Study programme : BSc in Biology

Degree level: Bachelor degree

Course title: Techniques of Molecular Biology

Professor: dr Jelena Purać, dr Andjelka Ćelić

Elective course: elective

Number of ECTS: 5

Prerequisites:

Course objective:

The main goal of this course is to offer students theoretical and practical knowledge in experimental techniques used in molecular biology.

Course outcome:

Following succesfull completion of preliminary and final exams, students will have obtained knowledge and experience in basic molecular biology techniques that they will be able to apply to their future research in a wide range of biological laboratories.

Course content:

Theoretical part

An introduction to methods used to study nucleic acids (DNA, RNA) and proteins as informational and operating molecules in living systems, whose processes depend on their structure, function and interactions. Model organisms used to study biological phenomena in molecular biology (e.g. microorganisms, cell lines, viruses, multicellular organisms); and model organisms used for fundamental research and the production of recombinant proteins using cloned genes will be compared. We will also discuss genetically modified domestic animals, and the proper choice of model organisms in biological research. Specific methods for studying the structure and function of nucleic acids (e.g. using *E.coli*, Saccharomyces cerevisiae, plamids, bacteriophage, cosmids, and synthetic chromosomes in bacteria and yeast); as well as methods for nucleic acid isolation and purification, quantification, identification and analysis of DNA and RNA will be presented. Introduction of DNA into bacterial and mammalian cells, enzymatic manipulation of DNA and RNA molecules, methods for the construction and analysis of cDNA and genomic libraries, DNA sequencing, genetic engineering, PCR and modifications, and microarrays will also be covered. In addition, an overview of basic and current techniques used in protein analysis will be introduced, including: protein isolation, spectrophotometry, electrophoresis, protein detection and identification (ELISA, Western blotting), chromatography-based purification, analysis of postranslational modifications and proteomics. Methods for the study of protein-DNA interactions (EMSA and variations of this method, CHIP assay, DNA affinity chromatography); Protein-protein interactions (immunoprecipitation, protein fusion); Immunological methods in molecular biology (in situ hibridization, immunocytochemistry, FISH); Theoretical and experimental approaches in mouse genome analysis („knockout" mice); and the use of bioinformatics in molecular biology will be addressed.

Practical part

There will be a set of experimental laboratory classes combined with lectures: cell transformations, production and genetic manipulation of DNA, mutagenesis, design and production of recombinant proteins, and transient and stable gene transfection.

Reading List:

1. Sambrook, J., Fritsch, E.F., and Maniatis, T. (2001). Molecular cloning: a laboratory manual, Vol 1, 2, 3, 2nd edition (Cold Spring Harbor Laboratory Press).
2. Christopher Howe (2007) Gene Cloning and Manipulation, 2nd edition, (Cambridge University Press)
3. Terry A. Brown (2010). Gene Cloning and DNA Analysis: An Introduction (Wiley-Blackwell)

Total hours:				
Lectures: 2	Practicals:	Other:2	Student research work:	

Methods of instruction:

Assessment (maximum number of points 100)

Requirements	points	Final exam	points
Active participation in lectures		Written exam	25
Active participation in practicals		Oral exam	25
Laboratory reports	15		
Essay	15		
Preliminary exams	2x10		

Remark: