UAB
Universitat Autònoma de Barcelona

Biochemistry

Code: 107970
ECTS Credits: 4

2025/2026

Degree	Type	Year
Environmental Biology	OB	1

Contact

Name: Enea Sancho Vaello

Email: enea.sancho@uab.cat

Teaching groups languages

You can view this information at the end of this document.

Prerequisites

There are no official prerequisites. However, it is assumed that the student has acquired the basic knowledge covered in high school Biology and Chemistry courses.

Objectives and Contextualisation

In the Biochemistry course, the structural and functional characteristics of biomolecules are studied from a basic and general perspective, with a focus on proteins and, in particular, enzymes, during the first part of the course. In the second part, these concepts are applied in a dynamic way to understand bioenergetics, signal transduction, and the main metabolic pathways. The general objective of the course is to provide foundational knowledge of molecular and metabolic concepts necessary to support the study of various subjects within the Degree in Environmental Biology.

Specific objectives of the course:

- Understand the fundamental structural features of biological molecules and be able to draw conclusions about their stability, functionality and ability to replicate structures.
- Understand the kinetic principles of enzymatic action in the context of biological reactions and their regulation.
- Describe the general mechanisms by which living organisms obtain and transform energy from the environment.
- Understand the main molecular mechanisms of signal transduction.
- Describe the main pathways of intermediate metabolism of carbohydrates, lipids, and nitrogen compounds, including their regulation and coordination.
- Apply the acquired knowledge to solve qualitative and quantitative problems.

Learning Outcomes

1. CM19 (Competence) Integrate theoretical knowledge in the field of biochemistry to solve experimental problems in this field.

2. CM20 (Competence) As a team, assess ways to solve problems and practical cases in the field of biochemistry, developing interpersonal skills inherent to the professional environment (collaborative work and communication).
3. KM24 (Knowledge) Describe cellular mechanisms at the molecular level, from the replication of genetic material and its expression in proteins to metabolism.
4. KM24 (Knowledge) Describe cellular mechanisms at the molecular level, from the replication of genetic material and its expression in proteins to metabolism.
5. KM25 (Knowledge) Describe the main metabolic pathways and their control and integration mechanisms.
6. KM26 (Knowledge) Identify specific bibliographic sources in biochemistry to autonomously develop and expand the acquired knowledge.
7. SM25 (Skill) Apply biochemical concepts to understand the mechanisms of life at the cellular level.

Content

THEORY

UNIT 1. ELEMENTS, MOLECULES, AND PHYSICAL ENVIRONMENT OF LIVING ORGANISMS. The chemical logic of biological processes. Chemical elements present in living beings. Biomolecules. Structural organization levels of biomolecules. Biological importance of water. Non-covalent interactions in aqueous environments. Ionization of water, ionic equilibrium, and buffer systems.

UNIT 2. PROTEINS: FUNCTIONS AND STRUCTURE. Types of proteins and their functions. Structure and properties of amino acids. Classification of amino acids. Peptides and the peptide bond. Composition and sequence of amino acids in proteins. Levels of protein structure. Description of the alpha-helix and beta-sheet. Fibrous proteins. Globular proteins. Quaternary structure. Prions.

UNIT 3. ENZYMES, ENZYME KINETICS AND REGULATION. Enzymes: nature and function. Classification and nomenclature of enzymes. Effects of catalysts on chemical reactions. Enzymatic mechanisms. Initial reaction rate. Enzyme kinetics. Enzyme cofactors. Enzyme inhibition. Regulation of enzyme activity: allosterism, covalent modification, and changes in enzyme concentration. Biomedical, biotechnological, and environmental applications.

UNIT 4. PROTEIN FUNCTION: OXYGEN-TRANSPORTING PROTEINS. Oxygen storage: myoglobin. Oxygen transport: hemoglobin. Allosterism and cooperativity of hemoglobin. Different forms of hemoglobin: physiological adaptations and associated pathologies.

UNIT 5. CARBOHYDRATES. Types of carbohydrates and their functions. Description and properties of monosaccharides. Glycosidic bond. Oligosaccharides. Polysaccharides. Glycoproteins and glycolipids.

UNIT 6. NUCLEIC ACIDS. Composition, classes, and functions of nucleic acids. Primary and higher-order structures of nucleic acids. Chromatin and chromosome organization.

UNIT 7. LIPIDS. Types of lipids and their functions. Structure and function of lipoproteins.

UNIT 8. ISOLATION AND CHARACTERIZATION OF MACROMOLECULES. Separation methods: centrifugation, chromatography, and electrophoresis. Spectroscopic methods and their applications. Amplification and sequencing of nucleic acids.

UNIT 9. INTRODUCTION TO METABOLISM. Metabolism: concept, organization, and types. Biochemical reactions and thermodynamics: free energy in biological processes. Role of ATP and other phosphorylated compounds. Biological redox reactions and the role of electron carriers. Regulation of metabolic processes.

UNIT 10. CELL SIGNALING. Extracellular chemical signals: hormones, neurotransmitters, nitric oxide, and growth factors. Properties of signal transduction mechanisms. Main signal transduction systems: membrane and intracellular receptors.

UNIT 11. CARBOHYDRATE METABOLISM. Glucose degradation: glycolysis and pentose phosphate pathway. Fermentations. Gluconeogenesis. Glycogen synthesis and degradation.

UNIT 12. CENTRAL PATHWAYS OF OXIDATIVE METABOLISM AND OXIDATIVE PHOSPHORYLATION. Acetyl-CoA production. Citric acid cycle. Energy yield and regulation. Anaplerotic reactions. Glyoxylate cycle. Mitochondrial electron transport chain and oxidative phosphorylation.

UNIT 13. PHOTOSYNTHESIS. Basic photosynthesis process. Photosynthetic pigments. Light energy absorption. Electron transport and photophosphorylation. Carbon dioxide assimilation and photosynthetic biosynthesis of carbohydrates (Calvin cycle). Regulation of photosynthesis.

UNIT 14. LIPID METABOLISM AND NITROGEN CYCLE. Fatty acid metabolism. Regulation of fatty acid metabolism. Nitrogen cycle.

PROBLEMS

The content of this section, which will be provided as a dossier at the beginning of the semester, consists of a set of problem statements related to the topics covered in the theory part. Due to thenature of the theoretical topics, the problem statements will focus on specific aspects such as chemical equilibrium and buffer systems, enzyme kinetics, methods of purification and analysis of macromolecules, and bioenergetics.

LABORATORY PRACTICALS

Two laboratory sessions will be held, each lasting three hours.
Attendance at practical sessions is mandatory. Students will receive a "Not Assessable" grade if their absence exceeds 20% of the scheduled sessions.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practices	6	0.24	CM19, CM20, SM25, CM19
Problem classes	5	0.2	CM19, CM20, CM19
Theory classes	24	0.96	KM24, KM25, KM26, SM25, KM24
Type: Supervised			
Tutoring	3	0.12	
Type: Autonomous			
Study	53.5	2.14	KM24, KM25, KM26, SM25, KM24

The training activities are divided into three components: theory classes, problem-solving classes and laboratory practicals, each with its specific methodology.

Theory classes

The teacher will explain the course content using audiovisual materials, which will be made public to students in advance through the Virtual Campus (Moddle) at the beginning of each topic. These lectures constitute the

core of the theory section. It is recommended that students bring the material published on the Moddle in printed form so that they can follow the sessions more comfortably.

Under the guidance of the professor, and through communication via the Virtual Campus , students will be expected to independently research and study selected parts of the course content through autonomous learning.

Problem-solving classes

The group will be divided into two subgroups of approximately 30 students. The subgroup lists will be published at the beginning of the academic year, and students must attend the sessions scheduled for their a

At the start of the semester, a problem set dossier will be made available through the Virtual Campus. This set will be used throughout the semester. In these sessions, the teacher will explain the experimental and calculation principles required to solve the problems, provide guidelines for problem-solving, and reinforce knowledge related to laboratory concepts.

Laboratory practicals

The group will be subdivided into three subgroups, which will remain the same across all subjects for the semester. Subgroup lists will be announced in advance.

Students must attend lab sessions wearing a lab coat, bring a printed and previously read version of the lab manual (available on Moodle), and carry a notebook for recording observations and data.

On the scheduled dates, students will attend the Biochemistry laboratory to carry out basic experiments in biochemical properties and biomolecule analysis. Laboratory sessions and assessments will be conducted in groups of two people. At the end of each session, students must submit a questionnaire containing their experimental results and responses to specific questions.

Attendance at lab sessions is mandatory, except in cases where students provide a valid, documented excuse.

Material available on the Moddle of the subject

· Teaching guide

· Presentations used by the teacher in theory classes

· Dossier of problem classes

· Protocols of the practical classes

· Calendar of teaching activities (classroom, laboratory classes, tutorials, assessments ...)

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Problem exams	20%	2.5	0.1	CM19, CM20
Questionnaire of practices	10%	1.5	0.06	CM19, SM25
Theory exams	70%	4.5	0.18	KM24, KM25, KM26, SM25

The evaluation of the subject will be carried out by means of a continuous evaluation consisting of two tests, corresponding each one to approximately half of the theoretical and problem agenda. Each test will have two parts. The first part will consist of several test questions and may also include short questions. In the second part, the student will have to solve one or two problems. Those students who have not passed the partial tests will have to complete a final test in order to recover these partial tests. The final test will have two parts. In the first part the student will find a test with questions like a test, which may also include short questions, for each partial to retrieve. In the second part, the student will have to solve two problems, one for each partial to retrieve. The final test will also be open to any student who, having passed the continuous assessment, wishes to improve the grade obtained in the continuous evaluation. In this case, the student resigns to the previous note.

Each of the laboratory practices will be evaluated just after its completion by answering a questionnaire related to the practice carried out.

The final grade obtained will be calculated as follows:

A) Students who have passed the subject during the continuous evaluation:

- 70% of the average of the first part of each partial test (35% each partial test)

- 20% of the average of the second part of each partial test (10% each partial test)

- 10% of the average of the practices.

They will only promise those qualifications in the partial test that are equal or superior to four.

B) Students who present themselves to the final exam:

- 70% of the first part of the final test (35% each partial test)

- 20% of the second part of the final test (10% each partial test)

- 10% of the average of the practices

To be eligible for the retake process, the student must have been previously assessed in a set of activities that together account for at least two-thirds (67%) of the final grade for the course or module. Therefore, the student will be graded as "No Avaluable" (Not Evaluable) if the weight of all completed assessment activities is less than 67% of the final grade.

Attendance at practical sessions is mandatory. Students who miss more than 20% of the scheduled sessions will be graded as "No Avaluable" (Not Evaluable).

Single Evaluation Test:

Students who opt for the single evaluation must complete the Laboratory Practice sessions, and passing them is mandatory. These sessions will account for 10% of the final grade.

The single evaluation consists of one exam, which includes multiple-choice questions (may also include short questions) covering the entire theoretical content (70%), as well as two problems to solve (20%).

The single evaluation exam will take place on the same date as scheduled in the calendar for the final continuous assessment test. The same retake procedure will apply as for the continuous evaluation.

Bibliography

Basic bibliography (by alphabetical order):

THEORY

Berg, J.M., Tymoczko, J.L., Stryer L. "Bioquímica. Curso básico" Ed. Reverté. Correspon a la traducció de la 2a. Ed. en llengua anglesa.
Feduchi, E. i altres. "Bioquímica. Conceptos esenciales". Ed. Panamericana.
Mathews, C.K., van Holde K.E. i Ahern, K. G. "Bioquímica" Ed. Addison/Wesley.
McKee, T i McKee, J.R. "Bioquímica. Las bases moleculares de la vida" Ed. McGraw-Hill-Interamericana.
Nelson, D.L. i Cox, M.M. "Lehninger Principles of Biochemistry" Ed. W.H. Freeman & Co. Traduïda la 5a. Ed: "Principios de Bioquímica" (2009). Omega.

PROBLEMS

van Eikeren P. Guía de Principios de Bioquímica de Lehninger. Ed. Omega.
Macarulla J.M., Marino A. i Macarulla A. Bioquímica Cuantitativa. Ed. Reverté.
Segel I.H. Biochemical Calculations. Ed. Wiley & Sons.

Software

There are not computer programs for this subject

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	211	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	212	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	211	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	212	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	213	Catalan	first semester	morning-mixed
(TE) Theory	21	Catalan	first semester	afternoon