

## COURSE UNIT DESCRIPTION - MOLECULAR MECHANISMS OF SYMBIOSIS

Course unit title	Code
<b>MOLECULAR MECHANISMS OF SYMBIOSIS</b>	

Lecturer(s)	Department(s)
<b>Coordinator:</b> Prof. Rolandas MEŠKYS <b>Other(s):</b>	Institute of Biochemistry of Vilnius University, Mokslininkų 12, LT-08662 Vilnius

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	2 <sup>nd</sup> semester, spring	Lithuanian

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

Number of credits allocated to the course unit	Student's total workload	Contact hours	Self-study and research hours
4	107	48	59

### Purpose of the course unit: programme competences to be developed

Upon the successful completion of this course, students will acquire:

*Subject-specific competences:*

- knowledge on the symbioses existing in the nature, their diversity, formation strategies at the molecular and cellular levels; molecular mechanisms of organism interaction, complexity of biological systems;
- skills to analytically, critically and systemically analyze and evaluate information on the organism interaction, present science based conclusions;
- skills to integrate knowledge of different scientific fields to solve cell molecular biology-related problems.

*General competences:*

- analytical and critical thinking;
- skills to clearly and scientifically present knowledge on the organism interaction at the molecular level to the professionals and non-professionals;
- readiness to study continuously and autonomously, ability to evaluate critically the novelties in the field of molecular biology and related sciences, ability to improve and update knowledge and skills and to seek new ones.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
Explains formation strategies and molecular mechanisms of symbioses that are widespread in nature.	Problem-oriented teaching during lectures, analysis of literature, discussions during seminars.	Student presentation, final exam
Explains current techniques of molecular biology used in analyses of symbiotic relationships	Problem-oriented teaching during lectures, analysis of literature, discussions during seminars.	Student presentation, final exam
Demonstrates the ability to integrate knowledge from other related disciplines, such as biochemistry, genetics, molecular biology, cell biology, microbiology.	Problem-oriented teaching during lectures, analysis of literature, discussions during seminars.	Student presentation, final exam

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. Symbiosis between unicellular eukaryotes and prokaryotes</b>	4		2	1			7	7	Analysis of the topic-related scientific papers; seminar presentation, self-directed learning
Mechanisms of symbiotic methanogenesis	2		1				3	4	
Symbiosis-based defense mechanisms	2		1	1			4	3	
<b>2. Plant-prokaryotic symbiosis</b>	4		2	1			7	7	Analysis of the topic-related scientific papers; seminar presentation, self-directed learning
Mechanisms of symbiont-host recognition, bacteroides and molecular signals of their formation	2		1				3	4	
Nitrogen fixation and joint metabolic pathways	2		1	1			4	3	
<b>3. Plat-fungi symbiosis</b>	4		2	1			7	7	Analysis of the topic-related scientific papers; seminar presentation, self-directed learning
Mycorrhizas, biosynthesis and regulation of secondary metabolites, joint metabolic pathways	2		1				3	4	
Lichens	2		1	1			4	3	
<b>4. Chemosynthetic symbiosis</b>	4		2	1			7	7	Analysis of the topic-related scientific papers; seminar presentation, self-directed learning
Formation, regulation and peculiarities of joint metabolic pathways	2		1				3	4	
Symbiotic fixation of carbon dioxide	2		1	1			4	3	
<b>5. Symbiosis between insects and microorganisms</b>	4		2	1			7	7	Analysis of the topic-related scientific papers; seminar presentation, self-directed learning
Quorum sensing systems in prokaryotes	2		1				3	4	
Molecular mechanisms of formation of symbiotic organs	2		1	1			4	3	
<b>6. Gut symbiosis</b>	4		2	1			7	7	Analysis of the topic-related scientific papers; seminar presentation, self-directed learning

Mechanisms of symbiont-host recognition	2		1				3	4	
Regulation of metabolic pathways, defense	2		1	1			4	3	
<b>7. Organelles</b>	<b>4</b>		<b>2</b>	<b>1</b>			<b>7</b>	<b>9</b>	Analysis of the topic-related scientific papers; seminar presentation, self-directed learning
Mitochondrion, genetic and biochemical relationships	2		1				3	5	
Chloroplasts, genetic and biochemical relationships	2		1	1			4	4	
<b>8. Complex symbioses</b> (more than two organisms, mechanisms of action)	<b>4</b>		<b>2</b>				<b>6</b>	<b>8</b>	Analysis of the topic-related scientific papers; seminar presentation, self-directed learning
<b>Total</b>	<b>32</b>		<b>16</b>				<b>48</b>	<b>59</b>	

Assessment strategy	Weight, %	Assessment period	Assessment criteria
Topics 1-8 -related seminar presentation	50	1 <sup>st</sup> to 15 <sup>th</sup> week of the course	<p>During assessment is considered: prepared slides (the quality of *.ppt); presentation during the seminar; answers to questions and discussions (during the seminar), presentation of ideas.</p> <p><b>Assessment criteria:</b></p> <p><b>5:</b> a material of the seminar was prepared and presented excellent or very well; participation in seminar was active, participation in discussions was active, questions were asked, comments were presented.</p> <p><b>2.5:</b> a material of the seminar was prepared and presented moderately; questions were asked, but there was no participation in discussions..</p> <p><b>0:</b> no participation in the seminar, a material of the seminar was not prepared or not presented.</p>
Exam	50	16 <sup>th</sup> week of the course	<p>Final exam (written) is allowed only after positive assessment of the term paper and presentation during the seminars.</p> <p>Task of the exam consists of two problem-oriented elective or open type questions; correct answers are assessed in max. 5 points.</p> <p><b>Assessment criteria:</b></p> <p><b>5:</b> answers are prepared and presented excellent or very well; comments are presented.</p> <p><b>2.5:</b> answers are prepared and presented moderately; comments are presented not appropriately.</p> <p><b>0:</b> answers are not prepared and presented.</p>
Total	100		The final grade is based on an overall assessment of seminars and written final exam.

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
<b>Compulsory reading</b>				
		Nature, Science, Nature Reviews, Trends in Biochemistry and other journals		<a href="http://www.sciencedirect.com">http://www.sciencedirect.com</a> <a href="http://onlinelibrary.wiley.com">http://onlinelibrary.wiley.com</a> <a href="http://pubmed.gov">PubMed.gov</a>