

PHYS-302

Biophysics : physics of biological systems

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Cursus	Sem.	Type
Biomedical technologies minor	H	Opt.
Computational and Quantitative Biology		Opt.
Ing.-phys	MA1, MA3	Opt.
Life Sciences Engineering	MA1, MA3	Opt.
Mechanical engineering	MA1, MA3	Opt.
Physicien	MA1, MA3	Opt.
Physics of living systems minor	H	Opt.
Physics		Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	4 weekly
Lecture	2 weekly
Exercises	2 weekly
Number of positions	

Summary

Understand and use the results and methods of population genetics, population dynamics, network theory, and reaction network dynamics to analyze and predict the behavior of living systems

Content

Master equation, population genetics, finite populations, genetic drift, stochastic modeling, fluctuating environments

Introduction to networks, dynamics on networks

Biochemical reaction networks, Michaelis-Menten kinetics, cooperativity, autoregulation, feedback and bistability, switches, oscillations, feed-forward loop network motif, stochastic gene expression, causes and consequences of stochastic gene expression, robustness

Keywords

physics of living systems, population genetics, population dynamics, genetic networks, systems biology

Learning Prerequisites**Recommended courses**

physics, mathematics, and biology at the introductory university level

Learning Outcomes

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

- Analyze biological dynamics
- Solve the Master equation in different contexts
- Formulate dynamical equations describing biological systems

Teaching methods

Flipped classroom, lectures (online and in person), in-person discussions, discussions of research articles, problem solving

Expected student activities

attend lectures, watch online lectures, complete exercises, read and present recent papers in the field

Assessment methods

40% homework, 60% final project

Supervision

Office hours	Yes
Assistants	Yes

Resources

Moodle Link

- <https://go.epfl.ch/PHYS-302>