

Computational Biology and Data Analysis

Code: 44784
ECTS Credits: 6

Degree	Type	Year	Semester
4318297 Plant Biology, Genomics and Biotechnology	OB	0	1

Contact

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Teaching groups languages

You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Laura Rodríguez Botigué

Ivan Reyna Llorens

Robertas Ursache

External teachers

Jae-Seong Yang

Víctor Manuel González Miguel

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

The rise of the latest technologies combining physics, optics, chemistry and its application to molecular biology has led to high-performance experiments, resulting in an explosion of data that is publicly available. This data ranges from next generation sequencing (NGS) to transcriptomics, phenomics, metabolomics and even large-scale single-cell data, the so-called "omics". In this module, students will learn how to generate their own experimental data.

To understand the new molecular mechanisms from large data sets, researchers today must be trained in

quantitative sciences. The aim of this module is to present a small set of fundamental concepts for exploring, analyzing, viewing and understanding these data sets. To this end, the focus will be on solving synthetic biology problems using computational analysis tools.

Learning Outcomes

- 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.
- 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.
- CA12 (Competence) Use new bioinformatic tools to describe predictive models of experimental omics data in the fields of Plant Biology, Genomics and Biotechnology.
- KA09 (Knowledge) Critically identify public and scientific information related to the development of computational biology in relation to the scientific and business environment.
- KA10 (Knowledge) Select study methodologies and case study examples in plant biology and genomics.
- SA16 (Skill) Interpret and discover patterns in experimental data using appropriate knowledge of biostatistics.
- SA17 (Skill) Apply mathematical methods of analysis and predictive modelling by assimilating different types of experimental omics data and using an appropriate programming language.
- SA18 (Skill) Apply the most appropriate methods and techniques to genomics, phenomics, transcriptomic, proteomic and metabolomic analyses.
- 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.

Methodology

- 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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
bioinformatic sessions	15	0.6	CA10, CA11, CA12, KA09, KA10, SA16, SA17, SA18, SA19, CA10
exam preparation	20	0.8	CA10, CA11, CA12, KA09, KA10, SA16, SA17, SA18, SA19, CA10
lectures	18	0.72	CA10, CA11, CA12, KA09, KA10, SA16, SA17, SA18, CA10
Type: Supervised			
supervision in the development of practical exercises	16	0.64	CA10, CA11, CA12, KA09, KA10, SA16, SA17, SA18, SA19, CA10
Type: Autonomous			
autonomous studies	40	1.6	KA09, KA10, SA16, SA17, SA18, SA19, KA09
bibliographic studies	30	1.2	KA09, KA10, SA16, KA09

Assessment

The evaluation of this module will take the form of a continuous evaluation in order to encourage the student's efforts. Evaluation activities are:

- Examination of the contents treated in the theory classes.
- Practical case resolution based on scientific papers and bioinformatics data. This activity will require the student to present a proactive attitude, class participation, scientific rigour of contributions, etc. These items will be continuously evaluated

Assessment Activities

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

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.