MICRO-391 **Interfaces in biology and nanoscience**

Roke Sylvie

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

A biological system is composed of water, macromolecules and interfaces. Processes inside the cell depend on biomolecular interactions that are decomposed into elementary physical and chemical interactions. Organizing, quantifying, and contextualizing these interactions are the course objectives.

Content

Introduction and numerical aspects
Driving forces in biological systems
Langmuir films; surfaces in 2D and electrical aspects
Water
Interfaces in 3D: self-assembly
Techniques to probe interfaces
State of the art

Learning Prerequisites

Important concepts to start the course

Thermodynamics, partial properties, Boltzman distribution, Chemical structural elements (pi bonds, H bonds), intergartion, differentation

Learning Outcomes

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

- Recognize the following interactions to liquids and biomolecules: Charge-charge, Charge-dipole, Dipole-dipole, Hydrogen bonding, Dispersive interactions
- Characterize how the intermolecular interactions between many molecules are coming together on an interface and how interfacial properties can be measured.
- Quantify the relevant molecular forces and interactions in a liquid system exemplary of a biochemical system
- Contextualise a biological situation into a physic-chemical description
- Assess / Evaluate the combined interactions on the molecular level and estimate the driving force for nanoparticle formation and self-assembly of micelles, liposomes and other membrane structures.
- Apply abstract rules in a systematic matter to a liquid system and calculate simple predictions about the stability
- between abstract concepts learned in math, physics and chemistry and apply them to a situation in a cell.
- Analyze a biochemical molecule, a solution or an interface and be able to determine what the important characteristics and interactions are.

Teaching methods

Lectures, exercises, projects

Expected student activities

Students are expected to studye the book as instructed during the course, the are encouraged to make the exercises during class and part of the course may consist of the students contributing to the exam material

Assessment methods

There will be one exam. During the semester there will be opportunities to make exercises that are typical exam questions. The teaching assistants will be present for providing feedback.
One bonus point can be awarded from assignments during the semester, which entitles the student to add maximum one point to the final grade.

Resources

Bibliography

Jacob N. Israelachvili, Intermolecular and Surface Forces, Third Edition, Copyright © 2011 Elsevier Inc.
ISBN: 978-0-12-375182-9
And on occasion parts of:
Peter Atkins and Julio de Paula, Physical Chemistry 8th Edition, 2006, Oxford University Press
ISBN: 9780198700722

Ressources en bibliothèque

- Atkins' physical chemistry / Atkins
- Intermolecular and Surface Forces / Israelachvili

Moodle Link

- http://: http://moodle.epfl.ch/course/view.php?id=13711