Universitat Autònoma de Barcelona

2018/2019

Basic Research Skills in Biochemistry, Molecular Biology and Biomedicine

Code: 42894
ECTS Credits: 9

Degree	Type	Year	Semester
4313794 Biochemistry, Molecular Biology and Biomedicine	OB	0	A

Contact

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Use of languages

Principal working language: english (eng)

Other comments on languages

All classes, discussions, materials, the instructors' responses to questions, and the students' assignments will be in English. Therefore an upper-intermediate level of English is required.

Teachers

Ester Boix Borrás

Jaume Farrés Vicén

Antonio Casamayor Gracia

Rosemary Thwaite

Miguel Chillon Rodriguez

Enrique Claro Izaguirre

Assumpció Bosch Merino

Elena Galea Rodríguez de Velasco

Carlos Alberto Saura Antolin

Jose Ramon Bayascas Ramirez

David Reverter Cendrós

Alex Peralvarez Marin

Irantzu Pallarés Goitiz

External teachers

Martí Aldea

Oscar Zaragoza

Prerequisites

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

English is the only language used in the course. That includes class explanations by the instructors, tutorials, discussions in the classroom, materials, oral presentations by the students, and evaluated assignments. Therefore an upper-intermediate level (B2, Cambridge First, TOEFL 87-109) is highly recommended).

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, Antonio Casamayor, 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

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, Antonio Casamayor.

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.

- Theresearch 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 R. Bayascas, Ester Boix, Assumpcio Bosch, Miguel Chillon, Elena Galea, Irantzu Pallares, David Reverter, Carles Saura, Alex Peralvarez.

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 and understand 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 experimentalresults.

- To 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 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	10	0.4	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. Specific details will be provided by the instructors. A significant part of the mark depends on classroom presentations and on tutorial reports.

Important: Written assignments will be scanned for plagiarism. Whenever plagiarism is detected in any of the submitted works, the student will fail the whole module.

1- Assignments. Experimental design (DGQ 25%). Exercises on scientific communication (EC 25%). Assignment on lab safety and biosafety (JF + AC 15%). Exercises on scientific English (RMT 15%). The instructors strongly believe in experiential learning as the most (and perhaps the only) effective learning strategy. Therefore all face-to-face sessions involve work in the classroom. Missing a session will proportionally affect the final mark.

2- Presentation and discussion of Journal Clubs (20%). All students must attend 5 different Journal Club sessions out of a choice of 9 different articles. Missing one of the sessions or attending but not contributing to the discussion will score as zero for that session.

Students who fail the course after handing-in learning evidences amounting for at least 2/3 of the global grade (irrespectively of passing or failing them), will qualify to take a referral evaluation of the most essential failed assignment/s.

Students who hand-in less than 2/3 of the learning evidences will qualify as "non-avaluable".

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Assignments	80	10	0.4	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
Journal Clubs	20	8	0.32	17, 3, 5, 4, 10, 11, 12, 13, 15, 20, 7, 9, 1, 18, 21, 26, 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.

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