Universitat de Lleida

DEGREE CURRICULUM

BIOINFORMATICS

Coordination: VAQUEIRO DE CASTRO ALVES, RUI CARLOS

Academic year 2020-21

Subject's general information

<table>
<tr><td>Subject name</td><td>BIOINFORMATICS</td></tr>
<tr><td>Code</td><td>101612</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>Master's Degree in Biomedical Research</td><td></td><td>COMPLEMENTARY TRAINING</td><td>Attendance-based</td></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>3</td><td>COMPULSORY</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>4</td><td>2</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>Teaching load distribution between lectures and independent student work</td><td>55 Classroom Hours
100 Non Classroom hours</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Anglès</td></tr>
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Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
PROFESSOR PENDENT ASSIGNAR		4,8	
VAQUEIRO DE CASTRO ALVES, RUI CARLOS	rui.alves@udl.cat	7,2	

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.

Significant competences

General Competences

Graduates in Biotechnology must:

- Know how to develop protocols and applications for biotechnology for the production of goods with human interest.
- Work in biotechnology companyies, in R&D, or in the manufacturing of bioproducts.
- Design projects by identifying innovative biotechnological applications, business ideas, work plans and implementation of new techniques and equipment.
- Communicate information, ideas, problems and solutions to both specialist and non-specialist audience.

Specific Competences (according to the study guide)

1 To be able to design simple studies, and analyze and interpret the results in accordance with the objectives of those studies.

2 Understand, critically evaluate how to use technologies and sources of clinical and biomedical dat; obtain, organize, interpret and communicate clinical, scientific and Health information.

3 To know how to apply and to perform the analysis of the structure and expression of the genome and cellular proteome.

4 Be able to use different bioinformatics tools to extract information from databases with regard to the structure and function of genes and proteins, and learn methods of comparing sequences and different genomes.

5 Understand the fundamentals of programming languages that allow the extraction of information from databases of genomic, proteomics and metabolomics.

6 Understand the concept of a mathematical model of a system and its role in the evaluation of the hypothesis on the integration of various elements of the system that is being studied.

7 Understand the importance of dynamic aspects in the evaluation of metabolic problems, with special attention to the role of simulation in evaluating models.

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 (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 COVID19 epidemics situation requires that they are online.

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 29 %	56% (2 activitats avaluables, cadascuna 28%)	0	15%

Notes

• In order to pass the course you must get at least 6 out of 10 in each work and on the final exam. 15% of the

final grade depends on the discretion of the teacher.

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