Universidad de Navarra

Structural and Functional Biochemistry (F.Ciencias)

Teaching guide 2025-26

INTRODUCTION

This course focuses on the study of the structural and functional properties of sugars, lipids, nucleic acids and proteins. The study of proteins, will focus on the relationship between structure and function using the examples of myoglobin and hemoglobin, together with the principles of enzyme action and the Michaelis-Menten kinetics. It also explores the principles of cellular metabolism and the processes involved in the expression and transfer of genetic information: replication, transcription and translation.

- **Degrees**: Degrees of the Science Faculty
- **Module**: Biochemistry
- **ECTS**: 6
- **Course, semester**: 1st year, Annual
- **Subject**: Introductory course
- **Professors**:
  - Marisol Aymerich (maymerich@unav.es)
  - María Iraburu (miraburu@unav.es)
- **Language**: English
- **Classroom, Schedule**: See calendar: http://www.unav.edu/web/facultad-de-ciencias/alumnos/horarios

LEARNING OUTCOMES (COMPETENCES)

General and basic competences for the degrees in Biology, Biochemistry and Chemistry:

Structural and Functional Biochemistry is a basic course that it is required in the Biology, Biochemistry and Chemistry degrees. Therefore, the basic and general competences for students are common for the three degrees.

- CB1: To demonstrate knowledge and understanding in a particular field of study whose starting point is the general secondary education and includes aspects in the frontiers of knowledge, with the support of advanced textbooks.
- CB4: To be able to communicate information, ideas and answer questions to specialist and non-specialist audiences.
- CB5: To adquire skills to undertake further studies with a high degree of autonomy.
- CG1: To plan and to organize time, to manage continuous training updating the knowledge in the last scientific discoveries and technological innovations and to analyze future trends.
- CG3: To develop team-working capacities, to be able to select and to choose the appropriate methodologies and distribution of functions. To listen and to speak with positive and constructive interventions.

Specific competences for the Degree in Biology:

- CE1: To formulate and to solve qualitative and quantitative problems in biology through scientific hypotheses based on knowledge and theories available that can be demonstrated empirically.
- CE2: To plan, to develop and to discuss critically experiments and to use techniques and instruments of experimentation in biology.

- CE3: To know how to work properly and safely in a laboratory, including the proper handling and disposal of waste.
- CE4: To use mathematics, statistics and computer science to collect, analyze and interpret data and to model biological systems and processes.
- CE5: To apply knowledge, concepts and biological theories into practice.
- CE12: To understand the structure and function of biomolecules, particularly of complex macromolecules, to know the main metabolic pathways and their regulation and the principles governing the exchanges of matter and energy with the environment. To understand the organization, dynamics and expression of genes and genomes, the laws of inheritance and the sources of genetic variation.

Specific competences for the Degree in Biochemistry:

- CE1: To analyze qualitative and quantitative problems in biochemistry through scientific hypotheses that can be demonstrated empirically.
- CE2: To apply safely the techniques and instruments of experimentation in Biochemistry, Molecular Biology and Biology.
- CE3: To apply the acquired knowledge in mathematics, statistics and computer science to analyze and interpret data and to model systems and biochemical processes.
- CE9: To understand the structure and function of bio/macromolecules, to know the main metabolic pathways involved in their transformation and how they are regulated and the principles governing the exchanges of matter and energy with the environment. To understand the molecular alterations of these processes under pathological conditions. To know the principles and the utility of recombinant DNA technology.

Specific competences for the Degree in Chemistry:

- CE3: To plan, to design and to execute research projects, from problem identification to evaluation of results, including written and oral presentation of data in a credible and coherent way.
- CE14: To know the structure and reactivity of various classes of biomolecules and the chemistry of the main biological processes.

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. Nucleotides
7. Nucleic acids
8. Proteins: amino acids
9. Proteins: peptides and secondary structure
10. Proteins: tertiary structure
11. Proteins: quaternary structure
12. Enzymes: biological catalysts
13. Enzymes: kinetics and inhibition
14. Enzymes: mechanism of action and regulation of enzymatic activity
15. Introduction to metabolism

16. Redox reactions and ATP
17. DNA replication
18. Transcription
19. Protein synthesis

Problem sessions:

The students will have access to the problems in advance in the document section of ADI. The problems will be included and evaluated in the mid-term and final exams for this subject.

First semester (3 sessions):

- Acid-base properties of amino acids

Second semester (3 sessions):

- Enzyme kinetics: Michaelis-Menten kinetics. Calculation of K_m and Vmax

- Enzyme inhibition: Calculation of K_i and Vmax in competitive and non-competitive inhibition

- Thermodynamics of biological reactions. Relationship between free energy change and Kc.

PRACTICAL PROGRAM

The manual with the laboratory specifications, the timetable and the groups will be available in the document section of ADI. Each laboratory session will last 1.5 hours.

First semester (3 sessions):

- Sugars: Identification of sugars
- Nucleic acids: Quantification and separation of nucleic acids
- Proteins: Quantification and separation of proteins

Second semester (2 sessions):

- Amylase. Enzymatic activity
- Tyrosinase. Enzyme kinetics

EDUCATIONAL ACTIVITIES

LECTURE FORMAT (42 hours)

Lectures are based on the presentation of a topic by the professor. The content of the classes is based on this theoretical program. Power Point slides will be made available to students in advance through ADI.

- 2 sessions, 1 hour each, every week throughout the course.

PROBLEM-SOLVING SESSIONS (6 hours)

Sessions aimed at the practical application of theoretical concepts and problem solving, which take place after the relevant theoretical content has been explained. Students must solve the problems before each class.

- 6 sessions throughout the course

LABORATORY PRACTICE (15 hours)

Each practice will be carry out individually by each student. The basis of the practice and accesory material will be provided to the students in advance. Once in the laboratory, students will answer a set of test questions through Socrative and, at the end of the practice they will complete a brief questionaire related to the results obtained. Complementary material for the practical sessions will be provided and assessed through ADI/Socrative.

- 5 laboratory sessions of 1-2 hours each

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 is carried out individually and lasts 1,5-2 hours.
- The basis of each practice will be provided to the students before the sessions. At the beginning of the session, the students will answer a series of questions related to the practice via Wooclap. At the end of each session, they will complete a short questionnaire to assess their understanding of the procedures.
- It is mandatory to assist to the practical sessions and to obtain a pass (grade >5) in order to obtain a pass this 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 professor. Both assistance and correct answers will be counted to obtain the full grade for this section.
  - Mock exam grade.
- Final exam: 65%
  - There will be two mid-term exams, one in December and one in May, each worth 50% of the grade for the theoretical content of the course. Students who do not pass the mid-term exam in December will be given the opportunity to retake this part in May.
  - Each examination will consist of two sections accounting for 50% of the grade: one with multiple choice questions and the other one with short questions, problems can be included in any section. It is necessary to obtain at least 35% of the grade in each part to calculate the final grade.
  - **Key question:** in the mid-term examination in December, one of the short questions will be to draw the structures of different biomolecules. This is a key question and must be **successfully completed** in order to proceed with the correction of the exam.

Universidad de Navarra

- Students will take a mock exam in October and in March similar to the course exams that will account for the continous assesment.
- Assessment of problem sessions problems will be included in any section of the exam.

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

EXTRAORDINARY ASSESSMENT

- The grade obtained in the continuous assessment wil be retained.
- 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 assessement in order to re-sit this part of the course.

BIBLIOGRAPHY

- Nelson, D.L. y Cox, M.M. (2009). Lehninger Principios de Bioquímica. 6ª 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. (2013). Bioquímica. 7ª Edición. Ed. Reverté. Localízalo en la Biblioteca
- Feduchi, E., Blasco, I., Romero, C.S. y Yáñez, E. (2015). Bioquímica. Conceptos esenciales. 2ª edición. Ed. Médica Panamericana. Localízalo en la Biblioteca ; Electrónico
- Koolman, J. y Rohm, KH (2012). Bioquímica. Texto y atlas. 4ª edición. Ed. Médica Panamericana. Localízalo en la Biblioteca

CONTACT INFORMATION

Dra. Marisol Aymerich (maymerich@unav.es)

- Ask for an appointment by email