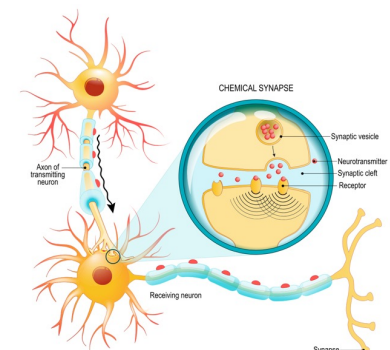
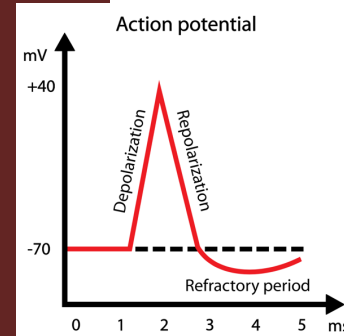
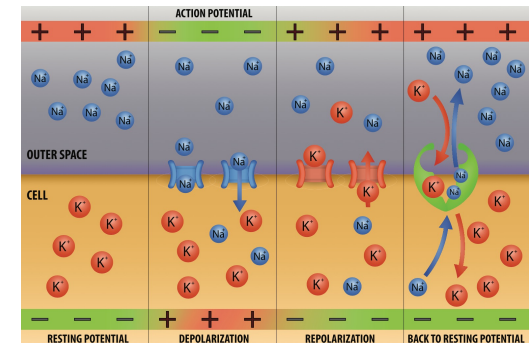
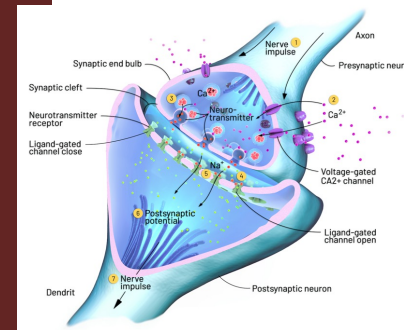


The Nervous System – Signal Transmission

- Neural Transmission
- Potential Difference
 - Resting Potential, Depolarization, Action Potential, Repolarization
- Membrane Channels
- Sodium/Potassium Pump
- Synaptic Transmission
- Neurotransmitters – Types of Functions
- Synapse Inhibition



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Neural Transmission (Nerve Signaling)

- Nerve impulses are powered by cellular energy and the electrical impulse is just as strong at the end of the neuron as it was at the beginning



Giant axons of the longfin inshore squid were crucial for scientists to understand the action potential.

Neural Transmission

- _____
- Activation (firing) of the neuron takes place when the neuron is stimulated by pressure, heat, light, or chemical information from other cells
 - The type of stimulation necessary to produce firing depends on the type of neuron
- Neuron firing is “all-or-nothing” meaning that it either fires or it doesn’t
 - All firing produces the same movement of charge no matter the stimulus

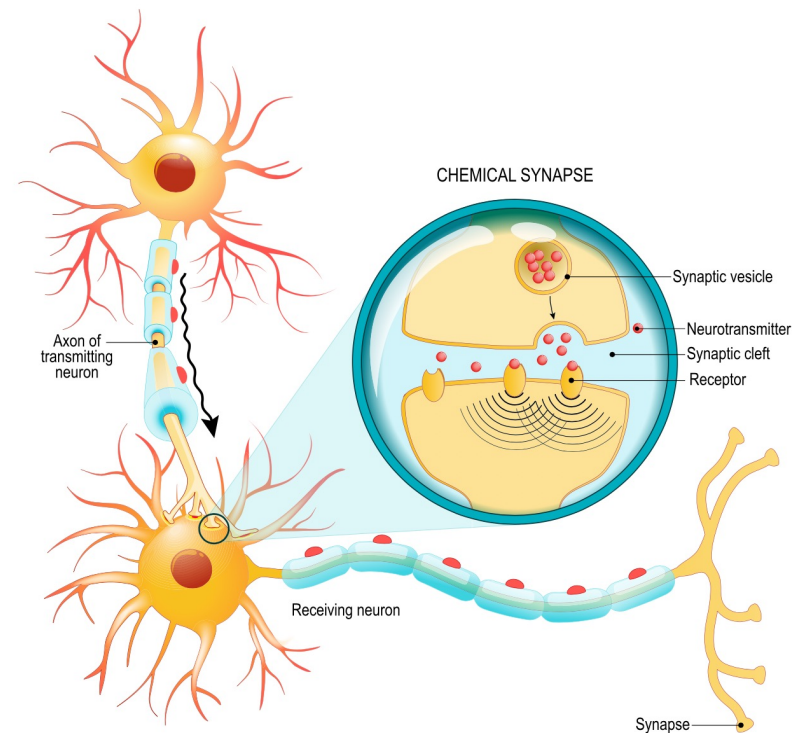
The Signal



1

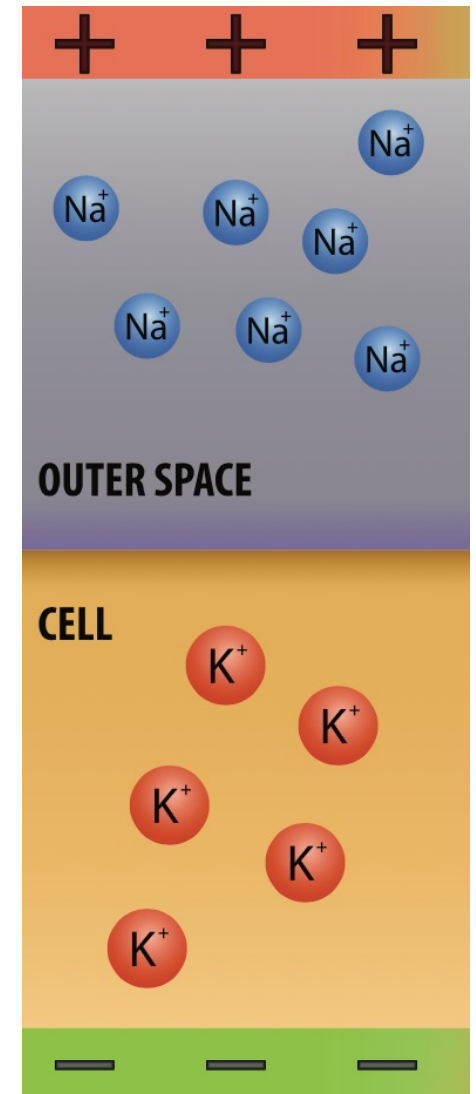
- Every fast signal sent from one part of the body to another is done through the electrical conduction down one neuron

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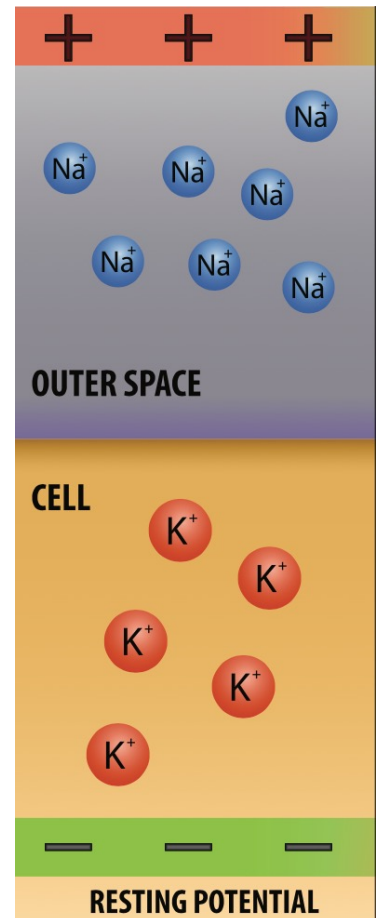
Potential Difference

- _____
- This is caused by the unequal distribution of “+” and “-” ions
- This cell has more positives on the outside compared to inside the cell



Stage 1 - Resting Potential (Pre-stimulus)

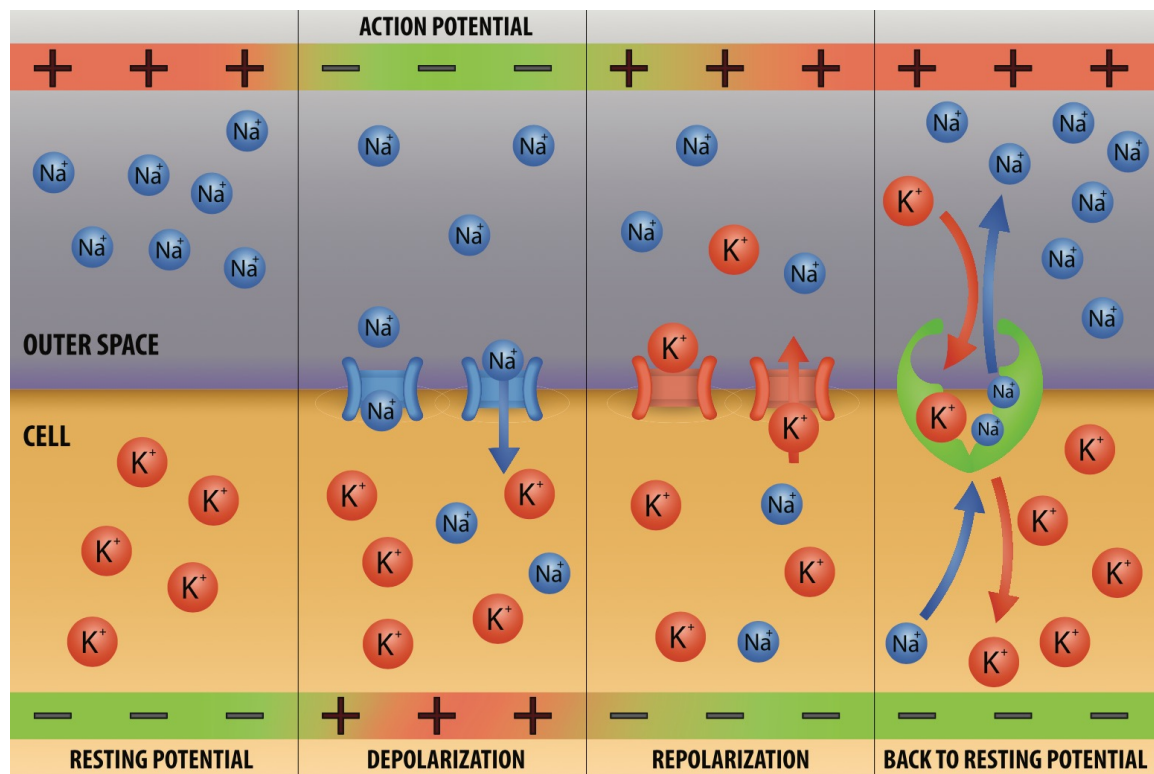
- _____
- The charges cannot freely move across the membrane



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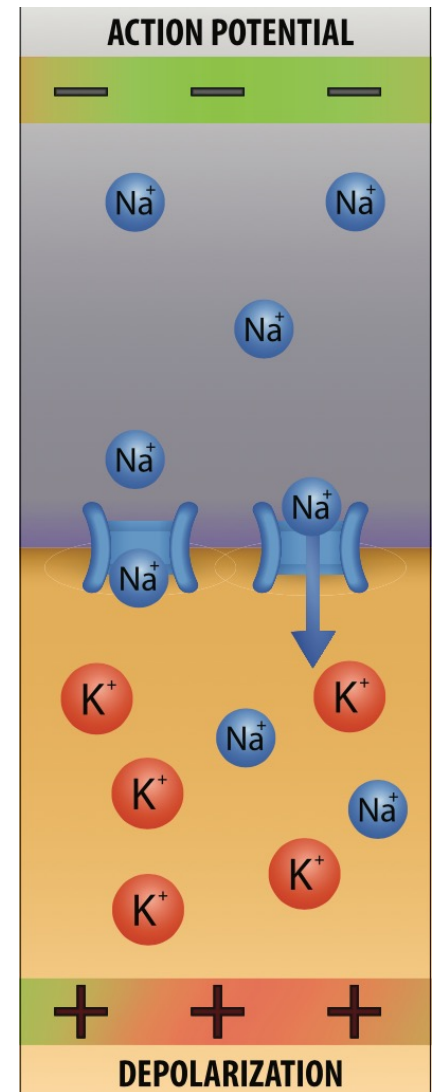
Membrane Channels

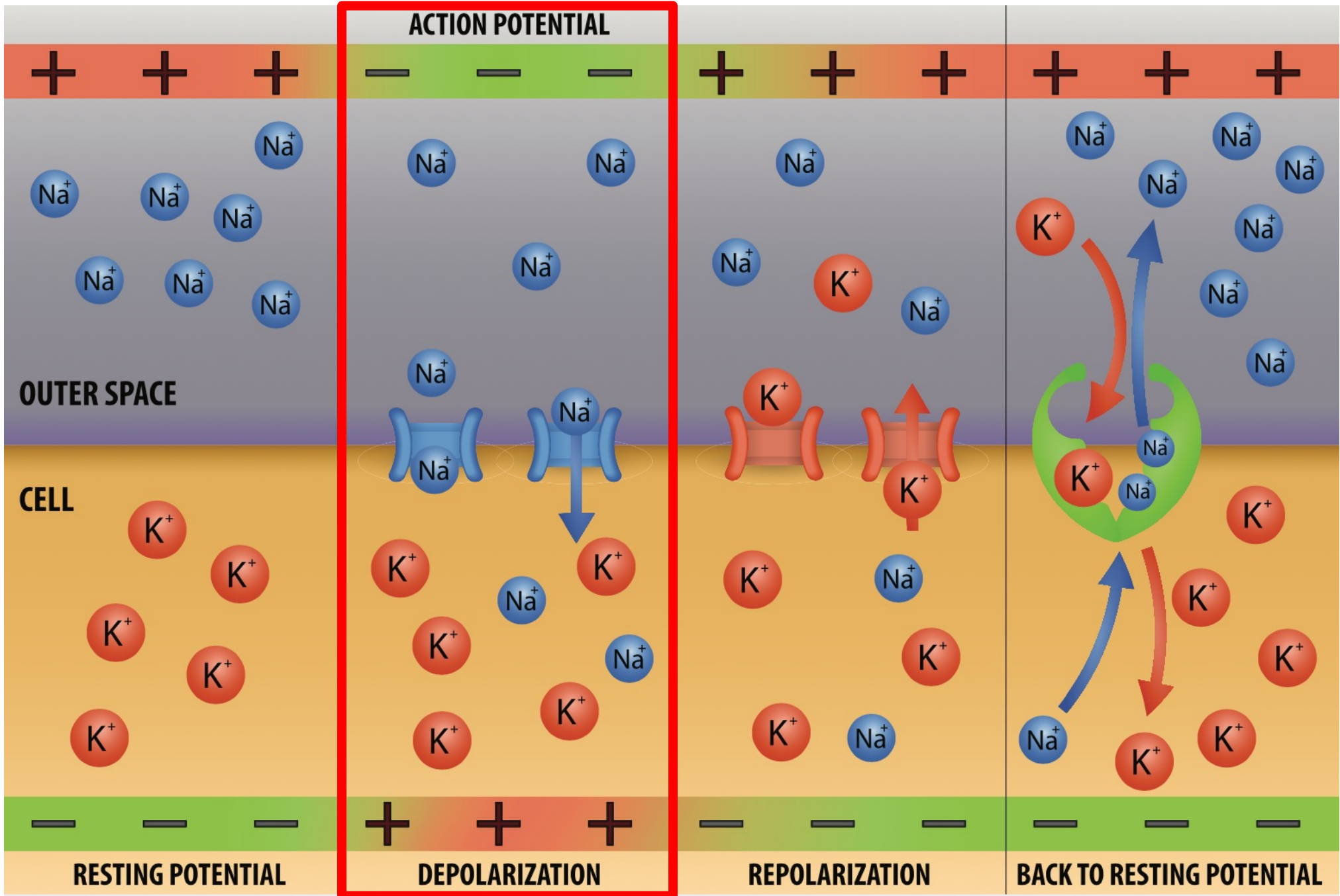
The membrane channels are the only way the ions can move across the membrane.



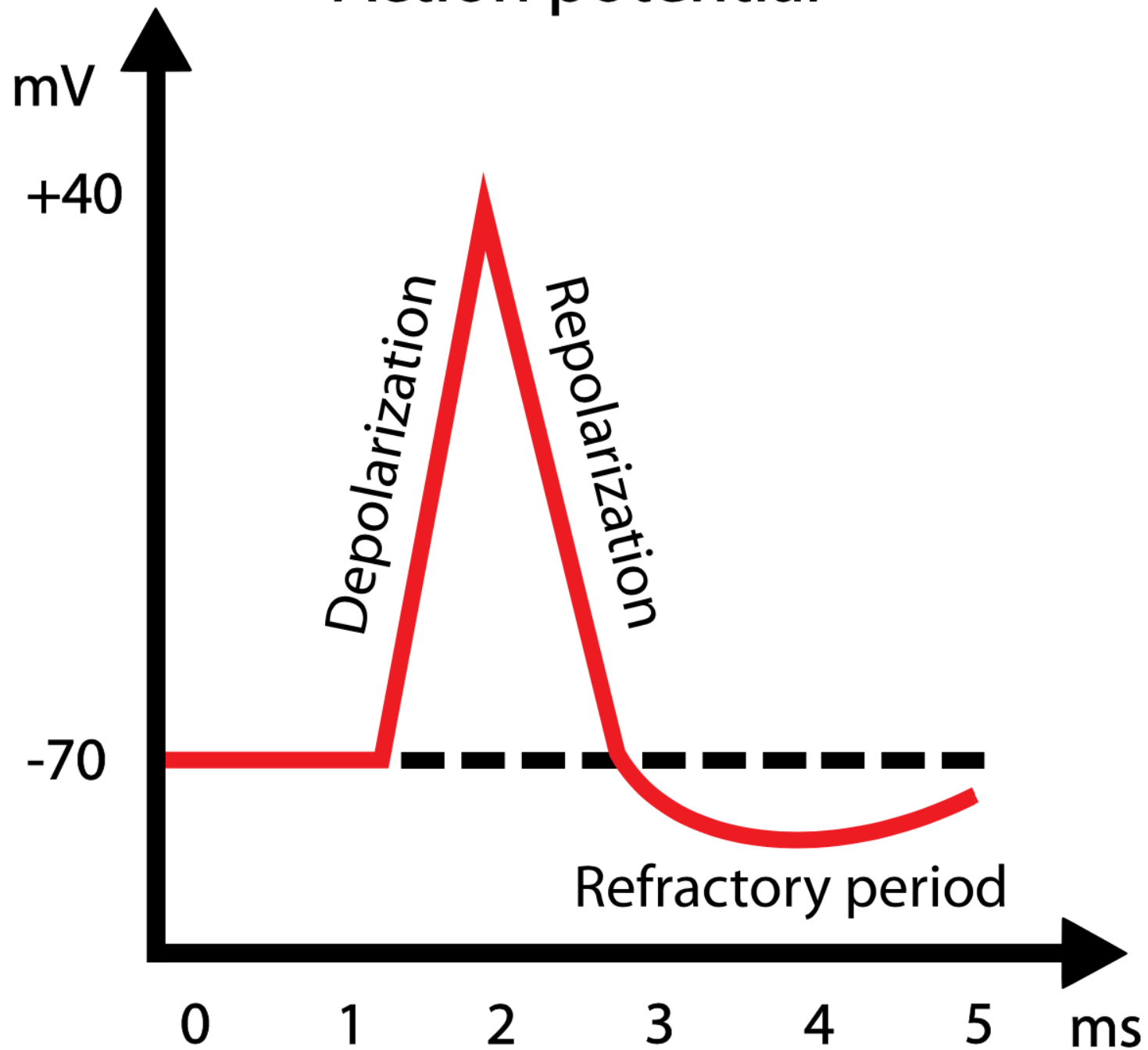
Stage 2 - Depolarization

- When a signal is sent through a neuron, it depolarizes (an abrupt change in the charge difference across its membrane)
- This is called an action potential
- _____
 - Stimulus can be pressure from touching something or stimulation by another neuron

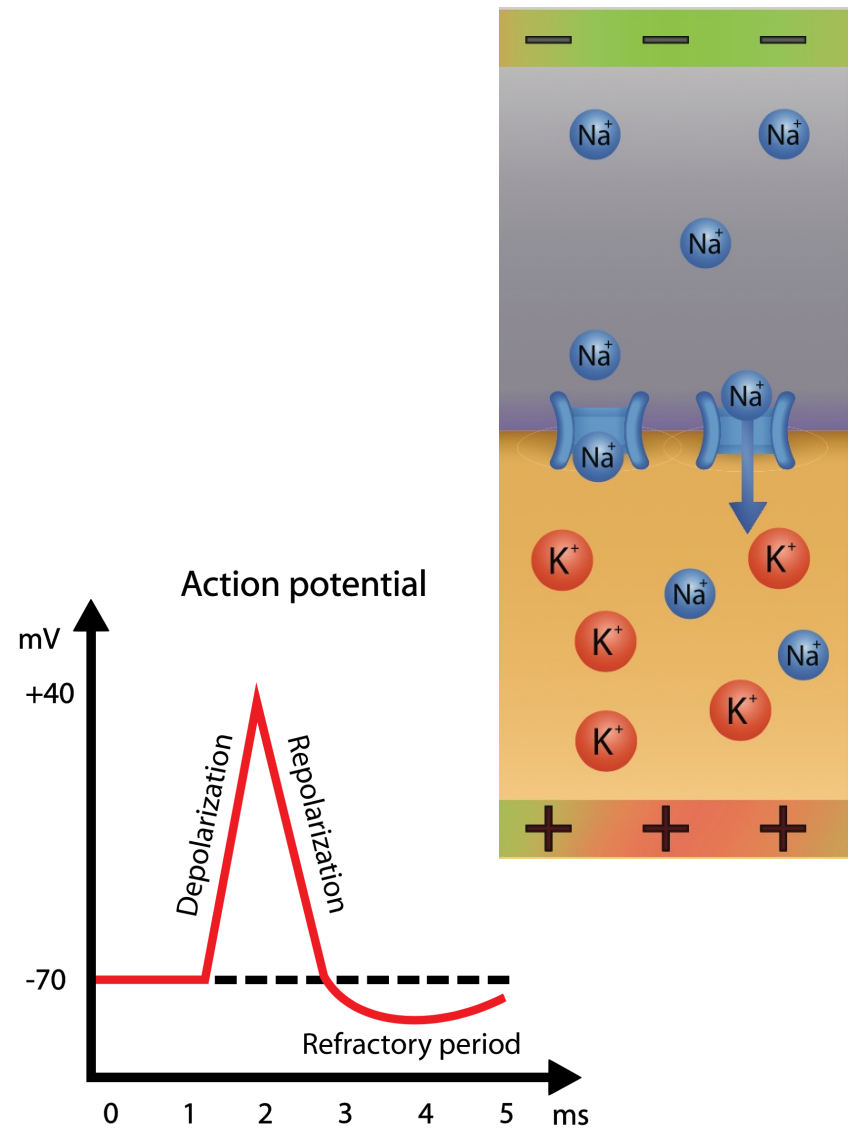




Action potential



Stage 3 - Action Potential

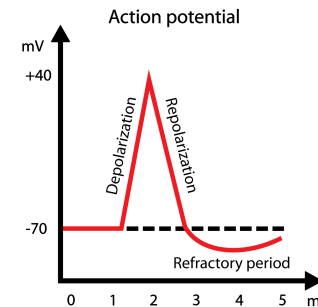


Action Potential

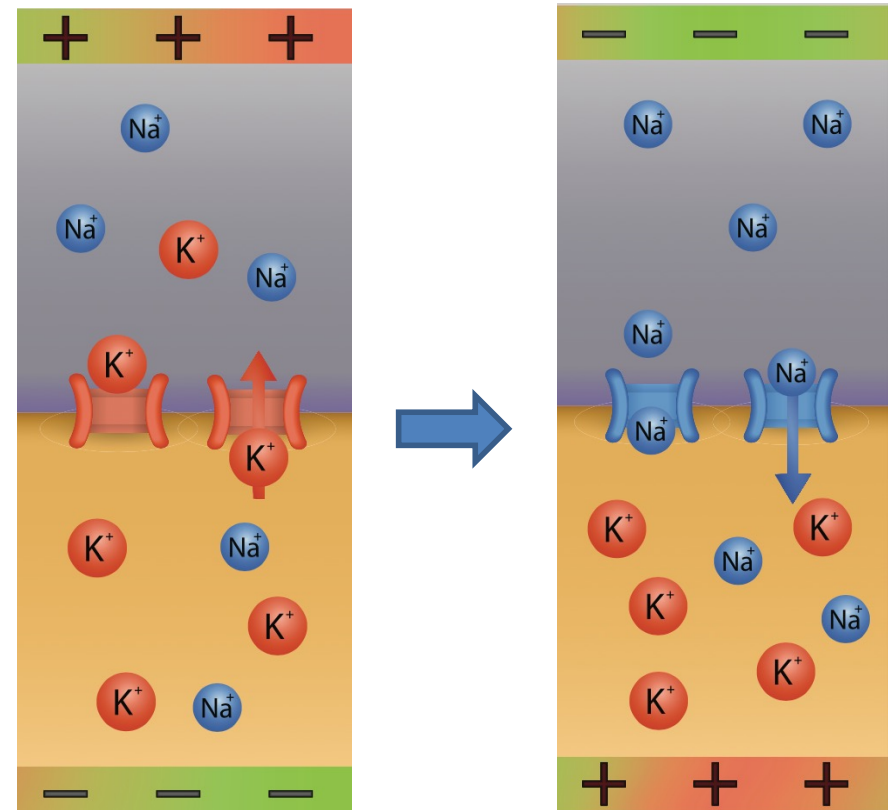


2

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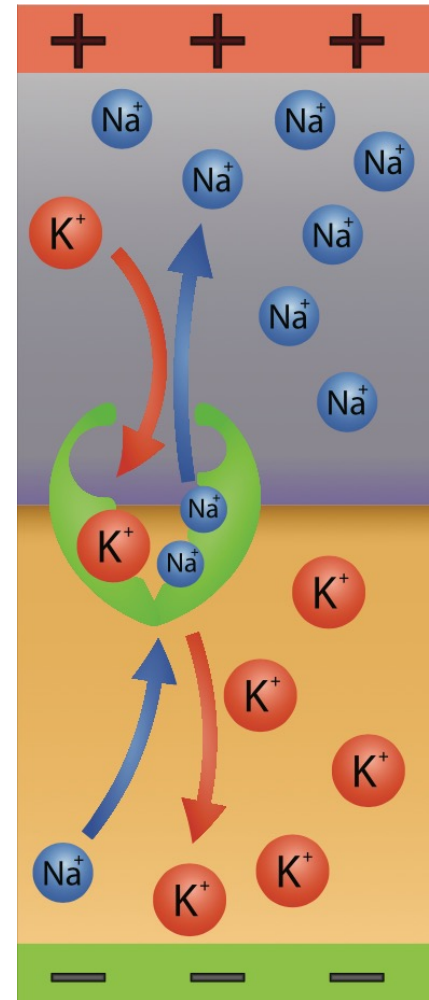
- _____
- K^+ channels open in the first area and K^+ ions diffuse out
- This starts the repolarization process behind the action potential



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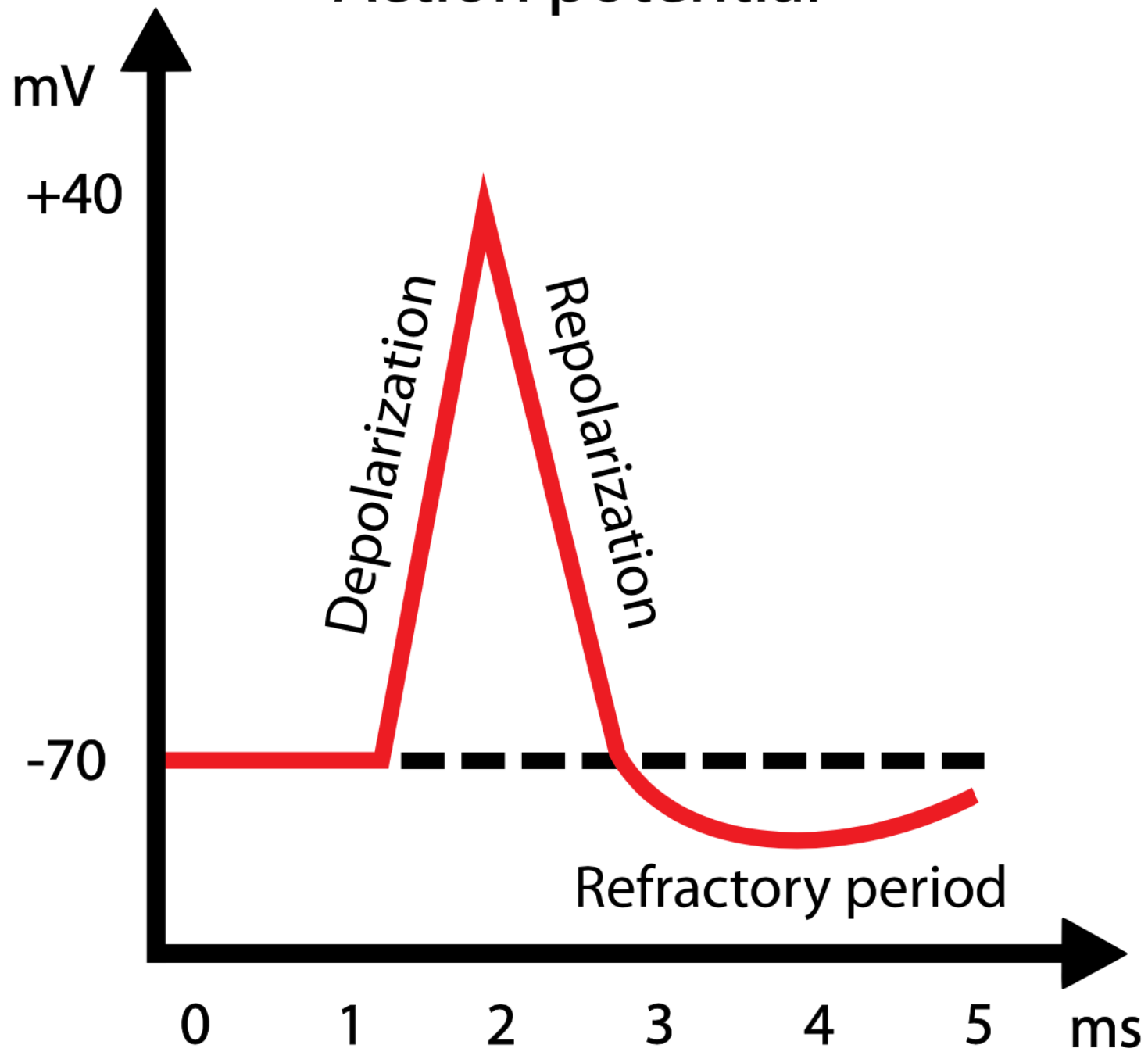
Sodium-Potassium Pump

- _____
- 3 Na^+ are transported out of the nerve cell
- 2 K^+ are transported into the nerve cell
- ATP is needed to run the pump



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Action potential



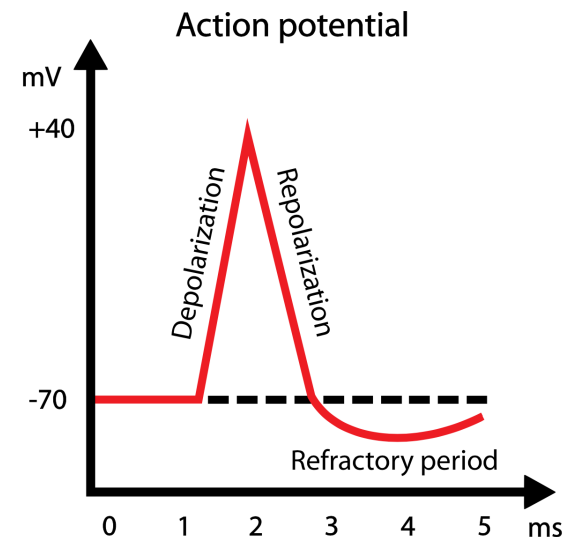
Refractory Period



4

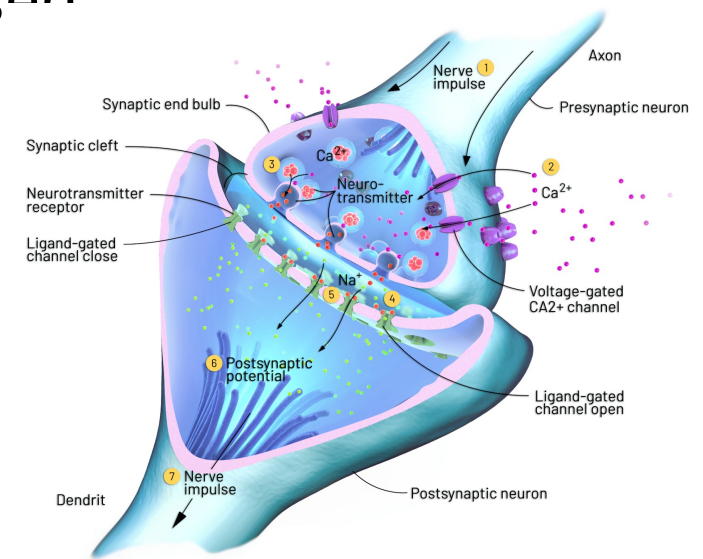
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- Recovery period required before a neuron can produce another action potential
- _____
- Re-establish the -70 mV potential across the membrane
- Approximately 1-10ms (milliseconds)
- Prevents the signal from going backwards



Synaptic Transmission

- _____
- Neurotransmitters: chemicals released from vesicles into synapses
- Presynaptic Neuron: Neuron that carries impulse to synapse
- _____
- Postsynaptic Neuron: Neuron that carries impulse away from the synapse

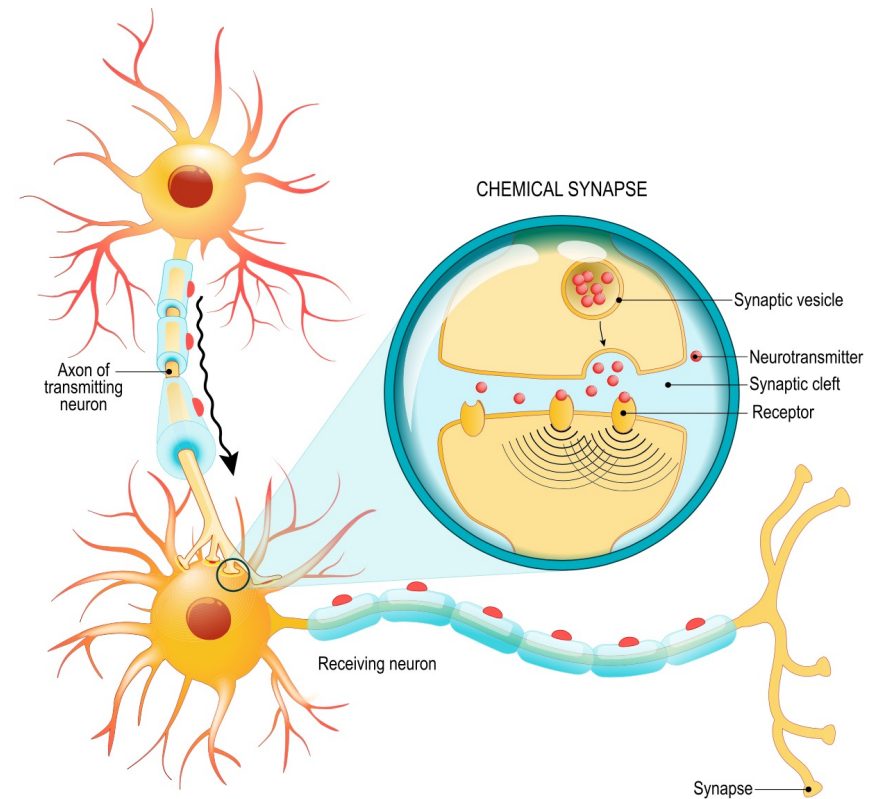


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Neurotransmitters



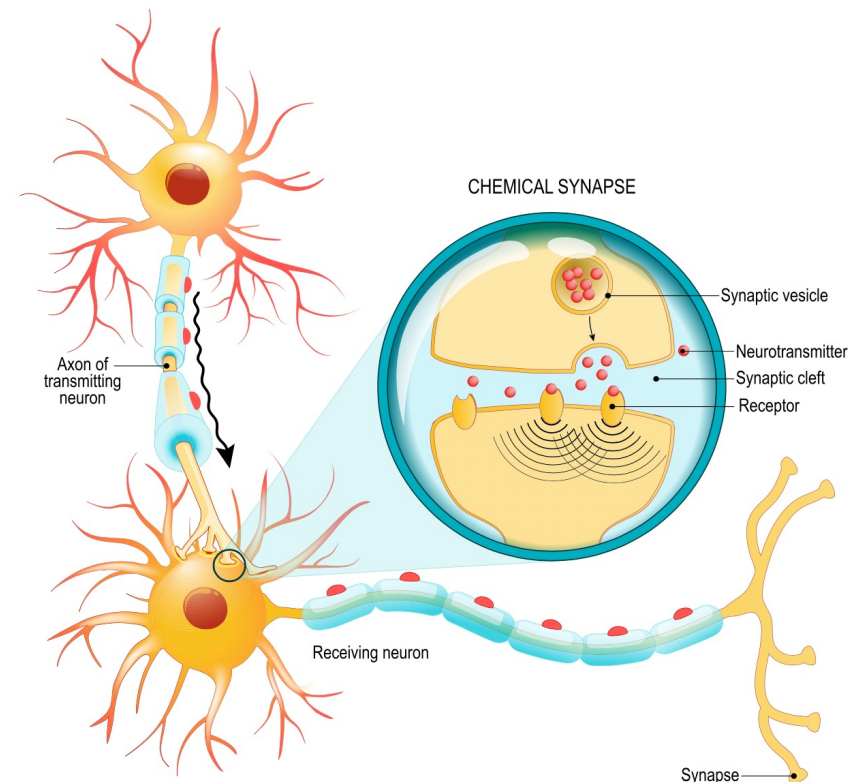
5



- They are made in the nerve cell body

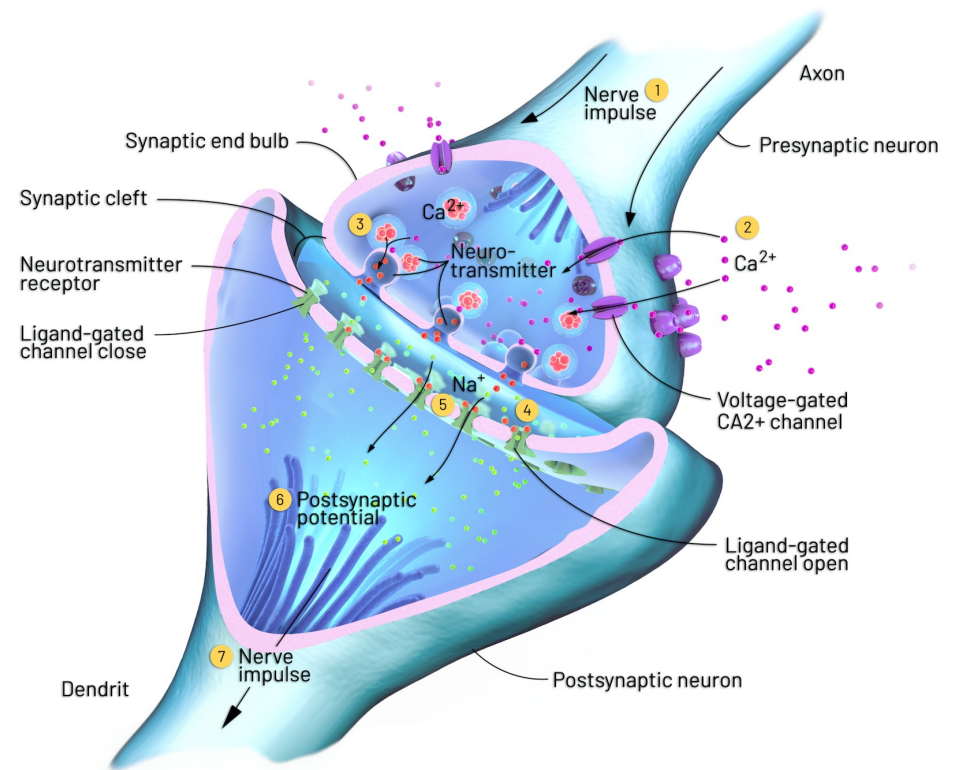
Neurotransmitters

- Acetylcholine is responsible for much of the stimulation of muscles, including the muscles of the gastrointestinal system
- _____
- Curare-tipped darts have been used by hunters for hundreds of years



Synaptic Transmission

- When an action potential (1) reaches the axon terminal, it causes Ca^{2+} gates to open and Ca^{2+} to rush into the cell (2)
- _____
- This binding can either excite the next neuron by opening Na^+ channels (5) and causing a new depolarization or inhibit it and prevent a new depolarization



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Neurotransmitters and Mood

- How does the brain dictate how we feel?
 - It can change the way we feel by triggering certain connections in the brain _____
 - Certain connections are made with certain neurotransmitters
- _____
- We feel pain when our nerve cells send the pain message to our brain using neurotransmitters
 - If we block these messages from reaching the brain, no more pain