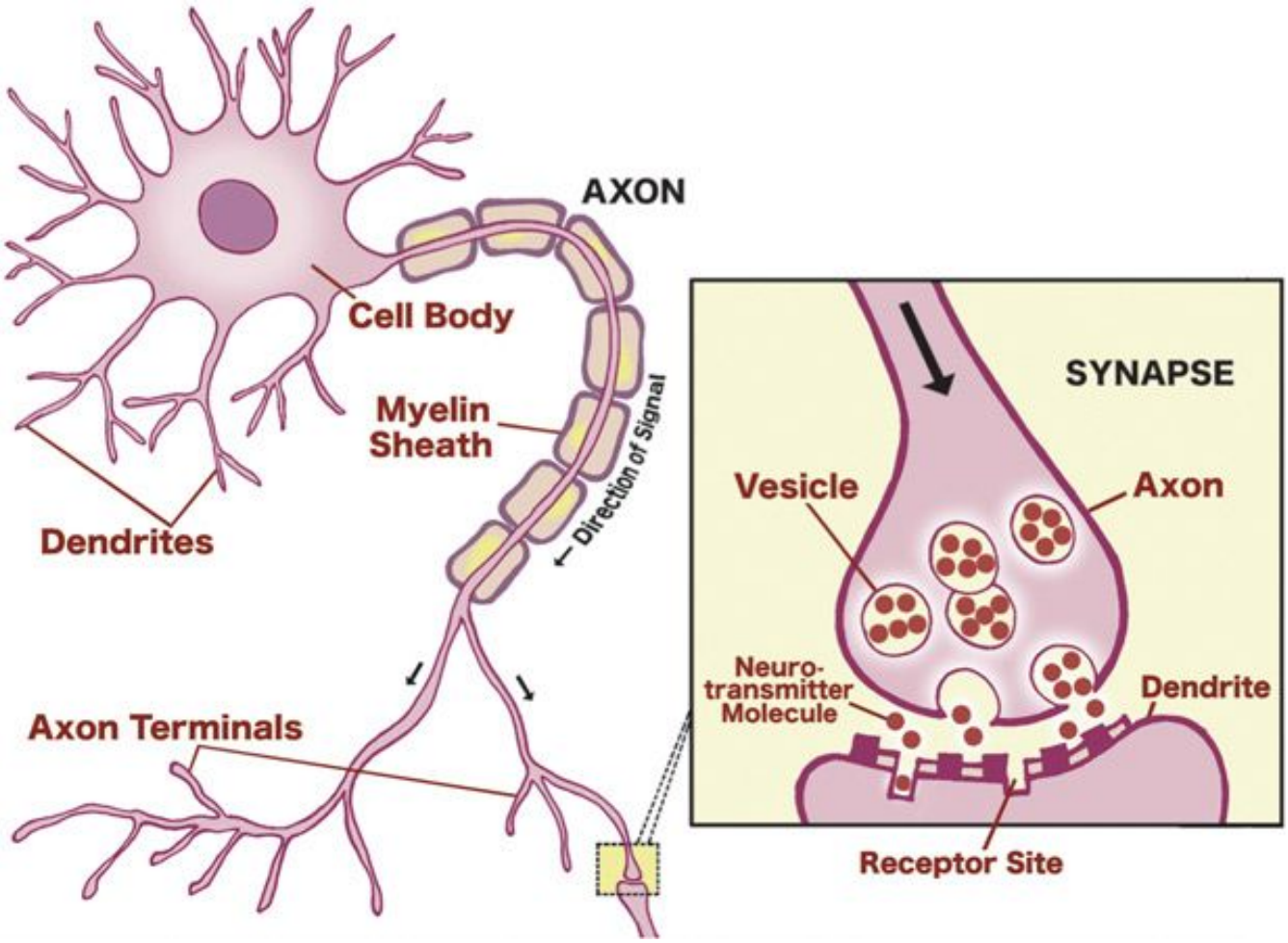
Synaptic Plasticity- Synapse Pong

What is plasticity? The brain's ability to adapt to environmental changes or a new experience is called plasticity. You need to explain some basic concepts like the parts of a neuron and that neurons use chemical signals to communicate.



Ideas:

1. We will have a poster of the parts of the neuron to help you through this part. Neurons are special cells in our brains. There are 80 billion of them!! There are different specialized parts of the neuron that allow it to do its job of taking in information, processing it, and sending it along to where it needs to be. Talk them through the parts. You can vary how long you spend based on interest and age of child.
2. Neurons in the brain use chemical and electrical signals to communicate. Electrical signals travel the length of the neuron just like electricity in your phone cable as it gets from the wall to recharge your battery. At the end of the cell, at the axon terminal, these electrical signals trigger the release of the

chemical signals (neurotransmitters) at the axon terminal/synapse. These chemicals are stored in vesicles, little containers that hold a certain number of the chemicals. In our model, you have a baggie (that is the vesicle) holding (5) cotton balls (that is the chemical/neurotransmitter). Ask them how many are in each bag. Count a couple bags. Is it always the same?

3. These chemical signals leave the cell and travel into the gap between neurons, that is called the synapse. The synapse is an actual space between the two neurons. On the posterboard in front of you on the table, you have a drawing of the synapse. You are standing on the side of the cell sending the chemical signal. We call that the presynaptic cell and you are standing in the area that would be the axon.
4. There is another cell drawn on the poster. This is the postsynaptic cell and you are looking at the dendrites. These plastic cups, these are the receptors. And you want to get the neurotransmitters into the cups just like a golf ball into the cup or a basketball into the hoop. The receptors are what receives the signal. And just like in golf or basketball, sometimes the neurotransmitters miss and are just left in the synapse.
5. When enough of the receptors get enough of the neurotransmitters, then the postsynaptic cell knows to send on the signal.
6. Let's play. You have 2 vesicles so how many cotton balls/neurotransmitters? (10). There are 5 receptors right now. You need to get one neurotransmitter in 3 receptors to send the signal on. Let's open the first vesicle and see if you can do it. (Hopefully they can, if not, open vesicle 2). When they get three in, wave your hands or snap your fingers to let them know they have activated the neuron to send the signal!
7. Now ask, what is your favorite subject in school or a hobby you spend a lot of time practicing? Ex playing the violin.
8. So when you are playing the violin, there are millions of neurons in your brain that are signaling each other. And the more you practice, the better your neurons get at signaling each other. Do you want to see one way they do this?
9. Now take a few more cups/receptors with velcro on the bottom and stick them onto the postsynaptic cell. Now you have more receptors. Ask the kid, do you think it will be easier or harder to hit three of these now? Let them play to test it out.
10. There are changes happening at the level of the synapse all the time. These changes can be very long-lasting.

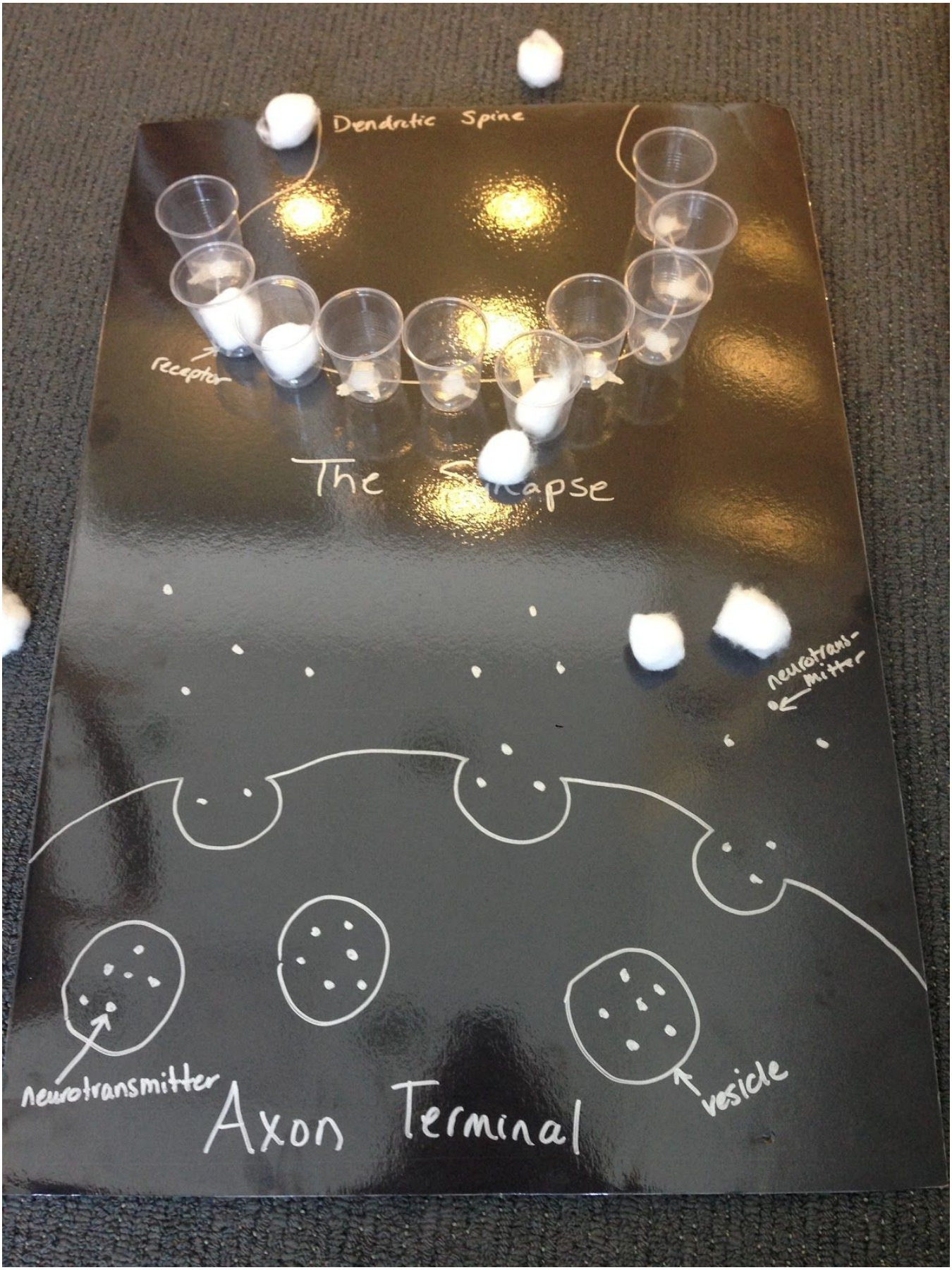

Dendritic Spine
receptor
The Synapse
neurotrans-
mitter
neurotransmitter
vesicle
Axon Terminal

Image of the board (we have 2). Participant will stand at the axon terminal side and volunteer will stand at the dendritic spine side. Not all cups/receptors should be attached to start. After step 7, instruct the participant to add more cups (or do it for them). After completing the game, reset the board to have only a few cups. Note, I also added the receptor drawings without measuring the width of the cup. You do not need to add cups to every velcro point because in some places it is tight.