UNIVERSITY OF NEW ENGLAND
Center for Excellence in the Neurosciences

Traumatic Brain Injury
Grades 6-8

Driving Question: What are symptoms of a traumatic brain injury and how is the head naturally designed to protect the brain?

Objectives: Students will be able to…
- Describe the role that cerebrospinal fluid has on brain anatomy and safety.
- Compare and contrast helmet use during high impact sports and activities.
- Demonstrate proper helmet fitting by explaining the "Rule of Two's".
- Describe symptoms of a concussion.

Next Generation Science Standards:
- MS- LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

Materials:
- Egg
- Helmets
- Materials to design a helmet

Procedure:
Engage: Ask the students the following questions:
- Make a list of things that your brain is responsible for.
- How do you think your brain supported in the head?

Explore:
- Egg Drop Cerebrospinal Fluid (CSF) Discussion
- Helmet Safety Fitting Demonstration/ Brain Injury Discussion
- Post-Traumatic Brain Injury Cranial Nerve Exam Demonstration

Explain:
- Egg (CSF) Demonstration
    - Show the egg to the students, and ask them to describe the egg. What is inside? How is the egg protected?

    - Think of CSF like an egg: the yolk represents the brain, the egg white is the CSF and the shell is the skull. The CSF allows the yolk to move around but keeps it protected within the skull.
    - The shell of the egg is similar to your head in that it provides protection for the yolk (brain) but still needs to be protected.
    - What is an easy way to protect our brain? (Wear a helmet!)
    - Place the egg in the plastic box with the styrofoam. Tape the egg in securely and ask for a student volunteer to drop the egg wearing the "helmet".
        - The egg was saved because it was wearing a helmet! If the egg breaks or falls out, explain that helmets aren't 100% guaranteed to prevent injury, but they help make the injury much less than it would be without it.
    - Repeat, but place the egg in a plastic bag so it is not "wearing a helmet" and ask a student volunteer to drop the egg.
- Helmet Safety
    - Helmets are specially designed for head protection. A helmet that has been in an accident should not be used again.
    - Describe activities in which we wear helmets. Are all helmets alike? How are they different?
    - If you had to redesign a helmet, how would you design it so that it is even better at protecting the brain?
    - Explain the "Rule of Two's"
- Traumatic Brain Injury
    - Brain injury is more common than you think. Name a very common brain injury (concussion). What does the word *traumatic mean?* How do you know when someone has had a concussion? What are the symptoms?
    - Symptoms include:
        - Dizziness
        - Nausea
        - Fatigue
        - Confusion
        - Stumbling/ loss of balance
        - Pupil dilation changes
        - Changes in hearing
        - Changes in smell
        - Changes in tactile (touching) sensation

Elaborate:

- Egg (CSF) Demonstration
    - The *choroid plexus* in your brain creates cerebrospinal fluid. It supports, nourishes, and takes care of waste.
    - Cerebrospinal fluid surrounds the brain so that it can "float" and have shock absorption.
- Helmet Safety

    - Rule of Two's: two finger width from the top of the eyebrow to the helmet brim, two fingers between the chin and chin strap, and two fingers width between the earlobe and corner of the two straps.
- Traumatic brain injury:
    - Brain injury can be anything between a minor hit to the head to a traumatic injury. A common example of a TBI is a concussion. Students should be able to easily relate to this due to personal experience or through witnessing a concussion. Move on to discuss cerebrospinal fluid.
    - For more information, visit **http://www.cdc.gov/concussion/index.html**

Evaluate:

- Did the CEN Outreach volunteer teach the student objectives?
- Did the CEN Outreach program reach the goals of the teacher?
- Did the CEN Outreach program reach it's own goals/objectives?

NGSS Description:

- MS- LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

Students will demonstrate MS-LS1-8 when they learn about traumatic brain injury. Symptoms of a concussion and how the sensory receptors are affected by the concussion are discussed.