

Basic Molecular and Cell Biology

Code: 102493
ECTS Credits: 6

Degree	Type	Year	Semester
2502444 Chemistry	FB	1	1

Contact

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Teaching groups languages

You can check it through this [link](#). To consult the language you will need to enter the CODE of the subject. Please note that this information is provisional until 30 November 2023.

Teachers

Carles Arus Caralto

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Teresa Anglada Pons

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Prerequisites

Although there are no prerequisites to attend it, it is recommended that the student have previous knowledge of:

1. Biomolecules and their functions
2. The structure and the basic functions of cell organelles

Moreover, taking into account that most up-to-date sources of information in the field of Molecular and Cell Biology are in English, it is highly recommended that the students who study this subject have a basic knowledge of this language.

Objectives and Contextualisation

The subject Fundamentals of Molecular and Cell Biology, is a subject of the 1st semester of the 1st year of the Chemistry Degree .

Objectives of the subject:

- 1) To understand the basic structural features of biomolecules.

- 2) To know the mechanisms of expression and transmission of genetic information.
- 3) To know the methods of analysis and manipulation of biomolecules, as well as the basic techniques in biochemistry and molecular biology.
- 4) To explain the cell structure and ultrastructure.
- 5) To describe the functions of cell organelles and other cellular structures and to understand that their coordinated functioning is essential for the cell tasks' development .
- 6) To understand the processes of differentiation, specialization and cell death, their importance for the correct functioning of an organism and to identify the cellular bases of certain pathologies associated with cell functioning errors.

Competences

- "Interpret data obtained by means of experimental measures, including the use of IT tools; identify their meaning and relate the data with appropriate chemistry, physics or biology theories."
- Apply knowledge of chemistry to problem solving of a quantitative or qualitative nature in familiar and professional fields.
- Communicate orally and in writing in one's own language.
- Handle standard instruments and material in analytic and synthetic chemical laboratories.
- Have numerical calculation skills.
- Learn autonomously.
- Manage the organisation and planning of tasks.
- Reason in a critical manner
- Recognise and analyse chemical problems and propose suitable answers or studies to resolve them.
- Show an understanding of the basic concepts, principles, theories and facts of the different areas of chemistry.
- Use IT to treat and present information.
- Use the English language properly in the field of chemistry.
- Work in a team and show concern for interpersonal relations at work.

Learning Outcomes

1. Apply knowledge of biology to solve problems in biological chemistry.
2. Communicate orally and in writing in one's own language.
3. Describe the molecular mechanisms responsible for the replication and transcription of DNA, as well as the translation of mRNA and the regulation of genic expression.
4. Describe the processes of cellular differentiation, specialisation and death, as well as the cellular bases of pathologies associated to functional errors.
5. Have numerical calculation skills.
6. Identify structural protein domains and motifs and their functional and evolutionary relationships.
7. Integrate the functions of the different organelles and cell structures with the overall functioning of the cell.
8. Interpret the results of experiments performed in the biology laboratory.
9. Learn autonomously.
10. Make bibliographic enquiries in the field of biology in the English language.
11. Manage the organisation and planning of tasks.
12. Master the basic techniques for manipulating and analysing nucleic acids.
13. Properly describe the basic structural and functional characteristics of biomolecules.
14. Reason in a critical manner
15. Relate the methodologies used in cell biology to the knowledge these can provide, handle laboratory tools and make cell cultures
16. Relate the structure of the different parts of a cell to their functioning.

17. Select the most suitable experimental approaches to studying the structure and function of biomolecules
18. Use IT to treat and present information.
19. Use specific bibliographic sources on cellular biology to develop and expand the acquired knowledge.
20. Work in a team and show concern for interpersonal relations at work.

Content

THEORETICAL LESSONS

BIOCHEMISTRY AND MOLECULAR BIOLOGY

Unit 1. Molecular organization of living beings: General concept of Biochemistry. Chemical elements in living matter. Structural hierarchy of biomolecules. Biological importance of water. Non-covalent interactions in aqueous medium.

Unit 2. Proteins: Primary structure and biological functions: Protein types and functions. Chemical structure, properties and classification of amino acids. Peptides and peptide bond.

Unit 3. Three-dimensional structure of proteins: Structural levels of proteins. Description of the α -helix and β -sheets. Fibrous proteins. Globular proteins. Quaternary structure.

Unit 4. Biological catalysts: Nature and function. Classification and nomenclature. Bases of enzymatic action. General mechanisms of enzymatic catalysis. Enzyme kinetics. Cofactors. Regulation of enzyme activity.

Unit 5. Carbohydrates: Types of carbohydrates and their functions. Monosaccharides: description and properties. Glycosidic bond. Oligosaccharides. Structural and reserve polysaccharides. Glycoproteins: glycoproteins, proteoglycans and glycolipids.

Unit 6. Lipids: Types of lipids and functions. Storage lipids. Structural membrane lipids. Other lipid structures.

Unit 7. Nucleic acids: Types of nucleic acids and functions. Nucleotides. Primary structure of nucleic acids. Secondary structure: Watson and Crick models and alternative structures. Tertiary structure. DNA-protein complexes: chromosome organization.

Unit 8. Basic Concepts of Molecular Biology: DNA replication. Transcription of DNA. RNA processing. Regulation of gene expression. Translation: the genetic code, the ribosome and mechanism of protein synthesis.

CELL BIOLOGY

Unit 9: Plasma membrane. Structure and transport mechanisms.

Unit 10. Cytosol. Intracellular compartments. Intracellular protein trafficking.

Unit 11. Nucleus. Structure and nucleus-cytoplasm transport.

Unit 12: The internal membranous system. Vesicular transport. Endoplasmic reticulum, synthesis and modification of lipids and proteins. Golgi apparatus, structure and modifications of proteins. Selection and distribution of proteins for vesicular transport. Lysosomes and Endosomes.

Unit 13: Mitochondria. Structure and functions.

Unit 14: Cytoskeletal elements. Role in cell functioning and tissue maintenance. Actin microfilaments, structure and function. Microtubules, structure and function. Intermediate filaments, structure and function. Cell junctions.

Unit 15. Cell Cycle. Cell cycle and its control. Mitotic and meiotic cell division.

CLASSROOM PRACTICES - PROBLEMS

BIOCHEMISTRY AND MOLECULAR BIOLOGY

The content of this section consists of two parts. In the first, the most relevant aspects for the purification and characterization of proteins will be discussed. The second will be focused in buffer systems, methods of purification and analysis of macromolecules and enzyme kinetics. The problem statements will be delivered in the form of a dossier at the beginning of the semester.

CELL BIOLOGY

The list of problems will be available through the *Moodle* classroom of the Virtual Campus before the sessions. Students should try to solve them, autonomously, prior to the problem sessions, where they will be corrected.

LABORATORY PRACTICES

BIOCHEMISTRY AND MOLECULAR BIOLOGY

A four-hour laboratory session will be held: Separation of proteins by gelfiltration and by electrophoresis.

CELL BIOLOGY

There will be two sessions of two hours each:

- Introduction to the use of the optical microscope. Study of the plant cell.
- Introduction to the use of the optical microscope. Study of the animal cell.

WARNING ON LAB SAFETY: If a student is involved in an incident that may have serious security consequences may be expelled from the laboratory and may not pass this subject.

Methodology

The subject of ***Fonaments de Biologia Molecular i Cel·lular*** consists of Theoretical classes, classroom practices lessons, and Laboratory classes.

THEORY

The basic theoretical knowledge of Biochemistry and Molecular Biology will be taught in 23 face-to-face hours and that of Cellular Biology in another 17 hours.

The theoretical classes will be accompanied by a visual support material in *power point* format prepared by the teacher. This support material will be available to students in the *Moodle* classroom of the *Campus Virtual* of this subject. Students will be download this material and use it as a support when taking notes. In some subjects, videos or animations will also be projected to facilitate the understanding of certain processes.

NOTE: 15 minutes of a class will be set aside, within the calendar established by the center/degree, for students to fill in the teacher performance and subject evaluation surveys /module.

CLASSROOM PRACTICES - PROBLEMS

In the Classroom practices classes students will solve experimental problems related to the contents of the theoretical classes. In these classes, each students' group of theroretical classes will be divided into two subgroups of approximately 30 students. The lists will be made public at the beginning of the course. Students will attend the sessions programmed for their group.

Classroom practice classes are designed to work in small groups of students, with the objective of acquiring group work and critical reasoning skills.

In the corresponding part of Biochemistry and Molecular Biology, the methodology for the purification and characterization of proteins and problems of buffer systems and enzyme kinetics will be treated.

In the Cell Biology part, the students (same groups) will have to solve problems related to the theory topics that delve into the components and molecular mechanisms of the eukaryotic cell. These problems will later be discussed in the problem sessions.

LABORATORY PRACTICES

The practical classes in the lab are designed to learn the use of laboratory instruments and as a complement to the theoretical training. The students will perform a total of 3 sessions of practices, the first of 4 hours and the second and third of two hours each.

ATTENTION: In order to attend practicals, students must prove that they have passed the biosafety and security tests that they will find in the Virtual Campus and that they know and accept the operating rules of the laboratories of the Faculty of Sciences and the Faculty of Biosciences .

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom practices	8	0.32	1, 2, 8, 14, 17, 20, 18, 19
Laboratory practices	8	0.32	11, 7, 8, 14, 15, 20
Theoretical classes	36	1.44	9, 2, 13, 3, 4, 11, 6, 7, 14, 10, 16, 17
Type: Autonomous			
Individual study	78.5	3.14	9, 13, 3, 4, 11, 6, 7, 14, 10, 16, 19
Problems resolution	12	0.48	1, 9, 2, 11, 8, 14, 10, 17, 5, 20, 18, 19

Assessment

EVALUATION

In order to pass the subject, the weighted final grade must be greater than or equal to 5 points out of 10.

ATTENTION: Attendance at laboratory practices is mandatory. Failure to attend practice without justification will mean that the student CANNOT pass the subject.

1- CONTINUOUS EVALUATION

The continuous evaluation activities scheduled are:

1.1- THEORY

First partial theoretical exam (Biochemistry and Molecular Biology): It will represent 45% of the final grade and the Molecular Biology content of the subject will be evaluated. The exam can include quiz-type questions, short-answer questions and problems.

Second partial theoretical exam (Cellular Biology): It will represent 35% of the final grade and the Cell Biology contents of the subject will be evaluated. The exam will include quiz and/or outline questions or short answer questions.

• In order for the 2 partial theoretical exams to be averaged, the minimum mark for the Cell Biology part must be greater than or equal to 3.5. If the student obtains a mark lower than 3.5, they can make it up on the day of the make-up exam. There is no minimum mark for the Biochemistry and Molecular Biology partial exam to average.

Theory recovery exam: This exam will be used to recover the partial exams.

- In order for the theory grade to be averaged with the practice and problem grade, the average of the 2 partial exams or the make-up exam must be equal to or higher than 3.5.
- To be able to access recovery, students must have been assessed in a set of activities whose weight is equivalent to a minimum of two-thirds of the subject's total assessment activities.

1.2- PROBLEMS

Problems of the Biochemistry and Molecular Biology part: They will be included in the first partial exam and in the make-up exam (Molecular Biology part).

Problems of the Cell Biology part: It will represent 10% of the final mark of the subject. This part will be assessed with a problem to be solved on the day of the second partial theory exam. There will be a make-up problem on the day of the theory make-up exam.

1.3- LABORATORY PRACTICES

Laboratory practices represent 10% of the final grade of the subject and will be evaluated through:

Biochemistry and Molecular Biology practices: They will represent 5% of the final mark of the subject. To grade the practicals, the attitude of the students in the laboratory will be taken into account, as well as the evaluation of the questionnaires that they will have to complete at the end of the practical.

Cell Biology Practices: They will represent 5% of the final grade of the subject. The practice grade will be obtained from the arithmetic mean of the short questionnaires that will be completed at the end of each practice.

Summary table of the weight of each of the parts:

Lab practices BM	5%
Lab practices BC	5%
Problem BC	10%
Theory & Problems BM and Theory BC	80% (45% BM & 35% BC)

1.4- OTHER CONSIDERATIONS

- NOT ASSESSED: Students who complete less than 50% of the assessment activities described above will be considered as not assessed, that is to say that they do one or none of the activities.
- For students who do not pass the theoretical part of the subject, but pass the practical part (obtaining a minimum of 5 points out of 10), this mark will be kept for a period of three additional enrollments (but you will have to register again for the ENTIRE subject).
- For students who pass the Cellular Biology part (obtaining a minimum of 5 points out of 10), this mark will be kept for a period of three additional registrations (but you will have to register again for the ENTIRE subject). The mark for the Molecular Biology part is not saved from one course to another.
- Under no circumstances will the mark of problems be saved.
- Students who cannot attend an individual assessment test for justified reasons (such as a health problem, death of a relative up to the second degree, accident, enjoy the status of elite athlete and have a competition or sports activity with compulsory attendance, etc.) and provide the corresponding official documentation to the teaching staff and the coordination of the degree (official medical certificate explicitly stating the inability to take an exam, police report, justification of the competent sports body, etc.), will have the right to take the test on another date. The coordination of the qualification will ensure the completion of this test, after consultation with the teaching staff of the subject.
- Students who wish to IMPROVE THE MARK must have passed the theory, practical and problems part, and will take a final exam of the theory and problems part. To be able to attend, the student must renounce the mark obtained before, notifying the professor responsible for the subject at least three days before the make-up or recovery exam. The mark will be that of the last exam that the student has taken.

2- SINGLE EVALUATION

Students who opt for the single assessment must request it within the deadline and form indicated by the Faculty.

2.1- THEORY AND PROBLEMS

This part represents 90% of the final mark of the subject and it will be evaluated through:

Single exam of theory and problems: The single assessment of theory and problems will consist of an exam that will be carried out on the day of the 2nd partial test of the subject and will consist of:

- Test-type questions and/or questions or short exercises referring to all the theory and problems content of Biochemistry and Molecular Biology and theory contents of Cell Biology;
- A Cell Biology problem.

Theory and problems recovery exam: The recovery of the single assessment will be on the same day and time as the recovery test of the continuous assessment.

2.2- PRACTICES IN THE LABORATORY

ATTENTION: Although the student takes the single assessment, he must do the lab practices of this subject in face-to-face sessions. At the end of each practical session, the students will complete the evaluation questionnaire. Attendance at the practical lessons is MANDATORY and INDISPENSABLE to be able to take the single theory and problems exam.

Laboratory practices represent 10% of the final mark of the subject and will be evaluated through:

Biochemistry and Molecular Biology Practices: They will represent 5% of the final mark of the subject. To mark the lab practices, the attitude of the students in the laboratory will be taken into account, as well as the evaluation of the questionnaires that they will have to complete at the end of the practical lessons.

Cell Biology Practices: They will represent 5% of the final grade of the subject. The practice mark will be obtained from the arithmetic mean of the short questionnaires that will be completed at the end of each practice.

2.3- OTHER CONSIDERATIONS

- For students who do not pass the theoretical part of the subject, but pass the practical part (obtaining a minimum of 5 points out of 10), this mark will be kept for a period of three additional enrollments (but you will have to register again for the ENTIRE subject).
- Under no circumstances will the mark of problems be saved.
- Students who cannot attend an individual assessment test for justified reasons (such as a health problem, death of a relative up to the second degree, accident, enjoy the status of elite athlete and have a competition or sports activity with compulsory attendance, etc.) and provide the official documentation corresponding to the teaching staff and the coordination of the degree (official medical certificate explicitly stating the inability to take an exam, police report, justification of the competent sports body, etc.), will have the right to take the test on another date. The coordination of the qualification will ensure the completion of this test, after consultation with the teaching staff of the subject.
- Students who wish to IMPROVE THE MARK must have passed the theory, practical and problems part, and will take a final exam of the theory and problems part. To be able to attend, the student must renounce the mark obtained before, notifying the professor responsible for the subject at least three days before the make-up or recovery exam. The mark will be that of the last exam that the student has taken

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
1st Partial Examination. Biochemistry and Molecular Biology contents	35% of the global score	2.5	0.1	9, 2, 13, 6, 14
2nd Partial Examination. Cell Biology contents	35% of the global score	2.5	0.1	9, 2, 3, 4, 7, 14, 16, 19
Biochemistry and Molecular Biology Problems examination	10% of the global score	0.5	0.02	1, 12, 14, 17, 5
Cell Biology Problems examination	10% of the global score	0.5	0.02	9, 11, 14, 10, 5, 18
Laboratory practices	10% of the global score	1.5	0.06	2, 12, 11, 8, 15, 20, 18

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Cooper: <http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=cooper>

Alberts: <http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=mboc4>

Software

No specific software will be used