

## COURSE UNIT DESCRIPTION - CANCER MOLECULAR BIOLOGY

Course unit title	Code
<b>CANCER MOLECULAR BIOLOGY</b>	

Lecturer(s)	Department(s)
<b>Coordinator:</b> Prof. Kęstutis SUŽIEDĖLIS	Faculty of Natural Sciences, Department of Biochemistry and Molecular biology

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

Mode of delivery	Period of delivered	Language(s) of instruction
Face to face	1 <sup>st</sup> semester, autumn	Lithuanian (English)

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

Number of credits allocated to the course unit	Student's total workload	Contact hours	Self-study and research hours
5	133	Lectures 32	61
		Seminars 16	
		Laboratory works 24	

Purpose of the course unit: programme competences to be developed
<p>Upon the successful completion of this course, students will acquire:</p> <p><i>Subject-specific competences:</i></p> <ul style="list-style-type: none"> <li>• knowledge in the basic molecular mechanisms leading to the emergence and development of cell malignization and cancer;</li> <li>• skills to apply molecular biology knowledge, methods and technologies in biomedical research;</li> <li>• skills to analytically, critically and systemically analyze and evaluate information related to molecular processes of malignant transformation and cancer;</li> <li>• skills to integrate knowledge of different scientific fields to solve molecular biology-related problems.</li> </ul> <p><i>General competences:</i></p> <ul style="list-style-type: none"> <li>• skills to perform research and practical work requiring analytical and innovative thinking;</li> <li>• skills for self-development, study skills in order to study molecular biology;</li> <li>• skills to clearly and scientifically present knowledge on the cancer molecular biology and related sciences to the professionals and non-professionals;</li> </ul>

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
<ul style="list-style-type: none"> <li>• Describes molecular processes leading to the cell malignant transformation, the roles of genomics and epigenomics in cancer development;</li> <li>• Describes features of the cancer cell;</li> <li>• Describes principles of tumor development, microenvironment, angiogenesis, principles of development of metastases;</li> <li>• Describes principles of senescence, death and mortality of normal and cancer cells;</li> <li>• Explains the importance of immune system in cancer and their research;</li> <li>• Describes molecular principles of anticancer therapy;</li> <li>• Describes directions of modern cancer research towards</li> </ul>	Lectures; Seminars; Laboratory works; Self-study	Seminar presentation; Completion of laboratory Works; Exam

development of more effective cancer treatment strategies; • Applies DNA microarray technologies for gene expression analysis; • Analytically, critically and systemically evaluates the molecular biology information related to the cancer biology.		
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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
<b>1. Introduction. History of Cancer Biology</b>	3		3				6	3	
Cancer definition	1		1				2	1	Analysis of the topic-related scientific papers and material presented by teacher; self-directed learning.
Cancer in Human and Animal History	1		1				2	1	
Development of Cancer Theories	1		1				2	1	
<b>2. Tumor Grading and Staging.</b>	2		2				4	5	
Principles of Tumor Characterization and Classification	1		1				2	2	Analysis of the topic-related scientific papers and material presented by teacher; self-directed learning.
Systems for Tumor Staging	0.5		0.5				1	1	
Tumor Molecular Classification	0.5		0.5				1	1	
<b>3. The Hallmarks of Cancer Cell.</b>	2		2				4	4	
Roads to Cancer Cell Transformation	1		1				2	2	Analysis of the topic-related scientific papers and material presented by teacher; self-directed learning.
Molecular Differences in Normal and Cancer Cell	1		1				2	2	
<b>3. Molecular Mechanisms of Cell Malignant Transformation</b>	12		3				15	17	
Cell Division Cycle, Molecular Division Control and Cancer	6		1				7	8	Analysis of the topic-related scientific papers and material presented by teacher; self-directed learning.
Cancer Related Genes	6		2				8	9	
<b>4. Apoptosis, Telomeres, Senescence and Cancer</b>	2		2				4	4	
Cell/Organism Senescence and Cancer, Molecular Basis of Cancer Cell Immortality	1		1				2	2	Analysis of the topic-related scientific papers and material presented by teacher; self-directed learning.
Molecular Control of Cell Death and Cancer	1		1				2	2	
<b>5. Tumor Microenvironment, Metastases. Cancer Immunology</b>	9		2				11	15	
Tumor Three-dimensional Structure	2						2	3	Analysis of the topic-related scientific papers and material presented by teacher; self-directed learning.
Angiogenesis	2		1				3	5	
Molecular Stages of Cancer Cell Metastasis	3		1				4	5	
Cancer Immunology	2						2	2	
<b>6. Modern Directions in Cancer Research.</b>	2		2				4	7	
Model Systems in Cancer Research	0.5		0.5				1	2	Analysis of the topic-related scientific papers and material presented by teacher;
Cancer research in Post genomic Era	1		1				2	3	

Perspectives of Use of Results of Biomedical Research in Anticancer Therapy	0.5		0.5				1	2	self-directed learning.
<b>Laboratory Works</b>									
Isolation of RNA from ionizing radiation-treated and untreated cancer cells. RNA quality analysis, cDNA synthesis and labeling.					8		8	2	Preparation for laboratory work, reading and analysis of principles of experimental techniques in e-course.
Hybridization of cDNA to DNA microarray containing a set of human genes.					8		8	2	
Microarray analysis and data interpretation.					8		8	2	
<b>Total</b>	<b>32</b>		<b>16</b>		<b>24</b>		<b>72</b>	<b>61</b>	

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.
Seminar	20	15 <sup>th</sup> week of the course	Preparation and oral presentation of the course topic, at the beginning of course (virtual learning environment).
Exam	80	Exam session	Test (virtual learning environment) of 50 questions from all course topics and material discussed in seminars.  <24 answered questions - 2-4 (insufficient) 24 answered questions - 5 (sufficient) 25-29 answered questions -6 (satisfactory) 30-34 answered questions - 7(highly satisfactory) 35-39 answered questions -8 (good) 40-44 answered questions -9 (very good) 45-50 answered questions -10 (excellent)
Total	100		Seminar 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 two evaluated parts.

Author	Year of publication	Title	Publishing place and house or web link
<b>Compulsory reading</b>			
Weinberg R. A	2012	The biology of cancer, 2nd ed.	Garland Science
K. Sužiedėlis, E. Sužiedėlienė, D. Characiejus, V. Pašukonienė.	2008	Cancer Biology (in Lithuanian), e-book.	Kaunas University of Technology Publishing
<b>Optional reading</b>			
Ed. Pelengaris S and Khan M	2006	The molecular biology of cancer	Blackwell publishing
D. O. Morgan	2007	The cell cycle: Principles of control	Oxford Univesity Press