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Neuro 430

Marvelous Myelin

Purpose: to illustrate how the process of myelination increases the rate of signal transmission in the nerve. The idea of capacitance will be illustrated as a means by which myelin achieves this.

Materials: tennis balls (Na), kids, cardboard funnel, flashlight, tape, bell, timer, magnets, steel marble

Procedure: There will be two trials one after the other; the first trial will represent unmyelinated signal transmission in the nerve axon. The kids will line up in a sequence (to represent an axon). The start of the exercise will be signaled by our "activator" flashlight; the first kid will then have to bounce tennis balls to the next person, who will then pass them onto the next, etc. However, in this trial each kid will have to wait 1-2 seconds before passing it on to demonstrate charging of the membrane. The balls will be collected at the end of the series by being placed in a bucket which is situated as a balance on a fulcrum—to the other end will be a weight to raise signaling the end. The whole exercise will be timed. The myelinated trial will begin next where the children will be sectioned into a couple groups in between the start and finish. The first person will again bounce tennis balls, but this time, into the large cardboard funnels of the next sectioned groups bypassing much more space. Other kids in the group will be responsible for relaying and throwing balls to the next group until reaching the end. The balls being able to get to the end faster will take less time to sound the bell at the end showing the rise of the weight. The two times of the trials will then be compared and a discussion will then ensue as to what this experimental information means. The second part of this station will show how the myelin decreases capacitance of the membrane to make the signal conduction faster. A ramp will be constructed out of cardboard of an incline of a few degrees. In the first trial a metal ball will be rolled down and timed when it gets to the end. A second trial will have two magnets affixed to the sides of the ramp. The magnetic field will impede and decelerate the ball down the ramp causing the start to finish time to be greater than the first "no magnet" trial. We will then debrief this exercise to explain that the magnets show what happens when there is high capacitance in the membrane and since the membrane must be charged at every point before going on the signal travels much slower. Both experiments will play off each other and reinforce myelination makes signaling faster in the body.

Issues: This exercise does not address the exact ion channel mechanisms of propagating the signal—it only shows how the signal is passed on. The presence of magnets on the ramp may lead some children to believe this is the effect of adding myelin; also, the magnetic field of the magnets is not the same electrical force causing a polarized membrane, capacitance.

Lesson plan: The children should learn that myelinated neurons conduct signals faster, because this process does not make the signal "wait" for the membrane to be charged up like how the magnets made the ball roll slower. They should also gain from the first task that myelination allows for points along

the way where the signal is being jumped. We will ask them questions at the end as to why they think axons need to be faster and myelinated and explain how demyelination can cause disease such as Multiple Sclerosis, as an example to how this applies to them. Also, we will begin the exercises with a brief introduction as to what they are learning and a poster board showing the scale at which this is all happening and what the nerve axon looks like we are describing for them. A discussion as to what they learned today will end our stations.