Basic Research Skills in Biochemistry, Molecular Biology and Biomedicine

Code: 42894
ECTS Credits: 9

2025/2026

Degree	Type	Year
Bioquímica, Biología Molecular y Biomedicina	OB	1

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

Graduates in Biomedical Sciences, Molecular Biology, Human Biology, Biochemistry, Biotechnology, Genetics, Microbiology, Medicine, Chemistry, Pharmacy, Computer Sciences, Physics, or Veterinary Medicine.

English is the only language used in the module, both in lecturers' explanations and in tutorials, classroom discussions, materials, as well as in students' oral presentations and written assignments. Therefore, it is highly recommended to have an upper-intermediate level of English (B2, Cambridge First, TOEFL iBT 72-94 or higher), above the level required for admission to the Master's programme (B1).

Objectives and Contextualisation

The primary objective of the module is to equip the student with fundamental competencies in biomolecular and biomedical research, providing a solid foundation for the development of their scientific career. Specific objectives are detailed in the Content section.

Learning Outcomes

1. CA01 (Competence) Use scientific terminology to describe the conclusions of experimental results in the fields of Biochemistry, Molecular Biology and Biomedicine.
2. CA02 (Competence) Assess sex and gender-based inequalities in the academic and professional workplace in the fields of Biochemistry, Molecular Biology and Biomedicine.
3. KA01 (Knowledge) Define molecular mechanisms in research contributing to the advancement of knowledge in the fields of Biochemistry, Molecular Biology and Biomedicine.
4. KA02 (Knowledge) Understand research methods and techniques in the fields of Biochemistry, Molecular Biology and Biomedicine in the context of experimental work and/or emerging fields in this area of study.
5. KA03 (Knowledge) Identify the current state of knowledge and frontiers in Biochemistry, Molecular Biology and Biomedicine and the influence of activities on biomedical and socioeconomic advancement.
6. SA01 (Skill) In the context of basic, translational and/or economically relevant experimental work, apply knowledge of molecular mechanisms to problems in the fields of Biochemistry, Molecular Biology and Biomedicine.
7. SA02 (Skill) Understand available and emerging research methods and techniques in the fields of Biochemistry, Molecular Biology and Biomedicine in the context of basic, translational and/or economically motivated experimental work.
8. SA03 (Skill) Propose scientific solutions in the context of basic, translational and/or economically motivated experimental work, based on inductive reasoning and deductive methods.

Content

1- At the bench

1.1- Experimental Design

Instructor

David G. Quintana

Objectives

To equip students with a deep understanding of planning, designing, conducting, analyzing, and interpreting scientific experiments in biomolecular sciences.

Contents

- Brief overview of scientific epistemology.

- Defining the research question:

    - Background research and inductive reasoning.

    - Identifying a researchable question and approach.

    - Formulating the research objective.

- Research paradigms:

    - Hypothesis-driven research.

    - Crafting a testable, falsifiable hypothesis.

    - Recognizing and mitigating bias.

    - Emerging paradigms: question-driven research; non-hypothesis-driven research; the artificial intelligence revolution

- Designing the experiment: from theory to practice:

    - Selecting the optimal experimental system.

    - Outlining the experiment: formulation of a testable prediction through deductive reasoning.

    - Defining the variables, constants, controls.

    - Defining the *a priori* positive and negative outcomes.

    - Determining the appropriate sample sizes, replicas, replicates, time course.

- Data analysis and interpretation:

    - Understanding statistical significance and confidence level.

    - Causal inference: distinguishing correlation from causation.

    - Identifying and addressing sources of error, hidden and confounding variables.

    - Reproducibility.

    - Further model validation: by testable predictions; by replication; iterative refinement of the experimental design.

1.2- Lab Life Basics

Instructors

Oscar Zaragoza, Jaume Farres, David G. Quintana.

Objective

An overview of general biolab organization and procedures.

Blocks

- Organization of Biolabs.

- Handling of typical equipment and instruments.

- Your bench.

- Types of storage.

- The lab notebook.

- Lab safety. Good laboratory practices. Disposal of lab waste. How to react when facing spills and other accidents. Working with radioisotopes. Biosafety.

1.3- Scientific Integrity

Instructor

Oscar Zaragoza

Objective

For the student to become aware of the conflicts, tensions and uncertainties encountered in scientific research.

Contents

Case-based learning. Sources of pressure. Misconduct, fabrication, falsification, suppression, plagiarism. Misinterpretation, a priori convictions, insufficient reproducibility. Criteria for authorship.

2- Communication skills in Science

Instructors

Enrique Claro, Joaquin Arino.

Objectives

- For the student to acquire fundamental skills in written and oral communication of research results, in a concise, clear, honest manner.

- For the student to develop the ability to integrate knowledge and formulate reasonable conclusions from available information.

Blocks

- Oral skills.

- The research article.

- The MSc and PhD thesis.

- Posters.

3- Journal Clubbing

Instructors

(In alphabetical order): Marti Aldea, Jose R. Bayascas, Ester Boix, Javier Garcia-Pardo, Irantzu Pallares, Jordi Pujols, Natalia Sanchez de Groot, Enea Sancho, Carles Saura, Nathalia Varejao.

Objectives

An initiation to journal club as an essential, standard tool to:

- Develop the ability to analyze, reason, and discuss (defend and criticize) scientific results.

- Get acquainted with and understand advanced research work.

- Keep up with constant, fast-paced progress in biomolecular sciences.

- Integrate MSc/PhD students' knowledge in Biochemistry, Molecular Biology, and Biomedicine.

- Practice preparing and delivering oral presentation and discussion/defense of experimental results.

- Serve as a way of identifying some of the current frontiers in biomolecular research, including emerging methods and techniques.

Blocks

- How to critically dissect a research article.

- Relevant articles will be proposed by the different tutors for the students to work on at home, and then present and discuss them in small groups.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Full group classes (TEm, double helix) and split group seminars (SEMm, Crick / Franklin)	51	2.04	CA01, CA02, KA01, KA02, KA03, SA01, SA02, SA03, CA01
Type: Supervised			
One-on-one tutoring	4	0.16	CA01, KA02, SA01, SA02, SA03, CA01
Presentation of Journal clubs	6	0.24	CA01, KA01, KA02, KA03, SA01, SA02, CA01
Supervised work in the classroom in collaborative work teams	20	0.8	CA01, KA01, KA02, KA03, SA01, SA02, SA03, CA01
Type: Autonomous			
Work on assignments and on Journal Clubs	128	5.12	CA01, KA01, KA02, KA03, SA01, SA02, CA01

This is a highly practical course, as it is aimed at developing research competencies and self-confidence in future biomolecular researchers. Consequently, all sessions are based on hands-on, experiential learning, with the student at the center of the learning process. Due to this approach, the workload -which is evaluated- is substantial.

In general, TEm and SEMm sessions will follow the structure described below, although the instructors may adjust this as needed:

- Session 1:
    - Introductory presentation.

- Supervised teamwork (*peer instruction*), to develop relevant competencies, such as:
    - Experimental design
    - Resolving safety issues and scientific integrity conflicts related to lab work
    - Oral and written communication tasks
- Independent coursework, related to the supervised work initiated in the classroom.
- Session 2:
    - Presentation of homework assignments, followed by discussion-based learning.
    - Synthesis of key points.

In addition to TEm and SEMm sessions, students must prepare four Journal Club sessions. They are required to prepare and defend the presentations of 4 research articles of their choice from a selection of ten provided.

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
Presentation and defence of assignments	80%	8	0.32	CA01, KA01, KA02, KA03, SA01, SA02, SA03
Presentation and discussion of Journal Clubs	20%	8	0.32	CA01, CA02, KA01, KA02, KA03, SA01, SA02, SA03

Continuous evaluation:

Specific details of the different assignments will be provided by the instructors. The contribution of each block to the final grade is proportional to the workload.

- Experimental design (DGQ 25%)

- Scientific communication (EC 25%, JA 10%)

- Scientific integrity, safety, good laboratory practices, biosafety (JF 10%, OZ 10%)

- Presentation and discussion of the Journal Clubs (20%)

Class attendance:

Instructors of Module 1 consider hands-on, experiential learning to be the most effective educational strategy. Therefore, all face-to-face sessions include in-class activities that cannot be made up. Consequently, absences without documented justification due to force majeure will result in a proportional score of zero for the missed hours when calculating the final overall grade.

Use of large language models (AI):

Students are encouraged to utilize textbooks, reputable academic online resources, and artificial intelligence tools that help in their learning process and in the development of assignments. It is the instructors' responsibility, as part of the evaluation process, to ensure that the student has genuinely acquired the expected knowledge, understanding, and skills, and is not merely presenting copied information, which would constitute scientific misconduct and academic fraud (see below).

Late submission of coursework:

Coursework submitted after the deadline without a documented extenuating circumstance will incur a penalty. For each working day past the submission date, 10% of the total score will be deducted. This penalty applies until the solutions are released. Once solutions are made available, submissions will not be accepted, and a score of zero will be assigned.

Retake evaluation:

As the evaluation is based on continuous work, this module does not offer a retake evaluation option.

Single evaluation:

This module does not offer a single evaluation option.

Non-assessable:

A student who submits coursework accounting for less than two-thirds of the total grade will be classified as "Non-assessable".

Misconduct:

All written work and presentation materials will be scanned using plagiarism detection software. The detection of a single instance of academic misconduct-including the use of large language model-generated content that the student is unable to understand, rationalize, elaborate upon, or explain-will result in direct failure of the entire module (not just the specific assignment), irrespective of any disciplinary proceedings that may be initiated.

Bibliography

The recommended textbooks are available at the UAB libraries.

- At the Bench. A laboratory Navigator. Kathy Barker. Cold Spring Harbor Laboratory Press, 2005.

- Experimental Design for Biologists. David J. Glass. Cold Spring Harbor Laboratory Press, 2007.

- Statistics at the Bench. A Step-by-Step Handbook for Biologists. Martina Bremer. Cold Spring Harbor Laboratory Press, 2009.

- How to Present at Meetings. George M. Hall, Neville Robinson. BMJ Books, London, 2011.

- University of Manchester Academic Phrasebank http://www.phrasebank.manchester.ac.uk/

Software

None.

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.

Name	Group	Language	Semester	Turn
(PLABm) Practical laboratories (master)	1	English	annual	morning-mixed
(PLABm) Practical laboratories (master)	2	English	annual	morning-mixed
(SEMm) Seminars (master)	1	English	annual	morning-mixed
(SEMm) Seminars (master)	2	English	annual	morning-mixed
(TEm) Theory (master)	1	English	annual	morning-mixed