Course code	Course group	Volume in ECTS credits	Course hours
BIO 6002	C	6	160

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

Course title in Lithuanian

BIONANOTECHNOLOGIJA IR BIOMODELIAVIMAS

Course title in English

BIONANOTECHNOLOGY AND BIOMODELING

Short course annotation in Lithuanian

Šis kursas skirtas supažindinti gamtamokslius studentus su pagrindinėmis bionanotechnologijos ir biomodelliavimo idėjomis ir principais, išaiškinami šių mokslų pasiekimai ir istorija; išanalizuojami jų uždaviniai, objektai ir metodai, bei praktinis pritaikymas. Kurso metu studentai supažindinami su bionanotechnologijos taikymu biologijoje, bio-technologijoje ir medicinoje; nagrinėjami nanovamzdeliai, kvantiniai taškai, nanokapsulės, nanoreaktoriai, nanodalelės, nanoadatos, nanoporos ir kiti taikymai. Aptariami bionanotechnologijos keliami pavojai, visuomenės sveikata, aplinkos ir vartotojų apsauga, bei ateities bionanotechnologija. Apžvelgiamos biomodeliavimo ištakos ir vieta biologijoje; biologinių molekulių duomenų bazės; pažangus biologinių sekų sugretinimas; daugybinis sekų sugretinimas; genų ekspresija ir prognozavimas; baltymų analizė biomodeliavimo įrankiais; molekulinė filogenija ir evoliucija bioinformatikoje.

Short course annotation in English

To outline the importance and potential applications of nanotechnology as an enabling technology to biotechnology, to present state-of-the-art research in the field. The course concludes with lectures devoted to the social and economic context of nanotechnologies and to their potential risks and possible solutions. Course is a survey of biomodeling in biology, emphasizing basic principles, practical use and future perspectives. It provides teoretical and practical knowledge on work with biological databases, biological se1uence advanced and multiple sequence alignment, gene expression and prediction, protein analysis by biomodeling tools, molecular phylogeny and evolution in bioinformatics.

Prerequisites for entering the course

Basic biology BIO1001, Biochemistry BBK3001, General genetics BIO 3005, Biophysics BIO3006, Microbiology and basic immunology BBK3010, Basic biotechnology and bioinformatics BIO4005

Course aim

Introduce the importance of biotechnology and bioinformatics sciences and place between other nature sciences; to explain main principles, laws and applications.

Links between course outcomes and criteria of learning achievement evaluation

Course outcomes	Criteria of learning achievement evaluation

• Know functioning of molecular, biochemical, biophysical, genetic and cellular organisms, structures of population, environmental impact of population identification and assessment of foundations, research methods and bioethics rules. • Know and is able to apply the latest techniques in bioinformatics analysis and simulation results.	Present ideas, practical use of bionanotechnology and biomodeling and connections with other Nature sciences. Present biomodeling practical use in macro, organism and molecular levels. Presents principles of biological data bases structure, practical use and data mining. Present methods and applications of progressive and multiple alignments. Present gene and protein prediction tools and applications. Present objective methods to construct phylogenetic and evolutionary trees.
• Know and apply modern molecular biology techniques. Understanding of molecular biology research used simulations of the structure and scope of basic and applied life sciences; • Have knowledge on current biotechnology issues, methods and application.	Can perform bionanotechnological experiments, construct the search of diferent biological sequences, find connections and links between different macromolecular databases, make right interpretation of database records; perform biologically meaningful progressive alignments of macromolecular sequences and structures. Present right interpretation of experiments results. Construct successful structural and functional prediction of genes and proteins by using different bioinformatic tools. Use right and biologically meaningful phylogenetic analysis.

Content (topics)

1. Bionanotechnology science and history.
2. Bionanotechnology tasks, objects and methods
3. Nanotechnology in biology, technology and medicine.
4. Risks of bionanotechnology.
5. Future bionanotechnology
6. Biomodeling science and history.
7. Data bases and tools for biomodeling
8. Specialized BLAST search
9. Finding distantly related proteins
10. BLAST-like alignment tools
11. Multiple sequence alignment
12. Data bases of multiple alignment
13. Gene prediction
14. Protein prediction.
15. Phylogenetic analysis.
Practical work (contents): Drug and DNA delivery by electroporation. Use of macromolecular databases. Specialized BLAST Analysis of dinosaur DNA Microarray data analysis. Prediction of eucaryotic genes ExPASy tools in proteomic analysis. Human and chimpanzee mitochondric DNA evolution.

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

Lectures – 45 hours, laboratory work– 15 hours, examination – 3 hours, individual work – 97 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 (17%) and assessment of laboratory works (33%).

Recommended reference materials

No.	Publication year	Authors of publication and title	Publishing house	Number of copies in		
				University library	*Self-study rooms*	*Other libraries*
Basic materials						
1.	2009	Pevsner J. Bioinformatics and functional genomics	John Willey and Sons, Inc., Hoboken, New Jersey, JAV		1	1
	2004	Niemeyer C.M., Mirkin C.A. Nanobiotechnology: Concepts, Applications and Perspectives.	John Wiley & Sons		1	
2.	2006	Wink M. (Eds.) An introduction to molecular biotechnology	John Wiley & Sons	1		
Supplementary materials						
1.	2007	*Xiaohua Hu, Yi Pan.. Hoboken (N. J.). Knowledge discovery in bioinformatics :techniques, methods, and applications*	John Willey and Sons, Inc., Hoboken, New Jersey, JAV			
2.	2005	*Andrade M. A. Bioinformatics and genomes :current perspectives*	Wymondham : Horizon Scientific Press			
3.	2005	*Baxevanis A. D., Ouellette B. F. F. Bioinformatics :a practical guide to the analysis of genes and proteins*	Wiley-Interscience			
4.	2004	*Orengo C., Jones D., Thornton J.*Bioinformatics :genes, proteins and computers	Wiley-Interscience			

	2004	Niemeyer C.M., Mirkin Nanobiotechnology: Concepts, Applications and Perspectives. C.A.	

Course programme designed by

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