

Neuron Gossip

Purpose: To demonstrate neuronal communication, specifically the concept of receptor/neurotransmitter specificity.

Materials: Tubing of different sizes (which may be made out of tin cans, paper and/or plastic), cardboard, 2 bins, tape, scissors, neurotransmitters (marbles, racquetballs, ping pong balls, large cubes, and random shapes), display poster board, markers and colored pencils.

Procedure: We will be constructing 3 “receptors” using different sizes of tubing. They will be constructed in a way that only one out of the numerous neurotransmitter options will bind correctly (see diagram). The receptors will all appear to have about the same opening size, but farther down the tube alterations of that tube will either prevent large objects from passing and/or allow small object to fall through so that only the correctly sized object will be able to make to the end of the tube (or “bind correctly”). The bulk of the tube apparatus will be obscured by a cardboard box, so the correct receptor will not be obvious to the 5th grader. The relay game we designed will require trial and error. They will know their neurotransmitter has correctly bound to the receptor because at the end of each tube there will be a window for them to see that it has made it to the correct binding site. The large neurotransmitters will have to be removed before a new one can be tried and the small ones will drop into a waste bucket behind the apparatus and we will place these back in the bin from which the children will be getting their neurotransmitters.

We will begin the demonstration by explaining that in order for brain signals to move to different parts of the body the neurons must signal to one another, but it is important that the correct signal is used. We will use the analogy that in order for people to be able to talk, the correct language must be used. We will use general pathways to demonstrate this idea. On a poster we will show pictures that will help the kids visualize motor (the brain to the arm and leg) and sensory pathways (hand to brain). We will start with this wider view then move in to show a simplified version of the nerves in the pathway. We will say that these neurons are like the people talking and the message needs to get to the hand/leg/brain. We will then zoom in again to show the actual “speaking zone” or the synapse. We will give the neurotransmitters names like “kick” so the kids can see that the neurotransmitter are the “words” the neurons are using to talk to one another. To get the kids to actually think about what they are hearing we may ask them to think about one of the pathways and what the words of the signal could be (so if we used the brain to foot example in the discussion we might ask them what the signal might be from the hand to the brain). After this explanation we will have them do a relay type game. They will be placed in three groups and line up next to the bin of neurotransmitters. Each group will have its own receptor. On the receptor box, the receptor will have pictures representing a type of pathway we described earlier. This will help tie the previous discussion in with what the students are doing in the game. When the game starts, one person at a time from each group will try to find a neurotransmitter that will “bind correctly” to their receptor. The kids will take turns until they have bound the correct neurotransmitter 3 times. The first group to do this wins the game.

Issues: The activation of the next neuron is not quite as simple as just the neurotransmitter binding, and it requires more than one receptor being active. There is more than just shape and size that are important to whether binding occurs (i.e. charge). Receptors and neurotransmitter are not always so specific that only one neurotransmitter will bind to one receptor.

Lesson Plans: The children will learn that for one neuron to communicate to another neuron, the signal from the first neuron has to be a signal that the next neuron can recognize. We will be asking them questions at the end. Some possible question:

1. What pathway did you activate? What could be the “words” be that the neurons were passing down the line? (brain to foot – kick; hand to brain – hot; brain to hand - raise)
2. What did the balls represent? (neurotransmitters)
3. What are neurotransmitters? (signals)
4. Why did this ball work here but not here (size, shape)

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