

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

Other comments on languages

És recomanable que els alumnes tinguin un coneixement de la llengua anglesa suficient com perquè puguin consultar sense dificultat les fonts bibliogràfiques i els recursos educatius on-line que anirà proposant la professora al llarg de l'assignatura.

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.

Competences

- 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.
- Think in an integrated manner and approach problems from different perspectives.

Learning Outcomes

1. Collaborate with other work colleagues.

2. Critically interpret the scientific literature
3. Describe strategies for purifying complex mixture biomolecules.
4. Describe the fundamental techniques used in the analysis, purification, and characterisation of biomolecules.
5. Describe the instrumentation used in the different techniques in biochemistry.
6. Design experiments and understand the limitations of experimental approaches.
7. Discuss the principal sources of information in biochemistry and molecular biology
8. Explain the fundamental theory behind basic and advanced techniques in biochemistry.
9. Explain the theoretical foundations of suitable techniques for the structural and functional characterisation of proteins and nucleic acids, and apply these.
10. Interpret experimental results and identify consistent and inconsistent elements.
11. 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 components.

Analytical centrifugation.

- Chromatography.

Basic principles. Types and materials: Planar 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 polyacrylamide 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).

Methodology

Guided learning: classroom sessions. The lecturer will deliver the classroom materials before each session. Materials can be power point presentations, recommended videos or exercises related to the contents of the course.

Autonomous learning: study.

Autonomous learning: 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 classroom 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 requested by the students. Students should contact the lecturer by e-mail in order to arrange a suitable date/time.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Lectures	25	1	3, 5, 4, 7, 6, 9, 8, 2, 10, 11
Type: Supervised			
Tutorial hours	6	0.24	1, 3, 5, 4, 7, 6, 9, 8, 2, 10, 11
Type: Autonomous			
Autonomous learning: MOODLE activities	22	0.88	1, 7, 6, 2, 10, 11
Self-study	10	0.4	3, 5, 4, 6, 9, 8, 10, 11

Assessment

Students will undergo two written assessments, which will account for the 45% of the final mark, respectively. 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 will be 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 lecturer, 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, according to the Faculty rules.

A 10% 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.

Those students who can not attend written assessments because of a justified and verifiable cause, must check with the lecturer about 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
First written assessment	45%	2	0.08	3, 5, 4, 6, 9, 8, 10, 11
MOODLE activities	10%	8	0.32	1, 7, 2, 10, 11
Second written assessment	45%	2	0.08	3, 5, 4, 6, 9, 8, 10, 11

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.
- 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.
- Recursos web indicats pel professor a través de MOODLE.