Universitat Autònoma de Barcelona

2023/2024

Cell Biology

Code: 106805
ECTS Credits: 6

Degree	Type	Year	Semester
2504602 Nanoscience and Nanotechnology	FB	1	1

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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.

Prerequisites

There are no prerequisites for studying Cell Biology. Nonetheless, in order to ensure the achievement of the learning objetives proposed, it is recommended for the students to have achieved a basic knowledge of biology. It is specially important previous knowledge regarding the general structure of eukaryotic cells, their compartments and their organic molecules such as proteins, nucleic acids, carbohydrates and lipids, as well as basic knowledge of the main pathways of cell metabolism.
On the other hand, in a scientific discipline such as Cell Biology where most bibliography and information resources are in English, it is highly recommended that students have at least a basic knowledge of this language.

Objectives and Contextualisation

Cell Biology is taught in the 1st semester of the 1st year of the degree in Nanoscience and Nanotechnology, and also in the same period in other degrees of the Sciences and Biosciences Faculty. Therefore it can be considered a basic subject. The learning objectives the student should achieve are:

1. Recognize the main differences between prokaryotic and eukaryotic cells.
2. Describe the structure, composition and main characteristics of cell membranes.
3. Explain the organization and composition of other elements of the cell surface.
4. Describe the transport processes through the cell membranes.
5. Describe the structure, composition and function of the different compartments of eukaryotic cells, as well as the relationships between them.
6. Explain the role of mitochondria in cellular bioenergetics.
7. Describe the classification systems and routes of intracellular protein traffic.
8. Describe the composition of chromatin and its organization in interphase and division cells.
9. List the components of the cytoskeleton and describe its composition and structure.
10. Explain the contribution of the cytoskeleton to cell shape and cell movement.
11. Identify and describe the molecules, structures and processes involved in the relationship and

communication of the cell with the external environment and with other cells.
12. Identify the molecules involved in the regulation of the cell cycle and explain its function in the cycle control system.
13. List and describe the different phases of the mitotic and meiotic cell division and compare the two types of cell divisions.
14. Relate the functioning of the eukaryotic cell with somediseases.
15. Integrate and apply the theoretical knowledge acquired to interpret the results of simple scientific experiments and to solve simple experimental problems of cell biology.
16. Use the appropriate scientific terminology in the field of cell biology.

Learning Outcomes

- CM08 (Competence) Relate the activity of cellular components with the metabolism and genetic expression of the cell.
- CM09 (Competence) Work collaboratively in teams to solve problems and practical cases in the field of cellular biology.
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- KM12 (Knowledge) Describe the structure of the different parts of a cell and how they work.
- KM13 (Knowledge) Identify the mechanisms that take place within cells regarding energy transfer, the transmission of signals and a description of its metabolism.
- KM14 (Knowledge) Identify the fundamental biological processes of living organisms and their levels of organisation.
- SM13 (Skill) Gather, analyse and adequately measure both qualitative and quantitative data and observations in the field of cell biology.
- SM13 (Skill) Gather, analyse and adequately measure both qualitative and quantitative data and observations in the field of cell biology.
- SM14 (Skill) Safely use the techniques, materials and instruments common to a biology laboratory.
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Content

CONTENTS OF THE SUBJECT

THEORY LESSONS

Topic 1. Introduction. Organization of the prokaryotic and eukaryotic cells.

Topic 2. Structure, composition and functions of the plasma membrane.

Topic 3. Transport of molecules through the cell membrane. Simple diffusion and osmosis. Transport of ions and small molecules: passive transport through permeases and channel proteins; primary and secondary active transport.

Topic 4. Extracellular matrix. Composition and functions.

Topic 5. Nucleus. Structure, components and bidirectional nucleus-cytoplasm transport. Chromatin: composition, organization and structure.

Topic 6. Cytosol. Composition and structural organization. Functions of the cytosol.

Topic 7. Introduction to the intracellular compartments and the traffic of proteins. Cell compartmentation. Intracellular protein trafficking.

Topic 8. Endoplasmic reticulum. Structure, composition and functions of the rough andsmooth endoplasmic reticulum.

Topic 9.Golgi apparatus. Structure, composition and function of the Golgi apparatus. Basis of vesicular trafficking.

Topic 10. Endosomes, lysosomes. Structure, composition and functions.

Topic 11. Mitochondria. Structure, composition and functions.

Topic 12. Peroxisomes. Structure, composition and function.

Topic 13. Microtubules. Structure and composition. Polymerization of the tubulin. Proteins associated with microtubules.

Topic 14. Actin microfilaments. Structure and composition. Polymerization of actin. Actin binding proteins.

Topic 15. Intermediate filaments. Structure and composition. Polymerization Proteins associated with intermediate filaments. Functions

Topic 16. Unions and cell adhesion. Type of cell unions. Cell adhesion: adhesion molecules.

Topic 17. Cell signaling. Basic principles of cell signaling.

Topic 18. Cell cycle. Phases and control of the cell cycle.

Topic 19. Mitosis. Phases of mitosis and organization of the mitotic axis. Cytokinesis.

Topic 20. Meiosis. Phases of meiosis, synapse of chromosomes and genetic recombination.

PRACTICAL LESSONS

Practice 1- Introduction to the optic microscope and the plant cell

Practice 2- The animal cell

Practice 3- Introduction to the electronic microscope

Practice 4- Osmosis and simple diffusion

Practice 5- Mitotic cell division

Practice6- Meiotic cell division

Methodology

The subject of Cell Biology consists of theoretical lessons, lessons to solve cell biology problems and practical lessons in the biology laboratory*.

*The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Theory lessons:
The content of the theory program will be taught mainly by the professor in the form of master classes with audiovisual support. The material used in class by the teacher will be available on the Virtual Campus/Moodle. It is recommended that students download it or print it and bring it to class in order to use it as a support during lessons attendance. Although it is not essential to extend the contents of the lessons (unless explicitly

requested by the professor), it is recommended that students consult regularly the books recommended in the Bibliography section of this guide, in order to consolidate and clarify, if necessary, the lessons's contents.

In addition to classes attendance, the follow-up of the subject will also imply an active role of the student, who will autonomously prepare some topics from the theory program based on the guidelines provided by the teacher. The objective of this activity is, on one hand, to encourage the consultation of bibliographic sources and, on the other hand, to allow the students to search, interpret and synthesize information and to work independently. The topics prepared by the students will not be corrected by the professor and will serve as individual study material.

Lessons of cell biology problems:
There will be 4 sessions of cell biology problems. These exercises will be related to the theory program and will be avilable at the Campus Virtual/moodle beforehand. During these lessons, the professor will help the students to solve doubts regarding the resolution of the problems, which will be solved autonomously. The resolution of these exercises has the objective of consolidating theory knowledge. Also, it will provide the means for the student to become familiar with some of the techniques used in cell biology research, with the interpretation of scientific data and with the resolution of problems based on real experimental situations.

Students must have solved the exercises autonomously before the lesson, since these sessions will serve to solve doubts, not to solve the excercises.

The individual ability of each student to efficiently solve a scientific problem will be evaluated in the second partial test, where they will have to solve a problem similar to those analysed during the lessons throughout the semester. The mark obtained from the resolution of the cell biology problem will contribute to the final mark of the subject.

Practical lessons:
The practical lessons are designed for the students to complement the theoretical concepts and to learn to use the instrumental of the cell biology laboratory, especially the optical microscope. The students will attend 6 practical lessons of 2 hours each. The students will work in groups of two and, at the end of each practical lesson, they will have to complete a questionnaire individually. The marks from all the questionnaires will be averaged and will contribute to the final grade of the subject.

In order to attend practical lessons, students must justify having passed the biosafety and safety tests foundonthe Virtual Campus and guarantee their knowledge and accept the rules ofof the laboratories of 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			
Cell biology problems	4	0.16	CM09, KM13, KM14, CM09
Practical lessons	12	0.48	CM09, SM13, SM14, CM09
Theory lessons	36	1.44	CM08, KM12, KM13, KM14, CM08
Type: Autonomous			
Individual study	58	2.32	CM08, CM09, KM12, KM13, KM14, SM13, CM08
Prepare theory topics autonomously	20	0.8	KM12, KM14, KM12

Solving cell biology problems	10	0.4	KM12, KM13, SM13, KM12

Assessment

EVALUATION

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

In order to pass the subject, students must obtain a mark of ≥5 points (out of 10).

1 - CONTINUOUS EVALUATION

1.1 - THEORY:

It will represent 70% of the final mark. There will be 2 partial tests and each of them will weight 35% on the final mark. The first test will be performed when approximately half of the theoretical lessons have been taught. The second test will be performed at the end of the theoretical lessons.

Although each partial test will evaluate different lessons, the second partial test may also include, indirectly, theory contents of the first one.

In order to obtain an average mark from the 2 partial tests, the mark of each partial test must be ≥ 3.5.

Students who do not take any of the partial tests or do not reach the minimum mark after taking any of them, can take the make-up or recovery test.

Students who have NOT attended the partial exams without justifiable reason, will NOT be able to attend the make-up test.

1.2 - PROBLEMS:

It will represent 10% of the final mark and will be obtained by solving a problem individually during the 2nd partial test. Students who do not take the 2nd partial test because of a justified reason, will be able to do this exercise during the final make-up test.

1.3 - LAB PRACTICES

Practices represent 20% of the final mark. At the end of each practice, students will take a short quiz. The practice mark will be the average obtained from the marks of all the quizzes.

Failure to attend one practical lesson without justification will result in the reduction of the average mark of the questionnaires to 75%. Non-attendance to two practical lessons without justification will imply a 50% reduction. In case of not attending three or more practical lessons without justification the student will not be able to pass the Cell Biology subject.

In order to attend practical lessons, students must justify having pass the biosafety and safety tests found on the Virtual Campus and guarantee their knowledge and accept the rules ofof the laboratories of the Faculty of Biosciences.

1.4 - OTHER CONSIDERATIONS:

• Students who attend less than 60% of the scheduled assessment activities will be considered NOT ASSESSED. Assessment activities: i) any test to assess the theoretical content; ii) the set ofpractices; iii) individual resolution of a problem. Attendance at ≥3 of these activities will require the introduction of a note in the student's file.
• In the event that the student does not pass the theoretical part of the subject, but passes the practice part (obtaining a minimum of 5 points out of 10), this lab practice mark will be kept for a period of three additional registrations.

• 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 exam on another date. The coordination of the grade will see to the realization of this, after consultation with the teaching staff of the subject.
• In order to be able to take the exam to IMPROVE the MARK, the student will need to have the two partial blocks and the problem and the practices approved, and will take an exam of the whole theory. Students must renounce in writing (e-mail) to the mark obtained through partials, notifying to the professor responsible for the subject at least three days in advance of the recovery exam. The mark that will be taken into account will be the one from the last exam 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 80% of the final grade of the subject, and 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 theory content;
• 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 - LABORATORY PRACTICES:

- ATTENTION: Even if students take the single assessment, they must do the lab practices for this subject in face-to-face sessions. Attendance at the lab practices is MANDATORY and INDISPENSABLE to be able to take the single theory and problems exam.
- The practices in the laboratory represent 20% of the final mark of the subject. At the end of each practice, students will take a short quiz about it. The practice mark will be the average obtained from the marks of all the quizzes.
- Failure to attend one practical lesson without justification will result in the reduction of the average mark of the questionnaires to 75%. Non-attendance to two practical lessons without justification will imply a 50%reduction. In case of not attending three or more practical lessons without justification, the student will not be able to pass the Cell Biology subject.

2.3 - OTHER CONSIDERATIONS:

• In the event that the student does not pass the theoretical part of the subject, but passes the lab practice part (obtaining a minimum of 5 points out of 10), this lab practice mark will be kept for a period of three additional registrations.
• Under no circumstances will the note 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 certificate, justification of the 'competent sports body, etc.), will have the right to take the test on another date. The coordination of the qualification will see to the realization of this, after consultation with the teaching staff of the subject.
• In order to be able to take the exam to IMPROVE the MARK, the student must have passed the theory, the problem and the practices, and will take an exam of the whole theory. Students must renounce in writing

(e-mail) the mark obtained through partials, notifying the professor responsible for the subject at least three days in advance of the recovery exam. The mark that will be taken into account will be that obtained in the last exam taken.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First partial test (theory lessons)	35%	2	0.08	CM08, KM12, KM13, KM14
Make-up test (theory lessons)	70%	4	0.16	CM08, KM12, KM13, KM14
Practical lessons	20%	1	0.04	CM09, KM12, SM13, SM14
Second partial test (theory lessons)	35%	2	0.08	CM08, KM12, KM13, KM14
Solving of a cell biology problem (individually)	10%	1	0.04	CM08, KM13, KM14, SM13

Bibliography

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Alberts B, Heald R, Johnson A, Morgan D, Raff M, Roberts K, Walter P, Wilson J, Hunt T. 2022. *Molecular Biology of the cell*. 7th Edition. W.W. Norton & Co.

E-book: ISBN: 978-0-393-42708-0: https://wwnorton.com/books/9780393884821

Alberts B, Bray D, Hopkin K, Johnson A, Lewis J, Raff M, Roberts K, Walter P. 2011. *Introducción a la Biología Celular*. 3ª Edición. Editorial Médica Panamericana.

Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Martin K, Yaffe M, Amon A,. 2021. *Molecular Cell Biology*. 8th Edition. Editorial macmillan.

E-book: ISBN:9781319365028:
https://store.macmillanlearning.com/ca/product/Molecular-Cell-Biology/p/1319208525#format01

Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Amon A, Scott MP,. 2016. *Biología Celular y Molecular*. 7ª Edition. Editorial Panamericana.

Karp G, Iwasa J, Marshall W. 2019. *Biología Celular y Molecular.* 8ª Edición. Editorial Mc Graw-Hill.

Karp G, Iwasa J, Marshall W. 2018. *Karp's Cell Biology, Global Edition*. Editorial Wiley.

E-book: Karp G, Iwasa J, Marshall W. 2021. Karp's Cell and Molecular Biology. 9th Edition. Editorial Willey

Some of the recommended books can be partially accessed *online*:

Alberts (Molecular Biology of the Cell, 4th Ed.): http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=mboc4

Cooper (The Cell, 2nd Ed.): http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=cooper

Software

There are no specific requirements of programs / software in this subject.