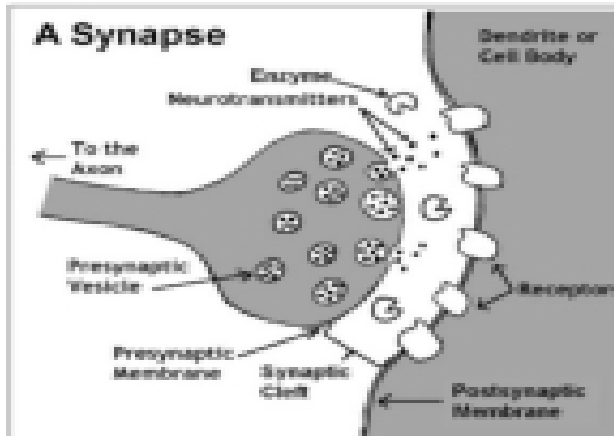


Chemical Transmission Between Nerve Cells



Some nerve cells transmit an impulse by directly sharing the action potential if the two cell membranes are touching (at an electrical synapse). However, most nerve cells do not actually touch other cells. The location of communication between a nerve cell and another cell where impulses are passed without touching is called a **chemical synapse**. The tiny space between the two cells is called the **synaptic cleft**. Nerve impulses are transmitted across this gap by changing the action potential into a chemical signal that moves across the cleft.

When the action potential arrives at the synaptic terminal, calcium gated ion channels open and calcium ions (Ca^{2+}) enter. The increased calcium concentration causes **presynaptic vesicles** to fuse with the presynaptic membrane and release molecules called **neurotransmitters**. Neurotransmitters are created by the nerve cells and stored in the vesicles until needed. The neurotransmitters diffuse across the synaptic cleft and bind to **receptor** molecules on the **postsynaptic membrane**, triggering a reaction in the second cell that can start a new action potential. These neurotransmitters are only temporarily bound.

The neurotransmitters may be removed from the receptors in one of three ways: they may be broken down by specialized enzymes in the synaptic cleft, reabsorbed by the synaptic (axon) terminal and recycled, or they may simply diffuse away. If the neurotransmitters were not removed, the receptors would never cease triggering.

Example: Transmission to Muscle Cells

The synapses that connect nerves to muscles are called **neuromuscular junctions**. Most neuromuscular junctions use the same neurotransmitter, acetylcholine, which is broken down by the enzyme acetylcholinesterase. A signal from a nerve to a muscle is transmitted in 4 stages: