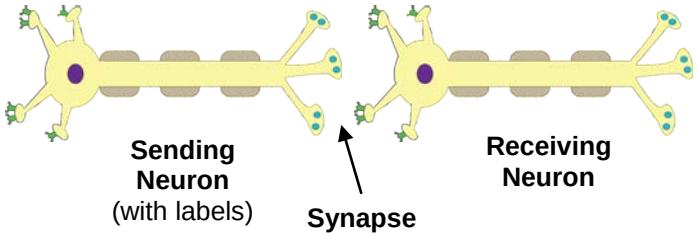
Nerve Cell Communication

Part 1: What are the parts of a nerve cell?

1. Read the information in the ***Biology Brief: Neurons***. As you read, circle the names of the structures (parts) of the neuron.

2. Obtain the following materials from your teacher:
   - Two large diagrams of neurons—a sending neuron and a receiving neuron.
   - A small bag of white label cards, blue function cards, colored beads, and a red (+/-) card.

3. Arrange the large diagrams of sending and receiving neurons on your desk so that they are separated from each other by a small gap. This gap is called a **synapse**.



4. Use the information in the ***Biology Brief: Neurons*** reading to place the **white structure label** cards in the correct boxes on the sending neuron diagram.

5. Call your teacher over to check your work. TEACHER INITIALS _____

Part 2: What are the functions of the parts of a nerve cell?

1. Read the ***Biology Brief: Neurons*** again. This time, underline the information in the reading that indicates functions of each part of a neuron.

2. Use the information in the ***Biology Brief: Neurons*** reading to place the **blue function cards** on top of the matching white structure cards. For example, place the blue "controls life activities card" on top of the white "nucleus" card.

3. Look at the beads (red, yellow, and white) in the bag. Which color of bead do you think best represents a neurotransmitter (chemical signal molecule) that would work to send a chemical message from the sending neuron to the receiving neuron? _____ Explain why you selected this bead.

   _____

4. Add neurotransmitter molecules to your model by placing one of the colored of bead that you selected (in question 3) into each of the vesicles.

5. Call your teacher over to check your work. TEACHER INITIALS _____

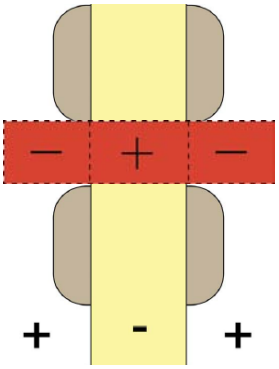
Part 3: How do nerve cells communicate?

1. Use the information in the ***Biology Brief: Two Types of Neuron Signals*** reading to answer the following questions.

2. What are two names for the <u>electrical</u> signal that is conducted along a neuron called?

   _____ or _____

3. Place a red "Impulse" card on one of the dendrites on the sending neuron model. Slide the red impulse card from the dendrite to the cell body, to the axon and to the terminal branches. *Hint: As the impulse travels along the axon, you should arrange the impulse card as shown in the diagram on the right.* **Stop** at the terminal branches because an impulse cannot jump across the synapse (gap) that separates the two neurons in your model.



4. The <u>outside</u> of the neuron that is <u>not</u> conducting an impulse will have a _____ (negative or positive) charge.

5. An impulse (action potential) could be described as area of _____ (negative or positive) charges that travel over the <u>outside</u> of the neuron.

6. Why can't an impulse pass directly from one nerve cell to another?

   _____

7. When the impulse reaches the terminal branches, the vesicles release neurotransmitter molecules into the synapse. The neurotransmitter molecules then diffuse across the synapse and attach to the receptors.

   - Model the release and movement of neurotransmitters by moving the red beads out of the vesicles in the terminal branches, across the synapse, and into the binding sites on receptors of the next neuron.

8. What is the chemical signal that diffuses across the synapse from a sending neuron to a receiving neuron called?

   _____

9. What causes the sending nerve cell to release a chemical message into the synapse?

   _____

10. Which part of the model represents a neurotransmitter—the chemical signal that carries information across the synapse?

_____

11. Which part of a neuron releases the chemical message?

_____

12. When a neurotransmitter temporarily binds to the receptor, the receptor triggers the receiving neuron to make a <u>new</u> impulse that travels through the receiving neuron.
    - Place the red impulse card on the neuron and move it along the axon to the terminal branches.
    - When the impulse reaches the terminal branches, the receiving neuron becomes a sending neuron that releases its neurotransmitters to send messages to other neurons.

13. Which part of a neuron receives the chemical message?

_____

14. What happens in a receiving neuron after neurotransmitters have attached to the receptors?

_____

15. Your lab kit contains yellow beads and white beads that represent other types of molecules such as hormones or food molecules. Do you think that these molecules (yellow and white beads) could be used to carry message from the sending to the receiving cell?

_____

16. Some drugs, such as heroin and oxycontin, have a shape that is like the shape of a neurotransmitter. Imagine that someone added some green beads that were the same size and shape as the red beads to the synapse of your model. What might happen in the receiving neuron if heroin was present in the synapse?

_____

_____

17. Some drugs block the binding of neurotransmitters to receptors. Imagine that someone plugged the receptors on your model with clay. How might this affect the receiving neuron?

_____

_____

18. There are **reuptake carriers** in the terminal branches that collect neurotransmitter molecules and return them to vesicles in the terminal knobs so that the neurotransmitters do not remain in the synapse and continue to stimulate the receiving neuron.

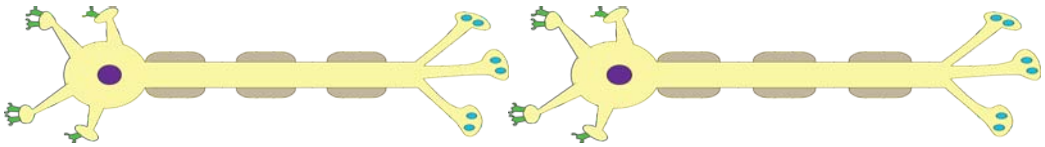
    - Act like a reuptake carrier by returning all of the beads to the vesicles in the terminal knob of the sending neuron diagram.

19. Some drugs, like cocaine, block the action of reuptake carriers. Imagine that someone plugged the reuptake carriers on your model with clay. What might happen in the receiving neuron if something blocked the action of reuptake carriers?

_____

_____

20. The diagram below shows two neurons. Draw arrows on the axons to indicate the direction that impulses would move in each of the neurons.



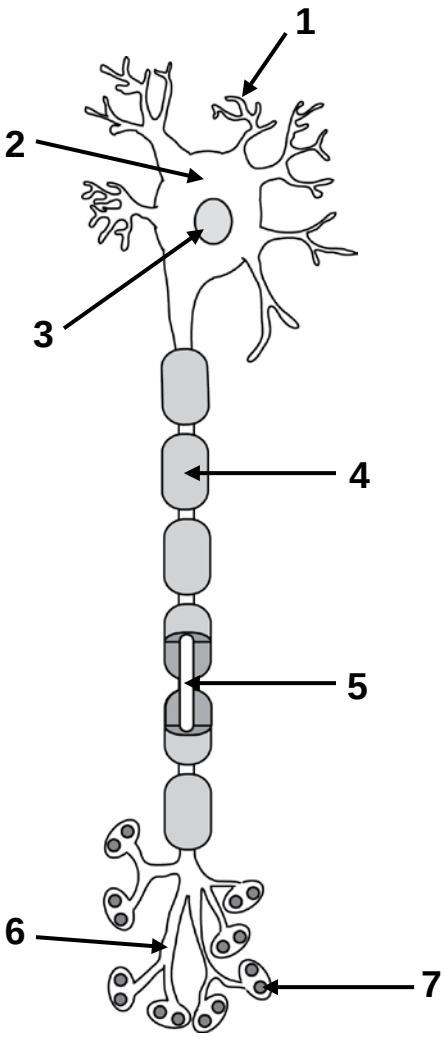
21. Explain why the impulses do not move in the opposite direction on the two neurons.

_____

_____

Part 4: Review and apply what you learned

For questions 1- 7, write the names of each of the numbered structures on the lines to the right. Refer to the information in the ***Biology Brief: Neuron*** if you do not remember the name of the structure.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

8. What is the electrical signal that is conducted by a neuron? _____

9. Which branches of neurons receive chemical signals from other neurons? _____

10. Which branches of neurons send chemical signals to other neurons? _____

11. Which branches of neurons conduct electrical impulses over long distances? _____

12. Which structure forms an insulated covering for axons? _____

13. Which structure in a neuron stores chemical signal molecules? _____

14. Which structure speeds up impulse conduction along an axon? _____

15. What are the chemical signal molecules produced by a neuron called?
_____

16. Which part of a neuron controls the life activities of the neuron? _____

17. What is the gap between two neurons called? _____

18. Which part of the neuron has receptor proteins attached to the cell membrane? _____

Base your answers to questions 19 through 22 on the information in the box on the right.

19. Which part of a neuron is like the ears of a person who is listening to a sound message?
_____

20. What acts like a sound message to carry information from one neuron to another?
_____

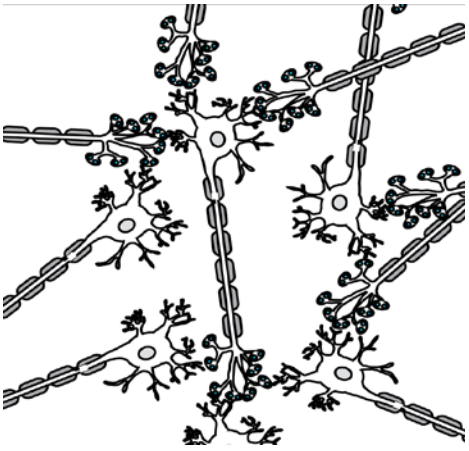
21. Do you think that a neuron can receive messages from many other neurons? Explain why or why not.
_____
_____
_____
_____

22. Do you think that a neuron can send messages to many other neurons? Explain why or why not.
_____
_____
_____
_____

People communicating

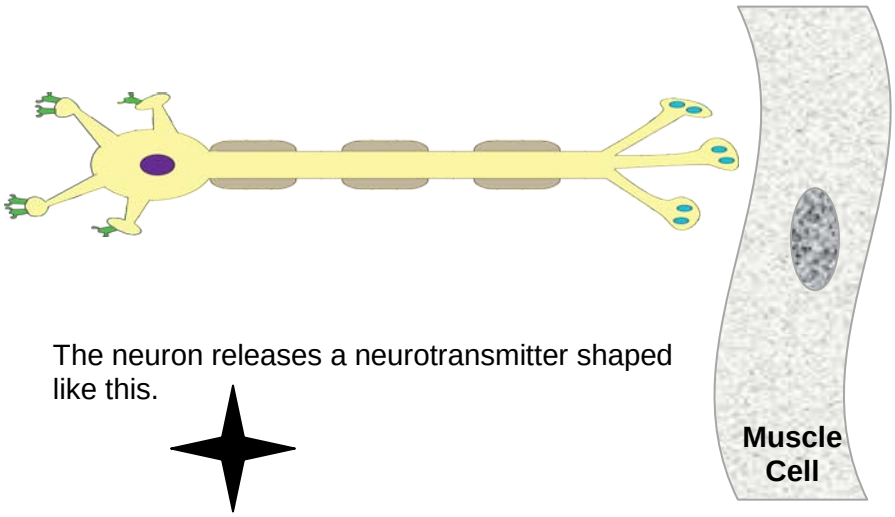
There are billions of neurons in your brain and the branching nerves in your body. Each of these neurons can form synapses with many other neurons.

Neurons communicating



23. Some neurons send messages to other neurons. Other neurons send messages to muscle cells in your body. When a muscle cell receives the message, it contracts to produce movement.

    The diagram below shows a neuron that is sending a message to a muscle cell.



    The neuron releases a neurotransmitter shaped like this.

    On the muscle cell, draw a receptor that could receive the chemical signal that causes the muscle cell to contract (get shorter).