

Introduction to molecular biophysics and general biology

II semester

Wednesdays, 11 a.m. - 1 p.m. (two lecture hours with a break), room B

The second semester of the course starts on October 9th, 2019

This lecture course is thought as a concise introduction into the interdisciplinary field for newcomers as well as for those who study(ied) biophysics and need some clarification, ordering and extension of their knowledge.

The full course encompasses two semesters, *ca.* 30 hours of lectures (**3 ECTS**) each. Written exams in the form of open descriptive questions are planned at the end of each semester.

The lecturers come from the Laboratory of Biological Physics (their initials are given in the last column of the table below):

prof. dr hab. Marek Cieplak	(MC)	
dr hab. Anna Niedźwiecka, prof. IF PAN	(AN)	Coordinator, e-mail: annan@ifpan.edu.pl
dr hab. Bartosz Różycki	(BR)	
dr Remigiusz Worch	(RW)	

No.	Date	Summary	Who
II semester			
Big picture of life			
1	09.10.19	The time scales of the biological evolution (I).	MC
Methods - Review of experimental methods and their applications (continued)			
2	16.10.19	1. Optical microscopy. Confocal microscopy, fluorescent proteins, small molecules and quantum dots as probes, immunolabeling. Confocal microscopy vs. hydrodynamics (FCS, FCCS). FRAP. 2. Colocalization, 3D imaging, FLIM, FRET, FLIP, FLAP, PA/PC. 3. Total internal reflection fluorescence (TIRF) microscopy.	AN
3	23.10.19	Scattering. Dynamic and static light scattering (DLS, MALS), Zimm equation, Debye plot, second virial coefficient vs. crystallization. Small-angle X-ray scattering (SAXS). Wide-angle X-ray scattering and diffraction.	AN
4	30.10.19	Surface plasmon resonance (SPR). Infrared spectroscopy, FTIR, attenuated total reflection (ATR), microwaves: electron paramagnetic/spin resonance (EPR/ESR) spectroscopy.	AN
5	06.11.19	Nuclear magnetic resonance (NMR) spectroscopy. Chemical shift, relaxation, Overhauser effect, multidimensional spectra. Structure determination of small molecules and macromolecules. MRI, fMRI.	AN

6	13.11.19	X-ray diffraction crystallography. Protein crystallization. In-house diffractometers, synchrotrons, XFELs. Structure determination of macromolecules.	AN
7	20.11.19	Electron microscopy: scanning EM, transmission EM. Negative staining and cryo-microscopy. 3D reconstruction of macromolecules. Cryo-electron tomography of cells.	AN
8	27.11.19	Single-molecule methods vs. ensemble methods. Optical tweezers. Atomic force microscopy (AFM), force spectroscopy, imaging, real-time kinetics.	AN
9	04.12.19	Mass spectrometry, isotopic envelope, proteomics, hydrogen-deuterium exchange, cross-linking, protein conformational dynamics.	AN
Towards big picture of life based on application of complementary methodological approaches			
10	11.12.19	Conformations of multi-component membranes, multi-domain proteins and multi-protein complexes.	BR
11	18.12.19	1. Spliceosome and alternative splicing. 2. Ribosome and translation. 3. Nuclear Pore Complex. 4. Membrane G protein-coupled receptors (GPCR) and signal transduction, conformational equilibria vs. drug design.	AN
12	08.01.20	Photosynthesis: photosystem II, photosystem I.	RW
13	15.01.20	The time scales of the biological evolution (II).	MC
14	22.01.20	The origin, definition and classification of life.	MC
15	29.01.20	Examples of the functions of proteins.	MC
	05.02.20	Exam (in written form, open descriptive questions)	