Universitat de Lleida

DEGREE CURRICULUM

CELLULAR BIOLOGY

Coordination: ENCINAS MARTIN, MARIO

Academic year 2021-22

CELLULAR BIOLOGY 2021-22

Subject's general information

<table>
<tr><td>Subject name</td><td>CELLULAR BIOLOGY</td></tr>
<tr><td>Code</td><td>101608</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>1</td><td>COMMON</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>7.5</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th colspan="2">PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>0.7</td><td>0.6</td><td>1</td><td>5.2</td></tr>
<tr><td>Number of groups</td><td>4</td><td>5</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>ENCINAS MARTIN, MARIO</td></tr>
<tr><td>Department</td><td>EXPERIMENTAL MEDICINE</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Horas presenciales Horas no presenciales
TEO 40 60
PRA 13 13
PRO 8 12
SEM 4 6
INF 10 10
Trabajo 0 10

Horas 75 111
Total 190 7,5 ECTS</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Distribution of credits</td><td>4,4 ECTS Teoría
1,3 ECTS Pràctiques
0,4 ECTS Seminaris
0,8 ECTS Problemes
1,0 ECTS Informàtica</td></tr>
</table>

CELLULAR BIOLOGY 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
ENCINAS MARTIN, MARIO	mario.encinas@udl.cat	0	
LLOVERA TOMAS, MARTA	marta.llovera@udl.cat	1,5	Ask for an appointment by e-mail
YERAMIAN HAKIM, ANDREE	andree.yeramian@udl.cat	13	

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.
- 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 (40 hours)

Block 1: STRUCTURE AND CELL OPERATION

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

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

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

Unit 4. THE CYTO SKELETON. (6h) 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.

Unit 5. NON-MEMBRANE ELEMENTS OF CYTOPLASM. (1h) The ribosome and the proteasome.

Unit 6-I. THE EXOCYTIC ROUTE . Endoplasmic reticulum (ER). (2h) 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.

Unit 6-II. THE EXOCYTIC ROUTE . Golgi apparatus (AG). (2h) Structure and composition of the AG. Functions: lipid and polysaccharide metabolism; protein glycosylation, classification and distribution; resident protein retention.

Unit 7. THE ENDOCITIC ROUTE. Endosomes, lysosomes and vacuoles. (1h) Characteristics, classification and functions of endosomes. Composition and functions of lysosomes. Origin of the material that reaches the lysosome. The vacuole in plant cells.

Unit 8. VESICULAR TRANSPORT. (2h) Bases of vesicular transport. Types of coated vesicles: formation and fusion with the target membrane.

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

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

Unit 11. PEROXISOMAS. (1h) Characteristics and composition. Biogenesis: import of lipids and proteins. Functions: oxidative reactions. Specific functions in plant cells.

Unit 12. THE NUCLEO. (3h) 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.

Block II: RELATIONS OF THE CELL WITH ITS ENVIRONMENT.

Unit 13. THE EXTRACELLULAR MATRIX. (1h) The matrix in animal cells: components and organization. The wall of plant cells.

Unit 14. CELLULAR ADHESION AND INTERCELULAR UNIONS. (3h) 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.

Block III: FUNCTIONAL REGULATION OF THE EUCARIOT CELL

Unit 15. CELL SIGNALING. (3h) Basic principles of cell signaling. Types of signal Intracellular and surface receptors, coupled to G protreins or enzymes. Description of the main signaling routes. Mechanisms of signal integration.

Unit 16. CELL CYCLE. (3h) 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.

Unit 17. MITOSIS. (1h) Structural and functional reorganization of the cell during phase M. Spindle formation and chromosome separation mechanisms. Cytokinesis

Unit 18. CELL DEATH: apoptosis versus necrosis. (2h) Features. Physiological role Signaling paths Pathological consequences of deregulation.

Problems (8h): 8 hours of classes will be devoted to solving problems to help the understanding of the subject.

Laboratory practices (13 hours)

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

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

Laboratory practice 3. Phase contrast and fluorescence microscopes (3h). Description of the utility and mode of operation of both microscopes. Obtaining preparations stained with fluorochromes and observation.

Laboratory practice 4. Introduction to the basic techniques of Cell Biology (4h). Use of antibodies for the detection of proteins and cellular structures by immunocytochemical techniques

Sessions in the computer room (10 hours): Access to computer resources that will help in understanding the matter and solving problems. These sessions will be also ussefull to evaluate knowledge adquisition by fellows

Seminars (4 hours)

Seminar 1. Microscopic techniques: Preparation of samples for observation with an optical microscope

Seminar 2. Transmission and scanning electron microscopes.

Seminar 3. Immunocytochemical techniques. Marking systems Direct and indirect methods. Markers used in immunodetection.

Seminar 4. Biochemical techniques: Introduction to cell subfractionation techniques and analysis by western blot.

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 two evaluations have the same weight and both must be passed in order to average grade.

The average mark of the evaluations constitutes 90% of the final mark. The remaining 10% is obtained based on attitude, participation in problem classes, activities carried out in INF sessions, and attitudes shown during practical classes. If the evaluations were to be carried out on-line, the value of this last section could reach 20%. It must be borne in mind that if this last % is not achieved due to attitude and participation, the average mark obtained in the two evaluations should be higher than 5.6 or 6.25 respectively to pass the subject.

A final evaluation is made in June for those students who did not pass the subject with the previous evaluation or who want to improve their grade.

Bibliography

- H. Lodish; A. Berk; CA. Kaiser; M. Krieger; A. Bretscher; H. Ploegh; KC. Martin; M. Yaffe; A. Amon (2021). *Molecular Cell Biology* (9th). Macmillan Learning Editor
- B. Alberts, A. Johnson, J. Lewis, P. Walter, M. Raff, K. Roberts (2017) -*Molecular Biology of the Cell*. (6th). Ed Taylor & Francis Group
- 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
- B. Alberts, K. Hopkin , A D Johnson, D. Morgan , M. Raff, K. P. Walter (2019) *Essential Cell Biology* (5th) WW Norton & co
- M L Casem (2016) *Case Studies in Cell Biology* (1st) Elsevier
- T. Pollard, W. Earnshaw, J. Lippincott-Schwartz, G. Johnson (2016) *Cell Biology (3trd)* Ed. Elsevier

- Pavelka M, Roth J (2005), *Functional Ultrastructure.* An Atlas of Tissue Biology and Pathology. Ed Springer.
- Berkaloff A, Bourget J, Favard P, Lacroix JC (1981-83), *Biologie et physiologie cellulaires*, (4 volumes). Éd. Hermann
- 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