



LESSON PLAN: Grab Your Helmet

Topic: The Importance of the Skull as a Protector of the Brain

Subject | Stream: Anatomy

Grade Level: Junior to Senior | Grades Grade 4 to 12

Length of Lesson: 45 Minutes

Objective(s):

- To familiarize participants with the fragility of the brain inside the skull.
- To convince participants of the importance of protecting the head with a helmet to avoid traumatic brain injury.
- To teach participants about the layers of cushioning that the human body employs to protect the brain (including the presence of cerebrospinal fluid).

Brief Summary:

This activity aims to teach students about the fragility of the brain inside its skull by comparing it to an egg that may crack under traumatic conditions.

Background Information:

The gap between the brain and skull is filled with cerebrospinal fluid to cushion the brain. While the presence of this protein-like fluid mitigates the impact on the brain, there are limits to how much protection it provides in the case of traumatic brain injury.

What is a traumatic brain injury (TBI)?

A TBI is a disruption in the normal function of the brain that can be caused by a bump, blow, or jolt to the head, or penetrating head injury. A TBI can be considered mild to severe and have wide-ranging physical and psychological effects. Some signs or symptoms may appear immediately after the traumatic event, while others may appear days or weeks later.

Physical symptoms may include: Headache, nausea or vomiting, fatigue or drowsiness, problems with speech, dizziness, or loss of balance.





Sensory symptoms may include: Sensory problems, such as blurred vision, ringing in the ears, a bad taste in the mouth or changes in the ability to smell, sensitivity to light or sound.

Cognitive, behavioural or mental symptoms may include: Loss of consciousness for a few seconds to a few minutes, no loss of consciousness, but a state of being dazed, confused, or disoriented, memory or concentration problems, mood changes or mood swings, feeling depressed or anxious, difficulty sleeping or sleeping more than usual.

How are brain tumours and brain injuries connected?

Although brain tumours are not caused by a TBI, a brain tumour can cause TBI-like symptoms for someone depending on the location of the tumour in the brain and / or any side-effects from brain tumour treatment. These side-effects could be short-term or lifelong.

Resources | Materials Required per Pair:

- X number of eggs (one per student or team + few extras for contingency).
- Several cups of room-temperature water (this will serve as the cushion that suspends the egg within the container; analogous to cerebrospinal fluid).
- A variety of unbreakable containers (i.e., plastic mason jars, cardboard boxes, etc.) - these containers will emulate the human skull.
- Optional: a ladder + permission to drop the eggs (in containers) from a tall place within the vicinity.

Activity Instructions:

Step 1: Ask participants to consider what would happen if they did not have a skull to protect their brain in the event of an accident.

Step 2: The facilitator must begin the activity by showcasing two demonstrations.

- a. Place an egg into a plastic mason jar that is a tad larger than the actual egg. The jar represents the skull, screw on the lid and shake. Participants should observe that shaking the 'brain' (egg) results in damage (a cracked egg).
- b. Repeat the experiment from part (a), however, this time fill the container with water. The water represents the cerebrospinal fluid that cushions the 'brain' (egg) so that when the container is shaken again, there is no resulting 'brain damage'.

Step 3: Participants are expected to test the following hypothesis: *a combination of protein-like cerebrospinal fluid and the human skull protects the brain from impact.* This hypothesis





will be tested by dropping the egg from a standard height in three different conditions.

- a. In the first condition, participants must fill a plastic mason jar with room-temperature water (simulating the presence of cerebrospinal fluid) and place the egg in the center of the jar. Tighten the lid and drop the container from a standard height. Note any observations: did the egg crack? did the egg suffer any damage?
- b. In the second condition, repeat part (a) but this time, do not include water. Did the egg crack without the presence of a fluid cushion when dropped from a standard height?
- c. In the third condition, repeat part (b) but this time, placing the egg in the center of a cardboard box. The importance of this condition is to extend the importance of the human skull as a physical barrier to protect the brain.

Step 4: All conditions in step (3) may be adjusted to include various forms of fluid cushioning and reusable container forms.

Step 5: The facilitator must conclude the experiment with a follow-up discussion that addresses the importance of protecting the head with a helmet to avoid traumatic brain injury → relate back to the experiment and demonstrations to argue this point.

