BIO-243 **Physical biology I**

De Los Rios Paolo

Cursus	Sem.	Type
Life Sciences Engineering	BA5	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

This course aims at introducing the basic notions of equilibrium and non-equilibrium statistical mechanics that are necessary to formulate quantitative, rigorous and predictive models of biological systems. Formal lectures will alternate with applications to biological systems and with exercises.

Content

1. Introduction: the need for a probabilistic description of biological systems
2. The formalism of statistical mechanics: free energy, Boltzmann distribution, partition function
3. Diffusion and transport
4. Rate equations: connection between equilibrium and kinetics; what is the rate?
5. Electrostatics in physiological solutions
6. Macromolecular crowding: the complex cytoplasm
7. Non-equilibrium processes in the cell: using energy to beat the second principle of thermodynamics

Learning Prerequisites

Required courses

All the general physics and analysis courses; probability and statistics.

Learning Outcomes

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

- Solve models of biological systems
- Develop models of biological systems

Assessment methods

Written exam

Resources

Notes/Handbook

Notes will be distributed by the instructor.