

COURSE OUTLINE

(1) GENERAL

SCHOOL	APPLIED BIOLOGY AND BIOTECHNOLOGY		
DEPARTMENT	BIOTECHNOLOGY		
STUDY LEVEL	Undergraduate		
COURSE CODE		SEMESTER	8 th
COURSE TITLE	ADVANCED BIOINFORMATICS		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total</i>		WEEKLY TEACHING HOURS	CREDITS
Lectures and Practicals		3	1,56
Laboratory exercises		2	0,88
Independent study			2,56
TOTAL			5,00
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Specialised		
PREREQUISITE COURSES:			
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	Greek		
IS THE COURSE OFFERED TO ERASMUS STUDENTS	Yes		
COURSE WEBSITE (URL)	https://oeclass.aua.gr/eclass/modules/auth/opencourses.php?fc=37		

(2) LEARNING OUTCOMES

Learning outcomes

The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.

Consult Appendix A

▮ Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area

▮ Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B

▮ Guidelines for writing Learning Outcomes

The course aims to gain an in-depth understanding of modern bioinformatics and high-throughput biology, with an emphasis on biological interpretation, multi-omics, and the linking of computational results to molecular mechanisms of disease. Upon successful completion of the course, students will be able to follow the current developments in the field of bioinformatics, evaluate the quality and reliability of big biological data.

The course offers the necessary theoretical and practical skills so that graduates can work in research institutions, biotechnological and pharmaceutical companies, diagnostic laboratories, as well as in the fields of biomedical data analysis and precision medicine.

Upon completion of the course, the student will be able to:

- explains the nature and characteristics of high-throughput data in modern Biology and Medicine
- understand the main sources of technical and biological error in omics data and assess their quality
- Biologically interprets the results of genomic and transcriptomic analyses
- Understand the basic principles of variant annotation and evaluate their operational impact
- correlates genomic and transcriptomic changes with phenotypic traits
- Understand proteomic data analysis techniques and their contribution to functional bioinformatics
- interprets metagenomics and microbiome data in a biological and clinical context
- Understands the multi-omics approach and its use in the study of complex biological phenomena
- analyzes the pathogenicity of genetic mutations and their molecular basis in human diseases
- Understands the principles of reproducibility and open science in bioinformatics
- Explains the importance of proper management of big biological data and FAIR principles
- Recognizes and evaluates ethical issues related to genetic data and personal health data

Upon completion of the workshops, the student will be able to use computational tools to:

- Assess OMICS data quality and identify technical artifacts
- Performs annotation and functional interpretation of genetic variants
- Analyzes and compares genomics, transcriptomic and proteomic data
- Applies basic multi-omics data integration approaches
- Constructs and interprets simple biological networks of genes and proteins

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking
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Others...
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Search for, analysis and synthesis of data and information, with the use of the necessary technology
Autonomous work
Working in an interdisciplinary environment

(3) COURSE CONTENT

Theory

1. High-Throughput Biology
2. Data quality, sources of error and biological interpretation
3. Characterization of variants and functional interpretation
4. Genomic / Transcriptomic analysis
5. Proteomics and functional bioinformatics
6. Microbiome bioinformatics and metagenomics
7. Databases and Algorithms in Bioinformatics
8. Big Biomedical Data - Dimensionability and Complexity
9. Pathogenicity of mutations and molecular basis of diseases
10. Cancer bioinformatics - multi-omics data integration
11. Ethics , reproducibility and open science, big biological data management, FAIR data and scientific transparency
12. Ethical issues and protection of personal data, reproducibility of computational analyses

(4) TEACHING and LEARNING METHODS - EVALUATION

TEACHING METHOD <i>Face-to-face, Distance learning, etc.</i>	in the classroom		
USE OF INFORMATICS and COMMUNICATION TECHNOLOGIES <i>Use of ICT in teaching, laboratory education, communication with students</i>	Lectures: Power point presentations Labs: Use of biological databases and bioinformatics software		
TEACHING ORGANISATION <i>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non-</i>	Activity	Semester workload	
	Lectures	39 h	
	Laboratory work	22h	
	Autonomous study	64 h	
	Course total (25 hours of student work load per ECTS)	125 h	
STUDENT EVALUATION <i>Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.,</i>	I. Theory: Written Examination (100%) II. Lab: Written Examination (100%)		

(5) ATTACHED BIBLIOGRAPHY

- 1.Εργαστηριακοί Υπολογισμοί στις Βιολογικές Επιστήμες (ΑΚΑΔΗΜΑΪΚΕΣ ΕΚΔΟΣΕΙΣ Ι. ΜΠΑΣΔΡΑ & ΣΙΑ)
2. Βιοπληροφορική & Λειτουργική Γονιδιωματική (ΑΚΑΔΗΜΑΪΚΕΣ ΕΚΔΟΣΕΙΣ Ι. ΜΠΑΣΔΡΑ & ΣΙΑ)