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Neuro 430
Modeling Project Proposal
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Title: **Action Potential: GO!!**

Purpose: To demonstrate how electrical impulses, action potentials, are used to pass messages down a nerve axon. Kids will learn that the flow of sodium and potassium ions in and out of the cell propagates this action potential. Finally, they will see how useful myelin is in speeding an action potential along the axon, as compared to unmyelinated axons.

Take home message (a handy phrase for the kids to memorize): Myelin speeds action potential propagation.

Materials: Painters drop cloth (24 feet), 120 balloons (2 colors), sand, white garbage bags, Velcro, spray paint, stopwatch, poster board, permanent markers.

Procedure: In a poster “science lesson” kids will first be introduced to how messages are passed down nerve axons as electrical impulses: the action potential. They will see that some neurons are myelinated and others unmyelinated. Then they will play a relay-type game to understand that an action potential travels faster in myelinated neurons.

Game: Action Potential: GO!!

Kids play in pairs. Each pair chooses “myelinated” or “unmyelinated” conditions for their turn. Unmyelinated pairs play first. One kid stands on either side of the fabric cell membrane (either inside or outside the cell.) When “Action Potential: GO!” is called, the kid outside opens the first channel and passes Na⁺ ion balloon through one at a time (three ion balloons per channel.) As soon as he/she has “flowed” all three ions, he/she opens the next NA⁺ channel and begins again. At the same time, the kid inside the cell may open his/her K⁺ channel and “flow” his/her three K⁺ balloons outside. At each set of channels Na⁺ must “flow” all three ion balloons inside before K⁺ can “flow” outside. The pair will race down the membrane and time is stopped when the K⁺ kid finishes flowing his/her ions outside. After a few “unmyelinated” pairs play, kids are asked for a hypothesis of what will happen when garbage bag myelin sheathing covers one-half of the channels. [Action potential will go faster.] The “myelinated” pairs now play the game. Kids will see that myelin increases the speed of an action potential by comparing their game time-scores. If time remains in each session, the “unmyelinated” pairs can play again with the myelin coverings in place. The kids

could also race the college group members and choose whether they wanted to be myelinated or not.

Issues: The major topic left out of our model is depolarization. The game does not represent the electrical or concentration gradients that cause ions to flow. There are no membrane potential or equilibrium potential explanations. The resetting of the resting membrane potential through the action of Na⁺/K⁺ pumps is also not considered. Our representation of opening ion channels is oversimplified, closing them is completely ignored, and the causal relationship with depolarization is not explored. While the Na⁺ ion bags and the Na⁺ channels are bigger than those pertaining to K⁺, we do not explain that the smaller Na⁺ with associated water molecules creates the need for a larger channel. Lastly, we model how myelin creates nodes and salutatory conduction, but leave out any effects the myelin has on membrane properties (resistance and conductance.)