



Universitat de Lleida

# DEGREE CURRICULUM

# **BIOLOGY AND GENETICS**

Coordination: LLOVERA TOMAS, MARTA

Academic year 2022-23

**Subject's general information**

<b>Subject name</b>	BIOLOGY AND GENETICS			
<b>Code</b>	100601			
<b>Semester</b>	1st Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	<b>Degree</b>	<b>Course</b>	<b>Character</b>	<b>Modality</b>
	Bachelor's Degree in Human Nutrition and Dietetics	1	COMMON/CORE	Attendance-based
	Double bachelor's degree: Degree in Human Nutrition and Dietetics and Degree in Physiotherapy	1	COMMON/CORE	Attendance-based
<b>Course number of credits (ECTS)</b>	9			
<b>Type of activity, credits, and groups</b>	<b>Activity type</b>	PRALAB	PRAULA	TEORIA
	<b>Number of credits</b>	2.1	2.4	4.5
	<b>Number of groups</b>	4	3	2
<b>Coordination</b>	LLOVERA TOMAS, MARTA			
<b>Department</b>	BASIC MEDICAL SCIENCES			
<b>Teaching load distribution between lectures and independent student work</b>	Classroom: 45h Virtual classroom: 45h Self learning: 135h			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	Catalan/Spanish			
<b>Distribution of credits</b>	Master class: 4.5 ECTS Practical sessions: 2.1 ECTS Seminars: 2.4 ECTS			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
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## Subject's extra information

### Introduction to the subject and contextualization within the degree

This area combines Cell Biology and Genetics

Cell biology is the study of cells and their processes. It mainly focuses on eucaryotic cells with an emphasis on the internal functions of the cells and the interactions between cells. Cell biology is a fundamental part of many biological disciplines including developmental biology, neurobiology, immunology, cancer biology, aging and disease states. The cell is the functional and structural basic unit of life, therefore the knowledge of cell composition and structure and the understanding of how cells work are fundamental aspects for biological and health sciences.

Genetics is one of the oldest and broadest fields in biology. All aspects of biology have a genetic component. Modern genetics deals with the evolution, transmission and expression of heritable traits, and includes the analysis of DNA sequence data which will help to answer basic questions of biology (Genomics). Genetic techniques are of current use by molecular biologists, cell biologists and ecologists in the quest to understand the hereditary basis of biological processes.

Topics in Cell Biology and Genetics are at the cutting edge of modern biological research. The disciplines are combined into one specialization due to their inter-relationship and overlap. Both combined areas are being used to understand disease and to design preventive measures and therapies. They also help to develop improved plant, animal, and bacterial species, and improve our knowledge and understanding of how cells function and communicate with each other. Both areas of research have contributed to the Biotechnology revolution and to the new field of Genomics.

## Learning objectives

1) At the level of knowledge the student that pass the course must::

- Understand and apply the theoretical concepts specified in the program.
- Learn the concepts used to interpret cellular and physiological aspects of human disease.
- Know the basic scientific terminology and language related to Cell Biology and Genetics

2) The main teaching objectives to be achieved with the activities planned are:

- Understand and identify the fundamental microscopic tissue of the human body and its peculiarities.
- Know the different cellular elements at the ultrastructural level and distinguish them.
- Understand the molecular organization and functional aspects of different cellular compartments and organelles. In addition, students will learn to apply this knowledge in the interpretation of pathophysiological situations.

3) In addition, students who pass the course must achieve the following skills:

- Knowing how to properly use the microscope.
- Knowing how to perform basic conventional techniques employed in the preparation of samples to be observed under the microscope
- Knowing how to describe what he observes with an optical microscope and to identify the fundamental tissues.
- Describe and interpret micro-electron microscopy pictures.
- Use correctly the basic technological environment in which they develop their training (Virtual Campus, email, electronic dossiers) and work with basic office software at the user-level
- Acquisition of habits to be Self-Learning
- Search, select and process information related to the subject using ICT
- Show good study habits
- Teamwork in problem solving.

## Competences

### Specific Competences

CE1 To know the chemical, biochemical and biological fundamentals of application in human nutrition and dietetics.

### General Competences

CG3. Recognize one's own limitations and the need to maintain and update one's professional competence, with special recognize one's own limitations and the need to maintain and update professional competence, giving special importance to learning, in an autonomous and continuous way, new knowledge, products and techniques in nutrition and food, as well as motivation for quality.

CG4. Communicate effectively, both orally and in writing, with people, health professionals or industry and the media, knowing how to use information and communication technologies, especially those related to nutrition and lifestyle habits.

### Basic competences

CB3 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

CB4 The students have to be able to transmit information, ideas, problems and solutions to both specialized and non-specialized audiences.

### Transversal Competences of the UdL

CT2 Mastering a foreign language

CT3 Mastering ICT

CT5. To acquire essential notions of scientific thinking.

## Subject contents

Unit 1 - **The cell as a structural and functional unit of the human body.** Cell Theory. Cell diversity: size and shape, cell types. Integration of cells into tissues: Concept and types of tissue.

Unit 2 - **The cellular environment.** The extracellular matrix (ECM). The extracellular matrix of animals. Connective tissue. Components of the extracellular matrix: fibrous, amorphous ground substance. Functions of the MEC

Unit 3 - **Biomembranes.** Diversity of cell membranes, molecular composition and organization.

Unit 4 - **Cell membrane.** Functional aspects. Transport through membranes. Molecular transport. Transporters, ion channels and pumps. Cellular Models of interchanges with the environment. Renal epithelium: the glomerulus. Gastrointestinal mucosa: the Enterocyte ..

Unit 5 - **The cytoplasm and the energy stores.** How energy accumulates in cells?. Cytosolic glycogen stores in liver and muscle. Mechanisms of regulation of these energy stores. Cytosolic lipid stores. Adipose tissue, adipocytes. Proteasome and protein degradation. The ribosome: protein synthesis.

Unit 6 - **The mitochondria.** Morphofunctional aspects. Cellular respiration, oxygen consumption and energy production in eukaryotic animals. Maternal or cytoplasmic inheritance abnormalities.

Unit 7 - **Interaction of cells with their environment.** Physiological, cellular and molecular bases of cell communication. Biological messengers.

Unit 8 - **Cell secretion.** Cells and secretory glands. Type of secretion: merocrine, apocrine and holocrine. Secretion products. Model to study the pancreas: pancreatic beta-cells.

Unit 9 - **Endomembrane system related to the secretory pathway.** Morphofunctional aspects: endoplasmic reticulum, Golgi apparatus, endosomes. intracellular trafficking

Unit 10 - **Intracellular digestion.** Endocytosis and exocytosis. Receptor mediated endocytosis. Intracellular digestion. Lysosomes: alterations of lysosomes

Unit 11 - **Cytoskeleton.** Organization of the cytoskeleton: Microtubules, microfilaments, intermediate filaments. Cell shape: centrioles and centrosomes. Microvilli and cytoplasmic extensions ..

Unit 12 - **Cytoskeleton and Cell Motility.** Motor proteins. Flagella and cilia. The skeletal muscle cell. The sarcomere.

Unit 13 - **Peroxisomes.** Morphofunctional aspects. Oxidation processes in the peroxisome. Lipid Metabolism detoxification

Unit 14 - **The nucleus.** Organisation. The envelope: pore nucleocytoplasmatic exchange. Chromatin: compacting states, morphofunctional aspects of chromatin. Nucleolus. DNA chromosome

Unit 15 - **From DNA to proteins.** RNA synthesis and processing. The ribosome. Protein synthesis and processing. Relationship between gene and DNA.

Unit 16 - **Playing cell.** The cell cycle and its regulation. Cell Division: Mitosis and functional significance. Meiosis

and functional significance. Chromosomes. The chromosomal inheritance. Cell death

Unit 17 - **Introduction**. Nutrigenetics and nutrigenomics. The importance of genetics in human nutrition.

Unit 18 - **The human genome**. Structure of nucleic acids. The eukaryotic chromosome. Genome structure levels. Sources of genetic variability: meiosis and recombination

Unit 19 - **Mutagenesis**. DNA replication. Concept and types of mutations. Punctual mutations. Chromosomal mutations.

Unit 20 - **The inheritance of characters**. Germline vs somatic mutations. Inheritance models. Variations in inheritance models.

Unit 21 - **Complex inheritance**. Qualitative vs. quantitative characters. Polygenic inheritance. Bonding studies. GWAS studies.

Unit 22 - **The gene**. Gene structure. Basic concepts of transcription. The genetic code and protein synthesis. Aspects of the coding of genetic information. The transfer RNA. Ribosomal RNA and ribosome. The translation

Unit 23 - **Regulation of gene expression**. Transcriptional regulation. Transcription factors. Translation and post-translation regulation.

Unit 24 - **Epigenetics**. Epigenetic modifications.

Unit 25 - **Techniques of analysis of genetic variability**. Restriction enzymes. The PCR. Sequencing. RFLPs. VNTRs. Microsatellites. SNPs.

Unit 26 - **Population genetics**. Hardy-Weinberg's law. Factors affecting Hardy-Weinberg equilibrium.

## Methodology

Activity	Description	Hours	Groups	
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TEORIA	Theory classes Biology	23x1h=23h	1	1
PRALAB	Practice sessions Biology	3x3h=9h	3	1
PRAULA	Seminars Biologia	7x2h=14h	2	1
<b>Total Biology hours</b>		<b>46 h</b>		
TEORIA	Theory classes Genetics	22x1h=22h	1	1
PRALAB	Practice sessions Genetics	2x3h=6h	3	1
PRAULA	Informatics sessions Genetics	2x3h=6h	2	1
PRAULA	Seminars Genetics	5x2h=10h	2	1
<b>Total Genetics hours</b>		<b>44 h</b>		
<b>TOTAL HOURS</b>		<b>90 h</b>		

## LABORATORY PRACTICES

It is MANDATORY that students bring in the course of teaching practices:

- White lab coat from UdL

You can buy it at the **ÚDELS** store of the UdL

Center for Cultures and Cross-Border Cooperation - Cappont Campus Carrer de Jaume II, 67 25001 Lleida

<http://www.publicacions.udl.cat/>

For more information, check the product listings

<http://www.nutricio.udl.cat/en/pla-formatiu/equipament/>

For other protection equipment (for example gloves, respirators, etc.), they depend on the type of practice to be performed. In this case, the responsible professor will inform if the use of these specific EPI is necessary.

Not carrying the EPI described or not complying with the general security regulations detailed below will mean that the student can not access the laboratories or have to leave the same.

## GENERAL SAFETY RULES IN LABORATORY PRACTICES

- Maintain the working place clean and tidy. The work table must be free of backpacks, folders, coats ...
- In the laboratory you can not come with shorts or short skirts.
- Bring closed and covered shoes during the performance of the practices.
- Bring long hair always tied back.
- Keep the lab coat fit to protect against spills of chemical substances.
- Do not carry wide bracelets, pendants or sleeves that can be trapped by the equipment, assemblies ...
- Avoid wearing contact lenses, since the effect of chemicals is much greater if they are introduced between the contact lens and the cornea.
- Do not eat or drink in the laboratory
- Smoking is prohibited within laboratories
- Wash your hands whenever you have contact with a chemical and before leaving the laboratory.
- Follow the teacher's instructions and consult any questions about security

## Development plan

The subject will be developed following the timetable of the First year- 1st semester that is available at the Degree website..

HND: <https://nutricio.udl.cat/ca/calendari-horaris/horaris/>

Double Degree Human Nutrition and Dietetics and Physiotherapy: <http://www.nutricio-fisioterapia.udl.cat/en/calendari-horaris/horaris/>

## Evaluation

The evaluation of the subject will be based on the following items:

1) Written tests: 2 theory exams (80%)

Eval.1-Biology: Theoretical exam of the Biology part (theory, seminars and practices) 40%

Eval.2-Genetics: Theoretical exam of the part of Genetics (theory, seminars and practices) 40%

You need **a minimum score of 4.5** to average and be able to compensate with the other grades.

Recovery exam: It will be possible to recover the part (s) of the theoretical matter that has been suspended. (Eval.1 or Eval.2)

2) Seminar questionnaires: 15%

3) Attendance (seminars and practical sessions): 5% (compensatory)

A minimum **global grade of 5** must be taken **to pass** the subject

## Exam type:

The assessment exams will contain different types of questions:

- Multiple choice questions, with 4 possible answers and only one is true (errors discount 0.25 pts)
- Short answer, fill the gap, or matching questions
- Problems

If it is necessary to perform a virtual assessment the Sakai test and quiz tool Will be used. The exam typology will be the same, but the order of the questions and options will be randomized.

## Final grade of the subject

Overall rating = 40% exam.1-Biology + 40% exam.2-Genetics + 15% seminars + 5% attendance at seminars and practical sessions

- You must take at least a **final grade of 5 to pass** the course

Suspended students may request to keep seminar's grades and attendance.for the next year.

They will also be able to ask to keep the mark of any of the written tests if they have obtained **a mark higher or equal to 5 in the exam**. However,the exam mark is only kept for one academic year.

## Bibliography

### Bibliografía bàsica

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Solari AJ. (2004). Genética Humana, fundamentos y aplicaciones en Medicina. Editorial Médica Panamericana

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Cooper and Hausman. **La Célula, 7 Ed**, 2017. Marban Libros. (ISBN: 9788416042630)

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Gerald Karp **Biología Celular y Molecular: Conceptos y experimentos 7 Ed**. 2014 McGraw-Hill Interamericana (ISBN : 9786071511379)

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## **Bibliografia complementària**

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J. H. Gillespie, Population Genetics: A Concise Guide (Johns Hopkins University Press, ed. 2nd, 2004)

M. S. Kang, Quantitative Genetics, Genomics, and Plant Breeding. M. S. Kang, Ed., Symposium on Quantitative Genetics and Plant Breeding in the 21st cent (CABI Publishing, 2002).