Universitat Autònoma de Barcelona

2018/2019

Advanced Cell Biology

Code: 100779
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	FB	2	1

Contact

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Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

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 subject of Advanced Cell Biology, is taught in the 1st semester of the 2nd year of the Biology degree. It is a specific subject of the Degree in Biology of the Faculty of Biosciences. It is a subject to extend the knowledge acquired in the subject of Cell Biology that is taught in the first year and that is a basic subject.

Training objectives of the subject:

1) Know the techniques most used in the field of cell biology that have not been described in other compulsory subjects of the degree.

2) Understand the regulation of the cell cycle and its relation to the processes of proliferation, cell death and cancer. Identify the molecules involved in the different processes (regulation of cell cycle, cell death and cancer)

3) To know the mechanisms of intracellular signaling, the components of the signaling and the different signaling pathways used by the cell.

4) Integrate and apply the theoretical knowledge acquired to understand and solve experimental problems of Cell Biology

Skills

- Be able to analyse and synthesise
- Be able to organise and plan.
- Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
- Develop independent learning strategies.
- Isolate, culture and modify microorganisms and cells and tissues of multicellular organisms.
- Respect diversity in ideas, people and situations

- Understand the processes that determine the functioning of living beings in each of their levels of organisation.
- Work in teams.

Learning outcomes

1. Be able to analyse and synthesise.
2. Be able to organise and plan.
3. Describe the processes of cell differentiation, specialisation and death, and the cellular bases of the pathologies associated with functional errors.
4. Describe the structure of the different parts of a cell and their functioning.
5. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
6. Develop independent learning strategies.
7. Integrate the functions of the different organelles and cell structures with the overall functioning of the cell.
8. Relate the methodologies used in cell biology to the knowledge these can provide, handle laboratory tools and make cell cultures.
9. Respect diversity in ideas, people and situations.
10. Use the bibliographic sources specific to cell biology and genetics to work independently on acquiring further knowledge.
11. Work in teams.

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. Components of the signaling pathways. Types of signals. Ways of communication Signal receptors. Type of answer. Amplification and distribution of the signal. Regulation of the signal.

5. Type of receptors and activation of receptors.

6. According to messengers: cAMP. Activation PKA for cAMP. cGMP. Metabolism of phospholipids of inositol and inositol phosphates. Action phospholipase C. Via Inositol triphosphate and release of Ca2+. Via Diacilglicerol and activation of PKC. Action PI3-Kinasa.Paper of the Ca2+ as the second messenger. Other messengers Signal molecule NO. NO receptors

7. Transducers of signal proteins

8. Transmission of signals via protein Ras: Ras protein. Function of GAP and GEF. Raf-kinase effector of Raf. Other effectors

9. Transmission of signals via MAP kinases: Organization of the MAPK routes. Components of the tracks. MAPK activating signals

10. Membrane receptors associated with G proteins

11. Membrane receptors associated with enzymes: Cytokines. Activation cytokine receptors. Via Jak-Stat signage.

12. Transmission of signals via cell adhesion: Transcription via integrins. Transmission via cadherins

Control of the cell cycle

13. Cell cycle regulation: Phases of the cell cycle. Control of the cell cycle. Mechanisms of regulation. Cyclin-dependent kinase proteins (CDKs).

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 PROBLEMS

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 PRACTICAL CLASSES

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. In vivo detection of different cellular structures (transfection product). Observation 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

Methodology

The subject of Advanced Cell Biology consists of master classes using audiovisual media, practical classes in the laboratory and problem classes.

Master classes:
Lectures will be made using audiovisual material prepared by the teacher, material that the students will have

at their disposal in the Virtual Campus (CV) of the UAB before each session. Students will also have in the CV the schedule of the subject and, it is recommended, that the students consult the audio-visual material and the books recommended in the Bibliography section of this teaching guide in order to consolidate the contents explained in class.

Practical classes:
The practical classes are designed so that the students learn to use laboratory instruments and complement the theoretical training. The students will complete a week of practices of four and a half hours every day. The students will work in groups of 2, and at the end of the practices will be valued and the results obtained in the different practices will be discussed. Each pair will have to give a report showing and discussing the results obtained by both the couple and the practice group. The objective of this activity is to promote the scientific reasoning as much individual as in team.

Problem classes:
The classes of problems are organized so that the students work in small groups (3 students), and they acquire group work abilities and critical reasoning.

In the first two sessions, the teacher will explain in a very summarized manner different techniques that the student should know to solve the problems. It will also explain the mechanics to follow to solve a problem.

In these sessions the class group is divided into two groups organized from the coordination of the degree (A and B).

The resolution of the problems will be done in groups of 3 students. Each student must belong to a group.

The groups will work the problems outside the class schedule and will elaborate a dossier of answers that they will have to deliver through the CV before the deadline proposed by the professor. There will be 4 issues of problems. Each working group will deliver a single dossier. During the class, the corresponding problems will be discussed and corrected. The teacher will ask, in turns, the different groups to solve and explain to the rest of students one of the problems of the session.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Practical classes	22	0.88	8, 9, 1, 11
Theoretical classes	22	0.88	3, 4, 5, 7, 8, 9, 10
Troubleshooting classes	6	0.24	3, 5, 7, 9, 1, 11, 10
Type: Supervised			
Personalized tutorials	4	0.16	3, 7, 10
Problem preparation	2	0.08	3, 7, 10
Type: Autonomous			
Preparation of results and discussion of practices	4	0.16	6, 8, 1, 11
Problem solving	20	0.8	3, 6, 7, 1, 11, 10
Study	62	2.48	3, 6, 7, 1, 11, 10

Evaluation

To pass the subject, you must obtain a minimum overall score of 5 points with a maximum of 10 possible points. The scheduled evaluation activities are:

1) First theory exam. It will represent 30% of the value of the subject. In this exam approximately, half of the subject taught in the theoretical classes will be evaluated. An ≥ 4 grade in the first theoretical exam allows to do the second theory exam. Qualifications ≤ 3.99 oblige to submit to the retake process of this part of theory.

2) Second theory exam. It will represent 30% of the mark of the subject. In this exam approximately, half of the subject taught in the theoretical classes will be evaluated. An ≥ 4 grade in the first theoretical exam allows to do the second theory exam. Qualifications ≤ 3.99 oblige to submit to the retake process of this part of theory.

3) Resolution of a problem. It will represent 10% of the mark of the subject. The ability to solve a problem of similar difficulty to those given in problem classes will be assessed. The resolution of the problem will be done the same day as the second theoretical exam.

4) Correction of the problems presented through the virtual campus. It will represent 5% of the mark of the subject. The students will have a dossier with 12 problems. Students will have to solve the problems in groups of 3. Before the completion of each seminar, the students must submit the resolution of 3 problems (the problems and delivery days will be announced on the virtual campus). In addition, the teacher will ask the groups of students to present the resolution of these problems in public. The mark obtained will be the same for all the members of the group, except if a member of the group notifies the professor the presence of a problem. The note will take into consideration both the resolution of the problems presented and the public presentation carried out.

5) Laboratory practices. It will represent 12.5% of the mark of the subject. Attendance to practical laboratory sessions is mandatory. Punctuality is very important because during the first 30 minutes of each session the different methodologies that will be used during the practice will be explained. Delays of 10 minutes in the practical sessions reduce the score by 0.1 points for each delay (the questionnaire cannot be done, see below), when the delay exceeds 30 minutes, the penalty will be 0.3 points. Students missing more than 20% of programmed sessions will be graded as "No Avaluable". For the good functioning and understanding of the practices, the student must read the practical's document corresponding to each session, so every day they will have to complete a questionnaire before the start of the session about questions related to the practice of the day. This questionnaire will be evaluated with a maximum score of 0.1 point per day with a maximum of 0.4 points. Values lower than 0.4 will be subtracted into the note in this block.

The practices are done in pairs. The students will have to give a dossier of the results obtained and will have to discuss both their results (couple) and those of the group "class of practices" compared to the expected results. The work will have a maximum value of 10 points. The delivery will be made through the campus virtual.

6) Exam of techniques used in the laboratory. It will represent 12.5% of the mark of the subject. There will be a written exam about the different techniques that have been used throughout the practices. The exam will be held on the same day of the second theoretical exam.

Note of the subject = theory (30% + 30%) + problem (10% + 5%) + practices (12,5% + 12,5%)

Retake process

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equalling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighting of all conducted evaluation activities is less than 67% of the final score.

There will be a retake process for students who have not taken more than 3.99 in one of the two theory exams, and for students who, once the average has been done with the other qualifications of the subject, do not receive a qualification equal to or greater than 5. Students will only have to retake the exam not passed. It will not be possible to retake neither the practical exam, nor the examination of the resolution of a problem since both exams have a weight inferior to 15% in the final grade of the subject.

To raise the final grade.

The students who want to raise the final grade can present themselves to the first, the second or the two theory exams. There will be no retaken exams for practice, nor for resolution of a problem, since the two exams have a weight less than 15% in the final grade of the subject. The presentation to the exam to improve the grade implies a resignation, on the part of the student, of the grade that had obtained in the previous exam.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Individual and group tests (problems)	10%	2	0.08	6, 5, 9, 1
Individual and group tests (laboratory practices))	30%	2	0.08	8, 2, 11
Individual tests (theoretical matter)	60%	4	0.16	3, 4, 7, 10

Bibliography

Textbook:

*Alberts B., Johnson A., Lewis J., Morgan, D., Raff M., Roberts K., Walter P. 2014. Molecular Biology of the Cell. 6th edition. Garland Science. New York.

*Lodish H., Berk A., Kaiser CA., Krieger M., Scott, MP., Bretsscher A., Ploegh, H., Matsudaira, P. 2013. Molecular and Cell Biology. 7th edition. WH. Freeman and Company. NY.

*Pollard TD., Earnshaw WC.,Lippincott-Schwartz, J. 2008. Cell Biology. 2nd edition. Saunders (Elsevier Science).USA.

*Becker WM et al. 2006. El mundo de la célula. 6a ed. Pearson Education, Madrid

* Karp, G. 2014. Biologia Celualr y molecular. Conceptos y experimentos. 7ª edición. Mc Graw Hill.México

Spezialized books:

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

*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 (està en paper i en recurs electrònic)

Journals:

*Current Opinion in Cell Biology. CB Current Biology

*Trends in Cell Biology. Elsevier Trends Journals

*Current opinion in structural biology. London: Current Biology