Universidad de Navarra

Structure and Function of Biomolecules

Teaching guide 2026-27

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
- Biochemistry. Module 3: Biochemistry and Molecular Biology. Subject 3.1: Structure, Function and Biosynthesis of Macromolecules. Course description. Type: Basic (Core).
- Biology. Module 3: Molecular Basis of Living Organisms. Subject 3.1: Biochemistry and Genetics. Course description. Type: Basic (Core).
- Chemistry Module 3: Complementary Studies. Subject 3.1: Fundamentals of Biochemistry. Course description. Type: Basic (Core).
- **ECTS:** 6
- **Course:** 1st year, semester:, 2nd
- **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 bio/macromolecules, the main processes of their transformation, the molecular mechanisms that regulate them, and their bioenergetic aspects.
- RA5: Explain the similarities and differences between living organisms including the structure and function of the prokaryotic and eukaryotic cell, as well as the structure, variation, function, and transmission of hereditary material.
- RA8: Explain the bases and applications of recombinant DNA technology, as well as the different quantitative instrumental methodologies used in Biochemistry and Molecular Biology.
- RA12: Manipulate chemical and/or biological material, including safety, waste disposal, annotated record of activities, and interpretation of results.
- RA13: Apply the techniques and instruments typical of 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 examined, applying, where appropriate, knowledge of informatics and computational biology.
- RA21: Explain the complexity of biological processes at the molecular scale as the foundation of the phenomena of life.

Learning Outcomes for the Biology Degree

- RA1: Describe the principles of scientific methodology in Biology
- RA4: Determine the bases of the structure and function of biomolecules, replication, transcription, translation, and modification of genetic material, metabolic pathways, and cell signaling.
- RA16: Interpret the structural and functional organization at the level of biomolecules, cells, tissues, and organs in living beings.
- 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 the various classes of biomolecules and the chemistry of the main biological processes.
- RA13: Solve qualitative and quantitative problems according to previously developed models or through the planning of new strategies
- RA20: Apply the basic principles of design and detail engineering in the planning of projects for the assembly and commissioning of chemical plants.
- RA27: Analyze how order, symmetry, and functional efficiency of matter at the atomic and molecular scale 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 acyds, triacylglycerols and phospholipids
5. Lipids: isoprenoids, steroids and eicosanoids
6. Proteins: amino acids
7. *Problems: Acid-base properties of aminoacids*
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 h)

- Lectures (37 h)

- Problem-solving (5 h)
- Lab sessions (15 hours)
- Final exam (3 hours)

Independent study (90 h)

ASSESSMENT

ORDINARY EXAMINATION

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 in 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%**
  - Quizzes for continuous assessment during class time.

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 30% 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 EXAMINATION

Final Examination (65%)

- Multiple-choice questions (32.5 %)
- Short-answer questions (32.5%)

Laboratory Sessions (25%)

The laboratory grade obtained during the regular assessment period will be retained. Students who pass the final examination but have failed the laboratory component will be given the opportunity to take an additional examination to reassess this component.

Continuous Assessment (10%)

The continuous assessment grade obtained during the course will be retained.

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