

Cell Biology

Code: 102954
ECTS Credits: 6

Degree	Type	Year	Semester
2502442 Medicine	FB	1	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

Teachers

Pere Puig Rosell
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Maria Oliver Bonet
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Alejandro Gella Concustell
Mariona Terradas III
Keyvan Torabi Asensio

Prerequisites

There are no prerequisites for taking the core subject of Cell Biology as it is a subject in the first semester of the first year. However, in order to ensure proper follow-up and the achievement of the learning objectives set out, it is recommended that students have a basic general knowledge of the structure, chemical composition and functions of the cells.

In addition, students should have good knowledge of English because many of the sources of information on this subject are in this language.

Objectives and Contextualisation

The subject of Cell Biology is attended to the first year of the Degree of Medicine, corresponding to a preclinical period, where students must obtain solid knowledge about the structural organization, functioning and regulation of the cells, Eukaryotic cells.

These basic skills are complemented with other basic and compulsory subjects in the Plan of Studies such as Biochemistry, Human genetics, Histology and Physiology, which will provide the student with a good understanding of the structural and functional organization of the human organism in the normal state (non-pathological).

On the other hand, the theoretical knowledge acquired in the subject of Cell Biology is complemented by practical training in the laboratory that allows students to introduce the techniques of study of the somatic and germinal cells, in a state of rest or division as well as of the observation of the cellular ultrastructure.

The formative objective of Cell Biology is that the students at the end of the subject are able to:

- Recognize the main differences between prokaryotic and eukaryotic cells
- Describe the structure, chemical composition and main functions of cell membranes
- Explain the processes of transport through the cell membranes
- Describe the organization and chemical composition of other elements of the cell surface
- Describe the structure, chemical composition and functions of the different cell compartments
- Explain the structure, chemical composition and functions of mitochondria and peroxisomes
- Describe the role of the cytosol
- Describe the structure, chemical composition and functions of the nuclear envelope and chromatin.
- Recognize the basic mechanisms of nuclear activity: replication and transcription
- List the different components of the cytoskeleton and describe its composition and structure
- Explain the contribution of the cytoskeleton in the formation of tissues
- Identify the molecules that participate in the control of the regulation of the cell cycle
- Describe the mechanisms involved in cell death for necrosis and apoptosis
- List and describe the different phases of the mitotic and myosic cell division and compare the two types of cell divisions
- Describe the process of male and female gametogenesis and compare the two types of processes
- Explain the Fertilization process
- Use properly the scientific terminology used in the field of Cell Biology

Competences

- Communicate clearly, orally and in writing, with other professionals and the media.
- Convey knowledge and techniques to professionals working in other fields.
- Critically assess and use clinical and biomedical information sources to obtain, organise, interpret and present information on science and health.
- Demonstrate basic research skills.
- Demonstrate knowledge of the principles and physical, biochemical and biological processes that help to understand the functioning of the organism and its disorders.
- Demonstrate understanding of the basic sciences and the principles underpinning them.
- Demonstrate understanding of the importance and the limitations of scientific thought to the study, prevention and management of diseases.
- Demonstrate understanding of the mechanisms of alterations to the structure and function of the systems of the organism in illness.
- Demonstrate understanding of the organisation and functions of the genome, the mechanisms of transmission and expression of genetic information and the molecular and cellular bases of genetic analysis.

- Demonstrate understanding of the structure and function of the body systems of the normal human organism at different stages in life and in both sexes.
- Formulate hypotheses and compile and critically assess information for problem-solving, using the scientific method.
- Maintain and sharpen one's professional competence, in particular by independently learning new material and techniques and by focusing on quality.
- Recognise the effects of growth, development and ageing on individuals and their social environment.

Learning Outcomes

1. Communicate clearly, orally and in writing, with other professionals and the media.
2. Convey knowledge and techniques to professionals working in other fields.
3. Demonstrate basic research skills.
4. Describe the functional and organisational structure of hereditary nuclear and mitochondrial material.
5. Describe the processes involved in somatic and germinal cell proliferation: mitosis and meiosis.
6. Describe the processes of cell differentiation, ageing and death.
7. Explain how alterations to cell components lead to structural and functional alterations to systems of the human organism.
8. Explain the molecular and cellular significance of tissue and system structure.
9. Formulate hypotheses and compile and critically assess information for problem-solving, using the scientific method.
10. Identify the basic functional and organisational structure of hereditary nuclear and mitochondrial material.
11. Identify the basic processes of life on various levels of organisation: cell, organ and individual.
12. Identify the cell processes that can be the cause or the consequence of pathological manifestations in the organism.
13. Identify the main cellular processes involved in growth, development and ageing in individuals and their social environment.
14. Identify the mechanisms and the molecular and cellular processes that can be the cause or the consequence of pathological manifestations in the organism.
15. Integrate the functions of the the different cell organelles and structures with the overall functioning of the cell.
16. Maintain and sharpen one's professional competence, in particular by independently learning new material and techniques and by focusing on quality.
17. Relate the structure of the different parts of cell to its functioning.
18. Use specific bibliographic sources in cell biology to work independently on acquiring further knowledge.

Content

Basic techniques in Cell Biology. Plasma membrane. Internal membrane system. Energy conversion organs. Cytoskeleton Extracellular matrix. Nucleus and its relation with the cytoplasm. Cell cycle: Interphase and Mitosis. Cell Death: Necrosis and Apoptosis. Meiosis. Male and female gametogenesis. Fertilization.

Distributive blocks

A. Levels of cell organization. Cell theory and general organization of the cell. General characteristics of prokaryotic and eukaryotic cells.

B. Plasma membrane. Macromolecular organization of the plasma membrane and glycocalyx. Characteristics of the membrane: fluidity and asymmetry. Functions of the membrane: transport of ions, small molecules, macromolecules and particles. Processes of endocytosis, pinocytosis, potocytosis, phagocytosis and exocytosis

C. Internal membrane system. Introduction to cell division and the traffic of proteins and other molecules. Elements of the internal membranous system. Structure and functions of the rugged and smooth endoplasmic reticulum, of the Golgi apparatus, of the endosomes and lysosomes

D. Mitochondria and peroxisomes. Structure and composition and functions of mitochondria and peroxisome. Functions of mitochondria and peroxisome. Oxidation in mitochondria and peroxisomes. Biogenesis. Mitochondrial genome and protein synthesis. Import of proteins and lipids from the cytosol

E. Cytosol and Cytoskeleton. Functions of the cytosol. Cytoskeleton Components: Functions. Structure of actin filaments, microtubules and intermediate filaments. Stable and stable microtubules. Associated proteins of actin and microtubule filaments. Types of intermediate filaments and presence according to cell types

F. Cell adhesion. Membrane and adhesion molecules. Structure and functions and the different types of joints: occlusives, anchorages, cell-cell adhesives, cell-matrix extracellular adhesives, and communicants

G. Nucleus and nuclear activity. Structure of its components: nuclear envelope, nuclear pores, nuclear lamina, nuclear matrix, nucleus, nucleoplasm and chromatin. Structure and organization of nuclear chromatin. Nuclear activity: processes of transcription, maturation and replication of chromatin

H. Control of the Cell Cycle. Phases of the cell cycle. Cell cycle control mechanism: Control points and participating components. Role of the cyclin-protein complex: Cyclin-dependent kinases

I. Cell Death. Differences between cell death for necrosis and apoptosis. Mechanism involved in apoptosis. Mitochondria paper

J. Mitosi i Meiosi. Mitotic division and phases: prophase, prometaphase, metaphase, anaphase and telophase and the cytokinesis process. Cycles of chromosomal condensation, fragmentation and assembly of the nucleus wrap. Meiotic division and the two divisions, reduction and equatorial, and the respective phases. Differences and similarities between the meiotic and mitotic process. Biological meaning of meiosis

K. Gametogenesis and Fertilization. Male gametogenesis. Female gametogenesis. Comparison of the two processes. Fertilization mechanism

Methodology

Directed Teaching

Theory lecture (TE). Classroom practices (PAUL). Laboratory practices (PLAB). Specialized seminars (SEM)

Supervised Teaching

Problem based learning

Autonomous Teaching

Personal study. Elaboration of works

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			
THEORY (TE) / CLASSICAL PRACTICES (PAUL) / LABORATORY PRACTICES (PLAB) / SPECIALIZED SEMINARS (SESP)	53	2.12	1, 3, 6, 5, 4, 2, 8, 7, 9, 14, 13, 11, 12, 10, 15, 16, 17, 18
Type: Supervised			

PROBLEM-BASED LEARNING (ABP)	23	0.92	1, 3, 6, 5, 4, 2, 8, 7, 9, 14, 13, 11, 12, 10, 15, 16, 17, 18
Type: Autonomous			
DEVELOPMENT OF WORK / PERSONAL STUDY	69	2.76	1, 3, 6, 5, 4, 2, 8, 7, 9, 14, 13, 11, 12, 10, 15, 16, 17, 18

Assessment

Ongoing assessment:

Continuous evaluation will be made through the course. It will include two partial tests (P1 and P2), eliminatory of subject content, plus two activities or tests that will evaluate the content of the lab sessions 2 (S2) and 3 (S3). Each of the two partial tests will be done through an objective exam with multiple-choice items, designed to demonstrate the acquisition of skills and the integration of theoretical and practical learning. It will consist of test-type questions with 4 answers, of which 1, 2 or 3 may be true. incorrect answers will be penalized proportionately.

The contents that will be evaluated in P1 are: i) Theory of the first topics (from A to D and cytosol) (32%), ii) the first two Seminars (5%) and iii) the first session of lab practices (5%).

The contents that will be evaluated in P2 are: i) Theory of the last topics (from E, except cytosol, to K) (38%) and ii) the last three Seminars (10%).

The tests or activities that will be carried out in S2 and S3 will evaluate the participation and knowledge acquired in each of these practice sessions. The activities or tests will be related to the practical activity performed in the lab.

The partial tests P1 and P2 will take place on the days indicated by the faculty, in the indicated classrooms. The activities or tests of S2 and S3 will be done in the same practice laboratory, at the end of each of the two sessions and are non-retrievable. Each of the tests and activities described in the previous paragraph will have the following weighting in the final grade of the subject:

P1 (42%) + P2 (48%) + S2 (5%) + S3 (5%).

To pass the subject you must meet the following requirements: i) that the two grades obtained in P1 and P2 are equal to or over 5 and ii) that the weighted average of P1 + P2 + S2 + S3 is equal to or over 5 on 10.

Attention: Attendance for laboratory practice is mandatory for students enrolled for the first time in this subject. Students retaking the course who have a grade higher than 5 in the S2 and S3 tests are not required to take them, and the grade obtained in the 21-22 course will be used as this year's grade.

Final referral exam:

In the case of failing to pass the subject through ongoing assessment, there will be a final referral exam of the partial tests with a grade below 5. Students with partial tests with a grade over 5 may also take the referral exam to raise the grade of one or both partials. In this case, you need to inform the subject coordinator in advanced. The grade obtained in the continuous assessment will be replaced by the grade obtained in the referral exam.

To be allowed to take this test, two requirements must be met: i) you must have taken the two partial tests P1 and P2 and ii) the weighted average mark of the continuous assessment (P1 (42%) + P2) 48%) + S2 (5%) + S3 (5%)) is equal to or higher than 2.5.

The referral exam will consist of two parts:

The first part (42% of the final grade) is an objective test that corresponds to the contents of P1, and therefore evaluates: i) Theory of the first topics (from A to D and cytosol) (32%), ii), the first two Seminars (5%) and iii) the first session of Laboratory Practices (5%).

The second part (48% of the final grade) is an objective test that corresponds to the contents of P2, and therefore evaluates the following contents: i) Theory (38%) of the last topics (of E, except cytosol, up to K), ii) the last three Seminars (10%).

Students who have passed one of the two partials through continuous evaluation with a grade equal to or higher than 5 may be examined only for the suspended partial.

The final subject grade will be the sum of the weighted grade for the referral exam plus the weighted grades for the two practice tests. If a student has passed one of the partials through continuous assessment, the obtained mark, correspondingly weighted, will be used for the calculation of the final mark of the referral exam.

The date and time of the revision of the midterm exams and the referral exam will be announced immediately upon publication of the marks.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Practice: written assessments through activities or test essays of restricted questions and objective tests of multiple choice items	15%	1	0.04	6, 5, 9, 14, 13, 12, 15, 16, 17, 18
Seminars: evaluations written through objective tests of multiple choice items	15%	1	0.04	1, 3, 5, 2, 9, 13, 12, 15, 16, 17
Theory: evaluations written through objective tests: multiple choice items	70%	3	0.12	6, 5, 4, 8, 7, 14, 13, 11, 12, 10, 15, 17

Bibliography

BASIC BIBLIOGRAPHY

- 1 - "Biología Molecular de la Célula". Alberts y col. 6ª edición. Ed. Omega. Barcelona, 2016
- 2 - "Molecular Biology of the Cell". Alberts et al. 6th edition. Garland Sciences. New York, 2015
- 3 - "La Célula". Cooper y Hausman. 7ª edición. Ed. Marbán Libros S.L. Madrid, 2017
- 4 - "The Cell". Cooper & Hausman 7th edition, Sinauer Associates (Oxford University Press), 2017
- 5 - "Introducción a la Biología Celular". Alberts y col. 3ª ed. Ed. Médica Panamericana. Madrid, 2010
- 6 - "Biología Celular Biomédica" Calvo A. Elsevier. Barcelona, 2015
- 7 - "Biología Celular y Molecular". Karp. 6ª edición. Ed. Mac Graw-Hill Interamericana S.A. México, 2011
- 8 - "Molecular Cell Biology". Lodish et al. 8th edition. WH Freeman and Company. New York, 2016
- 9 - "The World of the Cell". Becker et al. 7th edition. Pearson. San Francisco, 2008

INTERNET RESOURCES

- Books: <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?db=Books>
- Open access review articles and accessible review articles from the computers of the UAB Network. (If you are outside the campus, through the ARE service, Access to Electronic Resources service)

Software

There is no need for any specific software