

ChE-421

Advanced principles and applications of systems biology

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Cursus	Sem.	Type
Biotechnology minor	E	Opt.
Ing.-chim.	MA2, MA4	Opt.
Sciences du vivant	MA2, MA4	Opt.
Systems Engineering minor	E	Opt.

Language of teaching	English
Credits	3
Session	Summer
Semester	Spring
Exam	During the semester
Workload	90h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Project	2 weekly
Number of positions	

Summary

This course is a natural continuation of Principles and Applications of System Biology (ChE-411). The goal of this course is to introduce to students systems engineering methodologies as a tool for the study of complex biological networks.

Content

Specific topics include:

mathematical and computational analysis of metabolic reaction networks with focus on dynamic behavior of (bio)chemical reaction networks including feedback analysis, multi-stability and higher-level circuit properties such as robustness and retroactivity; Network motifs; Probabilistic approach to analysis of biological networks and Bayesian networks.

Systems of study:

metabolic pathways, signaling networks, genetic regulatory networks.

Learning Prerequisites**Recommended courses**

ChE-411 Principles and Applications of Systems Biology

Important concepts to start the course

For the computational exercises, MATLAB® will be used intensively.

Learning Outcomes

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

- Analyze quantitatively functioning of complex biological networks
- Construct computational models of cellular functions
- Identify recurring network motifs in biological networks
- Describe and analyze basic feedback systems appearing in living organisms
- Compare and implement current state-of-the-art tools for network analysis

Transversal skills

- Make an oral presentation.

- Summarize an article or a technical report.
- Use both general and domain specific IT resources and tools
- Set objectives and design an action plan to reach those objectives.

Assessment methods

Continuous control exam

Supervision

Office hours	Yes
Assistants	Yes

Resources

Bibliography

An Introduction to Systems Biology: Design Principles of Biological Circuits by Uri Alon
Systems Biology in Practice: Concepts, Implementation and Application by Klipp et al.

Ressources en bibliothèque

- [An Introduction to Systems Biology / Alon](#)
- [Systems Biology in Practice / Klipp](#)

Moodle Link

- <http://moodle.epfl.ch/enrol/index.php?id=13979>