Universitat Autònoma de Barcelona

2019/2020

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
Marc Torrent Burgas

External teachers

Irene Roman
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.

Competences

- 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 achieve an in-depth understanding of experimental design and data analysis processes.

Contents

- 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 and sample. Instrument calibration and controls. Types of experiments. Variables. Controls. Time courses. Reproducibility.

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

1.2- Clinical Research

Instructor

Irene Roman

Objectives

For the student to understand the specifics of the different clinical research approaches.

Contents

- Observational studies. Descriptive, ecological, case report/case series. Descriptive and analytic, cross-sectional, case-control, cohort. Mixed.

- Experimental studies, randomized clinical trials.

- Integration of individual studies. Systematic review. Meta-analyses.

- Screening tests. Screening criteria. Reliability. Validity.

1.3- Lab Life Basics

Instructors

Jaume Farres, Oscar Zaragoza, Antonio Casamayor, Marc Torrent, 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.

- Computer lab practices. Finding the information you need. Bibliographical and bioinformatics resources. Data mining.

1.4- Scientific Integrity

Instructor

Oscar Zaragoza

Objective

For the student to become awareof 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.

1.5- Science for Profit

Seminars by

Martí Aldea; Jordi Naval.

Objective

Understanding the economic opportunities of research in Biochemistry, Molecular Biology and Biomedicine. Learn from two successful experiences. Translational research. Transfer of knowledge. Patenting. Spin-offs.

2- Communicating Science

2.1-Communication skills

Instructors

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

- Oral skills.

- The research article.

- The MSc and PhD thesis.

- Posters.

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 Clubbing

Instructors

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

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.

- 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 andBiomedicine.

- to practice the preparation and deliveryof 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 small groups.

Methodology

This is an eminently practical course, as it is aimed at the acquisition of research competences and self-confidence by the future biomolecular researcher. In consequence, all sessions are based on practical, experiential learning, where the student is the centre of her/his own learning process. For the same reason, the load of (evaluated) work is significant.

In general, TE and SEM sessions will be developed as described below, although the instructor's specific needs will prevail at all times.

- Session 1:
  Introductory presentation.
  Supervised team work (peer-leaning), as a way to start developing the corresponding competencies, such as experimental design, solving safety cases and scientific integrity conflicts related to lab work, or oral and written communication tasks.
- 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			
Full group classes (TE, double helix), split group seminars (SEM, Crick / Franklin), and computer lab practices (PLAB-I)	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 work in the classroom	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 on Journal Club	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

Assessment

Continuous evaluation

1- Assignments. Details will be provided by the different instructors.

- Experimental design (DGQ 20%)

- Clinical research (IR 5%)

- Oral and written scientific communication (EC 20%, AC 5%)

- Scientific English (RMT 10%)

- Safety and good laboratory practices, biosafety, scientific integrity (JF 5%, AC 5%, OZ 5%)

- Data mining computer lab practices (MT 5%)

Written reports will be scanned with plagiarism detection software. Detection of a single plagiarism event (including English homework) will lead to failing the module with no option to referral evaluation.

Instructors in module 1 consider that practical, experiential learning is one of the most powerful learning strategies available. For such reason all sessions involve in-class work and missing a session decreases the mark proportionally to the fraction of hours missed / total hours for that evaluated block. Only documented force majeure cases (e.g. medical certificate) will be considered.

2- Journal Club presentation and discussion (20%). Students must participate in 5 Journal Club sessions of their choice, out of 8 possible. Missed sessions or sessions with no significant contribution will count 0 to the mark.

Referral evaluations

Students who fail to reach a global mark of 5 out of 10 upon continuous evaluation, and who handed in evidences that account for at least 2/3 of the total mark (regardless of having passed or failed them) will qualify for referral evaluation of the failed evidences. Details will be discussed with the corresponding instructor.

Non-assessable

A student who hands-in evidences that account for less than 2/3 of the total mark will be qualified "Non-assessable".

Assessment 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/