UAB
Universitat Autònoma de Barcelona

Biochemistry

Code: 107970
Credits: 4

2026/2027

Degree programme	Type	Course
Environmental Biology	OB	1

Contact lecturer

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Group languages

You can consult this information at the end of the 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

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

- CM19 (Integrate theoretical knowledge in the field of biochemistry to solve experimental problems in this field.) Integrate theoretical knowledge in the field of biochemistry to solve experimental problems in this field.
- CM20 (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).) 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).

- KM24 (Describe cellular mechanisms at the molecular level, from the replication of genetic material and its expression in proteins to metabolism.) Describe cellular mechanisms at the molecular level, from the replication of genetic material and its expression in proteins to metabolism.
- KM25 (Describe the main metabolic pathways and their control and integration mechanisms.) Describe the main metabolic pathways and their control and integration mechanisms.
- KM26 (Identify specific bibliographic sources in biochemistry to autonomously develop and expand the acquired knowledge.) Identify specific bibliographic sources in biochemistry to autonomously develop and expand the acquired knowledge.
- SM25 (Apply biochemical concepts to understand the mechanisms of life at the cellular level.) Apply biochemical concepts to understand the mechanisms of life at the cellular level.

Contents

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.

Learning activities and methodology

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

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 group.

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 ...)

Use of AI: In this course, the use of Artificial Intelligence (AI) technologies is not permitted in any of its phases. Any work (e.g., problems) that includes fragments generated with AI will be considered academic dishonesty and may result in a partial or total penalty to the grade of the activity, or more severe sanctions in cases of seriousness.

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

Continuous assessment activities

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

This subject includes two types of assessment: continuous and single.

The continuous evaluation will consist 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 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 retake. In the second part, the student will have to solve two problems, one for each partial to retake. Students who have had to retake the subject in the recovery exam will not be able to apply for the maximum honors grade (matrícula de honor), but may opt at most for an excellent grade.

The final exam will also be open to any student who, having passed the continuous assessment, wishes to improve the grade obtained in the continuous assessment; however, this will entail the resignation of the previous grade, and in that case, they will not be able to apply for the maximum honors grade.

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.

This modality must be requested from the teacher at the start of the course.

Irregularities in Assessment Activities: Any irregularity in an assessment activity (academic fraud, plagiarism, or improper use of AI, unless such use is expressly authorised in the course syllabus (guia docent)) that could lead to a significant change in the grade results in that activity being graded as 0. Should the course syllabus require that a minimum grade in this assessment activity be a prerequisite for passing the course, or should multiple irregularities occur across assessment activities in the same course, the final grade for that course is 0. Aside from this, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

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

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

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