BIOENG-518

Methods: from disease models to therapy

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Cursus	Sem.	Type
Life Sciences Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Withdrawal	Unauthorized
Session	Summer
Semester	Spring
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	1 weekly
TP	3 weekly
Number of positions	**24**

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

Summary

This course will describe methods underlying translational approaches from disease modeling and characterization to therapeutic applications. The presented techniques will be complemented by hands-on rotations in the technological platforms of the School of Life Sciences.

Content

The first part of the course will cover methods for developing disease models, using examples from SV labs. It will introduce key techniques for model characterisation, focusing on imaging methods, and outline approaches for therapeutic applications, discussing their rationale, uses and limits. In the second part, students will take part in hands-on rotations at technological platforms to apply the theory in a lab environment.
Topics covered:
Animal models
- Basis of the legal and ethical framework of research with animals in Switzerland
- Generation and phenotyping of mouse models
- In vivo imaging techniques
Histology
- General introduction into diverse techniques used to prepare samples for bright field microscopy
- Procedures for standard histology stains
- Detection of proteins and mRNA, multiplexing, spatial omics
Light-microscopy
- Introduction into light-microscopy
- Types of microscopes used to assess histological samples in a fast and reliable manner
- Image analysis, strategies to classify tissue samples
Transmission and scanning electron microscopy
- Basic principles of electron microscopy
- Sample preparation and imaging
- Image interpretation
Biomolecular integrative structural biology
- 3D high-resolution characterization of biological macromolecules
- X-Ray crystallography, single-particle Cryo-EM and Bio-NMR
- Introduction to 3D protein structure software and modeling tools as well as data interpretation
Academic drug discovery
- Introduction to the early drug discovery process: Basics of chemical libraries, medicinal chemistry and hits to leads
- High-thoughput molecular screening assays
- Advanced cellular models (3D formats and organoids)
Gene therapy

- Principles of gene delivery and its therapeutic applications
- Introduction to vector technologies and production methods
- Introduction to genetic manipulations in the context of gene therapy

Keywords

Animal models
Imaging
Drug discovery
Gene therapy

Learning Outcomes

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

- Choose the appropriate model to study a selected biological question
- Select appropriately histological and imaging technique(s) to design relevant experiments
- Describe the drug discovery process
- Illustrate the possibilities and limitations of gene therapy
- Contextualise theoritical and technical concepts of covered techniques

Transversal skills

- Use a work methodology appropriate to the task.
- Collect data.
- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Evaluate one's own performance in the team, receive and respond appropriately to feedback.

Teaching methods

7 weeks of common theoretical lectures
6 weeks of practical rotation sessions in small groups in scientific platforms

Assessment methods

Reports covering rotations in platforms and written exam.

Supervision

Office hours	Yes
Assistant.e.s	Yes
Forum	No

Resources

Websites

- https://www.epfl.ch/research/facilities/histology-core-facility/
- https://www.epfl.ch/research/facilities/ptbiop/
- https://www.epfl.ch/research/facilities/biological-electron-microscopy/
- https://www.epfl.ch/research/facilities/ptpsp/
- https://www.epfl.ch/research/facilities/biomolecular-screening/

Moodle Link

- https://go.epfl.ch/BIOENG-518