



CHAPTER 9 NERVOUS SYSTEM

The nervous system integrates the functions of all body systems.

It enables behavior, homeostasis, learning & memory AND it allows the body to respond to environmental stimuli.

NERVOUS SYSTEM
2 main divisions

CNS
Central N.S.

PNS
Peripheral N.S.

Brain

Spinal cord

Spinal & cranial nerves

Sensory nerves

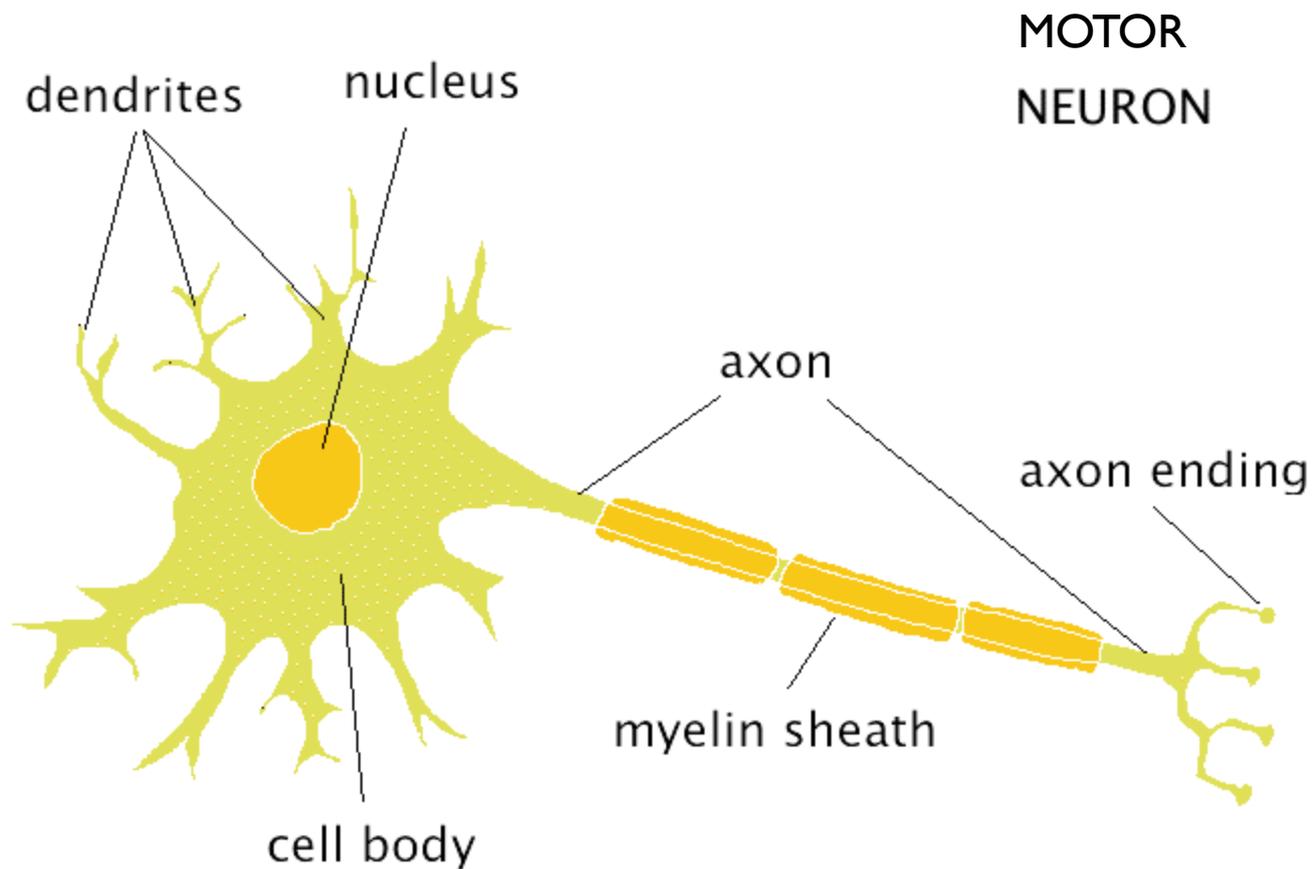
Motor nerves

Somatic N.S.

Autonomic N.S.

Integrative functions

Most nerves have both sensory & motor



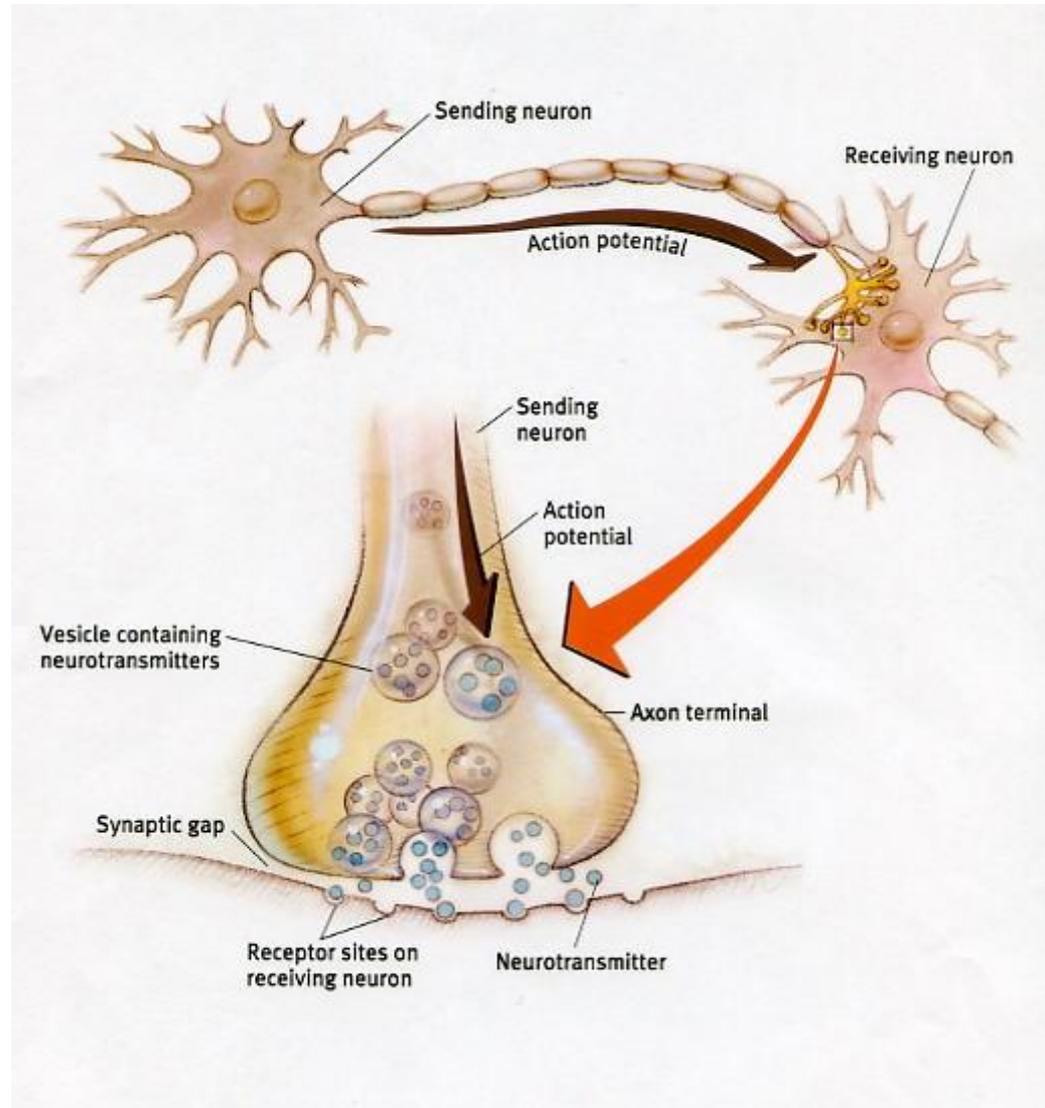
MYELINATED AXON (most neurons; “white matter”)

- has sheath
- insulates & speeds up transmission of impulse
- Nodes of Ranvier- gaps in sheath

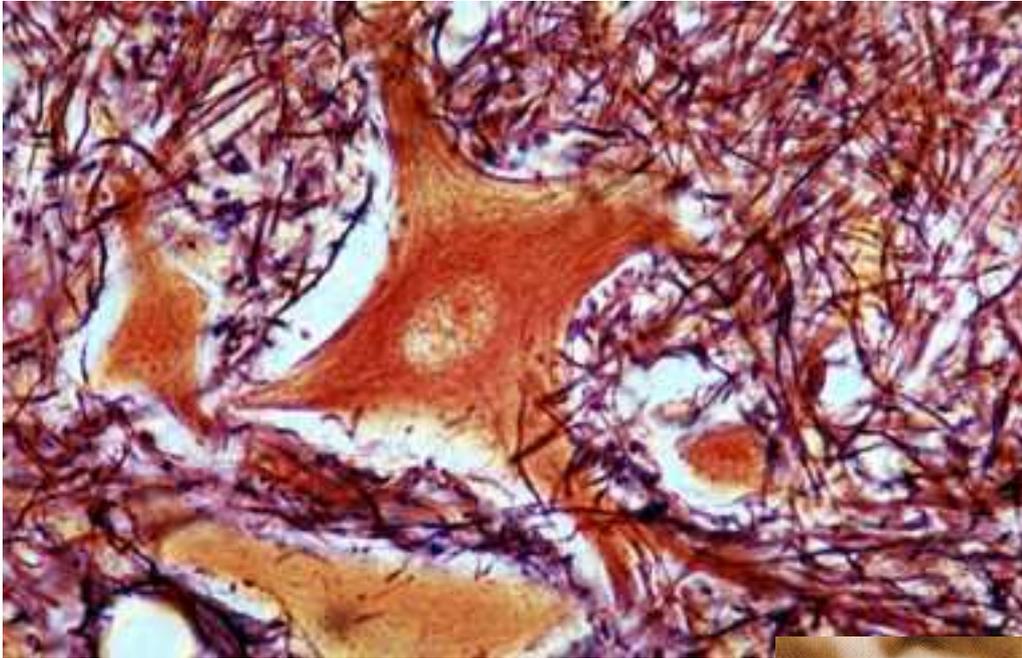
UNMYELINATED AXON (“gray matter”)

- no sheath

- **Synapse-** junction btw. 2 neurons
- Synaptic end knob (or bulb)
 - Stores & releases neurotransmitters



Spinal cord neuron



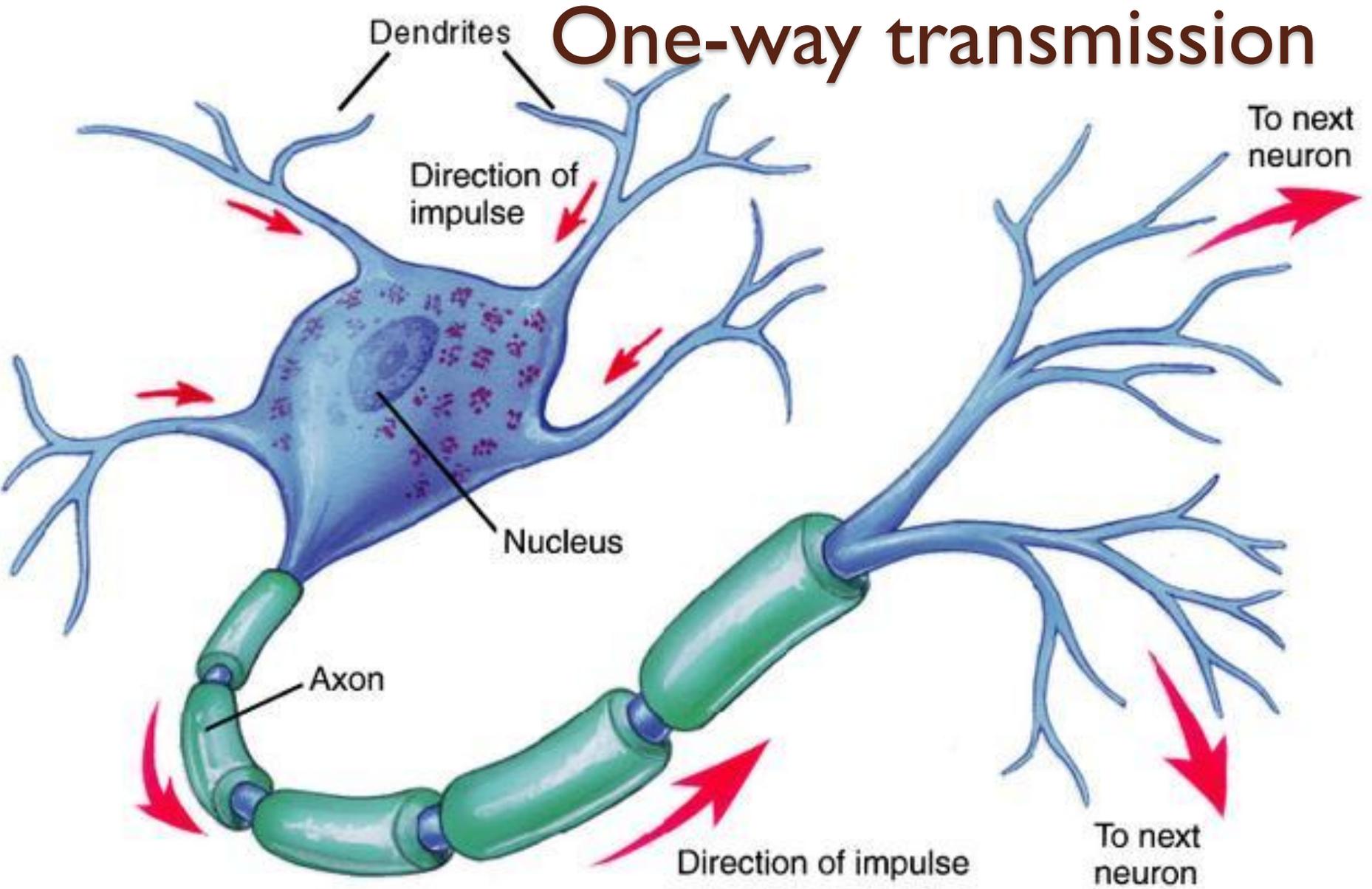
*~100 billion
neurons in our
nervous system*

Axon endings
(synaptic end knobs or
bulbs)

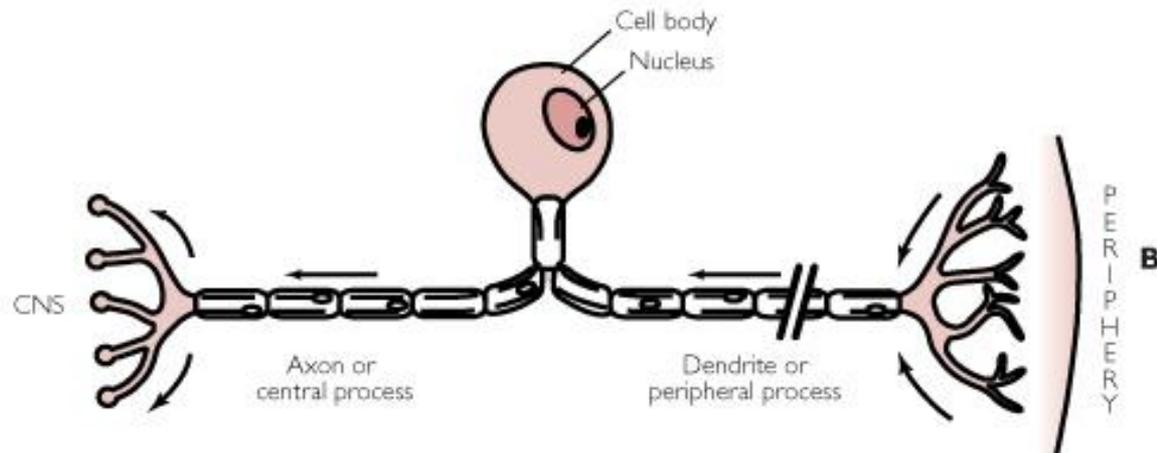
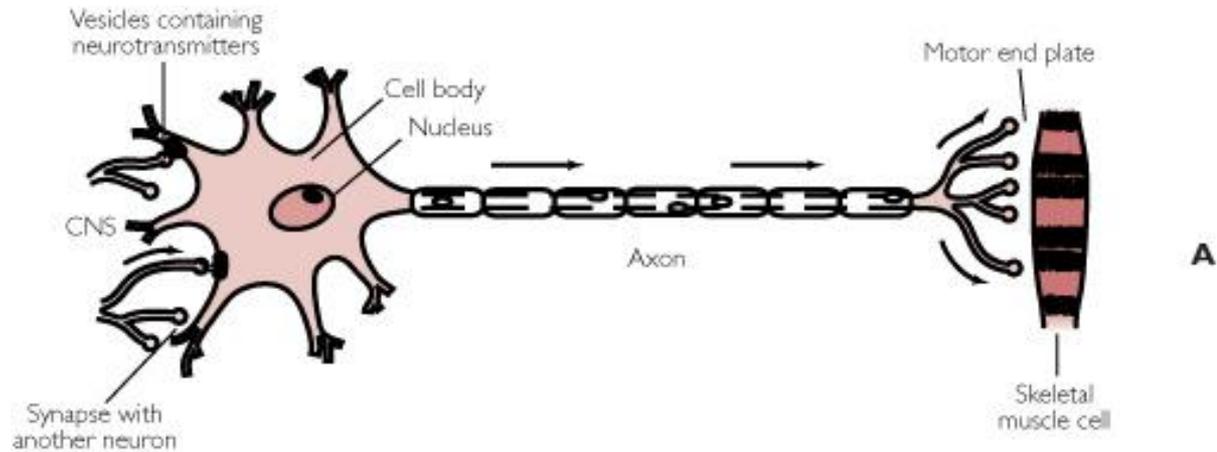
*~1,000-10,000 synapses for
every neuron*



One-way transmission

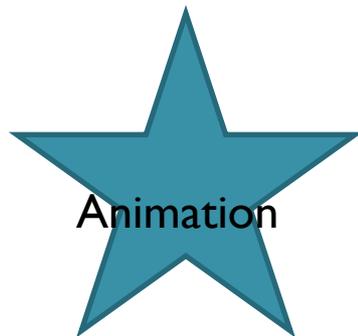
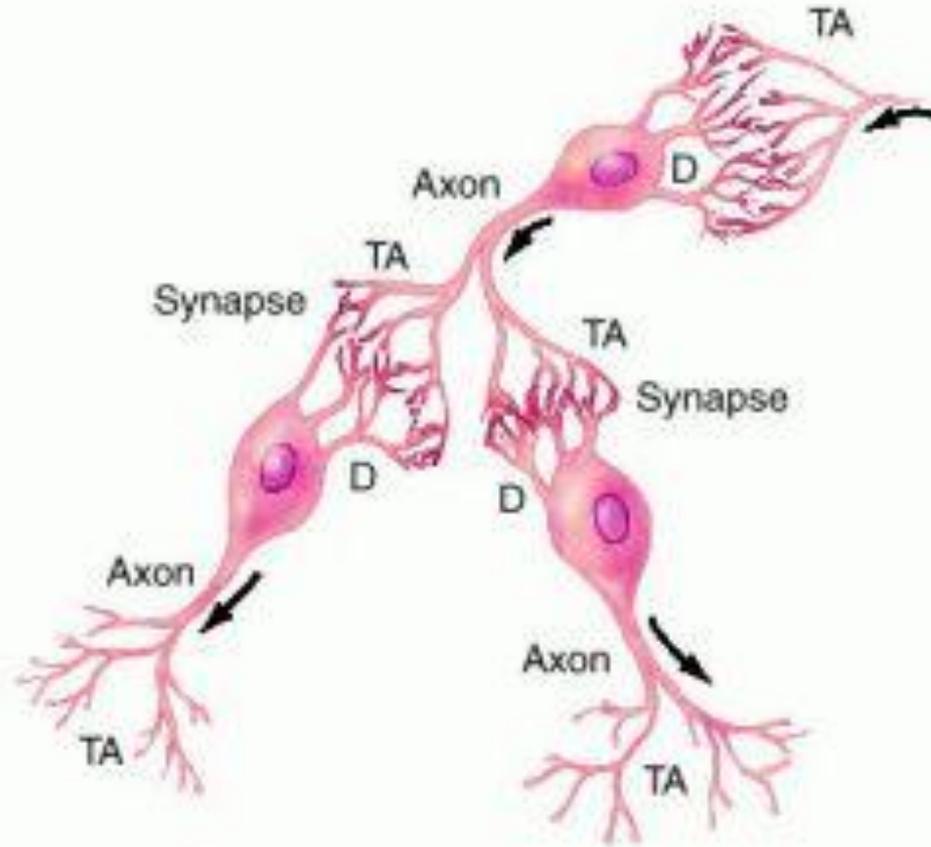


Motor vs. sensory direction



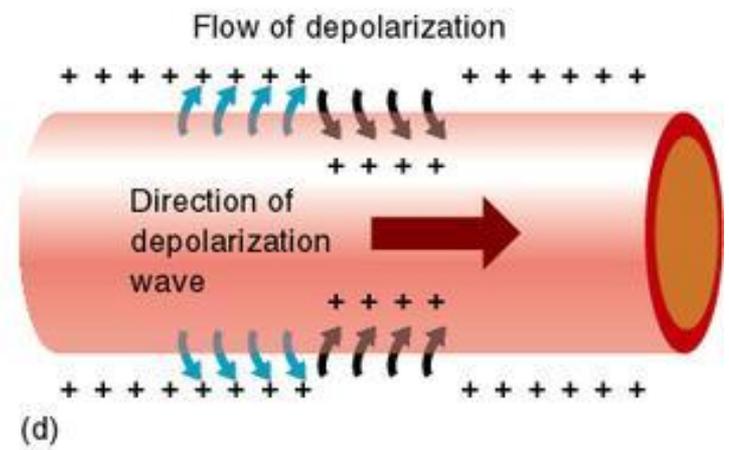
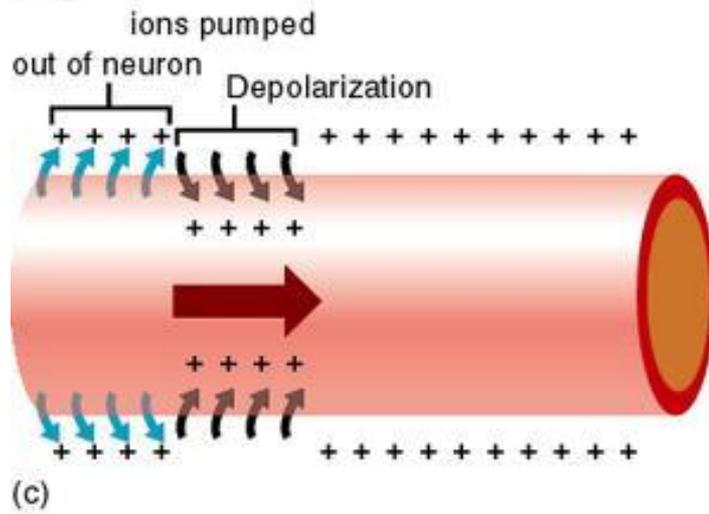
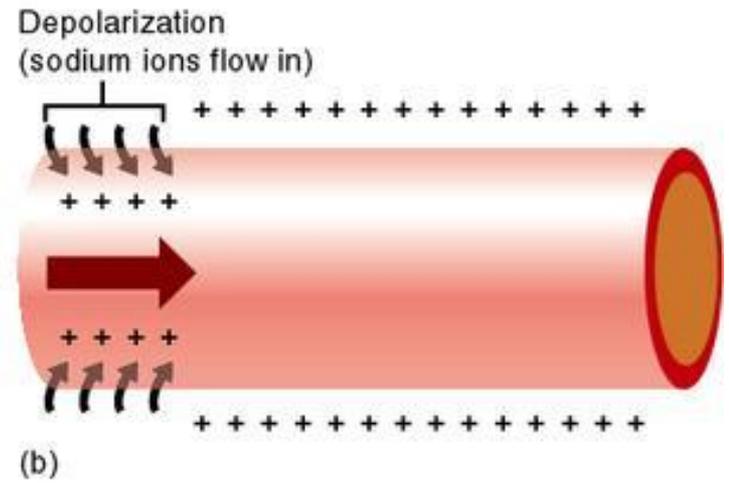
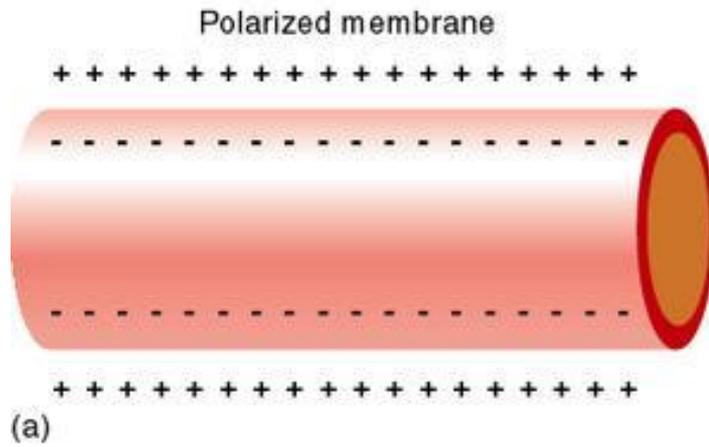
Pre- and post-synaptic neurons

- *The direction of impulse is from the terminal axons (TA) or nerve endings of the axon of one neuron to the dendrites (D) of another neuron.*



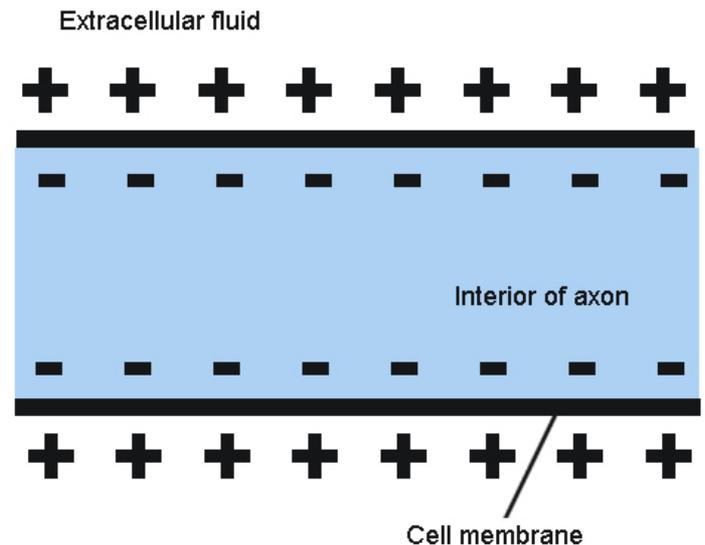
NEURON FUNCTION

- Signaling activity composed of electrical activity within neurons
AND
chemical flow between neurons
- **Cell membrane potential**= difference in electrical charge btw. outside of cell & inside cell
- aka. Cell membrane is **polarized**

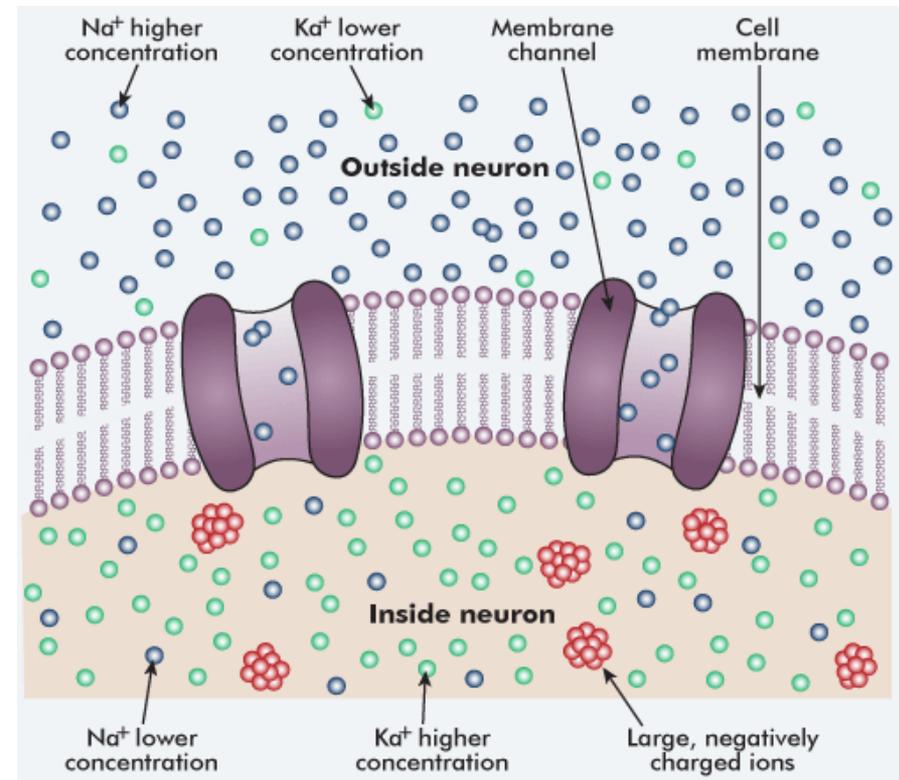


Resting potential

- Membrane is polarized (difference in electrical charge)
- Unequal distribution
- *Positive on outside*
- *Negative on inside*

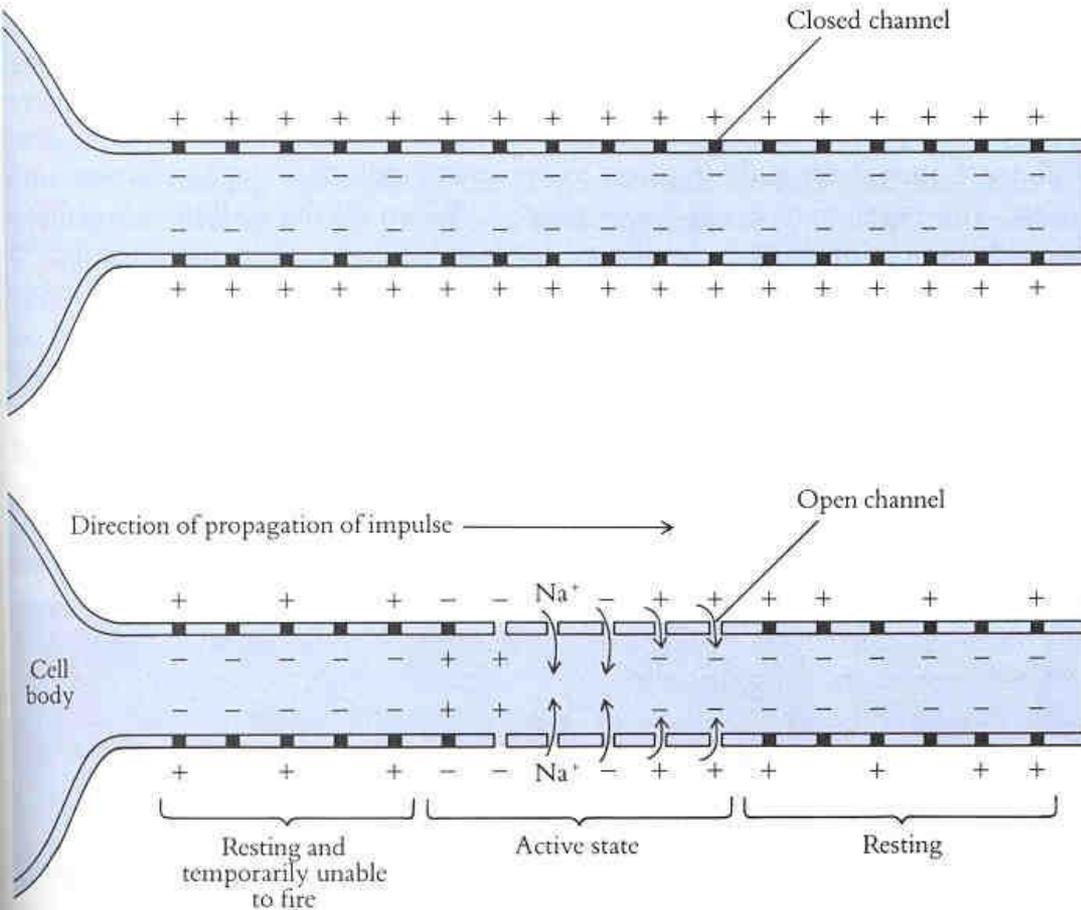


- More Na^+ on outside of membrane
- More K^+ on inside of membrane
and ALSO
- Other non-diffusible, negative (-) ions on inside



Equilibrium is prevented by the Na-K pump (maintains resting potential)

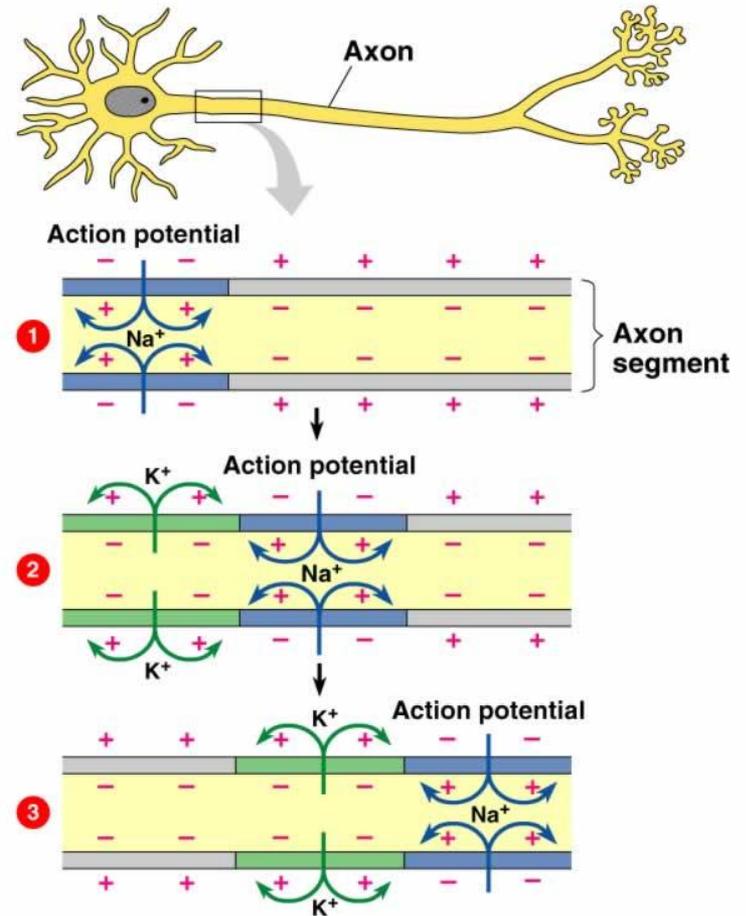
Action Potential



- Rapid change in potential
- Due to change in surrounding (temp, light, pressure outside body) or signal from nearby neuron
- 2 parts-
depolarization & repolarization

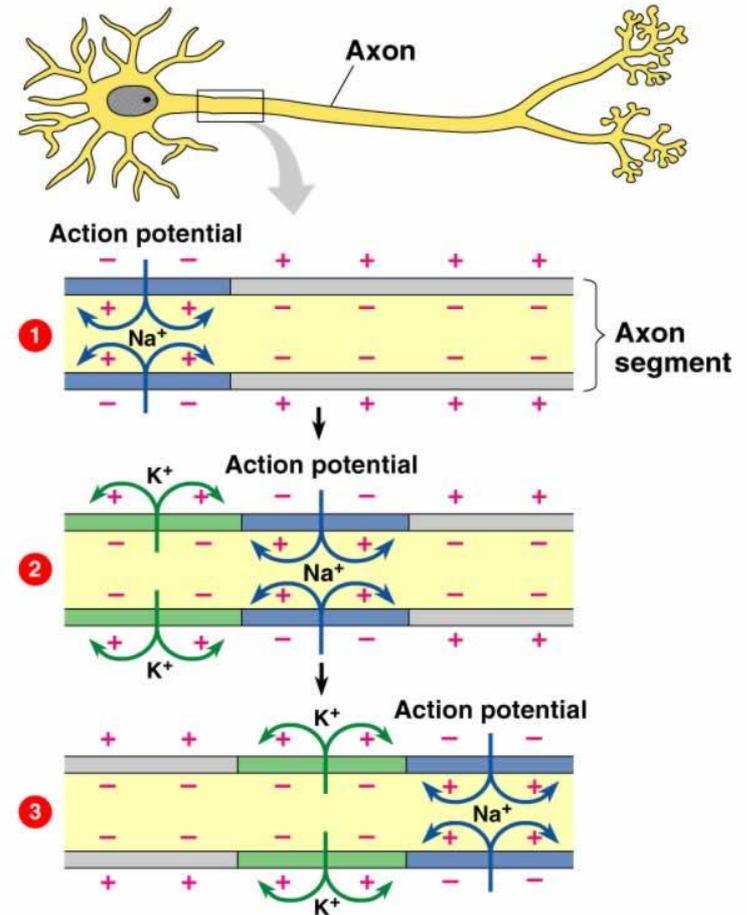
Depolarization

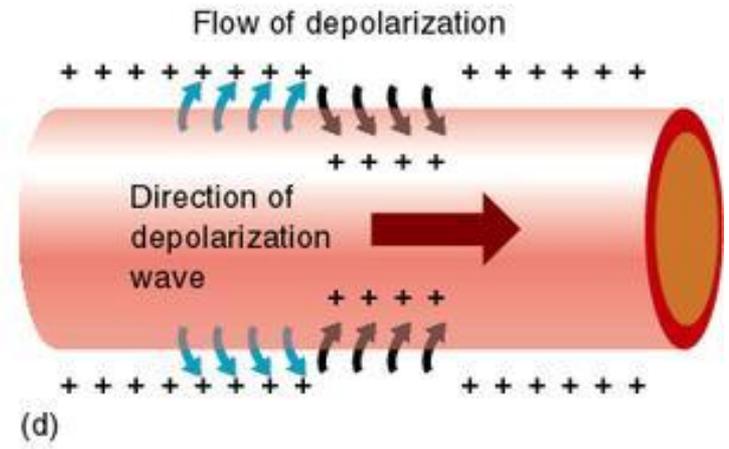
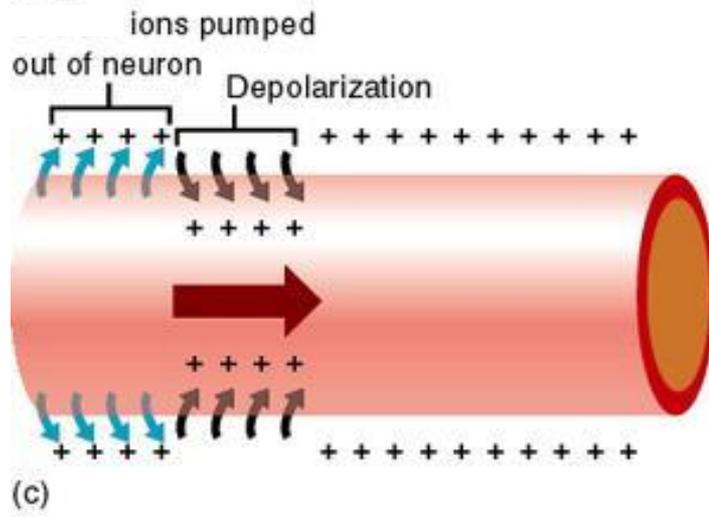
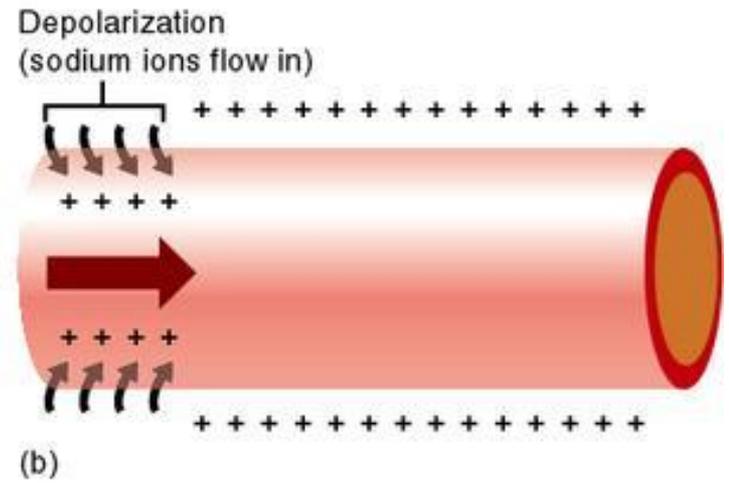
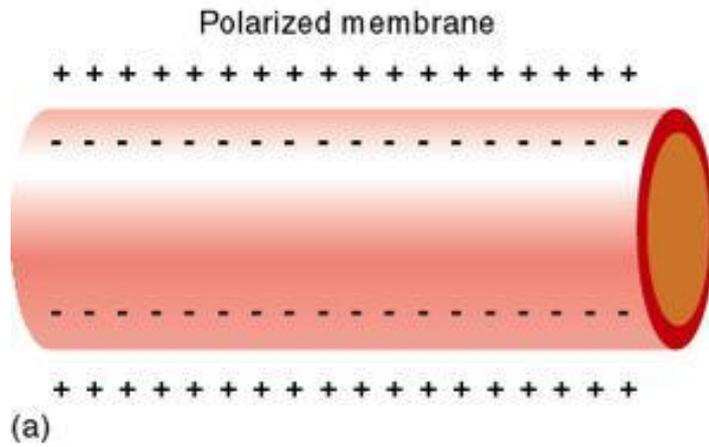
- Influx of Na^+ ions caused by stimulus
- Membrane potential is reversed
- #1
- *Negative on outside*
- *Positive on inside*



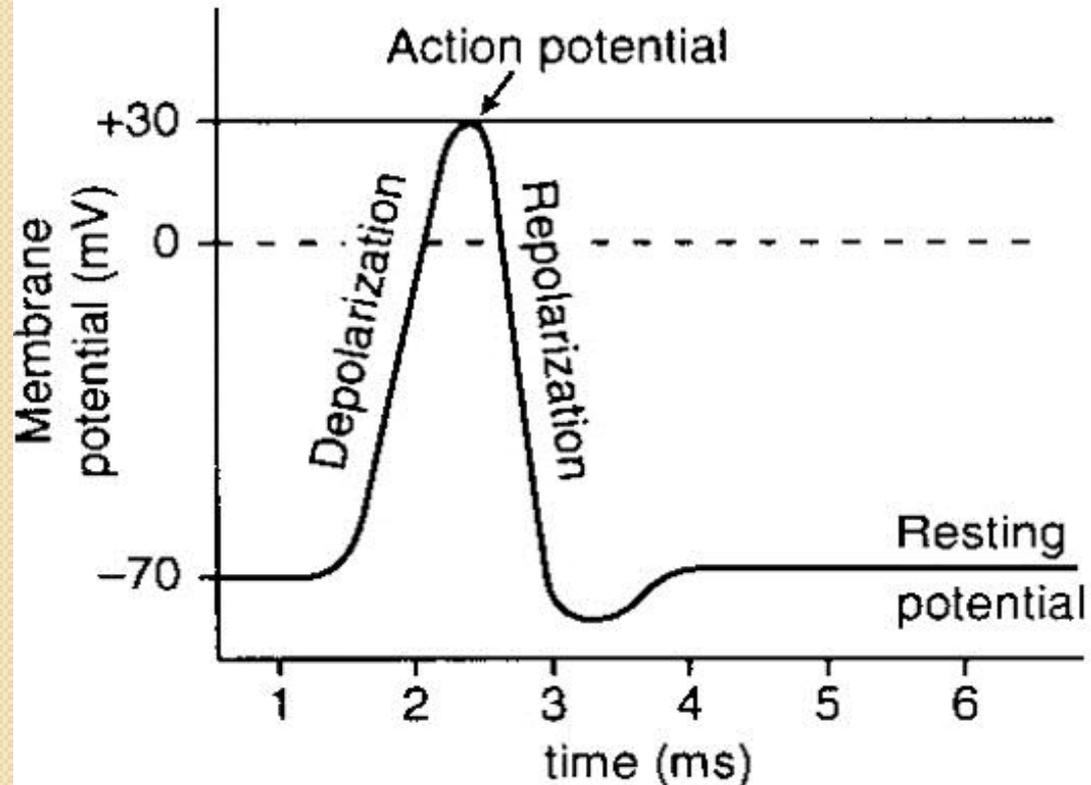
Repolarization

- K^+ diffuses out (K^+ channels open)
- Resting potential is restored
- #2
- *Positive on outside*
- *Negative on inside*
- Stays here at resting potential until there is another stimulus! #3

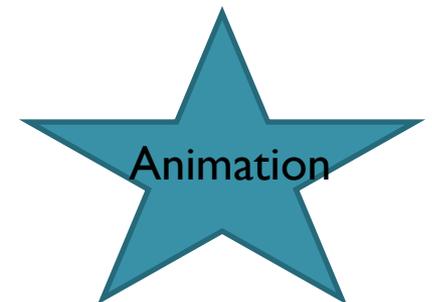




Record of electrical changes associated with ion movement



- -70 mV shows resting potential
- +30 mV shows depolarization
- Repolarization quickly follows
- Neuron stays at resting until there is another change in potential



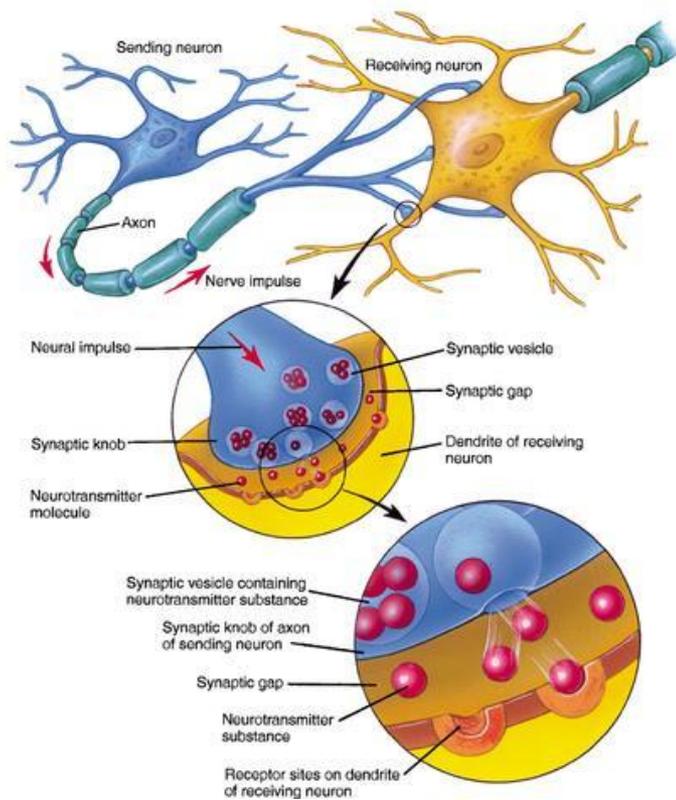
Nerve impulse= spread of action potentials

- Continuous conduction (unmyelinated)
- Saltatory conduction (myelinated)

- All-or-none response
 - Threshold stimulus required

- All impulses same strength & speed

Neurotransmitters



- Each neuron releases 1 or 2 kinds
- If enough released (reaches threshold stimulus), a nerve impulse is initiated

Excitatory

- Triggers impulse
- Increases permeability to Na⁺ ions
- Faster depolarization

- Examples:
 - Acetylcholine
 - Norepinephrine
 - Dopamine

Inhibitory

- Lessens chance of impulse
- Decreases permeability to Na⁺ ions
- Delays depolarization

- Examples:
 - GABA
 - Glycine

2 Types/Actions