

## **Degree in Biomedic Laboratory Techniques**

INTEGRATED COURSE: HISTOLOGY, BIOLOGY, ANATOMY AND GENETICS

SSD: BIO/17, BIO/16, BIO/13, MED/03

CFU: 8

Course Coordinator: CINZIA CICCACCI

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MODULE: HISTOLOGY

SSD: BIO/17

CFU: 2

Teacher: Micol Massimiani e-mail: [micol.massimiani@unicamillus.org](mailto:micol.massimiani@unicamillus.org)

MODULE : GENERAL AND CELLULAR BIOLOGY

SSD : BIO/13

CFU : 2

Teacher : Roberta Nardacci e-mail : [roberta.nardacci@unicamillus.org](mailto:roberta.nardacci@unicamillus.org)

MODULE : HUMAN ANATOMY

SSD: bio/16

Numero di CFU: 2

Teacher: Paolo Izzo e-mail: [paolo.izzo@unicamillus.org](mailto:paolo.izzo@unicamillus.org)

MODULE: MEDICAL GENETICS

SSD: MED/03

CFU: 2

Teacher: Cinzia Ciccacci e-mail: [cinzia.ciccacci@unicamillus.org](mailto:cinzia.ciccacci@unicamillus.org)

### **PREREQUISITES**

There are no prerequisites, but it should be better if student already knows basic elements of biology, physics and chemistry

### **LEARNING OBJECTIVES**

The Histology module aims to provide student with the skills necessary for the full understanding of the most important tissues of the human organism. The student must be able to acquire a correct terminology and develop skills of interpretation and application that, the graduate in Biomedical Laboratory Techniques, will have to use in the planning and management of work activities.

The Biology module aims at providing the students with the morphological and functional organization of prokaryotic and eukaryotic cells, focusing on both the descriptive aspects and the basic notions of biochemistry and cellular physiology required to understand the functions of the cell as a basic unit of living organisms.

The objective of the course is the learning of the constructive logic of the biological structures at the different levels of organization of living matter, the principles that govern the functioning of

the different biological systems, the learning of the experimental method and its applications to the study of biological phenomena.

Students will learn the unitary mechanisms that regulate cellular activities, gene expression and genetic material transmission.

The Anatomy module provides the student with the anatomical knowledge from a basic macroscopic point of view to understand the general organization of the human body.

The teaching objectives are the acquisition of the morphological knowledge and the topographic organization of the single systems, organs and apparatuses in order to acquire the basic notions for the subsequent integrated courses

The aim of the course of Medical Genetics is to provide to students the knowledge on the main notions on inheritance of monogenic, chromosomal and multifactorial diseases.

At the end of the course the student will be able to distinguish the main classes of genetic diseases and to recognize the modes of transmission of hereditary diseases. The student will acquire knowledge of the main methods of analysis useful for the diagnosis of these pathologies.

## LEARNING OUTCOMES

### Knowledge and understanding

At the end of the course the student should have acquired:

- The knowledge of the structures of the various tissues that compose the human organism
- The knowledge of the histological organization of the various human organs
- The ability to identify the morphology of the tissues, the cells that compose them, from a morphological and functional point of view
- The ability to synthesize and correlate the various topics.
- The classification principles of living organisms.
- The major structural differences between prokaryotic and eukaryotic cells.
- The knowledge of the cellular morphology.
- The knowledge the cellular compartments and their function.
- The knowledge of the general principles of cellular metabolism.
- The knowledge of the molecular basis of hereditary information.
- The knowledge of the differences between mitosis and meiosis.
- The knowledge of the location of anatomical structures in space using the appropriate terminology.
- The knowledge the structure of the organs that make up the devices studied.
- The knowledge the structural relationships between the organs of an apparatus.
- The knowledge of correct genetic terminology
- The knowledge of the main inheritance models of monogenic, chromosomal and multifactorial diseases
- The knowledge of the main biological mechanisms that cause hereditary diseases
- The knowledge of the main methods useful in genetic analysis
- The understanding of how to reconstruct family pedigrees and to calculate disease recurrence
- The understanding of the major kinds of genetic testing and their proper use.



### Applying knowledge and understanding

At the end of the course the student should have acquired:

- The ability to apply the histology knowledge to understand other closely related branches of biology such as anatomy, cytology, physiology.
- the knowledge and methodological tools for the study of the biological bases of life, the knowledge of the experimental method and its applications to the study of fundamental biological phenomena
- Use the knowledge acquired for the in-depth study of aspects relating to the specific field to which the student will dedicate himself in the professional activity
- The capacity to analyse family history and to reconstruct pedigrees
- the ability to calculate disease recurrence risk

### Communication skills

At the end of the course the student should:

- Use correct scientific terminology to identify, at a microscopic level, the different types of cells and tissues present in the human organism.
- to describe a biological phenomenon and demonstrate that they have learned an appropriate scientific language for the purposes of correct and rigorous communication.
- Use specific scientific terminology appropriately
- the ability to describe the main models of inheritance and the disease recurrence risk with correct use of terminology

### Making judgements

At the end of the course the student should:

- Carry out rough assessments of the topics covered.
- acquire skills and methods of learning suitable for the deepening and updating of their proficiency in biology
- make general assessments of the topics covered
- have the ability to synthesize and correlate the various topics
- have a critical ability on the use of genetic tests for the molecular diagnosis of monogenic and chromosomal diseases or for the evaluation of genetic susceptibility to complex diseases

These expected learning outcomes are measurable with the final assessment

## **COURSE SYLLABUS**

### **HISTOLOGY:**

#### Preparation of tissues for histological analysis

- Microscopy, preservation of biological structures, stainings.

#### Epithelial tissues

- Classification of epithelia, polarity of epithelial cells, junctions, absorptive epithelia, glandular epithelia.

#### Connective tissues

- Connective tissue proper: extracellular matrix and connective cells. The different types of connective tissue proper. Adipose tissue. Blood and hematopoietic tissues. Supportive connective: cartilage and bone.

### Muscle tissue

- Skeletal muscle: structure of muscle fibers, contraction mechanism, diversity of muscle fibers. Cardiac muscle: structure of cardiomyocytes and myocardial conduction mechanism. The smooth muscle.

### Nervous tissue

- The neuron. Glial cells. Myelinated and unmyelinated nerve fibers. General structure of the nerves.

## **BIOLOGY**

- Characteristic of living cells: Cellular theory. Classification principles of living organisms.
- Prokaryotic and eukaryotic cell models: classification and major structural differences.
- Cell Chemistry: Macromolecules: structure, shape and function
- Plasma membrane: properties and functions.
- Internal organization of the cell: Cellular compartments. Cytoplasm and cytoplasmic organelles, ribosomes, smooth and rough endoplasmic reticulum, Golgi apparatus, lysosomes, peroxisomes.
- The cytoskeleton. Microtubules, intermediate filaments and microfilaments. Cilia and flagella. Centrioles and centrosomes.
- Energy conversion: Glycolysis, fermentation, cellular respiration, photosynthesis. (outline). Mitochondria and Chloroplasts, structure and function.
- Molecular basis of hereditary information: DNA replication. DNA repair and its correlation with human diseases.
- RNA, structure and function: Main types of cellular RNAs and differences with respect to DNA in terms of molecular size, stability and biological functions. Transcription and RNA maturation.
- Genetic Code and its properties. Protein synthesis: How cells read the genome. Main post-translational modifications of the polypeptide chains.
- Post-synthetic fate of proteins, endomembranes and membrane traffic: Endocytosis and exocytosis.
- Cell Cycle, Mitosis and Meiosis

## **ANATOMY**

- Introduction
- General (General Anatomy).
- Locomotor apparatus (general information on osteology, arthrology, myology).
- Cardiovascular system(morphology and structure of the heart and large vessels).
- Lymphatic circulatory system and lymphoid organs(morphology and structure: general, pulmonary circulation, main lymphatic trunks).



- Respiratory system (morphology and structure: upper airways, lungs, pleurae, mediastinum).
- Digestive system (morphology, structure: pharynx, esophagus, stomach, small and large intestine, liver and biliary tract, pancreas).
- Urinary system (morphology and structure: kidney and urinary tract).
- Male and female genital apparatus (morphology and structure: testis, epididymis, vas deferens, ejaculatory duct, seminal vesicles, prostate, ovary, uterine tube, uterus and vagina).
- Nervous system (brief notes on the sensory and motor pathways, spinal cord, brainstem, cerebellum, diencephalon and telencephalon).

## MEDICAL GENETICS

- Basic Genetics: Definitions of Key Terms: gene, locus, allele, genotype, phenotype, haplotype, homozygous, heterozygous, haploid, diploid, dominance, recessivity, codominance, mutation, polymorphism.
- Principles of Genetic Transmission: Mendel's Genetic Hypothesis, The Monohybrid and dihybrid Crosses, Segregation in Human Pedigrees, Blood groups Genetics
- Monogenic Inheritance Models: Autosomal inheritance, Autosomal recessive inheritance, X-linked inheritance
- Genetic Risk calculation and pedigrees. Hardy-Weinberg equilibrium
- Chromosomes: Structure and Analysis, Chromosomes Pathologies
- Genomic Imprinting and X-chromosome inactivation
- Mitochondrial inheritance: mitochondrial DNA, pattern of inheritance
- Multifactorial inheritance: polymorphisms, susceptibility genes, gene-environment interaction, association studies
- Pharmacogenomics and Personalised Medicine
- Old and new technologies in Genetics. Examples with clinical cases
- Genetic tests and Counselling. Outlines

## COURSE STRUCTURE

The integrated course consists of 8 CFU, 2 CFU for each module, for a total of 80 hours. Attendance is mandatory.

The Histology course is structured in 10 hours of frontal teaching and 10 hours of lab practice (divided into lessons of 2 or 4 hours according to the academic calendar). During frontal teaching the Professor uses Power Point presentations and images of histological preparations obtained with an optical microscope and electronic and audio-visual media. In the hours of lab practice the student will be in the histology laboratory and will know the different instruments, such as microscopes, hoods, incubators, and will follow the activities of the laboratory.

The Biology module is structured in frontal lectures, for a total of 20 hours. The teacher uses educational tools such as presentations organized in powerpoint files with explanatory diagrams, illustrations and images taken from micrographies to describe the various cellular structures and

movies and animations to complement the processes described in class. The possibility of ongoing tests is provided for.

The Anatomy Teaching is structured in 20 hours of frontal teaching, divided into lessons of 2 or 3 hours according to the academic calendar. Lectures will include theoretical lessons on the topics covered.

The Genetics teaching is structured in 2 CFU with 20 hours of frontal lessons. Lectures will include theoretical lessons with power-point presentations and exercises (both in groups and alone).

### **COURSE GRADE DETERMINATION**

The acquisition of the expected learning results is ascertained through the exam. The student takes the tests of each module in a single session according to the methods listed below.

The Histology exam will be done in written form and will consist of about 30 multiple choice questions, for each correct answer a point will be awarded. The final score of the written test will be given by the sum of the partial scores assigned to each question answered correctly.

All the contents of the course are subject to evaluation.

In the evaluation, knowledge and understanding has a weight of 40%, applied knowledge and understanding of 40% and independent judgment of 20%

The Biology exam consists in a written test, organised into 30 multiple-choice questions. Each question consists of 5 answers of which only one is correct. Each correct answer is given a score of 1, each wrong answer is given a score of 0 (there is no penalty for wrong answers). If the written test has resulted in a sufficient grade, the student is given the opportunity to improve the grade obtained by an oral test.

In the evaluation, knowledge and understanding has a weight of 50%, applied knowledge and understanding of 30% and independent judgment of 20%

The Anatomy verification will take place with a written exam followed by an oral exam. The written test will consist of 30 questions with multiple choice answers, for each correct answer a point will be assigned. The final score of the written test will be given by the sum of the partial scores assigned to each question answered correctly.

To access the oral exam the student must have totalled at least a minimum of 18 points. During the oral exam, the examining committee will assess the student's ability to apply the knowledge and ensure that the skills are adequate to support and solve problems of an anatomical nature.

In the evaluation, knowledge and understanding has a weight of 50%, applied knowledge and understanding of 30% and independent judgment of 20%

The Genetics teaching will be assessed through a written exam held at the end of the course, in which the student answers to multiple choice questions on topics presented during lectures. The written test will consist of 30 questions with multiple choice answers, for each correct answer a 1 point will be assigned. The final score of the written test will be given by the sum of the partial scores assigned to correct answers. Oral exam is optional. To access the oral exam student must have obtained at least a minimum of 15 points at the written test (15/30). The minimum score to

pass the exam is 18/30. In the evaluation, knowledge and understanding has a weight of 40%, applied knowledge and understanding of 40% and independent judgment of 20%

In the final assessment, the weighted average of the teaching modules will be made

### **OPTIONAL ACTIVITIES**

In addition to the didactic activity, the student will be given the opportunity to take advantage of tutoring activities upon request.

### **READING MATERIALS**

The lessons will be provided to students in pdf format.

#### Reccomended books

##### **HISTOLOGY:**

- William Bloom, Don W. Fawcett, "Elementi di istologia", II edizione a cura di V. Cimini, CIC Edizioni Internazionali.

##### **BIOLOGY:**

- Sadava, Hillis, Heller, Hacker. Elementi di Biologia e Genetica Zanichelli editore, V ed.
- Raven, Johnson, Mason, Losos, Singer. Elementi di Biologia e Genetica Piccin editore II ed.

##### **ANATOMY:**

- Martini et al. Anatomia Umana, VII edizione - Edises;
- Seeley et al. Anatomia, II edizione - Idelson-Gnocchi
- Montagnani et al. Anatomia Umana Normale - Idelson-Gnocchi

##### **GENETICS:**

- Nussbaum, McInnes, Willard "Genetica in Medicina", Edises
- Dallapiccola, Novelli. "Genetica Medica Essenziale" Cic editore

### **STUDENT RECEPTION**

The teacher will reply to all booking requests that will arrive via e-mail. Receive by appointment.

Prof. ssa Cinzia Ciccacci

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