Universidad Zaragoza

**Year : 2020/21**

# 27204 - Biology

## Syllabus Information

**Academic Year:** 2020/21
**Subject:** 27204 - Biology
**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.Aims of the course

The subject and its expected results respond to the following approaches and objectives:
Provide the student with the basic knowledge about the fundamentals of Cell Biology.

### 1.2.Context and importance of this course in the degree

This subject is located in the Basic Module since it is intended that students acquire Molecular Knowledge basic on Cell Biology that will allow you to later understand the interrelation with Chemistry.

### 1.3.Recommendations to take this course

It is recommended to continue work on the contents and services of the subject, consulting the recommended bibliography and resolving the possible doubts with the professors, either during the developing of the classes, or by means of the use of the tutorials (make an appointment with the teacher).

# 2.Learning goals

### 2.1.Competences

**Upon passing the subject, the student will be more competent to:**

- To understand the composition, structure and function of living organisms, the vital processes and their diversity in the biosphere.
- To understand the relationship of living beings with the environment and the basic principles that govern their evolution.
- Know the structure and functions of the organs of a eukaryotic animal and plant cell.
- To have a general integrated vision of cellular functioning and be able to relate the activities of different cellular compartments.
- Know and understand the background of the basic instrumental techniques of molecular and cellular biology.
- To understand the biological bases on the fundamental bases of biology in several fields.
- To have an adaptable and flexible method of study and work.
- To be able to obtain, analyze and synthesize relevant information. Elaborate and defend the arguments based on the corresponding information.
- To be able to relate the theoretical knowledge in the different disciplines.
- To be able to apply the theoretical knowledge and interpret the experimental results.
- To understand and express themselves clearly orally and in writing, mastering the specialized language.
- To be able to teamwork.

### 2.2.Learning goals

1. Knows the structure and functions in the cells of the main types of biomolecules: identifying and formulating these biomolecules generically and being able to adequately explain (with concrete examples that are specified) the relationship between a certain structure and its function/s.
2. Knows and describes the characteristics of the main cell types (prokaryotes, animal and plant eukaryotes).
3. Identify the different cellular organelles and know their structures and the functions they perform, being able to adequately explain the relationship between a certain structure and its function / s.
4. Know the mechanisms of some cellular processes:

   - intra and inter cellular transport,

   - shape and movement,

   - synthesis of proteins and lipids,

   - main routes of intermediary metabolism,

   - concepts and basic models of cell signaling,

   - processes of expression and transmission of genetic information,

   - cell cycle and apoptosis.
5. Is able to answer correctly to the questions that in relation to the previous sections are raised justifying always properly all their answers.
6. Know the fundamentals and application of the main techniques used in the study of cells (those selected in the Practices Program).
7. Make simple preparations for observation under a microscope and use the optical microscope correctly.
8. Prepare reports related to the subject.

### 2.3.Importance of learning goals

The functioning of living beings is based on chemical processes. The graduate in Chemistry You must know these processes and how chemical COMPOUNDS affect living beings. Many of the products of the chemical industry (drugs, cosmetics, etc.) are designed to cause specific effects in human cells. Cells like bacteria and yeasts are frequently used in mixed processes in chemical and biotechnological plants.

## 3.Assessment (1st and 2nd call)

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

**The student must demonstrate that he has achieved the learning results with the practices evaluation activities:**

Written test (January / September) on the contents and services of the subject valued on 10 points: Rating T. The written test applies for 90% to the final grade.

Continuous evaluation of laboratory practices and evaluation of the corresponding practice notebook. Students who do not attend the practical sessions or suspend this part should take a practical test in the global evaluation. The overcoming of the practices (P grade greater than or equal to 5.0) is mandatory to pass the subject. The practices contribute 10% to the final grade as long as the written test has been passed (*): Rating P.
(*) The qualification of the laboratory practices will be saved for subsequent calls once they have been passed.

Final grade: 0.9 x T + 0.1 x P

The number of official examinations to which the registration entitles (2 per enrollment) as well as the consumption of these calls will be adjusted to the Regulations for Permanence in Undergraduate Studies and Regulations for the Evaluation of Learning Standards. To this last regulation, the general criteria for the design of the tests and the qualification system will also be adjusted, and according to the same the time, place and date in which the revision will be celebrated when the ratings are published will be made public. These regulations can be found at: http://wzar.unizar.es/servicios/coord/norma/evalu/evalu.html

## 4.Methodology, learning tasks, syllabus and resources

### 4.1.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.

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.

### 4.2.Learning tasks

The 6 ECTS course includes the following learning tasks:

- Theory sessions (4,5 ECTS): 45 hours. 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 (1,5 ECTS):15 hours. 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.

### 4.3.Syllabus

The course will address the following topics:

**Section I Introduction.**

- **Topic 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.

**Section II Composition of the cells.**

- **Topic 2. Chemical Components of Cells.** Chemical bonds. Carbon compounds. Water. Weak interactions in aqueous systems. Biomolecules.
- **Topic 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.
- **Topic 4. Enzymes.** The catalytic activity of enzymes. Mechanisms of enzymatic catalysis. Coenzymes. Regulation of enzyme activity.
- **Topic 5. Carbohydrates.** Monosaccharides and Disaccharides. Polysaccharides: structure and function. Glycoconjugates: Proteoglycans, glycoproteins and glycolipids.
- **Topic 6. Lipids.** Fatty acids. Triacylglicerols. Structural lipids in membranes: Glycerophospholipids, Sphingolipids. Cholesterol: vitamin D and steroid hormones. Dolichols. Eicosanoids.
- **Topic 7. Nucleic Acids.** Nucleotides. Other functions of nucleotides. Nucleic acids structure and function. DNA: the double helix. RNA: types. Ribozymes.

**Section III Cell Structure and Function**

- **Topic 8. Prokaryotes.** Prokaryotic cell structure: Cell wall, cell membrane, nucleoid, ribosomes, flagellum. Morphology. Reproduction. DNA transfer. Environment. Evolution and classification: Archea and Bacteria. Biofilms.
- **Topic 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.
- **Topic 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.
- **Topic 11. The cytoskeleton and cell movement.** Structure and organization of actin filaments. Actin,

Myosin and Cell movement. Microtubules. Microtubule motors and movement. Intermediate filaments.

- **Topic 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.
- **Topic 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.
- **Topic 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.

**Section IV The flow of genetic information**

- **Topic 15. From DNA to proteins.** DNA replication. DNA repair. DNA transcription. RNA processing. Translation of mRNA. Genetic code. Control of gene expression.
- **Topic 16. 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.

### 4.4.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.

### 4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=27204&year=2020