



## INTRODUCTION

The main objective of this course is to understand the internal dynamics of vital processes, identify the key molecular players, and determine how their structure influences the proper functioning of living organisms. This course examines the structural and functional characteristics of sugars, lipids, and nucleic acids. In the study of proteins, the course specifically addresses the structure-function relationship of myoglobin and hemoglobin, as well as the principles of enzymatic action and Michaelis-Menten kinetics. The processes involved in the expression and transmission of genetic information, replication, transcription, and translation are also studied. The theoretical explanations will be accompanied by some basic examples of the role these molecules play in biological and physiological processes and their alterations in certain pathologies. This course serves as a foundation for studying and understanding energy metabolism, cell signaling, and the transmission of genetic information.

- **Degrees:** Degrees of the Science Faculty
- **Module:** Biochemistry
  - Subject Area: Biochemistry and Molecular Biology (Biochemistry Degree) / Biochemistry and Genetics (Biology Degree) / Fundamentals of Biochemistry (Chemistry Degree)
- **ECTS:** 6
- **Course, semester:** 1st year, 2nd semester
- **Type:** Mandatory
- **Professors:**
  - Marisol Aymerich (maymerich@unav.es) - Course coordinator
  - María Iraburu (miraburu@unav.es)
- **Language:** English
- **Classroom, Schedule:** See calendar: <http://www.unav.edu/web/facultad-de-ciencias/alumnos/horarios>

## LEARNING OUTCOMES

### Learning outcomes for the Biochemistry Degree

- RA4: Explain the structure and function of biomolecules and macromolecules, the main processes involved in their transformation, the molecular mechanisms that regulate them, and their bioenergetic aspects.
- RA5: Explain the similarities and differences among living organisms, including the structure and function of prokaryotic and eukaryotic cells, as well as the structure, variation, function, and transmission of genetic material.
- RA6: Explain the structure and function of animal and human tissues, organs, and systems, understanding the regulation and integration of the organism's various functions for application in biomedicine.
- RA8: Explain the fundamentals and applications of recombinant DNA technology, as well as the various quantitative instrumental methodologies used in biochemistry and molecular biology.
- RA10: Identify the main topics of debate and future challenges in biomedical research, its social and economic dimensions, as well as its practical applications.
- RA12: Handle chemical and/or biological materials, including safety protocols, waste disposal, detailed recording of activities, and interpretation of results.
- RA13: Apply the techniques and instruments specific to experimentation and molecular analysis in the field of biomedicine with rigor and safety.
- RA15: Solve qualitative and quantitative problems in the field of biomedicine through scientific hypotheses that can be empirically tested, applying, where appropriate, knowledge of computer science and computational biology.
- RA16: Collaborate in work teams, distributing roles equitably and selecting appropriate methodologies for the development of a task or project.



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- RA21: Explain the complexity of biological processes at the molecular level as the foundation of life phenomena.

## Learning Outcomes for the Biology Degree

- RA1: Describe the principles of the scientific method in biology.
- RA4: Identify the fundamentals of the structure and function of biomolecules, the replication, transcription, translation, and modification of genetic material, metabolic pathways, and cellular signaling.
- RA11: Conduct analyses in the health, industrial, agri-food, and environmental sectors to solve problems using the scientific method.
- RA16: Interpret the structural and functional organization at the level of biomolecules, cells, tissues, and organs in living organisms.
- RA20: Efficiently manage resources and facilities, ensuring compliance with established protocols for waste management.

## Learning Outcomes for the Chemistry Degree

- RA8: Explain the structure and reactivity of various classes of biomolecules and the chemistry of major biological processes.
- RA13: Solve qualitative and quantitative problems using previously developed models or by devising new strategies.
- RA20: Interpret data from laboratory observations and measurements, recognizing their significance and the theories that underpin them.
- RA27: Analyze how the order, symmetry, and functional efficiency of matter at the atomic and molecular scales determine its properties, structure, and chemical reactivity.

## **PROGRAM**

### THEORETICAL PROGRAM

1. Introduction to biochemistry
2. Carbohydrates: monosaccharides and disaccharides
3. Carbohydrates: oligosaccharides and polysaccharides
4. Lipids: fatty acids, triacylglycerols and phospholipids
5. Lipids: isoprenoids, steroids and eicosanoids
6. Proteins: amino acids
7. Problems: Acid-base properties of amino acids
8. Proteins: peptides and secondary structure
9. Proteins: tertiary structure
10. Proteins: quaternary structure
11. Enzymes: biological catalysts
12. Enzymes: kinetics and inhibition
13. Problems: Enzyme kinetics and inhibition
14. Enzymes: mechanism of action and regulation of enzymatic activity
15. Nucleotides
16. Nucleic acids
17. DNA replication in prokaryotes and eukaryotes
18. Transcription in prokaryotes and eukaryotes
19. Translation in prokaryotes and eukaryotes

### PRACTICAL PROGRAM

- Practice 1: Identification of sugars
- Practice 2: Quantification of nucleic acids
- Practice 3: Quantification of proteins
- Practice 4: Amylase: effect of temperature and pH on enzyme activity
- Practice 5: Tyrosinase. Effect of enzyme concentration and substrate concentration on enzymatic activity. Enzyme inhibition



## EDUCATIONAL ACTIVITIES

### In-person activities (60 hours)

- Lectures (40 hours)
- Problem-solving (2 hours)
- Lab sessions (15 hours)
- Final exam (3 hours)

### Independent study (90 hours)

## ASSESSMENT

### ORDINARY ASSESSMENT

To obtain a pass in Structural and Functional Biochemistry, it is mandatory to pass the practical session assessment.

#### 1. Assessment of practical sessions: 25%

- Each practical session accounts for 5% of the final grade
- Practical sessions are carried out individually or in pairs and lasts 3 hours.
- The materials and instructions for each practical session will be provided to the students bin advance.
- At the beginning of each session, students will answer a series of questions related to the practice work using Wooclap.
- At the end of each session, students will complete a short questionnaire to assess their understanding of the procedures.

Attendance at the practical sessions is mandatory. In addition, students must obtain a passing grade (grade >5) in order to pass the course.

#### 2. Assessment of theoretical knowledge (ordinary call): 75%

- **Continuous assessment: 10%**
  - For 1st year students only\*: During the lectures, students will be asked to connect to Wooclap and answer questions posed by the lecturer.

#### **Final exam: 65%**

- The final exam will consist of two sections, a multiple-choice question section (32.5%) and a short-answer question section (32.5%).
- **Key question:** one of the short-answer questions will require students to draw the structures of different biomolecules. This is a compulsory key question and must be answered satisfactorily for the remainder of the examination to be marked.
- There will be one mid-term exam in March accounting for 50% of the grade for the theoretical component of the course. Students who do not pass this exam, will be examined of the whole content of the course in may.
- Problems may be included in either section.
- Students must obtain at least 35% of the marks in each section for the overall examination grade to be calculated.

*\*Students repeating the course will obtain their final grade only with the final exam (75%).*

### EXTRAORDINARY ASSESSMENT

- The grade obtained in the continuous assessment will be retained.



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- The examination will be equivalent to the ordinary call.
- The grade for the practical sessions will be retained despite failure in the theoretical part of the course and subsequent re-sits.
- For students who have failed the practical sessions, it is necessary to obtain a pass (>5) in the theoretical knowledge assessment in order to re-sit this part of the course.

## ATTENTION

Any attempt at **fraud, cheating, plagiarism, or other irregular behavior** constitutes a **serious offense**, as established in **Title IV, "Disciplinary Rules for Students,"** within the **University of Navarra's System of Rules on Campus Conduct.**

## STUDENTS WITH SPECIAL EDUCATIONAL NEEDS

Students with special educational needs must contact the **Faculty of Science Coordination Office** in advance to obtain authorization for the necessary accommodations (for example, extra time on exams). This authorization must then be sent by the student to [Prof. Marisol Aymerich](#). It is recommended that this process be completed at the **beginning of the semester.**

## BIBLIOGRAPHY

- Nelson, D.L. y Cox, M.M. (2018). Lehninger Principios de Bioquímica. 7ª Edición. Ed. Omega. [Localízalo en la Biblioteca](#)
- Voet, D. y Voet, J.G. (2011). Biochemistry. 4th Ed. NJ: John Wiley & Sons. [Localízalo en la Biblioteca](#)
- Mathews, C.K., Van Holde, K.E., Appling, D.R. y Anthony-Cahill, S.J. (2013). Bioquímica. 4ª Edición. Ed. Pearson. [Localízalo en la Biblioteca](#)
- Stryer, L., Berg, J. M. y Tymoczko, J.L. (2014). Bioquímica. Ed. Reverté. [Localízalo en la Biblioteca](#)
- Feduchi, E., Blasco, I., Romero, C.S. y Yáñez, E. (2020). Bioquímica. Conceptos esenciales. 3ª edición. Ed. Médica Panamericana. [Localízalo en la Biblioteca](#) ; [Recurso electrónico](#)
- Koolman, J. y Rohm, KH (2012). Bioquímica. Texto y atlas. 4ª edición. Ed. Médica Panamericana. [Localízalo en la Biblioteca](#)

## CONTACT INFORMATION

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- Ask for an appointment by email