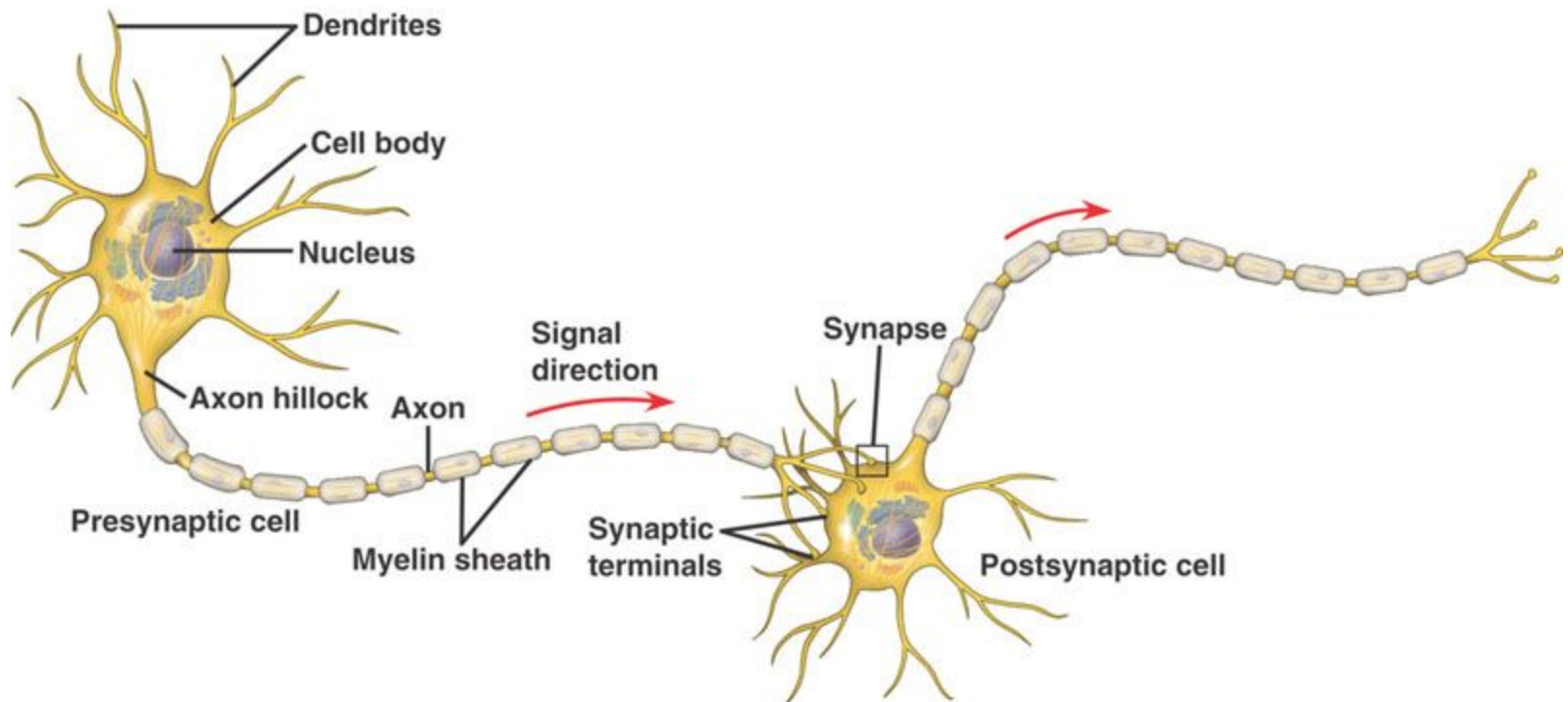


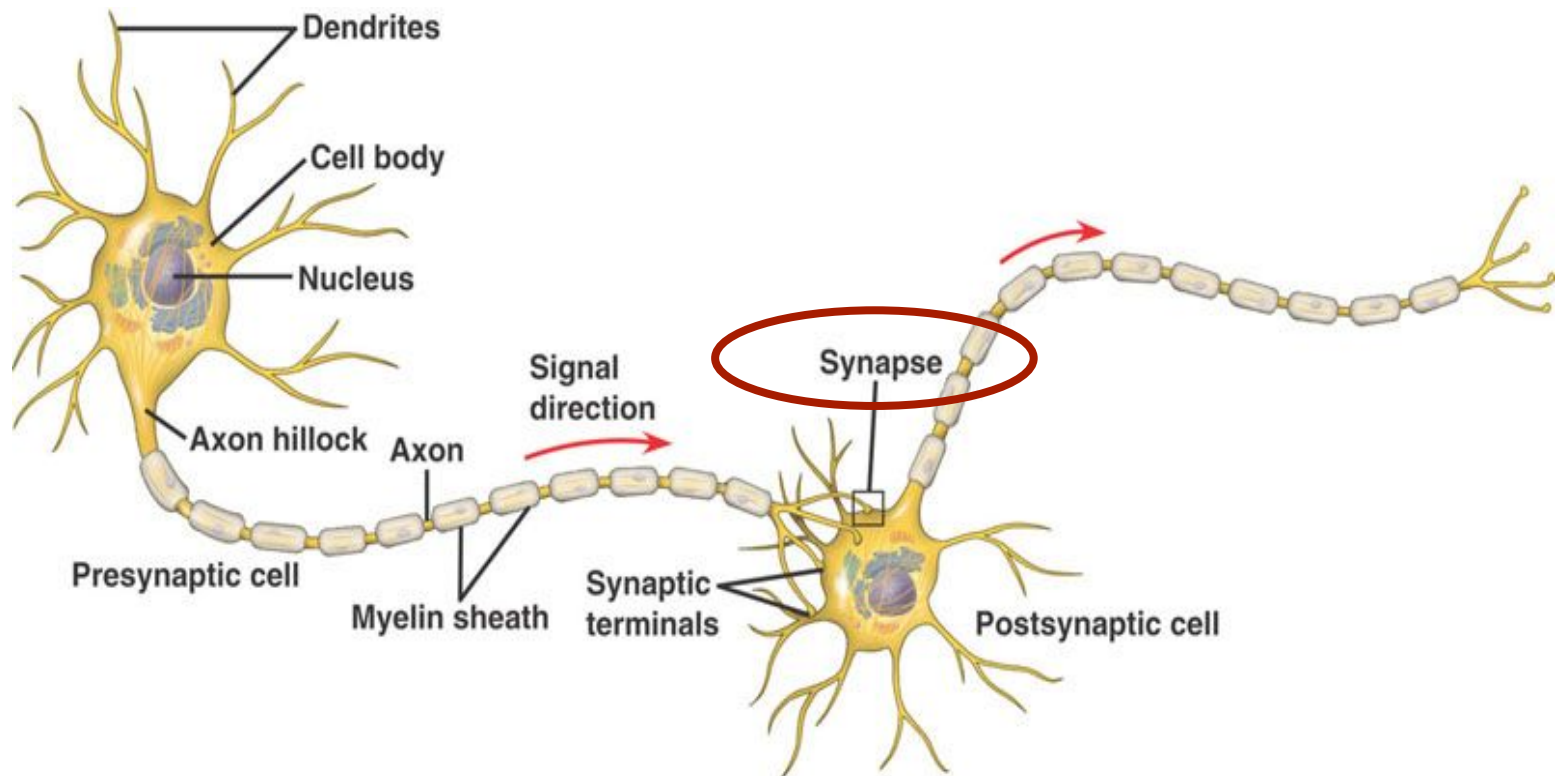
Neural Communication

- The nervous system depends on neurons to **communicate** information from sensory receptors to the CNS and back to an effector (a muscle or gland).



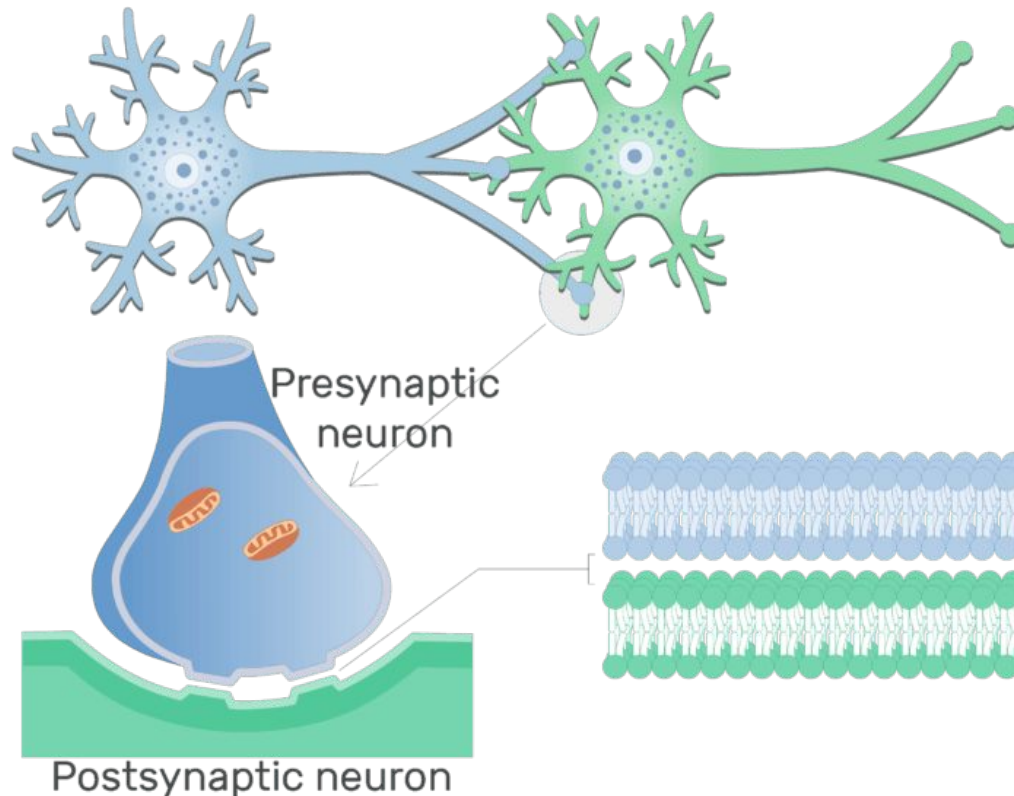
Neural Communication

- The junction where two neurons come together is called a **synapse**.
- The space between the two neurons is called the **synaptic cleft**.



Neural Communication

- The neuron that carries the impulse to the synapse is called the **presynaptic neuron**.
- The neuron that carries the impulse away from the synapse is called the **postsynaptic neuron**.

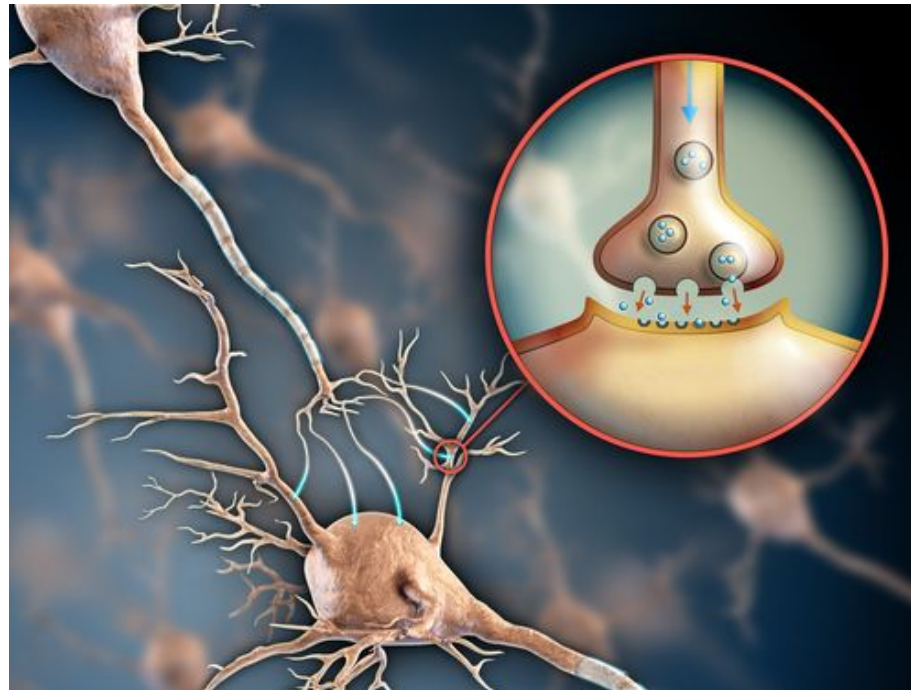


Neural Communication

How do you think an electrical nerve impulse (action potential) travels across the synaptic cleft to the next neuron (or effector cell)?

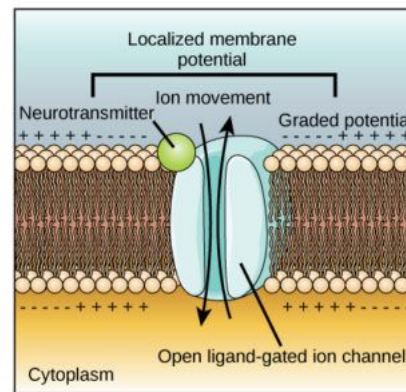
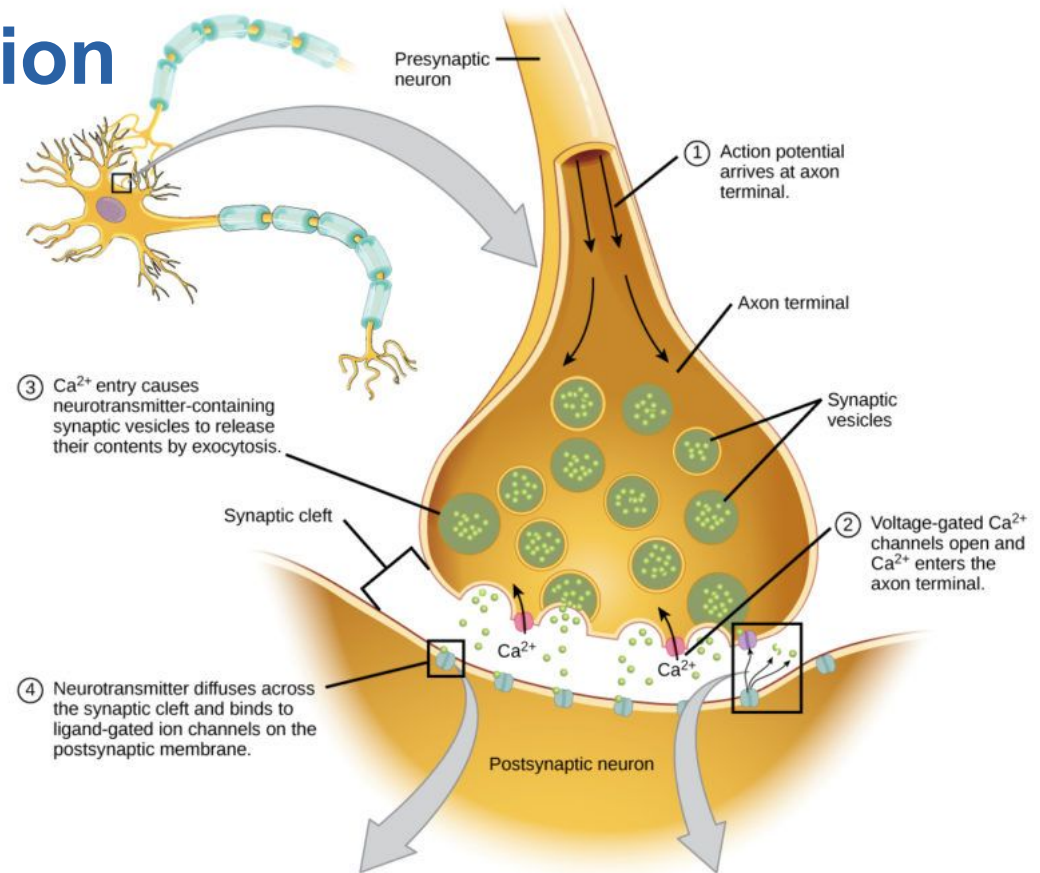
Neural Communication

- An electrical impulse does **NOT** travel across the synaptic cleft.
- Instead, a **chemical signal crosses the synapse to transmit the electrical signal from one neuron the next neuron/effector cell.**

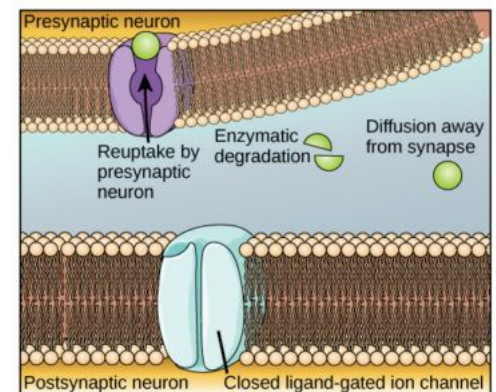


Chemical Transmission Across a Synapse

- The chemical transmission across a synapse involves a series of consecutive events:



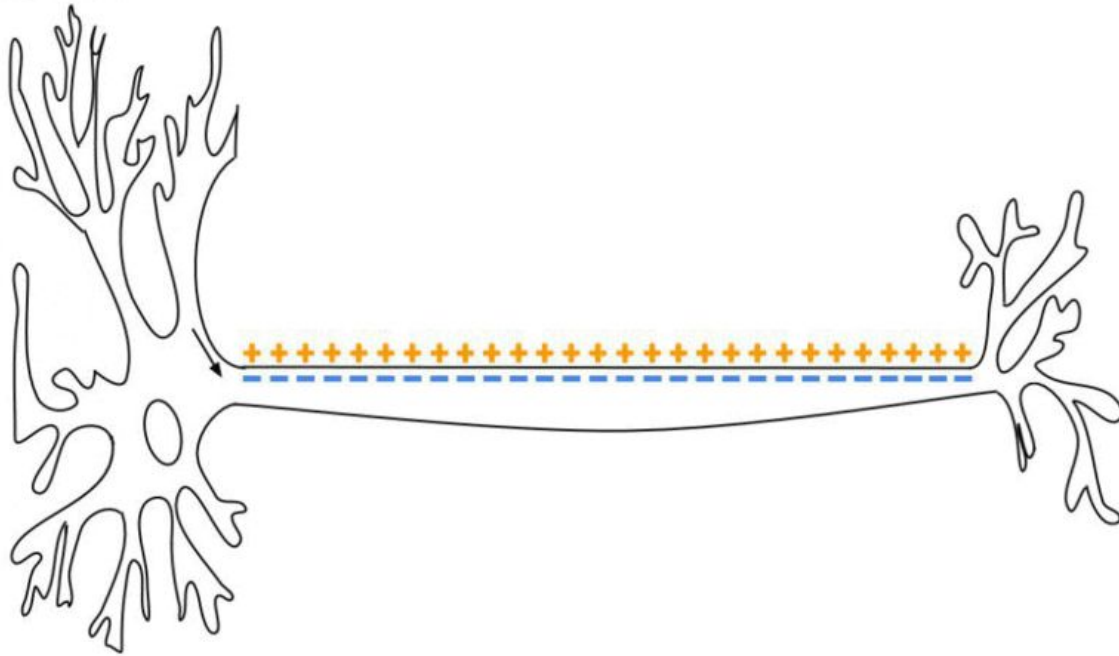
- ⑤ Binding of neurotransmitter opens ligand-gated ion channels, resulting in graded potentials.



- ⑥ Reuptake by the presynaptic neuron, enzymatic degradation, and diffusion reduce neurotransmitter levels, terminating the signal.

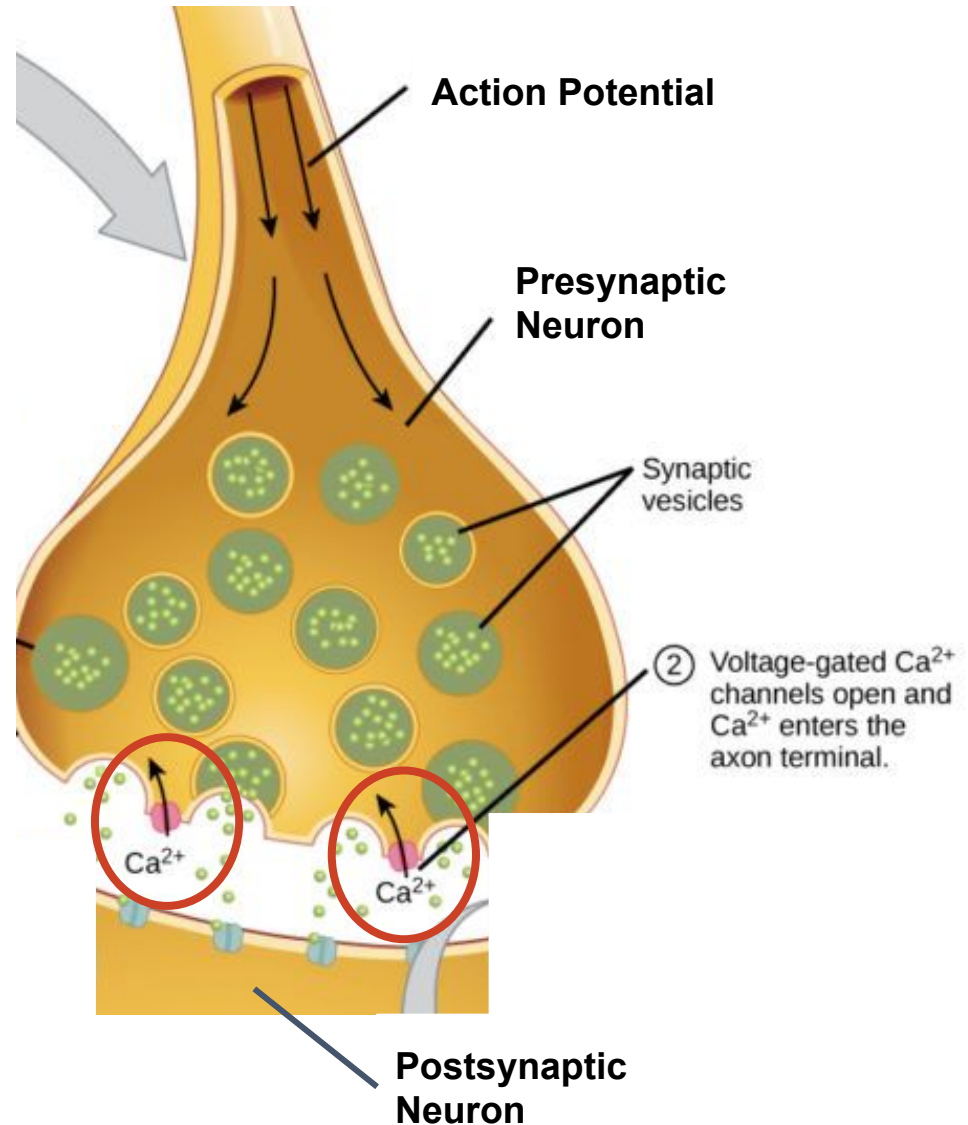
Chemical Transmission Across a Synapse

- **Step 1: An action potential (electrical impulse) travels along an axon and arrives at the end (terminal) of a presynaptic axon.**



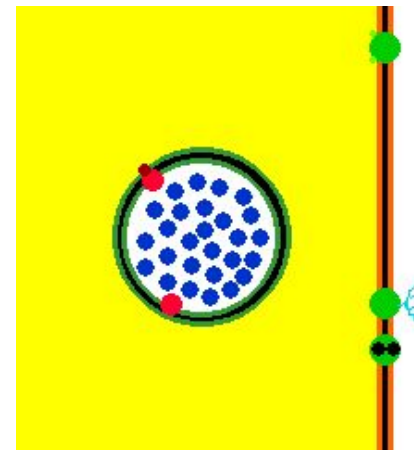
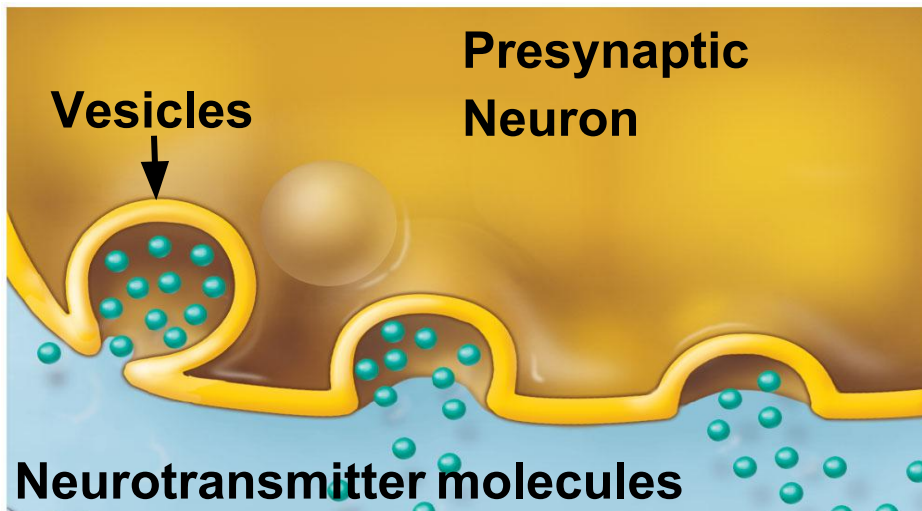
Chemical Transmission Across a Synapse

- Step 2: The action potential opens voltage-gated calcium channels on the presynaptic neuron.
- ✓ Calcium ions move into the presynaptic neuron along their concentration gradient.



Chemical Transmission Across a Synapse

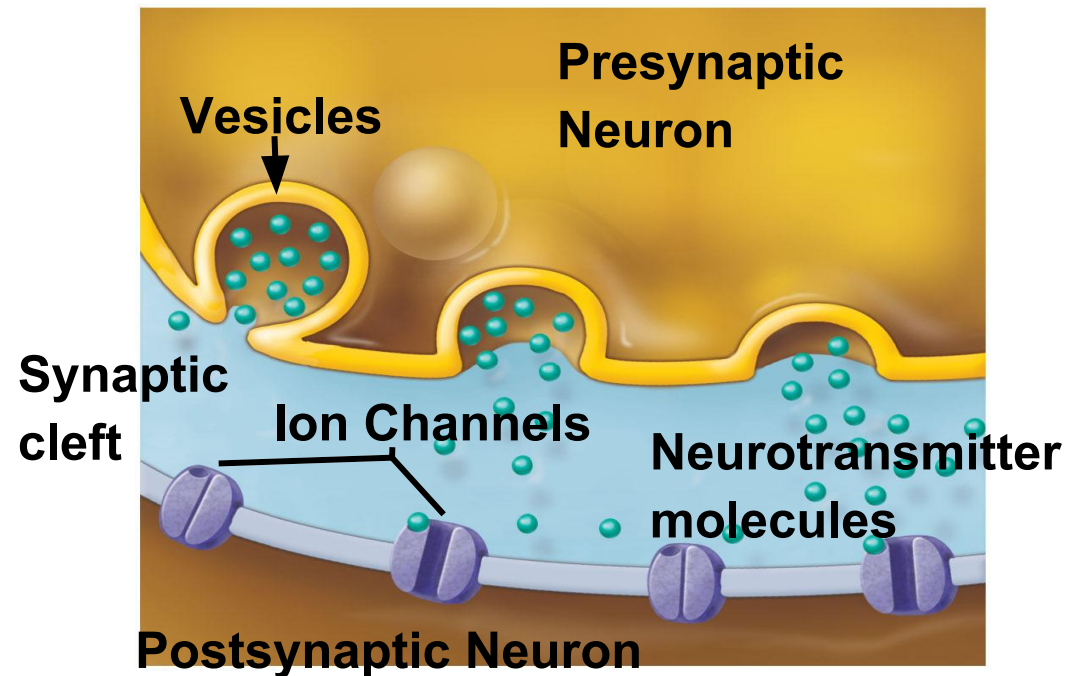
- Step 3: **Calcium entry causes neurotransmitter-containing synaptic vesicles to release their contents by exocytosis into the synaptic cleft.**



- Exocytosis = **contents of the vesicle are released to the outside of the cell through the fusion of the vesicle's membrane with the cell's membrane**

Chemical Transmission Across a Synapse

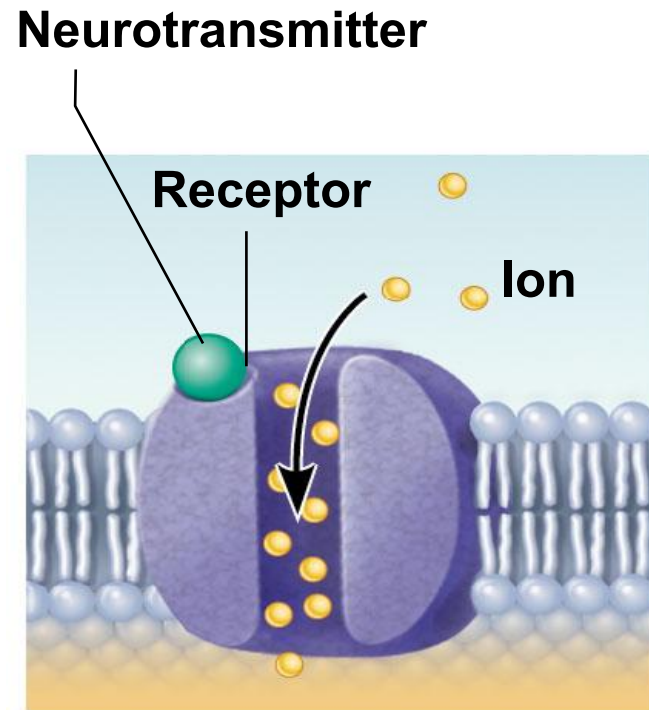
- Step 4: **Neurotransmitter molecules diffuse across the synaptic cleft and bind to ligand-gated ion channels on the postsynaptic neuron.**



- Ligand-gated = channel will only open when a specific ion binds to it**

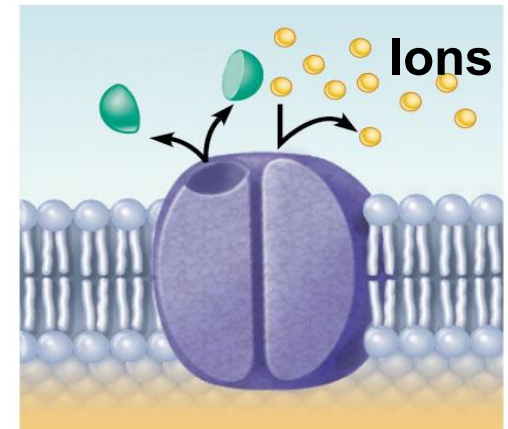
Chemical Transmission Across a Synapse

- **Step 5: Binding of neurotransmitters opens ligand-gated channels. Ions move along their concentration gradient into the cell, resulting in depolarization or hyperpolarization of the postsynaptic neuron.**



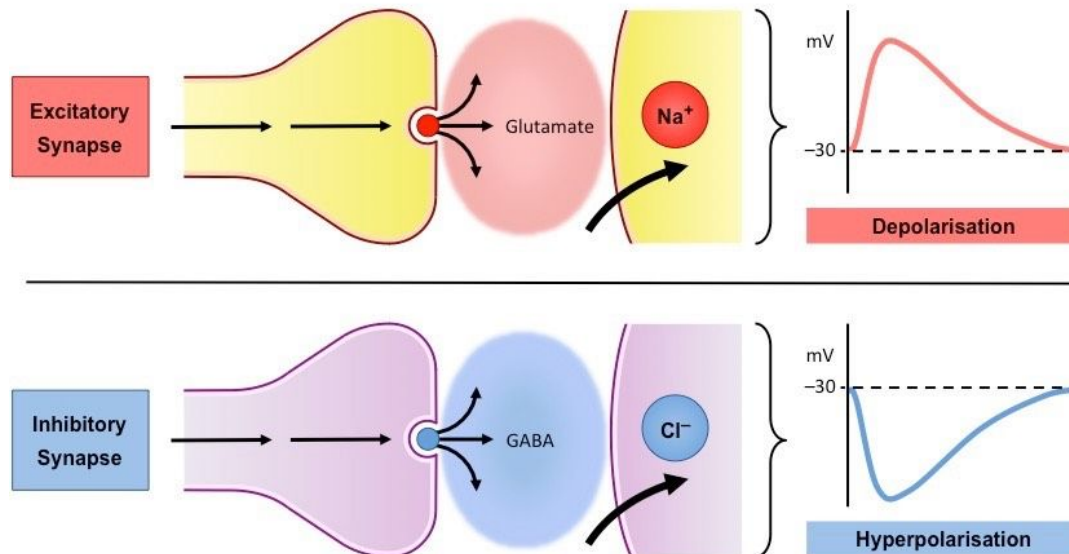
Chemical Transmission Across a Synapse

- **Step 6: The chemical signal is terminated after the neurotransmitter is released from the ligand-gated ion channel, closing the channel. The neurotransmitter then undergoes one of the following:**
 - ✓ Reuptake by the presynaptic neuron
 - ✓ Enzymatic degradation
 - ✓ Diffusion away from the synapse











Neurotransmitters

- Neurotransmitters can **excite or inhibit neurons**
- **Excitatory** neurotransmitters **depolarize** the postsynaptic neuron
 - ✓ Make the action potential **more** likely to occur
- **Inhibitory** neurotransmitters **hyperpolarize** the postsynaptic neuron
 - ✓ Make the action potential **less** likely to occur

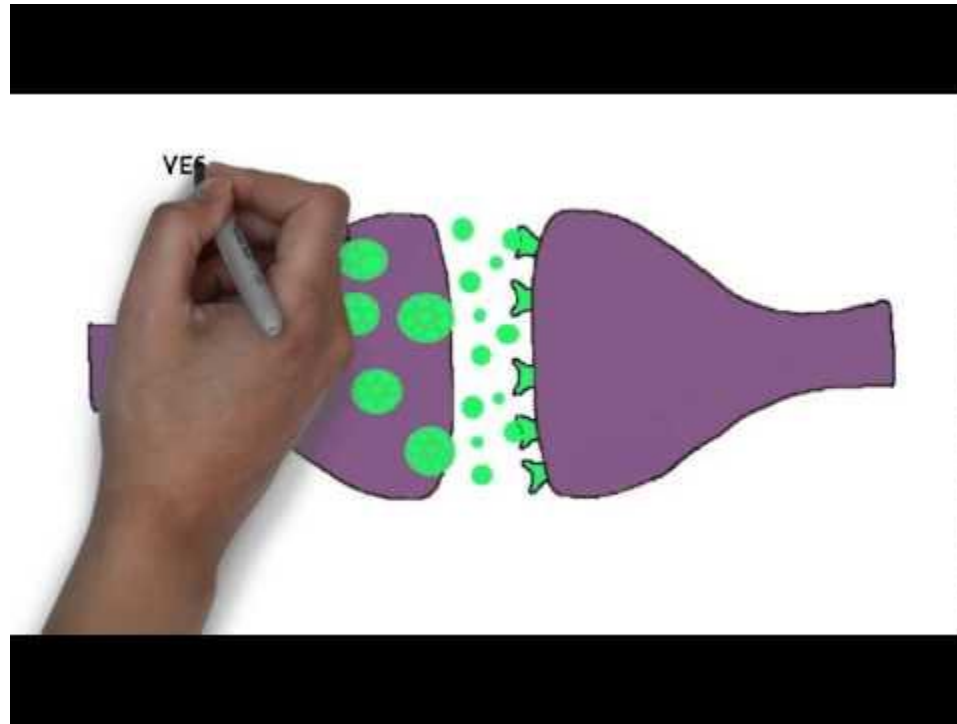


Neurotransmitters

- Some common neurotransmitters are **acetylcholine**, **norepinephrine**, **adenosine**, **dopamine**, **serotonin**, **glutamate** and **gamma aminobutyric acid (GABA)**.
 - ✓ Acetylcholine, glutamate and norepinephrine are **excitatory**
 - ✓ Dopamine, serotonin, adenosine, and GABA are **inhibitory**

ADRENALINE	NORADRENALINE	DOPAMINE	SEROTONIN
			
Fight or flight neurotransmitter	Concentration neurotransmitter	Pleasure neurotransmitter	Mood neurotransmitter
GABA	ACETYLCHOLINE	GLUTAMATE	ENDORPHINS
			
Calming neurotransmitter	Learning neurotransmitter	Memory neurotransmitter	Euphoria neurotransmitter

2 Minute Neuroscience Video



Your Brain on Caffeine

