



Universitat de Lleida

## DEGREE CURRICULUM

# **BIOLOGY AND GENETICS**

Coordination: LLOVERA TOMAS, MARTA

Academic year 2016-17

## 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>	Degree	Course	Typology	Modality
	Double bachelor's degree: Degree Physiotherapy and Degree in Human Nutrition and Dietetics	1	COMMON	Attendance-based
	Bachelor's Degree in Human Nutrition and Dietetics	1	COMMON	Attendance-based
<b>ECTS credits</b>	9			
<b>Groups</b>	2GG,3GM,6GP			
<b>Theoretical credits</b>	4.5			
<b>Practical credits</b>	4.5			
<b>Coordination</b>	LLOVERA TOMAS, MARTA			
<b>Department</b>	CIENCIAS MEDICAS BASICAS,MEDICINA EXPERIMENTAL			
<b>Teaching load distribution between lectures and independent student work</b>	Classroom: 90h 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			
<b>Office and hour of attention</b>	Book an appointment with the coordinator by e-mail			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
EGEA NAVARRO, JOAQUIN	joaquim.egea@cmb.udl.cat	6	
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## Subject's extra information

### 1. Introduction to the subject and contextualization

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 working 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

**Learn the basics of chemical, biochemical, and biological concepts with application in human nutrition and dietetics**

## 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 - **Molecular nature of genetic material.** Chemistry of nucleic acids. Type and structure of nucleic acids. Eukaryotic chromosome.

Unit 18 - **Transcription and RNA processing.** Basics of transcription in prokaryotes. Transcription in eukaryotes: promoters and phases. Processing of messenger RNA: splicing.

Unit 19 - **The genetic code and protein synthesis.** Aspects of encoding genetic information. The transfer RNA. The rRNA and ribosome. Translation.

Unit 20 - **The control of gene expression.** Epigenetics. Transcriptional regulation: transcription factors. Post-transcriptional regulation: alternative splicing. RNA interference. Translational and posttranslational regulation.

Unit 21 - **Replication, recombination and transposition.** Basics of DNA replication. The replication machinery. Regulation of replication. Replication of telomeres. Types and models of recombination. Gene conversion. Transposable elements.

Unit 22 - **Mutagenesis and DNA repair.** Concept and types of mutations. Origin of mutations: errors and damage. Repair mechanisms.

Unit 23 - **The Legacy in character.** Somatic vs. germline mutations. Qualitative vs. quantitative Traits. Inheritance models and mutations

Unit 24 - **The human genome.** Level of genome structure. First cause of variability: the replication of DNA. Second cause of variability: recombination. Techniques of analysis of genetic variability.

Unit 25 - **Genetic diagnosis and population studies.** Direct and indirect diagnosis. Ley Hardy-Weimberg.

Unit 26 - **Monogenic vs. polygenic diseases.** Case studies and controls. TDT studies..

## Methodology

Tipus Activitat	Descripció resumida de l'activitat (Títol de tema o activitat pràctica)	Dedicació presencial alumne (hores)	Grups	Dedicació total professors (hores)
TEO	Classe teoria Biologia	23x1h=23h	1	23
PRAC	Sessions practiques Biologia	3x3h=9h	4	36
SEM	Seminaris Biologia	7x2h=14h	2	28
Tot Bio		46 h		87 h
TEO	Classe teoria Genètica	22x1h=22h	1	22
PRAC	Sessions practiques Genètica	2x3h=6h	4	24
INF	Sessions informàtica	2x3h=6h	4	24
SEM	Seminaris Genètica	5x2h=14h	2	20
Tot Gen		44 h		90 h
TOTALS		90 h		177 h

## Evaluation

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

1) Written tests: two examinations

Evaluation-1: Review of the Theoretical Biology (theory and practical seminars) 35%

Evaluation-2: Theoretical exam of the Genetics (theory and practical seminars) 35%

It should take the average of 4.5 for power and compensate with other notes

Recovery: You can recover part of the material that has been suspended.

2) Work in small group seminars 20%

3) Attendance at seminars and practical 10%

Exam Type:

Review of 40 multiple choice questions with five possible answers and only one is true.

5 answers failure to anticipate a right.

Final grade for the course 35% Evaluation-1 + 35% Evaluation-2 + 20% seminars + 10% seminar attendance

It should take at least 5 to pass the course

## Bibliography

### Bibliografia bàsica

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Anthony J. F. Griffiths, Jeffrey H. Miller, David T. Suzuki, Richard C. Lewontin, William M. Gelbart, An Introduction to Genetic Analysis (W.H. Freeman & Company, ed. 8th, 2004).

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R. H. Tamarin, Principles of Genetics (William C Brown Pub, ed. 6th, 1999).

E. J. Eisen, The Mouse in Animal Genetics And Breeding Research (World Scientific Publishing Company, 2005).

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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).