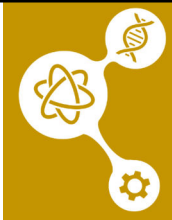
Academic year 2026/2027

Course Guide:

# Introduction to Biochemistry



FACULTY OF CHEMICAL SCIENCES

# 1. IDENTIFICATION

| | | | | | |
|---|---|---|---|---|---|
| Degree programme | Bachelor's Degree in Chemical Engineering | | | Code | 801544 |
| Course | Introduction to Biochemistry | | | ECTS | 3 |
| Subject area | Chemistry and Biochemistry | | | | |
| Module | Chemical Technology | | | | |
| Type | Compulsory | Year | Second | Semester | Second |
| Department | Biochemistry and Molecular Biology | | | | |

## Lecturers in Charge

| Activity | Lecturer | Email | Office |
|---|---|---|---|
| Course Coordinator | OLGA MARÍA ANTÓN HURTADO | olganton@ucm.es | Faculty of Chemistry, Building A, 4th Floor, Door 11A, Room QA 439 |

Group A

| Activity | Lecturer | Email | Office |
|---|---|---|---|
| Lectures Seminars Tutorials | OLGA MARÍA ANTÓN HURTADO | olganton@ucm.es | Faculty of Chemistry, Building A, 4th Floor, Door 11A, Room QA 439 |

Group B

| Activity | Lecturer | Email | Office |
|---|---|---|---|
| Lectures Seminars Tutorials | BEATRIZ MAESTRO GARCÍA-DONAS | marmae02@ucm.es | Faculty of Biology, Building B (annex building), 1st floor, L3 |

# 2. OBJECTIVES

## General Objective

Introduce students to the study of the fundamental principles underlying the chemical processes that take place in living organisms.

The aim is for students to acquire the essential knowledge needed to understand and relate the structure, properties and function of biological macromolecules.

Introduce students to the study of intermediary metabolism.

## Specific Objectives

o Provide a molecular basis for the understanding of biological macromolecules.
o Provide an analysis of the levels of organization of proteins and nucleic acids.
o Carry out a study of the most relevant functions of these biological molecules.
o Introduce the study of the structure-function relationship of proteins and nucleic acids.
o Establish the fundamental principles governing metabolic pathways.

# 3. PRIOR KNOWLEDGE AND RECOMMENDATIONS

## Prior Knowledge

Completion of this course requires that students have previously acquired the knowledge and competencies corresponding to the following subjects: mathematics; basic chemistry; organic chemistry. Although enrolment is not formally conditioned by these requirements, effective proficiency of such knowledge is essential for successfully undertaking this course with reasonable achievement expectations.

## Recommendations

It is recommended that students have a basic level of English for them to handle bibliographic resources, conduct information searches and communicate both orally and in writing in that language. Likewise, it is recommended that students be familiar with computer tools and software for solving complex problems, as well as applications for the writing, editing and presentation of technical reports.

# 4. CONTENTS

## Brief Description

Fundamental concepts of the cell. Structural levels of proteins and nucleic acids. Fundamental concepts of the function of these biomolecules. Introduction to metabolism.

The subject integrates the principles of green chemistry to design safer, more efficient and sustainable environmental processes.

## Course Syllabus

### Unit 1: The cell

Fundamental concepts. Function of subcellular organelles. Metabolic compartmentalization.

### Unit 2: Protein structure

Amino acids as protein components. The peptide bond. Structural levels of proteins. Native structure and denaturation

### Unit 3: Protein function

Transport and catalysis: Hemoglobin and enzymes. Enzymatic regulation.

### Unit 4: Structure and organization of nucleic acids

Nucleotides. DNA double helix. Types of RNA.

### Unit 5: Molecular bases of Genetic Engineering

Replication, transcription, RNA maturation and translation of nucleic acids.

### Unit 6: Basic principles of metabolism

Function of metabolic pathways. Regulation mechanisms. High-energy hydrolysis molecules. Metabolic role of the most relevant tissues.

# 5. COMPETENCES

## General

| | |
|---|---|
| • CG1-TQ1 | Use concepts for the autonomous learning of new methods and theories. |
| • CG5-TQ1 | Analyse, design, simulate and optimise processes and products. |

### Specific

| | |
|---|---|
| • CE24-QB12 | Use fundamental concepts in Biochemistry. |
| • CE24-QB13 | Describe the structure of large biological molecules. |
| • CE24-QB14 | Describe the catalytic function of enzymes and their regulation. |
| • CE24-QB15 | Explain the fundamentals of the biosynthesis of nucleic acids and proteins. |
| • CE24-QB16 | Explain the most basic aspects of metabolism. |

### Cross-cutting

| | |
|---|---|
| • CT1-TQ | Demonstrate capacity for analysis and synthesis. |
| • CT4-TQ | Ability to communicate in scientific terms using standard audiovisual media. |
| • CT5-TQ | Properly manage the available documentation sources. |
| • CT7-TQ | Ability to collaborate with other students. |
| • CT8-TQ | Demonstrate capacity for critical and self-critical reasoning.. |
| • CT11-TQ | Ability to carry out individual work. |

## 6. WORKLOAD DISTRIBUTION BY ACTIVITY

| Activity | Attendance (hours) | Self-study (hours) | Credits (hours) |
|---|---|---|---|
| Lectures | 19.5 | 35.5 | 2.2 |
| Seminars | 3 | 4.5 | 0.3 |
| Tutorials / guided work | 1 | 1.5 | 0.1 |
| Preparation of assignments and Exams | 3 | 7 | 0.4 |
| **Total** | **26.5** | **48.5** | **3** |

## 7. METHODOLOGY

Teaching activities will follow a hybrid methodology, making use of collaborative and individual learning. In-person activities are structured into **lectures, directed activities, seminars and tutorials.**

1.- In **lectures**, the professor will deliver an introduction of the course content. Theoretical concepts and experimental facts will be presented to provide the student with a global and comprehensive overview of the subject. At the beginning of each unit, the main content and objectives will be outlined. At the end of the unit, new proposals may be raised to interrelate the contents studied with the rest of the subject or other courses. To support theoretical explanations, students will be provided with appropriate teaching materials, either through photocopies or the **Virtual Campus**.

2.- To objectively monitor the student's work, provide more personalized follow-up and enhance autonomous group work, a series of **directed activities** will be proposed. These activities may consist of preparing short papers dealing with the course contents or related

topics, or participating in virtual campus fora, which will be monitored by the professor to foster collaborative work within the group.

3.- Seminars aim to apply the acquired knowledge to a set of questions and/or exercises. Students will be provided with a list of questions in advance to attempt their solution before class. Some exercises will be solved during the class by the professor, while in other instances, students will carry out the resolution.

4.- The professor will schedule tutorials regarding questions raised by students or the professor related to the course syllabus.

## 8. BIBLIOGRAPHY

### Basic

At the beginning of the course, the recommended bibliography will be presented, highlighting the most relevant aspects of each text. No specific textbook will be followed for the development of the course. Part of the specific recommended bibliography and supporting material uploaded to the virtual campus for the development of teaching activities may be in English. Below is a list of general recommended texts.


- Feduchi, E.; Romero, C.; Yáñez, E.; García-Hoz, C.: "Bioquímica. Conceptos esenciales" 3rd edition, Ed. Panamericana, 2021.
- Müller-Esterl, W.: "Bioquímica", 1st ed., Ed. Reverté, 2008.
- Tymoczko, J.L.; Berg, J.M.; Stryer, L.: "Bioquímica. Curso básico" (translation of the 2nd English ed. "Biochemistry. A short course"), Ed. Reverté, 2014


### Complementary


- Berg, J. M.; Tymoczko, J. L.; Stryer, L.: "Bioquímica", 6th ed., Ed. Reverté, 2008.
- Lodish, H. et al, "Biología Celular y Molecular", 5th ed., Panamericana, 2005.
- Mathews, C. K.; Van Holde, K. E.; Appling, D.R., Anthony-Cahill, S.J.: "Bioquímica", 4th ed., Ed. Pearson Educación, S.A., 2013
- García-Segura, J. M. et al, "Técnicas instrumentales de análisis en Bioquímica", Ed. Síntesis, 1996.
- Nelson, D.L.; Cox, M.M.: "Lehninger Principios de Bioquímica", 5th ed., Ed. Omega, 2009.
- Voet, D.; Voet, J. G.; Pratt, C. W.: "Fundamentos de Bioquímica", 2nd ed., Ed. Panamericana, 2007.


## 9. ASSESSMENT

Participation in the above proposed activities is mandatory for the final evaluation. To be eligible for the final evaluation, the student must have participated in at least 70% of the in-person activities.

The academic performance of the student and their final grade for the subject will be calculated on a weighted basis according to the following percentages, which will be maintained across all examination sessions:

- **WRITTEN EXAMS: 70%**

  The assessment of the acquired competences in the theory part of the subject (CG1-TQ1, CG5-TQ1, CE24-QB12, CE24-QB13, CE24-QB14, CE24-QB15, CE24-QB16, CT1-TQ1, CT4-TQ1, CT8-TQ1, CT11-TQ1) will be carried out through a single final examination. The

exam will consist of questions on the application of concepts learned during the course, as well as practical questions related to them.

### ❖ INDIVIDUAL WORK AND GUIDED ACTIVITIES: 20%

The evaluation of individual and group learning work carried out by the student will be carried out through the seminars and tutorials held throughout the course. The proficiency of the student in solving problems and exercises proposed via the virtual campus will be assessed.

The evaluation of these aspects will allow the determination of the degree of attainment of general competencies CG1-TQ1, CG5-TQ1, specific competencies CE24-QB12, CE24-QB13, CE24-QB14, CE24-QB15, CE24-QB16, and transversal competencies CT7-TQ1, CT8-TQ1, CT11-TQ1.

Students will be offered the possibility of carrying out individual or group projects on the course content or on topics related to those developed in-person classes. The possibility of participating in virtual campus fora will also be offered, which will function under the professor's supervision, seeking to foster collaborative work within the group. In this way, not only the quality of the work will be valued but also the clarity of the presentation, which will allow for determining the degree of attainment of general competencies CG1-TQ1, CG5-TQ1, specific competence CE24-QB12 and transversal competencies CT1-TQ1, CT4-TQ1, CT5-TQ1, CT7-TQ1, CT8-TQ1.

### ❖ ATTENDANCE AND ACTIVE PARTICIPATION: 10%

Student attendance and participation in all activities will be positively valued in the final grade. Repeated lack of attendance may be penalized. The evaluation of these aspects will be carried out electronically using mobile devices (i.e., Socrative) and the classroom's WiFi connectivity. In this way, it will be possible to determine the degree of attainment of general competencies CG1-TQ1, CG5-TQ1, specific competence CE24-QB12, and transversal competencies CT1-TQ1, CT8-TQ1.

The evaluation of activities complementary to written exams (i.e., personal work, tutorials, class participation, ...) will in no case be a condition for passing the subject, which can be achieved by passing the written exam, provided that the attendance requirements stated in the first paragraph of this section are met. That is, the evaluation of these other activities will therefore only contribute positively, complementing the written exam grade upwards.

# ACTIVITY PLANNING - SCHEDULE

| UNIT | ACTIVITY | HOURS | GROUPS | START | END |
|---|---|---|---|---|---|
| **1. The cell** | Lectures | 1 | 1 | 1st week | 1st week |
| **2. Protein structure** | Lectures | 4.5 | 1 | 1st week | 5th week |
| | Seminars | 1 | 1 | | |
| **3. Protein function** | Lectures | 6 | 1 | 5th week | 9th week |
| | Seminars | 1 | 1 | | |
| **4. Structure and organization of nucleic acids** | Lectures | 2 | 1 | 10th week | 11th week |
| **5. Molecular bases of Genetic Engineering** | Lectures | 4.5 | 1 | 11th week | 14th week |
| | Seminars | 1 | 1 | | |
| | Tutorials* | 1 | 4 | 12th week | |
| **6. Basic principles of metabolism** | Tutorials* | 1.5 | 1 | 15th week | 15th week |

* The scheduled tutorial is subject to possible modifications according to the joint planning of the course.

## SUMMARY OF ACTIVITIES

| ACTIVITY | ASSOCIATED COMPETENCES | TEACHING ACTIVITY | STUDENT ACTIVITY | ASSESSMENT | P | NP | TOTAL | C |
|---|---|---|---|---|---|---|---|---|
| Lectures | CG1-TQ1<br>CG5-TQ1<br>CE24-QB12<br>CE24-QB13<br>CE24-QB14<br>CE24-QB15<br>CE24-QB16<br>CT1-TQ<br>CT4-TQ<br>CT5-TQ<br>CT8-TQ<br>CT11-TQ | Presentation of theoretical concepts.<br>Raising of questions. | Note-taking, posing and answering questions. | Grading of written answers to questions related to the theoretical concepts explained. | 19.5 | 35.5 | 55 | **30%** |
| Seminars | | Application of theory to solving exercises and problems. | Note-taking. Carrying out exercises. Posing questions and doubts. | Grading of written answers for solving practical exercises. | 3 | 4.5 | 7.5 | |
| Personal work and tutorials | | Proposal of assignments. | Preparation of written individual assignments.<br>Cooperation with peers and critical analysis of work from other groups. | Assessment of the work, development, and presentation. | 1 | 1.5 | 2.5 | |
| | | Direction and supervision of student study and activities.<br>Raising of questions. | Consultation with the professor regarding difficulties encountered while preparing the subject.<br>Resolution of the questions raised. | Assessment of the work, presentation and development. | | | | |
| Exams | | Proposal, supervision, and grading of the exam.<br>Grading of the student. | Preparation and performance. | | 3 | 7 | 10 | **70%** |

**P**: Contact activities

**NP**: Non-contact activities (independent study)

**C:** Grade