UAB
Universitat Autònoma de Barcelona

# Cell Biology

Code: 101914
ECTS Credits: 6

2024/2025

| Degree | Type | Year |
|---|---|---|
| 2501230 Biomedical Sciences | FB | 1 |

## Contact

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## Teaching groups languages

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

## Prerequisites

Since Cell Biology is a first-semester subject of the Bachelor's Degree in Biomedical Sciences, there are no prerequisites for taking it. However, it is recommended that students have previous knowledge of basic biology, so that they can follow the classes. This would mostly include general aspects of cell structures and their organic composition (proteins, nucleic acids, carbohydrates, and lipids), as well as the main cellular metabolic pathways.

In addition, since most scientific information sources are in English, it is advisable to have a good grounding in this language.

## Objectives and Contextualisation

Cell Biology is a basic subject of the Bachelor's Degree in Biomedical Sciences at the Autonomous University of Barcelona. The course aims to establish sound knowledge of the structural organization, functioning and regulation of eukaryotic cells. These contents will be complemented by those of other basic and compulsory subjects within the Biomedical Sciences study plan, like Medical Genetics, Histology and General Physiology, and Molecular Cell Biology. Together, these subjects will provide a good understanding of the structural and functional organization of living organisms.

The theoretical contents corresponding to this subject will be complemented by practical laboratory training in the subject "Laboratory I" which integrates the practical content of all first-year subjects included in this Bachelor's Degree (for more information, see the corresponding Study Guide).

The following are the specific training goals of the subject Cell Biology:

- To recognize the main differences between prokaryotes and eukaryotes.

- To describe the structure, composition, and main features of cell membranes.

- To explain the organization and composition of other elements of the cell surface.

- To describe the transport processes through cell membranes.

- To describe the structure, composition, and function of the different compartments of eukaryotic cells, as well as the relationships between them.

- To explain the role of mitochondria in cell bioenergetics.

- To describe the protein classification systems and their intracellular distribution pathways.

- To describe chromatin composition and its organization throughout the cell cycle.

- To list the cytoskeleton elements and describe their composition and structure.

- To explain the contribution of the cytoskeleton to the cell shape and movement.

- To identify and describe molecules, structures and processes involved in a cell's communication with the external environment and other cells.

- To identify molecules involved in cell cycle regulation and explain their role.

- To list and describe the different mitotic and meiotic phases and to compare both types of cell divisions.

- To relate the functioning of eukaryotic cells with the occurrence of some diseases.

- To integrate and apply knowledge of theory when interpreting and resolving basic cell biology experiments.

- To use the appropriate scientific terminology in the field of cell biology.

## Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Describe biomedical problems in terms of causes, mechanisms and treatments.
- Display knowledge of the basic life processes on several levels of organisation: molecular, cellular, tissues, organs, individual and populations.
- Display knowledge of the concepts and language of biomedical sciences in order to follow biomedical literature correctly.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Describe the processes of cell differentiation, specialisation and death.
3. Integrate the functions of the different organelles and cell structures with the overall functioning of the cell.

4. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
5. Relate the structure of the different parts of a cell to their functioning.
6. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
7. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
8. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
9. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
10. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
11. Use the bibliographic sources specific to cell biology, cytology and histology and genetics to work independently on acquiring further knowledge.
12. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

## Content

The contents of this subject will include the following points:

BLOCK I-INTRODUCTION

Unit 1. Organization of prokaryotic and eukaryotic cell.

BLOCK II- CELL SURFACE

Unit 2. Structure and composition of the plasma membrane.

Unit 3. Transport of molecules through the membrane.

Unit 4. Extracellular matrix and cell wall.

Unit 5. Unions and cell adhesion.

BLOCK III- CYTOSKELETON

Unit 6. Microfilaments.

Unit 7. Microtubules.

Unit 8. Intermediate filaments.

BLOKC IV- INTRACEL·LULAR COMPARTMENTS

Unit 9. Introduction to the intracellular compartments and protein sorting.

Unit 10. Nucleus.

Unit 11. Cytosol.

Unit 12. Introduction to the endomembrane system. Endoplasmic reticulum.

Unit 13. Golgi apparatus. Basics of vesicular transport.

Unit 14. Endosomes, lysosomes, and vacuoles.

Unit 15. Mitochondria.

Unit 16. Peroxisomes.

BLOCK V- CELLULAR REGULATION

Unit 17. Cell signaling.

Unit 18. Cell cycle.

Unit 19. Mitosis.

Unit 20. Meiosis.

## Activities and Methodology

| Title | Hours | ECTS | Learning Outcomes |
|---|---|---|---|
| Type: Directed | | | |
| Problem-based classes | 9 | 0.36 | 1, 2, 3, 4, 10, 9, 8, 6, 7, 5, 12 |
| Theory classes | 36 | 1.44 | 1, 2, 3, 10, 6, 7, 5, 11 |
| Type: Autonomous | | | |
| Individual study | 59.5 | 2.38 | 1, 2, 3, 4, 10, 9, 7, 5, 11 |
| Problem resolution work in groups | 32 | 1.28 | 1, 2, 3, 4, 10, 9, 8, 6, 7, 5, 12, 11 |
| Self-learning work | 10 | 0.4 | 1, 2, 3, 4, 10, 9, 7, 5, 11 |

The subject of Cell Biology includes Theory classes and Problem-based classes. Below, the organization and teaching methodology for these two types of training activities are described.

Theory classes

The content of the Theory program will be taught mainly in the form of formal lectures with audio-visual support. This will include PowerPoint presentations containing an index for each unit with the most important points that will be described, illustrative schematics of the contents, and also images of cells or their components, to familiarize students with real cell structure and organization. The teacher will make supplementary audio-visual material available to the students through the Moodle classroom of the subject, to help them follow the lectures. They are recommended to bring this material to class as a support when taking notes. Some animations and videos related to cellular processes described in specific units will also be displayed.

Students will be advised to consult the recommended books listed in the Bibliography section of this Study Guide on a regular basis, in order to consolidate and, if necessary, clarify the contents described. In addition, it will also be recommended that they consult the links made available through the Moodle classroom: to additional videos and animations that, due to time constraints or content prioritization, cannot be shown in class.

As well as in the follow-up to lectures, students are also expected to play an active role in preparing certain course contents, which involves using alternative methodologies and requires them to develop transferable and generic competences related to independent learning. Specifically, students will be required to prepare some units of the program based on guidelines provided by the teacher. These guidelines will consist of a

detailed index of the contents and the most important concepts that the students must acquire. The teacher will suggest an approximate calendar to distribute the preparation of these units over the semester, together with sessions for dealing with any queries related to these contents. This calendar will be flexible enough to adapt to the progress of the Theory program and the Problem-based classes.

Problem-based classes

During these sessions, students will give presentations to the rest of the class, offering solutions to experimental problems related to the contents of the Theory program. In general, no additional content will be included in these sessions, as their main aim is to consolidate and facilitate comprehension of the contents presented in the Theory classes, and to familiarize students with interpreting scientific data and problem-solving through real experimental situations.

In these sessions, students will be distributed in work teams. They will present their solutions to the exercises they had previously been working on outside the classroom, as scheduled for that class. At the beginning of the semester, through the Moodle classroom, the teacher will provide the students with a dossier containing all the exercises to work on over the course, along with the calendar of presentations. In each session, the teacher will ask a member of a team to explain the solution to a problem to the rest of the class. The students who give these presentations will be chosen by the teacher, who will ensure that all students present at least one exercise throughout the course. The teacher will evaluate the presentations made by the students and the mark obtained will be the same for all members of the group independently of who had done the presentation.

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 |
|---|---|---|---|---|
| First interim test | 40% | 1.5 | 0.06 | 1, 2, 3, 10, 9, 6, 7, 5 |
| Problem-solving exam (individual assessment) | 5% | 0.5 | 0.02 | 1, 2, 3, 4, 10, 6, 7, 5 |
| Problem-solving oral presentations (group assessment) | 15% | 0 | 0 | 1, 2, 3, 4, 10, 9, 8, 6, 7, 5, 12, 11 |
| Second interim test | 40% | 1.5 | 0.06 | 1, 2, 3, 10, 9, 6, 7, 5 |

Students' progress in acquiring competences on the course can be monitored through continuous assessment or by a single term-end examination as detailed below.

Assessment of contents taught in Theory classes

The contents taught in Theory classes will have a weight of 80% of the final grade for the subject. In case of following a continuous assessment, students will have to perform two Interim Tests that the students will have to take individually. These tests will consist of a series of objective questions to show whether the students have assimilated the concepts required to pass the subject, and whether they know how to integrate and interrelate them. These tests will also include questions on the units that students will have prepared on their own in order to evaluate the corresponding learning outcomes.

The First Interim Test will have a weight of 40% of the final mark and will focus on the contents taught up to that moment including two units that students have had to prepare independently.

The Second Interim Test will include the rest of the contents (although some questions can also indirectly refer to aspects of the units evaluated in the First Interim Test). This test will also include two units that students must prepare independently. The weight of this Second Interim Test in the final mark will be 40%.

In case of not passing these tests, or wanting to improve the mark obtained, students will be able to perform a Recovery Exam of the contents corresponding to any of these parts (or both). Each one of these tests will include the contents relatedto the twoprevious Interim Tests and therefore its weight will again be 40%+40% of the final grade.

Students who request a single term-end examination will be able to take a Single term-end Exam that will integrate the whole theoretical content of the subject and will represent 80% of the grade. This test will take place on the same day as the Second Interim Test. These students will also be able to perform a Recovery Exam of this content which will again have a weight of 80% on the final mark and take place concurrently to the Recovery Exam of the students that follow continuous evaluation.

Assessment of contents taught in Problem-based classes

The contents related to the Problem-based classes will have a weight of 20% of the final mark. In this part, students' ability when solving experimental problems related to the theoretical content of the subject will be assessed.

On the one hand, in each session several students will be asked to orally present the solutions to the exercises programmed for that session. These students will be chosen by the teacher to ensure that everyone will present at least one exercise to the rest of the class during the course. The teacher will evaluate these presentations taking into account not only that the students have understood the problem, have adequately interpreted the data, and have arrived at the correct answer, but also their ability to communicate, as well as the clarity and organization of the presentation. If necessary, the teacher will ask questions to verify that the presenters have really understood and worked on the problem. The mark obtained for each presentation will be applicable to all members of the group regardless of who has given it, and this mark will represent 15% of the final grade for the subject. In these presentations the participation of the other teams will be encouraged: either by discussing the results presented or by assessing the possibility of other valid answers. Given that the teaching methodology applied in this part of the subject does not allow transferring this kind of assessment to a single term-end examination, these contents will be assessed in the same way by all students enrolled in the subject.

Related to this activity, at mid-semester and at the end of the course, all students must submit their responses to a questionnaire about the functioning of their team. This questionnaire will be prepared by the teacher and will be made available to students through the Virtual Campus. In it, each member of a team will have to evaluate his/her own participation and that of his/her team-mates. The objective is to track the development of teamwork and to be able to detect students who do not participate or interfere in the group tasks. Although the result of these questionnaires will not have a specific weight in the final grade of the subject, if a student is evaluated negatively by the rest of the team, indicating a lack of participation in the team's work, the final mark for the team will not be applied to this student, or his/her mark will be lowered.

On the other hand, the contents of the Problem-based classes will also be evaluated thought the individual resolution of a problem of similar characteristics to the ones worked on during the course. This exercise will be carried out together with the Second Interim Test and the mark obtained will represent 5% of the final grade for the subject.In the case of following a continuous assessment, students will solve this problem together with the Second Interim Test. In case of requesting a single term-end examination, students will solve this problem together with the Single term-end Exam.

Globally, the maximum mark that can be obtained after completing all these activities will be 10 points (out of 10). To be able to pass the subject, the following conditions must be fulfilled.

- Obtaining a mark equal to or greater than 4 points (out of 10) in each Interim Test or in the corresponding interim parts of the Recovery Exam (in case of following continuous assessment).

- Obtaining a mark equal to or greater than 4 points (out of 10) in the Single term-end Exam or in the Recovery Exam (in case of following single term-end examination).

- Obtaining an overall mark of ≥5 (out of 10) for all assessments received.

ADDITIONAL ASPECTS

If a student decides to take the Recovery Exam to improve the mark obtained, he/she will lose all previously obtained Theory marks.

Students will be considered "not assessable" if the combined weight of all the evaluation activities they have done is less than 67% of the final mark.

Students who engage in misconduct (plagiarism,copying, personation, etc.) in an assessment activity will receive a mark of"0" for the activity in question. In case of recurrence, the studentsinvolved will be given a final mark of "0" for the subject.

In the case of students who do not pass the subject in a given academic year, the marks obtained in the Problem-based classes will be kept for the next year whenever the competences associated with these classes have been obtained (obtaining >5 points out of 10 when considering all the assessed activities). Otherwise, they willhave to repeat the evaluation activities to obtain thecorresponding grade. This exemption will be maintained for a period of three additional enrolments.

Students who are unable to attend an exam due to extenuating circumstances (i.e. health problem, death of a first- or second-degree relative, an accident, or unavoidable competitions in the case of elite student athletes) and who provide the official documentation to the degree coordinator (respectively: official medical certificate that explicitly confirms the inability to carry out the exam, police statement, justification from the competent sports organization.), will be entitled to perform the test on another day. Both the Bachelor's Degree coordinator and the teacher will do as much as possible to resolve these situations.

## Bibliography


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*Last edition of the book in Spanish:*

Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walter P. Biología Molecular de la Célula. 6ª Edición. Ediciones Omega S.A., 2016.

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https://bibcercador.uab.cat/discovery/fulldisplay?docid=alma991007029139706709&context=L&vid=34CSU

Cooper GM, Hausman RE. The Cell: A Molecular Approach. 8th Edition. Oxford University Press, 2019.

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Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Amon A, Scott MP. Molecular Cell Biology. 9th Edition. WH Freeman and Company, 2021

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*Online open access available at the UAB library:*

https://bibcercador.uab.cat/discovery/fulldisplay?docid=alma991007006029706709&context=L&vid=34CSU

## Software

No specific software is used.

## Language list

| Name | Group | Language | Semester | Turn |
|---|---|---|---|---|
| (SEM) Seminars | 511 | Catalan | first semester | morning-mixed |
| (SEM) Seminars | 512 | Catalan | first semester | morning-mixed |
| (TE) Theory | 51 | Catalan | first semester | afternoon |