

Membrane Biophysics

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Contents:

Introduction: cell membranes, membrane models.
Intermolecular forces, hydrophobicity, physical properties of water.
Self assembly, lipid bilayers, lipid polymorphism, lipid phase diagrams.
Physical methods for studying structural and dynamic properties of membranes (DSC, PPC, SAXS, FT-IR, ²H-NMR, AFM, fluorescence microscopy, FCS, ...).
Effects of additives on membrane structure and dynamics (sterols, ions, peptides, ...).
Non-lamellar lipid phases, kinetics of lipid phase transitions, membrane fusion.
Lateral organization of membranes (domains, rafts).
Dynamical and thermomechanical properties of membranes.
Lipid-peptide/protein interactions.
Membrane proteins, membrane transport.
Applications: drug delivery, anesthesia, etc.

Text books:

T. Heimburg, *Thermal Biophysics of Membranes*, Wiley-VCH, 2007
R.B. Gennis, *Biomembranes*, Springer-Verlag, New York, 1989.
O. Mouritsen, *Life - as a Matter of Fat*, Springer-Verlag, Heidelberg, 2005.
B. 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.
G. Cevc (Hrsg.), *Phospholipids Handbook*, Marcel Dekker Inc., New York, 1993.
P. Yeagle, *The Structure of Biological Membranes*, CRC Press, London, 1992.
L. Tamm, *Protein-Lipid Interactions*, Wiley-VCH, Weinheim, 2005.
C.R. Cantor, P.R. Schimmel, *Biophysical Chemistry*, Vol. 1-3, W.H. Freeman & Co., San Francisco, 1980.
C. Tanford, *The Hydrophobic Effect: Formation of Micelles and Biological Membranes*, John Wiley & Sons, New York, 1980.
P.L. Luisi, P. Walde (Eds.), *Giant Vesicles*, John Wiley & Sons, Chichester, 2000.

Original papers are cited during the lecture.