



SYLLABUS of MODULE (MOLECULAR BIOLOGY)

General Information

Code	Title
Module type	<i>Obligatory</i>
Faculty	<i>Faculty of Medicine (MD)</i>
Field of study	<i>Medicine (MD)</i>
Major	<i>Not applicable</i>
Level of study	<i>II level/ long-cycle (S2J)</i>
Mode of study	<i>intramural</i>
Year of study	<i>1</i>
Semester	<i>Winter</i>
ECTS points	<i>2</i>
Types of training	<i>seminars/practical classes (5/25 hours)</i>
Tutor responsible for the module	<i>prof dr hab. n. med. Jan Lubiński – lubinski@pum.edu.pl prof dr hab. n. med. Tadeusz Dębniak – debniak @pum.edu.pl</i>
Osoby prowadzące zajęcia z zaznaczeniem adiunkta dydaktycznego lub osoby odpowiedzialnej za przedmiot	<i>prof dr hab. n. med. Tadeusz Dębniak – debniak@pum.edu.pl dr Urszula Teodorczyk – urteo@pum.edu.pl dr Elżbieta Złowocka-Perłowska – elzunik@wp.pl dr n. med. Helena Rudnicka – helena.rudnicka@pum.edu.pl dr n. med. Aniruddh Kashyap – kashyap@pum.edu.pl dr n. med. Katarzyna Paszkowska-Szczur- katpas@pum.edu.pl dr n. med. Katarzyna Gołębiewska – k.tutlewska@wp.pl</i>
WWW	<i>www.pum.edu.pl</i>
Language	<i>English</i>

Detailed information

Module objectives	<p>Respect for principles is the teaching of molecular methods that are routinely used in examples. in clinical genetics, molecular pathology, oncology, forensic medicine, pharmacology and infectious diseases. If this method is no longer valid, additional information should be provided. This knowledge is insufficient, entering, allowing itself to be easily transferred on this subject - "Clinical genetics". During the course the student gets acquainted with the methods of isolation. I am going to protect myself to do a decent molecular research. He can distinguish and distinguish. The student learns the PCR reaction, which is used in clinical trials, diagnostics of infectious diseases. The subject of Medical Biology is acquainted with the latest techniques that are currently up to date for cutting out genetic changes eg. These techniques are often used in PCR computers such as Simple Probes, HRMA technology, MALDI-TOF progress as well as the latest sequencing methods generation. The student gets acquainted with the basic issues of cytogenetics as well as learns the methods of chromosome research - this knowledge is the introduction to the subject - Clinical Cytogetics.</p>
Prerequisite/essential requirements	<p>Knowledge</p> <p>He knows the techniques of DNA and RNA isolation; Recognizes and defines the terms: mutation, polymorphism; knows the molecular techniques that detect: large, small and known mutations; knows the types of chromosomal aberrations, knows the use of molecular techniques in clinical practice; oncology, genetics, molecular pathology, forensic medicine and microbiology; knows the rules and application of real time PCR (rcal time PCR); knows the rules and application of real time PCR (rcal time PCR); knows routine direct DNA sequencing, in particular the Sangcra method; knows the methods of indirect detection of mutations and their application, including the detection of foundational mutations; knows the types of mutations, musesi somateczne, constitutional muateje, understands the essence of foundational mutations and their greatness for the occurrence of diseases in different populations; knows the methods of chromosomal aberration detection, knows the latest molecular research methods using microarrays (eg for the evaluation of single nucleotide polymorphisms used in GWAS research), knows the principles of next generation sequencing, including whole-body seachting as methods for assessing the sequence of all genes in a</p>

		person's study, knows the perspectives of applying these revolutionary techniques in medicine and science.
	Skills	Is able to prepare and perform PCR electrophoresis on agarose gel as well as interpret the obtained result; can read the sequence chromatograph and indicate the place in the sequence in which the mutation occurred, can recognize and name the type of change in the sequence; basically uses online databases and searches for necessary information using available tools; is able to perform non-complicated statistical calculations; can plan a simple research, interpret its results and draw conclusions; can design a simple system that detects individual DNA changes.
	Competences	The student is able to work in a team and perform the task entrusted to him; understands the need for self-education as well as accepts the need to know a foreign language.

Description of the learning outcomes for the subject/module

Number of learning outcome	Student, who has passed the (subject) Knows/is able to/can:	SYMBOL (referring the standards) EKK	Method of verification of learning outcomes
KL2JPW01	characterizes I-, II-, III- and tertiary structure of proteins; knows the post-translational and functional modifications of the protein and their importance	K B . W 1 2	Written form: during the semester, three multiple-choice tests and a multiple-choice written test are carried out
KL2JPW02	knows the functions of nucleotides in the cell, the structure of I- and II-row DNA and RNA, and the structure of chromatin	K B . W 1 3	as above
KL2JPW03	knows the functions of the genome, transcriptome and human proteome and the basic methods used in their study; describes the processes of DNA replication, repair and recombination, transcription and translation, and DNA, RNA and protein degradation; knows the concepts of gene expression regulation	KJ3.W14	as above
KL2JPW04	describes the basic catabolic and anabolic pathways, the	K B.W15	as above

	ways of their regulation and the influence of genetic and environmental factors		
KL2JPW05	knows the basic methods of statistical analysis used in population and diagnostic studies	KJ3.W31	as above
KL2JPW06	knows the principles of conducting scientific, observational and experimental research as well as <i>in vitro</i> research for the development of medicine	K B.W34	as above
KL2JPW07	knows the use of molecular techniques in clinical practice; oncology, genetics, molecular pathology, forensic medicine and microbiology		as above
KL2JPW08	74/5000 knows the rules and application of real-time PCR techniques		as above
KL2JPW09	knows routine direct DNA sequencing, in particular the Sanger method		as above
KL2JPW10	knows methods of indirect detection of mutations and their application, including the detection of foundational mutations		as above
KL2JPW11	knows the types of mutations, somatic mutations, constitutional mutations, understands the essence of foundational mutations and their significance for the occurrence of diseases in different populations		as above
KL2JPW12	knows the methods of detecting chromosomal aberrations		as above
KL2JPW13	knows the most modern molecular research methods using microarrays (eg for assessing single nucleotide		as above

	polymorphisms used in GWAS studies)		
KL2JPW09	knows the rules of next generation sequencing, including whole exome sequencing as a method for assessing the sequence of all genes in the study of a person, knows the perspectives of the application of these revolutionary techniques in medicine and science		as above
KL2JPU01	uses basic laboratory techniques, such as qualitative analysis, titration, colorimetry, pHmetry, chromatography, electrophoresis of proteins and nucleic acids	K B . U 1 0	as above
KL2JPU02	supports simple measuring instruments and evaluates the accuracy of measurements	K B . U 1 1	as above
KL2JPU03	uses databases, including websites, and searches for the necessary information using the available tools	K B . U 1 2	as above
KL2JPU04	knows how to plan and perform a simple scientific study and interpret its results and draw conclusions	K B . U 1 5	as above
KL2JPU05	can design a simple system that detects changes in DNA		as above
KL2JPU06	is able to perform a PCR reaction, add reagents for the reaction, trigger reactions in the PCR apparatus and evaluate the PCR products		as above
KL2JPU07	can isolate DNA from a peripheral blood sample for molecular testing		as above
KL2JPU08	can recognize DNA mutations in the DNA sequence, can write it, and differentiate it with polymorphism		as above
KL2JPU09	can assess the karyotype		as above

KL2JPK01	accepts the need for ethical standards;	K K 0 1	as above
KL2JPK02	shows the habit of self-education, understands the need to learn throughout life, can inspire and organize the learning process of other people	KJK03	as above
KL2JPK03	works with team members; can cooperate in a group, taking on different roles	K K 0 4	as above
KL2JPK04	accepts the need to speak a foreign language	K_K10	as above

Matrix presenting the learning outcomes of the subject/module in relations to the form of classes

Number of learning outcome	Student, who has passed the (subject) Knows/is able to/can:	Types of training							
		Lecture	Seminar	Laboratory classes	Project work	Clinical classes	Classes	Practical classes	Other..
KL2JPW01	characterizes I-, II-, III- and IV-row structures of proteins; knows the post-translational and functional modifications of the protein and their importance						X		
KL2JPW02	knows the functions of nucleotides in the cell, the structure of I- and 11-row DNA and RNA, and the structure of chromatin						X		

KL2JPW03	knows the functions of the genome, transcriptome and human proteome and the basic methods used in their study; describes the processes of DNA replication, repair and recombination, transcription and translation, and DNA, RNA and protein degradation; knows the concepts of gene expression regulation						X		
KL2JPW04	describes the basic catabolic and anabolic pathways, the ways of their regulation and the influence of genetic and environmental factors						X		
KL2JPW05	knows the basic methods of statistical analysis used in population and diagnostic studies	X							
KL2JPW06	knows the principles of conducting scientific, observational and experimental research as well as in vitro research for the development of medicine	X					X		
KL2JPW07	knows the use of molecular techniques in clinical practice; oncology, genetics, molecular pathology, forensic medicine and microbiology						X		

KL2JPW08	knows the rules and application of real-time PCR techniques	x					x		
KL2JPW09	knows routine direct DNA sequencing, in particular the Sanger method						x		
KL2JPW10	knows methods of indirect detection of mutations and their application, including the detection of foundational mutations	x					x		
KL2JPW11	knows the types of mutations, somatic mutations, constitutional mutations, understands the essence of foundational mutations and their significance for the occurrence of diseases in different populations	x					x		
KL2JPW12	knows the methods of detecting chromosomal aberrations						x		
KL2JPW13	knows the most modern molecular research methods using microarrays (eg for assessing single nucleotide polymorphisms used in GWAS studies)	x							

KL2JPU01	uses basic laboratory techniques, such as qualitative analysis, titration, colorimetry, pHmetry, chromatography, electrophoresis of proteins and nucleic acids						X		
KL2JPU02	supports simple measuring instruments and evaluates the accuracy of measurements						X		
KL2JPU03	uses databases, including websites, and searches for the necessary information using the available tools	X					X		
KL2JPU04	knows how to plan and perform a simple scientific study and interpret its results and draw conclusions	X					X		
KL2JPU05	can design a simple system that detects changes in DNA						X		
KL2JPU06	is able to perform a PCR reaction, add reagents for the reaction, trigger reactions in the PCR apparatus and evaluate the PCR products						X		
KL2JPU07	can isolate DNA from a peripheral blood sample for molecular testing						X		
KL2JPU08	can recognize DNA mutations in the DNA sequence, can write it, and differentiate it with polymorphism						X		

KL2JPU09	can assess the karyotype						X		
KL2JPK01	accepts the need for ethical standards;						X		
KL2JPK02	demonstrates the habit of self-education, understands the need to learn throughout life, can inspire and organize the learning process of other people	X					X		
KL2JPK03	works with team members; can cooperate in a group, taking on different roles	X					X		
KL2JPK04	accepts the need to speak a foreign language	X					X		

Module (subject) contents

Symbol of teaching programme	Content of teaching programme	References to learning outcomes
TK 01	Eukaryotic cell structure: cell membranes, mitochondria, lysosomes, Golgi apparatus, endoplasmic reticulum, ribosomes, testes, nucleolus. Functions of the eukaryotic cell and its organelles.	KL2JPU07
TK 02	Structure and functions of DNA. DNA replication. DNA isolation.	KL2JPW02, KL2JPW03
TK 03	In vitro amplification of DNA fragments - PCR method. The use of PCR in medical and molecular diagnostics.	KL2JPU01, KL2JPU02, KL2JPK03, KL2JPU06, KL2JPU05,
TK 04	Structure and function of RN A. Transcription. Reverse transcription. Construction of cDNA.	KL2JPW03
TK 05	Structure and function of proteins. Translation.	KL2JPW02, KL2JPW01, KL2JPW03
TK 06	Types of changes detected in DNA / RNA - mutations and polymorphisms: substitutions, deletions, insertion.	KL2JPK02, KL2JPU08, KL2JPW11

TK 07	Methods of detecting mutations and polymorphisms in DNA and RNA. Sequencing as a method of direct detection of mutations.	KL2JPU01, KL2JPK02, KL2JPU08, KL2JPW09
TK 08	Methods of detection of known mutations (methods: ASA-PCR, RFLP, Real time PCR: TaqMan probes, Simple probes, MALDI-TOF). Methods for detecting small mutations: DHPLC, SSCP.	KL2JPU01, KL2JPU04, KL2JPK02, KL2JPK03, KL2JPU05, KL2JPW10
TK 09	Detection methods for large mutations: MLPA, Long PCR	KL2JPU05, KL2JPU04,
TK 10	Cytogenetic tests - types, application. Karyotype, FISH, CGH.	KL2JPK01, KL2JPU09, KL2JPK04, KL2JPW12
TK 11	Types of mutations, mutation a polymorphism, inheritance.	KL2JPU08, KL2JPW11
TK 12	Individual genetic variation and predisposition to diseases, the concept of homogeneous populations, the importance of foundational mutations.	KL2JPW04, KL2JPW06, KL2JPK01, KL2JPK02, KL2JPK04
TK 13	Real-time PCR technique and its application.	KL2JPU05, KL2JPW08
TK 14	The mechanism of gene expression regulation including microRNA.	KL2JPW03
TK 15	Whole genome tests using microarrays and their applications.	KL2JPW06, KL2JPU03, KL2JPU04, KL2JPK02, KL2JPK04, KL2JPW13
TK 16	New generation sequencing - whole genome sequencing (WES).	KL2JPU04, KL2JPK02, KL2JPK04, KL2JPW09, KL2JPW13
TK 17	Examples of the use of molecular techniques in medicine.	KL2JPU03, KL2JPK01, KL2JPK02. KL2JPK04, KL2JPW07
TK 18	Elements of epidemiology and statistical analysis	KL2JPW05, KL2JPW06

References and educational resources:

1. DNA analysis theory and practice, Collective work edited by Ryszard Słomski, Poznań 2008
6. Genetyka medyczna / Lynn B. Jorde [et al.]; red. sciences. ed. poi. Jacek Wojcierowski; [Trans. with tongue Urszula Gąsowska. Tomasz Kubiowski. - Lublin: Czelej, 2002
2. Clinical genetics of cancers 2012: a monograph under red. Jan Lubinski. Szczecin 2012
3. Molecular diagnostics, George Patrinos and Wilhelm Ansorge, Elsevier Ltd. 2009
4. Principles of molecular diagnostics and personalized cancer medicine. Dongfeng Tan, M.D., Henry T. Lynch, M.D., Lippincott Williams & Wilkins 2013
5. Basics of genetics for students and doctors / edited by Gerard Drewa and Tomasz Ferenc; [Corner. Wanda Bratkowska et al. 1 Wrocław Wydaw. Medical Urban and Partner, clay. 2005
6. Medical Genetics / Lynn B. Jorde [et al.]; red. sciences. ed. poi. Jacek Wojcierowski; [Trans. with tongue Urszula Gąsowska. Tomasz Kubiowski. - Lublin: Czelej, 2002

Student's workload (balance sheet of ECTS points)			
Form of student's activity (in-class participation; activeness, produce a report, etc.)	Workload [h]		
	Tutor	Student	Average
Activities that require direct participation of tutors		30	
Preparation to the classes		20	
Reading of the indicated/specified literature		10	
Report writing/project making			
Time spent to prepare for the exam			
Other			
Student's workload in total			
ECTS points for the subject	2		
Uwagi :			

Methods of assessment, for example:

E – exam – problem resolving

S – verifying of practical skills

R - report

D - discussion

P - presentation

Others – C -credit