

Structure and Dynamics of Biomolecules

I. Biomembranes

Cell membranes, membrane models, self assembly, hydrophobic effect, lipid bilayers, lipid polymorphism, phase diagrams of lipid mixtures.

Physical methods for studying structural and dynamic properties of membranes (DSC, PPC; FTIR-, NMR- and fluorescence spectroscopy, FRET, FRAP; SAXS, TRSAXS, AFM, fluorescence microscopy).

Effects of additives on membrane structure and dynamics (sterols, anesthetics, peptides, ...).

Non-lamellar lipid phases; membrane fusion.

Lateral organization of membranes (domains, rafts).

Dynamic and thermomechanical properties of membranes, shape transformations.

Lipid-peptide interactions, membrane proteins, membrane transport.

Applications: drug delivery.

II. Proteins

Protein stability, free energy landscape.

Folding kinetics, folding theories.

Methods for folding studies (DSC, fluorescence, FTIR- and CD spectroscopy, TR XRD)

Cosolvent effects, Hofmeister series.

Misfolding and amyloidogenesis of proteins (e.g., Alzheimer, Diabetes mellitus).

Conformational dynamics; Single molecule techniques.

Molecular dynamics computer simulations of biomolecules.

Text books:

O. Mouritsen, *Life - as a Matter of Fat*, Springer-Verlag, Heidelberg, 2005.

T. Heimburg, *Thermal Biophysics of Membranes*, Wiley-VCH, Weinheim, 2007.

PhysicsB. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter, *The Cell*, GS Garland Science, Taylor & Francis Group, New York, 2002.

R. Winter, F. Noll, *Methoden der Biophysikalischen Chemie*, Teubner, Stuttgart, 1998.

J. N. Israelachvili, *Intermolecular and Surface Forces*, Academic Press, London, 1992.

D. Boal, *Mechanics of the Cell*, Cambridge University Press, 2003.

R. Lipowski, E. Sackmann (Hrsg.), *Structure and Dynamics of Membranes*, Vol. 1, 2, Elsevier, Amsterdam, 1995.

G. Cevc, D. Marsh, *Phospholipid Bilayers*, John Wiley & Sons, New York, 1987.

R. B. Gennis, *Biomembranes*, Springer-Verlag, New York, 1989.

P. Yeagle, *The Structure of Biological Membranes*, CRC Press, London, 1992.

L. Tamm, *Protein-Lipid Interactions*, Wiley-VCH, Weinheim, 2005.

P. L. Luisi, P. Walde (Eds.), *Giant Vesicles*, John Wiley & Sons, Chichester, 2000.

B. Nölting, *Protein Folding Kinetics*, Springer, Heidelberg, 1999.

A. Fersht, *Structure and Mechanisms in Protein Science*, W. H. Freeman, New York, 1999.

T. E. Creighton, *Proteins. Structures and Molecular Properties*, W. H. Freeman & Co., New York, 1993.

C. Branden, J. Tooze, *Introduction to Protein Structure*, Taylor & Francis, New York, 1999.

M. Daune, *Molecular Biophysics*, Oxford University Press, Oxford, 1992.

K. E. van Holde, W. C. Johnson, P. Shing Ho, *Physical Biochemistry*, Prentice Hall, New Jersey, 1998.

Original papers are cited during the lecture.