UAB
Universitat Autònoma de Barcelona

Advanced Cell Biology

Code: 107529
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biology	OB	2

Contact

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Teaching groups languages

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

Prerequisites

There are no prerequisites for taking the subject of Advanced Cell Biology. In spite of this to guarantee a good follow-up of the subject it is recommended to have passed the subject of Cell Biology of first course

Objectives and Contextualisation

The course Advanced Cell Biology is taught during the first semester of the second year of the Biology degree program. It is a specific course within the Biology degree offered by the Faculty of Biosciences. It builds upon the foundational knowledge acquired in the first-year core course, Cell Biology.

Learning objectives of the course:

1. To become familiar with the most commonly used techniques in the field of cell biology that are not covered in other compulsory courses of the degree, with a special focus on experimental methodologies involving cell cultures.
2. To understand the mechanisms of intracellular signaling, including the components involved and the main signal transduction pathways within the cell.
3. To analyze the regulation of the cell cycle and its connection to processes such as proliferation, cell death, and cancer development, identifying the key molecules involved in each of these processes.
4. To integrate and apply the theoretical knowledge acquired to interpret and solve experimental problems in the field of cell biology, promoting critical thinking and scientific autonomy.

Learning Outcomes

1. CM09 (Competence) Integrate theoretical and practical knowledge in the field of cell biology to understand and respond to experimental problems in cell biology.
2. CM10 (Competence) Evaluate as a team and collaboratively solve problems and practical cases in the field of cell biology, developing interpersonal and collaborative work skills inherent to the professional environment.

3. KM13 (Knowledge) Describe the processes of embryonic development, differentiation, specialisation and cell death, as well as the cellular bases of pathologies associated with functional errors and chromosomic changes.
4. KM14 (Knowledge) Describe the structure and function of the different parts of a cell and its mitotic and meiotic structure.
5. KM15 (Knowledge) Identify specific bibliographic sources in cell biology and its applications (assisted reproduction techniques) that allow, in an autonomous manner, to develop and extend the knowledge acquired.
6. SM10 (Skill) Apply the methodologies used in cell biology to solve problems and practical laboratory cases related to broad aspects of cell biology, cytogenetics and reproduction techniques.
7. SM11 (Skill) Carry out cellular biology analyses using specialised laboratory tools.
8. SM12 (Skill) Summarise the most relevant historical milestones in cell biology, assessing their contributions to current biology.

Content

PROGRAM OF THEORY CLASSES

Basic techniques in Cell Biology

1. Cell cultures:: Interest and applications. Type of cultures. Characteristics of cell lines.

2. Culture techniques (I): Physical conditions of the cultures. Biological conditions of culture. Sterilization, Cellular Criopreservation and Quantification.

3. Fluorescence microscopy: Fluorescence, Fluorescence microscope. Confocal laser scanning microscope. Other microscopes used in cell biology.

Transmission of signals

4. Signaling pathways: Types of intercellular communications. Bases of intercellular communication. Types of signals. Type of answer. Amplification and distribution of the signal. Regulation of the signal.

5. Type of receptors and activation of receptors.

6. Hydrophilic and hydrophobic secondary messengers

7. Transducers of signal proteins

8. Transmission of signals via protein Ras

9. Transmission of signals via MAP kinases

10. Membrane receptors associated with G proteins

11. Membrane receptors associated with enzymes

12. Transmission of signals via cell adhesion

Control of the cell cycle

13. Cell cycle regulation: Phases of the cell cycle. Control of the cell cycle. Mechanisms of regulation.

14. Regulation of the cell cycle: Phase G1. Phase S.

15. Regulation of the cell cycle: Phase G2. Phase M

16. Apoptosis: Differences between necrosis and apoptosis. Apoptosis in puricellular organisms. Inductors and inhibitors of apoptosis. Genes involved in the apoptosis process. Changes in the nucleus. Apoptosis and cell cycle. Apoptosis and cancer.

17. Cancer. Proto-oncogens. Tumor suppresor genes. Cell cycle, apoptosis and cancer.

PROGRAM OF PROBLEM-SOLVING

Tools and description of techniques needed to solve problems. Cellular purification. Techniques of cell separation. Cell characterization. Cell fractionation. Analysis of DNA and proteins.

Resolution of problems related to the subjects taught in the subject of Cell Biology of first year of degree and of the subject of Extension of Cell Biology of the second year of degree

PROGRAM OF LABORATORY

1. Subculture from an established cell line (Vero cells)

2. Obtaining of the culture curve of a cell culture of Vero cells

3. Detection by immunofluorescence of microtubules in Vero cells

4. Observation of cultured cells by the confocal laser scanning microscope

5. Freezing and defrosting of Vero cells. Evaluation of the use of different cryoprotective concentrations

6. Induction of apoptosis in a monocyte culture. Detection of apoptotic cells through Annexina-V-FLUOS

7. Induction of apoptosis in a cell culture Vero. Quantification ofapoptotic cells thrrough morphology

7. Observation of the different cell organelles in rat liver tissue using the electronic transmission microscope (TEM)

8. Observation of the morphology of a culture of monocytes differentiated to macrophages (fixation at different times) by the electronic scanning microscope (SEM).

9. Discussion of results

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	22	0.88	CM09, CM10, SM10, SM11, CM09
Sessions for problem soloving	6	0.24	CM09, CM10, SM10, CM09
Theoretical classes	22	0.88	KM13, KM14, KM15, SM12, KM13
Type: Supervised			
Personalized tutorials	4	0.16	CM09, CM10, KM13, KM14, KM15, SM12, CM09
Problem preparation	2	0.08	CM09, CM10, SM10, CM09
Type: Autonomous			

Preparation of results and discussion of practices	4	0.16	CM09, CM10, SM10, SM11, CM09
Problem solving	20	0.8	CM09, CM10, SM10, CM09
Study	62	2.48	CM09, KM13, KM14, KM15, SM10, SM12, CM09

The course combines various teaching methods to support the acquisition of both theoretical and practical knowledge, as well as the development of transversal skills such as teamwork, critical thinking, and problem-solving abilities.

Theoretical Lectures

Theoretical sessions will be delivered as lectures supported by audiovisual materials prepared by the instructor. These materials will be made available in advance on the UAB Virtual Campus (CV), along with the detailed course schedule. Students are encouraged to review the materials before each session and to complement their learning with the recommended bibliography to reinforce the concepts covered in class.

Laboratory Practical Sessions

The laboratory sessions aim to help students gain proficiency in using laboratory equipment and to reinforce theoretical knowledge through hands-on experimentation. These sessions will take place over an intensive one-week period, with daily sessions lasting four and a half hours. Students will work in pairs and, at the end of the week, will participate in a group discussion of the results obtained. Each pair must submit a written report presenting and analyzing both their own results and those of the entire group. This activity is designed to foster scientific reasoning, both individually and collaboratively.

Problem-Solving Sessions

These sessions are designed to encourage collaborative work and the development of critical thinking. Students will work in small groups of three. The first two sessions will provide a brief introduction to the techniques required for problem-solving and an explanation of the working methodology.

Problem-solving will be carried out outside of class hours, and four dedicated sessions will be held in which selected groups will present their proposed solutions to the rest of the class. These proposals will be discussed collectively with the guidance of the instructor, promoting idea exchange and critical reflection.

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
Individual and group tests (problems)	10%	2	0.08	CM10, SM10
Individual and group tests (laboratory practices))	30%	2	0.08	CM09, SM10, SM11
Individual tests (theoretical matter)	60%	4	0.16	KM13, KM14, KM15, SM10, SM12

Continuous Assessment

To pass the course, students must obtain a minimum overall score of 5 out of 10. The final grade will be calculated as follows:
Final grade = Theory (30% + 30%) + Problem-solving (15%) + Laboratory practicals (12.5% + 12.5%)

1. Theory exams (60%)

- First theory exam (30%): Covers the first half of the syllabus.
- Second theory exam (30%): Covers the second half of the syllabus.

To calculate the average between the different exams, a minimum grade of 4 is required in each one. If the grade is equal to or lower than 3.99, the corresponding resit exam must be taken.

1. Problem-solving (15%)
   Assesses the ability to solve a problem similar to those worked on in class. It will take place on the same day as the second theory exam.
   The score may be increased by up to 1 additional point if the student voluntarily presents a problem-solving proposal during the sessions (0.5 points per problem), provided they can defend it adequately, even if the solution is incorrect.

   To calculate the average between the different exams, a minimum grade of 4 is required in each one. If the grade is equal to or lower than 3.99, the corresponding resit exam must be taken.

2. Laboratory practicals (25%)
   • a) Practical report (12.5%)

- Work is done in pairs.
- A report must be submitted analyzing both individual and group results, comparing them with expected outcomes.
- Submission: 9 days after the end of the practicals via the Virtual Campus.

• b) Laboratory techniques exam (12.5%)

- Written exam on the techniques and results from the practical sessions.
- It will be held on the same day as the second theory exam.
- No minimum grade is required to calculate the average, as this exam cannot be retaken due to its weight being less than 15%.

• Attendance and preparation conditions:
Attendance at laboratory sessions is mandatory. Punctuality is essential, as the first 30 minutes ofeach session are used to explain the methodologies. Delays of 10 minutesreduce the score by 0.1 points per session (the quiz cannot be completed); delays over 30 minutes result in a 0.3-point penalty. Students will receive a "Not Assessable" grade if absences exceed 20% of sessions.
To ensure proper understanding, students must read the lab manual and watch the corresponding videos before each session. A daily quiz must be completed before the session begins, worth up to 0.1 points per day (maximum 0.4 points). Scores below 0.4 will proportionally reduce the grade for this component.
Practicals are done in pairs. Each pair must submit a report on their results and discuss both their own and the group's results, comparing them with expected outcomes. The report will be graded out of 10 points and submitted nine days after the end of the practicals via the Virtual Campus.

Retake an exam (resit)

To be eligible for the resit, students must have been assessed in activities representing at least 67% of the total grade. Otherwise, they will receive a "Not Assessable" grade.

A resit exam will be available for:

- Students who did not pass (score < 4) either of the theory exams or the problem-solving task.
- Students who, despite scoring > 4, do not reach a final grade of 5.

Only the failed theory part or problem-solving task may be retaken. The practical exam cannot be retaken, as it accounts for less than 15% of the final grade.

Single Assessment

To pass the course, students must obtain a minimum overall score of 5 out of 10.
The single assessment will consist of one comprehensive exam covering the entire course content (theory, problems, and practicals). This synthesis exam will account for 87.5% of the final grade. It will be held on the same day, time, and place as the last continuous assessment exam (second theory exam). The synthesis exam can be retaken on the officialresit date.
Students opting for the single assessment must still complete the laboratory practicals (PLAB) in person. These will account for 12.5% of the final grade. See conditions above.
Final grade = Synthesis exam (87.5%) + Practical report (12.5%)

Bibliography

Textbooks

* Molecular Biology of the Cell. Alberts B., Johnson A., Lewis J., Morgan, D., Raff M., Roberts K., Walter P. 2022. 7th edition. Garland Science. New York.

* Molecular Cell Biology. H. Lodish; A. Berk; C. A. Kaiser; M. Krieger; A. Bretscher; H. Ploegh; A. Amon; K. C. Martin. 2023.9th edition. WH. Freeman and Company. NY. (en paper i recurs electrònic (edició 2016))

* Cell Biology. T. Pollard, W. Earnshaw, J. Lippincott-Schwartz, G. Johnson. 2017. 3d edition. Saunders (ElsevierScience).USA.

* Becker`s world of the cell, Hardin, Becker et al. 2022. 10a ed. Pearson Education, Madrid

* Biologia Celular y molecular. Conceptos y experimentos. Karp, G. 2020. 8ª edición. Mc Graw Hill.México (en paper i recurs electrònic)

Specialized books

*Biochemistry of signal transduction and regulation. Gerhard Krauss (5th edition). Wiley-VCH, 2014 (en paper i recurs electrònic)

*The molecular biology of programmed cell death. MD Jacobson, N McCarthy. Oxford University press, 2002

*Culture of animal cells. A manual of basic technique (7th ed.) RI Freshney. Wiley-Liss, 2016 (en paper i recurs electrònic)

Electronic journals

*Current Opinion in Cell Biology. CB Current Biology

*Trends in Cell Biology. Elsevier Trends Journals

*Current opinion in structural biology. London: Current Biology

Software

No programmary is used in this course

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
(PAUL) Classroom practices	121	Catalan	first semester	morning-mixed
(PAUL) Classroom practices	122	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	121	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	122	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	123	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	124	Catalan	first semester	morning-mixed
(TE) Theory	12	Catalan	first semester	afternoon