BIOTECH-02:	**MOLECULAR BIOLOGY WITH GENETIC ENGINEERING**
GENERAL INFORMATION	
Course Coordinator(s)	Teuta Opačak-Bernardi, PhD, assist. prof.
Associate(s)	Stana Tokić, PhD, assist. prof. Barbara Viljetić, PhD, assist. prof.
Study Programme	Interdisciplinary Graduate Study Programme in English: Biotechnology
Course Status	Obligatory
Year of Study, Semester	1st Year / 1st Semester
Credits (ECTS)	**5**
Teaching Method (number of classes)	Lectures: 20; Seminars: 15; Exercises: 15
Expected Number of Students in the Course	25-30

COURSE DESCRIPTION

Course Aims

Learning about the basic principles of molecular biology, organisation and maintenance of the genome and control of gene expression, introducing the students with cellular interactions and signalling, understanding the processes and mechanisms of cell survival and linking the disruptions in genome maintenance and basic cellular processes with the development of diseases. Adopting the basic principles and applications of molecular biology methods and genetic engineering.

Prerequisites for Enrolment and the Entry Competencies Required for the Course

Completed undergraduate university study programme from the area of natural sciences (chemistry, biology) or biotechnical sciences, or biomedicine and healthcare.

Learning Outcomes at the Programme Level Contributed by the Course

BIOTECH-2; INDBIOT-1; INDBIOT-3; MEDBIOT-2

Learning Outcomes at the Course Level

After completing the course, the student will be able to:

1. Compare the organisation, maintenance and rearrangement methods for genomes of various species.
2. Explain different levels of gene expression regulation and ways to modulate gene expression
3. Connect the extracellular signals with control mechanisms and regulation of cell division and cell cycle
4. Explain the basis of genetic engineering and the methods used
5. Apply methods of genetic analysis and genetic engineering in research
6. Interpret the outcome of an experiment that includes using molecular biology methods, including genetic analysis and recombinant DNA methods

Course Content

Lectures. Molecular biology as the basis of biomedical and biotechnical science. Importance of molecular biology and genetic engineering. Organisation of cellular genome. Coding and non-coding DNA. Repetitive DNA sequences. Genome maintenance and rearranging. DNA repair. Excision repair. Translesion DNA synthesis. Double-strand repair. Homologous repair: models and enzymes. DNA rearrangement. Site specific DNA recombination. Regulation of gene expression. Regulation mechanisms in eukaryotes and prokaryotes. Tissue specific gene expression. Chromatin remodelling and epigenetic in gene expression. Cell cycle. Phases of cell cycle. Checkpoints. DNA repair. Cyclins and other protein involved in cell cycle regulation. Cell death. Programmed cell death. Caspases. Apoptosis. Regulators of programmed cell death. Basic cloning principles. Restriction endonucleases, polymerases, DNA ligase. Types of vectors. Selection markers. Plasmid vectors, α-complementation. Bacteriophage vectors. Hybrid vectors. Shuttle vectors. Expression systems.

Genetic engineering – basic principles and terms: transgene, transgenic organism, genetically modified organism. Transgenic animals. How to import a transgene. Transgene integration into the genome. Insect, herbicide and virus resistant plants. Advantages and shortcomings. Genetic engineering in biomedicine and industry. Commercial products made by recombinant microorganisms.
Seminars: Molecular biology methods. Types of DNA analysis: nucleotide sequence analysis and gene expression analysis. . Cloning and mutagenesis strategies. Random and targeted mutagenesis. PCR mutagenesis. Gene inactivation. Linkers and adaptors. Directed cloning. Serial cloning. Reporter genes.
Laboratory exercises. Polymerase chain reaction (PCR, real-time PCR, digital droplet PCR). Determining the nucleotide sequence (next generation sequencing). Hybridization.

Teaching Methods

Lectures; seminars; laboratory exercises

Students' Obligations

Attendance at all forms of classes is mandatory and the students are obligated to attend all knowledge tests. The students may be absent from 30% (full-time students) and 50% (part-time students) of each of the forms of classes, provided that the absence is justified. An exercise or a seminar which has not been completed must be made up through a midterm exam.

Monitoring the Activity of the Students *(Connecting Learning Outcomes, Teaching Methods, and Grading)*

Class-related activity	ECTS	Learning outcome	Student activity	Evaluation method	Grade points	
					Min.	Max.
Classes	0.5	1-6	Attendance	Keeping records	2	10
Seminars	1	1-6	Seminar – project presentation	Presentation	10	20
Laboratory practice	1	5.6	Practical work	Lab notes	8	20
Final exam	2.5	1-6	Studying for the final exam	Written exam	30	50
Total	**5**				**50**	**100**

Evaluation of the written part of the final exam

Percentage of correct answers (%)	Grade
>95.00	50
90.00-94.99	47
85.00-89.99	45
80.00-84.99	40
75.00-79.99	38
70.00-74.99	35
65.00-69.99	33
60.00-64.99	30

Forming the final grade:
The points granted for the final exam are added to the grade points awarded during class attendance. The grading process is conducted by absolute distribution, i.e. based on total achievements, and compared to the numerical system in the following manner:
A – Excellent (5): 90-100 grade points; B – Very Good (4): 80-89.99 grade points; C – Good (3): 65-

79.99 grade points; D – sufficient (2): 50-64.99 grade points		
Mandatory Literature (available in the library and via other media)		
Title	Number of copies in the library	Availability via other media
Bruce Alberts and Alexander D. Johnson. Molecular Biology of the Cell. W. W. Norton & Company; 6th Ed., 2014	10	
D.S.T. Nicholl, An Introduction to Genetic Engineering, 3rd Ed., Oxford University Press, Oxford, 2008.		yes
Additional Literature		
M.R. Green, J. Sambrook, *Molecular Cloning: A Laboratory Manual*, 4th Ed., Cold Spring Harbor Laboratory Press, New York, 2012.		
Quality Assurance Procedures Designed to Ensure the Acquisition of Outcomes and Competencies		
Anonymous, quantitative, standardised student survey on the course and the teacher's work implemented by the Quality improvement office of the Faculty of Medicine Osijek and/or Faculty of Food Technology Osijek.		
Note		
E-learning is not included in the class quota, but it is used in teaching and it contains links to various sites and video and audio materials available on websites.		