Course code	Course group	Volume in ECTS credits	Course valid from	Course valid to	Reg. No.
BBK6003	C	6	2013 05 31	2016 05 31	

Course type (compulsory or optional)	**Compulsory**
Course level (study cycle)	**Master**
Semester the course is delivered	**Autumn**
Study form (face-to-face or distant)	**Face-to-face**

Course title in Lithuanian

VISUMINĖ BIOLOGINIŲ SISTEMŲ ANALIZĖ

Course title in English

INTEGRATIVE ANALYSIS OF BIOLOGICAL SYSTEMS

Short course annotation in Lithuanian (up to 500 characters)

Dalykas formuoja sistemų biologijos požiūrį ir suteikia žinių apie adekvačius tiriamųjų sistemų sudėtingumui holistinius gyvų sistemų tyrimo būdus. Nuosekliai pristatomos visuminės analizės sampratos ir tyrimų technologijos, taikomas hierarchiniuose sistemų biologijos lygmenyse: fenomikos, genomikos, transkriptomikos, proteomikos, metabolomikos, glikomikos, lipidomikos, fluksomikos, citomikos. Nagrinėjamas šių lygmenų sąryšis, biologinių molekulių sąveikos ir srautų valdymo teorija, aiškinamas bioinformatikos metodų taikymas.

Short course annotation in English (up to 500 characters)

The cours introduces concepts of systems biology and provides knowledge about the holistic approach as a tool adequate for analysis of the complex living systems. The research methodologies for the overall analysis at all hierarchical levels of living systems are introduced including phenomics, genomics, transcriptomics, proteomics, metabolomics, glicomics, lipidomics, fluxomics, cytomics. The interrelationships between these levels, as well interactions among biological molecules are considered. The applications of metabolic control theory and methods of bioinformatics are explained.

Prerequisites for entering the course

Physico-chemical analysis methods, Methods of spectral analysis, Enzymology, Molecular biology, Biochemistry

Course aim

The aim of the course is to form an approach to biological objects as system and provide students with the knowledge on holistic investigation methods adequate to system complexity: -omics.

Links between study programme outcomes, course outcomes and criteria of learning achievement evaluation

Course outcomes	Criteria of learning achievement evaluation
Understand the principles of integrative analysis methods for biological system analysis	Gives definitions for different –omics, can define the principles of suitable modern methods for an appropriate biological system analysis
Understand the principles of biological system interactions	Presents holistic view of interactions and control in different levels of biological system organisation: between molecules, cellular structures, pathways, networks etc.

Implement data bases search and suits for -omics	Can find and align sequences, construct preliminary molecular models, metabolic pathways and networks using open source data bases and programs
Manage to analyse complex protein samples	Can prepare the sample, perform the separation and identify proteins in complex mixtures using electrophoresis, HPLC, mass spectrometry and biodata bases.

Link between course outcomes and content

Course outcomes	Content (topics)
1. Understand the principles of integrative analysis methods for biological system analysis 2. Understand the principles of biological system interactions.	**1.** Analysis methods for biological systems. Era of -omics. **2.** Phenomics. **3.** Genome and genomics. **4.** Transcriptomics and interpheromics. **5.** Methods of DNA and RNA sequencing. **6.** Proteome and proteomics. **7.** Post-translational modifications of proteins. Phosphoproteomics. **8.** Metabolome, metabolomics and metabonomics. **9.** Glycomics. Lipidomics. Interactomics. **10.** Fluxomics and metabolic control theory **11.** Cytomics, tissue arrays, application of –omics in biotechnology and biomedicine
Implement data bases search and suits for –omics	**12.** System biology and integrative analysis. **13.** Bioinformatics for –omics.
Manage to analyse complex protein samples	**15.** Sample preparation Application of separation methods in proteomics **16.** Application of mass spectrometry for biological system analysis

Study (teaching and learning) methods

Teaching methods: material presentation; illustration with examples; problems' solution and explanation; consulting.
Learning methods: discussion; problem analysis; consulting; literature analysis; studying of lecture and practical work material; practical problem solution; individual student's work: information search in the literature and information analysis.

Methods of learning achievement assessment

Written tests, practical problem solution.

Distribution of workload for students (contact and independent work hours)

Lectures	**45 hours**
Laboratory work	**15 hours**
Individual students work	**100 hours**
Total:	**160 hours**

Structure of cumulative score and value of its constituent parts

Final assessment sums the assessments of written final examination (50%), written mid-term examination (30%) and assessment of laboratory works (20%).

Recommended reference materials

No	Publicati	Authors of publication and title	Publishing	Number of copies in

.	on year		house	*University library*	*Self-study rooms*	*Other libraries*
Basic materials						
1.	2008	A. M. Lesk. Introduction to Bioinformatics. 3rd ed.	University Press, New York Oxford		1	
2.	2009	**M. L. Mo and B. Ø. Palsson.** Understanding human metabolic physiology: a genome-to-systems Approach. **Trends in Biotechnology**, **27, 1**, 37-44 **http://www.sciencedirect.com/science/article/pii/S0167779908002667**	Internet			
3.	2007	R. M. Twyman. Principles of Proteomics.	Taylor&Francis, UK	1		
4.	2009	**E. Klipp**, **W. Liebermeister**, **C. Wierling**, **A. Kowald**, **H. Lehrach**, **R. Herwig**. Systems Biology: A Textbook.	Wiley&Blackwell	1		
5.	2007	Quantitative Proteomics by Mass Spectrometry. S. Sechi (ed.)	Humana Press, Totowa, New Jersey			
Supplementary materials						
1.	2010	D. M. Dziuda. Data mining for genomics and proteomics. Analysis of gene and protein expression data.	Wiley, New Jersey	1		

Course programme designed by

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