27204 - Biology

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	452 - Degree in Chemistry
ECTS	6.0
Year	1
Semester	First semester
Subject Type	Basic Education
Module	---

1.General information

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It favors the understanding of the different biochemical compounds and processes that occur in the cells. A wide range of teaching and learning tasks are implemented, such as theory sessions, laboratory sessions, assignments, and tutorials.

Students are expected to participate actively in the class throughout the semester.

27204 - Biology

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

5.2.Learning tasks

The course includes 6 ECTS organized according to:

- Theory sessions (4,5 ECTS): 45 hours.

- Laboratory sessions (1,5 ECTS): 15 hours.

-Theory sessions: lecture notes and a series of problems (and its solutions) will be available for the students. At the end of each topic, some of the problems will be solved in class by the professor and the rest will be done individually.

-Laboratory sessions: 1-2-hour sessions take place approximately every week. Students are provided with the practical session' instructions to be done as well as a theoretical introduction to the session's contents. The students must deliver a portfolio on the regulated practices upon completion.

-The tutorials will take place in concert with the corresponding teacher appointments when needed.

5.3.Syllabus

The course will address the following topics:

Part I Introduction.

1. The origin and evolution of cells. Chemical evolution. RNA world.The first cell. The evolution of metabolism. Present day prokaryotes. Eukaryotic cells. The origin of eukaryotes. The development of multicellular organisms. Classification of living organisms. The virus.

Part II Composition of the cells.

2. Chemical Components of Cells. Chemical bounds. Carbon compounds. Water. Weak interactions in aqueous systems. Biomolecules.

3. Proteins. Amino acids. Peptide bonds. Peptides and proteins. The structure of proteins: primary structure. Protein secondary structure. Protein tertiary and quaternary structures. Protein function.

27204 - Biology

4. Enzymes. The catalytic activity of enzymes. Mechanisms of enzymatic catalysis. Coenzymes. Regulation of enzyme activity.

5. Carbohydrates. Monosaccharides and Disaccharides. Polysaccharides: structure and function. Glycoconjugates: Proteoglycans, glycoproteins and glycolipids.

6. Lipids. Fatty acids. Triacylglicerols. Structural lipids in membranes: Glycerophospholipids, Sphingolipids. Cholesterol: vitamin D and steroid hormones. Dolichols. Eicosanoids.

7. Nucleic Acids. Nucleotides. Other functions of nucleotides. Nucleic acids structure and function. DNA: the double helix. RNA: types. Ribozymes.

Part III Cell Structure and Function

8. Prokaryotes. Prokaryotic cell structure: Cell wall, cell membrane, nucleoid, ribosomes, flagellum. Morphology. Reproduction. DNA transfer. Environment. Evolution and classification: Archea and Bacteria. Biofilms.

9. Eukaryotic cell. Cell membranes. Cytoplasm. Membrane lipids. Membrane proteins. Cell membrane structure: the phospholipid bilayer. The glycocalix. Transport across membranes: Passive diffusion and carrier proteins. Ion channels. Active transport driven by ATP hydrolysis. Active transport driven by ion gradients. Endocytosis.

10. The endoplasmic reticulum, the Golgi apparatus and lysosomes. Protein sorting and transport. The endoplasmic reticulum and protein secretion. Targeting proteins to the endoplasmic reticulum. Insertion of proteins into the ER membrane. The smooth ER and lipid synthesis. Export of proteins and lipids from the ER. Organization of Golgi. Protein glycosylation within the Golgi. Lipid and polysaccharide metabolism in the Golgi. Protein sorting and export from the Golgi. Vesicular transport. Cargo selection, coat proteins and vesicle budding. Vesicle fusion. Lysosomal acid hydrolases. Endocytosis and lysosome formation. Phagocytosis and autophagy.

11. The cytoskeleton and cell movement. Structure and organization of actin filaments. Actin, Myosin and Cell movement. Microtubules. Microtubule motors and movement. Intermediate filaments.

12. Mitochondria and Chloroplast. Peroxisomes and Glyosysomes. Organization and function of mitochondria. Mitochondrial genetic system. Protein import and assembly. The structure and function of chloroplast. The chloroplast genome. Other plastids. Structure and function of peroxisomes and glyosysomes.

13. Bioenergetics and Metabolism. Energy, Catalysis, and Biosynthesis.Free energy and ATP. The generation of ATP from glucose, lipids and amino acids. Krebs cycle. The electron transport chain. Chemiosmotic coupling. Photosynthesis. Cell Communication.

14. The nucleus. The structure of nuclear envelope. Nuclear lamina. The nuclear pore complex. Transport of proteins to and from the nucleus. Transport of RNAs. Chromatin. The nucleolus and rRNA processing.

Part IV The flow of genetic information

15. Molecular genetics. Chromosomes: centromeres and telomeres. Genomes. Asexual and sexual reproduction. Mendelian inheritance. Genes. Introns and exons. Genetic variation. Mutations. Repetitive DNA sequences. Gene

duplication and pseudogenes.

16. From DNA to proteins. DNA replication. DNA repair. DNA transcription. RNA processing. Translation of mRNA. Genetic code. Control of gene expression.

17. The Cell Cycle and Apoptosis. The eukaryotic cell cycle. Regulators of the cell cycle progression. Mitosis. Meiosis. Cell death: necrosis and apoptosis. Programmed cell death.

Laboratory sessions

Session 1.- Basic techniques in Molecular and Cellular Biology I: Optical microscopy. Fluorescence microscopy. Immunofluorescence. Electron microscopy: transmission and scanning.

Session 2.- Basic techniques in Molecular and Cellular Biology II: Cells as experimental models: cell culture and subcellular fractionation. Model experimental organisms.

Session 3.- Introduction to the operation of the optical microscope. Measurement of the size of a microscopic object.

Session 4.- Observation of cell types. Prokaryotes.

Session 5.- Observation of cell types. Multicellular eukaryotes.

Session 6.- Observation of eukaryotic cell types.

Session 7.- Staining of chromosomes: observation of mitosis.

Session 8.- Cellular transport: cellular turgor and plasmolysis.

5.4.Course planning and calendar

For further details concerning the timetable, classroom and further information regarding this course please refer to the "Facultad de Ciencias" website (https://ciencias.unizar.es/calendario-y-horarios) and in the learning platform Moodle within the *Biología 27204* course.

5.5.Bibliography and recommended resources

BB	Alberts, B. Essential Cell Biology. 4th edition Editorial Médica Panamericana [Garland Sciencies]
BB	Bioquímica : conceptos esenciales / Elena Feduchi Canosa ... [et al.] ; colaboradora, Carlota García-Hoz Jiménez . 1ª ed.

Universidad Zaragoza

27204 - Biology

	Madrid [etc.] : Editorial Médica Panamericana, D.L. 201
BB	Essential cell biology / Bruce Alberts ... [et al.] . 3rd ed. New York : Garland Science, cop. 2010
BB	Introducción a la biología celular / Bruce Alberts ... [et al.] . 3ª ed. Buenos Aires ; Madrid [etc.] : Editorial Médica Panamericana, cop. 2011
BB	McKee, Trudy. Bioquímica : las bases moleculares de la vida / Trudy McKee, James R. McKee ; traducción, Martha Elena Araiza Martínez, Anahí Hurtado Chong . 5ª ed. Madrid [etc.] : McGraw-Hill Interamericana, cop. 2014
BC	Alberts, B.. Molecular Biology of the cell. 6th edition. Garland Science S.A.
BC	Biología molecular de la célula / Bruce Alberts ... [et al.] ; traducción coordinada por Juan Francisco Montes Castillo, Miquel Llobera i Sande . 6ª ed. Barcelona : Omega, D.L. 2016
BC	Nelson, D.L. and Cox, M.M. . Lehninger "Principles of Biochemistry". 6th edition. Omega S. A.
BC	Nelson, David L.. Lehninger principles of biochemistry / David L. Nelson, Michael M. Cox. 5th ed. New York : W. H. Freeman and Company, cop. 2008