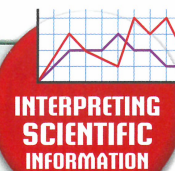


## Concussion

The following is an extract from an article in *The Irish Times* (28 August 2014) by Michel Destrade. Read the article and answer the questions below.



### A Sporting Chance Against Brain Injury

Our skulls may be hard, but what is inside is up to 20 times softer than jelly, which is why researchers are working to better understand brain trauma and how it can be avoided.

What happens when two heads collide on a hurling, rugby, soccer or other sports pitch? The human skull is particularly resistant to shocks and hard to fracture, but how tough are its contents?

When tested in the lab, brain matter turns out not to be as stiff as you might think. This softness explains why we can be vulnerable to head impacts and traumas, whether due to accidents, bomb blasts or repetitive sport moves (think of the thousands of times footballers practise headers during their careers).

At the DCU centre for medical engineering research, Dr Jerry Murphy works on measuring the engineering characteristics of brain matter. ‘Surprisingly little is known about its most basic aspects, such as its stiffness, its resistance to tear or its response to shearing or twisting forces,’ he says. ‘By measuring these, we will be able to design better body protection in cars and better helmets in sports.’

#### Helmet shortcomings

Currently, most helmets only deal with head-on impacts. They do not especially protect the area below the temporal bone on the base of the skull, which is thin and vulnerable to side impacts, nor can they protect from twisting motions, which can be very damaging to neurons – special cells that are the brain’s pathways for information.

#### Head-to-head: minimising rugby injury

Is brain matter stiffer or softer than jelly? Most people would guess the wrong answer.

When tested, brain tissue turns out to be 10–20 times less resistant to shearing forces than ordinary gelatine. Although encased in a very tough enclosure, the brain can still be shaken and stretched by pressure waves following an impact, such as those that occur accidentally on a rugby pitch. At a high enough level, the impact leads to concussion.

The mechanisms set in motion by a concussion event are not well understood. They might include high stress waves, swelling, altered biochemical signals and even damage at the neuron level.

Assessing the severity of a head injury can be difficult in the heat of a rugby game. To help with this task, both the Irish Rugby Football Union and the International Rugby Board have recently created and enforced new protocols intended to reduce the risk of a concussed player not leaving the pitch after an impact.

The pitch-side concussion assessment tool endorsed by the International Rugby Board was recently tested in a pilot study covering more than 700 matches over the last two years. Its results have just been published by the *British Journal of Sport Medicine*.

‘We were pleased to see that the International Rugby Board tool is very good at identifying and removing players with concussions, which were confirmed later by a thorough clinical judgment,’ says one of the co-authors, Prof Philippe Decq, a neurosurgeon at the Beaujon Hospital in France.

‘Although there have been some animal trials to find out what happens exactly in the brain during an injury, we do not have much information for the propagation of pressure waves in the human brain.’

### QUESTIONS

- The article states that the skull is resistant to shocks and is hard to fracture. In that case, why are head injuries in sport dangerous?
- Name three possible causes of damage to the brain mentioned in the article.
- The article mentions ‘shearing forces’. What are these? If you do not know, carry out some research on the topic.
- In what way are current helmet designs not adequate to protect the brain?
- Gelatine is the ingredient that makes jelly stiff. In what way is the human brain different to this, according to the article?
- In what way is technology being used to assess whether a rugby player who has a suspected concussion can return to the match?
- The article mentions that some animal trials have been carried out to research what happens to the brain during injury. How do you think these trials might have been carried out? What is your view on the ethics of this?