

Master's student Anita Ebrahemyan Masihi tests her electronic circuit board prototype in the lab. Essential tools such as power supplies and oscilloscopes are routinely used in the field of bioelectronics.

Biomedical engineering

with Professor Benoit Gosselin,
Félix Chamberland and
Michelle Janusz

Talking points

Knowledge

1. What are smart biomedical microsystems?
2. What is a myoelectric prosthesis?

Comprehension

3. Why is interdisciplinary collaboration so important in biomedical engineering?
4. How is Félix training the artificial intelligence (AI) system in his smart prosthetic hand?
5. How does the technique of optogenetics work?

Application

6. How do you think the development of smart prosthetic hands/arms might differ to the development of smart prosthetic legs/feet?
7. How do you think Michelle's smart vertebra implant could result in future treatments for chronic pain?
8. How have advances in AI opened new possibilities for biomedical engineering? What further potential can you think of beyond those explored in the article?

Evaluation

9. What ethical concerns do you think the team needs to consider, in terms of the involvement of humans in their research? How do you think these concerns are addressed?
10. What major advances in biomedical engineering do you anticipate in the next decade? What benefits would these devices bring to society?

Activities

1. Choose one of the projects explored in the article:

- A smart prosthetic hand
- A smart vertebra implant

On a large piece of paper, draw an annotated diagram of your chosen biomedical device. Use the article and online resources (e.g., find out more from the lab's website: biomicrosystems.ca) to inform your diagram. Make sure to address the following questions within your diagram:

- What are the components involved in the device?
- What is the smart biomedical microsystem involved?
- Where and how does the device interact with the body?
- How does the device process inputs?
- How does the device respond?
- What skills are needed for the development of each labelled component?
- What are the real-world advantages of the device?

When you are finished, find a classmate who chose the other device. Share your diagrams and use them as a tool for comparing the two devices. What further questions do you have about these devices and their development?

2. Chose a medical condition (e.g., a specific disease or injury) and design a smart biomedical device to address it.

What challenges does the condition cause the patient, and how could a smart biomedical device help to overcome these challenges? Using inspiration from the devices being developed in the Smart Biomedical Microsystems Laboratory and your own creativity and imagination, sketch a labelled diagram of your device. What disciplinary expertise will be needed in the collaboration to create your device?

More resources

- Visit the team's Futurum webpage to read the article in French: futurumcareers.com/how-is-ai-improving-smart-biomedical-devices
- This video from CrashCourse gives an overview of biomedical engineering and its importance for society: [youtube.com/watch?v=O6IENrRANxY](https://www.youtube.com/watch?v=O6IENrRANxY)
- Learn what a career in biomedical engineering could involve: cmbes.ca/about/what-is-a-biomedical-engineer
- The EMBS is the world's largest international society of biomedical engineers: embs.org