

BIOENG-408

Synthetic and applied microbiology

Jeschek Markus

Cursus	Sem.	Type
Chimiste	MA2, MA4	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	Oral
Workload	90h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Synthetic microbiology aims at constructing microbes with new-to-nature functions to provide sustainable solutions for societal challenges such as climate change, resource scarcity and disease. This demands engineering of microbial systems on all levels of the central dogma with predictable outcome.

Content

This course covers state-of-the-art approaches and technology for the engineering of synthetic microbial systems. It will cover the following topics:

- highly-parallelized gene synthesis
- whole-genome assembly and re-coding
- next-generation sequencing
- mutagenesis tools
- engineering and directed evolution of gene regulation, proteins/enzymes, genetic circuits and metabolic pathways
- high throughput screening technology
- data-driven modelling for prediction and design (AI)

The topics will be introduced in an interactive lecture format and discussed in the context of current primary literature with student involvement in the exercises.

Keywords

synthetic biology, microbiology, directed evolution, protein engineering, metabolic engineering, bioprocesses, gene editing, next-generation sequencing, high-throughput experiments, machine learning in biology

Learning Prerequisites**Required courses**

Students should have basic knowledge in biology and chemistry, and should have completed Bachelor-level courses in biochemistry, chemical biology, biotechnology/bioengineering, cell biology or alike.

In cases of questions about the prerequisites, please contact Prof. Markus Jeschek via E-Mail briefly outlining your experience and previously completed courses in this context.

Teaching methods

Combination of interactive lectures and exercises with student presentations on primary literature underlining the topics from the lecture.

Expected student activities

active participation in the lecture and discussions; exercises: reading/presentation of primary literature on distributed topics in student teams

Assessment methods

Oral examination, student presentations

Supervision

Office hours	No
Assistants	Yes
Forum	Yes
Others	A moodle forum for questions is available.

Resources

Notes/Handbook

There is no single textbook that covers all the subjects for this course. Lecture slides and presentations combined with personal notes and self studying are thus the most useful resource and cover all relevant learning topics.

Slides are posted in advance of each lecture in moodle (link will be provided in the course).

Moodle Link

- <https://go.epfl.ch/BIOENG-408>