



Course title: CELL BIOLOGY  
Course number: 18871  
Center: Faculty of Sciences  
Titulation: Science & Engineering Program Boston University-Faculty of Science UAM  
Course level: BSc  
Course type: compulsory subject  
Credit allotment: 6 credits

## COURSE TITLE / ASIGNATURA

CELL BIOLOGY

### 1.1. Course number / Código

### 1.2. Content area / Materia

CELL BIOLOGY

### 1.3. Course type / Tipo

COMPULSORY SUBJECT

### 1.4. Course level / Nivel

BACHELOR

### 1.5. Year / Curso

1<sup>st</sup>-2<sup>nd</sup>

### 1.6. Semester / Semestre

1<sup>st</sup> SEMESTER

### 1.7. Credit allotment / Número de créditos

6 ECTS CREDITS

### 1.8. Prerequisites / Requisitos previos

Previous knowledge on biology is required. Students from Boston University are expected to have followed CAS BI 108 and CAS CH 102 or equivalents. Students from Universidad Autonoma de Madrid should have taken a previous course of General Biology, equivalent to a last High School year (2º Bachillerato) or First Degree Course at University.



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## 1.9. Minimum attendance requirement / Requisitos mínimos de asistencia a las sesiones presenciales

Attendance is highly recommended for theoretical lessons and seminars and is mandatory for practical sessions.

## 1.10. Faculty data / Datos del equipo docente

### INSTRUCTORS

<b>PALOMA FERNÁNDEZ FREIRE</b>		
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Department: Biology	Faculty of Sciences	
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## 1.11. Course objectives / Objetivos del curso

### GOALS OF THE COURSE:

- 1.- Acquire basic knowledge of eukaryote cell components: molecules, genomes and organelles.
- 2.- Understand the main processes operating in cells: genome expression, protein synthesis, intracellular trafficking, membrane transport, cell movement, cell communication, cell adhesion, cell proliferation and differentiation.
- 3.- Develop data analysis competences and critical thinking.
- 4.- Acquire basic skills for the observation and identification of cellular samples under the microscope.

## 1.12. Course contents / Contenidos del programa

### FIRST PART: INTRODUCTION. ORGANIZATION AND PROCESSING OF GENETIC INFORMATION

1. Introduction: features of eukaryote cells. Origin and evolution of cells.
2. Fundamentals of cell biochemistry: sugars, lipids, proteins and nucleic acids.
3. Research tools in cell biology: cell cultures, model organisms, molecular techniques, cellular and organism modification, microscopy techniques.
4. Cell nucleus: nuclear envelope, chromatin structure and nuclear compartmentalization.
5. Genome organization: types of DNA sequences and their proportions and origin.
6. DNA: replication, repair and recombination.
7. RNA: transcription and processing.
8. Proteins: synthesis, folding and degradation.

### SECOND PART: CELL SURFACE AND ORGANELLES

9. Cell membranes: composition, organization and dynamics.
10. Membrane transport: passive diffusion, passive transport, active transport, endocytosis and exocytosis.
11. Protein sorting and transport I: endoplasmic reticulum and the secretory pathway.



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12. Protein sorting and transport II: Golgi apparatus, vesicular transport and lysosomes.
13. Bioenergetics and metabolism: mitochondria, chloroplasts, cellular energetics and peroxisomes.
14. Cell surface: cellular interactions and extracellular matrix.
15. Cell signaling: signaling molecules and receptors, transduction mechanisms and signaling pathways.

### THIRD PART: CYTOSKELETON AND CELL PROLIFERATION

16. Actin microfilaments: organization, polymerization, regulation and functions.
17. Intermediate filaments: organization, polymerization, regulation and functions.
18. Microtubules: organization, polymerization, regulation and functions.
19. Cell cycle: phases of the cell cycle, regulation by CDK-cyclin complexes, checkpoints.
20. Mitosis: phases and events of mitosis, checkpoints, APC, cytokinesis.
21. Cell differentiation and death: stem cells, differentiation of cells in tissues, events of apoptosis, intrinsic and extrinsic apoptotic pathways.
22. Cancer: cellular approaches to cancer study and therapy.

### PRACTICAL PROGRAM

The program of the course is complemented with practical activities. These will mainly focus on the preparation of cellular samples and their observation under the optical microscope. There will be three practical sessions of 4 hours each, focused on the following topics:

Session 1.- Handling of the optical microscope. Cell shape and movement: observation of living freshwater organisms, elaboration and observation of samples from animals and plants (November 23<sup>th</sup>).

Session 2.- Cytoskeleton: observation of actin filaments and microtubules by fluorescence microscopy (November 30<sup>th</sup>).

Session 3.- Cell cycle and division: estimation of cell cycle parameters. Mitosis. (December 7<sup>th</sup>).



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## 1.13. Course bibliography / Referencias de consulta

The organization and contents of the course will follow mainly the book:

- Cooper, G.M. and Hausman, R.E. The Cell, A Molecular Approach. 5<sup>th</sup> Edition. Sinauer Associates, 2009. ISBN: 987-0-87893-3006.

Other recommended bibliography:

- Alberts, B., Bray, D., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. Molecular Biology of the Cell. B. 5<sup>th</sup> Edition. Garland Science, 2008. ISBN: 978-0-81534-1055.
- Alberts, B., Bray, D., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. 2010. Essential Cell Biology. Garland Science. 3<sup>th</sup> Edition. ISBN: 978-0-8153-4130-7.
- Hardin, J., Bertoni, G.P. and Kleinsmith, L.J. 2011. Becker's World of the Cell. Pearson/Benjamin Cummings. 8th Edition. ISBN: 978-0321716026.
- Pollard, T.C., Earnshaw, W.C. and Lippincott-Schwartz, J. 2007. Cell Biology. Elsevier. 2<sup>nd</sup> Edition. ISBN: 1-4160-2255-4.

## 2. Teaching methodology / Métodos docentes

### LECTURES

The goal of the course is to understand the fundamental principles of cell biology. The aim of the lectures is to convey to the students the theoretical contents of the composition and functions of cells. Lectures will have a duration of 50 minutes within the schedule, where the lecturer will present in a simply way the contents of each topic always encouraging students to participate with questions and comments.

### DISCUSSION SEMINARS

Each of the three theoretical parts of the program will be accompanied by two seminars. These seminars seek to encourage students analyze the experimental nature of contemporary research in the Cell and Molecular Biology field, and understand its relationship with the fundamental background information given during the theoretical lectures. The seminars will be led by the teacher, but will mainly focus on student's direct participation with oral presentations, comments, questions and suggestions.



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### TUTORIALS

The University recommends that students attend tutorials for the resolution of questions regarding the content of the course. These tutorials will be held individually and upon request with the teacher assigned.

### PRACTICAL SESSIONS

In the practical sessions the students will be instructed in the use of the optical microscope, the preparation of biological samples for microscopy, the identification of cellular components and the approach to the estimation of cellular parameters. These activities will NOT include the handling of dangerous or poisonous substances and will be carried out under strict safe conditions.

## 3. **Student workload** / Tiempo de trabajo del estudiante

ACTIVITY	Presential	Non-presential	TOTAL
LECTURES	30	60	90
DISCUSSION SEMINARS	6	18	24
PRACTICAL SESSIONS	12	8	20
EXAMS	6		6
TOTAL WORKLOAD:	54	86	140



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#### 4. Evaluation procedures and weight of components in the final grade / Métodos de evaluación y porcentaje en la calificación final

Student's final grading will be based on the understanding of theoretical concepts (80%) and participation in discussion seminars (20%).

##### THEORY

Lectures will be divided in three parts, each of them taught by a different lecturer. There are two mid-term evaluations and one final evaluation scheduled, covering the complete syllabus. These exams will review the knowledge and skills collected by the students during the course. The 80% of the grade that corresponds to theory concepts will be based on the result of the 3 examinations, with the two mid-term evaluation exams weighing 25% of the total grade and the final evaluation exam being the remaining 30% of the total grade.

##### DISCUSSION SEMINARS

The 20% of the total grade will be based of seminars. Student participation, skills for communicating the concepts learnt and discussion capability will be evaluated during the discussion seminars.

##### PRACTICAL SESSIONS

Attendance to the practical sessions is mandatory, but they will not contribute to the final grade.

Summary of the assessment rates	
	Percentage of the final grade
First evaluation exam	25%
Second evaluation exam	25%
Final evaluation exam	30%
Discussion Seminars	20%
TOTAL	100%



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## 5. Course calendar \*/ Cronograma\*

\*This calendar is tentative.

### THEORY/SEMINARS

#### FIRST PART: INTRODUCTION. GENETIC INFORMATION ORGANIZATION AND PROCESSING

- Theory lessons: 10 hours
- Discussion seminars: 2 hours
- First mid-term evaluation exam: 1 hour

#### SECOND PART: CELL SURFACE AND ORGANELLES

- Theory lessons: 10 hours
- Discussion seminars: 2 hours
- Second mid-term evaluation exam: 1 hour

#### THIRD PART: CYTOSKELETON AND CELL PROLIFERATION

- Theory lessons: 10 hours
- Discussion seminars: 2 hours

#### FINAL EVALUATION OF THEORETICAL CONCEPTS: 2 hours

### PRACTICAL SESSIONS

Session 1: November 23<sup>th</sup>

Session 2: November 30<sup>th</sup>

Session 3: December 7<sup>th</sup>

Week	Contents	Contact hours	Independent study time
1 (10-IX)	Introduction / Organization and processing of genetic information	1/2	6
2 (17-IX)	Organization and processing of genetic information	3	6
3 (24-IX)	Organization and processing of genetic information	3	6
4 (1-X)	NO ACTIVITIES (CHEMISTRY PRACTICS)		
5 (8-X)	Organization and processing of genetic information / Discussion seminars	3	6
6 (15-X)	Discussion seminars / <b>Mid-term evaluation</b> / Cell surface and organelles	1/1/1	6



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Week	Contents	Contact hours	Independent study time
7 (22-X)	Cell surface and organelles	3	6
8 (29-X)	Cell surface and organelles	3	6
9 (5-XI)	Cell surface and organelles	3	6
10 (12-XI)	Discussion seminars / <b>Mid-term evaluation</b>	2/1	6
11 (19-XI)	Cytoskeleton and cell proliferation <b>Practical session 1</b>	3	6
12 (26-XI)	Cytoskeleton and cell proliferation <b>Practical session 2</b>	3	6
13 (3-XII)	Cytoskeleton and cell proliferation <b>Practical session 3</b>	3	6
14 (10-XII)	Cytoskeleton and cell proliferation / Discussion seminars / <b>FINAL EVALUATION</b>	1/2/2	6