The axoplasm has neurofibrils and mitochondria while it lacks nissl's granules and golgi elements. The part of cyton from where axon arises is called an axon hillock. There may be side branches known as axon collaterals. The axon and its collaterals terminate by branching into several fine filaments called telodendria.

Neurons arrangment :- The neurons may lie end to end forming a chain or may be aggregated into the cell mass. A cell mass in the brain or spinal cord is called nucleus. While a cell mass of sensory neurons outside CNS in the cranial and spinal nerve is called ganglion. Each neuron receives a nerve impulse through its dendrons and passes on the same to the next neuron through its axon. An axon ends into a number of branches, the terminal arborization. The ends of which form knob-like swelling called Synaptic knobs which come to lie very close to the dendrons of next neuron to form the Synapses. There is a microscopic gap of about 200Å called Synaptic cleft. Nerve impulses are transmitted from axon to dendron with the help of chemical called neurotransmitters, produced by the secretory vesicles of the Synaptic knobs. These neurotransmitter may be acetylcholine (Ach) or adrenaline.

Types of neurons :- Neurons are two types -

(A) on the basis of function - divided into following catagories :

① Somatic afferent (Sensory): carry Sensory impulses from Skin, Skeletal muscles, joints and connective tissue to the CNS.

② Somatic efferent (motor): CNS to Skeletal muscles.

③ Visceral afferent: Impulse from visceral organs to CNS.

④ Visceral efferent: CNS to visceral organs.

⑤ Special afferent: Receptor cells to CNS.

⑥ Special visceral efferent: Brain to muscles of jaws, pharynx, facial, expression, larynx.

(b) On the basis of Structure - divided into following catagories :-

① Apolar :- Have no processes. These are the most primitive neurons which are devoid of cytoplasmic processes like dendrites or axon and rare in vertebrates. Each neuron bears several branched processes, having no functional defference of dendrites and axon. Hence each process can bring an impulse to the cyton, or can take away from cyton

(ii) Unipolar :- Have single processes. Very common sensory neuron in PNS. Such neurons are common in invertebrates and vertebrates embryos.

(iii) Bipolar :- Two processes - a dendrites and an axon, e.g. Retina, Cochlea and Smell receptor.

(iv) Multipolar :- Many processes - many dendrites but one axon. eg. Brain and Spinal cord.

Resting Membrane potential :-

- The resting membrane potential of large nerve fibers when they are not transmitting nerve signals is about -90 mV. That is the potential inside the fiber is 90 mV more negative than the potential in the extracellular fluide on the outside of the fiber.

Active transport of sodium and potassium Ions through the membrane - The Sodium-potassium ($Na^+ - K^+$) pump :- All cell membranes of the body have a power $Na^+ - K^+$ pump that continually transport Sodium ions to the outside of the cell and potassium ions to the inside. This is an electrogenic pump because more positive charges are pumped to the outside than to the inside (three Na^+ ions to the outside for each two K^+ ions to the inside)

leaving a net deficit of positive ions on the inside and causing a negative potential inside the cell membrane.

The Na^+-K^+ pump also causes large concentration gradients for sodium and potassium across the resting nerve membrane. These gradients are as follows —

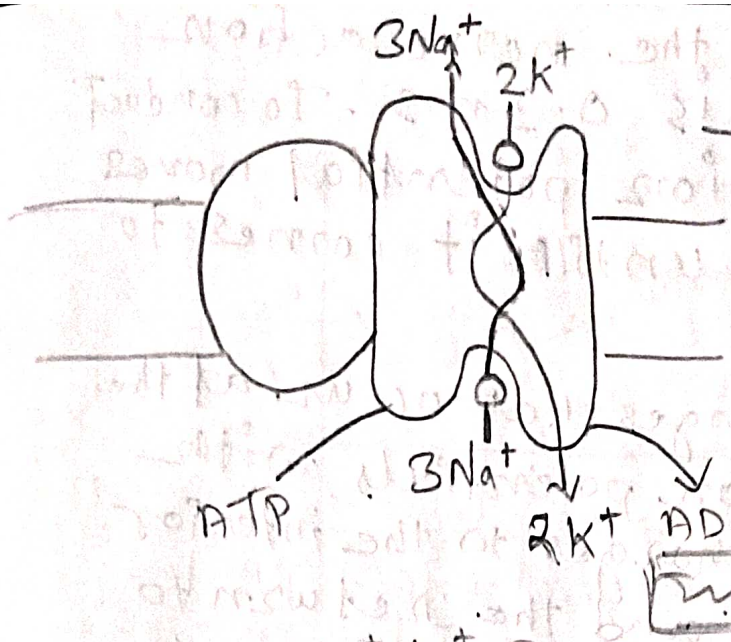
Na^+ (outside): 124 m.Eq/L
Na^+ (inside): 14 m Eq/L
K^+ (outside): 4 m Eq/L
K^+ (inside): 140 m Eq/L

The ratio of these two respective ions from the inside to the outside are as follows:

$$\frac{Na^+ \text{ inside}}{Na^+ \text{ outside}} = 0.1$$

$$\frac{K^+ \text{ inside}}{K^+ \text{ outside}} = 35.0$$

Leakage of potassium through the nerve cell membrane :—



Na+-K+ pump.

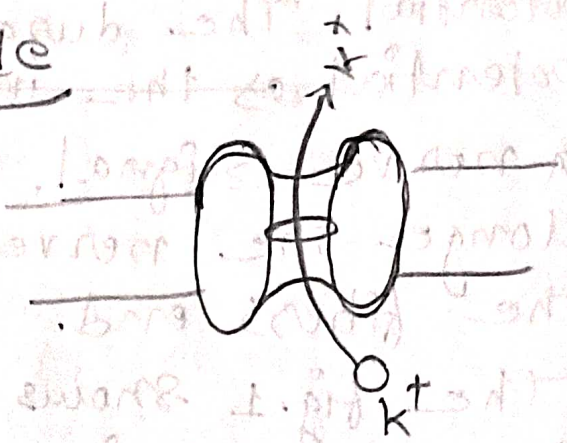


Fig:- K+ leak channels

Fig:- Sodium-potassium pump (Na+-K+ pump)

The upper figure shows a channel protein, sometimes called a "tandem pore domain" potassium channel or potassium "leak" channel, in the nerve membrane through which potassium can leak even in a resting cell. These K+ leak channels may also leak sodium ions slightly, but are far more permeable to potassium than to sodium, normally about 100 times as permeable.

Action potential:

Nerve signals are transmitted by action potentials which are rapid changes in the membrane potential that spread rapidly along the nerve fiber membrane. Each action potential begins with a sudden change from the normal resting negative membrane potential to a positive potential and ends with an almost equally rapid change back to the negative

potential. The duration of the nerve action potential ~~as the indicate~~ is 0.3 ms. To conduct a nerve signal, the action potential moves alonge the nerve fiber until it comes to the fiber's end.

The fig. 1 shows the changes that occur at the membrane during the action potentials, with the transfer of positive charges to the interior of the fiber at its onset and the return to the positive charges to the exterior at its end.

The fig. 2 shows graphically the successive changes in membrane potential over a few ten-thousandths of a second, illustrating the explosive onset of the action potential and the almost equally rapid recovery.

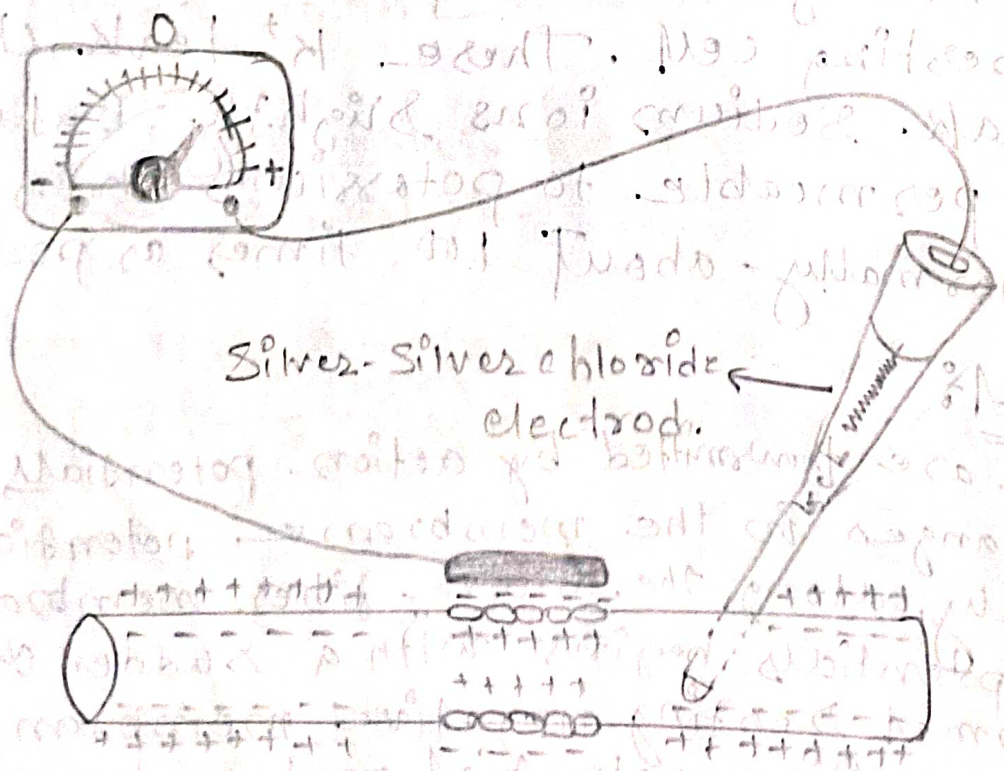


Fig:- 1.

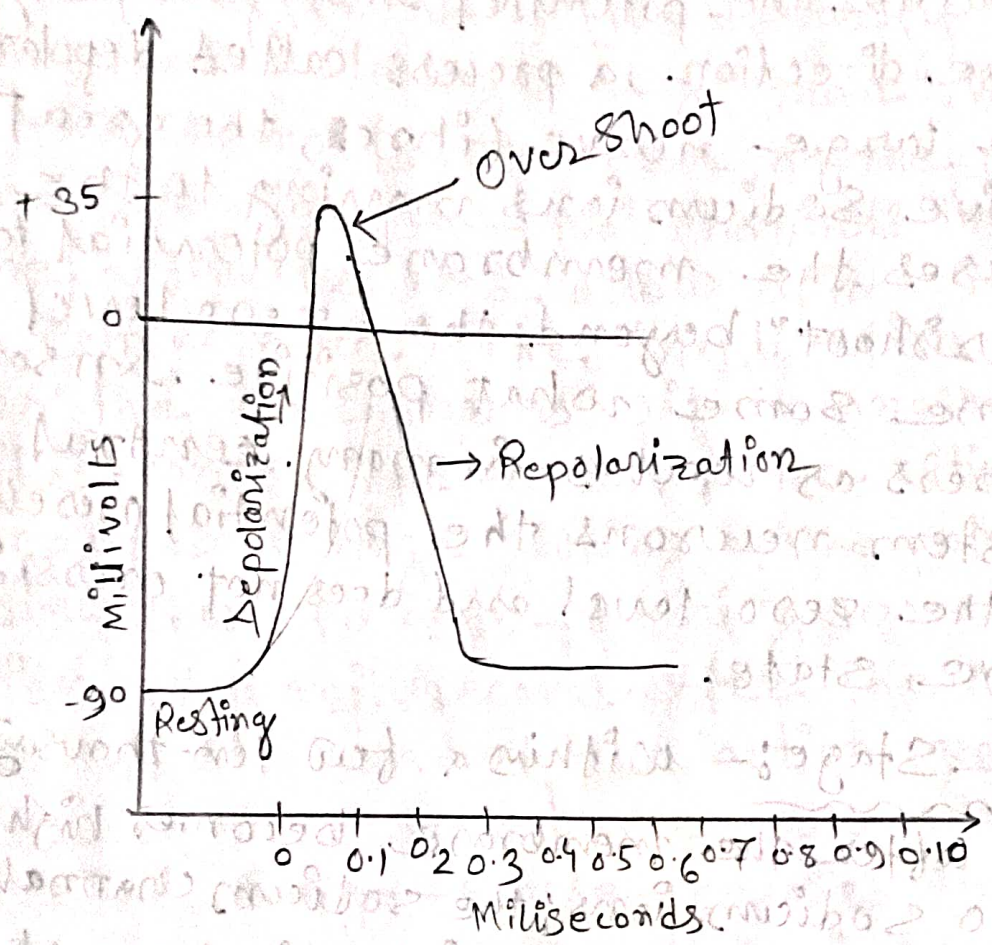


Fig:-2. Typical action potential recorded by the method shown in fig. 1.

The succesive stages of the action potential are as follows

Resting Stage:- The resting stage is the resting membrane potential before the action potential begins. The membrane is said to be "pollarized" during this stage because of the -90 mV negative membrane potential that is present.

Dipollarization Stage:- At this time the membrane suddenly becomes permeable to sodium ions, allowing tremendous numbers of positive charged sodium ions to diffused to the interior of the axon. The normal "polarized" state of -90 mV is immediately

neutralized by the inflowing positively charged Sodium ions. With the potential rising rapidly in the positive direction, a process called depolarization. In large nerve fibres, the great excess of positive Sodium ions moving to the inside causes the membrane potential to actually "overshoot" beyond the zero level and to become somewhat positive. In some smaller fibers as well as in many central nervous system neurons, the potential merely approaches the zero level and does not overshoot to the positive state.

Repolarization Stage:- Within a few ten-thousandths of a second after the membrane becomes highly permeable to sodium ions; the sodium channels begin to close and the potassium channels opens to a greater degree than normal. Then rapid diffusion of potassium ions to the exterior reestablishes the normal negative resting membrane potential, which is called repolarization of the membrane.

Rectification:- The return of membrane to its original ionic state is achieved through the continued action of the Sodium-potassium electrogenic pump.

Summary of the Events that causes the Action potential:- During the resting state before the action potential begins, the

conductance for K^+ is 50-100 times as great as the conductance for Na^+. This disparity is caused by much greater leakage of K^+ than Na^+ through the leak channels. However, at the onset of the action potential, the Na^+ channels instantaneously become activated and allow upto a 5000-fold increase in Na conductance. The inactivation process then closes the Na channels within another fraction of a milliseconds. The onset of the action potentials also causes voltage gating of the potassium channels causing them to begin opening more slowly a fraction of a millisecond after the Na channels open. At the end of the action potential, the return of the membrane potential to the negative ~~Stage~~ state causes the K channels to close back to their original status, but again only after a additional millisecond or more ~~Delay~~ delay.

Propagation of Nerve impulse:-

An action potential elicited at any one point on an exitable membrane usually excites adjacent portions of the membrane, resulting in propagation of the action potential along the membrane. The mechanism is demonstrated in fig. Fig A shows a normal resting nerve fiber and fig B shows a nerve fiber that has been excited in its mid portion - that is the mid portion suddenly develops increased permeability to sodium. The arrows show a "local circuit" of current flow from the polarized areas of the

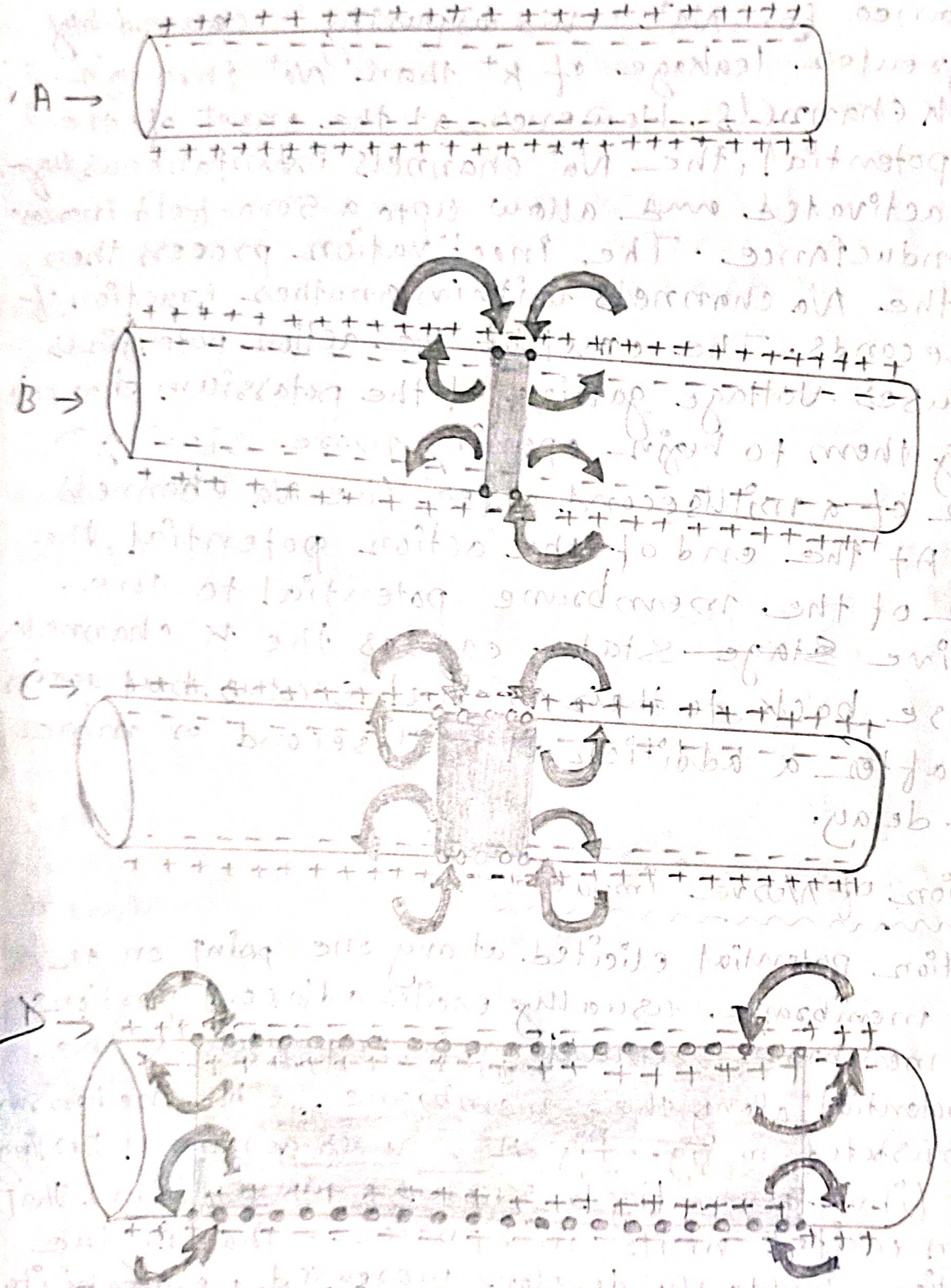


Fig:- Propagation of action potential through axon.

to the adjacent resting membrane areas. That is; positive electrical charges are carried by the inward-diffusing Sodium ions through the depolarized membrane and then for several millimeters in both directions along the core of the axon. These positive charges increase ~~that~~ the voltage for a distance of 1-3 mm inside the large myelinated fiber to above the threshold voltage value for initiating an action potential. Therefore, the Na channels in these new areas immediately open as shown in fig C and D and the explosive action potential spreads. These newly depolarized areas produce still more local circuits of current flow father along the membrane causing progressively more and more de-~~polarized~~ polarization. Thus the depolarization process travels along the entire length of the fiber. This transmission of the depolarization process along a nerve or muscles fiber is called nerve or muscles impulse.

Direction of propagation:- Excitable membrane has no single direction of propagation but the action potential travels in all directions away from the stimuly even along all branches of a nerve fiber - until the entire membrane has become depolarized. Thus when a nerve impulse is propagated in the normal direction, it is reffered to as orthodromic conduction while if the impulse is conducted in the opposite

direction it is refferred as antidromic direction.

All-or-nothing principle:—

once an action potential has been elicited at any point on the membrane of a normal fiber the depolarization process travels over the entire membrane if conditions are right but it is does travel at all if conditions are not right. The prine is called the all-or-nothing principle and it applies to a normal excitable tissues. Occasional the action potential reaches a point on the membrane at which it doesn't generate sufficien voltage to ~~stimulus~~ stimulate the next area of the membrane. When this situation occur the spread of depolarization stops. Therefore for continued propagation of an impulse to occur, the ratio of action potential to threshold for excitation must be at all times greater than 1. This greater than 1' requirment is called the safety factors for propagation.

Action potential propagation through myelinated and unmyelinated nerve fiber:-

The central core of fiber is the axon, and the membrane of the axon is the membrane that actually conducts the axon potential. The axon is filled in its center with axoplasm. which is viscid intracellular fluid. Surrounding the axon

is a myelin sheath that is often much thicker than the axon itself. About once every 1-3 mm along the length of the myelin sheath is a node of Ranvier.

The myelin sheath is deposited around the axon by Schwann cells in the following manner. The membrane of a Schwann cell first envelops the axon. The schwann cell ~~that~~ then rotates around the axon many times, laying down multiple layers of Schwann cell membrane containing the lipid substances sphingomyelin. This substance is an excellent electrical insulator that decreases ion flow through the membrane about 5000-fold. At the juncture between each two successive Schwann cell along the axon, a small uninsulated area only 2-3 μm in length remains. Where ions still can flow with ease through the axon membrane between the extracellular fluid and the intracellular fluid inside the axon. This area is called the node of Ranvier.

Saltatory conduction in Myelinated fibers from node to node:-

Even though almost no ions can flow through the thick myelin sheaths of myelinated nerves they can flow with ease through the nodes of Ranvier. Therefore, action potentials occur only at the nodes. Yet the action potentials are conducted from node to node.

This is called Saltatory conduction. That is electrical current flows through the surrounding extra-cellular fluid outside the myelin sheath, as well as through the axoplasm inside the axon from node to node, exciting successive nodes one after another. Thus the nerve impulse jumps along the fiber, which is the origin of the term Saltatory.

Saltatory conduction is of value for two reasons. First by causing the depolarization process to jump long intervals along the axis of the nerve fiber, this mechanism increases the velocity of nerve transmission in myelinated fibers as much as 5- to 50 fold. Second, Saltatory conduction conserves energy for the axon because only the nodes depolarize, allowing perhaps 100 times less loss of ions than would otherwise be necessary, and therefore requiring little energy expenditure for reestablishing the Na and K concentration difference across the membrane after a series of nerve impulse.

The excellent insulation afforded by the myelin~~ated~~ membrane and the

50-fold decreases in membrane capacitance also allow repolarization of occurs with little transfer of ions.

~~Types of Synapses are classified according to the~~

Types of Synapses :-

(a) According to their nature of connections -

(1) Axo-dendritic Synapes :- This types of synapse occurs between the axon of one neuron and dendrite of the other. This synapse is reported in cerebellum.

(2) Axo-axonic Synapes :- This types of synapse develops between the axons of different neuron is called axo-axonic synapes.

(3) Axo-somatic Synapes :- The pre-synaptic terminal of the axon ends in the cell body of the other neurons. In the cerebellum synapse connections is between the basket cell and purkinje cells are of axo-somatic types. The axon of basket cell make synapses with the cell body (Soma) of the purkinje cells. This type of synapse is also present in cerebral cortex where basket cell makes synapse with the cell body (Soma) of the pyramidal cells.

④ Dendro-dendritic Synapse: The synapses develops between the dendrites of different neurons is the dendro-dendritic synapses.

⑤ Soma-Somatic synapses:- It is the most primitive type of synapse which is developed between the cytons of different neurons.

⑥ Neuromuscular Junction:- The motor nerve before ending into the muscle fibers losses its myelin sheath. The nerve fibers at its termination, branches into several expanded complicated structures which are known as axon terminals or sole feet. Under light microscope the neuromuscular junction shows naked motor nerve endings with the Schwann cell. The expanded nerve ending or sole feet lies within the corrugated Sarcolemma - the junctional the folds of the muscles fibers. The corrugated Sarcrolemma is formed by numerous invaginations of the Sarcoplasm. These invaginations are collectively called, Synaptic gutter.

~~The~~ .

Difference between Chemical and electrical Synapse :—

Chemical Synapse	Electrical Synapse.
A chemical synapse is a cell-to-cell junction through which nerve impulses are transmitted in one direction by means of neurotransmitter	An electrical synapse is a cell junction between two nerve cells through which rapid transmission by means of ions.
Found in higher vertebrates.	Found in lower vertebrates and invertebrates.
Nerve impulse transmits a chemical signal by means of neurotransmitter.	Transmission of signals occurs in two-way.
Large in size (10-20 nm)	Smaller in size (0.2 nm)
Synaptic knobs contain synaptic vesicles and a large number of mitochondria	Synaptic knobs contains no synaptic vesicles and very few mitochondria.
Chemoreceptors are present on the post-synaptic membrane.	Chemoreceptors are absent on the post-synaptic membrane.
Transmission of information is slow.	Transmission of information occurs at high speed.
More vulnerable to fatigue.	Less vulnerable to fatigue
Sensitive to hypoxia and pH.	Insensitive to hypoxia and pH.

Synaptic transmission :—

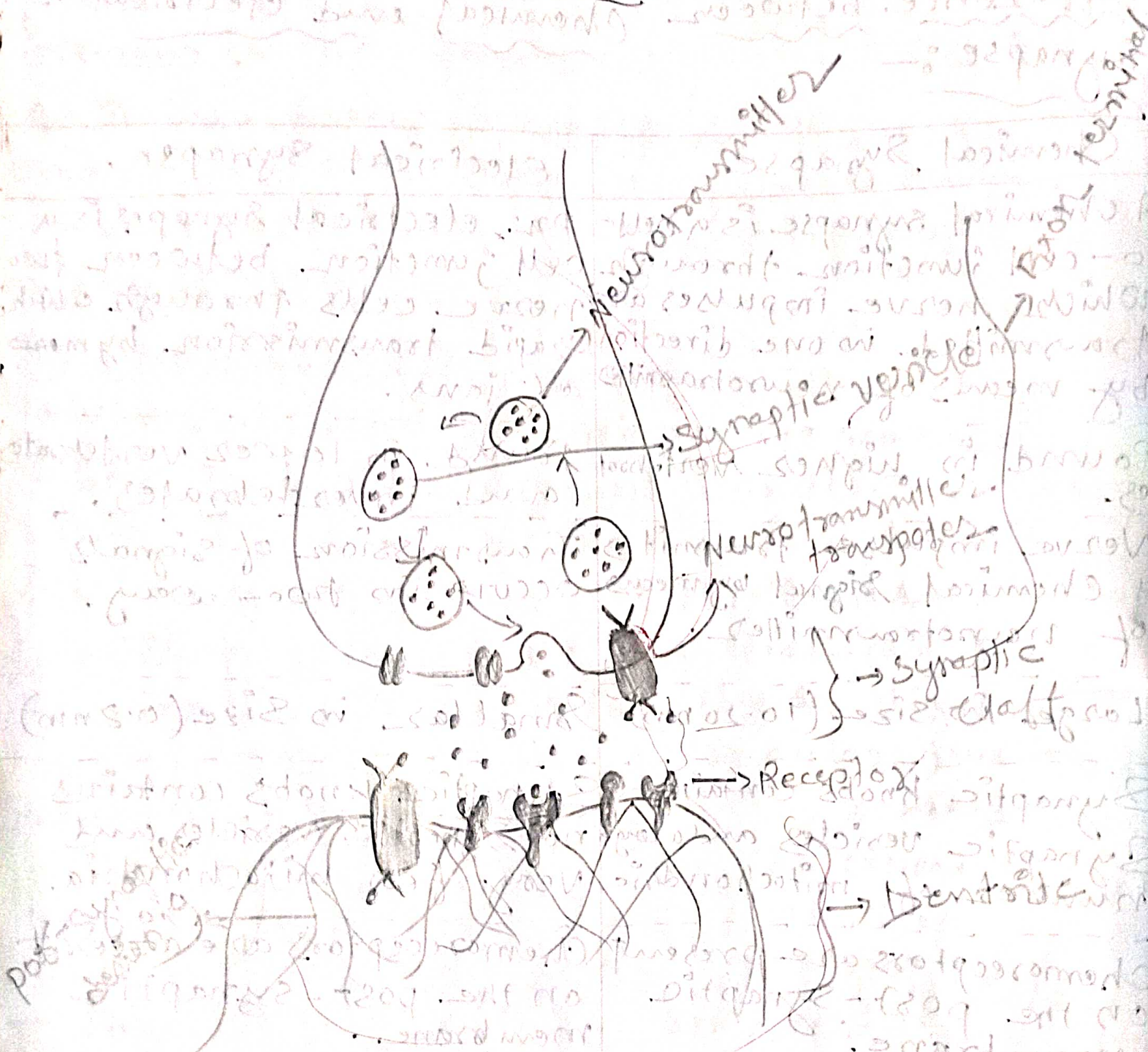


Fig :- Representation of Synapse

General description :-

Neurotransmitters are the spontaneously packed in vesicles and released in individual quanta packets independently of presynaptic action potentials. This slow released is detectable and produces micro-inhibitory or micro-excitatory effects on the postsynaptic neuron. An action potential briefly amplifies this process. Neurotransmitter containing vesicles cluster around active sites and after they have been released may be recycled by one of three proposed mechanism. The first proposed mechanism involves partial opening and then re-closing of the vesicle. The second two involve the full fusion of the vesicle with the membrane followed by recycling, or recycling into the endosome. Vesicular fusion is driven largely by the concentration of calcium in micro domains located near calcium channels, allowing for only microseconds of neurotransmitter release while returning to normal calcium concentration takes a couple of hundred of microseconds. The vesicle exocytosis is thought to be driven by a ~~port~~ protein complex called SNARE, that is the target for botulinum toxins.

Stages in neurotransmission at the synaps:—

① Syntheris of the neurotransmitter. This can take place in the cell body, in the axon, or in the axon terminal.

② Storage of the neurotransmitter in storage granules or vesicles in the axon terminal.

③ Calcium enters the axon terminal during an action potential, causing release of the neurotransmitter into the synaptic cleft.

④ After its release, the transmitter binds to and activates a receptor in the postsynaptic membrane.

⑤ Deactivation of the neurotransmitter. The neurotransmitter is either destroyed enzymatically, or taken back into the terminal from which it came, where it can be ~~re~~ reused, or degraded and removed.

P.T.O →

Physiological Anatomy of the Neuromuscular junction:-

Skeletal muscle fibers are innervated by large myelinated nerve fibers that originate from large motoneurons in the anterior horns of the spinal cord. Each nerve fiber, after entering the muscle belly, normally branches and stimulates three to several hundred skeletal muscles fibers. The nerve fibers forms a complex of branching nerve terminals that invaginate into the surface of muscle fiber but lies outside the muscles fiber plasma membrane. The entire structure is called the motor end plate. It is covered by one or more Schwan cells that insulate it from the surrounding fluids.

Fig shows the junction between a single axon terminal and the muscle fiber membrane. The invaginated membrane is called the synaptic gutter or synaptic trough and the space between the terminal end the fiber membrane is called synaptic space or synaptic cleft. This space is 20-30 nm wide. At the bottom of the gutter are numerous smaller folds of the muscle membrane called subneural cleft.

which is greatly increase the surface area at which the synaptic transmitter can act.

In the axon terminal are many mitochondria that supply ATP the energy source that is used for synthesis of an excitatory transmitter, acetylocholin. The acetylocholin is turn excites the muscle fiber membrane. Acetylocholin is synthesized in the cytoplasm of the terminal, but it is absorbed rapidly into many small synaptic vesicles, about 300,000 o/s which are normally in the terminals of a single end plate. In the Synaptic Space are larges quantities of the enzyme ~~ac~~ acetylcholinesterase, which ~~destroid~~ destroys acetylocholine a few milli-Seconds after it has been released from the Synaptic vesicles.

Secretion of Acetylcholine by the nerve Terminal:-

When a nerve impluse reaches the neuro-muscular junction about 125 vesicles of acetylcholine are released from the terminals into the Synaptic Space.

on the inside surface of the neural

membrane are linear dense bars. Each side of each dense bar are protein particles that penetrate the neural membrane, this are voltage-gated calcium channals. When an action potential spread over the terminal, these chanals open and allowed calcium ions to diffuse from the synaptic space to the interior of the nerve terminals; The calcium ions are belived to activate Ca^{++}-~~channels~~ Calmodulin-dependent protein kinase, which in turn, phosphorylates Synapsin proteins that anchor on the acetylcholine vesicles to the cytoskeleton of the presynaptic terminals. This process frees the acetylocholine vesicles from the cytosketon and allows them to move to the active zone of the presynaptic neural membrane adjacent to the dense bars.

The vesicles then dock at the release sites, fuse with the neural membrane, and empty their acetylocholine into the synaptic space by the process of exocytosis.

Although some of the aforementioned details speculative, it is known that the effective stimulus for causing acetylocholin release from the vesicles in entry of calcium ions and that acetylocholin from the vesicles is then

emptied through the neural membrane adjacent to dense bars.

Characters of neurotransmitter:-

① It should be present in the synaptic cleft.
② It should be released from the pre-synaptic neuron.
③ It should have a specific receptor in the post-synaptic neuron.
④ It should be able to generate action potential in the post-synaptic neuron.
⑤ After being released, the neurotransmitter should be degraded or should be uptaken by the pre-synaptic neuron.

Reflex action and its types- Reflex arc :-

certain kinds of stimuli produce responses without conscious thinking. These responses are called the reflexes. Reflexes are brought about by a chain of nerves between the sensory and effector organs. The simplest chain is called a reflex arc. In reflex arc a sensory organ like skin, sends an impulse through an afferent nerve to the spinal cord or brain. An efferent nerve coming from the brain or spinal cord carries an appropriate response to an effector organ like the muscle. This entire process takes place without thinking; the co-ordination betn the sensory and effector organ takes

place through the autonomic nervous systems.

The reflex actions are defined as - these are spontaneous, automatic, mechanical responses produced by stimulating specific receptors. In these actions, will is not involved So there is no choice and same stimulus receives same response irrespective of conditions.

Few examples of reflex arc :-

① Coughing :- This occurs as a reflex reaction when some solid food or other particle reaches into our trachea. The reaction includes a sudden forced expiration through mouth to expel the particle from the trachea with the force of air. The forceful expiration causes intense vibration in the vocal cords, producing coughing.

② Withdrawal of hand :- The withdrawal of hand takes place when pricked with a riddle.

③ Visceral functions :- Like peristalsis, heart-beat, secretion from the gland etc. are also reflex actions.

Mechanism of reflex action :-

A reflex action works in the following ways —

- Receptor organ - It receives the stimulus and initiates a sensory nerve impulse.
- Sensory or afferent nerve fibre - it conducts sensory impulse from the receptor organ to spinal cord.
- Spinal cord - it act as a modulator and changes sensory impulse into the motor impulse.
- Motor or efferent nerve fibre :- it conducts motor nerve impulse from spinal cord to effectors.
- Effector organ :- it gives the response. This produces either the movement of some muscle or secretion from a gland.

The path followed by an impulse in a reflex action is called reflex arc. Impulses flow only in a single direction in a reflex arc because each synapse in a single direction. —

Significance of reflex action:-

Reflex actions have two fold advantages-

- These enable the body to give quick responses to harmful stimuli so that chance of damage to body are decreased.
- These prevent the overloading of the brain, so prevent its fatigue.

Kinds of reflexes:- The reflexes are of two types -

(i) Unconditioned or inborn or Inherited reflexes:- These are initiated every immediately after the birth and need no previous encounter with the stimulus. These are shown by all individuals of a species without training eg- Simple reflex, compound reflex, chain reflex etc. The stimulus for an unconditioned reflex is called unconditioned stimulus.

(ii) Conditioned reflexes:- These are those responses which can be evoked to a stimulus other than one which normally initiated that response.

Physiology of vision:-

About eye pigment: A photo pigment consist of a protein containing an associated non-peptide organic molecule called chromophore. The absorption of a photon by chromophore produces chemical reaction called transduction cascade. The chromophore of animal photo receptor is Retinal. Which is bound to the integral membrane protein Opsin to produced light sensitive pigment Rhodopsin.

Ratinal is produced from vitamine A. The absorption of light produces a photochemical reactions which twist the aldehyde tail of the chromophore, which is followed by a series of Opsin. This results into activation of Rhodopsin (Activated Rhodopsin is called metarhodopsin) which takes 1 milisecond.

Rhodopsin activates G-protein link Signal transduction cascade.

In vertebrates, which have camera eyes, the cornia and the lense focus an inverted image of the visual fild on the retina. Light is refracted upon entering eye, at the cornia.

In the next stage, lense refraction focus the image into the retina. Wherever the lense often changes its shape.

The retina of vertebrate eye is a development outgrowth of the brain. It contains rod and cone photoreceptors ~~called~~ cell and a network of neurons. A pigmented epithelia lies at the back of the retina and absorbs light not absorb by retina. This epithelium synthesises Retinal. The retina is said to inverted with the photoreceptor in the outermost layer (furthest away from the incoming light.

In human retina a central high acuity region in which the intervening cell layers and blood vesels are displaced to the side, creating a depression of 1.5 mm (5° visual angle) is called fobia. The central 1° of fobia contains tightly packed cones to the exclusion of other neurons. The rod cells are absent in this part of the human fobia. But greatly out numbers in other parts of retina.

The axons of retinal ganglion cells which formed the optic nerve come off the inner side of the retina, facing the lense. The axons exit through the retina at the optic ~~disk~~ disc, producing a ~~blide~~ blind spot to the visual field.

The more sensitive rods are used in dearn light and the cones are used in brighter lights for colour vision and for high activity vission in humans and other animals having a fobia. Nocturnal animals tends to have Retina in which most of all photoreceptors are rods whereas cones predominates in retinas of diurnal animals. Both rods and cones have an outer segment containing photosentive membranes and inner segment contain nucleus, mitochondria etc and the synaptic terminals. The outer segment contains flattented lamellae of membrane called discs which numbes upto 100-1000. The discs ~~containing~~ contains the photo pigments.

Steps in photoreception:-

(i) Light activates the rhodopsin.

(ii) Activated Rhodopsin Stimulates a G-protein which is called Transducine to activate a phosphodiester-ase enzyme.

(iii) The phosphodiesterase decrease the concentration of cGMP in the photoreceptor cytoplasm.

(iv) The decrease in cGMP closes cyclic nucleotide gated ion-chanals.