Universitat de Lleida

DEGREE CURRICULUM

BIOINFORMATICS

Coordination: VAQUEIRO DE CASTRO ALVES, RUI CARLOS

Academic year 2023-24

BIOINFORMATICS 2023-24

Subject's general information

Subject name	BIOINFORMATICS
Code	101612
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Biotechnology	3	COMPULSORY	Attendance-based
Master's Degree in Biomedical Research		COMPLEMENTARY TRAINING	Attendance-based

Course number of credits (ECTS)	6
Type of activity, credits, and groups	

Activity type	PRAULA	TEORIA
Number of credits	4	2
Number of groups	2	1

Coordination	VAQUEIRO DE CASTRO ALVES, RUI CARLOS
Department	BASIC MEDICAL SCIENCES
Teaching load distribution between lectures and independent student work	55 Classroom Hours 100 Non Classroom hours
Important information on data processing	Consult this link for more information.
Language	Anglès

BIOINFORMATICS 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BASALLO CLARIANA, ORIOL	oriol.basallo@udl.cat	,4	
MARÍN SANGUINO, ALBERTO	alberto.marin@udl.cat	6,2	
USIE CHIMENOS, ANA ISABEL	anabel.usie@udl.cat	3	
VAQUEIRO DE CASTRO ALVES, RUI CARLOS	rui.alves@udl.cat	2,4	

Subject's extra information

Third year course for Bachelors of Biotechnology. It is taught in the first semester of the academic year. This course aims to provide students who already have basic training in biotechnology with knowledge to use bioinformatics and computational methods in the study of cellular 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 and Computational Biology, 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 problema 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 biotechnology.

• 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

The graduate in Biotechnology must:

CB2 That the students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems 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 social, scientific, or ethical issues

CB4 That students can convey 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 skills

The graduate in Biotechnology must:

CG1 Be able to selectively search and use sources of information necessary to achieve training objectives.

CG2 Interpret scientific-technical information with a critical sense, and be able to make presentations based on this information.

CG3 Work in a team, with a multidisciplinary vision and with the ability to make a rational and effective distribution of tasks among team members.

CG4 Know and use appropriately the scientific and technical vocabulary of the different areas of Biotechnology.

CG5 Work in the laboratory applying quality criteria and good practice.

CG6 Know and know how to use the software and the specific databases in the different fields of the

Biotechnology.

CG7 Use the scientific method to analyze data and design experimental strategies with biotechnological applications.

CG8 Be able to form a critical judgment on the ethical, legal and environmental implications of biotechnology.

CG12 Develop work skills and interpersonal relationships in a work environment and know the organization, structure of a company or institution

Transversal competencies

The graduate in Biotechnology must:

CT1 Be able to make comprehensible written and oral reports on the work done, with a justification based on the theoretical-practical knowledge obtained.

CT2 To be able to communicate and communicate in the international field in their professional development.

CT3 Use information and communication tools and techniques for data analysis and the preparation of oral and written reports and other training and professional activities.

CT4 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.

CT5 Apply the gender perspective to the functions of the professional field

Specific competences (according to the Curriculum document)

CE10 Be able to apply mathematical procedures to scientific-technical situations necessary throughout the studies and in the future exercise of the profession.

CE11 Know and be able to use the basic concepts of the statistical method, being able to statistically analyze the results of studies and interpret them critically.

CE14 To know the biology of living beings at their molecular, cellular, organic and population levels, with emphasis on organisms of biotechnological interest.

CE15 Know the biomolecules essential for life and the basic concepts of enzymology.

CE17 To know the essential metabolic processes of living beings and their regulation.

CE18 Acquire an integrated view of cellular structures, relating them to their specific functions and the biochemical processes involved.

CE19 To know the singularities of the genetic analysis and its biotechnological functions.

CE20 Understand the function of genes and their regulation in response to external changes in the cell.

CE22 Acquire a precise knowledge of the basic principles and physiological mechanisms of animal and plant organisms.

CE28 Know and know how to apply the techniques of omic analysis and interpretation of the results.

Subject contents

Theme 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 (2h).

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 professional situation of the teaching assitants requires that they are online.

Some of the practice classes may take place in a practical class, but with the teacher 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 accounting 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 student 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).

Bibliography

Basic Bibliography

Alves, R., Vilaprinyo, E. & Sorribas, A. (2008) Integrative Computational Biology: Perspectives and Possibilities for in silico network reconstruction in Molecular Systems Biology. Current Bioinformatics, 3: 98-129

Gromiha, M. M. (2010) Protein bioinformatics : from sequence to function. Elsevier

Lesk, A. M. (2008) Introduction to Bioinformatics. Oxford

Lengauer, T. (2007) Bioinformatics: From genomes to therapies. Wiley

Savageau, M. A. (2010) Biochemical Systems Analysis: A Study of Function and Design in Molecular Biology, CreateSpace Press