# COURSE DATA

## DATA SUBJECT

**Code:** 33138
**Name:** Methods in biochemistry
**Cycle:** Undergraduate Studies
**ECTS Credits:** 12
**Academic year:** 2026-27

## STUDY (S)

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1109 - Degree in Biochemistry and Biomedical Sciences | Facultat de Ciències Biològiques | 2 | Annual |

## SUBJECT-MATTER

| Degree | Subject-matter | Character |
|---|---|---|
| 1109 - Degree in Biochemistry and Biomedical Sciences | Métodos instrumentales | COMPULSORY |

## COORDINATION

IGUAL GARCIA JUAN CARLOS

QUILIS BAYARRI INMACULADA

MARTINEZ PASTOR M TERESA

# SUMMARY

The course of "Methods in Biochemistry" is included within the subject "Methods in Molecular Biosciences", which is compulsory in the second degree course in Biochemistry and Biomedical Sciences. This course has 27 ECTS credits and it is offered through annual length in four courses: "Methods in Biochemistry" (12 ECTS), "Genetic Engineering" (6 ECTS), "Techniques of genetic analysis" (4, 5 ECTS credits) and "Cell analysis techniques" (4.5 ECTS).

The general objectives of the course "Methods in Biochemistry" are: 1) Describe the fundamentals of the methods in the field of Biochemistry and Molecular Biology. 2) Be familiar with techniques to purify, characterize and manipulate biomacromolecules. 3) Analyze the application of the studied methodologies to solve biological problems.

# PREVIOUS KNOWLEDGE

## RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

## OTHER REQUIREMENTS

# COMPETENCES / LEARNING OUTCOMES

## 1109 - Degree in Biochemistry and Biomedical Sciences

Acquire skills to use the methodologies of molecular biosciences and to keep an annotated record of activities.

Be able to think in an integrated manner and approach problems from different perspectives.

Be able to use new information and communication technologies.

Capacidad para la asimilación de textos científicos en inglés.

Have capacity for analysis, synthesis and critical reasoning in the application of the scientific method.

Know how to design multidisciplinary experimental strategies in the field of molecular biosciences to solve complex biological problems, especially those related to human health.

Know how to use the different bibliographic sources and biological databases and be able to use bioinformatic tools.

Know how to work responsibly and rigorously in the laboratory, considering the safety aspects in experimentation as well as the legal and practical aspects of the handling and disposal of waste.

Know the usual procedures used by scientists in the area of molecular biosciences and biomedicine to generate, transmit and disseminate scientific information.

Show initiative and leadership for multidisciplinary teamwork and cooperation.

Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.

Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.

Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.

Students must have the ability to gather and interpret relevant data (usually in their field of study) to make

judgements that take relevant social, scientific or ethical issues into consideration.

Understand experimental approaches and their limitations and interpret scientific results in molecular biosciences and biomedicine.

## DESCRIPTION OF CONTENTS

**ITEM 1. ABSORPTION SPECTROSCOPY.**

Physicochemical fundamentals of spectroscopy. Measure the absorption of radiation. Molecular absorption spectroscopy in the ultraviolet-visible (UV-V). Spectroscopy in the region of infrared (IR). Biochemical applications. (13 hours T, 3 hours P).

**ITEM 2. FLUORESCENCE SPECTROSCOPY.**

Dissipation of energy by excited molecules. Fluorescence and chemiluminescence. Fluorescence spectroscopy, generalities. Induced energy transfer by resonance. Biochemical applications: intrinsic and extrinsic fluorescence of proteins, nucleic acids and membranes. Cellular studies. (13 hours T, 4 hours P).

**ITEM 3. CHROMATOGRAPHY.**

General fundamentals of chromatography. Partition chromatography. Adsorption chromatography. Ion exchange chromatography. Exclusion chromatography. Affinity chromatography. Biochemical applications. (6 hours T, 3 hours P).

**ITEM 4. ELECTROPHORESIS.**

General. Electrophoresis techniques. Free electrophoresis capillary. Zonal electrophoresis in polyacrylamide and agarose. Transfers to other media. Applications. Isoelectric focusing. Two-dimensional electrophoresis. (5 hours T, 2 hours P).

**ITEM 5. CENTRIFUGATION.**

The process of sedimentation. Sedimentation coefficient. Preparative sedimentation homogeneous medium. Sub cellular fractions in density gradient sedimentation, and isopycnic zonal. (2 hours T, 2 hours P).

**ITEM 6. ISOTOPIC METHODS.**

Fundamental principles of the use of isotopes in biochemistry. Radioactive decay. Measurement of radioactivity. Applications: in vivo and in vitro. Radioimmunoassays. Autoradiography: autoradiographic methods. (4 hours T, 2 hours P).

**ITEM 7. MASS SPECTROMETRY.**

Introduction. Mass spectra and load / mass. Mass spectrometry of high molecular weight compounds. Biochemical applications. (7 hours T, 3 hours P)

**Practical sessions of Llaboratory**

PRACTICE 1. INTRODUCTION TO THE ABSORPTION SPECTROSCOPY. Management of the spectrophotometer. The Lambert-Beer Law: determination of the extinction coefficient of hemoglobin. Influence of pH on the absorption spectrum. Analysis of mixtures of chromophores. (4h).

PRACTICE 2. STUDY OF ENZYMATIC KINETIC BY SPECTROSCOPY. Measurement of alkaline phosphatase activity by spectrophotometry. Determination of kinetic parameters and types of inhibición. Hyperchromic effect. Determination of nuclease activity by hyperchromic effect. Calculation of hyperchromicity of DNA (4h).

PRACTICE 3. MEASUREMENT OF ENZYME ACTIVITY AND METABOLITES BY SPECTROSCOPY. Determination of nuclease activity by hyperchromic effect. Calculation of a DNA hyperchromicity. Determination of ethanol concentration in samples by enzymatic assay. (4h)

PRACTICE 4. INTRODUCTION TO FLUORESCENCE SPECTROSCOPY. STUDY OF PROTEIN-LIGAND INTERACTION. Management of the spectrofluorimeter. Excitation and emission spectra. Influence of solvent polarity on the emission spectrum of a fluorophore. Fluorescence protein. Study of protein-ligand interaction. (4h).

PRACTICE 5. DETERMINATION OF Ca2+ CONCENTRATION AND pH USING FLUORESCENT PROBES. Determination of intracellular calcium and intracellular pH using permeable fluorophores. (4)

PRACTICE 6. SEPARATIVE TECHNIQUES. Purification of a protein (RUBISCO) using differential precipitation, dialysis, chromatography and polyacrylamide gel electrophoresis. Yield analysis and purification factor. (20h)

## WORKLOAD

### PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|
| Theory | 61,00 |
| Laboratory | 40,00 |
| Classroom practices | 19,00 |
| **Total hours** | **120,00** |

### NON PRESENCIAL ACTIVITIES

| Activity | Hours |
|---|---|

| | |
|---|---|
| Attendance at other activities | 0,00 |
| Individual or group project | 35,00 |
| Independent study and work | 110,00 |
| Preparation of lessons | 35,00 |
| Preparation for assessment activities | 0,00 |
| Resolution of case studies | 0,00 |
| **Total hours** | **180,00** |

## TEACHING METHODOLOGY

**Lectures of Theory:**

Sessions of an hour will be held to cover this facet of teaching. This course aims to promote active learning by students. The lectures are intended as general introductions to each topic which will present the different research techniques and will try to give a global and co-related them. Prior to the lectures, the students will have bibliographic information and material provided by the teacher.

**Lectures of problems and questions:**

One-hour sessions will be held throughout the course, interspersed with theory classes. These sessions will be structured so that students solve some of the problems before class for later discussion.

**Practical laboratory sessions:**

The teacher will provide in advance to the student with a booklet containing not only the protocols to follow, but also references and some theoretical questions. Once the experiments are done, the students must submit a technical report containing the results and conclusions that can be drawn from them. The attendance at the practical sessions is mandatory.

## EVALUATION

The assessment of learning will be completed according to the following criteria:

a) 80% of the mark will come from written tests where it will be considered the student knowledge and its ability to apply this knowledge to the interpretation of experimental results and to the resolution of questions and problems related to the experimental methodology employed. The exams will consist of one part of theoretical questions and problems.

b) 20% of the mark will come from the evaluation of practical sessions. This mark will valuate how students developed the practice (provided solutions to theoretical issues outlined above), conducted the experiments (degree of understanding and care in following the protocols) and the final technical report (presentation, clarity and appropriateness of the conclusions obtained).

There will be two qualifying exams. The first will valuate the knowledge for the spectroscopy techniques

(items 1 and 2). The second examination shall cover the topics of radioactivity, separation techniques and mass spectrometry (items 3 to 7). Each exam is scored on 10 points. The average of the two tests are multiplied by a factor 0.8, to be added the qualification of practical sessions (a total of 2 points) for the overall rating of the subject. The earning of a mark below 4.0 in any of the exams, an average value of the two exams below 4.5, or an overall course mark below 5.0, will force to a re-evaluation in a second annual convocation. The mark of one of the parts can be keep up to the second convocation just if the score is above 4.5.

To pass the subject, it is mandatory to complete the practical work.

## REFERENCES


- García Segura, J.M., Gavilanes, J.G., Martínez del Pozo, A., Montero, F., Oñaderra, M. Y Vivanco, F. Técnicas instrumentales de análisis en Bioquímica. Ed. Síntesis, 1996.
- Barceló Mairata, F. Técnicas instrumentales en Bioquímica y Biología. Ed. Universitat de les Illes Balears, 2003.
- Roca, P., Oliver, J. Y Rodriguez, A.M. Bioquímica. Técnicas y Métodos. Ed Hélice. 2004
- Freifelder, D. "Técnicas de bioquímica y biología molecular" Ed. Reverté, 1991
- Sheehan, D. Physical biochemistry: Principles and Applications (2ª edición). Ed. Wiley-Blackwell, 2009.
- Wilson, K. y Walker, J. (eds.) "Principles and Techniques of Biochemistry and Molecular Biology" (6ª edición). Cambridge University Press, 2005
- Holme, D.J. y Peck, H. Analytical Biochemistry (3ª edición). Ed. Pearson Education Limited, 1998.
- Serdyuk, I.N., Zaccai, N. Zaccai, J. Methods in molecular biophysics Ed. Cambridge University Press, 2007.