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. |

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|---|---|
| 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

Contents:
1. Use of single-cell transcriptomic technologies and analyses in fundamental and biomedical science

2. Dynamic analysis of gene expression, signalling and cell fate choices in single cells

3. Single-cell and Spatial metabolomics to reveal cellular heterogeneity in biology

4. Single-cell Genomics Technologies to study gene regulation

5. Single-cell Multiomics and Data Integration across technologies

6. Mini-Symposium with external Speakers

## Keywords

Single Cell Technologies, Multiomics, Metabolomics, Transcriptomics, Genomics

## 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

## Teaching methods

The course is organized in three main parts, each containing alternating lectures and journal clubs presented by the students in groups or computational exercises. Half-day symposium featuring external and internal speakers.

## Assessment methods

50% graded computational exercises and journal clubs
50% Final exam

## Resources

### Moodle Link

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