Course unit (module) title	Code
Epigenomics	

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Kristina Daniūnaitė (PhD) **Other(s):**	Life Sciences Center, Vilnius University

Study cycle	Type of the course unit (module)
Second cycle	Compulsory

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face-to-face, on-line platform (interactive environment), self-study; Lectures, seminars, practice, laboratory tasks	Spring semester	English

Requirements for students	
Prerequisites: Fundamentals of Genetics and Genomics, Computer Programming, Statistics	**Additional requirements (if any):** Minimal practical experience in Genetics, or Molecular Biology, or Biochemistry laboratory, or Cell Biology

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5 ECTS	139	64	75

Purpose of the course unit (module): programme competences to be developed		
Students will acquire knowledge about epigenetic regulation of the genome and develop competence to discuss and evaluate scientific arguments in Epigenetics and Epigenomics fields, and analyze experimental data		
Learning outcomes of the course unit (module)	**Teaching and learning methods**	**Assessment methods**
2.1; 2.2; 3.1; 5.1 Ability to highlight the issues assessed in scientific publications and ability to propose solutions to the analysed problems	Group discussions, tutorials, self-study assignments, report preparation, exercises	Completion of exercises, performance in group discussions, written examination
2.1; 2.2; 3.1; 4.2. Ability to plan epigenomics experiments and to report, critically analyse, and interpret the obtained experimental data	Group discussion, tutorials, report preparation, database analysis, laboratory works, individual presentations	Two written reports (one report on experiment planning, one report on data analysis), performance in group discussions and during laboratory works, individual presentation, written examination
3.1; 5.1; Ability to operate with main epigenetic processes underlying regulation of gene expression in living organisms	Lectures (problem-based teaching), group discussions, self-study assignments, database analysis	Completion of practical assignments (one written colloquium/test, completion of exercises), performance in group discussions, written examination
3.1; 5.1 Ability to work with specialized and basic equipment of modern Epigenomics/Epigenetics laboratory in compliance with safety requirements	Laboratory works	Performance during laboratory works

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**
1. History of Epigenetics as a discipline, breakthroughs, contribution of Lithuanian scientists	1						**1**	**2**	Self-study of the most recent achievements in the field of epigenomics
2. Covalent DNA modifications (cytosine methylation and others), distribution in mammalian epigenomes and functions, epigenetic modifier proteins ("writers", "readers", and "erasers"), epigenome-wide analysis methods	4		1	2	10		**17**	**15**	Primer design for DNA methylation analysis (report), preparation for seminar topics
3. Histone modifications and associated modifier proteins, structure of nucleosomes, chromatin reorganization, chromosome positional effect, dynamics of nuclear structure, analysis methods	3		1	2			**6**	**6**	Database analysis-based self exercises, preparation for seminar topics
4. Epigenomic hereditary, epigenetic variability, X inactivation, imprinting, epigenomes of twins	1		1	1			**3**	**5**	Database analysis-based self exercises, preparation for seminar topics
5. Epigenetic reprogramming, epigenetic regulation of cellular differentiation and development	1		1	1			**3**	**5**	Critical review of students' selected recent research papers on particular topics (to be discussed during seminar)
6. Non-coding regulatory RNAs (microRNAs, piRNAs, siRNAs, snoRNAs, lncRNAs, and others), their biogenesis and structure, regulation of gene expression, distribution in genomes, RNA interference, P-bodies, associated proteins, circular RNAs, epigenome-wide and targeted analysis methods	5		1	1	10		**17**	**15**	Database analysis-based self exercises, critical review of scientific publications related to indicated topic (to be discussed during seminar)
7. Epigenetic consortia (ENCODE, Roadmap Epigenetics, etc.)	1		2	1			**4**	**6**	Scientific literature review of students' selected recent research papers on particular topics with a focus on experimental and analysis methods
8. Epigenomic changes of cancer and other human diseases, epigenetic aberrations as biomarkers for clinical diagnostics and targets for therapy	1		2		2		**5**	**6**	Database analysis-based self exercises, preparation for group discussion on particular topics during seminar
9. Model organisms, basics of experimental design, critical analysis of scientific publications, reporting of scientific experiment	1		2	1			**4**	**10**	Report of experimental data analysis

10. Epigenetic regulation of memory and behaviour, influence of environmental and dietary factors on epigenome, senescence-associated epigenetics			2				**2**	**5**	Presentation on a particular topic
11. Invited guest lecturer and/or excursion to Lithuanian science institution			2				**2**		
Total	**18**		**15**	**9**	**22**	**0**	**64**	**75**	

Assessment strategy	**Weigh t,%**	**Deadline**	**Assessment criteria**
Written colloquium/test (compulsory)	15%	During the cycle	Accumulative score (≥20 multiple choice and short open questions, up to 10 various questions/ tasks with illustrations/ schemes focused on identifying the required elements of data and interpretation)
Individual presentation and group discussions during seminars (compulsory)	10%	During the cycle	Accumulative score (activity during seminars, performance in group discussions, oral and written presentations on particular topics)
Completion of exercises and performance during laboratory works (compulsory)	5%	During the cycle	Pass/ fail (completion of ≥50% exercises, ability to operate specialized and basic equipment at the laboratory, performance at the laboratory in compliance with safety requirements; attendance of laboratory works is compulsory)
Reports of experiment design and experimental data analysis (compulsory)	20%	Until the end of cycle	Accumulative score (detailed written report of the proposed experiment design/ experiment planning, detailed written report on experimental data analysis)
Written examination (compulsory)	50%	During the exam session	Accumulative score (Up to 5 open problem-based complex questions testing both theoretical knowledge and practical skills obtained during exercises and seminars) If a student has not completed the compulsory tasks, he/she is not allowed to take the exam.

Author	**Year of public ation**	**Title**	**Issue of a periodical or volume of a publication**	**Publishing place and house or web link**
Compulsary reading				
Carlberg C and Molnar F	2018	Human Epigenomics	1st edition	Springer Singapore
Craig JM and Wong NC	2011	Epigenetics: a reference manual	1st edition	Caister Academic Press
Ringrose L	2017	Epigenetics and Systems Biology	1st edition	Academic Press
Optional reading				
Tollefsbol T	2011	Handbook of Epigenetics. The new molecular and medical genetics		Academic Press, Elsevier
Tollefsbol T	2008	Cancer Epigenetics		CRC Press, Taylor & Francis Group
Esteller M	2008	Epigenetics in Biology and Medicine		CRC Press, Taylor & Francis Group
Allis CD, Caparros ML, Jenuwein T, Reinberg D	2015	Epigenetics	2nd edition	Cold Spring Harbor Laboratory Press

Armstrong L	2013	Epigenetics		Garland Science, Taylor & Francis Group

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