

## Communication Between Neurons

A junction at which a neuron meets another cell is called a **synapse** (*SIHN aps*), shown in Figure 4. At synapses, neurons usually do not touch the cells they communicate with. Between an axon terminal and a receiving cell is a tiny gap called a synaptic cleft. At a synapse, the transmitting neuron is called a presynaptic neuron, and the receiving cell is called a postsynaptic cell.

When a nerve impulse arrives at an axon terminal of a presynaptic neuron, the impulse cannot cross the synaptic cleft. Instead, the impulse triggers the release of signal molecules called **neurotransmitters** into the synaptic cleft. Neurotransmitter molecules are produced by neurons and are stored inside vesicles. There are many different neurotransmitters and several mechanisms of neurotransmitter action. For example, in human muscles the principal neurotransmitter is a chemical called acetylcholine (*as ee tihl KOH leen*). The brain utilizes several neurotransmitters such as glutamate (*GLOO tuh mayt*) and dopamine.

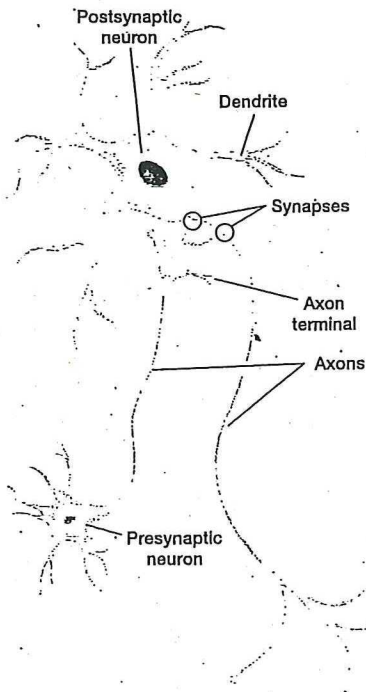
### Release of Neurotransmitter

A nerve impulse causes a presynaptic neuron to release neurotransmitter molecules into the synaptic cleft. When an action potential reaches an axon terminal of the presynaptic neuron, vesicles that contain neurotransmitter molecules fuse with the cell membrane. This releases neurotransmitter molecules into the synaptic cleft by exocytosis. Neurotransmitter molecules diffuse across the synaptic cleft and interact with the postsynaptic cell. As shown in Figure 5, neurotransmitter molecules bind to receptor proteins on the postsynaptic cell. In some cells, ion channels open when a neurotransmitter binds to these receptor proteins. Such channels are called chemical-gated ion channels; whether these channels are open or closed depends on the binding of a chemical—in this case a neurotransmitter molecule.

A neurotransmitter may either excite or inhibit the activity of the postsynaptic cell it binds to. For example, when the neurotransmitter opens chemical-gated ion channels, ions move across the cell membrane of the postsynaptic cell. This causes the membrane potential of the postsynaptic cell to change depending on the charge of the ions that move into or out of the cell. If positively charged ions enter a postsynaptic neuron, an action potential may be produced (excitation). On the other hand, if positively charged ions flow out of the postsynaptic neuron, or if negatively charged ions enter the neuron, an action potential may be suppressed (inhibition).

**Figure 4 Synapse.**

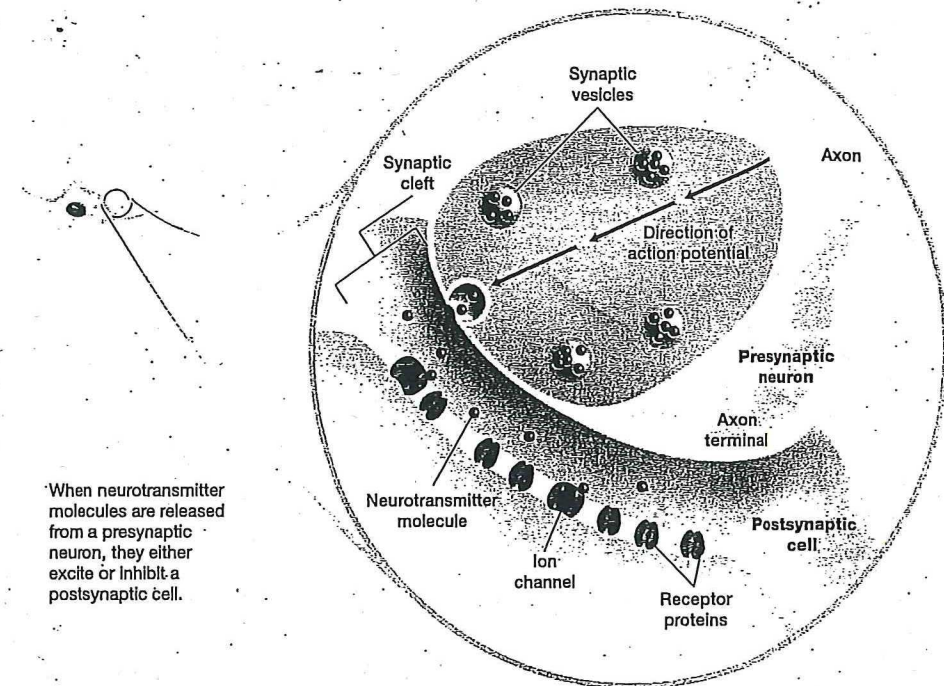
A synapse is a junction at which signals are transmitted between a neuron and another cell.



Neurotransmitter molecules do not remain in the synaptic cleft indefinitely. Instead, most neurotransmitter molecules are cleared from the synaptic cleft very shortly after they are released. Many presynaptic neurons reabsorb neurotransmitter molecules and use them again. At other synapses, neurotransmitter molecules are broken down by enzymes or other chemicals. This happens, for example, at the synapses between neurons and skeletal muscle cells. The reuptake or breakdown of the neurotransmitter molecules ensures that their effect on postsynaptic cells is not prolonged.

**Figure 5 Synaptic transmission**

Neurotransmitter molecules are released from a presynaptic neuron, diffuse across the synaptic cleft, and interact with a postsynaptic cell.



When neurotransmitter molecules are released from a presynaptic neuron, they either excite or inhibit a postsynaptic cell.

## Section 1 Review

- 1 Describe the structure of a typical neuron. ⓐ 4A 10A
- 2 Describe how the movement of ions across the cell membrane determines the membrane potential. ⓐ 4B 10A
- 3 Summarize the events involved in the synaptic transmission of a nerve impulse. ⓐ 4B 10A
- 4 **Critical Thinking Inferring Relationships** How does the membrane potential affect the permeability of a neuron's cell membrane? ⓐ 4B
- 5 **TAKS Test Prep** The junction at which a neuron communicates with another neuron or a muscle cell is called a ⓐ 10A  
 A myelin sheath. C nerve.  
 B synapse. D neurotransmitter.