DESCRIPTION OF THE COURSE OF STUDY

Course code	12.6-3LEK-F-BM	
Name of the course in	Polish	**Biologia molekularna w medycynie**
	English	**Molecular Biology in Medicine**

1. LOCATION OF THE COURSE OF STUDY WITHIN THE SYSTEM OF STUDIES

1.1. Field of study	**medicine**
1.2. Mode of study	**full-time**
1.3. Level of study	**uniform Master's study**
1.4. Profile of study*	**practical**
1.5. Specialization*	**lack**
1.6. Unit running the course of study	Faculty of Medicine and Health Sciences
1.7. Person/s preparing the course description	dr hab. Jan Pałyga, prof. UJK
1.8. Person responsible for the course of study	dr hab. Jan Pałyga, prof. UJK
1.9. Contact	jan.palyga@ujk.edu.pl

2. GENERAL CHARACTERISTICS OF THE COURSE OF STUDY

2.1. Affiliation with the module	Facultative Optional
2.2. Language of instruction	English
2.3. Semesters in which the course of study is offered	4th-9th semester
2.4. Prerequisites*	Biochemistry Genetics

3. DETAILED CHARACTERISTICS OF THE COURSE OF STUDY

3.1. Form of classes		L– 15 , classes - 20 hours
3.2. Place of classes		**Courses in the JKU teaching rooms**
3.3. Form of assessment		**Credit with grade**
3.4. Teaching methods		Problem-based lecture, classes
3.5. Bibliography	**Required reading**	Kurreck J, Stein C.A., *Molecular Medicine: An Introduction*, Wiley-Blackwell 2015. Allison L A. *Fundamental Molecular Biology*, 2nd edition, Wiley 2012.
	Further reading	McLennan A., Bates A., Turner P, White M. *BIOS Instant Notes in Molecular Biology*, Garland Science 2012.

4. OBJECTIVES, SYLLABUS CONTENT AND INTENDED TEACHING OUTCOMES

4.1. Course objectives ***(including forms of classes)***

4.1. Aims

C1- Introduction to basic molecular biology methods used in genetic manipulations.

C2- Creating recombinant DNA molecules *in vitro* - inserting DNA fragments into a vector.

C3- Acquaintance with the strategies for gene cloning (genomic libraries, cDNA libraries and methods for their screening), as well as with DNA sequencing methods.

C4- Introduction to basic tools and selected methods of molecular analysis of the genome, transcriptome and proteome.

4.2. Detailed syllabus ***(including all forms of classes)***

Basic techniques used in genetic manipulation. DNA electrophoresis in agarose and polyacrylamide gel and fluorescent techniques labeling of DNA by agarose gel. Transfer of DNA and RNA to nitrocellulose or nylon membrane, and hybridization of nucleic acids on membranes. Isotopic labeling, chemiluminescent and fluorescent of nucleic acid. Transfer of proteins to the membrane and detection of proteins on membranes. Transformation of Escherichia coli by means of vectors with insertions of DNA. The use of polymerase chain reaction (PCR) and its variations to amplify and analyze DNA.

Cutting and joining DNA molecules. Restriction endonucleases: sticky and blunt ends of DNA. Cutting DNA with two restriction enzymes and connect compatible and incompatible ends. Linearization of the vector and removing phosphate residues using alkaline phosphatase. Connecting DNA insert with vectors using DNA ligase. Adapters and linkers to link the DNA ends. Cloning of PCR products.

Basics of Biology of plasmid vectors and phage. Plasmid vectors, plasmid replication and selectable markers. Plasmid DNA purification. Plasmid vectors for cloning and the features of the pUC vectors. Bacteriophage replication, main

promoters and termination of transcription. Vectors based on phage λ: Insertion vectors and vectors for the exchange of DNA fragments and their use.
Advanced and specialized vectors. The vectors for cloning large DNA fragments: cosmids, phagemids, vectors BAC, PAC i YAC. Derivatives of vectors for single-stranded DNA sequencing, expression vectors with strong promoters, and with specific promoters for a particular cell type. Efficient expression of proteins from the cloned gene into a vector and facilitated purification of the protein.
Strategies for gene cloning. Genomic libraries, and cDNA libraries. PCR as an alternative to the cloning of genomic DNA and cDNA, and for screening gene libraries. Probes for the detection of genes and identification of genes in genomic libraries, as well as cDNA libraries by hybridization. Expression library screening with immunochemical methods. Specialized cloning techniques: complementation cloning, positional cloning and walking along the chromosome, gene libraries enriched with the desired sequences.
Gene sequencing and short DNA fragments. Sequencing by the Sanger method using the dideoxynucleotides for the termination of the DNA chain synthesis. Manual and automated DNA sequencing. DNA sequence analysis in real time using pyrosequencing method.
Analysis of the genome, transcriptome, epigenome and proteome in normal and pathological states. The use of microarray hybridization techniques for the analysis of gene expression in cells and tissues. The application of molecular techniques for the prognostic and predictive purposes in medicine. The role of molecular biology in personalized medicine.
Testing your knowledge – final written test

4.3 Education outcomes in the discipline

Code	A student, who passed the course	Relation to teaching outcomes
within the scope of **KNOWLEDGE:**		
W01	understands the indications for genetic testing performed to ensure the individualization of pharmacotherapy;	C.W40.
W02	knows the basic trends of therapy development, in particular the possibility of applying cell therapy, gene therapy as well as targeted therapy in specific diseases;	C.W41.
W03	knows the types of biological materials used in laboratory diagnosis and the rules for the collection of research material;	E.W37.
within the scope of **ABILITIES:**		
U01	recognizes histological structures of organs, tissues, cells and cellular structures on the optical or histological microscope images, makes descriptions and interprets the structure and relations between the structure and the function;	A.U2.
U02	makes a decision on the need to perform cytogenetic and molecular tests;	C.U3.

4.4. Methods of assessment of the intended teaching outcomes

Teaching outcomes *(code)*	**Method of assessment (+/-)**																					
	Exam oral/written*			**Test***			**Project***			**Effort in class***			**Self-study***			**Group work***			**Others***		
	Form of classes			***Form of classes***			***Form of classes***			***Form of classes***			***Form of classes***			***Form of classes***			***Form of classes***		
	L	*C*	...	*L*	*C*	...	*L*	*C*	...	*L*	*C*	...	*L*	*C*	...	*L*	*C*	...	*L*	*C*	...
...W01																					
…																					
...U01																					
...																					
...K01																					
...																					

delete as appropriate

4.5. Criteria of assessment of the intended teaching outcomes

Form of classes	Grade	Criterion of assessment
lecture (L)	**3**	61% -68% correct answers
	3,5	69% - 76% correct answers
	4	77% - 84% correct answers

	4,5	85 % -92% correct answers
	5	93-100
classes (C)*	**3**	61% -68% correct answers
	3,5	69% - 76% correct answers
	4	77% - 84% correct answers
	4,5	85 % -92% correct answers
	5	93-100
others (...)*	**3**	
	3,5	
	4	
	4,5	
	5	

5. BALANCE OF ECTS CREDITS – STUDENT'S WORK INPUT

Category	**Student's workload**
	Full-time studies
NUMBER OF HOURS WITH THE DIRECT PARTICIPATION OF THE TEACHER /CONTACT HOURS/	**35**
*Participation in lectures**	**15**
*Participation in classes, seminars, laboratories**	**20**
*Preparation in the exam/ final test**	
*Others**	
INDEPENDENT WORK OF THE STUDENT/NON-CONTACT HOURS/	**15**
*Preparation for the lecture**	
*Preparation for the classes, seminars, laboratories**	**10**
*Preparation for the exam/test**	**5**
*Gathering materials for the project/Internet query**	
Preparation of multimedia presentation	
*Others**	
TOTAL NUMBER OF HOURS	**50**
ECTS credits for the course of study	**2**

Accepted for execution *(date and signatures of the teachers running the course in the given academic year)*

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