



INTRODUCTION

Description:

- **Degree:** Medicine
- **Module:** 1: Morphology, structure and function of the human body
- **Topic:** 1.1. Biochemistry and Cell Biology
- **Type of course:** Basic
- **ECTS:** 12
- **Year and bimester:** 1st year, 1st bimester
- **Schedule:** Monday, Tuesday, Thursday and Friday, from 9:00 AM to 1:00 PM
- **Room:** 4E02
- **Language:** English

Course director:

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COMPETENCES

BASIC COMPETENCES

CB1 - That students have shown themselves to possess and understand knowledge in an area of study that develops from general secondary education, and is usually at a level that, although requiring advanced textbooks, also includes some aspects that imply knowledge from the forefront of their field of study.

CB2 - That students know how to apply their knowledge, in a professional manner, to their work or vocation, and that they possess the abilities that are usually demonstrated through the preparation and justification of arguments and the resolution of problems in their field of study.

CB3 - That students have the capacity to collate and interpret relevant data (normally within their area of study) in order to express opinions that include reflection on relevant subjects of social, scientific or ethical nature.

CB4 - That students can transmit information, ideas, problems and solutions to specialist and non - specialist audiences alike.

CB5 - That students have developed the learning skills necessary to carry out further study with a high level of autonomy.



GENERAL COMPETENCES

CG5 - To recognize one's own limitations and the need to maintain and update one's professional abilities, lending special importance to learning new knowledge and techniques in an autonomous way and to being motivated by a quest for quality.

CG6 - To develop professional practice with respect to other health professionals, acquiring teamwork skills.

CG7 - To understand and recognize the structure and normal function of the human body at the levels of the molecule, cell, tissue, organ and system over the different stages of life and in both sexes.

CG8 - To recognize the bases of normal human behavior and its alterations.

CG9 - To understand and recognize the effects, mechanisms and manifestations of disease on the structure and function of the human body.

CG15 - To have the capacity to prepare an initial diagnostic evaluation and to establish a reasoned diagnostic strategy.

CG17 - To establish diagnosis, prognosis and treatment, by application of principles based on the best information possible and on conditions of clinical safety.

CG23 - To communicate in an effective and clear way, both when speaking and in writing, with patients, with family members, with media, and with other professionals.

CG24 - To establish good interpersonal communication skills to facilitate relating efficiently and sympathetically with patients, family members, media, and other professionals.

CG25 - To recognize a population's determinants of health, both genetic and those that depend on sex, life - style, demography, environment, and social, economic, psychological and cultural factors.

CG31 - To know about, to critically evaluate and to know how to use sources of clinical and biomedical information to obtain, organize, interpret and communicate scientific and health information.

SPECIFIC COMPETENCES

CE1 - To know cellular structure and function.

CE2 - Bio - molecules.

CE3 - Metabolism.

CE4 - Metabolic regulation and integration.

CE5 - To know basic principles of human nutrition.

CE6 - Cellular communication.

CE7 - Excitable membranes.

CE8 - The cell cycle.



CE9 - Cellular differentiation and proliferation.

CE10 - Genetic information, expression and regulation.

CE11 - Inheritance.

CE15 - Homeostasis.

CE16 - Adaptation to the environment.

CE17 - To manage basic laboratory material and techniques.

CE18 - To interpret normal laboratory analyses.

CE20 - To carry out functional tests, to determine vital signs and interpret them.

CE109 - To evaluate the risk/ benefit relationship of diagnostic and therapeutic procedures.

CE110 - To know the indications for biochemical, hematological, immunological, microbiological, anatomical - pathological tests and imaging.

CE112 - Inflammation.

CE115 - Biochemical, cytogenetic and molecular biological markers applied to clinical diagnosis.

CE139 - To know how to obtain and process a biological sample for study by means of the various diagnostic procedures.

CE140 - To know how to interpret the results of diagnostic laboratory tests.

PROGRAM

Didactic Unit I. Basic structure of eukaryotic and prokaryotic cells: Cellular organelles

- Lec 1.1. General organization of cells
- Lec 1.2. Light and electron microscopy. Immunofluorescence and immunohistochemistry
- TBL 1.1. Ultrastructure of the eukaryotic cell
- WS 1.1. Normal and pathological blood cells under the microscope

Didactic Unit II. Chemical structures of biomolecules: General functions in humans

- Lec 2.1. The chemistry of life: functional groups and ionization
- Lec 2.2. Proteins I: structure and properties of amino acids
- Lec 2.3. Proteins II: peptide bond, protein conformation
- Lec 2.4. Carbohydrates I: monosaccharides
- Lec 2.5. Carbohydrates II: disaccharides and polysaccharides
- Lec 2.6. Enzymes: how enzymes work, regulatory enzymes
- Lec 2.7. Lipids: fatty acids, TAGs and biologically active lipids
- Lec 2.8. Nucleotides and nucleic acids I: types
- Lec 2.9. Nucleotides and nucleic acids II: structure
- TBL 2.1. The importance of pH in biology
- TBL 2.2. Practical enzymology: enzyme kinetics and inhibition



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- TBL 2.3. Protein structure-function relationship: the example of myoglobin and hemoglobin

Didactic Unit III. Membrane transport and cell-cell and cell-matrix interactions

- Lec 3.1. Molecule structure of membranes I: composition
- Lec 3.2. Molecule structure of membranes II: architecture, function, transport
- Lec 3.3. Components of the extracellular matrix: collagen, elastin, proteoglycans
- Lec 3.4. Microtransport through the membrane
- Lec 3.5. Macrotransport through the membrane
- Lec 3.6. Organization of the cytoskeleton I
- Lec 3.7. Organization of the cytoskeleton II
- Lec 3.8. Endomembrane system
- TBL 3.1. Cell junctions
- WS 3.1. The cell in the tissue context. Importance of the cell-cell and cell-matrix interaction

Didactic Unit IV. Cell responses to external stimuli

- Lec 4.1. General mechanisms of cell signaling
- Lec 4.2. Signaling through GPCRs
- Lec 4.3. Signaling through ion channel receptors
- TBL 4.1. Signaling through tyrosine kinases. Resistance to insulin in type II diabetes

Didactic Unit V. Metabolism of carbohydrates, amino acids, lipids and nucleic acids

- Lec 5.1. Metabolism: Basic concepts
- Lec 5.2. Bioenergetics and electron transport in the metabolism
- Lec 5.3. Generation of ATP from glucose: glycolysis, anaerobic glycolysis, transport of electrons to the mitochondria
- Lec 5.4. Generation of ATP from other carbohydrates
- Lec 5.5. Krebs cycle
- Lec 5.6. Gluconeogenesis and glycogen metabolism
- Lec 5.7. Oxidative phosphorylation and mitochondrial function
- Lec 5.8. Pentose phosphate pathway
- Lec 5.9. Amino acid catabolism: the urea cycle
- Lec 5.10. Fatty acid catabolism and ketone bodies
- Lec 5.11. Nucleotide metabolism: purines
- Lec 5.12. Nucleotide metabolism: pyrimidines
- Lec 5.13. Synthesis of lipids
- Lec 5.14. Cholesterol metabolism and lipid transport
- Lec 5.15. Amino acid catabolism: the urea cycle
- TBL 5.1. Ethanol metabolism
- TBL 5.2. Metabolism-related clinical case
- TBL 5.3. Integration of metabolic pathways

Didactic Unit VI. Principles of laboratory medicine

- Lec 6.1. The clinical laboratory. Preanalytical phase I
- Lec 6.2. The clinical laboratory. Preanalytical phase II
- Lec 6.3. Measurement techniques and test results I
- Lec 6.4. Measurement techniques and test results II



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- Lec 6.5. Interpretation of test results I
- Lec 6.6. Interpretation of test results II
- Lec 6.7. Clinical enzymology I: liver enzymes and muscular enzymes
- Lec 6.8. Clinical enzymology II: pancreatic enzymes and cardiac proteins
- TBL 6.1. Specimen collection and processing
- TBL 6.2. Analytical and clinical evaluation methods. Point of Care Testing
- TBL 6.3. Laboratory analysis of lipid metabolism
- TBL 6.4. Laboratory analysis of glucose metabolism and diabetes mellitus
- TBL 6.5. Plasma proteins

Didactic Unit VII. Genetic and cellular dynamics during the life cycle of a cell

- Lec 7.1. The cell cycle: Mitosis
- Lec 7.2. Meiosis
- Lec 7.3. DNA replication
- Lec 7.4. Levels of chromatin packaging
- Lec 7.5. General features of the human genome
- Lec 7.6. Protein coding and non-coding genes
- Lec 7.7. Genetic variation
- Lec 7.8. DNA damage, repair and recombination
- TBL 7.1. Apoptosis and senescence
- TBL 7.2. Forensic DNA analysis

Didactic VIII. From the DNA to the protein: Gene expression regulation and protein fate

- Lec 8.1. DNA transcription I
- Lec 8.2. DNA transcription II
- Lec 8.3. Regulation of gene expression
- Lec 8.4. Epigenetics: DNA methylation and histone modifications
- Lec 8.5. The genetic code
- Lec 8.6. Protein synthesis
- Lec 8.7. Protein maturation, folding and targeting
- Lec 8.8. Protein degradation: lysosomes
- TBL 8.1. Epigenetic-related diseases: Diagnosis of Prader-Willi and Angelman syndromes
- TBL 8.2. *In silico* gene analysis

Didactic Unit IX. Transmission of genetic traits and examples of genome-related diseases

- Lec 9.1. General principles of clinical cytogenetics and genome analysis
- Lec 9.2. Patterns of single gene inheritance
- Lec 9.3. Polygenic inheritance and multifactorial diseases
- Lec 9.4. Cancer genetics
- TBL 9.1. Diseases caused by expansion of trinucleotide repeats
- TBL 9.2. Polymerase chain reaction (PCR)
- TBL 9.3. Dysregulation of the cell cycle in cancer
- TBL 9.4. Ethical aspects of genetics
- TBL 9.5. Gene mutations as therapeutic targets in cancer



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- **Lectures** (2.5 ECTS, 67 hours): lectures are given with the aim of providing the conceptual framework of the main themes. The professor will post on ADI the power point presentation. The flipped classroom methodology will be used in many of the sessions. Videos and reading material will be provided to the students prior to the sessions.
- **Active learning activities** (1.8 ECTS, 45 hours): team-based learning collaborative sessions (TBLs) and workshops. Attendance at these activities are required.
- **Formative assessment** (0.6 ECTS, 15 hours): quizzes and self-assessment tests.
- **Personal work** (6.7 ECTS, 170 hours): study prior to flipped classroom sessions will be required, as well as post-class personal study on a daily basis. Students will have to be able to integrate material learnt throughout the course.
- **Tutoring** (0.2 ECTS, 5 hours): throughout the course, students can arrange tutoring, individually or collectively, with the course director or with any of the other teachers.
- **Evaluation** (0.2 ECTS, 5 hours): two final exams to assess the accomplishment of the course objectives. One based on multiple-choice questions and one based on practical applications, concepts, problems, etc.

ASSESSMENT

ORDINARY CALL

Assessment of students' progression and learning will be made throughout the course by the following activities:

- **Continuous assessment:** evaluation through works or tools such as ADI examiner or Woodlap. There will be both individual and group activities.
- **Formative assessment** (voluntary and without weight in the final grade): there will be two formative evaluations based on multiple-choice tests. The feedback information will allow students to self-assess their degree of knowledge acquisition.
- **Final exam of theoretical knowledge:** based on multiple-choice questions.
- **Final exam of applied knowledge:** based on applied questions related to practical application of concepts, problems, etc.

To pass the course, students will need to **attend a minimum of 80% of the TBL sessions and the two workshop sessions, and pass both the multiple-choice and the applied exams.**



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The final grade will be calculated from the marks obtained in the continuous assessment (20%), the final exam of theoretical knowledge (50%) and the final exam of applied knowledge (30%). Students whose final grade is 5 points or more will pass the course.

After publication of the final grades, students will have the opportunity to review their exam and activity evaluations in a scheduled interview with the course director.

EXTRAORDINARY CALL

Students who do not pass the course in the ordinary call will have to take the following exams in the extraordinary call:

- Final exam of theoretical knowledge: multiple-choice questions.
- Final exam of applied knowledge: questions related to practical application of concepts, problems, etc.

To pass the course, **students will need to pass both the multiple-choice and the applied final exams.**

In the extraordinary call, there will be two alternative methods of calculating the student's final grade:

Option 1) Considering the continuous evaluation as in the ordinary call: 20% continuous evaluation, 50% multiple choice test, 30% applied exam.

Option 2) Without considering the continuous evaluation: 65% final exam of theoretical knowledge and 35% final exam of applied knowledge.

The method that yields the highest grade for the student will be applied. Students whose final grade is 5 points or more will pass the course.

After publication of the final grades, students will have the opportunity to review their exam evaluations in a scheduled interview with the course director.

OFFICE HOURS

One-on-one teaching consultations should be request by email:

Prof. Dr. Ruben Pío (Course Director): rpio@unav.es

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BIBLIOGRAFÍA

- **LEHNINGER. PRINCIPLES OF BIOCHEMISTRY.** David L. Nelson & Michael M. Cox. 7th edition. Macmillan Education. 2017. [Find it in the library](#) (paper format)
- **CLINICAL BIOCHEMISTRY. AN ILLUSTRATED COLOUR TEXT.** Michael J. Murphy, Rajeev Srivastava & Kevin Deans. 6th edition. Elsevier. 2018. [Find it in the library](#) (electronic format)
- **BIOLOGÍA CELULAR BIOMÉDICA.** Alfonso Calvo. Elsevier. 2nd ed. 2023. [Find it in the library](#) (electronic format). 2015 [Find it in the library](#) (paper format)

For all Lectures and TBLs of **GENETICS** (Prof. Novo), you can use his **official class notes**, which are (loosely) based on the textbook: GENETICS AND GENOMICS IN MEDICINE. Tom Strachan, Judith Goodship & Patrick Chinnery. Garland Science. 2019. [Find it in the library](#) (paper format).

[Class notes FMC I \(Genetics\).pdf](#)