Study Program: PhD in Biology

Course Title: Membrane Biology

Instructor: Dr. Anđelka Ćelić

Type and Level of Study: Doctoral degree

Status: Elective

ESPB number: 15

Requirements:

Learning Objectives:

The first biological membranes played a key role in emergence of life on this planet, by defining what is allowed into the interior of primordial cell and what is kept outside. Today's biological membranes, in addition to this role, also compartmentalize cells to provide energy by formation of ion and charge gradients, provide selective permeability, and organize and regulate many enzymes. The basic elements of membranes, cell receptors allow communication between the cell and its environment, and represent the basis for the development of multi-cellular organisms, while ion channels and transporters regulate cellular homeostasis. The goal of this course, **Membrane Biology**, is to enable students to combine knowledge of biological membranes acquired during their previous studies in biology and introduce them to detailed studies and analysis of specific elements of cell membranes, with special focus on receptors and ion channels.

Learning Outcomes:

Students are expected to master the theoretical basis of membrane biology, and become familiar with current methods and techniques used in the study of biological membranes and their elements. Upon successful completion of this course, students will be able to follow and critically evaluate primary scientific literature in this area.

Syllabus:

Theoretical Instruction

The following subjects will be covered during lectures:

- Membrane composition, diversity of lipids, bilayer structure
- Membrane models: single layer membranes, planar bilayers, liposomes, micelles, nanodiscs
- Classes of proteins that interact with membranes
- Classes of integral membrane proteins
- Ion channels: structure, function, conformational changes and oligomerization
- G-protein coupled receptors (GPCRs): structure, activation, function, regulation and signaling
- Membrane bound enzymes, transducers and transporters

Details of the course will be customized in accordance with individual student research interests, in a way that will enable in depth study of areas closely related to their own scientific research.

Practical Instruction

One of the course requirements is to write a term paper in which students will apply the theoretical aspects of this course to analyze in depth a topic in membrane biology related to their own doctoral research.

Literature:

1. Mary Luckey *Membrane Structural Biology* Cambridge 2008
2. SH Chung, OS Andersen, V Krishnamurthy *Biological Membrane Ion Channels Dynamics, Structure, Application* Springer 2007
3. I Shahidul *Transient Receptor Potential Channels* Advances in Experimental Medicine and Biology Springer 2011
4. Alan Smrcka *G protein Signaling* Methods in Molecular Biology 2004
5. IN Serdyuk, NR Zaccai, J Zaccai *Methods in Molecular Biophysics: structure, dynamics, function* Cambridge 2007

Weekly Teaching Load				
Lectures: 5	Exercises:	Other forms of teaching:	Student Research: 5	Other

Teaching Methodology

Theoretical instruction will include lectures and consultations, and practical instruction will be organized around student research.

Grading Method (Out of maximum 100 points)

Course Activities 30 points

Term paper with oral presentation 70 points