



Universitat de Lleida

DEGREE CURRICULUM
BIOLOGY AND GENETICS

Coordination: LLOVERA TOMAS, MARTA

Academic year 2021-22

Subject's general information

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

ATTENTION

The teaching methodology can be modified according to the containment measures for COVID-19 established by the competent authorities throughout the development of the semester.

| Activity | Description | Hours | Groups | |
|-----------------------------|-------------------------------|-------------|--------|----------|
| | | | Lleida | Igualada |
| TEORIA | Theory classes Biology | 23x1h=23h | 1 | 1 |
| PRALAB | Practice sessions Biology | 3x3h=9h | 3 | 1 |
| PRAULA | Seminars Biologia | 7x2h=14h | 2 | 1 |
| Total Biology hours | | 46 h | | |
| 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 |
| Total Genetics hours | | 44 h | | |
| TOTAL HOURS | | 90 h | | |

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.html>

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

Evaluation

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

1) Written tests: two examinations

Evaluation-1: Theoretical exam of Biology (theory and practical seminars) 40%

Evaluation-2: Theoretical exam of Genetics (theory and practical seminars) 40%

The minimum note of an exam must be 4.5 to be able to compensate with other qualifications.

Retaking exams: You must re-examine the part of the subject with a score that do not allow you to reach a 5.0 on the final qualification.

2) Work of seminars 15%

3) Attendance at seminars and practical sessions 5%

Exam Type:

1) In case of a face-to-face exam

Exam of 40 test questions, with 5 possible answers and only one is true.
5 wrong answers discount a right question

2) In the event that it is necessary to carry out a virtual assessment, different types of questions will be combined depending on the teacher's criteria, to avoid as much as possible the exchange of information between the students during the development of the test. The possibility of conducting individual oral evaluations is also open.

Final score of the subject: 40% Evaluation-1 + 40% Evaluation-2 + 15% seminars + 5% seminar and lab practice attendance

The final score must be at least 5 to pass the subject

Bibliography

Bibliografia bàsica

Sudbery P. (2004). Genética molecular humana. Pearson/Prentice Hall.

Novo Villaverde FJ. (2007). Genética humana: conceptos, mecanismos y aplicaciones de la Genética en el campo de la Biomedicina. Pearson/Prentice Hall

Nussbaum RL, et al. (2004). Genetics in Medicine. Thompson & Thompson.

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

de Juan-Herrero J et al. 2022 **Biología Celular. Conceptos esenciales**. Editorial Médica Panamericana (ISBN 9788498357714)

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

Bruce Alberts. **INTRODUCCION A LA BIOLOGIA CELULAR (3RD ED.)**, 2011. Panamericana, (ISBN: 9786077743187)

Gerald Karp **Biología Celular y Molecular 8 Ed**. 2016 Panamericana (ISBN: 9789500606264)

Bibliografia complementària

Griffiths, Miller, Lewontin & Suzuki. Genética. McGraw-Hill / Interamericana de Espana, S.A.

W. S. Klug, M. R. Cummings, Genética (Pearson Educacion, S.A., ed. 1a, 1998).

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).

M. R. C. William S. Klug, Essentials of Genetics (Prentice Hall, ed. 5th, 2004).

D. P. S. E.J. Gardner, M.J. Simmons, Principles of Genetics (John Wiley and Sons Ltd, ed. 8th, 1991).

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).

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).