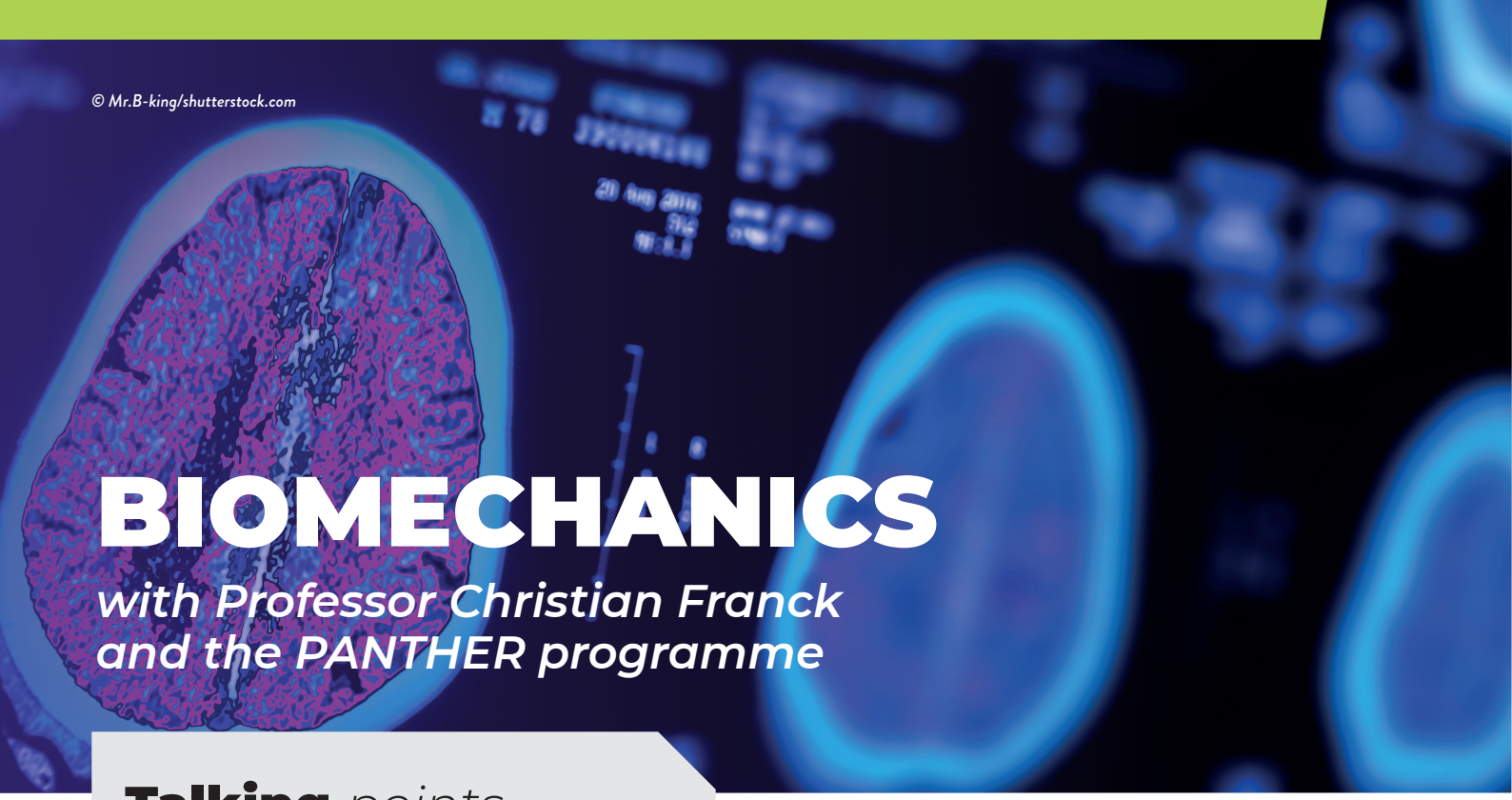

BIOMECHANICS

with Professor Christian Franck and the PANTHER programme

Talking *points*

KNOWLEDGE

1. Roughly how many neurons are in the human brain?
2. Name three neurodegenerative diseases.

COMPREHENSION

3. What are the differences between primary and secondary injuries?
4. Why is it so important to detect asymptomatic traumatic brain injuries (TBIs)?

APPLICATION

5. If you saw someone hit in the head by a basketball, how could you tell if they were suffering from a concussion?
6. What factors would affect how a medic might decide to treat a TBI? For example, in what way would a medic treating a military injury have to respond differently to a medic treating a sporting injury?

ANALYSIS

7. The PANTHER programme involves research from a wide range of scientific disciplines. How important has this been to the programmes' success?
8. Christian hopes that PANTHER will be able to get its first 'brain-protective' helmets to market within the next two years. How important might this be for military personnel?

SYNTHESIS

9. Working as part of an interdisciplinary team spread across the country can have its challenges. Imagine that you are in charge of such a team. How would you overcome these challenges to ensure that all of your researchers from different disciplines and institutions were working well as a team?

EVALUATION

10. How important do you think Christian's research is for people who are not in the military or do not play contact sport? Why?

Activities

1. Asking questions

Christian highlights how important it is to be curious and ask questions about how things work. There are so many things that we use in our daily lives that were designed and built by engineers, but do you know how most of them work?

Choose an item that you might find in your house or in your school that you use most days. This could be anything from a microwave to a toilet, to a television or a laptop. Imagine that you are with the person who designed the object; what questions would you ask them about how the object works?

Write a list of ten questions about your chosen item that you could ask its designer to help you figure out how the item works. Your questions could be about the design, material and function. Be curious and devise probing questions that demand detailed answers.

Once you have your list of questions, get yourself into groups of three. In your groups, discuss each other's questions and see if you can come up with answers to any of them. For more technical questions, you might need to do some online research.

2. Interdisciplinary nature of research

Christian says that one of the most important and rewarding aspects of scientific research is bringing people together from different disciplines. When people with different skill sets and backgrounds come together, real progress can be made in tackling some of society's biggest problems.

Choose a field of science that interests you. It can be anything from nuclear physics, molecular chemistry or engineering through to marine biology, anthropology or social science. There are hundreds of scientific disciplines, so have a look on the internet to explore the different options. The British Library has a useful page to start: **www.bl.uk/voices-of-science/disciplines**

Take some time to research your chosen discipline. What kinds of topics would a researcher in your discipline study? What tools and techniques might they use? How is their research applied to the real world?

Once you have chosen your discipline, organise yourselves into groups of four or five. Think of a societal problem that you want to tackle. You can choose your own or pick one from the following list: Climate change, food security, air pollution, biodiversity loss, antibacterial resistance, infectious diseases, drug and alcohol addiction, the energy crisis.

As a team, think about the ways in which you could tackle this problem. Think about the knowledge and expertise that each of your disciplines brings to the table. Think about the research techniques and scientific equipment that each of you would be able to utilise. How could your disciplines work together to solve your problem?

Construct a mind map as you do this, noting down the ways in which each of your disciplines could help tackle the problem. Can you see any similarities or ways in which your disciplines could complement each other? Draw arrows between your disciplines to show how these similarities could be taken advantage of to help solve the problem. Also, think about the challenges that might arise when your disciplines work together and how you might overcome them.

3. Design a Solution

Solving global problems requires more than just thinking about them; it involves designing and implementing solutions as well.

Stay in your groups from the last activity and consider the societal issue that you were trying to solve. As a team, imagine and design a device or a machine that could help solve your issue.

For example, can you come up with a new design for farming equipment to help solve the issue of food security? Or a new product that could help slow the spread of infectious diseases? What about a new piece of technology that could help lower carbon emissions to help tackle climate change?

Sketch out your design and be as detailed as possible. What materials will it be made of? How big will it be? How will it be built? How will it be powered? How much will it cost to build? Evaluate your design. Is it realistic? Is it based on science? How successful could your design be in helping people cope with the problem?

Optional extra

1. If you have the time and resources, why not build a prototype of your design? You can build a prototype out of anything from cardboard and Sellotape to wood and metal, or even LEGO! This will help bring your design to life and give you a better idea of how it functional it actually is.

4. Look ahead

Imagine you are living 500 years in the future. What kind of technology might be available to you then? What new problems might the world be facing, and what new devices might we need to solve them?

Have some fun and sketch out your futuristic devices. Even though they may not be possible now, it is still important that your devices are based on physics and engineering principles.

More *resources*

- The College of Engineering at the University of Wisconsin-Madison often interacts with an outreach programme called Discovery Outreach, which is organised by the Morgridge institute for research and the Wisconsin Institute for Discovery: **morgridge.org/community**
- The College of Engineering also offers outreach programmes to local schools, youth clubs and other educational organisations: **engineering.wisc.edu/departments/biomedical-engineering/about/community-outreach-programs**
- The University of Wisconsin-Madison runs a free summer residential programme that seeks to introduce participants to computer modelling and simulation techniques: **sbel.wisc.edu/procsi**
- The American Society for Mechanical Engineering has an option for student membership and it runs student competitions and other events: **www.asme.org/membership/student-membership**
- The Society of Women Engineers' SWENext programme is specifically designed for young women who are interested in a career in engineering. Read FUTURUM Career's article about SWENext here: **futurumcareers.com/empowering-girls-inspiring-engineers**