SZKOŁA GŁÓWNA GOSPODARSTWA WIEJSKIEGO

Basics of bioinformatics

Educational subject description sheet

Basic information

Field of study Biotechnology	**Didactic cycle** 2024/25
Speciality -	**Subject code** BBTBTjS_D.310.01604.24
Organizational unit Faculty of Biology and Biotechnology	**Lecture languages** english
Study level first cycle (engineering degree)	**Mandatory** Obligatory subjects
Study form full-time studies	**Block** Basic subjects
Education profile General academic	**Disciplines** Biological sciences

Coordinator	Marek Koter
Teacher	Marek Koter

Period	**Examination**	**Number of ECTS points**
Semester 5	Pass with grade **Activities and hours** Laboratory exercises: 45	4

Goals

Code	Goal
C1	The aim is to bring the basic concepts related to the analysis of rapidly growing sequential, structural and functional data. Now a basic skill for everyone biotechnologist is to compare and analyze their own results in the context of other genomic data (transcriptomes, proteomes, metabolomes). Many databases have been created in the last dozen or so years many computer programs that allow you to use the information listed. Biotechnologist should be able to choose the appropriate bioinformatics tool, use and properly interpret it received results.

Entry requirements

genetics, molecular biology, basic service computer skills, web browser
The student has knowledge of the basics of the functioning of genes, ways of inheriting traits, and theoretical knowledge of basic experimental techniques in molecular biology

Subject's learning outcomes

Code	Outcomes in terms of	Effects	Examination methods
Knowledge – Student knows and understands:			
W1	the databases of biological sequences and scientific literature	BTj_K3_W04, BTj_K3_W05, BTj_K3_W07_inz, BTj_K3_W12, BTj_K3_W13_inz	Written credit, Project
Skills – Student can:			
U1	edit and describe newly sequenced nucleic acid molecules as well as the sequence nucleic acid and protein from the database, and can design primers for PCR reactions	BTj_K3_U15_inz, BTj_K3_U17, BTj_K3_U19, BTj_K3_U22	Written credit, Project
U2	infer the putative function of an unknown biological sequence based on himself comparisons made to other sequences in databases	BTj_K3_U12_inz, BTj_K3_U17, BTj_K3_U18, BTj_K3_U22	Written credit, Project
Social competences – Student is ready to:			
K1	solve simple bioinformatics problems and deepening knowledge based on database	BTj_K3_K01	Written credit, Project

Study content

No.	Course content	Subject's learning outcomes	Activities
1.	What is and what does bioinformatics, genome sequencing projects, model organisms, sequence - structure - function, bioinformatics institutes, bioinformatics and transcriptome, proteome, metabolome, basic sequence information. Biological databases, data formats, inquiry form. Comparing 2 sequences, amino acid similarity, similarity tables, similarity factor, similarity search in databases, FASTA and BLAST algorithms, expect value. Methods of reading and processing sequence data (Chromas). Preparation of a restriction map (REMAP program from the EMBOSS package). Reading frames using an application from the EMBOSS package (PLOT ORF, SHOW ORF and GET ORF). Generating a protein sequence based on a nucleotide sequence (TRANSEQ program from the EMBOSS package) Basic sequence databases (DDBJ, EMBL, GenBank). Protein sequence databases. Genomic browsers. Reaching various sources of biological information via ExPASy server, databases: Swiss Prot, PROSITE. Principles of primer design, basic and advanced parameters, programs: OLIGO, eprimer3 (EMBOSS)), PRIME (GCG).	W1, U1, U2, K1	Laboratory exercises

Course advanced

Activities	Methods of conducting classes
Laboratory exercises	Individual work, Interpreting the results

Activities	Examination method	Percentage
Laboratory exercises	Project	80%
Laboratory exercises	Written credit	20%

Activities	Credit conditions
Laboratory exercises	Over 50% correctly performed tasks

Literature

Obligatory

1. Bioinformatics and Functional Genomics, Jonathan Pevsner, Wiley-Blackwell
2. Introduction to Bioinformatics, Arthur Lesk, Oxford University Press
3. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins 4th Edition, Andreas D. Baxevanis (Editor), Wiley

Optional

1. Bioinformatics For Dummies 2nd Edition, Jean-Michel Claverie, Cedric Notredame, For Dummies
2. Bioinformatics: An Introductory Textbook, Thomas Dandekar, Meik Kunz, Springer
3. Bioinformatics: Genomics and Proteomics, Ruchi Singh, Vikas
4. Practical Bioinformatics, Michael Agostino, Garland Science
5. Bioinformatics for Beginners: Genes, Genomes, Molecular Evolution, Databases and Analytical Tools, Supratim Choudhuri, Academic Press

Calculation of ECTS points

Activity form	Activity hours*
Laboratory exercises	45
Preparation for the test	15
Preparing the project	25
Self-study on the content covered in class	15
Student workload	**Hours** 100
Number of ECTS points	**ECTS** 4

* hour means 45 minutes

Effects

Code	Content
BTj_K3_K01	The graduate is ready to proper storage of data, updating and extending knowledge on topics related to biotechnology and the related sciences;
BTj_K3_U12_inz	The graduate can plan and perform experiments related to the preparation, creation and utilisation of biological material in a production process;
BTj_K3_U15_inz	The graduate can design modification of the features of a biological organism and the conditions of a process associated with the multiplication of biological material in accordance with the adopted assumptions, select devices and unit operations related to the extraction, purification and preservation of a bioproduct;
BTj_K3_U17	The graduate can analyse topics from genetics and molecular biology, provide and explain certain detailed examples;
BTj_K3_U18	The graduate can coherently communicate within the scope of the topics pertaining to biotechnology both with specialists and with outside receivers;
BTj_K3_U19	The graduate can use a foreign language in speech and in writing within the scope of fields of science and scientific disciplines proper for the field of biotechnology, according to the requirements defined for level B2 of the Common European Framework of Reference for Languages;
BTj_K3_U22	The graduate can find and assess information from various sources, including from original research, and present in a well organised manner (e.g. essays, reports and laboratory reports);
BTj_K3_W04	The graduate knows and understands the necessity to use proper simple computational techniques (including statistical analysis, computational tools and computer software suites) for biological data
BTj_K3_W05	The graduate knows and understands the principles which define the three-dimensional structure of biological macromolecules, with the ability to explain and provide the examples of the relationship between structure and function
BTj_K3_W07_inz	The graduate knows and understands experimental methods serving the examination of important areas in the field of biotechnology, chemistry, biochemistry, biophysics, molecular biology and the related sciences;
BTj_K3_W12	The graduate knows and understands the principles of mathematics and statistics for assessing and interpreting phenomena and processes occurring in the environment;
BTj_K3_W13_inz	The graduate knows and understands the importance of processes necessary to asses and initiate research in the field of biotechnology;