

**COURSE DATA****Data Subject**

<b>Code</b>	33044
<b>Name</b>	Cellular structure
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2021 - 2022

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. Period</b>
1100 - Degree in Biology	Faculty of Biological Sciences	1 Second term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1100 - Degree in Biology	5 - Biology	Basic Training
1100 - Degree in Biology	6 - Biology	Basic Training

**Coordination**

<b>Name</b>	<b>Department</b>
CRESPO RUPEREZ, CARLOS	357 - Cellular Biology, Functional Biology and Physical Anthropol.
VAREA LOPEZ, EMILIO	357 - Cellular Biology, Functional Biology and Physical Anthropol.

**SUMMARY**

"Structure of the Cell" is taught as a basic training course in the second semester of the first degree course in Biology. With it, it is intended that students acquire in the first grade year all the basics needed to understand how the cell is organized. Given that the cell is the structural and functional basis of living matter, the subject should be considered a cornerstone of the training the student in this grade. The study of cell structure is interrelated at all times to study its function, thus intends to convey a dynamic view of cell biology. From a comparative analysis of different levels of organization of living matter, from viruses to prokaryotes and finally to the eukaryotes. Emphasis will be placed along the course in the structural organization of eukaryotic cells, both animal and plant, studying their maximum levels of complexity.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

## OUTCOMES

### 1100 - Degree in Biology

- Capacidad de análisis, síntesis, trabajo metódico y riguroso.
- Capacidad de análisis crítico de textos científicos.
- Manejo del inglés científico.
- Develop the capacity for organisation and planning.
- Capacidad de presentación escrita y oral de datos científicos.
- Capacidad de divulgación del conocimiento científico.
- Habilidad para el trabajo en equipo.

## LEARNING OUTCOMES

- Perform histological preparations for light and electron microscopy
- Interpret electron microscopy images
- Appropriate correspondence between biomolecules and cellular structures
- Appropriate correspondence between cellular metabolic processes and structures
- Identify the stage of cell cycle from histological preparations
- Design experiments on cell function and interpret the results

## DESCRIPTION OF CONTENTS

### 1. Introduction

Methods of Study in Cell Biology. Prokaryotic and eukaryotic cell. Viruses, structure and life cycle. Organization of the prokaryotic cell. Organization of the eukaryotic cell. Animal and plant cell.



## **2. Plasma membrane**

Fluid mosaic model. Components of the membranes. Membrane receptors, ion channels, transporters and ion pumps. The chemical potential and the electrical potential of membrane.

## **3. Cell nucleus**

Nuclear envelope. Nuclear pores. Chromatin organization. Ribonucleoprotein structure. The nucleolus. Structure and biogenesis of ribosomes.

## **4. Endomembrane system**

Smooth endoplasmic reticulum. Rough endoplasmic reticulum. Distribution and transport and protein degradation. The ubiquitin-proteasome system. Golgi apparatus. Lysosomes. Vacuoles. Peroxisomes. Glyoxysomes. Endocytosis. Exocytosis. Vesicular traffic.

## **5. Cytoskeleton**

Intermediate filaments. Microtubules, microtubule organizing center, cilia and flagella. Microfilaments. Cell mobility.

## **6. Cell surface**

Intercellular contacts. Cell polarity. Glycocalyx. Tight junctions. Adherens junctions. "Gap" junctions. Plasmodesmata. Cell adhesion proteins. Membrane receptors. Cell signaling.

## **7. Extracellular matrix**

Cell wall. Collagen. Elastic fibers. Adhesive glycoproteins. Basal lamina. Amorphous matrix. Biogenesis of matrix components.

## **8. Mitochondria and chloroplasts**

Mitochondrion structure. Electron transport chain and ATP synthesis in mitochondria. Transport of proteins into mitochondria. Mitochondrial biogenesis. Structure of chloroplasts. Components of thylakoid membranes. Types of plastids. Biogenesis of plastids. Endosymbiont theory.

## **9. Cell cycle**

Cell cycle phases. Mitosis: stages of mitosis. Metaphase chromosomes. Cytokinesis. Notions of cell cycle regulation. Stem cells. Cellular senescence and apoptosis.

**10. Meiosis**

Phases of meiosis. Sexual and asexual reproduction. Gametogenesis in animals. Spermatogenesis and spermiogenesis. Oogenesis.

**11. Fertilization and embryonic development**

Fertilization, cleavage and gastrulation. Cell differentiation. Germ layers.

**12. Practical classes**

PRACTICE 1.-The optical microscope: types. Sample preparation.

PRACTICE 2.- Inclusion and microtomy.

PRACTICE 3.- Dyes and Stains.

PRACTICE 4.- Cell proliferation and division processes.

PRACTICE 5.- Cell cultures (I).

PRACTICE 6.- Cell cultures (II). Organelles labelling.

PRACTICE 7.- Electron microscopy: types. Sample Preparation.

PRACTICE 8.- Observation and study of organelles in electron microscopy micrographs (I).

PRACTICE 9.- Observation and study of organelles in electron microscopy micrographs (II).

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	39,00	100
Laboratory practices	18,00	100
Tutorials	3,00	100
Development of group work	10,00	0
Preparation of evaluation activities	20,00	0
Preparing lectures	40,00	0
Preparation of practical classes and problem	20,00	0
<b>TOTAL</b>	<b>150,00</b>	

**TEACHING METHODOLOGY**

The acquisition of knowledge by the student, will be based on four cornerstones:

**1. Theory classes.**



Theory classes consist of one hour classroom sessions where the teacher orally transmitted knowledge of the subject the student. This transmission is supported at all times of the materials the teacher deems appropriate for each topic.

In the lectures, the teacher will encourage student participation by asking questions or approach issues and questions arising out of debate.

Virtual Classroom will be used as a tool where the teacher can provide students with all learning materials it deems appropriate to supplement the lectures.

## **2. Practical classes.**

Practical classes will consist of laboratory sessions of two hours where the student works on different topics of the course. In general, it is intended that the methodology used in these sessions for learning is very variable.

In some sessions, the student becomes familiar with the use of the microscope as a basic tool for the analysis of cells and with the most basic techniques of sample preparation.

In other sessions, the student will prepare their own samples, performs some simple stains and interpret them with the optical microscope.

There are also sessions where the student looks at photographs of different preparations and optical microscopy and transmission electron. This is intended to recognize and identify all components of cells.

## **3. Interdisciplinary Activity: Poster.**

Conducting a scientific poster on this subject type arises from an interdisciplinary perspective in conjunction with other subjects of the same course, mainly with "Basic Tools in Biology." Students will prepare in small groups interdisciplinary poster on a topic proposed by the teachers of these subjects, to do so on the advice and help from teachers. You have to make an oral presentation of the poster, as part of a congress of Biology to be held at the end of the course. The poster and presentation will be evaluated jointly by the subject teachers concerned.

Alternatively to this activity, it can make other interdisciplinary activity of a project of educational innovation supported by the CAT

## **4. Student's class work.**

Should be considered as all the work that the student engaged in the preparation of the course regardless of attendance at lectures, practices, seminars, tutorials and exams. Includes various activities.

On one side are the hours of study each week to be spent to expand and consolidate the knowledge acquired in the classroom and in practical classes.

It also includes additional work that the teacher can plan for the student to perform throughout the semester to supplement the lectures and practices (answering questionnaires, editing pictures or diagrams that provide the teacher on some issues, present written work, conduct literature searches ...). All this extra work may arise in some cases as individual work and in others as a collective work to be done in small groups.





To complement the above, the methodology also includes tutorials, raised as one-hour sessions that will assist the teacher can track the degree of student learning. Sessions were presented as open to dialogue and participation of all students, which will formulate and solve questions and discuss concerns or issues which interest related to the knowledge of the subject.

## EVALUATION

Learning in this subject will be evaluated considering, on the one hand, the knowledge acquired in theory classes and practices; and on the other hand, the evaluation obtained in carrying out interdisciplinary activities. For this reason, the subject will be divided into “two independent evaluation blocks”.

### 1. Evaluation of the theoretical-practical block:

To assess the knowledge acquired in this block, the student will take a written exam that will consist of two parts: a theory test and a practical test. The grade obtained in this block will compute 90% of the final grade.

To pass the subject, it will be necessary to have passed the exam of the theoretical-practical block. To pass the exam, the student must obtain a minimum of 5 points out of 10 in the theory test and a minimum of 5 points out of 10 in the practical test. The mark obtained in the theory test will suppose 80% of the final mark in this block. The mark obtained in the practical test will suppose the remaining 20%.

If a student does not pass the exam of the theoretical-practical block in the first call, they will have to re-examine the entire block in the second call.

### 2. Evaluation of the interdisciplinary activity:

The grade obtained in the interdisciplinary activity will compute the remaining 10% of the final grade.

This grade will be the result of the joint and centralized assessment that is made at the end of the course for all groups.

If by adding the two blocks, having passed the theoretical-practical block, a final grade of less than 5 is obtained, the subject will be suspended.



## REFERENCES

### Basic

- Alberts, B. et al. (2011) Introducción a la Biología Celular, 3a ed, Panamericana, México.
- Alberts, B., et al. (2016) Biología Molecular de la célula, 6a ed, Omega, Barcelona.
- Becker, W.M., Kleinsmith, L.J., Hardin, J. (2006) El mundo de la célula, 6a edn, Pearson Addison Wesley, Madrid.
- Cooper, G.M. (2014) La célula, 6ª ed, Marban, Madrid.
- Cooper, G.M. (2016) The Cell: A Molecular Approach, 7a ed, Sinauer, Sunderland MA
- Gilbert, S.F. (2016) Developmental biology, 11th edn, Sinauer, Sunderland MA.
- Karp, G. (2014) Biología celular y molecular: conceptos y experimentos, 7a ed, McGraw-Hill Interamericana, México.
- Lodish, H. et al. (2016) Biología celular y molecular, 7a ed, Médica Panamericana, Buenos Aires
- Lodish, H. et al. (2016) Molecular cell biology, 8th edn, W. H. Freeman, New York

### Additional

- Bloom y Fawcett (1995) Tratado de Histología. 12ª ed,. Interamericana.
- Cortes (1980) Histología Vegetal Básica. Blume. Histología y Organografía Animal.
- Fahn (1985) Anatomía Vegetal. Blume.
- Gartner, L.P. y Hiatt, J.L. (1997). Histología. McGraw-Hill Interamericana, México.
- Gartner, L.P. y Hiatt, J.L. (2001). Color Textbook of Histology. W B Saunders Co; Philadelphia.
- Geneser, F. (2000). Histología, sobre bases biomoleculares. 3ª ed. Médica Panamericana, Buenos Aires.
- Houillon (1972) Embriología. Omega.
- Krstic (1984) Illustrated Encyclopedia of Human Histology. Springer Verlag.
- Krstic (1989) Los tejidos del Hombre y de los Mamíferos. McGraw Hill.
- Paniagua et al. (1997). Citología e Histología Vegetal y Animal. 2ª ed. Interamericana-McGraw-Hill.
- Paniagua, R., M. Nistal, P. Sesma, M. Alvarez-Uria, B. Fraile, R. Anadón, F. J. Sáez, M. Paz de Miguál, M. (1999). Biología Celular. 1. ed. McGraw Hill. Interamericana
- Raven et al. (1991). Biología de las Plantas. Tomo 1. Reverté.
- Rhodin (1974) Histology, a text and atlas. Oxford.
- Robards (1971) Electron Microscopy and Plant Ultrastructure. McGraw-Hill.
- Ferrer, J.R. (1997) Las células de los tejidos vegetales . Ed. Vedral, Barcelona



- Weiss (1988) Cell and Tissue Biology. A Textbook of Histology. 6th ed, Urban & Schwarzenbert

## **ADDENDUM COVID-19**

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

### **1. Contents**

The contents initially collected in the teaching guide are maintained. The teacher supplies the students with the appropriate elaborated materials to achieve the initially programmed objectives.

### **2. Workload and teaching planning**

The activities that add the hours of dedication in ECTS credits marked in the original teaching guide are maintained, with greater flexibility, adapting to the circumstances that are required.

The face-to-face sessions are held; but if circumstances require, they could be reinforced or replaced by online tutoring sessions (chat, email or other types, depending on technical possibilities).

### **3. Teaching methodology**

If necessary, face-to-face teaching would be reinforced with virtual communication (chats, Virtual Classroom forum and / or emails), and with the provision of elaborated materials to facilitate student learning.

In this sense, slide presentations of the different topics and activities of the subject have been prepared, all of them adapted and edited to facilitate the study by the student in conditions of non-attendance. Additional materials, such as notes, have also been developed to reinforce learning and self-assessment questionnaires.

### **4. Evaluation**

If the teaching could not be taught face-to-face, complementary activities could be evaluated, such as questionnaires or others, which would have a maximum weight of 20% within the theoretical-practical exam section. So this section is left with 20% of the complementary activities and 80% of the exam. Within the exam, the theoretical part will have a weight of 80% and the practice of 20%.

For the final grade, the cross-section of activities continues to have 10% and the exam section (including self-evaluations) 90%.





The final exam will be written and will be done in person. If it cannot be done in person, it will be done using the tools of the Virtual Classroom platform.

If a person does not have the means to establish a connection and access the virtual classroom, they must contact the teaching staff by email at least 10 days before the exam.

If, for duly justified technical reasons, a student cannot take an exam, the possibility of taking an alternative test will be studied, which, in any case, will be oral.

## **5. Bibliography**

## **6. Additional information**

Due to the fluctuations in the evolution of the pandemic, the specific details of the adjustments of teaching activities to the different health scenarios that may occur will be informed through the "Aula Virtual".