Universitat de Lleida

DEGREE CURRICULUM

CELLULAR BIOLOGY

Coordination: YERAMIAN HAKIM, ANDREE

Academic year 2023-24

CELLULAR BIOLOGY 2023-24

Subject's general information

Subject name	CELLULAR BIOLOGY
Code	101608
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Biotechnology	1	COMMON/CORE	Attendance-based

Course number of credits (ECTS)	7.5
Type of activity, credits, and groups	

Activity type	PRALAB		PRAULA	TEORIA
Number of credits	0.7	0.6	1	5.2
Number of groups	4	5	2	1

Coordination	YERAMIAN HAKIM, ANDREE
Department	EXPERIMENTAL MEDICINE
Teaching load distribution between lectures and independent student work	Classroom courses (hours) Student personal work (hours) TEO 42 70 PRA 13 5 PRO/INFO 10 10 SEM 10 10 Horas 75 95 Total 170 7,5 ECTS
Important information on data processing	Consult this link for more information.
Language	Catalan/Spanish/English
Distribution of credits	4,2 ECTS Theory 1,3 ECTS Laboratory work 1 ECTS Seminars 1 ECTS Problems

CELLULAR BIOLOGY 2023-24

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
LLOVERA TOMAS, MARTA	marta.llovera@udl.cat	1,9	Ask for an appointment by e-mail
PARISI CAPDEVILA, EVA MARIA	eva.parisi@udl.cat	4,6	
VAQUERO SUSAGNA, MARTA	marta.vaquero@udl.cat	,8	
VAQUERO SUSAGNA, MARTA	marta.vaquero@udl.cat	2,7	
YERAMIAN HAKIM, ANDREE	andree.yeramian@udl.cat	3	Ask for an appointment by e-mail

Subject's extra information

Subject / subject in the whole curriculum

Cellular Biology constitutes a fundamental subject for the student who has to obtain the Biotechnology degree. The contents of the subject are intended to ensure that the student who exceeds it knows the structure and functioning of the eukaryotic cell so that it allows them to better understand the technological processes related to it. The subject is taught in a coordinated manner with related subjects, such as Biochemistry and Molecular Genetics. On the other hand, the knowledge acquired will also be important for a good understanding of subjects such as Physiology, Immunology or Cell Culture, among others.

Learning objectives

Learning objectives and outcomes.

The student who passes the subject must be able to:

- Apply the knowledge acquired in the theoretical classes to problem solving.
- Know how to use the appropriate sources of information to resolve doubts.
- Be able to interpret scientific information and prepare reports from it.
- Develop skills in the laboratory and use the microscope correctly.

Competences

General competences

The graduate in Biotechnology must:

CG1 Be able to selectively search and use sources of information necessary to achieve the training objectives.

CG2 Interpret scientific-technical information with a critical sense, and be able to make presentations based on this information.

CG3 Work as a team, with a multidisciplinary vision and with the ability to make a rational and efficient distribution of tasks among team members.

CG4 Know and properly use the scientific and technical vocabulary typical of the different areas of Biotechnology.

CG5 Work in the laboratory applying quality criteria and good practice.

CG7 Use the scientific method to analyze data and design experimental strategies with biotechnological applications.

Specific competences (according to the Study Plan document)

CE14 To know the biology of living organisms at their molecular, cellular, organic and population levels, with an emphasis on organisms with biotechnological interest.

CE15 To know the essential biomolecules for life and the basic concepts of enzymology.

CE16 To be able to use basic analytical techniques to determine biochemical parameters.

CE18 To acquire an integrated vision of cell structures, relating them to their specific functions and the biochemical processes involved.

Subject contents

Theory (42 hours)

Block I: STRUCTURE AND FUNCTION OF THE CELL.

Unit 1. INTRODUCTION. Concept and organization of the eukaryotic cell. Cellular diversity Main milestones in the history of Cellular Biology: The cell theory (1h) .

Unit 2. THE PLASMATIC MEMBRANE. Composition and molecular organization. Characteristics: Fluency and asymmetry. Functions (2h) .

Unit 3. TRANSPORT ACROSS THE MEMBRANE. The membrane as a selective barrier. Passive transport and active transport. Types of proteins involved in transport. Cotransport Membrane potential (3h) .

Unit 4. THE CYTOSKELETON. General organization and elements. **Microfilaments**: structure and composition. Actin polymerization. Rotary Exchange Actin associated proteins. Organization of microfilaments in muscle and non-muscle cells. Cellular movement. **Microtubules:** structure and composition. Polymerization of tubulin. Proteins associated with microtubules. The phenomenon of dynamic instability. Centrioles, cilia and flagella: structure, biogenesis and functions. **Intermediate filaments:** diversity and organization (4h) .

Unit 5. NON-MEMBRANE ELEMENTS OF CYTOPLASM. The ribosome and the proteasome (2h).

Unit 6-I. THE EXOCYTIC ROUTE . Endoplasmic reticulum (ER). Structure and composition of the ER. Functions of smooth ER: lipid synthesis and cell detoxification. Roles of the rough ER: protein synthesis and modification, quality control and retention of resident proteins (2h).

Unit 6-II. THE EXOCYTIC ROUTE . Golgi apparatus (AG). Structure and composition of the AG. Functions: lipid and polysaccharide metabolism; protein glycosylation, classification and distribution; resident protein retention. Bases of vesicular transport. Types of coated vesicles: formation and fusion with the target membrane (3h).

Unit 7. THE ENDOCITIC ROUTE. Endosomes, lysosomes and vacuoles. Characteristics, classification and functions of endosomes. Composition and functions of lysosomes. Origin of the material that reaches the lysosome. Endocitic vesicule formation and coating (2h) .

Unit 8. THE CYTOSOL AS AN ENERGY SOURCE: The hyaloplasm. Sol-Gel Composition and cytosol organisation: Lipid droplets and glycogen (2h) .

Unit 9. MITOCONDRIAS. Structural and functional compartmentalization. Oxidative metabolism, ATP synthesis and heat production. Biogenesis. Import of lipids and proteins. The mitochondrial genome **(**2h) .

Unit 10. CHLOROPLASTS. Structural and functional compartmentalization. Photosynthesis. Biogenesis. Protein import (2h).

Unit 11. PEROXISOMES. Characteristics and composition. Biogenesis: import of lipids and proteins. Functions: oxidative reactions. Specific functions in plant cells (2h).

Unit 12. THE NUCLEUS. Structure of the nuclear envelope, the lamina and the nuclear pores. Chromatin and heterochromatin: organization in the interphase and mitotic nucleus. Bidirectional transport nucleo-cytoplasm. The nucleolus: structure and function (3h) .

Block II: REGULATION OF CELL RELATION WITH ITS ENVIRONMENT.

Unit 13. THE EXTRACELLULAR MATRIX. The matrix in animal cells: components and organization. The plant cell wall (2h) .

Unit 14. CELLULAR ADHESION AND INTERCELULAR UNIONS. Cell adhesion molecules: Types and properties. Role of adhesion in histogenesis and cell differentiation. Adhesions cell-cell and cell-matrix extracellular. Hermetic joints. Adherent joints. Communicating unions. Relationship with the components of the cytoskeleton. Plasmodesms of plant cells (2h) .

Block III: FUNCTIONAL REGULATION OF THE EUCARIOTIC CELL

Unit 15. CELL SIGNALING. Basic principles of cell signaling. Communication mechanisms. Intracellular and surface receptors. Description of the main signaling pathways. Mechanisms of signal integration (3h) .

Unit 16. CELL CYCLE. Phases of the cell cycle. Characteristics of the G1-S and G2-M transitions. Cell cycle control: components and control points. Concept of protooncogen, oncogen and tumor suppressor gene. Cyclins and CdK. Role of p21, p53 and Retinoblastoma proteins. Structural and functional reorganization of the cell during phase M. Spindle formation and chromosome separation mechanisms. Cytokinesis (3h).

Unit 17. CELL DEATH. apoptosis versus necrosis. Features. Physiological role Signaling paths Pathological consequences of deregulation (2h).

Problems (10h): 10 hours of classes will be dedicated to solving problems and to helping in understanding the topic.

When access to computer resources is needed, the sessions will be held in the "computer class".

Laboratory practices (13 hours)

Laboratory practice 1. The optical microscope. Description of its mechanical and optical components. Management and observation of preparations. Maintenance and conservation (3h).

Laboratory practice 2. Microscopic observations . Preparation of temporary and permanent samples and observation under an optical microscope (3h).

Laboratory practice 3. Preparing samples of animal origin for microscopy. Sample obtention and its processing for its observation on optical microscope (4h).

Laboratory practice 4. Introduction to special techniques of Cell Biology such as cytochemistry and immunofluorescence. Use of antibodies for the detection of proteins and cellular structures by immunocytochemical techniques (3h).

Seminars (10 hours)

Seminar 1. Lipid rafts, cell membrane composition and molecular transport (channels, pumps and carriers) (2h).

Seminar 2. Endomembranous system, vesicular transport (2h).

Seminar 3. Protein analysis by biochemical techniques: SDS-Page and Western Blot (2h).

Seminar 4. Mitochondria and protein detection by immunofluorescence (2h).

Seminar 5. Cell signaling and transduction pathays (2h).

Methodology

Activity type	Description	Presential activity		Non presential activity	
		Aims	Hours	Student personal work	Hores
Master classes	These classes will be held in the lecture room	Lectures, classes of the topics detailed in the degree	42	Learn and be able to summarize key concepts	70
Problems	These classes will be held in the lecture room	Exercices, introduction to research methods, active discussions.	10	To be able to resolve problems and understand how to address a scientific question	10
Seminars	Exchange of ideas and networking	work in group in order to discuss and resolve problems, issues related to the topics.	10	To learn to think and be able to summarize concepts	10
Laboratory work	Laboratory sessions	Understand key biological and biochemical aspects of the laboratory work.	13	To learn the concepts related to the laboratory practices	5

Evaluation

Evaluation:

All activities will be evaluated

Two evaluations will be done throughout the course.

1st Evaluation: Themes 1 to 8 of theory (20h). Practices, seminars and problems.

2nd Evaluation: Themes 9 to 18 of theory (9pm). Practices, seminars and problems.

The conceptual and theoretical knowledge will be evaluated with a partial exam (1st and 2nd partial).

The two evaluations have the same weight and both must be passed with a grade of 4.5 or more in order to average the grade.

The average mark of the evaluations constitutes 90% of the final mark. The remaining 10% is obtained based on participation in problems in class, activities carried out in INF sessions, and participation during practical classes and seminairs. The final grade is obtained by adding the grade of the 2 partials (90%) + the participation grade (10%).

A minimum grade of 5 must be obtained in order to pass the course, as long as a 5 has been passed in the theoretical exam (sum of the two partials, or final recovery exam).

To pass the course, the two partials or the final recovery exam must be passed with a grade of at least 5, and the average grade must be 5 or more. Of note, if the average grade is 5 or more, but the student has a partial or the recovery exam failed (the theory failed), the course shall be considered as failed.

ALTERNATIVE ASSESSMENT

The student who takes advantage of the alternative evaluation modality must take a single exam on the day and time that has been scheduled for the 2nd evaluation. This exam represents 100% of the mark. Exam composition: 90% theory questions and seminars + 10% practice questions. The student will be exempt from the obligation to attend the seminars and practices of the subject.

RECOVERY EXAM

It will be possible to recover all or part of the theoretical subject in which a 4.5/10 or a 5 in the case of the alternative

evaluation has not been obtained. The recovery date will be established by the grade coordinator for all students.

EXAM FORMAT

The evaluation exams will be multiple choice, with 5 possible answers and only one correct one (errors deduct 0.25 pts).

Bibliography

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- G. Karp, J. Iwasa, W . Marshall. (2019) *Karp's Cell and Molecular Biology* (9th)Ed. Wiley
- G: Cooper (2018). *The Cell: A Molecular Approach* (8th). Ed Sinauer
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- William V. DashekGurbachan S. Miglani (2016) *Plant Cells and their Organelles*. John Wiley & Sons, Ltd.
- WV. Dashek, M. Harrison (2006) *Plant Cell Biology* (1st Edition) CRC Pre
- J. de Juan Herrero, E. Fernández, FJ Iborra, J. Ribera (2021) *Biología Celular, Conceptos esenciales* (2021) Medica Panamericana