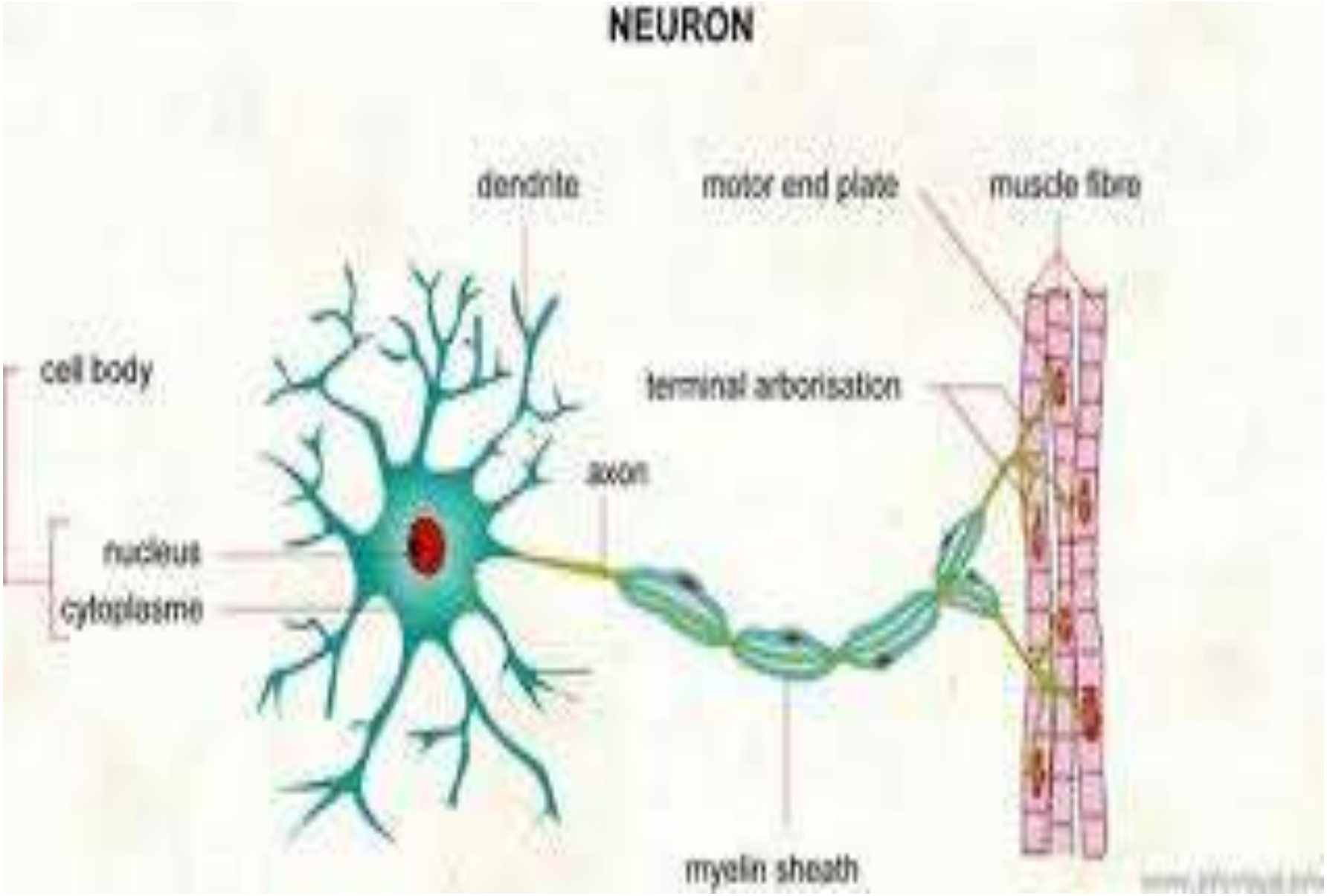
Nerve cell(neuron)
The building unit of nervous system.


NEURON
dendrite
motor end plate
muscle fibre
cell body
terminal arborisation
axon
nucleus
cytoplasme
myelin sheath

Structure of neuron (nerve cell):

Cell body: contain all organelles.
Axon: long fibrous extension from neuron body.
The axon transmit the nerve impulses from one neuron to another.
The axon ends with synaptic knobs called terminal buttons contain vesicles.
The vesicles store the neuro transmitter .
Dendrites are short process transmit or received the nerve impulses to neuron body.

The neuron divided according to:

A. Sheath :

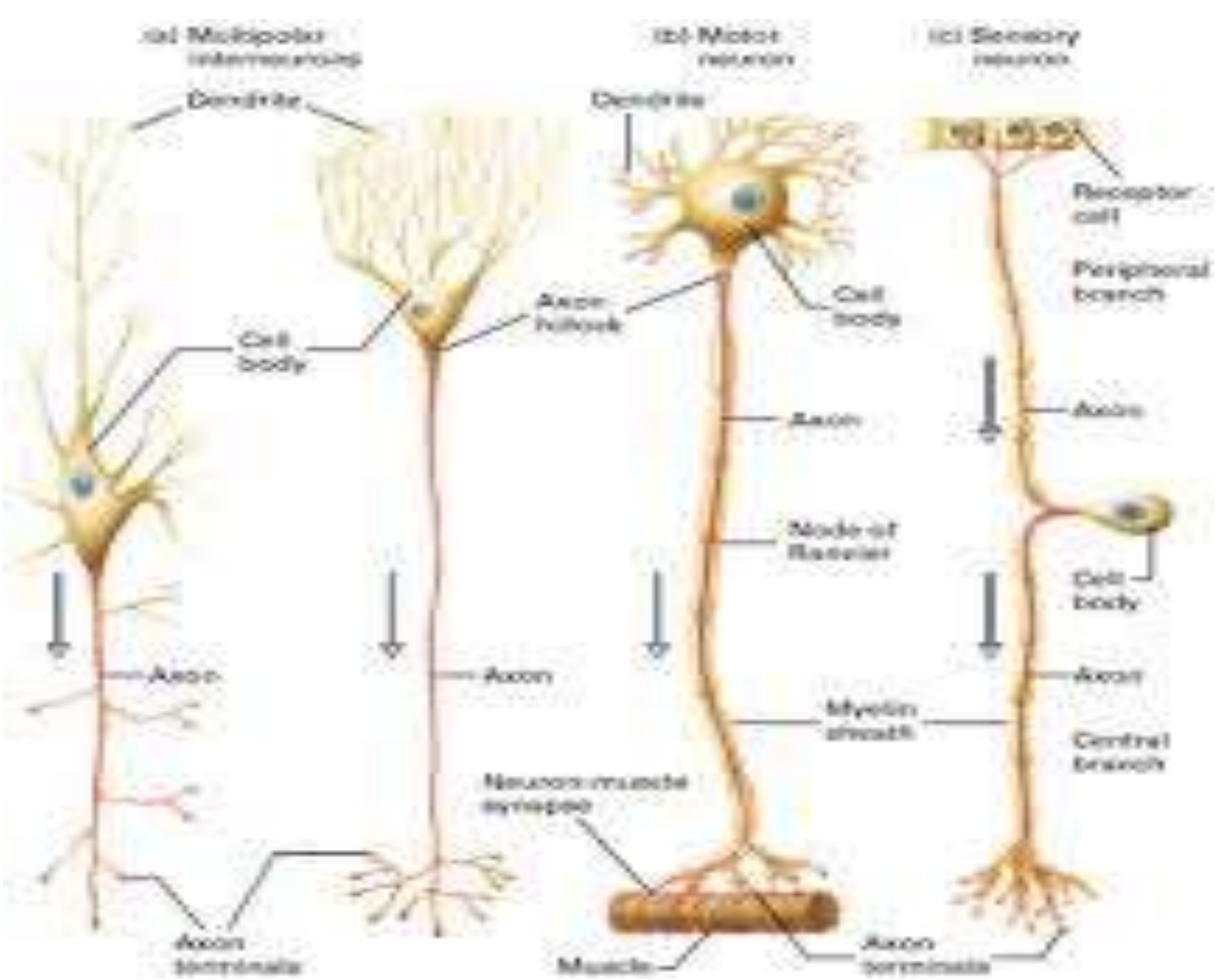
1.Myelinated neuron: the axon of this type has myelin sheath(which is a multilayer of Schwann cell membrane and it is lipoprotein in nature).
The area not covered by myelin sheath called node of ranvior. This type of neuron found in all vertebrae, act as insulator. The myelinated neuron transmit the nerve impulses faster than non myleinated.
2.Non myelinated :not covered, low speed, does not act as insulator, found in invertebrae.

B.Process:

1.Unipolar: this type has one process which separated into diverse direction after short release from neuron body. This type found in sensory ganglia.

2.Bipolar: has one dendrites and one axon found in retina.

3.Multipolar: contain many dendrites and axon such as pyramidal cell in motor cortex.


(a) Multipolar interneuron
Dendrite
Cell body
Axon
Axon terminals
(b) Motor neuron
Dendrite
Axon hillock
Cell body
Axon
Node of Ranvier
Neuron-muscle synapse
Muscle
(c) Sensory neuron
Receptor cell
Peripheral branch
Axon
Cell body
Axon
Myelin sheath
Central branch
Axon terminals

C.Shape:

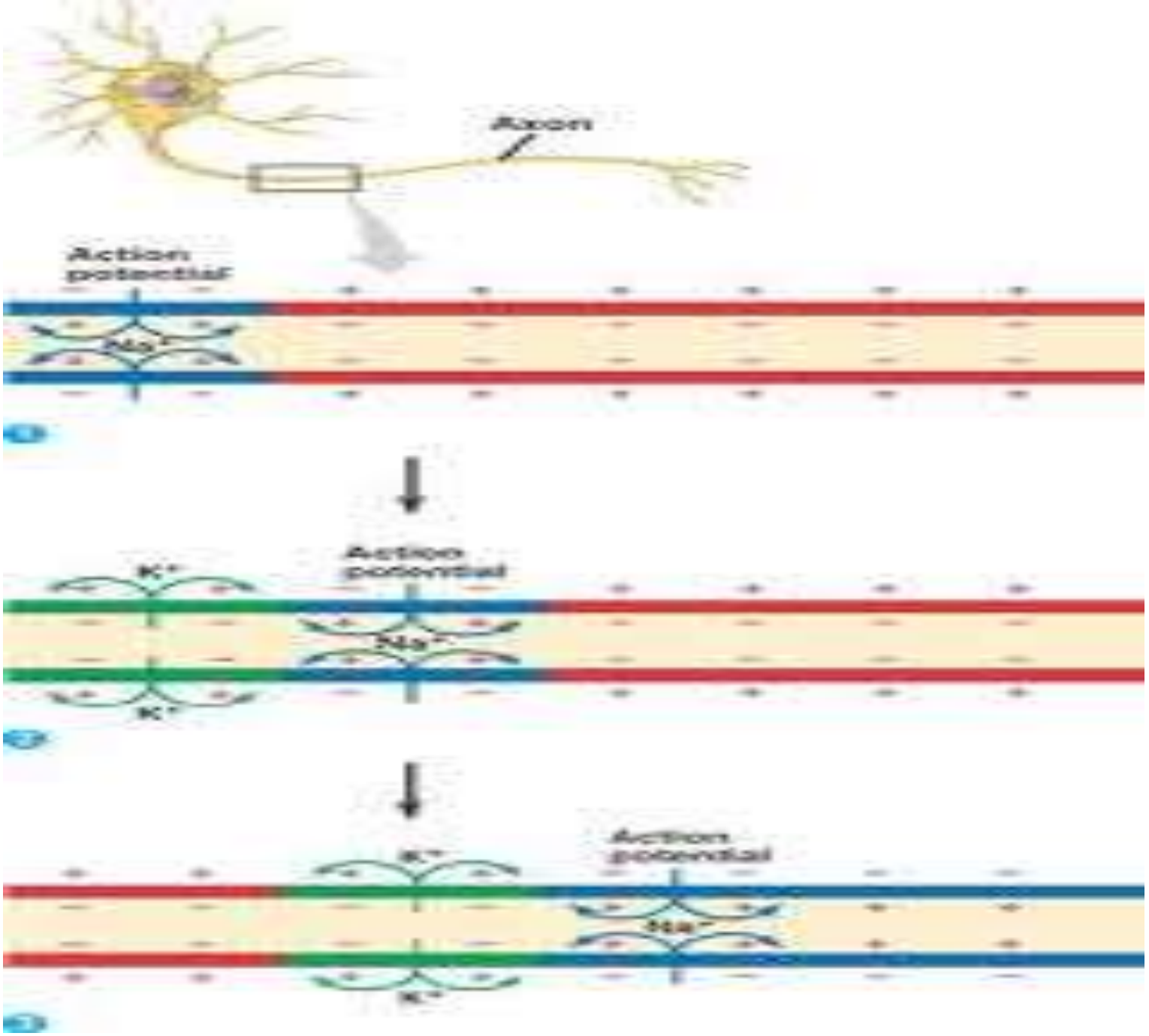
1.Golgi I: has one axon extend to long distance.

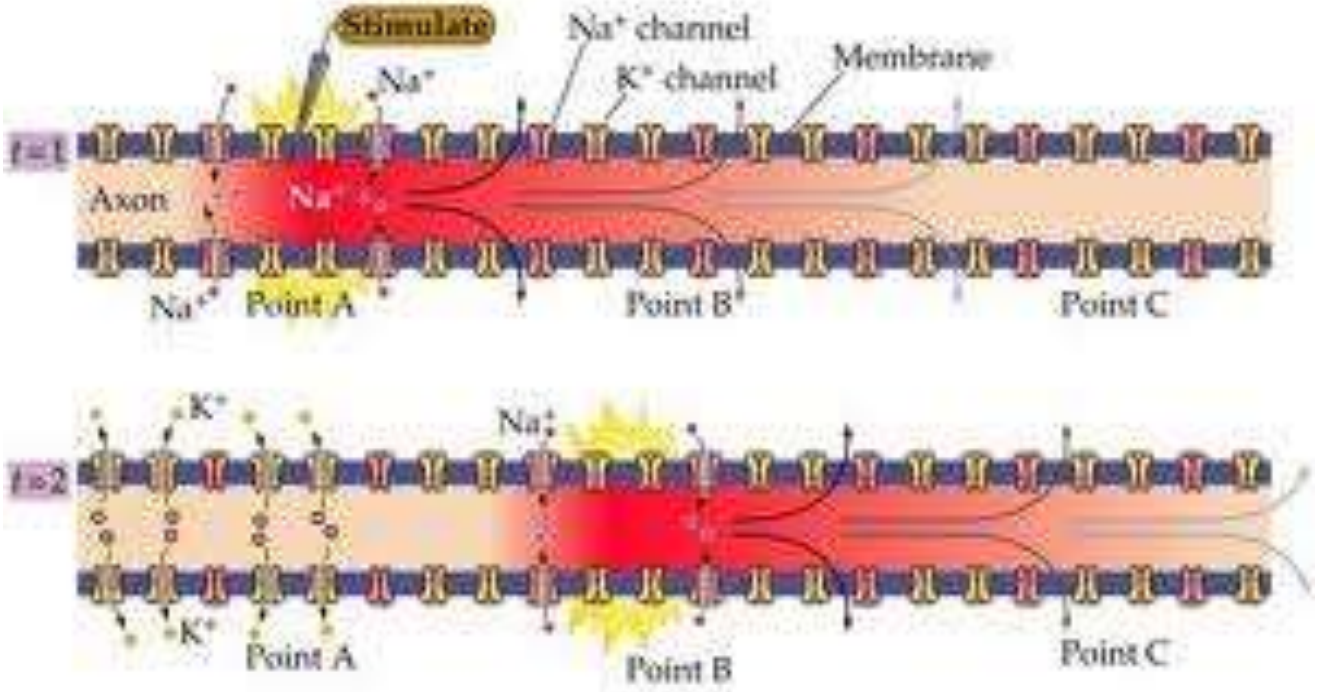
2.Golgi II: has short axon remain within same area.

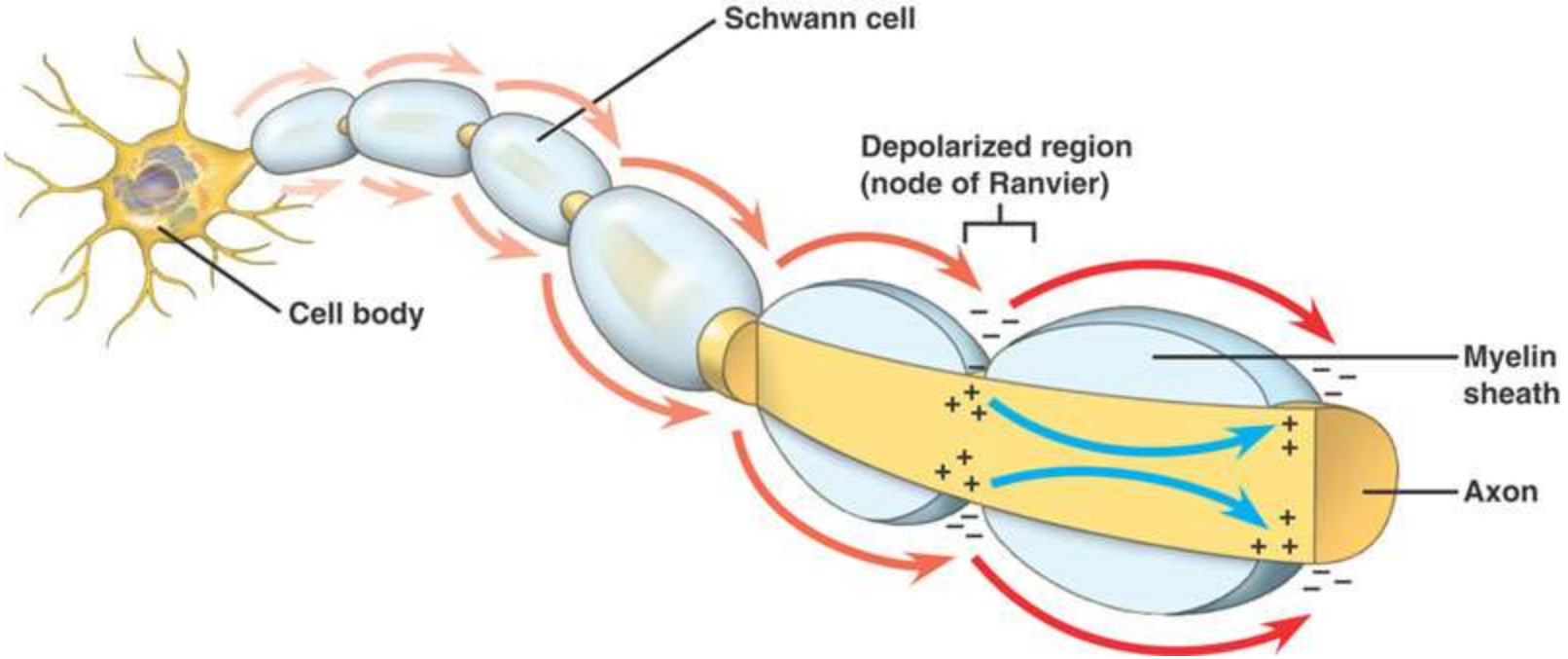
Conduction of action potential in one neuron:

1.***Local circuit theory***: this type occur in non myelinated neuron. The stimulus cause active region(+ inside _ out side) this + current move to other region. occur in non mylinated neuron.

2.***Salutatory conduction;*** this type occur in myleinated neuron. The action potential transmit from one node of ranvior to another.


Axon
Action potential
Na^+
K^+
Action potential
Na^+
K^+
K^+
Action potential
Na^+
K^+


Stimulate
Na+ channel
K+ channel
Membrane
Na+
t=1
Axon
Na+
Na+
Point A
Point B
Point C
K+
Na+
t=2
K+
Point A
Point B
Point C


Schwann cell
Depolarized region
(node of Ranvier)
Cell body
Myelin
sheath
Axon

Synapse :

The meeting area of two neuron called synapse.

The neuron before synapse called ***presynaptic*** (which participate by axon) while the neuron after synapse called ***post synaptic*** (which participate by cell body).

The pre synaptic neuron contain vesicle which contain neurotransmitter.

There are three type of synapse:

1.Axo-denteric synapse: (pre synaptic axon)×(post synaptic dendrites).

2.Axo-somatic synapse:(pre axon)×(post synaptic soma).

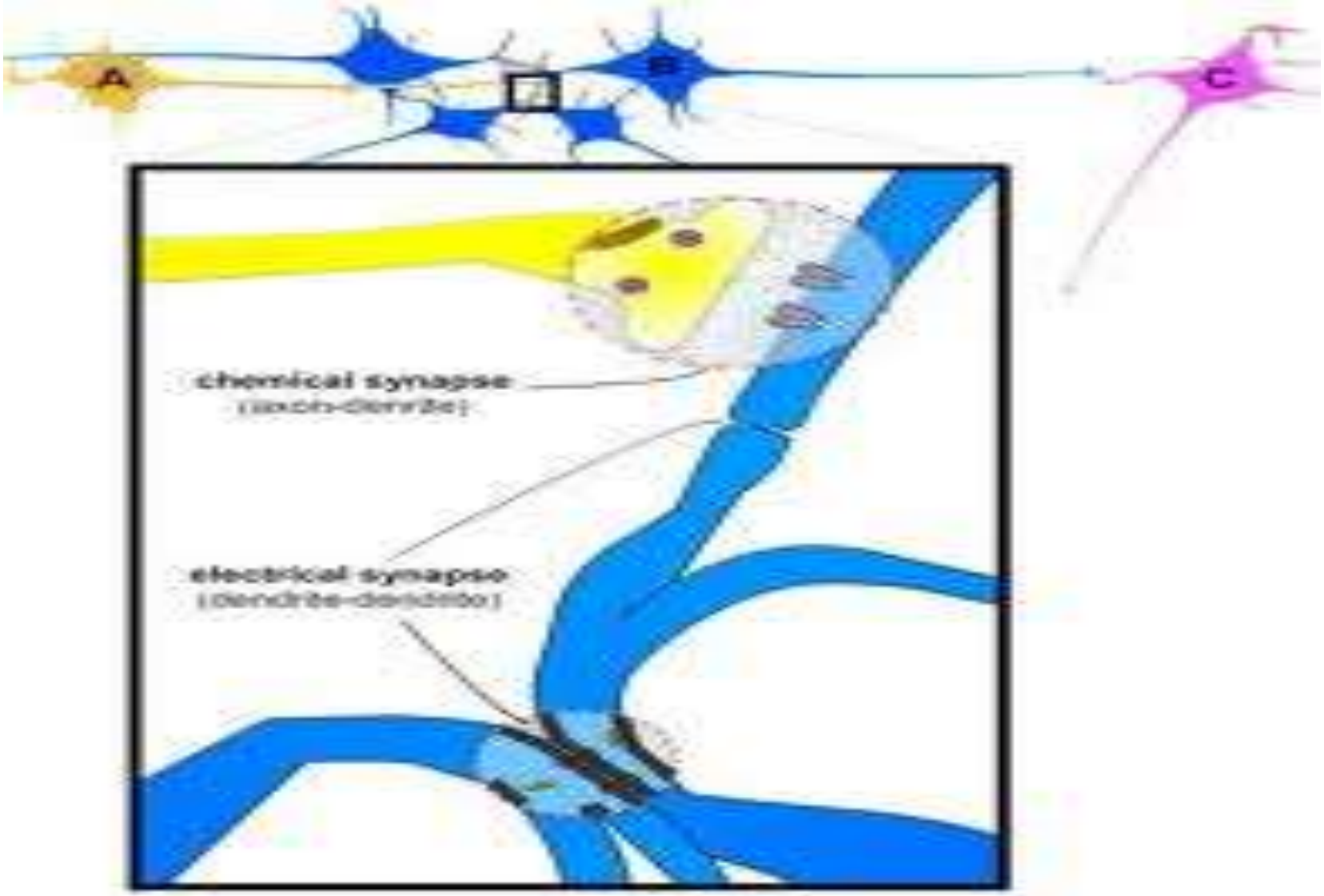
3.Axo- axonic synapse: (preaxon)×(postaxon).

Mechanism of nerve impulses transmission between neurons:

1.Chemicaltransmission.

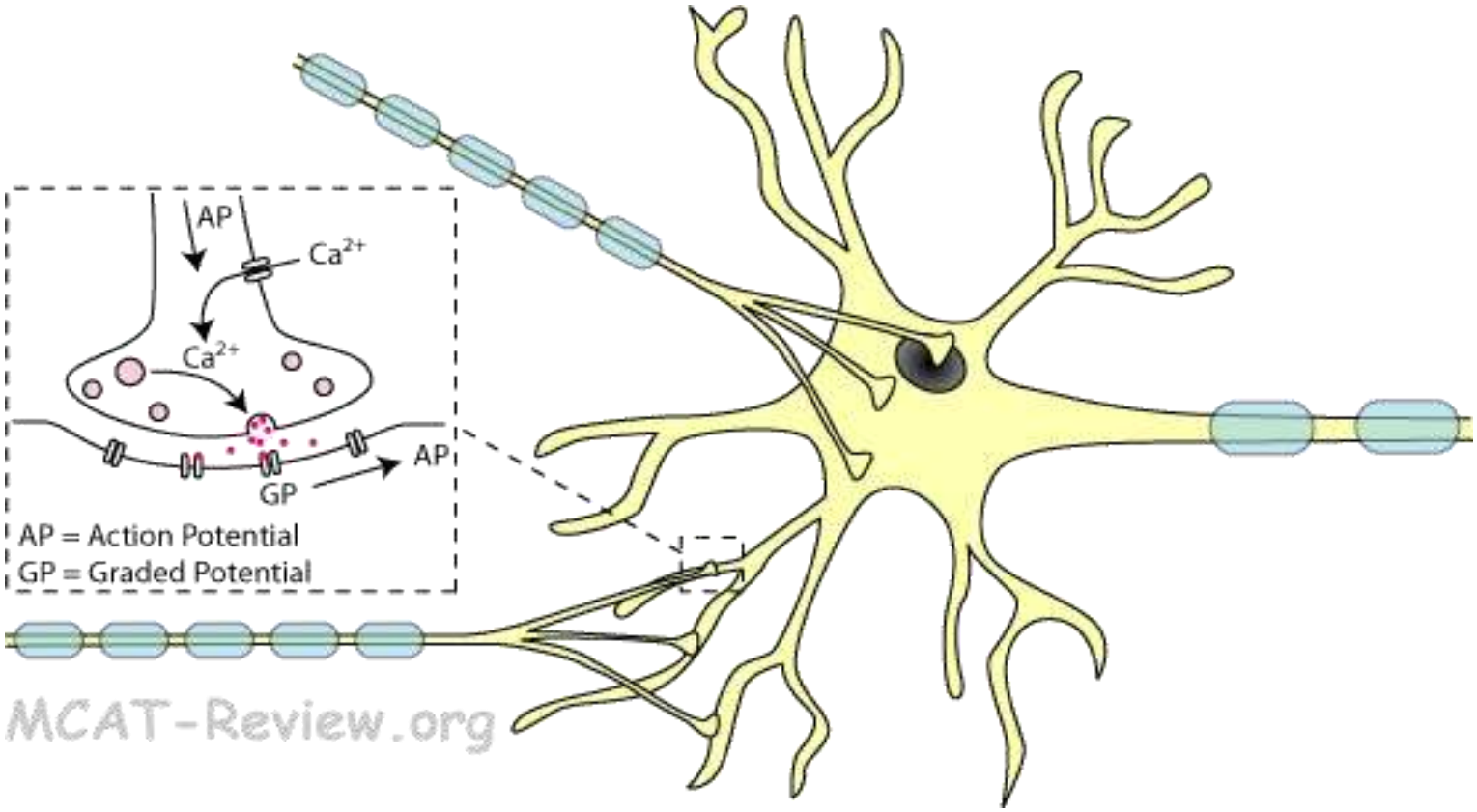
2.Electric transmission.

3.Mixed.


A
B
C
chemical synapse
(axon-dendrite)
electrical synapse
(dendrite-dendrite)

Chemical transmission:

Action potential in presynaptic n. lead to release of neurotransmitter from vesicles by exocytosis this neurotransmitter bind to its receptor in post synaptic → change in membrane permeability → increase Na permeability → action potential in post synaptic neuron.



Electric transmission:

Action potential in presynaptic → excitatory of post synaptic
due to low resistance bridge between cell.

Note: the nerve impulses transmit in all type is one way conduction.

There are two type of neurotransmitter affected the post synaptic:

a.Excitatory by → increase Na permeability.

b.Inhibitory by → prevent neurotransmitter release from presynaptic.

→ Increase negative inside the cell by increase Cl permeability.

Neurotransmitter : chemical substances secreted by vesicles:

1. Acetylcholine (Ach): choline+acetate → Ach

Under effect of choline acetyl transferase.

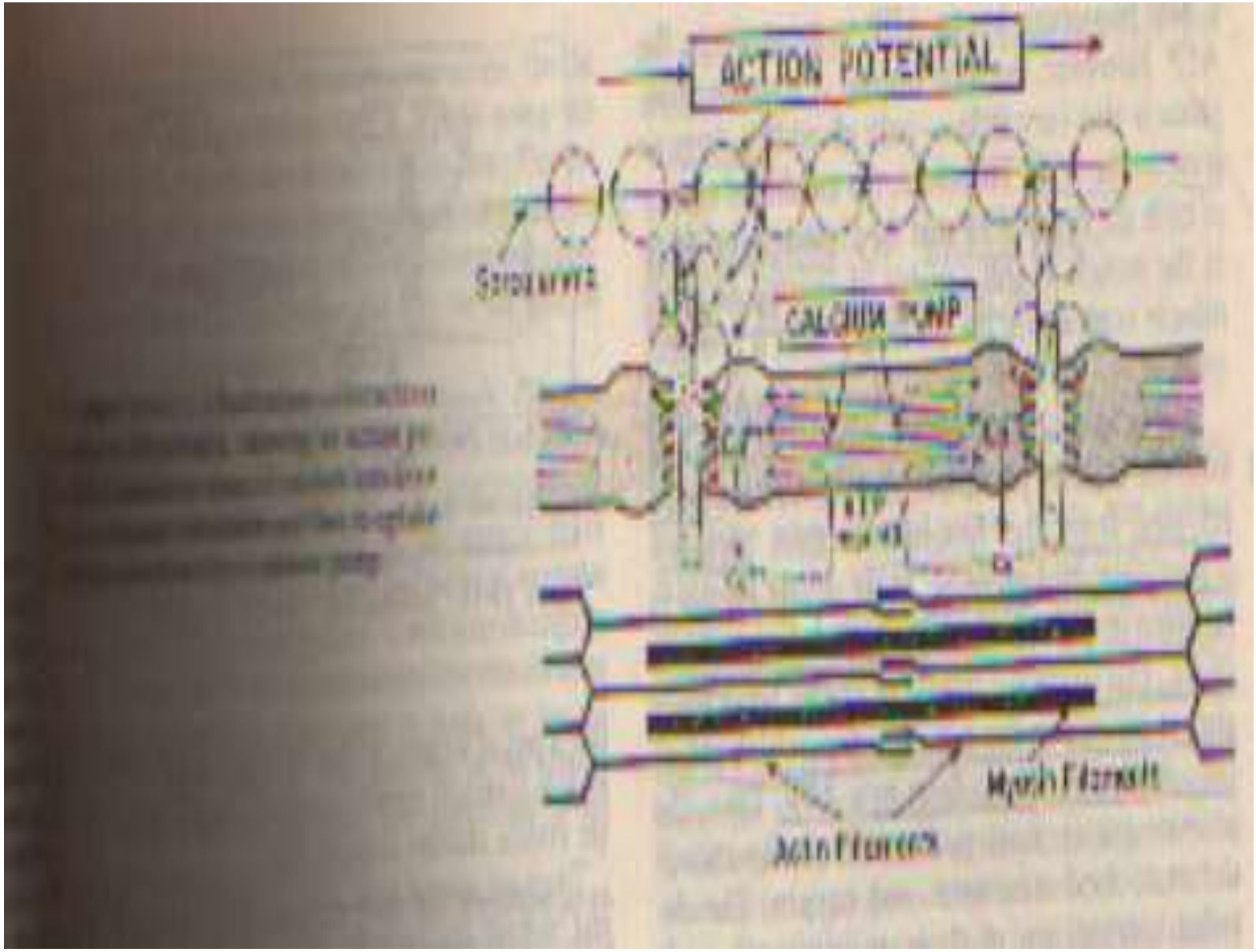
Has two receptor → muscarenic
→ Nicotinic

2. Norepinephrine (NE): has two receptor → alfa
→ Beta

3. Dopamine
4. Serotonin
5. GABA gamma amino butric acid
6. Histamine
7. Substance P peptide
8. Other peptide morphin, opiate.

Excitation -contraction coupling:

The process by which depolarization of muscle fiber initiates contraction.


ACTION POTENTIAL
CALCIUM PUMP

Steps of contraction:

1. Discharge of motor neuron.
2. Release of transmitter at motor end plate.
3. Generation of end plate potential.
4. Generation of action potential in muscle fiber.

5.Spread of depolarization along T tubule.
6.Release of Ca from sarco plasmic reticulum.
7.Binding of Ca to troponin uncovering myosin bind sites on actin.
8.Formation of cross linkage between actin and myosin and sliding of actin and myosin produce shortening.

Steps in relaxation:

1.Ca pumped back into sarcoplasmic reticulum.

2.Release of Ca from troponin

3.Cessation or stop the interaction between actin and myosin.