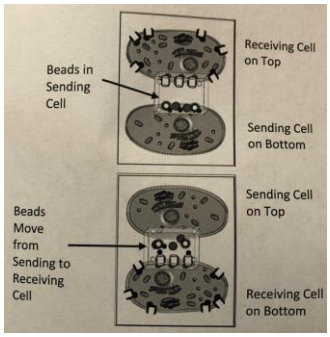
Cell Communication Kit
Science Take Out

Use the model in the Cell Communication kit to explore how cells send, receive, and respond to signals, model what happens when there are problems with cell communication, and answer the questions in your IN.

Cells communicate by sending and receiving signals. Most of the signals that cells respond to are molecules (chemicals) produced by one type of cell and received by other types of cells. Answer question 1.

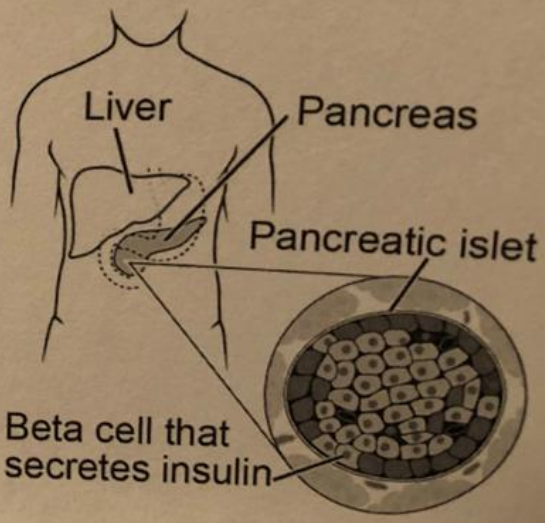


Tilt your model so all the beads are in the signal sending cell (see picture to the right). Now tilt your model so the signal molecules travel from the sending cell to the signal receiving cell. Answer question 2 and 3 in your IN.

Regulating Blood Glucose Levels

When you eat and digest food, glucose (sugar) from the food diffuses from your digestive system into your blood. Your blood carries the glucose to all the cells in your body. To remain healthy, you need to keep a normal level of glucose in your blood. Your body uses glucose as a fuel for cellular respiration that provides energy for your life activities.

When the glucose level in your blood increases above normal levels, beta cells in your pancreas detect the glucose and begin secreting insulin, a chemical signal molecule (hormone). Insulin is secreted into the blood and travels in the blood to all cells of the body.



Using the information above and your model, answer questions #4-7 in your IN.

To receive the insulin signal, body cells have insulin receptors on the outside of their cell membranes. Receptors are like locks into which only keys that have a specific matching shape can fit. Insulin receptors have just the right shape to allow the insulin molecules to bind (attach) to them. The binding of insulin to an insulin receptor causes the receptor to trigger specific changes in the cell's interior.

Using the information above and your model, answer questions #8-10 in your IN.

The binding of insulin to insulin receptors triggers changes in the cytoplasm of the receiving cell.

- All body cells respond to the insulin signal by the opening of glucose transport proteins in the cell membrane to allow glucose to diffuse out of the blood and into the body cells. This movement of glucose from the blood into cells results in decreased blood sugar level.
- In liver and muscle cells, the enzymes that convert glucose into glycogen (long chains of glucose molecules) are activated.
- In adipose (fat storing) cells, the enzymes that convert glucose into fat are activated.

Using the information above and your model, answer questions #11-13 in your IN.

People with diabetes have problems with the cell communication that regulates their blood glucose levels. Their blood glucose is too high because glucose cannot get into their body cells, so it stays in their blood.

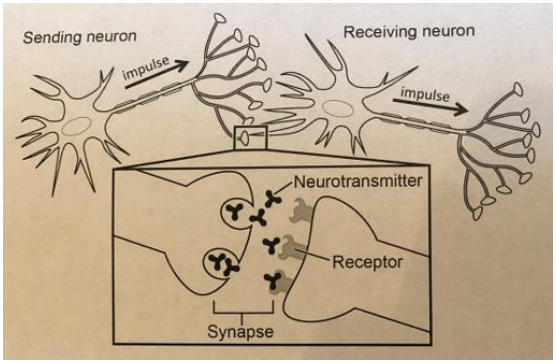
Approximately 5-10% of all people diagnosed with diabetes have **Type 1** diabetes. Type 1 is an autoimmune disease because the immune system attacks the person's own pancreas cells. The cells in the pancreas that produce and release insulin are destroyed. Most people with this type of diabetes produce little to no insulin.

Type 2 diabetes accounts for about 90-95% of all diagnosed cases of diabetes. People can develop type 2 diabetes at any age - even during childhood. People with this type of diabetes produce insulin, but their cells do not respond normally to it. The problem may be caused by a lack of insulin receptors or by the failure of insulin receptors to trigger changes in the cell function.

Using the information above and your model, answer questions #14-16 in your IN.

Your nervous system is made up of nerve cells called neurons. Neurons are long thin cells that carry electrical signals called impulses through your brain and your body. Neurons must be able to communicate with other neurons, but neurons do not touch each other.
Instead, they are separated by a tiny gap called a synapse.

When an impulse reaches the end of a sending neuron, it cannot jump across the synapse. To get a signal from one neuron to the next, they produce and release signal molecules called neurotransmitters. These are chemical signals that diffuse across the synapse and bind to receptors on a receiving neuron. This binding has a rapid effect. It causes ion gates on the receiving cell to open allowing Na^+ (sodium) ions to rush into the neuron. This produces a new impulse that travels along the neuron until it reaches the next synapse.



Using the information above and your model, answer questions #17-19 in your IN.

Endorphins are natural feel-good chemicals manufactured in the brain. Neurons in the emotion and pain areas of the brain have specific receptor sites for endorphins. When natural endorphins do their work, a person feels good and feels relief from pain.

Opiate drugs like opium, heroin, codeine, and morphine have a chemical structure similar to endorphins. Like an evil twin, the opiate molecules can bind to the endorphin-receptor sites on neurons and begin the succession of events that makes a person feel good, high, or euphoric, and relief from pain.

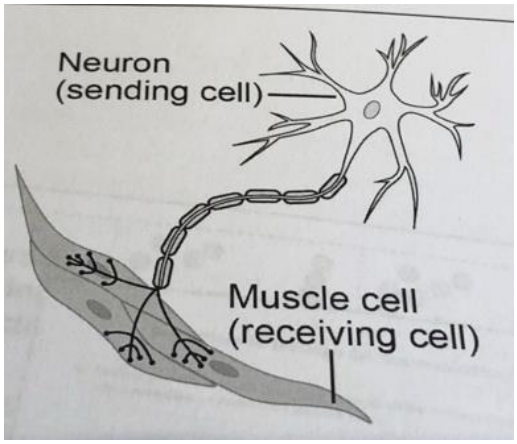
Using the information above and your model, answer questions #20-21 in your IN.

Normally to make a muscle contract, neurons release acetylcholine signal molecules. Acetylcholine binds to

receptors on muscle cells causing the muscle cells to contract.'

Botox is a chemical used to prevent muscle contractions that can lead to wrinkled skin. It does this by preventing the release of acetylcholine from nerve cells.

Myasthenia Gravis is a disease that causes muscle weakness. People with this disease produce antibodies that attack and block the acetylcholine receptors on their muscle cells.



Using the information above and your model, answer questions #22-23 in your IN.