

PHYS-301

**Biophysics : physics of the cell**

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Cursus	Sem.	Type
Biomedical technologies minor	E	Opt.
Life Sciences Engineering	MA2, MA4	Opt.
Mechanical engineering	MA2, MA4	Opt.
Physics of living systems minor	E	Opt.
Physics	BA6	Opt.

Contact language	English
Credits	3
Session	Summer
Semester	Spring
Exam	Written
Workload	90h
Weeks	14
<b>Hours</b>	<b>3 weekly</b>
Lecture	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**Summary**

In this course we will study the cell (minimum unit of life) and its components. We will study several key cellular features: Membranes, genomes, channels and receptors. We will apply the laws of physics to develop models to make quantitative and predictive statements.

**Content****Introduction to cell biophysics**

Topics (lectures):

1. Biological membranes: Hydrophobic effect, 2D elasticity (2-4)
2. Molecular events: Ligand binding, ion channel function (5-7)
3. Transport in cellular systems: Diffusive, directed, crowded (8-11)
4. Genomes: 1D elasticity, regulation, transcription, synthetic biology (12-14)

Content:

1. Introduction of biological systems and concepts
2. Description of observations and measurements
3. Estimates of relevant numbers / development of quantitative models
4. Exposure to current research articles

**Learning Prerequisites****Recommended courses**

Mathematics and physics courses of the 1st and 2nd years

**Learning Outcomes**

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

- Elaborate a model of a biophysical phenomena
- Develop hypotheses to simplify a model of a biophysical phenomena
- Solve the mathematics necessary to construct a model of a biophysical phenomena
- Critique the results of a model of a biophysical phenomena
- Apply models to solve problems and applications

**Teaching methods**

Ex cathedra and exercises in classrooms

### Assessment methods

Written exam

### Supervision

Others                      No

### Resources

#### Bibliography

Lectures notes and list of recommended books  
Moodle: slides, exercises and their solutions

#### Notes/Handbook

- Physical Biology of the Cell, Rob Phillips et al, 2013 Garland Science

#### Moodle Link

- <https://go.epfl.ch/PHYS-301>