COURSE UNIT DESCRIPTION - MOLECULAR BIOLOGY MODEL SYSTEMS

Course unit title	Code
MOLECULAR BIOLOGY MODEL SYSTEMS	

Lecturer(s)	Department(s)
Coordinator: Prof. Kęstutis SUŽIEDĖLIS **Others:** *Lectures, seminars, laboratory works:* prof. Kęstutis Sužiedėlis, prof. Vida Kirvelienė, prof. Donaldas Čitavičius, prof. Donatas Žvingila, dr. Vaiva Kazanavičiūtė, assoc. prof. Virginija Bukelskienė	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 (2nd stage)	1 out of 1	Elective

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

Prerequisites and corequisities	
Prerequisites: Biochemistry, genetics, cell biology, molecular biology, physiology, immunology	**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	48	61
		Seminars	8	
		Laboratory work	16	

Purpose of the course unit: programme competences to be developed

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

Subject-specific competences:

- understanding of the structural and functional features of molecular biology model organisms and their importance for biomedical and related sciences;
- basic knowledge of the modern experimental and bioinformatic methods used in the probing of the structure and functions of model organisms;
- knowledge of the application areas of model organisms in fundamental and applied life science research, in studying human diseases and their cure;
- skills to analytically, critically and systemically analyze and evaluate information related to the molecular biology model systems and their application.

General competences:

- skills for self-development, study skills in order to study molecular biology;
- skills to present in written and verbal forms the knowledge on the model organisms;
- skills to participate in the scientific discussion;

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
• Describes the features of *Saccaromyces* and their application in molecular and genetic research; • Describes the features of *Arabidopsis thaliana* and their application in molecular biology/ genetics/biotechnology; • Describes the features of *Cenorhabditis elegans* and its application in molecular biology/ genetics/developmental biology; • Describes the features of of *Dictyostelium discoideum* and its application in molecular cell biology/ genetics/developmental	Lectures, seminars, laboratory works, self-study	Midterm exam, Seminar presentation

biology;		
• Describes the features of *Xenopus laevis* and its application in molecular biology/ genetics/developmental biology; • Describes the features of *Drosophilla melanogaster* and its application in genetics/developmental biology/clinical research; • Describes the features of *Mus musculus* and its application in cell biology/genetics/developmental biology/clinical research; • Is able to depend one's point of view about usage necessity of animals against alternatives; • Analytically, critically and systemically evaluates the molecular biology information related to the molecular biology model systems and their application.	Lectures, seminars, laboratory works, self-study	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**
Unicellular models									
1. *Yeast*	**7**						**7**	**6**	Analysis of the topic-related scientific papers and material presented by teacher in e-course; self-directed learning.
Yeast life cycles and their regulation. Regulation of division of yeast cell	3						3	3	The same
Yeast regulatory and signaling systems. Research tools for yeast analysis.	4						4	3	The same
2.*Dictyostelium discoideum*	**6**						**6**	**6**	Analysis of the topic-related scientific papers and material presented by teacher in e-course; self-directed learning.
Amoeba life cycle. Differentiation and molecular mechanisms of cellular communication.	3						3	3	The same
Application of *D. discoideum* in studying cellular organelles, phagocytosis, movement and chemotaxis.	3						3	3	The same
Multicellular models									
3. *Cenorhabitis elegans*	**6**						**6**	**6**	Analysis of the topic-related scientific papers and material presented by teacher in e-course; self-directed learning.
Structure. Male, hermaphrodites and their differences. Life cycle. Development and its features.	3						3	3	The same
Cell biology of *C. elegans:* molecular, genetic and biochemical features. Research tools for *C. elegans* analysis. Transgenic worms	3						3	3	The same

and their importance for research.									
4. *Arabidopsis thaliana*	**7**						**7**	**7**	Analysis of the topic-related scientific papers and material presented by teacher in e-course; self-directed learning.
Description of the plant. Using *A. thaliana* in research of cellular molecular mechanisms.	3						3	3	The same
Principles of construction of transgenic plants.	4						4	4	The same
5. *Drosophilla melanogaster*	**6**						**6**	**6**	Analysis of the topic-related scientific papers and material presented by teacher in e-course; self-directed learning.
Description of invertebrate model. Genome features. *D. melanogaster* as a model of human diseases.	3						3	3	The same
Gradients of information macromolecules in *D. melanogaster* embryo and determination of primary body plan.	3						3	3	The same
6. *Xenopus laevis*	**8**						**8**	**7**	Analysis of the topic-related scientific papers and material presented by teacher in e-course; self-directed learning.
Maturation and development stages of *Xenopus* oocyte/embryo. Changes in cell division scenarios. *X. laevis* genome.	4						4	**4**	The same
Structure and features of *X. laevis* oocyte and application in research. Microinjection, micro dissection, transgenic frogs.	4						4	**3**	The same
7. *Mus musculus*	**7**						**7**	**7**	Analysis of the topic-related scientific papers and material presented by teacher in e-course; self-directed learning.
General knowledge about laboratory mouse.	1						1	1	The same
Genetic variety of laboratory mice.	2						2	2	The same
Transgenic mouse technology: principles and methods of receiving; field of usage.	2						2	2	The same
The role mouse model in biomedical research.	2						2	2	The same
Seminars		**8**					**8**	**10**	Analysis of the topic-related scientific papers and material presented by teacher in e-course; seminar presentation, self-directed learning.
Two- day seminar presentations on selected course topics.		8					8	10	The same

Laboratory works					**16**		**8**	**6**	Preparation for laboratory work, reading and analysis of principles of experimental techniques in e-course.
Introduction to *Xenopus laevis* frog, preparation of oocytes by surgery, analysis of progesteron induced meiotic maturation of oocytes.					8		8	2	The same
Introduction to *Cenorhabditis elegans* growth; microscopy of transgenic worms.					2		2	2	The same
Introduction of *Arabidopsis thaliana* organism, microscopyof transgenic plants.					2		2	1	The same
Practical introduction to transgenic *Mus musculus* organisms and their features.					4		4	1	The same
Total	**48**	**8**			**16**		**72**	**61**	

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	25	15th 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	9/10th week of the course	Four open answer questions on the topics 1-4 in written. 2-4 (insufficient) 5 (sufficient) 6 (satisfactory) 7(highly satisfactory) 8 (good) 9 (very good) 10 (excellent)
Exam	35	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 5-7 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 publica-tion**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsary reading				
Course teachers		Course e-resourcesin virtual learning environment		http://vma.esec.vu.lt/
		e-resources		http:/dictybase.org
		e-resources		www.arabidopsis.org/
		e-resources		http://www.wormbook.org/

		e-resources		http://www.xenbase.org
Horst Feldman	2009	Yeast: Molecular and Cell Biology		
	2010	Drosophila: methods and protocols (Methods in molecular biology)		Humana Press
Ed. By J. Faber and P. D. Nieuwkoop	1999	Normal Table of *Xenopus laevis* (Daudin): A Systematical & Chronological Survey of the Development from the Fertilized Egg till the End of Metamorphosis.		Cold Spring Harbor Laboratory Press
Šimkevičienė V., Rukšėnas O.	2001	Laboratorinių gyvūnų mokslo pagrindai (Fundamentals of laboratory animal science, *in Lithuanian)*		Vilnius UniversityPress
Optional reading				
Ed. By Howard B., Nevalainen T., Perretta G.	2010	The COST Manual of Laboratory Animal Care and Use. Refinement, Reduction and Research		CRC Press
Hau J, Van Hoosier G.L.	2010 2011 2012	Handbook of Laboratory Animal Science, Second Edition: Essential Principles and Practices, Volume I, II, III		Braintree Scientific, Inc
Ed by. R. Dickinson and M. Sweizer	2004	Yeast Physiology: The Metabolism and Molecular Physiology of Saccharomyces cerevisiae.		
R. H. Kessin.	2010	Dictyostelium: Evolution, cell biology, and the development of multicellularity (Developmental and Cell Biology Series)		Cambridge University Press
		e-resources		http://www.wormatlas.org/