Structural Biochemistry and Molecular Biology

Code: 103596
ECTS Credits: 6

2025/2026

Degree	Type	Year
Medicine	FB	1

Contact

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Teaching groups languages

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

Prerequisites

There are no official prerequisites. However, it is convenient to review the following subjects of the baccalaureate program:

- Chemical binding types

- Chemical balance. Acid-base balance

- Formulation of organic chemistry

- Types of chemical reactions

- Structure and components of eukaryotic cells

Objectives and Contextualisation

The subject is programmed in the first year of the Degree in Medicine (first semester) and forms part of the group of basic education skills. It is, therefore, part of the scientific basis necessary for the training of medical graduates. Its general objectives are the study of the chemical basis of life, specifically applied to the composition and function of the human organism, and the knowledge of the main biochemical elements that contribute to the improvement of medical practice. The subject has a close relationship and complementarity with Biophysics and Cell Biology subjects, both programmed in the first year of the degree.

The achievement of its objectives, in addition to its general importance in the degree, is essential as a basis for the Metabolic Biochemistry subject, scheduled in the second semester of the first course, and is also relevant for several later subjects such as those corresponding to the fields of Physiology, Pharmacology, Genetics, Immunology and Endocrinology.

Competences

- Communicate clearly, orally and in writing, with other professionals and the media.
- Critically assess and use clinical and biomedical information sources to obtain, organise, interpret and present information on science and health.
- Demonstrate basic research skills.
- Demonstrate, in professional activity, a perspective that is critical, creative and research-oriented.
- Demonstrate knowledge of the principles and physical, biochemical and biological processes that help to understand the functioning of the organism and its disorders.
- Demonstrate understanding of the basic sciences and the principles underpinning them.
- Demonstrate understanding of the importance and the limitations of scientific thought to the study, prevention and management of diseases.
- Demonstrate understanding of the mechanisms of alterations to the structure and function of the systems of the organism in illness.
- Demonstrate understanding of the organisation and functions of the genome, the mechanisms of transmission and expression of genetic information and the molecular and cellular bases of genetic analysis.
- Demonstrate understanding of the structure and function of the body systems of the normal human organism at different stages in life and in both sexes.
- Formulate hypotheses and compile and critically assess information for problem-solving, using the scientific method.
- Maintain and sharpen one's professional competence, in particular by independently learning new material and techniques and by focusing on quality.
- Use information and communication technologies in professional practice.

Learning Outcomes

1. Communicate clearly, orally and in writing, with other professionals and the media.
2. Demonstrate basic research skills.
3. Demonstrate, in professional activity, a perspective that is critical, creative and research-oriented.
4. Describe the basic molecular mechanisms of storage, transmission and expression of hereditary information.
5. Describe the molecular basis of the structure of the biological macromolecules and of how this structure conditions their activity.
6. Describe the role of of the biomolecules that participate in the life processes of the human organism.
7. Explain the mechanisms and relate the molecular processes that can be the cause or the consequence of pathological manifestations in the organism.
8. Explain the molecular significance of the structure and function of the systems of the human organism.
9. Formulate hypotheses and compile and critically assess information for problem-solving, using the scientific method.

10. Identify the basic processes of life on various levels of organisation: molecule, cell, tissue, organ, and individual.
11. Identify the biochemical tools that help to improve medicine.
12. Identify the chemical bases that help to understand the functioning of the organism, at both cell and tissue level.
13. Identify the mechanisms of enzymatic transformation of biomolecules.
14. Identify the rules that govern energy transfer in the chemical processes of the human organism.
15. Maintain and sharpen one's professional competence, in particular by independently learning new material and techniques and by focusing on quality.
16. Make correct use of biochemistry terminology.
17. Relate alterations to the structure and function of biomolecules to structural and functional alterations to systems of the human organism.
18. Relate the molecular and cellular processes that can be the cause or the consequence pathological manifestations in the organism.
19. Relate the molecular mechanisms that can generate pathological manifestations in the organism.
20. Use information and communication technologies in professional practice.
21. Use specific bibliographic sources and databases on biochemistry to work independently on acquiring further knowledge.

Content

In addition to the basic physicochemical principles, the contents of the course include the description of the structure and functional roles of biological macromolecules, with special emphasis on the relationship between chemical structure and biological function. It also incorporates the acquisition of skills in some basic techniques of the biochemical laboratory and the conceptual and methodological language of molecular biology.

Thematic blocks of theory and seminars:

Topic I. MOLECULAR CHARACTERISTICS OF LIVING MATTER (2 h)

- Chemical elements of living matter

- Biomolecules

- Composition and characteristics of the extracellular and intracellular environment

- Acid-base chemistry. Role of the bicarbonate system in maintaining blood pH

At the end of the topic there will be a seminar session (2 h)

Topic II. BIOENERGETICS (3h)

- General principles: Variation of free energy in chemical reactions

- Role of ATP and other compounds in energy transfers

- Energetics of redox reactions

At the end of the topic there will be a seminar session (2 h)

Topic III. STRUCTURE AND FUNCTION OF PROTEINS (5h)

- Composition, structural levels, functions and classification

- Aminoacids

- Covalent structure of peptides and proteins

- Three-dimensional structure of proteins

- Relationship between structure and function: myoglobin and hemoglobin as exemples

When finishing the subject there will be two seminar sessions (4 h)

Topic IV. ENZYMES (4h)

- General concepts

- General mechanisms of enzymatic catalysis

- Kinetics of the enzymatic reactions

- Regulation of the enzyme activity

Topic V. MEMBRANES ANDTRANSPORTATION (1h)

- Transport through membranes

At the end of topics IV and V there will be two seminar sessions (4 h)

Topic VI. MOLECULAR BIOLOGY (10h)

- Nucleotides and Nucleic Acids.

- Genes and Genomes. Cloning of DNA

- Replication of DNA.

- DNA transcription and RNA maturation.

- Genetic Code and Translation.

- Regulation of gene expression.

- Molecular Biology Techniques Applied in Medicine.

When finishing the subject there will be three sessions of seminars (6 h)

LABORATORY PRACTICES

1.- Separation techniques of biomolecules: Fractionation of serum proteins in cellulose acetate and determination of molecular weights by electrophoresis in SDS-polyacrylamide.

2.- Molecular Biology: Detection of polymorphisms by PCR.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
LABORATORY PRACTICES (PLAB)	9.5	0.38	1, 3, 2, 6, 4, 5, 9, 11, 15, 17, 16, 21, 20

SEMINARS (SEM)	18	0.72	1, 3, 2, 6, 4, 5, 8, 7, 9, 13, 10, 12, 11, 14, 15, 19, 18, 17, 16, 21, 20
THEORY (TE)	25	1	6, 4, 5, 8, 7, 13, 10, 12, 11, 14, 19, 18, 17, 16, 21
Type: Autonomous			
SELF STUDY / PREPARATION OF WRITTEN WORKS	92.5	3.7	3, 6, 4, 5, 8, 7, 9, 13, 10, 12, 11, 14, 15, 19, 18, 17, 16, 21, 20

Teaching Methodology

The teaching methodology will consist of theoretical classes (TE), specialized seminars, and laboratory practices (PLAB), all of which are directed activities. The main teaching materials for these activities will be provided through the UAB's Moodle platform.

- Theoretical classes (25 sessions of 1 hour) will be delivered in lecture format for each full enrollment group. During these sessions, the instructors will present the theoretical content and discuss the complementary materials available for the other activities, including self-learning resources.
- Specialized seminars (SATs) (9 sessions of 2 hours) will be held in small groups and will focus on the discussion of problems and practical/clinical cases. Students will have a guide with questions and cases in advance, which they must prepare before or during the session to discuss with their peers and the tutor, who will act as a moderator.
- Laboratory practices (2 sessions of 4.5-5 hours) will involve carrying out experimental protocols following a pre-established guide. After each session, students will be required to complete a set of questions related to the practice.

Additionally, students will have access to personal or group tutorials, which will be scheduled in coordination with the instructor responsible for the theoretical classes.

Note: 15 minutes of one class, within the calendar established by the department or degree program, will be reserved for students to complete the evaluation surveys on the performance of the teaching staff and the course

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
Exam 1: Written assessments through essay test and/or selection items	50%	2	0.08	1, 3, 2, 6, 5, 8, 7, 9, 13, 10, 12, 11, 14, 15, 19, 18, 17, 16, 21, 20
Exam 2: Written assessments through essay tests and/or selection items.	40%	2	0.08	1, 3, 2, 6, 5, 8, 7, 9, 13, 10, 12, 11, 14, 15, 19, 18, 17, 16, 21, 20
PLAB1: Evaluation of laboratory questionnaires (reasoning, redacction, graphics, calculation)	5%	0.5	0.02	1, 3, 2, 6, 4, 5, 8, 9, 11, 15, 17, 16, 21, 20

PLAB2: Evaluation of laboratory questionnaires (reasoning, redacction, graphics, calculation)	5%	0.5	0.02	1, 3, 2, 6, 4, 5, 8, 9, 11, 15, 17, 16, 21, 20

EVALUATION OF THIS COURSE CAN BE OF TWO TYPES: CONTINUOUS OR SINGLE ASSESSMENT.

Continuous assessment is the default evaluation method, unless the student expressly requests single assessment through the Academic Management Office of the Faculty, within the established deadlines (see the Faculty Website and Academic Regulations for more information).

1. CONTINUOUS ASSESSMENT

The final grade for the course will be based on several assessable activities:

a) Midterm Exam 1 (P1)

Covers content from topics 1 to 5, guided self-learning seminars (SAT) 1 to 6, and the first lab session (PLAB1). It will be an in-person exam, consisting of multiple-choice and/or essay-type questions. Weight: 50% of the final grade.

b) Midterm Exam 2 (P2)
Covers content from topic 6, SATs 7 to 9, and the second lab session (PLAB2). It will also be an in-person exam, with multiple-choice and/or essay-type questions. Weight: 40% of the final grade.

Each midterm will be considered passed if a score equal to or greater than 5.0 out of 10 is achieved.

c) Evaluation of laboratory practices (PLAB)

Assessed through a questionnaire or other evidence of acquired competences, with a total weight of 10% of the final grade (5% for each practice). Each lab session will be graded based on the resolution of the questionnaire or associated activity at the end of the session.

Attendance at lab sessions is not mandatory; however, students who do not attend will forfeit the grade for that specific practice.

Schedule and requirements to pass the course:

P1 and P2 exams will be held on the dates and in the rooms designated by the Faculty.

To pass the course through continuous assessment, students must meet both of the following requirements:

1. Obtain a grade of 5.0/10 or higherin both P1 and P2 (or their respective make-up exams).
2. Achieve a weighted average of all assessment activities of 5.0/10 or higher, calculated as:

$(P1 \times 0.5) + (P2 \times 0.4) + (PLAB1 \times 0.05) + (PLAB2 \times 0.05)$

MAKE-UP EXAMS

a) Partial Make-up

Students who score below 5.0 in either P1 or P2 may retake only the failed part in the final make-up exam. This will be an in-person exam, with multiple-choice and/or essay-type questions, graded out of 10.

To pass the course after a make-up exam, the final weighted average must be at least 5.0. Otherwise, the maximum final grade will be 4.8.

b) Global Make-up

Students who fail both P1 and P2 must take a comprehensive make-up exam covering the entire course content. This exam will include material from both midterms, and the grade will account for 90% of the final mark. The remaining 10% will come from the lab practice grades (PLAB). The format will be the same: multiple-choice and/or essay-type questions.

To be eligible for the make-up exam, students must have been previously assessed in activities that represent at least two-thirds of the total course weight.

Therefore, students who have completed less than 67% of the evaluable activities will receive a grade of "Not assessable."

Note: Taking any make-up exam automatically avoids any previously obtained grade for that part.

c) Make-up for Single Assessment (SA)

Students who opted for single assessment (see section 2) and score below 5.0 in the single assessment exam may take a specific make-up test for this modality.

This exam will accountfor 100% of thefinal grade, and the course will be considered passed with a minimum score of 5.0. The format will be the same: multiple-choice and/or essay-type questions.

Students who do not attend the scheduled exams will receive a grade of "Not assessable."

2. SINGLE ASSESSMENT

Students may opt for the single assessment system, in accordance with Faculty regulations. Single assessment is based on the same course content, competency acquisition, and academic standards as continuous assessment.

The single assessment exam consists of two parts:

- Integrated evaluation of theoretical knowledge and practical skills from the seminars and lab sessions. Weight: 90%
- Specific evaluation of the understanding of laboratory concepts. Weight: 10%

The exam will take place on the same date and time scheduled for the second midterm of the continuous assessment.

To pass the course, the final grade must be 5.0 or higher.

If not passed, students may take a make-up exam with the same single assessment format, which will be held on the date and time set by the Faculty for continuous assessment make-up exams.

Bibliography

It is recommended to work regularly with the following books. Titles marked with an asterisk (*) indicate that they are available free of charge in electronic format through the UAB library website, either in their latest edition or in previous ones.

Comprehensive textbooks:

- Nelson DL, Cox MM. *Lehninger Principles of Biochemistry*, 7th ed. Editorial Omega, 2018.
- Voet D, Voet JG, Pratt CH. *Fundamentals of Biochemistry: Life at the Molecular Level*, 4th ed. Editorial Médica Panamericana, 2016. (*)

Intermediate-level textbooks:

- Stryer L, Berg JM, Tymoczko JL. *Biochemistry: A Short Course*, 7th ed. Editorial Reverté, 2019. (*)
- Lieberman MA, Peet A. *Marks' Basic Medical Biochemistry: A Clinical Approach*, 6th ed. Wolters Kluwer, 2023. (*)

Basic textbooks:

- Denise R. Ferrier. *Lippincott's Illustrated Reviews: Biochemistry*, 7th ed. Wolters Kluwer, 2018. (*)
- John W. Baynes, Marek H. Dominiczak. *Medical Biochemistry*, 6th ed. Elsevier, 2023. (*)
- Feduchi. *Biochemistry: Essential Concepts*, 3rd ed. Editorial Médica Panamericana, 2021. (*)

Use of AI

Restricted use: For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks, such as bibliographic or information searches and text correction.

Students must clearly identify which parts have been generated using such technologies, specify the tools used, and include a critical reflection on how these tools have influenced both the process and the final outcome of the activity.

Lack of transparency in the use of AI for any assessable activity will be considered a breach of academic integrity and may result in a partial or total penalty on the grade for the activity, or more severe sanctions in serious cases.

Software

no need for specific software

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
(PLAB) Practical laboratories	101	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	102	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	103	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	104	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	105	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	106	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	107	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	108	Catalan/Spanish	first semester	morning-mixed

(PLAB) Practical laboratories	109	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	110	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	111	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	112	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	113	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	114	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	115	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	116	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	117	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	118	Catalan/Spanish	first semester	afternoon
(PLAB) Practical laboratories	119	Catalan/Spanish	first semester	morning-mixed
(PLAB) Practical laboratories	120	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	101	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	102	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	103	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	104	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	105	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	106	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	107	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	108	Catalan/Spanish	first semester	afternoon
(SEM) Seminars	109	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	110	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	111	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	112	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	113	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	114	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	115	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	116	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	117	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	118	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	119	Catalan/Spanish	first semester	afternoon

(SEM) Seminars	120	Catalan/Spanish	first semester	afternoon
(TE) Theory	101	Catalan/Spanish	first semester	afternoon
(TE) Theory	102	Catalan/Spanish	first semester	afternoon
(TE) Theory	103	Catalan/Spanish	first semester	morning-mixed
(TE) Theory	104	Catalan/Spanish	first semester	morning-mixed