Universitat de Lleida

DEGREE CURRICULUM

CELLULAR BIOLOGY

Coordination: CASAS HERRANZ, CELIA

Academic year 2019-20

CELLULAR BIOLOGY 2019-20

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>1.3</td><td>0.7</td><td>0.3</td><td>5.2</td></tr>
<tr><td>Number of groups</td><td>5</td><td>6</td><td>3</td><td>1</td></tr>
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<tr><td>Coordination</td><td>CASAS HERRANZ, CELIA</td></tr>
<tr><td>Department</td><td>EXPERIMENTAL MEDICINE</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
</table>

CELLULAR BIOLOGY 2019-20

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CASAS HERRANZ, CELIA	celia.casas@udl.cat	14,4	
LLOVERA TOMAS, MARTA	marta.llovera@udl.cat	2,4	

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.

Competences

General competences

The graduate in Biotechnology must:

- Being able to selectively search and use sources of information necessary to achieve the training objectives.

- Interpret scientific-technical information with critical sense and be able to make presentations based on that information.

- Being able to make written and oral reports understandable about the work done, with a justification based on the theoretical and practical knowledge gained (strategic competence of the UdL).

- Work as a team with a multidisciplinary vision and with the ability to make a rational and effective distribution of tasks among team members.

- Being able to communicate and communicate internationally in their professional development (competence of the UdL).

- Use tools and techniques of information and communication for data analysis and preparation of oral and written reports and other training and professional activities (strategic competence of the UdL).

- Respect the fundamental rights of equality between men and women, the promotion of human rights and the values of a culture of peace and democratic values (strategic competence of the UdL).

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

- Work in the laboratory using criteria of equality and good practice.

- Know and know how to use the specific program and databases in the different fields of Biotechnology.

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

- Being able to establish a critical judgment on the implications of biotechnology at an ethical, legal and environmental level.

- Being able to develop a professional activity in accordance with safety regulations and respect for the environment and with ethical criteria.

- Transmit technology strategies and applications to the company based on the general fundamentals of the business economy.

- Acquire criteria for choosing the most appropriate analytical techniques for each specific case study.

Specific competences (according to the Study Plan document)

- Understand the concept of cellular organization and the two possible forms of this organization.

- Know the different cellular structures and their function.

- Know the structures, molecules and mechanisms involved in the relationship of the cell with its environment.

- Understand the eukaryotic cell cycle and its regulation, as well as the molecular mechanisms involved in cell transformation.

- Learn to observe the cells through the optical microscope, as well as to apply microscopic techniques in an experimental design.

- Learn to handle the material and basic laboratory techniques.

- Learn techniques of subfractionation and biochemical analysis of cells.

- Develop your critical and scientific capacity.

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. (5h) 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. THE EXOCYTIC ROUTE I. 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 7. THE EXOCYTIC ROUTE II. Golgi apparatus (AG). (2h) Structure and composition of the AG. Functions: lipid and polysaccharide metabolism; protein glycosylation, classification and distribution; resident protein retention.

Unit 8. THE ENDOCITIC ROUTE. Endosomes, lysosomes and vacuoles. (2h) 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 9. VESICULAR TRANSPORT. (2h) Bases of vesicular transport. Types of coated vesicles: formation and fusion with the target membrane.

Unit 10. MITOCONDRIAS. (2h) Structural and functional compartmentalization. Oxidative metabolism, ATP synthesis and heat production. Biogenesis. Import of lipids and proteins. The mitochondrial genome.

Unit 11. CHLOROPLASTES. (2h) Structural and functional compartmentalization. Photosynthesis. Biogenesis. Protein import

Unit 12. PEROXISOMAS. (1h) Characteristics and composition. Biogenesis: import of lipids and proteins. Functions: oxidative reactions. Specific functions in plant cells.

Unit 13. 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 14. THE EXTRACELLULAR MATRIX. (2h) The matrix in animal cells: components and organization. The wall of plant cells. Unit 15. CELLULAR ADHESION AND INTERCELULAR UNIONS. (2h) 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.

Unit 15. CELLULAR ADHESION AND INTERCELULAR UNIONS. (2h) 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 16. 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 17. 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 18. MITOSIS. (1h) Structural and functional reorganization of the cell during phase M. Spindle formation and chromosome separation mechanisms. Cytokinesis

Unit 19. CELL DEATH: apoptosis versus necrosis. (1h) Features. Physiological role Signaling paths Pathological consequences of deregulation.

Laboratory practices (20 hours)

Laboratory practice 1. The optical microscope (2h). 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 Cellular Biology (2h). Introduction to histochemical techniques: Detection of the neuromuscular synapse.

Practice 5. VISIT to the Electronic Microscopy service (2h).

Laboratory practices 6 and 7. Introduction to the basic techniques of Cell Biology (8h). Use of antibodies for the detection of proteins and cellular structures by immunocytochemical techniques (Practice 6: 2 + 3h) and western blot (Practice 7: 3h).

Sessions in the computer room (3 hours) Access to computer resources that will help in understanding the matter and solving problems.

Problems (8 hours) Resolution of problems related to the theoretical content.

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 overcome to can average grade. A final evaluation is made in June for those students who did not exceed the previous two or who want to improve their grade.

Bibliography

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ØLodish , Berk , Krieger , Kaiser , Scott , Bretscher, Ploegh, Matsudaira, 2008. **Molecular Cell Biology**, 6th edition. WH Freeman and Co., New York.

ØLodish H, Berk A, Zipursky SL, Matsudaira P, Baltimore D, Darnell J. 2005. **Biología Celular y Molecular**, 5ª edición. Editorial Médica Panamericana, Madrid.

ØKarp G 2010. **Cell Biology**. 6th Edition. John Wiley & Sons. Inc New York

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