Basic Research Skills in Biochemistry, Molecular Biology and Biomedicine 2014/2015

Code: 42894
ECTS Credits: 9

Degree	Type	Year	Semester
4313794 Bioquímica, Biologia Molecular i Biomedicina	OB	0	A

Contact

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Use of languages

Principal working language: anglès (eng)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Teachers

Joaquín Ariño Carmona
Ester Boix Borrás
Jaume Farrés Vicén
Salvador Ventura Zamora
Rosemary Thwaite
Miguel Chillon Rodriguez
Enrique Claro Izaguirre
Assumpció Bosch Merino
Xavier Vallve Sanchez
Elena Galea Rodríguez de Velasco
Carlos Alberto Saura Antolin
Victor Jose Yuste Mateos
Jose Ramon Bayascas Ramirez
David Reverter Cendrós
Irantzu Pallarés Goitiz

Prerequisites

Graduates in Biochemistry, Biotechnology, Biology, Biomedical Sciences, Genetics, Microbiology, Chemistry, Computing Sciences, Physics, Veterinary Medicine, Pharmacy or Medicine.
An upper-intermediate level of English is required, as all the classes in the module are in English.

Objectives and Contextualisation

The global objective of the course is for the student to acquire fundamental competencies in Biochemistry, Molecular Biology and Biomedical research, to gain a solid grounding as a biomolecular scientist. Specific objectives are detailed in the Content section.

Skills

- Analyse and correctly interpret the molecular mechanisms operating in living beings and identify their applications.
- Apply techniques for modifying living beings or parts of these in order to improve pharmaceutical and biotechnological processes and products or develop new products.
- Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
- Conceive, design, develop and synthesise scientific and/or biotechnological projects within biochemistry, molecular biology or biomedicine.
- Continue the learning process, to a large extent autonomously.
- Develop critical reasoning within the subject area and in relation to the scientific or business context.
- Identify and propose scientific solutions to problems in molecular-level biological research and show understanding of the biochemical complexity of living beings.
- Identify and use bioinformatic tools to solve problems in biochemistry, molecular biology and biomedicine.
- Integrate contents in biochemistry, molecular biology, biotechnology and biomedicine from a molecular perspective.
- Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
- Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
- Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
- Use and manage bibliography and IT resources related to biochemistry, molecular biology or biomedicine.
- Use scientific terminology to account for research results and present these orally and in writing.
- Work individually and in teams in a multidisciplinary context.

Learning outcomes

1. Acknowledge the contribution of technical innovations to progress on the frontiers of knowledge.
2. Analyse and correctly interpret the molecular mechanisms operating in living beings.
3. Analyse the state of the art in a particular area in order to formulate a relevant research question.
4. Apply knowledge of methods that are of use in solving problems in biochemistry, molecular biology and biomedicine.
5. Apply knowledge of molecular mechanisms operating in living beings to identify experimental applications, whether basic, translational or of economic interest.
6. Assess the social and economic importance of research in biochemistry, molecular biology and biomedicine.
7. Communicate and justify conclusions clearly and unambiguously to both specialist and non-specialist audiences.
8. Conceive, design, develop and synthesise scientific and/or biotechnological projects to test a hypothesis.
9. Continue the learning process, to a large extent autonomously.
10. Develop critical reasoning within the subject area and in relation to the scientific or business context.
11. Formulate correct conclusions.
12. Identify available emerging methods within biomolecular research.
13. Identify emerging fields in research into biochemistry, molecular biology and biomedicine.
14. Identify the most appropriate organism for tackling a particular experimental problem.

15. Integrate knowledge and use it to make judgements in complex situations, with incomplete information, while keeping in mind social and ethical responsibilities.
16. Make an appropriate choice in the context of an experimental study.
17. Propose, based on findings, new experiments to take the research further .
18. Recognise molecular mechanisms in a research context.
19. Show mastery of the different methodologies used to modify living organisms in research and their uses.
20. Solve problems in new or little-known situations within broader (or multidisciplinary) contexts related to the field of study.
21. Use acquired knowledge as a basis for originality in the application of ideas, often in a research context.
22. Use and manage bibliography and IT resources related to biochemistry, molecular biology or biomedicine.
23. Use bioinformatic resources and databases as research tools.
24. Use inductive reasoning and deductive methods to test a hypothesis and predict results.
25. Use scientific terminology to account for research results and present these orally and in writing.
26. Work individually and in teams in a multidisciplinary context.

Content

1- At the bench

1.1- Experimental Design

Instructor

David G. Quintana.

Objectives

For the student to fully understand experimental design and data analysis processes.

Blocks

- A brief introduction to the epistemology of Science.

- The problem/question framework: Defining the research objective and the best suited question to address it. What would be an acceptable answer? Defining the experimental project.

- Hypothesis driven research. Inductive vs deductive reasoning. The need for a testable, falsifiable hypothesis. The new paradigm: Question driven research. Data driven research.

- Experimental design. Choosing the optimal experimental system. Instrument calibration and controls. Types of experiments. Independent and dependent variables; constants; hidden variables. Positive and negative controls; blind and double-blind experiments. Time courses. Reproducibility. Analysis of statistical significance.

- Data analysis and interpretation. Correlation vs causation. Sources of bias. Model formulation; validating the model through predictions that can be tested experimentally. Necessity vs sufficiency.

1.2- Lab Life Basics

Instructors

Jaume Farres, Oscar Zaragoza, Miguel Chillon, 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 rules.

- Finding the information you need. Bibliographical and bioinformatics resources. Not all sources are equal.

1.3- Scientific Integrity

Instructor

Oscar Zaragoza.

Objective

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

Blocks

Case-based learning dealing with:

- Sources of pressure.

- Misconduct: fabrication, falsification, suppression, plagiarism.

- Misinterpretation, a priori convictions, insufficient reproducibility.

- Criteria for authorship.

1.4- Science for Profit

Instructor

Xavier Vallve.

Objective

Understanding the economic opportunities of research in Biochemistry, Molecular Biology and Biomedicine.

Blocks

- Translational research.

- Transfer of knowledge.

- Patenting.

- Spin-offs.

2- Communicating Science

2.1- Scientific Writing

Instructor

Enrique Claro, Joaquin Ariño.

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

- Scientific writing.

- The research article.

- The article submission process.

- The MSc and PhD thesis.

- Posters.

- Oral presentation of research results.

2.2- Writing Science in English

Instructor

Rosemary Thwaite.

Objective

To familiarize students with the genre of the scientific research paper, focusing on strategies and tools to improve writing skills in English.

Blocks

- Introducing your topic: Purpose and format of the introduction, sentence length and linking, use of citation.

- Presenting your methods and results: Active /passive, parallelism, descriptive statements and result statements, prepositions.

- English versus Spanglish: Awareness of typical faults of style in scientific writing and vocabulary misuse (verbosity, false friends, collocation).

- Discussing your results: Features of the discussion, interpretation and argumentation, appropriate use of speculation, take home message.

3- Journal Club

Instructors

Jose Ramon Bayascas, Ester Boix, Assumpcio Bosch, Miguel Chillon, Elena Galea, Irantzu Pallares, David Reverter, Carlos Saura, Salvador Ventura, Victor Yuste.

Objectives

- An initiation to journal clubbing as an essential, standard tool:

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

- To get acquainted with andunderstand advanced research work.

- To keep up with constant, fast progress in biomolecular sciences.

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

- To practice the preparation and delivery of the oral presentation and discussion/defense of experimental results.

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

Blocks

- How to dissect a research article critically.

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

Methodology

This is an eminently practical course, as it is aimed at acquiring skills and self-confidence for the future biomolecular researcher. Therefore all sessions integrate theoretical and practical learning. The student is the center of her/his own learning process and the load of (evaluated) work is significant.

In general, each block is developed as follows:

- Session 1:
  Introductory master class.
  Supervised team work, as a way to start developing the corresponding competencies, such as solving cases related to lab work, scientific integrity conflicts, writing an article or delivering a scientific oral presentation.

- Autonomous homework, related to the supervised work begun in the classroom.

- Session 2:
  Presentation of the homework. Learning through discussion.
  Synthesis.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Master classes	51	2.04	17, 3, 4, 8, 10, 16, 11, 14, 15, 20, 7, 9, 21, 26, 24, 23, 22,

			25, 6
Type: Supervised			
Presentation of assignments and Journal clubs	28	1.12	17, 2, 3, 5, 4, 8, 19, 10, 16, 11, 12, 14, 13, 15, 20, 7, 9, 1, 18, 21, 26, 24, 23, 22, 25, 6
Supervised class work	30	1.2	17, 3, 5, 4, 8, 10, 16, 11, 12, 14, 15, 20, 7, 9, 21, 26, 24, 23, 25, 6
Type: Autonomous			
Work on assignments and Journal Club preparations	116	4.64	17, 2, 3, 5, 4, 8, 19, 10, 16, 11, 12, 14, 13, 15, 20, 7, 9, 1, 18, 21, 26, 24, 23, 22, 25, 6

Evaluation

Continuous evaluation:

- In-class work and contributions to discussions (requires attending all sessions), and written reports.

- Presentation and discussion of Journal Clubs.

Each mark will contribute to the final grade according to the corresponding fraction of hours being evaluated.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Continuous evaluation, no specific exam (see details)	0	0	0	17, 2, 3, 5, 4, 8, 19, 10, 16, 11, 12, 14, 13, 15, 20, 7, 9, 1, 18, 21, 26, 24, 23, 22, 25, 6

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.

- Interuniversity Style Guide for Writing Institutional Texts in English. Xarxa Vives d'universitats, 2013. http://ddd.uab.cat/pub/docins/2013/106815/Intstyleguide_a2013.pdf