

Physiology

1. language

Italian

2. Course Contents

Coordinator: **Prof. Claudio Grassi**

Year Course: II; 2022/2023

Semester: 2°

UFC: 10

Modules and lecturers:

- PHYSIOLOGY I (6 UFC) - Prof. Cristian Ripoli

- PHYSIOLOGY II (4 UFC) - Prof. Claudio Grassi

3. bibliography

Suggested books:

-Conti F. - Fisiologia Medica, Edi-Ermes

-Boron W.F., Boulpaep E.L. – Fisiologia Medica, Edra

-Berne R.M. e Levy M.N. Fisiologia, Casa Ed. Ambrosiana

4. LEARNING OBJECTIVES

The course aims to give the student a sound understanding of the functions of the human body, the molecular and cellular mechanisms underlying the functioning of the various organs and systems and the main processes of integration, regulation and homeostatic control.

The training activities will allow the student to acquire the skills for evaluating and interpreting the main functional parameters in humans under physiological conditions. This knowledge will provide the students with a physiological reference framework necessary for understanding the disciplines that will follow during their studies.

Knowledge and understanding - The student must demonstrate knowledge and understanding of the molecular and cellular mechanisms underlying the functions of various organs and systems.

Applied knowledge and understanding skills - The student must demonstrate the ability to adequately interpret and understand the possible implications of the knowledge acquired in clinical fields. The student should also demonstrate an ability to perform instrumental investigations for the assessment of physiological parameters covered by the training and an understanding of the principles underlying these methods.

Personal judgment – The student must develop autonomous skills in understanding the functional integrations between different apparatuses under physiological conditions and predict the body's responses to their modifications.

Communication skills – The student should be able to describe and communicate the acquired information using appropriate terminology.

Learning ability – The student must be able to update and expand his knowledge by consulting textbooks, scientific articles and online platforms. Students are also expected to be able to self-

evaluate their skills.

5. PREREQUISITES

Students must have acquired knowledge of basic disciplines such as: Physics, Chemistry, Biology, Biochemistry and Human Anatomy.

6. TEACHING METHODS

Teaching will mainly consist of classroom lessons. The topics listed in the program will be presented in a context preparing students for their future professional roles. Therefore, when possible, clinical examples and references to medical therapy will be used to illustrate physiological principles.

The course also includes the following teaching activities:

1) Theoretical-practical activities, organized in small groups, will enable the student to observe, learn and perform instrumental evaluations of physiological parameters, such as:

- Electrocardiogram
- Blood pressure measurement
- Spirometry
- Visual field and visual acuity

2) Internship in Physiology (optional; 0.5 - 1 UCF)

The internship allows students to be involved in research activities performed in the laboratories of the Physiology Section of the Department of Neuroscience, for a period of six (0.5 UCF) or twelve months (1 UCF).

7. other information

N/A

8. methods for verifying learning and for evaluation

The exam consists of an oral test verifying the knowledge of the topics covered in the course. Passing the exam requires a minimum grade of 18/30. A student who fully answers all questions and has achieved excellent results in the professional training achieves the maximum score (grade: 30/30 with honors).

The requirements for achieving the maximum score (30/30 with honors) are:

- Fully comprehensive answers to the questions
- A critical view of the interactions between different physiological mechanisms
- Excellent expository skills with reference to the terminology and logical framework of the topics covered
- Full understanding and excellent skill acquired in theoretical-practical activities

9. program

PHYSIOLOGY I

Cell physiology:

- Ion channels and electrogenesis
- The resting membrane potential

- Genesis and propagation of the action potential
- Synaptic transmission: neurotransmitters, transporters and receptors
- Postsynaptic potentials and their integration
- Synaptic plasticity

Autonomic and Central Nervous system:

- Functional organization of the nervous system
- Orthosympathetic system: functions, neurotransmitters and receptors
- Parasympathetic system: functions, neurotransmitters and receptors
- Functional organization of sensory systems
- Limbic system and memory

Muscle system:

- Skeletal muscle: excitability, neuromuscular transmission, end-plate potential and action potential
- Excitation-contraction coupling in skeletal muscle
- Muscle twitch and tetanus
- Energetics of muscle contraction; muscle fatigue
- Smooth muscle: structure, function, coordination mechanisms, regulation and control of contraction, latch-state

Endocrine and Reproductive system:

- General aspects of the endocrine function
- Hypothalamic-pituitary axis: neurohypophyseal and adenohypophyseal hormones
- Thyroid hormones
- Adrenal hormones
- Male reproductive system
- Female reproductive system

Gastrointestinal system:

- Functional anatomy and general principles of the gastrointestinal tract
- Enteric nervous system
- Motility of the gastrointestinal system
- Secretions of the gastrointestinal system: mechanisms of regulation
- Digestion and absorption of carbohydrates, lipids and proteins
- Energy intake, utilization and storage

PHYSIOLOGY II

Cardiovascular system:

- Blood: general characteristics and hemostasis
- Action potential of cardiac cells; functions of the specific conducting tissue
- Electrocardiogram
- Cardiac muscle: excitation-contraction coupling
- Mechanical properties of cardiac muscle cells
- Cardiac cycle: pressures and flow
- Heart work
- Relationships between cardiac output, contractility, venous return, and atrial pressure
- Action of orthosympathetic and parasympathetic systems on heart
- Measurement of cardiac output
- Blood pressure and short-, medium- and long-term regulatory mechanisms
- Vascular elasticity and compliance; Laplace's law
- Microcirculation: architecture, function, diffusion and filtration
- Lymphatic architecture and function
- Venous return

Sistema respiratorio

- Functional organization of the respiratory system
- Functions of the upper airways
- Lung volumes and capacities
- Respiratory muscles
- Role of the pleural cavity
- Mechanics of ventilation
- Elastic resistances of the respiratory system and role of surfactant
- Static pressure/volume curves and compliance of the lung, thorax, and thoraco-pulmonary system
- Non-elastic resistances of the respiratory system
- Respiratory work
- Alveolus-capillary gas exchanges
- Transport of O₂ and CO₂ in the blood
- Ventilation/perfusion ratio
- The role of respiration in the regulation of acid-base equilibrium
- Nervous control of ventilation
- Chemical control of ventilation

Renal system:

- Water-salt balance
- Functions of the kidney and role of the various components of the nephron in urine formation
- Glomerular filtration and its regulation
- Renal clearance
- Mechanisms of reabsorption and secretion at the renal tubule
- Handling of the most important plasma components while passing through the kidney
- Water reabsorption: regulation of the osmolality of urine and body fluids
- Contribution of kidney to the control of blood pH
- Contribution of kidney to the regulation of blood volume and blood pressure
- Renal regulation and self-regulation
- Urination