

Structure and Dynamics of Biomolecular Systems

- Aspects of Theoretical Biophysical Chemistry -

Synopsis:

- Dynamics and Transport: random walks in biology, diffusion, FRAP, fluctuations (FCS), QENS, MD, conformational and reaction dynamics
- Single-molecule techniques, high resolution microscopic techniques
- Crowding effects, cosolvent effects, Hofmeister series
- Protein stability, free energy landscape, folding kinetics, folding theories, fast reaction techniques
- Misfolding and amyloidogenesis of proteins (e.g., Alzheimer's, Diabetes mellitus type II)
- Molecular associations and interactions, binding studies (SPR, ITC, etc.)
- Cell membranes, membrane models, lateral organization, dynamical and thermomechanical properties of membranes, shape transformations, membrane fusion
- Lipid-peptide interactions, membrane proteins, membrane transport
- Applications: e.g., drug design - thermodynamics and delivery

Text books:

R. Winter, F. Noll, C. Czeslik, *Methoden der Biophysikalischen Chemie*, Teubner+Vieweg, 2. Auflage, 2011

K. A. Dill, S. Bromberg, *Molecular Driving Forces*, Garland Science, London & NY, 2011

R. Phillips, J. Kondev, J. Theriot, H.G. Garcia, *Physical Biology of the Cell*, Garland Science, London, 2013

M. B. Jackson, *Molecular and Cellular Biophysics*, Cambridge University Press, 2006

J. Kuriya, B. Konforti, D. Wemmer, *The Molecules of Life*, Garland Science, London & New York, 2013

C. R. Cantor, P. R. Schimmel, *Biophysical Chemistry* I, II, III, Freeman, San Francisco, 1980

K. E. Van Holde, W. C. Johnson, P. S. Ho, *Principles of Physical Biochemistry*, Prentice-Hall, 1998

H. C. Berg, *Random Walks in Biology*, Princeton University Press, Princeton, 1993

Israelachvili, *Intermolecular Forces & Surface Forces*, Academic Press, New York, 1992

M. Daune, *Molecular Biophysics*, Oxford University Press, Oxford, 1999

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

J. R. Lakowicz, *Principles of Fluorescence Spectroscopy*, Springer Verlag, New York, 2006

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

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

D. Boal, *Mechanics of the Cell*, Cambridge University Press, 2012

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

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

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

B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter, *The Cell*, GS Garland Science, 2002

Original papers are cited in class.