DEGREE CURRICULUM

BIOINFORMATICS AND SYSTEMS BIOLOGY

Coordination: VAQUEIRO DE CASTRO ALVES, RUI CARLOS

Academic year 2023-24

BIOINFORMATICS AND SYSTEMS BIOLOGY 2023-24

Subject's general information

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<tr><td>Subject name</td><td>BIOINFORMATICS AND SYSTEMS BIOLOGY</td></tr>
<tr><td>Code</td><td>101518</td></tr>
<tr><td>Semester</td><td>1st Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biomedical Sciences</td><td>3</td><td>COMPULSORY</td><td>Attendance-based</td></tr>
<tr><td>Master's Degree in Biomedical Research</td><td></td><td>COMPLEMENTARY TRAINING</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>3</td><td>3</td></tr>
<tr><td>Number of groups</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>VAQUEIRO DE CASTRO ALVES, RUI CARLOS</td></tr>
<tr><td>Department</td><td>BASIC MEDICAL SCIENCES</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>English</td></tr>
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BIOINFORMATICS AND SYSTEMS BIOLOGY 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BASALLO CLARIANA, ORIOL	oriol.basallo@udl.cat	,6	
GABAS MASIP, JOEL	joel.gabas@udl.cat	3,6	
USIE CHIMENOS, ANA ISABEL	anabel.usie@udl.cat	3	
VAQUEIRO DE CASTRO ALVES, RUI CARLOS	rui.alves@udl.cat	3,6	

Subject's extra information

Third year course for Bachelors of Biomedical Sciences. It is taught in the first semester of the academic year. This course aims to provide students who already have basic training in Biomedical Sciences with knowledge to use bioinformatics, systems biology and computational biology methods in the study of processes responsible for normal and abnormal functioning of organisms that are important for applications biomedicine and biotechnology. This should enable them to think about scientific problems, develop strategies to solve those problems, and apply these strategies in a scientifically rigorous and appropriate manner. In addition to facilitating the acquisition of transversal competences, it is intended that students acquire skills regarding terminology and basic concepts of Bioinformatics , Systems Biology, Computational Biology, and Medical Bioinformatics both at the theoretical and practical levels. Also, they should become familiar with the methods and tools used in the area. Students will acquire communication and teamwork skills as well as skills in the use of ICT (Information and Communication) to obtain and manage information.

This course will also help students to acquire that ability to perform autonomous learning, and perform tasks independently and outside of the classroom.

Learning objectives

Students who pass the course must: (Knowledge objectives)

• Understand and apply the theoretical concepts specified in the program.

• Understand the basic scientific terminology and language related to bioinformatics and computational biology.

• Know how to use the concepts related to the subject matter to critically evaluate the various tools available to perform the same job and their limits.

• Know how to use the concepts related to the subject matter to carry out, evaluate, and interpret results of a given project.

• Learn to identify what tools to use once the biological or medical problem is defined.

• Learn how to independently use these tools.

• Know how to write scientific papers.

• Successfully carry out the work required for the evaluation of relevant concepts.

• Interpret the results and observations of research projects in bioinformatics. Students who pass the course should be able to: (Capacity objectives)

• Provide scientific training in all aspects related to biomedicine.

• Develop the skills and attitudes necessary to be able to act broadly in the area of biotechnology research.

• Provide future professionals extensive knowledge in basic sciences, techniques and methods of biomedical research and research management organization, legal and ethical aspects of research, public health, additional languages and other subjects.

• Recognise own limitations and the need to maintain and upgrade professional skills, paying particular attention to learning independently and continuously obtaining new knowledge, products and techniques in biotechnology, as well as being motivated for improving quality.

• Gain basic training in research, being able to formulate hypotheses, collect and interpret information to solve problems using the scientific method. Understand the importance and limitations of scientific thinking in biotechnology.

Competences

Basic skills

CB1 That students have demonstrated that they have and understand knowledge in an area of study that is based on general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study

CB2 That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study

CB3 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature.

CB4 That students can transmit information, ideas, problems and solutions to both specialized and non-specialized audiences.

CB5 That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

General Competences

CG1. Have a correct oral and written expression

CG2 Master a foreign language.

CG3 Master ICT

CG4 Respect the fundamental rights of equality between men and women, the promotion of Human Rights and the

values of a culture of peace and democratic values.

CG5 Apply the gender perspective to the tasks of the professional field

Competencias Especificas

CE44. Describe the structure, properties, and levels of organization of DNA and RNA.

CE45. Define the molecular bases and mechanisms of the flow of genetic information and its regulation.

CE46. Apply the basic criteria for the quantitative validation of analysis at the global level of cell or organism.

CE47. Assess the techniques of analysis of the structure and expression of genomes.

CE48. Assess the techniques of studying the cellular proteome.

CE49. Evaluate the study techniques of cellular metabolites.

CE50. Distinguish the singularities of molecular genetic analysis and its biotechnological and biomedical implications.

CE55. Use the different bioinformatics tools to extract information from databases in relation to the structure and function of genes and proteins, and know the methods of sequence comparison and comparison between different genomes.

CE56. Distinguish the fundamentals of programming languages that allow the extraction of information from genomics, proteomics and metabolomics databases.

CE61. Differentiate the technical and methodological means used in Biomedical research

Subject contents

T**heme 1: Introduction to classical Bioinformatics. (5 H)**

Genome sequencing and assembly. Genome annotation.

Bioinformatics of non coding genes. Genes to proteins.

Predicting properties of proteins. Omics bioinformatics techniques.

Theme 2: Introduction to Molecular Networks Bioinformatics (5 H)

Integration of information for inferring genetic and protein networks. Representation of networks.

Theme 3: Introduction to physiological predictions (10 h)

Representation of a network to predict the dynamic behavior. Mathematical Models of molecular systems.

Limitations of mathematical models of biological systems.

Examples of application of the different tools and methods to research problems.

Theme 4: Medical Informatics: Bioinformatics in health and disease (5h).

Epidemiology and efficiency of the health system. Management and monitoring of patients.

Assisted diagnosis.

Practical activities

- Laboratory practice in computer lab. (Pr)

These will be held simultaneously with all students and are mandatory. In practical activities groups will solve biological problems by applying theoretical concepts. The work will be done in groups of four students that will remain constant during the course.

Methodology

Type of activity	Description	Classroom Student work		Student Work outside of the classroom		Evaluation	Total Time
		Objectives	Hours	Student work	Hours	Hours	Hours
Lectures	Lecture (Class. Large group)	Explanation of the main concepts	**22**	Study: Learn, understand and synthesize knowledge	**10**	2	**34**
Problems and cases	Class participation (Class. Large group)	Problem solving	**0**	Learning how to solve problems	**0**		**0**
Seminars	Class participation (Medium- sized group)	Activities of discussion or implementation	**0**	Problem solving and discussion	**0**		**0**
Lab	Laboratory Practice (Medium-sized group)	Implementation of the practice: to fully understand, measure ...	**0**	Study and monography writing	**0**		**0**
Computer room	Computer classroom practice (Medium-sized group)	Implementation of the practice: to fully understand, measure ...	**28**	Study and monography writing	**110**	1	**139**
Field Work	Practice Fieldwork (Medium- sized group)	Implementation of the practice: to fully understand, measure ...	**0**	Study and monography writing	**0**		**0**
Visits	Visit farms or industries	Making the Visit	**0**	Study and monography writing	**0**		**0**
Guided Activities	Student work (individual or group)	Guiding Student study (in tutoring hours)	**0**	bibliographic work, study, etc.	**0**		**0**
Others			**1**		**1**		**1**
Totals			**50**		**120**	3	**174**

Development plan

Theoretical classes will be held in the classroom, enabling virtual access via campus virtual.

Practical classes will be held in the Informatics class, unless the profesional situation of the Teaching assistants requires that they are online.

While the practice classes will take place in a practical class, the teacher might be present virtually, to incorporate the expertise of teachers who work outside the country.

In the practical classes, students will work autonomously in groups of 3-5 students, with professor supervision in case the need arises.

Evaluation

Exam	Practical work	Case studies	Other activities
Final exam in classroom or alternative activity to be determined if a classroom exam can not be held 30 %	60% (2 tasks, each counting for 30% of the final grade)	0	10%

Notes

• In order to pass the course you must get at least 6 out of 10 in each work and on the final exam. 10% of the final grade depends on the discretion of the teacher.

Alternative assessment:

In the event that the students cannot carry out the continuous evaluation due to any of the cases included in the UdL evaluation regulations, they must notify the professor during the first week of classes.

In this case, the student will be able to carry out a single assessment at the end of the course, delivering the two practical assignments carried out individually (33% of the final grade each) at the same time that they will take a final exam (34% of the final grade).