# Molecular Biophysics
(5 ECTS, 2nd semester)

## I. Molecular Machines

1. Introduction to molecular devices: examples.
2. Generic ingredients in machines: the cycle and its steps.
3. Physical elements of molecular machines: forces and Langevin equation.
4. Chemical elements of molecular machines.
5. Energy sources: ATP hydrolysis and ion flux.
6. Phenomenology of some molecular machines.
7. Modelling.

## II. Biophysics of Nucleic Acids

1. DNA topology
2. RNA
3. Structural transitions in nucleic acids

## III. Protein structure and function

1. The chemical bond
2. Notions of organic chemistry
3. Protein structure
4. Thermodynamics of protein folding
5. Kinetics of protein folding
6. Protein function
7. Simple theoretical approaches
8. Atomistic simulation of proteins

**Core Bibliography**

1. Stryer; Berg; Tymoczko; *Biochemistry, 6th ed (*W. H. Freeman; 2006)
2. M. B. Jackson, *Molecular and cell biophysics (*Cambridge, 2006).
3. K. Dill and S. Bromberg, *Molecular Driving Forces* (Garland Science, 2002)

**Other references**

4. Alberts et al., *Essential cell biology*, (Garland Science, 1998).
5. J. Howard, *Mechanics of motor proteins and the cytoskeleton*, Sinauer Associates Inc. (2001).
6. P. Nelson, *Biological Physics*, W. H. Freeman and company (2004).
7. R. J. Nossal and H. Lecar, *Molecular and cell biophysics*, Addison Wesley (1991).
8. K. Sneppen and G. Zocchi, *Physics in molecular biology*, Cambridge (2006).
9. C. R. Calladine and H. R. Drew, *Understanding DNA*, Academic press (1997).
10. J. Watson et al, *Molecular biology of the gene*, Benjamin Cummings (2004).
11. K. E. Van Holde, W. C. Johnson and P. S. Ho, *Principles of Physical biochemistry*, Pearson education (2006).
12. T. Schlick, *Molecular modeling and simulation*, Springer Verlag (2002).

13. R. Zwanzig, *Nonequilibrium statistical mechanics*, Oxford University Press (2001).
14. M. Duane, *Molecular Biophysics: Structures in Motion*, Oxford University Press (1999).
15. Gregory A. Petsko and Dagmar Ringe, *Protein Stucture and Function* (Primers in Biology), (New Science Press, 2003).
16. Alan Fersht, *Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding* (Freeman, 1998)
17. Clayden; Greeves; Warren; and Wothers; *Organic Chemistry* (Oxford University Press, 2000)