Cora Fix and Kelly Blindheim

My Oh Myelin!

Purpose: To demonstrate the importance of myelin in the propagation and speed of transmission of action potentials down the axon.

Materials:
Tape
Poster board
Markers
Foam tubes, boxes or anything else to simulate myelin
Ping pong balls
string

Methods:
The importance and concept behind how myelin works will be introduced by showing children how myelin concentrates receptors at nodes. Children will sit to form one line in a taped off unmyelinated nerve simulating an unmyelinated axon. Ping pong balls will be released in front of them and each student must collect 5 balls before they can transmit the signal to the next student by squeezing hands (they each are acting as voltage gated sodium channels). This must be done in proper order. Then students will cluster into groups to 2 or 3 with a piece of myelin between them. A piece of string will pass through the myelin and the first student of the second group will hold the string. When the cluster of students picks up five balls they can pull the string signaling the next group to start collecting ping pong balls. Each method of signal transduction will be timed.
Finally, myelin degeneration and its consequences will be explained. This will be demonstrated by removing a section of myelin (box and string) and replacing it with a box with more string on the inside making it take longer for the student to pull all of the string to signal the next student. Next, the section of myelin will be removed completely to demonstrate how complete demyelination can prevent signal transduction all together..

Issues: Action potential propagation is much more complicated than what will be demonstrated to the 5^{th} graders. First, many more ions such as potassium, calcium and chloride are involved besides sodium are involved in action potential propagation, but for the sake of simplicity, only sodium will be dealt with. Although the clustering of receptors works to increase the speed of A.P propagation, the myelin also increases the resistance and decreases the capacitance of the nerve membrane which consequently shortens the time constant of the nerve and lengthens the length constant. This allows for the depolarization at a node to be felt further down the axon while the time that it takes to charge the membrane to 63% of its total value is decreased. This creates a neuron that has faster more effective depolarization. As far as demyelination is concerned, the model in which more string is added is not a perfect analogy to what actually happens in demyelination where current is lost through the membrane.