BIO-493

Scientific project design in integrative neurosciences

Cursus	Sem.	Type
Life Sciences Engineering	MA1, MA3	Opt.
Neuro-X minor	H	Opt.
Neuro-X	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Lecture	1 weekly
Exercises	3 weekly
Number of positions	**20**

It is not allowed to withdraw from this subject after the registration deadline.

Remark

Pas donné en 2024-25. only one registration per student to a scientific thinking course

Summary

This course will provide a forum in which students engage themselves in learning how to design an integrative neuroscience research project that bridges scales to allow a causal mechanistic analysis of brain function.

Content

Unraveling the mysteries of the brain involves exploring it at different scales and with different modalities whether this is in experiment, theory or simulation. While a faithful description at any single scale or modality is already challenging, the most formidable aspects of this quest is how to do this in an *integrative way*. In this course, students will work in teams spending the semester together to design a scientific project demonstrating the *bridging of scales* and amenable to *causal argumentation*. The project shall describe the design of a proposed study encompassing experimental and computational elements. We will focus on the causal analysis of neuronal circuit function underlying reward-based learning and context-dependent sensorimotor processing in head-restrained mice.
A further key goal of this course is to stimulate independent student thinking and to enhance problem solving capabilities. In addition, the course provides an important component of working together with other students as a team. Learning to organize team work and to recognize strengths of team members is therefore also a critical component of the project success.

Keywords

Innovation, group work, scientific study design in neuroscience, causal mechanisms of brain function

Learning Prerequisites

Recommended courses

BIO-482 Neuroscience: cellular and circuit mechanisms

Learning Outcomes

By the end of the course, the student must be able to:

- Analyze scientific papers and understand their methods
- Integrate information across different conceptual levels in neuroscience
- Design new experiments to test specific hypotheses
- Design a computational setup to complement analysis of experiments or formulation of experimentally testable hypotheses
- Analyze scientific papers and understand their methods
- Investigate information across different conceptual levels in neuroscience
- Design new experiments to test specific hypotheses
- Design a computational setup to complement analysis of experiments or formulation of experimentally testable hypotheses

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Set objectives and design an action plan to reach those objectives.
- Communicate effectively, being understood, including across different languages and cultures.
- Give feedback (critique) in an appropriate fashion.
- Demonstrate a capacity for creativity.
- Demonstrate the capacity for critical thinking
- Make an oral presentation.
- Write a scientific or technical report.
- Communicate effectively, being understood, including across different languages and cultures.

Teaching methods

The teachers and students will discuss topics in weekly meetings.
Students will work together in groups of ~5 people to solve the selected challenge.

Expected student activities

Students need to develop an idea that they will explore in more detail through literature searches, with teachers providing advice and guidance.

Each group of students should jointly write a ~20 page report.

Each student should give a ~20 minute oral presentation.

Assessment methods

The oral presentation will account for one-third of the final grade.
The written report of the group will account for two-thirds of the final grade.

Resources

Moodle Link

- https://go.epfl.ch/BIO-493