

COURSE UNIT DESCRIPTION - MOLECULAR MECHANISMS OF PATHOGENESIS

Course unit title	Code
MOLECULAR MECHANISMS OF PATHOGENESIS	

Lecturer(s)	Department(s)
Coordinator: Professor Edita SUŽIEDĖLIENĖ Others: <i>Lectures, seminars:</i> Associate Professor Arvydas Markuckas, Professor Vilmantė Borutaitė, dr. Marius Strioga <i>Laboratory works:</i> Prof. Edita Sužiedėlienė	Faculty of Natural Sciences, Department of Biochemistry and Molecular biology, Čiurlionio 21, LT 03101.

Cycle	Level of the course unit	Type of the course unit
Full-time studies (2 nd stage)	1 out of 1	Elective

Mode of delivery	Period of delivered	Language(s) of instruction
Face to face	1 st semester, autumn	Lithuanian

Prerequisites and corequisites	
Prerequisites: Biochemistry, genetics, cell biology, molecular biology, physiology, immunology	Corequisites (if any):

Number of credits allocated to the course unit	Student's total workload	Contact hours		Self-study and research hours
5	134	Lectures	32	70
		Seminars	16	
		Laboratory work	16	

Purpose of the course unit: programme competences to be developed
Upon the successful completion of this course, students will acquire: <i>Subject-specific competences:</i> <ul style="list-style-type: none"> • Knowledge of the basic molecular mechanisms leading to the emergence and development of the disturbed cell states and pathological processes; • skills to apply molecular biology knowledge, methods and technologies in biomedical research; • skills to analytically, critically and systemically analyze and evaluate information related to molecular processes of pathogenesis. <i>General competences:</i> <ul style="list-style-type: none"> • skills for self-development, study skills in order to study molecular biology; • skills to present in written and verbal forms the knowledge of the molecular pathogenesis; • skills to participate in the scientific discussion;

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
<ul style="list-style-type: none"> • Describes the molecular basis of the immune system dysfunction and its related diseases; • Describes structure and functions of amyloids, molecular basis of amyloids and their role in the development of neurodegenerative diseases; • Describes molecular basis of mitochondrial diseases, mitochondria-dependent senescence; • Describes molecular principles of bacterial pathogenesis; • Analytically, critically and systemically evaluates molecular biology information related to the molecular basis of diseases, their 	Lectures, seminars, laboratory works, self-study	Midterm exam; Seminar; Presentation; Exam

development and cure; <ul style="list-style-type: none"> Integrates knowledge of different scientific fields to solve molecular biology -related problems; Applies molecular analysis tools for identification and characterisation of bacterial pathogens. 		
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Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	Contact hours	Self-study hours	Assignments
1. Molecular basis of immunological diseases	8		4				12	15	Analysis of the topic-related scientific papers and material presented by teacher in e-course; seminar presentation; self-directed learning.
Type I hypersensitivity. Anaphylactic and atopic reactions.	1		0,5				1,5	1	The same
Type II hypersensitivity. Autoimmune diseases.	1		0,5				1,5	2	The same
Type III hypersensitivity. Pathological immune complex-mediated diseases.	1		0,5				1,5	2	The same
Type IV hypersensitivity. Delayed-type cellular hypersensitivity reactions	1		0,5				1,5	2	The same
Allergy and hygiene: conception, epidemiological data, proposed molecular and cellular mechanisms	1		0,5				1,5	2	The same
Pharmacological immunomodulators and their mechanisms of action at molecular and cellular levels.	1		0,5				1,5	2	The same
Antitumor immunity: interactions between cancer and immune system, tumor antigens, effector mechanisms of antitumor immunity.	1		0,5				1,5	2	The same
Molecular and cellular mechanisms of tumor evasion from the immunosurveillance.	1		0,5				1,5	2	The same
2. Molecular basis of amyloidoses. Neurodegenerative diseases	8		4				12	15	Analysis of the topic-related scientific papers and material presented by teacher in e-course; seminar presentation; self-directed learning.
Misfolding of polypeptides; The structure of amyloids and mechanisms for its formation; Properties of amyloids and methods of its detection;	2		1				3	4	The same
Neurotoxicity of beta-amyloid; Formation mechanisms of amyloids plaques and Lewy bodies; Formation mechanisms of <i>Tau</i> protein neurofibrillary tangles; Chemistry and	2		1				3	4	The same

biology of amyloid inhibition;									
Pathogenesis of Alzheimer disease (beta-amyloid plaques, <i>Tau</i> protein neurofibrillary tangles, neuronal death and brain atrophy, degeneration of cholinergic neurons); Genetics of Alzheimer disease; Current and future therapies for Alzheimer disease;	2		1				3	5	The same
Pathogenesis of Parkinson disease (beta-synuclein and others proteins, Lewy bodies); Genetics of Parkinson disease	2		1				3	4	The same
3. Molecular basis of mitochondrial diseases.	8		4				12	15	Analysis of the topic-related scientific papers and material presented by teacher in e-course; seminar presentation; self-directed learning.
4. Molecular basis of bacterial pathogenesis.	8		4				12	15	Analysis of the topic-related scientific papers and material presented by teacher in e-course; seminar presentation; self-directed learning.
Molecular basis of host defense against bacterial pathogens.	2		1				3	5	The same
Molecular basis of bacterial virulence. Host invasion strategies. Toxins, virulence factors, their structure, functions, regulation.	3		2				5	5	The same
Evolution of bacterial pathogens. Genomes. Molecular basis of antibiotic resistance.	3		1				4	3	The same
Laboratory works						16	16	10	Preparation for laboratory work, reading and analysis of principles of experimental techniques in e-course.
Genotyping of gram-negative bacterial pathogens by pulsed field electrophoresis (PFGE).							10	5	The same
Detection of methicillin-resistant <i>Staphylococcus aureus</i> (MRSA) by real time PCR.					6		6	5	The same
Total	32		16		16		64	70	

Assessment strategy	Weight, %	Assessment period	Assessment criteria
Laboratory work	Pass/ Fail	Every third week	All laboratory works must be done, reports prepared and discussed with the instructor.
Seminars	20	15 th week of the course	Preparation and oral presentation of the course topic, selected from the list, which is presented by the course teachers at the beginning of course (virtual learning environment).
Midterm exam	40	9/10 th week of the course	Four open answer questions on the topics 1-2 in written. 2-4 (insufficient) 5 (sufficient) 6 (satisfactory) 7 (highly satisfactory) 8 (good) 9 (very good)

			10 (excellent)
Exam	40	Exam session. The final exam is allowed only when all laboratory works are completed, reports prepared and discussed with the instructor.	Three open answer questions on the topics 3-4 in written. 2-4 (insufficient) 5 (sufficient) 6 (satisfactory) 7 (highly satisfactory) 8 (good) 9 (very good) 10 (excellent)
Total	100		Seminars, midterm exam and exam parts each must be completed with the minimal evaluation (sufficient, 5) to obtain the final evaluation. The final grade is the sum of all evaluated parts.

Author	Year of publication	Title	Publishing place and house or web link
Compulsory reading			
Course teachers	Since 2012	Course e-resources in virtual learning environment	http://vma.esec.vu.lt/
M.Ramirez-Alvarado, J.W.Kelly, C.M.Dobson (eds).	2010	Protein misfolding diseases: Current and emerging principles and therapies (Wiley series in protein and peptide science).	Wiley
S.S.Sisodia, R.E.Tanzi (eds)	2010	Alzheimer's disease: Advances in genetics, molecular and cellular biology.	Springer
A.K.Abbas, A.H.Lichtman, S. Pilai	2010	Cellular and molecular Immunology. 7 th ed.	Saunders
Joseph D. Rosenblatt , Eckhard R. Podack , Glen N. Barber , Augusto Ochoa	2013	Advances in Tumor Immunology and Immunotherapy	Springer
B.A. Wilson, A.A. Salyers, D.D. Whytt, M.A. Winkler	2011	Bacterial pathogenesis: a molecular approach, 2nd ed.	ASM Press
Optional reading			
		e-resources	http://www.textbookofbacteriology.net/kt_toc.html
R.K.Chaturvedi, M.F.Beal	2013	Mitochondrial diseases of the brain.	Free radical biology and medicine V. 63, P. 1-29.