Course Unit Descriptor

Study Programme: BSc in Biology

Course Unit Title: Methods in Structural Biology

Course Unit Code: OB059

Name of Lecturer(s): Assoc. Prof. Edward Petri, PhD

Type and Level of Studies: Bachelor's studies

Course Status (compulsory/elective): Elective

Semester (winter/summer): Winter

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): Face-to-face

Number of ECTS Allocated: 6

Prerequisites: None

Course Aims:

Structural biology enables an understanding of the working mechanisms of the molecular components involved in biological processes. The major goal of this course is to introduce students to methods used in macromolecular structure determination and the study of their interactions, and to develop a deeper understanding of the connection between protein structure and function.

Learning Outcomes:

Following successful completion of preliminary and final exams, students will be able to:

- Understand the structural basis of biological processes, the connection between genes and the structure of biomolecules, and the structural basis of genetic conservation
- Distinguish between techniques and methods used in structural biology and evaluate their use under different conditions and for different biological problems
- Use online tools and databases for macromolecular modeling
- Create and analyze high resolution of macromolecular structures
- Critically read scientific literature containing structural information
- Understand the structural basis of bioinformatics
- Use proteomic databases from the internet (PDB, SWISS PROT, NCBI, BLAST, EBI....) necessary for research in modern biology.

Syllabus:

Theory

Methods for determination of protein structure, dynamics and interactions. Heterologous expression and protein purification. Protein crystallization. Protein structure determination. Parameters of structure quality. Nuclear magnetic resonance (NMR). Electron microscopy (cryoEM). Isothermal calorymetry titration (ITC). Fluorescence spectroscopy (FRET/BRET). Circular dichroism (CD). Limited proteolysis. Protein folding, processing and degradation. Protein-protein interactions. Biology of membrane proteins. Connection between structure and funtion of proteins, nucleic acids and other macromolecules. Connection between genes and structures of biomolecules, structural basis for genetic conservation. Proteomics, structural bioinformatics and macromolecular modeling.

Practice

The practical part of the course will be organized in computer labs, combined with lectures, which will allow students to master the use of proteomic and bioinformatics internet resources and programs for 3D macromolecular visualization and analysis.

Required Reading:

1. Bourne P., Structural bioinformatics, Wiley-Liss (2003).

2. Serdyuk, I., Zaccai, N., Zaccai, J., Methods in molecular biophysics: structure, dynamics, function, 2010

3. Branden, C. & Tooze, J. Introduction to Protein Structure, 2nd Edition, Garland Publishing, New York. 4. Lucky, M. Membrane Structural Biology, Cambridge, 2010			
Weekly Contact Hours: 4	**Lectures:** 2	**Other:** 2	
Teaching Methods: Lectures, computer-based exercises, semester project, consultations			
Knowledge Assessment (maximum of 100 points):			
Pre-exam obligations	points	**Final exam**	points
Laboratory reports	20	written exam	30
Essay	20	oral exam	10
Preliminary exams	20		