

BIOENG-420

Single cell biology

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Cursus	Sem.	Type
Computational and Quantitative Biology		Opt.
Life Sciences Engineering	MA2, MA4	Opt.
Minor in life sciences engineering	E	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	3 weekly
Courses	3 weekly
Number of positions	

Summary

The students are exposed to experimental and analytical approaches specific to single cell biology, with an emphasis on quantitative aspects.

Content

The course is organized in four parts, each containing alternating lectures and journal clubs presented by the students in a 1:1 ratio (see Teaching methods below for more details). Part 1 (weeks 1-4) will focus on the fundamental and biomedical research values of single cell genomic and transcriptomic analyses. Part 2 (weeks 5-8) will focus on dynamic analysis of gene expression, signaling and cell fate choices in single cells. Part 3 (weeks 9-10) will focus on engineering approaches to single cell analysis. Finally, part 4 (weeks 11-12) will focus on non-genetic heterogeneity in bacteria and its consequences. Week 13 will consist of a half-day symposium featuring external and internal speakers (week 13) and an oral exam (week 14).

Learning Outcomes

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

- Explain the limitations of bulk analysis that can be overcome by single cell analysis
- Explain the advantages and limitations of single cell analysis in gathering quantitative data
- Explain how single cell analyses can have diagnostic or biomedical value
- Propose experimental approaches to investigate phenotypic heterogeneity in a cell population
- Propose experimental approaches to investigate temporal fluctuations in gene expression
- Propose experimental approaches to investigate cell fate choices and bacterial resistance to drugs at the single cell level

Assessment methods

Oral exam during the semester

Resources**Moodle Link**

- <https://go.epfl.ch/BIOENG-420>