

Bachelor's Degree in Chemistry

Subject Guide

1. Information about the subject

SUBJECT	Biology	CODE	GQUIMI01-1-008
EDUCATIONAL OFFER	Bachelor's Degree in Chemistry	CENTER	Facultad de Química
TYPE	Core	N° TOTAL CREDITS	6.0
PERIOD	First Semester	LANGUAGE	Spanish
COORDINATORS/ES		EMAIL	
Roca Martínez Agustín Antonio		aroca@uniovi.es	
LECTURERS		EMAIL	
Roca Martínez Agustín Antonio		aroca@uniovi.es	(English Group)
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2. Context

The subject 'Biology' assigned with 6 ECTS, belongs to the basic module and is programmed within the 1st semester during the first course in the Grade of Chemistry. The content of this subject aims to provide deeply knowledge about the living organisms. The subject is primary divided into two different blocks, namely 'Cell Biology' and 'Genetics'.

The specific contents of the first block, Cell Biology, is to provide students with a wide view of cells and animal tissues from a functional perspective, as well as to offer students with a vision of the major state-of-the-art techniques employed in this discipline. Our major goal would be that students, in addition to use the correct technical terminology, will be able to understand the different structure levels of cellular and tissue organization, as well as to develop procedures and abilities to identify animal cells and tissues at the microscopy level.

The second block content is focus on the genomic organization and the mechanisms used by organism to direct character transmission in both, prokaryotes and eukaryotes. Even though it is intended to be a theoretic subject, it is basically dedicated on practical examples to enhance students' scientific approach. Contents included in this second block are partially related and supplemented with contents included in the first block. Furthermore, this block is highly related with other subjects such as 'Biochemistry', planed for the 4th course in this Grade.

Faculty's professors in charge of this subject are enrolled into the 'Cell Biology' area, which belongs 'Departamento de Morfología y Biología Celular' as well as the Genetics area included in 'Departamento de Biología Funcional', both in the Universidad de Oviedo. Both departments have a vast teaching experience as well as a well-documented scientific background related with all the contents included in the subject. Students are expected to show an open-minded, flexible and cooperative attitude during all the semester.

Professors in charge:

Block I: Cell Biology. Dr. Juan Carlos Mayo, Departamento de Morfología y Biología Celular (CEX, PAs, TGs)

Block II: Genetics. Carolina Gomez Díaz, Departamento de Biología Funcional, Área de Genética (CEX, PAs, TGs)

Coordinators:

Professors Juan Carlos Mayo y Carolina Gómez Díaz, (English groups)

Dr. Juan C. Mayo will be in charge of the first block (Cell Biology) for both the lectures, seminars and group tutorials (CEX, PA's, TG's) while Dr. J. Fernando Martín will teach the lectures, seminars and group tutorials of the second part (Genetics) (CEX, PA's, TG's)

3. Requirements

Since subject aims the study of both cytology and genetic features of living organisms, professors would expect students who have included Biology as a choice subject in either, high school or any other previous studies in which they had been enrolled.

4. Competencies and learning results

The subject intends to provide students with most of the current knowledge about the structure of living cells, focused on the study of cells, tissues and genetics principles that rule such structure. To this aim, we have established the following major objectives:

1. To provide an integrative view of the eukaryotic cells and tissues at a functional level.
2. To promote the development of technical and visualizing abilities for identifying cells and tissues at microscopic levels.
3. To stimulate students for a using an adequate terminology
4. To understand the general principles that rule the heredity at the molecular level, including transmission and expression in both prokaryotic and eukaryotic cells
5. To understand the transmission of hereditary information.

Additionally, the skills and aptitudes that students are expected to acquire will be:

A) Skills

Professional skills

A.1) To solve quantitative and qualitative problems according to previously provided models (CE-20)

Academic skills

A.2) To relate and put in context Chemistry with other subjects, i.e. Biology (CE-34)

B) Aptitudes

B.1) To show analytical and synthetic abilities (CG-1).

B.2) To solve problems in a practical manner (CG2)

B.3) To manage information adequately (CG-6)

B.4) To use and handle fluently an alternative language, specifically English (CG-7)

B.5) To handle correctly the specific vocabulary at oral and writing levels (CG-8)

B.6) To be able to learn autonomously (CG-9)

B.7) To show interest for environmental issues (CG-12)

B.8) To develop a critical and deductive thought (CG-17)

B.9) To be able to work as part of a team (CG-18)

All these competences would translate into the following learnings:

1. To be able to elaborate and present a technical appraisal at oral and written levels (CG-1, CG-6, CG-8, CG-12, CG-18). Among the transversal proposals, students should read a scientific text related to either Biology or environmental issues and be able to summarize in a small abstract to be presented orally to their classmates. Additionally, they will present a brief seminar about a topic, either proposed by the professor or chosen by them under professor supervision, using all the adequate materials (computer presentation, video, etc.) to show it to their classmates.
2. To propose and solve issues within the Biology context (CG-2, CG-6, CG-9, CG-17 y CG-18, CE-20).
3. To show sensibility and respect with the environmental issues (CG-12). Among the transversal activities proposed by the Grade directive, students will visit different local factories and will elaborate a final report following previous instructions and guidelines provided by professors, which are in accordance with the environmental implications derived from the specific industrial activity in each case.
4. To be proficient at showing and using the basic scientific knowledge acquired in this subject, and be able of relating this knowledge to the chemical processes that happen in the living beings (CE-34). This learning will be evaluated in the theoretical exams and through the involvement of the students in the seminars and group tutorials.

5. Contents

Block 1: Cell Biology and Histology (Total: 21h)

Part I. Introduction (1.5h)

Unit 1.- Introduction to Biology in the context of Chemical Science. Importance and scientific relations.

Unit 2.- The chemistry of cells. Macromolecules and energy sources.

Unit 3.- Study of cells: a practical approach. Types of microscopy.

Part II: Cell Biology

Unit 4.- The cell: a global view. General structure and organizing levels. Defining tissues and organs (1h).

Unit 5.- The cell barrier. Plasma membrane and cell Surface. Organization and molecular structure of plasma membrane. Cells and environment: transport of substances. The cell wall (2h)

Unit 6.- Inner cellular organization. The cytoskeleton. Filaments. Microtubules and complex structures (3h).

Unit 7.- Cell-cell and cell-matrix interactions: cell junctions and cell adhesion complexes (1h)

Unit 8.- Intracellular compartments and organelles. Protein sorting. The nucleus. Transport between nucleus and cytoplasm. Energy organelles: mitochondria and chloroplast (3.5 h)

Unit 9.- Intracellular vesicular traffic. Endoplasmic reticulum and Golgi. Endocytosis and exocytosis (3h)

Unit 10.- The cell cycle. Control systems. Mitosis and cytokinesis. Cell growth regulation. Cancer. Apoptosis and autophagy (1.5 h)

Part III. Cell within the organism context.

Unit 11.- Tissues and organs. Adult tissues classification. A) Epithelial tissue. B) Connective tissue and its variants. C) Muscle tissue. D) Nerve tissue: neurons and glia (3h).

Unit 12. Basic concepts of stem cells and tissue regeneration. Concept of Cell engineering (1h)

Unit 13.- Impact of Biology on the professional profile of future chemists (0.5h).

Block 2: Genetics (Total: 21 h)

Unit 1.- DNA structure and replication. Gene types. Transcription, RNA translation and Genetic Code. Genome organization and replication in prokaryotes and eukaryotes. Gene structure: regulatory regions, introns and exons. Regulation of gene expression

(3h)

Unit 2.- Cell-division cycle: Mitosis. Karyotype. Sexual reproduction: Meiosis. Haplontic, Diplontic and Diplohaplontic life cycles. Meiotic chromosome segregation (2h)

Unit 3.- Nuclear inheritance. Genotype and Phenotype relationship: Dominance, Codominance and Recessivity. Allelic series: allelism and complementation test. Gene interaction and epistasis. Lethal genes. Pleiotropy. Statistical analysis applied to mendelian genetics (4h)

Unit 4.- Genetics and environment interaction. Susceptibility genes. Genealogy analysis. Analysis of independent characters. Maternal effect genes. Sex-linked inheritance. Extranuclear inheritance (4h)

Unit 5.- Genetic linkage. Analysis of the segregation of two linked loci: recombination fraction calculation. Genetic maps and linkage group (3h)

Unit 6.- Spontaneous mutation caused by DNA replication and reparation errors. Types of genetic mutations. Induced mutation: physical and chemical mutagens (3h)

Unit 7.- Chromosomal structural changes: deletions, duplications, inversions and translocations. Chromosomal numerical changes: haploids; autopolyploids and allopolyploids; hybrids; and aneuploids. Origin, transmission and genetic implications (2h)

6. Methodology and working plan

1. Lectures (4,2 ECTS). For the theoretical exposure, we propose using the classical lecture, though based on a more interactive professor-student approach, including scientific and 3D simulation videos and questions for inducing a critical view of the units, thus prompting students to participate as much as possible. Since this is a subject based greatly on image support (structural and ultrastructural micrographs, genetic models, etc.) professor should use multimedia sources and blackboard diagrams as a crucial supporting teaching methodology. PP/pdf presentations as well as other supporting material including webgraphy are on the virtual campus at students' requirement. Students are invited to use both, moodle and electronic mailing for an easy and fast exchange of information
2. Seminars (0.7 ECTS). Seminars are aimed to be used for students to present updated studies or specific cases with a critical view to the rest of classmates

for a debate.

3. Group tutorials (0.4 ECTS), in which students are encouraged not only to ask questions regarding specific contents within units but also to ask and debate about clinical, pathological or updated information recently published or appeared within the media partially related with any issue included in the subject syllabus. Professor can also follow up among students to check any specific difficulties or individual requirements to address the questions proposed. These tutorials might also be a system to introduce all the students to participate throughout the sessions, and attendance is mandatory.
4. Other activities (0.4 ECTS). These include out-of-the-room sessions in which students will visit different University Facilities, including electron microscopy services as a good example to check the technical methods commonly used for studying life organisms. Attendance is mandatory.

Evaluation sessions (0.3 ECTS). These are the sessions aimed for exams and tests, according to the methodology explained below.

7. Evaluation of the student's learning results

In order to evaluate the overall theoretical and practical learning process, two final exams will be programmed, each containing one of the two major blocks, i.e. Cell Biology and Genetics. Each of the two blocks will be graded between 0 and 10 points. In addition to the exams, complementary activities will also be taken into consideration for evaluation purposes, including participation in seminars and tutorials, as well as the general participation in lectures sessions. The final score would be calculated as follows:

1. Theoretical learning evaluation. Mean scores of both exams, Cell Biology and Genetics, will account for 90% of the final score.
2. Seminars, tutorials and other activities. These will account for 10% of the final score.
3. To pass the subject, final score must be over 5.0, provided that at least a partial score of 4.0 in the exam of each block is required for performing the mean.

After the first block, students will have to pass a partial exam focused on the contents of this first part of the subject. The score obtained in this exam will account for the final score.

In the extraordinary calls (May/June), the evaluation will consist of a written test, containing topics from both subject blocks. In this case, the final score (0-10) will be the mean between both blocks. A minimum score of 5 is required to pass but students must obtain at least a score of '4'

in each block to pass.

8. Resources, bibliography and complementary documentation

Resources, Bibliography, Webgraphy and complementary information.

Cell Biology

Basic textbooks

Alberts, B et al. Molecular Biology of the Cell. Garland Science, 2015, 6th ed. ISBN: 978-0-8153-41

Lodish, H et al. Molecular Cell Biology. W.H. Freeman and Co., New York, 2015. 8th Ed. ISBN:978-0-7167-7601

Other Recommended textbooks

Cooper, GM et al. The Cell. A molecular approach. ASM Press, Washington, 2013. 6th Ed. ISBN: 160-5-35155-5

Karp, G. Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons, Inc., 2013, 7th Ed., ISBN: 978-0-470-04217

Animal Histology

Basic textbooks

Wojciech P. Ross Histology: A Text and Atlas With Correlated Cell and Molecular Biology. 2015, 7th ed. ISBN: 0-683-30242-6

Young, B. Wheater's Functional Histology. 6th ed, 2013. ISBN: 978-0702047473

Other recommended textbooks

LP Gartner et al. Texto Atlas de Histología, McGraw-Hill, 2013. 4ª Ed

LC Junqueira et al., Basic Histology, McGraw-Hill. 2013, 13th ed. ISSN: 978-0-07-160431-4.

Webgraphy. Internet websites of interest

<http://www.johnkyrk.com/>

http://www.youtube.com/watch?v=zufaN_aetZI

http://www.biology.arizona.edu/cell_bio/cell_bio.html

http://www.sciencedaily.com/news/plants_animals/cell_biology/

http://www.protocol-online.org/prot/Cell_Biology/index.html

<http://www.cellbio.com/>

<http://www.springerprotocols.com/>

<http://www.uniovi.es/notfound?referer=/morfologia/Atlas/>

<http://www.unioviedo.es/morfologia/asignatu/biologia/embriologia/Hinicio.html>

<http://histology-umms.org/>

<http://campus.usal.es/~histologia/histologia.htm>

<http://www.e-histologia.unileon.es/1inicio/home/Inicio800x600.html>

<http://webs.uvigo.es/mmegias/6-tecnicas/6-optico.php>

Genetics

- Griffiths, A.J.; Wessier, S.R.; Lewontin, R.C. y Carroll, S.B. Genética (9ª edición). McGraw Hill. Madrid 2008.
- Pierce, B.A. Genética. Un enfoque conceptual. (2ª ed). Editorial Médica Panamericana. Madrid 2006.

