

The Anatomy of a Synapse

Neurons form elaborate networks through which nerve impulses—action potentials—travel. Each neuron has as many as 15,000 connections with neighboring neurons.

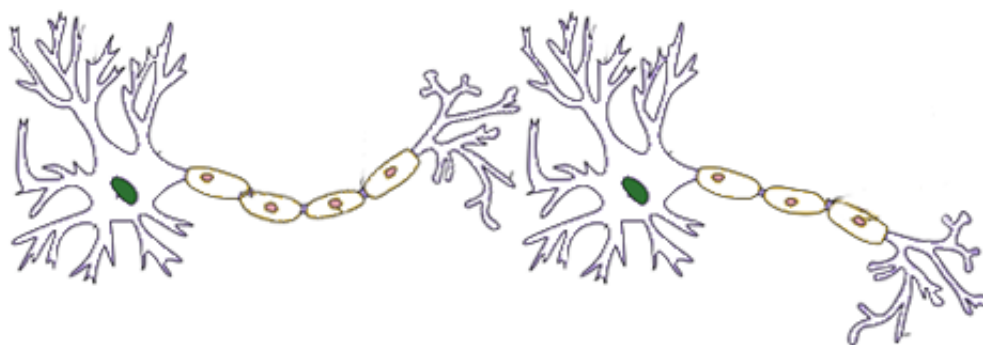
Neurons do not touch each other; instead, neurons interact at contact points called **synapses**: a junction within two nerve cells, consisting of a miniature gap which impulses pass by a neurotransmitter. A neuron transports its information by way of a nerve impulse called an **action potential**. The action potential can originate in the cell body when it has received a stimulus, then it moves down the axon of that neuron. When an action potential arrives at the synapse, it stimulates the release of **neurotransmitters**. These neurotransmitters are released into the synaptic cleft to bind to the receptors of the adjacent cell.

On the image below: Color the cell body and the dendrites blue.

Color the axon (and myelin sheaths) red.

Highlight the synapse with yellow.

Use an arrow to show movement of the action potential.



On a cellular level, the neuron cell has vesicles that contain the neurotransmitters. Each neurotransmitter can carry a different type of message. Some neurotransmitters, like serotonin, regulate appetite, sleep and mood. Serotonin is thought to be associated with certain types of depression and anxiety disorders.

The image below shows how serotonin is released from the neuron and how a drug called SSRI (selective serotonin re-uptake-inhibitors) is used to treat mood disorders. The neuron, like most cells of the body has mitochondria which provide the energy the cell needs to function. Color the mitochondria (A) orange and the axon on the nerve cell (X) blue.

The axon area contains the vesicles that store the neurotransmitters. These neurotransmitters are released into the synaptic cleft where they cross the gap and land on the receptors of the dendrites of the next neuron.

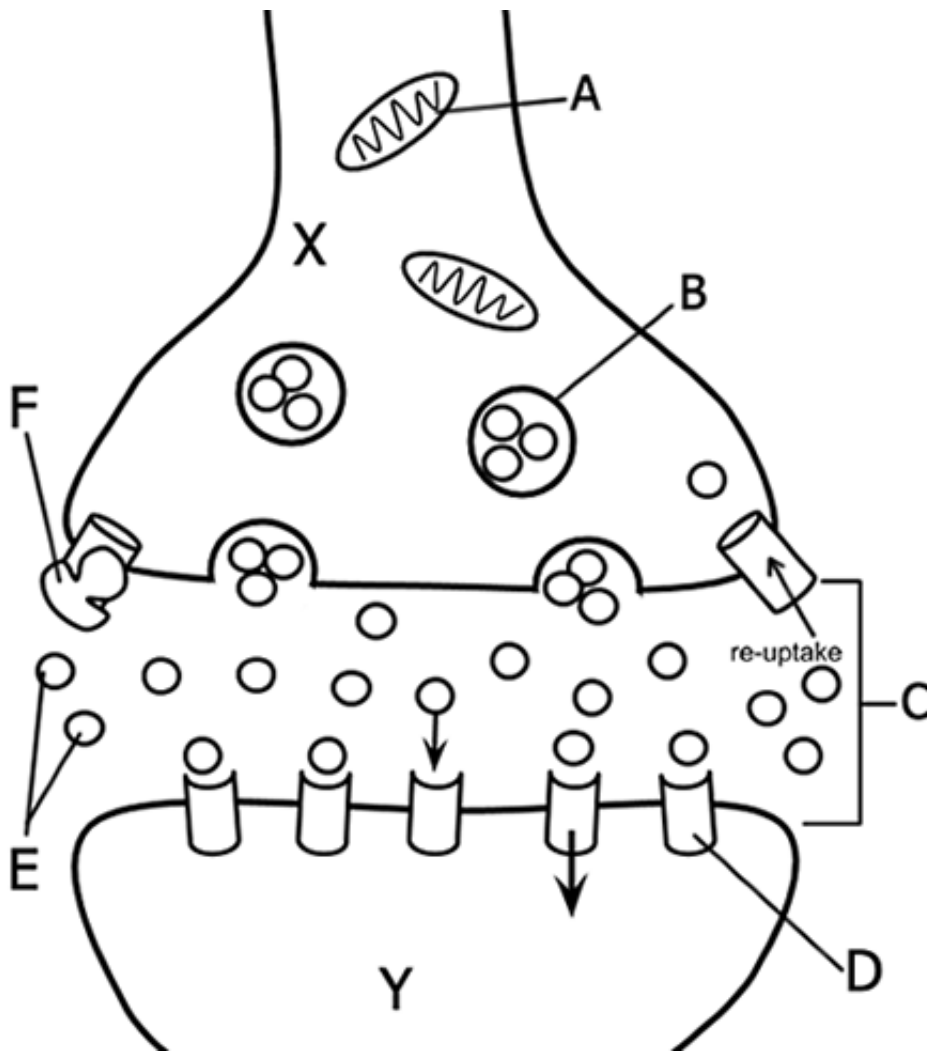
Color the axon (X) light blue. Color the neurotransmitters (E) red.

Color the vesicles (B) pink. Color the receptors (D) green.

Color the dendrite (Y) yellow.

The neurotransmitters are returned to the original cell through transporters, a process called re-uptake. As long as the neurotransmitter remains in the cleft, the receptors will continue to be stimulated. Certain drugs, called SSRI's can inhibit this re-uptake process, leaving the serotonin neurotransmitter active for longer within the cleft. This has an effect of elevating the person's mood or reducing anxiety and depression. Many anti-depressants are marketed as SSRI's.

Color the transporter (re-uptake area) purple. Color the inhibitor (F) brown.



Identify each of the letters:

- A _____
- B _____
- C _____
- D _____
- E _____
- F _____
- X _____
- Y _____

Questions:

1. What is the relationship between a receptor and a neurotransmitter?
2. Where are neurotransmitters stored in the cell?
3. What happens if the re-uptake transporter is blocked?
4. What is an SSRI? What does this type of drug treat?

5. An **agonist** is a chemical capable of binding to a receptor and initiating a reaction. An **antagonist** is a chemical that binds to the receptor but does not cause a reaction, effectively blocking that receptor. Sketch a model (using the one you colored as a guide) to show how an antagonist works.

