Hacking the Code of Life: An Introduction to Biotech and Computational Biology

Description

Biology governs how we work and function, but we don't understand enough of it. Computation and technology have been increasingly applied in biology to model complex biological systems, as well as design solutions for disorder and disease. For example, how can we identify the genetic patterns that are responsible for a disease? Can we model the connections and dynamics between neurons in the brain? How can we build a predictor to design the optimal drug for a specific disease?

In this workshop, you will begin to answer these questions and gain insight into how you can use your engineering and tech skills to solve the toughest problems in biology and medicine.

Learning Outcomes

After this workshop, you will be able to:
- Map out the emerging fields in biotech and why they are important
- Understand with concrete examples of how computer science and engineering principles can be applied to advancing biology
- Gain insight into how to get involved in biotech and explore it further

Prerequisite Knowledge

No past biology knowledge or coding experience required.

Technical Jargon and Definitions

- **Biotechnology**: the use of cutting-edge biological tools, engineering, and technology to make new discoveries and advancements in biology and medicine.
- **Computational Biology:** the application of computational tools and techniques to model, simulate, and predict complex biological systems and processes.
- **Bioelectronics**: the application of electrical engineering principles to create new diagnostic and therapeutic applications

- **Nanotechnology**: the manipulation of matter on a near-atomic scale to produce new structures, materials and devices
- **Biomanufacturing**: the application of biological systems to produce commercially important biomaterials and biomolecules for use in medicines, food and beverage processing, and industrial applications
- **Neuroscience**: the study of the brain and how it works
- **Neurotechnology**: the application of engineering and technology to predict the state of the brain, recover lost function, or enhance human capabilities

Timeline (1 Hour)

Time	Module	Description
10 min.	Why I'm in biotech	The stories behind the driving force that got me started and keeps me going in biotech, my career journey thus far and where I'm headed.
5 min.	What is biotech	A high level overview of the biotech field in the context of engineering.
20 min.	What biotech can solve	Emerging fields in biotech and two concrete examples of computational biology and how technology can be used to understand and solve biological problems.
5 min.	Why we need you in biotech	A call-to-action to join the biotech field!
10 min.	How to get involved in biotech	A guide on how to get started in biotech, including where to find communities, events, courses, and job opportunities.
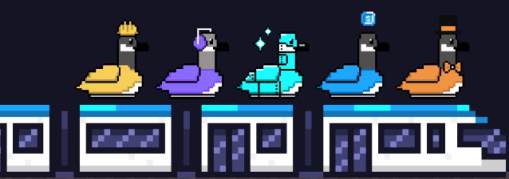
Workshop Lead Contact

Jennifer Tsai
jennifer.tsai11@gmail.com LinkedIn Twitter

Additional Resources

Hack the North Resources

Hack the North 2023 Event Schedule

Check this out to stay up-to-date on activities, workshops, and other key happenings this weekend.

Workshop-Specific Resources

How to Get Involved

- Biotech In a Nutshell
- List of Unsolved Problems in Biology (Wikipedia)

Connectomics

- Google Colab interactive code tutorial
- Graph theory and connectomics: an introduction
- Connectome: Graph theory application in functional brain network architecture
- Connectomics and graph theory analyses: Novel insights into network abnormalities in epilepsy

RNA Folding

- RNAFold interactive web server
- mRNA-based therapeutics: powerful and versatile tools to combat diseases
- Review of machine learning methods for RNA secondary structure prediction
- RNA secondary structure prediction with convolutional neural networks
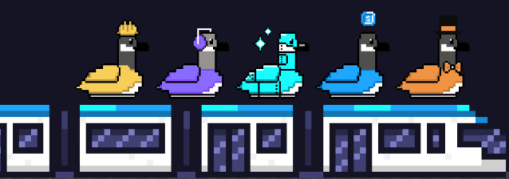
- [Prediction of RNA-protein sequence and structure binding preferences using deep convolutional and recurrent neural networks](#)

More Google Colab code tutorials

- [Alphafold (protein folding) example](#)