**Interfaces in biology and nanoscience**

**Cursus**
Ingénierie des sciences du vivant  
Sem.: BA5  
Type: Opt.

**Language**: English  
**Credits**: 4  
**Session**: Winter  
**Semester**: Fall  
**Exam**: Written  
**Workload**: 120h  
**Weeks**: 14  
**Hours**: 4 weekly  
**Lecture**: 2 weekly  
**Exercises**: 2 weekly  

**Remarque**
Pas donné en 2018-19

**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, differentiation

**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 study 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
And on occasion parts of:

Ressources en bibliothèque
• Intermolecular and Surface Forces / Israelachvili
• Atkins' physical chemistry / Atkins

Moodle Link
• http://moodle.epfl.ch/course/view.php?id=13711