Protecting Your Brain: The Egghead Bicycle Helmet

Your brain experiences countless forces every day of your life, in everything you do: running up the stairs, turning your head, even bumping your head against a cabinet door. But these activities don't normally injure the brain. That's because the skull and a series of protective membranes and fluids beneath it shield the brain from the bumps and other stresses of daily life. In a sudden impact, however, a sharp blow can cause serious injury to the brain. In this activity, you will investigate how model bicycle helmets provide protection from the forces generated during an impact, such as falling from a bike onto the pavement.

Procedure

Round 1—First Egg

1. Work with a partner. Place each of three eggs inside a plastic sandwich bag and then wrap each bag in two layers of paper towel. Staple or tape the paper towel layers to the sides and top of the bag. Leave a space on the top edge of the bag so you can peek in after each drop.
2. Drop one of these "eggheads" from a height of two centimeters. In the chart below, write "pass" if the egg survived the drop at that height, and "fail" if the egg cracked.
3. Increase the drop height by two centimeters. Repeat Step 2 and continue until the egg cracks.
4. On a separate sheet of paper, draw a table like the one below. Fill in the table for each drop.

Round 2—Second Egg

1. Use the materials your teacher provides to design and build a "helmet" to protect the second egg. Your goal is to develop a helmet that allows your egg to survive being dropped from the height that cracked the first egg.
2. Repeat Steps 2–4 from Round 1. You may make adjustments to the helmet between drops. Take notes on any changes you make to the helmet.

Round 3—Third Egg

1. Study your notes and results from Rounds 1 and 2. Design a new helmet to help your egg survive a drop from the height that cracked the second egg.
2. Repeat Steps 2-4 from Round 1. You may make adjustments to the helmet between drops. Take notes on any changes you make to the helmet.

Questions

1. Explain what the eggs, bags, and paper towels represent in your model. What does a cracked egg represent?
2. In what ways were the "helmets" you designed and built good models of bike helmets? In what ways were they unrealistic models?
3. What effect did additional padding have on the outcome of the egg drop? Why do you think padding made this difference?
4. What other types of data could you collect to understand more completely the factors that affect the brain during a sudden impact?
5. Bike helmets do reduce the risk of skull fractures and brain injuries. Yet, concussions are still common in sports in which helmets are worn. Why might this be the case?

Height	Egg in bag with paper towel ("egghead")	Egg with first helmet design	Egg with second helmet design

Note: Expand your table as needed to accommodate more heights for the drops