Universitat Autònoma de Barcelona

2022/2023

Basic Instrumental Techniques

Code: 100879
ECTS Credits: 3

Degree	Type	Year	Semester
2500252 Biochemistry	OB	1	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Prerequisites

There are no prerequisites for this course. The student is advised to refresh the chemistry and biology knowledge acquired during the "batxillerat".

Objectives and Contextualisation

The general objective of this course is to familiarise the student with the basic techniques used in the biochemistry/molecular biology laboratory. This is a classroom-based course centred in theoretical aspects, which will be worked out in the lab in the Laboratori integrat I and II, scheduled later during the academic year.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Apply the principal techniques used in biological systems: methods of separation and characterisation of biomolecules, cell cultures, DNA and recombinant protein techniques, immunological techniques, microscopy techniques, etc.
- Clearly perceive current advances and possible future developments by reviewing scientific and technical literature in the area of biochemistry and molecular biology.
- Collaborate with other work colleagues.
- Design experiments and understand the limitations of experimental approaches.
- Identify molecular structure and explain the reactivity of the different biomolecules: carbohydrates, lipids, proteins and nucleic acids.
- Interpret experimental results and identify consistent and inconsistent elements.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Think in an integrated manner and approach problems from different perspectives.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Collaborate with other work colleagues.
3. Critically interpret the scientific literature
4. Describe strategies for purifying complex mixture biomolecules.
5. Describe the fundamental techniques used in the analysis, purification, and characterisation of biomolecules.
6. Describe the instrumentation used in the different techniques in biochemistry.
7. Design experiments and understand the limitations of experimental approaches.
8. Discuss the principal sources of information in biochemistry and molecular biology
9. Explain the fundamental theory behind basic and advanced techniques in biochemistry.
10. Explain the theoretical foundations of suitable techniques for the structural and functional characterisation of proteins and nucleic acids, and apply these.
11. Interpret experimental results and identify consistent and inconsistent elements.
12. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
13. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
14. Think in an integrated manner and approach problems from different perspectives.

Content

- Introduction to the biochemistry laboratory.

  Safety, good practices, laboratory notebook, use of materials and reagents, quantitative transfer of liquids, pipette use, statistical analysis, computer tools. Buffers, electrodes, biosensors. Sample preparation techniques.

- Spectroscopy.

  Basic principles and instrumentation: Beer-Lambert law. UV, visible and fluorescence spectroscopy.

  Applications, protein and nucleic acid quantification.

- Centrifugation.

  Basic principles.

  Instrumentation. Types of centrifuges depending on their speed: low, high and ultracentrifugation. Rotor types.

  Applications: fractional centrifugation for subcellular fractionation, gradient density centrifugation for the separation of blood coponents.

  Analytical centrifugation.

- Chromatography.

  Basic principles. Types and materials: Planaar and column chromatography. Gel filtration, ionic exchange, affinity. HPLC.

  Basic types and applications.

- Electrophoresis.

  Basic principles.

  Electrophoretic methods and instrumentation. Supports: paper, agarose and polyacrylamide.

Applications: nucleic acid separation in agarose gels and polyacrilamide gel electrophoresis (PAGE) for protein separation. PAGE types.

- Introduction to molecular biology techniques.

  Isolation and characterisation of DNA, restriction digestion of DNA. Nucleic acid amplification: the polymerase chain reaction (PCR). Basic principles of PCR and applications.

- Immunological techniques.

  Antibody production, immunoelectrophoresis, Western blot, enzyme-linked immunosorbent assay (ELISA), immunofluorescence, fluorescent activated cell sorting (FACS), LFA.

Methodology

- Guided learning (lectures): The instructor will deliver the classroom materials before each session through the MOODLE platform. Materials can be power point presentations, recorded lectures, recommended videos or exercises related to the contents of the course.
- Autonomous learning:
  Study.
  MOODLE activities.The lecturer will propose several autonomous activities. Results will be delivered through the MOODLE platform. Activities can consist in visualisation of videos or tutorials, questionnaires or others, depending on the subject matter. In general terms, activities will have a close relationship with the aspects covered during classrom sessions. Sometimes it might be necessary that students deliver the MOODLE activity before a particular classroom session, in order to fully benefit from the classroom session.
- Tutoring: Individual or small-group sessions, focused in difficulties, as virtual meetings. These will be scheduled by the instructor and/or on demand by students.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	25	1	1, 13, 12, 4, 6, 5, 8, 7, 10, 9, 3, 11, 14
Type: Supervised			
Tutorial hours	8	0.32	2, 4, 6, 5, 8, 7, 10, 9, 3, 11, 14
Type: Autonomous			
Autonomous learning: MOODLE activities	20	0.8	1, 13, 12, 2, 8, 7, 3, 11, 14
Self-study	10	0.4	4, 6, 5, 7, 10, 9, 11, 14

Assessment

- Students will undergo two written assessments, each of them accounting for 35% of the final mark. The two assessments will be taken on the same day, one after the other.
- The first assessment will evaluate the theoretical concepts, and the second one will consist of exercises (problem-solving). Each test is passed if the mark is equal or higher than 5. The two tests can be

compensated if the mark on one of them is in the interval [4,5-4,9], and the average between the two is equal or higher than 5.

- The two assessments can be retaken. Students can retake each or both assessments in case they fail one or both assessments, or those who wish to improve their marks.
- Those students who retake any test with the purpose to improve their marks give up their former mark, and must give a 48h prior notice to the instructor, in order to plan the logistics of the assessment (e.g. booking a suitable exam room).
- The written assessment results will be available for revision on a previously agreed date and place, accordind to the Faculty rules.
- A 30% of the weight will be obtained by the evaluation of the activities performed by the student, and delivered through the MOODLE platform (continuous assessment). MOODLE activities must be delivered on time and can not be retaken.
- Written assessments can not be compensated with MOODLE marks.
- Those students who can not attend written assessments because of a justified and verifiable cause, must check with the lecturer aabout the possibility to retake the assessment(s).
- In all cases, the evaluation regulations of the faculty will be applied.
- In order to retake the written assessments, students must have previously been evaluated in a set of activities equal to two thirds of the total weight of the subject. Therefore, students will be considered "No Evaluable" when the evaluation activities taken amount for less than 67% of the final mark.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
MOODLE activities	30%	8	0.32	1, 13, 12, 2, 8, 3, 11, 14
Problem solving test	35%	2	0.08	4, 6, 5, 7, 10, 9, 11, 14
Theoretical concepts test	35%	2	0.08	4, 6, 5, 7, 10, 9, 11, 14

Bibliography

• Biochemistry Laboratory: Modern Theory and Techniques, 2nd Edition, 2012. Rodney Boyer. Ed. Pearson. ISBN: 9780136043027.
• Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, 8th Edition, 2018. Andreas Hofmann and Samuel Clokie. Ed. Cambridge University Press. ISBN: 9781316614761.
• Técnicas instrumentales de análisis en Bioquímica. Juan Manuel García Segura. 1999. Ed. Síntesis. ISBN: 8477384290.
• Calculations for Molecular Biology and Biotechnology. Frank Stephenson. 3rd Edition. 2016. Ed. Elsevier. ISBN: 9780128022115. https://www-sciencedirect-com.are.uab.cat/science/book/9780128022115
• Biochemical Calculations: How to Solve Mathematical Problems in General Biochemistry, 2nd Edition, 1976. Irwin Segel. Ed. Wiley. ISBN: 978-0-471-77421-1
• Fundamentals of Biochemical Calculations. Second Edition. 2008. Krish Moorthy. Ed. CRC Press. ISBN: 9780429142185.
• Biomedical Science Practice. Experimental and Professional Skills (Fundamentals of Biomedical Science). Glencross, H. Ahmed, N. Wang, Q. 1ª Ed. 2010. ISBN 9780199533299. Oxford University Press.
• Practical Skills in Biomolecular Science 5th edn, 5th Edition. Weyers & Jones (2017) ISBN-13: 9781292100739. Pearson Eds.
• Recursos web indicats pel professor a través de MOODLE.

Software

No special programs are needed. Only a computer with web access, Excel/Googlesheets and PowerPoint/GoogleSlides or similar and a standard PDF viewer.