

BIOENGINEERING

WITH PROFESSOR PIERRE-ALEXIS MOUTHUY

Talking points

KNOWLEDGE

1. What is bioengineering?
2. What is a tendon?

COMPREHENSION

3. Why does bioengineering of tendon tissue involve incorporating mechanical stresses?
4. Why was the development of the bioreactor for tendon tissue a significant challenge for the research team?

APPLICATION

5. What questions would you ask to find out more about how 'electrospinning' works?
6. What specific results and measurements do you think Pierre and the team will be looking for as they compare their system to traditional systems that apply only linear mechanical stress?

ANALYSIS

7. What do you think are some of the advantages and disadvantages of using either stem cells or tenocytes as the starting point for a tendon tissue culture?
8. The research team partnered with a company specialising in humanoid robotics. What applications do you think such robots have outside of bioengineering?

EVALUATION

9. Many bioengineering projects involve years of expensive and time-consuming research and testing before they can be applied within clinical medicine. What arguments do you think research teams such as Pierre's use to secure and justify the funding they receive?
10. Nicole mentions challenges surrounding accessibility for people with disabilities within universities and research institutes. What do you think some of these challenges might be, and what are some possible solutions?

Activity

Pierre says that his team's research is still preliminary, with years to go before it is likely to be included within clinical treatments. Imagine the world 20 years into the future, and write a short story or news report about a scenario where the team's research findings are being applied in the real world.

Consider:

- What does the treatment/bioengineering innovation look like?
- Has the team's research led them to what they predict/hope for, or has it taken a different direction?
- How might other scientific/technological advancements in related fields affect your story/report?
- Could it be possible to bioengineer 'augmented' tissues in the future with better properties than the originals? What societal or ethical issues might this raise?

If you are writing a story, think about:

- who your protagonist (main character) will be – a patient, clinical doctor or a bioengineer?
- your story arc - what are the main events at the beginning, the middle and the end?

If you are writing a news report, think about:

- the who, what, where, when and why of what you are informing your reader about – what makes this event news-worthy?
- the comments and opinions Pierre or Nicole of the future might contribute to your report? Which other experts could you quote?
- the implications for the future. Is this an ongoing news event that you will be updating your readers on?

Share your story or report with a classmate, and read or listen to theirs:

- What are the interesting similarities or differences in the creative choices you have both made?
- To what extent are you in agreement about where you see bioengineering leading in the future?

More resources

- This video from Nature provides a fascinating insight into the work of Pierre and his team to combine tissue culture and robotics:
www.nature.com/articles/d41586-022-01491-8
- This Nature paper provides an in-depth insight into the research team's work and their findings so far:
www.nature.com/articles/s44172-022-00004-9
- The Bioengineering and Translational Medicine journal features hundreds of open-access papers on all aspects of bioengineering:
aiche.onlinelibrary.wiley.com/hub/journal/23806761/homepage/productinformation.html
- This article from the Royal Society of Biology provides a different insight into the field of bioengineering and careers in the area:
thebiologist.rsb.org.uk/biologist-features/spotlight-on-bioengineering