Course Unit Descriptor

Study Programme: Bachelor Academic Studies in Biochemistry

Course Unit Title: Structure and function of nucleic acid

Course Unit Code: IB-504

Name of Lecturer(s): Associate Professor Marija Lesjak

Type and Level of Studies: Bachelor of Science Degree

Course Status (compulsory/elective): Compulsory

Semester (winter/summer): Summer

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: The goal of the course is to provide students with the theoretical and experimental knowledge related to structure and function of nucleic acids, with special emphasis on: structure and function of DNA and RNA, genes, chromosomes and human genome, DNA replication, gene expression, synthesis of proteins, gene mutations and DNA reparation. Furthermore, during the course students will get familiar with the state-of-the-art experimental methods practised in the research related to structure and function of nucleic acids. Also, the goal of the course is to enable students to understand the molecular and genetic basis of human diseases, the ways of their diagnosis and therapy.

Learning Outcomes: Upon successful completion of the course, student should be able to recognize and describe: 1. the unique role of nucleic acids in biological systems; 2. mechanisms of replication, gene expression and protein synthesis and the ways how they are controlled; 3. types of DNA mutations and repair mechanisms. Student should be able to understand and independently perform experimental methods used in the field of nucleic acid research.

Syllabus:

Theory

Structure and function of DNA, RNA and chromosomes. Structure of human genome. Human genome project. DNA replication. Transcription and gene expression. Post-transcriptional modifications of primary transcript. Roles of non-coding RNA. Translation. DNA mutations and repair. Epigenetics. Methods for DNA sequence amplification - PCR and cloning. Nucleic acid hybridization in the identification of DNA and RNA sequences. Experimental methods used nucleic acids research (sequencing, genotyping, quantitative-PCR, southern blot, northern blot, gene silencing, DNA microarray and DNA fingerprinting, etc.). Basics of molecular pathology. Basics of gene therapy. Manipulation of genetic material.

Practice

Isolation, purification and characterization of DNA and RNA. Electrophoresis of DNA and RNA on agarose gel. Application of restriction enzymes. DNA sequencing. PCR, RT-PCR and qPCR. Southern blot and northern blot. DNA microarray. Gene silencing. Heuristic database search methods (FASTA and BLAST).

Required Reading:

1. Strachan T, Read A: Human Molecular Genetics, 4th ed., Garland Science, USA, 2010.
2. Blackburn GM, Gait MJ, Loakes D, Williams DM: Nucleic Acids in Chemistry and Biology, 3rd ed., RSC publishing, UK, 2006.
3. Bloomfield VA, Crothers DM, Tinoco I, Hearst JE, Pete WDE: Nucleic Acids: Structures, Properties, and Functions, University Science Books, USA, 2010.

4. Elliott D, Ladomery M: Molecular Biology of RNA, Oxford University Press Inc, USA, 2011.
5. Relevant scientific papers from the field

Weekly Contact Hours: 5 (75)	**Lectures:** 3 (45)	**Practical work:** 2 (30)

Teaching Methods: Lectures, laboratory work, consultations, e-learning

Knowledge Assessment (maximum of 100 points): 100

Pre-exam obligations	points	**Final exam**	points
Active class participation	10	written exam	60
Practical work	15	oral exam	
Preliminary exam(s)	/	…….	
Seminar(s)	15		

The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.