COURSE UNIT DESCRIPTION –

Course unit title	Code
Molecular mechanisms of aging and rejuvenation technologies	

Lecturer(s)	Department(s)
Coordinator: Prof. dr. Vytautė Starkuvienė-Erfle **Others:** *Lectures and seminars:* Prof. dr. Vytautė Starkuvienė (lectures – 28h., seminars – 16h.) Prof dr. Aurelija Žvirblienė (lectures – 2h.) Prof. dr. Gintautas Tamulaitis (lectures – 2h.) Prof. Dr. Artūras Petronis (lectures -2h) Dr. Urtė Nėniškytė (lectures – 2h)	Faculty of Natural Sciences, Vilnius University, Life Sciences Center, Vilnius.

Mode of delivery	Period of delivered	Language(s) of instruction
in person and via teams	2st semester, spring	Lithuanian, English

Prerequisites and corequisities	
Prerequisites: Biochemistry, genetics, molecular and cell biology, biotechnology	**Corequisities (if any):**

Number of credits allocated to the course unit	Student's total workload	Contact hours		Self-study and research hours
5	135	Lectures	36	83
		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 molecular mechanisms leading to aging
- Molecular and evolutionary theories of aging
- Major strategies of rejuvenation on molecular and cellular levels
- Aging biomarkers

General competences:

- Systematic and critical study of the selected topic
- Combine knowledge of different disciplines to tackle down complex relationships
- To present a complex topic and/or contradicting ideas in a concise way

Learning outcomes of the course unit	Teaching and learning methods	Assessment methods
After successful completion of this course a student should be able to know:		
• the theories of aging • the major cellular and organismal model systems that are used for aging research • the major mechanisms that are responsible for aging processes • aging markers, to explain their function; and understand the methods for the estimation of biological age • know approaches of rejuvenation, their strengths and limitations, potential risks	Lectures, seminars, preparation of the seminars via working in groups, self-study	1) 50% of the grade: seminars on the selected course topic 2) 50% of the grade: a written exam

Content: breakdown of the topics	Contact hours							Self-study work: time and assignments	
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work	Contact hours	Self-study hours	Assignments
I. Theory									
1. **Introduction to aging research**	**4.5**		**2**				**6.5**	**15**	
Aging, its socio-economic impact and technological milestones in increasing the life-span	0.5							2	Analysis of the topic-related scientific papers and material presented by teacher self-directed learning, seminar presentations
Metrics of human population aging	0.5							2	
Evolution theories of aging and longevity	1							4	
Model organisms of aging research	2							4	
Molecular theories of aging – an overview	0.5							3	
2. Molecular mechanisms of aging and corresponding rejuvenation strategies	**26**		**12**				**38**	**57**	
Senescence and senolytics	2.5							6	
Aging of nuclear envelope	0.5							2	
Telomeres and aging	1							3	
Aging of DNA	0.5							3	
Genome remodelling	2							5	Analysis of the topic-related scientific papers and material presented by teacher self-directed learning, seminar presentations
Gene editing for anti-aging	2							5	
Protein folding, aggregation, degradation and autophagy in aging	1							4	
Mitochondrial homeostasis and oxidative damage	1							4	
Nutrient sensing and metabolic control	5							8	
Drugs for rejuvenation	1								
Aging of immune system	2							5	
Stem cell aging	1							2	
Aging of cell interaction to the environment	1.5							3	
Gut microbiome in aging	1							2	
Circadian rhythms in aging	2							2	
Aging of CNS	2							3	
3. Aging biomarkers	**3**		**2**				**5**	**7**	
Aging biomarkers and their detection methods	3							7	Analysis of the topic-related scientific papers and material presented by teacher self-directed learning, seminar presentations
4. Healthy aging	**2**						**2**	**4**	
Centenarians	1.5							3	
Anti-aging social trends	0.5							1	
	35.5		**16**				**51.5**	**83**	

Assessment strategy	Weight, %	Assessment period	Assessment criteria

Seminar	50	After every seminar	Presentations the selected topic in a form of the seminar. The quality of the presentation, the sources of information and active discussion during the seminars and lectures will be evaluated
Exam	50	Exam session Exam is allowed when the seminars are completed	Open questions in a written or oral exam 2-4 (insufficient) 5 (sufficient) 6 (satisfactory) 7 (highly satisfactory) 8 (good) 9 (very good) 10 (excellent)
Total	100		The final grade is the sum of all evaluated parts, accordingly weighted

Author	**Year of publica-tion**	**Title**	**Publishing place and house or web link**
Compulsory reading			
Reviews and research papers covering the course topics in the following journals: Nature, Science, Cell, Nature Reviews Molecular Cell Biology, Nature Ageing, Nature Medicine, Current Opinions in Cell Biology, Journal of Gerontology, Aging Cell, Aging Research Reviews, Experimental Gerontology Several examples are provided below:			
Cohn et al	2023	The hererogeneity of cell senescence: insights on the single cell level	Trends in Cell Biology
Scott et al	2022	The economic value of targeting aging	Nature Aging
Vaiserman et al	2021	Telomere Length as a Marker of Biological Age: State-of-the-Art, Open Issues, and Future Perspectives	Frontiers Genetics