UAB
Universitat Autònoma de Barcelona

Computational Biology and Data Analysis

Code: 44784
ECTS Credits: 6

2025/2026

Degree	Type	Year
Plant Biology, Genomics and Biotechnology	OB	1

Contact

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Teachers

Ivan Reyna Llorens

Robertas Ursache

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Although there are no official prerequisites for studying this module, it is recommended to have basic knowledge in biochemistry and Molecular and Genetic Biology, preferably in the area of plants.

Objectives and Contextualisation

Recent technological advances that combine physics, optics, chemistry, and molecular biology have led to increasingly powerful experimental methods, generating vast amounts of publicly available biological data. This includes next-generation sequencing (NGS), transcriptomics, metabolomics, phenomics, and large-scale single-cell datasets-collectively known as "omics."

At the same time, synthetic biology and gene editing technologies are enabling the design, construction, and modeling of new genetic circuits, pushing the boundaries of what we can engineer and understand in plant biology and beyond.

In this module, students will use publicly available data and computational tools to explore synthetic biology questions in silico. The focus will be on building a solid foundation in data analysis, visualization, and interpretation, with an emphasis on applying these skills to problems in modern molecular design.

Learning Outcomes

1. CA10 (Competence) Apply the appropriate scientific terminology to argue the results of the research and communicate their conclusions to specialised and non-specialised audiences in a clear and unambiguous way.
2. CA11 (Competence) Apply the knowledge acquired and your ability to solve problems in new or unfamiliar environments within broader (or multidisciplinary) contexts related to Plant Biology, Genomics and Biotechnology.
3. CA12 (Competence) Use new bioinformatic tools to describe predictive models of experimental omics data in the fields of Plant Biology, Genomics and Biotechnology.
4. KA09 (Knowledge) Critically identify public and scientific information related to the development of computational biology in relation to the scientific and business environment.
5. KA10 (Knowledge) Select study methodologies and case study examples in plant biology and genomics.
6. SA16 (Skill) Interpret and discover patterns in experimental data using appropriate knowledge of biostatistics.
7. SA17 (Skill) Apply mathematical methods of analysis and predictive modelling by assimilating different types of experimental omics data and using an appropriate programming language.
8. SA18 (Skill) Apply the most appropriate methods and techniques to genomics, phenomics, transcriptomic, proteomic and metabolomic analyses.
9. SA19 (Skill) Apply bioinformatic tools to genomic studies of plant systematics and phylogeny and interpret the results obtained from the experiments carried out.

Content

Introduction to R programming with Tidyverse.

Biostatistic.

Synthetic Biology Tools.

Data scanning.

Genomics bioinformatics.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
bioinformatic sessions	15	0.6	
exam preparation	20	0.8	
lectures	18	0.72	
Type: Supervised			
supervision in the development of practical exercises	16	0.64	

Type: Autonomous			
autonomous studies	40	1.6	
bibliographic studies	30	1.2	

- Interactive master class in computer classroom

- Seminars and Practice Resolution

- Elaboration of reports

- Forum participation

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
exam related to the classes	60	5	0.2	
Proactive attitude, class participation, scientific rigor in discussions, etc	40	6	0.24	CA10, CA11, CA12, KA09, KA10, SA16, SA17, SA18, SA19

Evaluation in this module will be based on continuous assessment, with the aim of encouraging student engagement and sustained effort. The assessment activities include:

- A written exam covering theoretical content discussed in the lectures.
- Analysis and discussion of practical case studies based on scientific articles and real bioinformatics datasets. This activity will require proactive participation, critical thinking, and scientific rigor. These elements will be assessed throughout the course.

In addition, the evaluation will promote a set of key learning outcomes that, are essential for acquiring core competencies in computational and synthetic biology:

- Critically identify scientific and public information related to computational biology and its scientific and industrial context.
- Select study methodologies and practical case examples in plant biology and genomics.
- Interpret and identify patterns in experimental data using appropriate biostatistical knowledge.
- Use the most suitable methods and techniques in studies of genomics, transcriptomics, phenomics, proteomics, and metabolomics.
- Use appropriate scientific terminology to argue findings and communicate conclusions clearly to both specialized and general audiences.

- Apply acquired knowledge and problem-solving skills in new or multidisciplinary contexts related to plant biology, genomics, and biotechnology.

Bibliography

http://r4ds.had.co.nz/

Revolutionizing agriculture with synthetic biology | Nature Plants

The Big Book of Machine Learning Use Cases | Databricks

Fundamentals of Biostatistics; Rosner, B. (8ª Edición Agosto 2015) ISBN 9781305268920, Editorial CENGAGE

Software

These classes will be performed using the computers in the UAB computer classroom, which will have installed all required programs.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.