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Reflexes and Why We Have Them

Purpose: We will demonstrate the different types of neurons (sensory, motor, and interneurons) using the knee-jerk reflex arc as a model system. We selected the knee-jerk reflex since children are familiar with this test at the doctor's office.

Materials: Tennis balls, baseballs, PVC tubing, surgical tubing, ruler, paper, cardboard, rubber mallet, ruler.

Procedure: We will make a Rube Goldberg-type contraption to help 5th grade students visualize what happens in a simple reflex arc. The contraption will be set up so we can demonstrate the reflex with or without the inhibitory signal sent to relax the hamstring muscles. Each student will use the rubber mallet to hit the patellar tendon on the paper knee. This will release the loaded tennis ball, sending the ball up the PVC pipe. The ball represents the sensory signal being passed up the length of the sensory neuron (PVC pipe). The ball will strike a mechanism that will affect both the analogous motor neuron and interneuron simultaneously. For the motor neuron, a baseball will be released down a PVC pipe, returning to the leg. The baseball will roll down the other PVC tube, representing the motor neuron, striking the leg. The baseball will cause the 'leg' to kick forward, completing the reflex. The hamstring will be represented with a rubber band or surgical tubing connected to the leg. When the inhibitory signal is sent, the elasticized constraint will be removed, demonstrating the relaxation of the muscle. The students will observe the magnitude of the kick reflex using the ruler, both with and without the inhibitory signal. We will also demonstrate and discuss additional reflexes if there is enough time, including the eye blink, pupillary and startle reflexes.

Issues: This project does not focus on the specifics of intra- and inter-neuron signal transmission. Although a signal is sent to the brain, this aspect is not addressed. The motor response of excitation and inhibition is simplified. The intensity change in the reflex resulting from a stronger stimulus to the patella cannot be conveyed by this method.

Lesson Plan: Children will learn the functions of the three types of neurons, specifically their roles in the reflex arc. Their understanding will be determined by asking questions like "How do you think the inhibitory neuron affects the intensity of the reflex?", "Can you think of similar reflexes that a person might experience?", "How do you think the signals would be sent?" and "If the leg doesn't kick forward when you hit the knee, what may be the problem?" We will also ask them when they think reflexes may be important, or what may be beneficial about having reflexes.