UAB
Universitat Autònoma de Barcelona

Computational Biology and Data Analysis

Code: 44784
ECTS Credits: 6

2024/2025

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

Contact

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Teachers

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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

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

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	CA12, SA16, SA17, SA18, SA19, CA12
exam preparation	20	0.8	CA10, CA11, SA16, SA18, SA19, CA10
lectures	18	0.72	CA10, CA11, CA12, SA16, SA17, SA18, SA19, CA10
Type: Supervised			
supervision in the development of practical exercises	16	0.64	CA10, CA11, KA09, SA16, SA17, SA18, SA19, CA10
Type: Autonomous			

autonomous studies	40	1.6	CA10, KA09, KA10, SA16, CA10
bibliographic studies	30	1.2	KA09, SA16, KA09

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

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

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.

Language list

Name	Group	Language	Semester	Turn
(PAULm) Classroom practices (master)	1	English	first semester	morning-mixed
(TEm) Theory (master)	1	English	first semester	morning-mixed