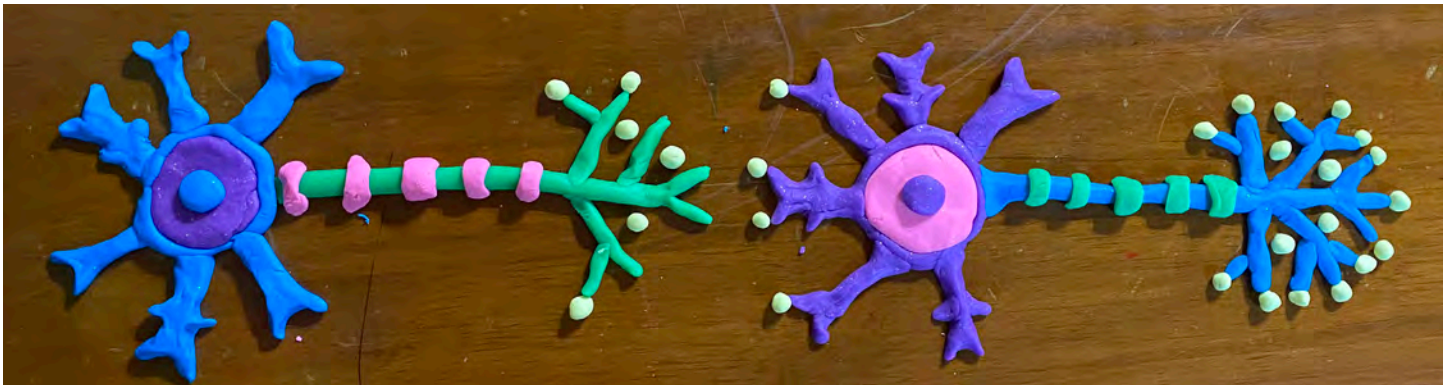
# Let's Build a Neuron with Playdough



This activity only requires playdough or clay. You can use multiple colors of playdough or a single color. If you do not have any playdough you can make some by following the receipe at the end of this activity.

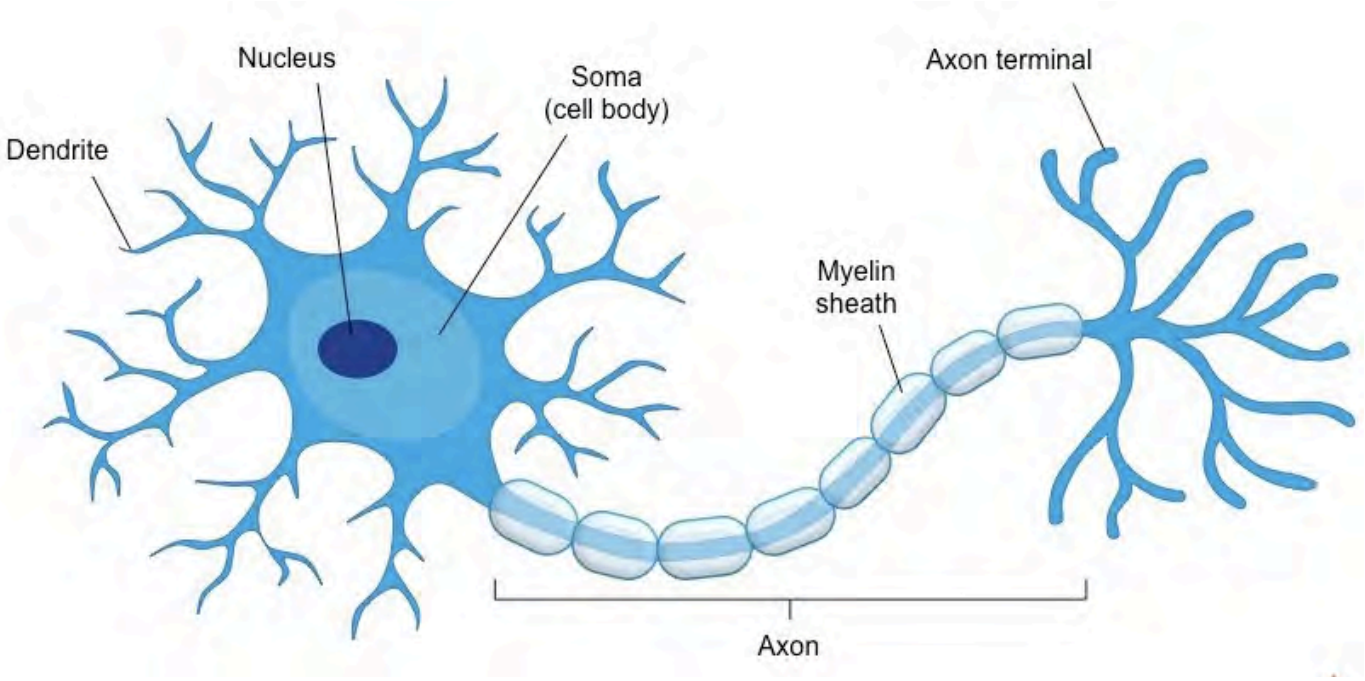
## Contents:



## What you will need:

- This Handout includes step by step instructions
- Playdough or clay

## Motor Neuron Diagram:



**Motor Neurons:**
Neurons are types of cells throughout the nervous system that send messages to one another. One type of neuron, a motor neuron, transmits signals from the brain to a part of the body by using electricity. For example, a motor neuron is how instructions to move your fingers would travel all the way from your brain to your hand. Before a motor neuron sends an electrical signal, it first receives a chemical message on its **dendrites,** which are small branches off the main **cell body**. These chemical messengers are known as **neurotransmitters** and they help information get passed between neurons. The cell body of the motor neuron then converts this chemical message into an electrical one. This electrical signal is called an **action potential**. The actional potential travels down the length of the **axon**, which is the part of the neuron responsible for carrying a signal from one end of the cell to the other. A fatty layer, or **myelin sheath,** covers parts of the axon and creates insulation that allows the action potential to move very quickly. The electrical signal can move quickly down the axon because it 'jumps' between nodes that are not covered with myelin. The action potential moves all the way from the cell body of the neuron to the **axon terminal,** which stores neurotransmitters. The motor neuron can then convert the electrical signal back into a chemical message that will be passed along to the next neuron.

## LET'S BUILD:

**Step 1:** Make a ball out of playdough and flatten into a circle. Lay the disk on the table.

This represents the **Soma or Cell Body**: the circular portion of the neuron. With the nucleus, it is in charge of the function of the cell.

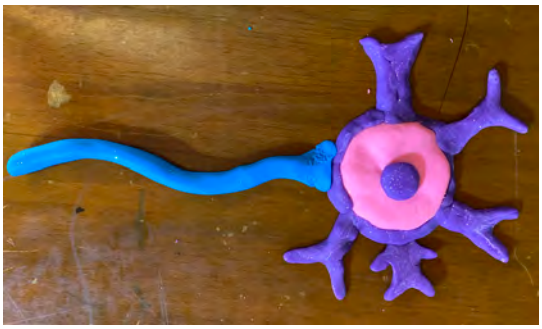
**Step 2:** Make a much smaller ball of playdough and smash into a disk. Set this disk on top of the first disk representing the nucleus.

The **Nucleus** is the organelle that is located within the cell body that holds the blueprint of the neuron or DNA.

**Step 3:** Time to get creative! Here you can roll out logs and create little tree-like branches. Then attach them around the cell body to create the Dendrites. Neurons come in lots of shapes and sizes. Make as many dendrites as you'd like!

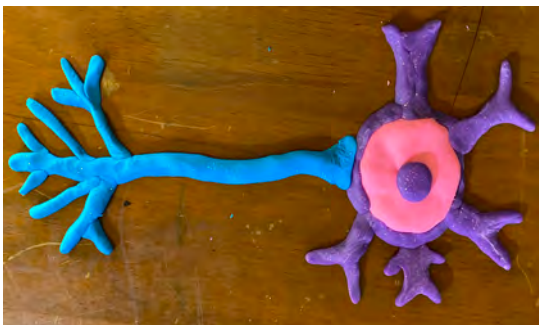
**Dendrites** receive messages from other neurons, the information on to the cell body to activate the cell.

# LET'S BUILD continued:



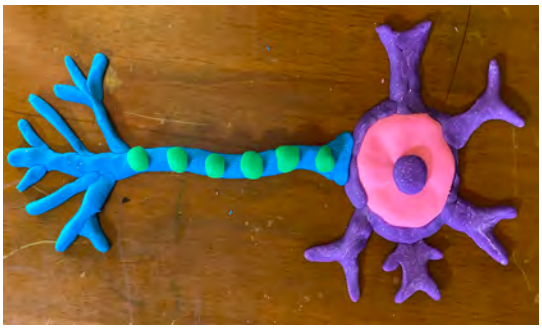
**Step 4:** Roll out a long log of playdough to attach to the cell body between dendrites to represent the axon.

The **Axon** is a long fiber from the cell body that transmits action potentials from the nucleus to the axon terminal.



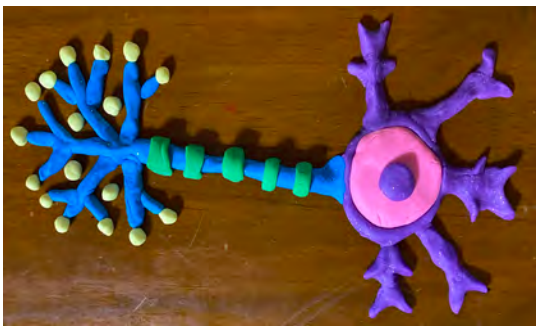
**Step 5:** Create several small rolls of playdough and attach them like branches at the end of your axon to make the axon terminals.

The **Axon Terminal** is the location where the action potentials are changed into neurotransmitters to be released to the next neuron.



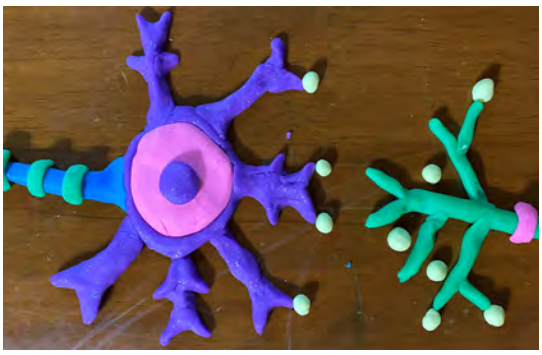
**Step 6:** make several small balls and flatten them into ovals or rectangles. Use them to wrap over your axon to represent the myelin sheath.

The **Myelin Sheath** is like insulation that surrounds the axon, helping to transmit the action potentials quickly to the axon terminal.



**Step 7:** Create several little balls of playdough and place some at the very tips of the axon terminal and some within the branches. These are your neurotransmitters.

**Neurotransmitters** are chemical messengers that move the message from the axon terminal of one neuron to the dendrites of the next neuron.

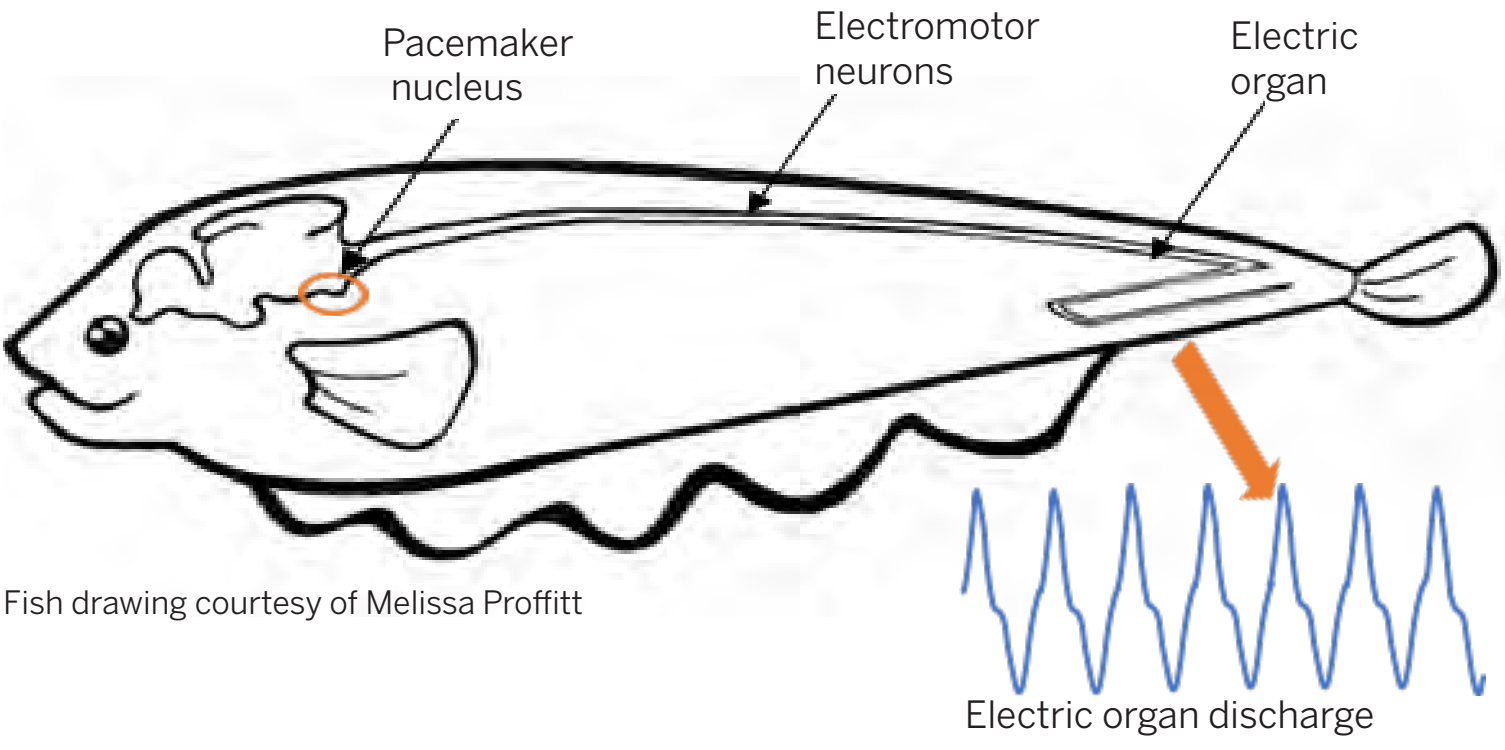


**Challenge:**
The neurotransmitters at the tips of the terminal are being released while the ones within the terminals are stored and waiting release. Make a 2nd neuron and line them up and practice jumping the neurotransmitters from the axon terminal of one neuron to the dendrites of the next neuron like you are sending a message.

# Science Spotlight: Electric Fish

We typically think that the job of motor neurons is to transmit information from our brain to our body to help us move around and interact with the world. Interestingly, some species of animals also have specialized motor neurons that can help them interact with the world in a very unique way. This is true of electric fishes, which are a group of fishes that are native to South America and includes the electric eel. However, unlike the electric eel, which produces a strong electrical current for hunting prey, most species of electric fish only produce weak electric signals. These weakly electric signals are instead used for communication and electrolocation. So, these fishes are actually using electrical signals to sense their surroundings, similar to how we use our eyes to see the world. These signals, known as electric organ discharges (EODs), are produced from an electric organ that is located in the fish's tail. EODs look very similar to sine waves and are produced at a particular rate or frequency. When there are objects in the fish's environment, the electric field they produce gets distorted and provides the fish with information about the identity of the object. Electric fish have a region in their brain, known as the pacemaker nucleus, that controls the rate of the EOD. Similar to how your brain might tell your arm to move, the pacemaker nucleus sends a message to the electric organ about how fast the EOD should be. This electrical message is transmitted along the spinal cord using electromotor neurons, which are a specialized type of motor neuron in electric fish. These unique motor neurons carry the message about how fast the EOD is from the pacemaker nucleus down the spinal cord in the form of an action potential. This signal then tells the electric organ what frequency the discharge should be.

**Click the link to learn more about Electric Fish:** Smith Lab Electric Fish Video




Fish drawing courtesy of Melissa Proffitt

# Playdough Recipe

**Ingredients:**

- 1 cup flour
- 1 cup water
- 2 teaspoons cream of tarter
- 1/3 cup salt
- 1 tablespoon vegetable oil
- Gel food coloring

**Instructions (Stovetop):**

1. Mix together all the ingredients, except the food coloring, in a medium saucepan.
2. Cook over low/medium heat, stirring. Once it begins to thicken, add the food coloring.
3. Continue stirring until the mixture is much thicker and begins to gather around the spoon
4. Once the dough is not wet, remove and put onto wax paper or a plate to cool.
5. After cooling (30 minutes) knead playdough for a few seconds. PLAY!
6. Store in an airtight container in the fridge

# Motor Neuron