COURSE UNIT DESCRIPTION

Course unit title	Code
Molecular Biology Fundamentals	**-**

Lecturer(s)	Department(s)
Coordinator: Dr. Julija Armalytė Lectures – 32 h. Seminars – 16 h.	Life Sciences Center, Institute of Biosciences, Saulėtekio av., 7, Vilnius

Cycle	Level of the course unit	Type of the course unit
Bachelor	1 out of 1	Elective

Mode of delivery	Period of delivered	Language(s) of instruction
Contact/auditorium	Spring semester	English

Prerequisites and corequisities	
Prerequisites: Biochemistry (basics), Cell biology	**Corequisities (if any):** -

Number of credits allocated to the course unit	Student's total workload	Contact hours		Self-study and research hours
5	133	Lectures	32	85
		Seminars	16	

Purpose of the course unit: programme competences to be developed
Upon the successful completion of this course, students will acquire: *Subject-specific competences:* • Knowledge of the basic concepts of molecular biology, the basic knowledge of the mechanisms by which the genetic material of the cells is replicated, transcribed and translated into proteins; knowledge of the similarities and differences of major molecular biology processes in prokaryotic and eukaryotic cells. • Skills to analytically, critically and systemically analyze and evaluate information related to molecular biology field. *General competences:* • 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 biology; • skills to participate in the scientific discussion; • skills to organize and plan their work and time.

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
The student will understand and be able to apply the knowledge about the basic structural units, molecular and cellular processes, their relationships and importance in determining the functions of all living organisms.	Lectures, tutorials, self-evaluation tests, discussions during seminars, self-study	Exams, seminar presentations

The student will understand the basis of life processes at the molecular level; will be able to explain the structural and functional properties and transformations of basic biological molecules.	Lectures, tutorials, self-evaluation tests, discussions during seminars, self-study	Exams, seminar presentations
The student will develop the skills to analytically, critically and systemically find, analyze and evaluate information in scientific literature related to molecular biology field	Self-study for preparing the material for seminars, discussions during seminars	Seminar presentation
The student will develop the skills to participate in scientific discussion related to molecular biology field	Discussions during seminars	Seminar presentation, extra credits for active participation

Content: breakdown of the topics	**Contact hours**							**Self-study work: time and assignments**	
Topics	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work	Contact hours	Self-study hours	**Assignments**
Introduction to Molecular biology	**2**		**2**				**4**	**5**	Self-directed assessment of knowledge level in biochemistry and cell biology
Introduction to the origin and field of study of Molecular biology, general definitions used.	2						2	2	The same
Assessment of students' level of knowledge and assignment of additional reading material if need be.			2				2	3	The same
1. The molecular structure of DNA, RNA and proteins	**7**		**4**				**11**	**15**	Analysis of the topic presented at the lectures. Self-study of the topic-related material (course e-resources). Preparation of presentations and discussions during seminars.
The molecular structure of DNA, supercoiling. Molecular structure of chromatin, levels of DNA compaction. Nucleosome structure and higher levels of chromatin packaging.	3		2				5	6	The same
Molecular structure of RNA, differences from DNA. RNA functions and their diversity.	2		2				4	6	The same
Molecular structure of proteins. Function and diversity of proteins	2						2	3	The same

2. DNA biosynthesis	**5**		**4**				**9**	**15**	Analysis of the topic presented at the lectures. Self-study of the topic-related material (course e-resources). Preparation of presentations and discussions during seminars.
Prokaryotic and eukaryotic DNA polymerases, intrinsic mechanisms of replication accuracy	1						1	2	The same
Replication in prokaryotes and eukaryotes	2						2	4	The same
Extrachromosomal replication mechanisms and diversity (mitochondria, chloroplasts plasmids)			2				2	3	The same
Replication initiation and control during the cell cycle	2		2				4	6	The same
Midterm Exam	**4**						**4**	**10**	Self-directed learning in preparation for Midterm Exam. 1-3 topic discussion during consultation/tutorial
Consultation/tutorial on the topics presented prior to Midterm Exam	2						2	10	The same
Midterm Exam	2						2		The same
3. RNA biosynthesis	**7**		**4**				**11**	**15**	Analysis of the topic presented at the lectures. Self-study of the topic-related material (course e-resources). Preparation of presentations and discussions during seminars.
RNA polymerases, the mechanism of transcription.	1						1	2	The same
Transcription in prokaryotes. Transcription in eukaryotes Transcription regulation.	4		2				6	7	The same
RNA processing	2		2				4	6	The same
4. Protein biosynthesis	**5**		**2**				**7**	**15**	Analysis of the topic presented at the lectures. Self-study of the topic-related material (course e-resources). Preparation of presentations and discussions during seminars.
Translation apparatus. Ribosome structure	2						2	4	The same
The principles of translation. Translation in prokaryotes and eukaryotes	2						2	5	The same
Post-translational modification	1		2				3	6	

Preparation for final Exam	**2**						**2**	**10**	Self-directed learning in preparation for Midterm Exam. 1-3 topic discussion during consultation/tutorial
Consultation/tutorial on the topics presented prior to Exam	2						2	10	The same
Total	**32**		**16**				**48**	**85**	

Assessment strategy	**Weight,%**	**Assessment period**	**Assessment criteria**
Midterm Exam	40%	8th week (+/- one week) of the semester	A test on the course virtual environment (moodle platform), composed of 25-40 questions on the topics covered in 1-2 parts. The questions include: multiple choice, true/false, arranging answers to a given question in the correct order, short open questions. A grade from 1 to 10 is assigned according the percentage of correct answers (10 – all questions are answered correctly, 9 – 90% questions answered correctly, etc.). Less than 45% of correct answers (a grade of <4.5) is considered as failed Midterm Exam. A fail in the Midterm Exam prohibits from taking the final Exam. The Midterm Exam must be taken in person at the auditorium at the assigned date (during lecture time, unless alternative time is agreed between the lecturer and students in advance), except when a justifiable reason (with a confirming document) is presented. Not showing up for Midterm Exam without a justifiable reason is considered a fail.
Exam	40%	Exam session	A test the course virtual environment (moodle platform), composed of 25-40 questions on the topics covered in 3-4 parts. The questions include: multiple choice, true/false, arranging answers to a given question in the correct order, short open questions. A grade of 1 to 10 is assigned according the percentage of correct answers (10 – all questions are answered correctly, 9 – 90% questions answered correctly, etc.). Less than 45% of correct answers (a grade of <4.5) is considered as failed Exam. The Exam must be taken in person at the auditorium at the assigned date during exam session, except when a justifiable reason (with a confirming document) is presented. Not showing up for Exam without a justifiable reason is considered a fail.
Seminars	20%	Every second week of the semester	Individual preparation and oral presentation of the course related topic, selected from the list (presented on the course virtual environment (moodle platform)) at the beginning of course by the student, or chosen by the student and approved by the lecturer until the indicated date. The presentation must be made at the assigned seminar date and be of the indicated length and format, which are agreed at the beginning of the course between the lecturer and the students. Failure to present at the assigned date without a justifiable reason (with a confirming document) will reduce the seminar grade to 0.

			During the presentation, three aspects of the presentation are graded by the lecturer (grades 1 to 10): - Adequate covering of the topic; - Presentation quality and clarity; - Answers to the question from lecturer and other students. The grades are assigned according the quality in the mentioned three aspects: 10 – Outstanding 9 – Excellent 8 – Very good 7 – Good 6 – Acceptable 5 – Passable 4 – Below average 3 – Significantly below average 2 – Failing 1 – Unprepared The average of the three grades is the final grade for the seminars. Participation in the seminars during the semester is mandatory. If a student fails to attend the seminars without a justifiable reason (with a confirming document), the seminar grade is reduced, depending on the number of seminars not attended: 1 seminar – no reduction of grade; 2 seminars – the seminar grade is reduced by half; 3 or more seminars – the seminar grade is reduced to 0
Extra credit (active participation)	10% (extra credit)	The whole semester (during lectures and seminars)	To gain extra credit, students are encouraged to: - During the seminars, ask presenting students questions and participate in scientific discussion; - Participate in voluntary self-evaluation quizzes at the end of each lecture. The most active students can be awarded 5-10% extra credit to their final score.
Total	100%		Midterm Exam and Exam parts each must be completed with minimal passable evaluation (≥ 4.5) to be eligible to obtain the final evaluation. The final grade is the weighted average of Midterm Exam, Exam and Seminar grades; Extra credits can be added to the final grade (not exceeding the maximum final grade of 10)

Author	Year of publica-tion	Title	Publishing place and house or web link
Compulsory reading			
Course e-resources in the virtual learning environment	Since 2025	Molecular Biology Fundamentals	https://emokymai.vu.lt/
Optional reading			
Allison L.A.	2012	Fundamental Molecular Biology (2nd edition)	John Wiley & Sons Inc (available at Vilnius University library)