

BIOENG-421

Basics in bioinstrumentation

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Cursus	Sem.	Type
Biomedical technologies minor	H	Opt.
Electrical and Electronical Engineering	MA1, MA3	Opt.
Life Sciences Engineering	MA1, MA3	Opt.
Robotics	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Withdrawal Session	Unauthorized Winter
Semester Exam	Fall During the semester
Workload	120h
Weeks	14
Hours	4 weekly
Courses	1 weekly
Exercises	1 weekly
Lab	2 weekly
Number of positions	18
It is not allowed to withdraw from this subject after the registration deadline.	

Summary

This combined practical and theoretical course will provide the basics in bioinstrumentation, including the construction of a droplet-microfluidic workstation for high-throughput, single-cell analysis. Many of the learned concepts are equally applicable to other widely used lab instruments.

Content

This interdisciplinary course is based on lectures covering the theoretical aspects and introducing common design principles in bio instrumentation.

In parallel, the students work in teams to present the basic working principles of an instrument of their choice (to be approved) and to build a droplet microfluidic work station from the ground up. A detailed and comprehensively illustrated protocol (including animations) will help to successfully implement all practical tasks.

Keywords

- High throughput fluorescence analysis
- Single-cell assays
- Microfluidics
- System engineering
- Hands-on practice
- LabVIEW control software

Learning Prerequisites**Required courses**

none

Learning Outcomes

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

- Design an instrument converting a cellular feature (e.g. an enzymatic activity or the presence of a surface receptor)

into an electric signal that can be quantified and processed to provide active feedback loops (e.g. to trigger cell sorting)

- Conduct microfluidic experiments
- Construct a prototype and characterize the performance
- Have basic knowledge about other types of lab equipment
- Describe the basic working principles of other lab equipment

Transversal skills

- Collect data.
- Make an oral presentation.
- 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 with professionals from other disciplines.
- Write a scientific or technical report.

Teaching methods

- Teaching is done through interactive lectures, including case studies presented by the students
- In parallel, the students go through a hands-on practical session every week ("learning by doing"), comprising the construction of a fully functional bioinstrument

Expected student activities

Prepare a blueprint for a droplet microfluidic workstation, based on a comprehensive protocol

Present a bioinstrument of your choice (to be approved), based on comprehensive literature search

Construct a functional bioinstrument, collect data, present results in oral and written form

Assessment methods

Presentation of a bioinstrument of your choice (to be approved; Group activity, 30%)

Construction of a fully functional microfluidic instrument, presentation of experimental results (Group activity; 30%), submission of a written report (Group activity, 20%)

Q & A sessions with individual students at the very end of the course (Individual activity, 20%)

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Notes/Handbook

Protocols, slides and literature will be made available on Moodle