Master's Degree in Medicine and Surgery

Integrated Course: **Physiology II**

SSD: BIOS-06/A, MEDF-01/B

Coordinator of Integrated Teaching: **Saviana Antonella Barbati**

Total number of credits: **10**

Module: **Physiology**

SSD: **BIO/09**

Number of credits (CFU) of the single module: **9**

Lecturer name:

Saviana Antonella Barbati	(1 CFU)	e-mail saviana.barbati@unicamillus.org
Francesco Di Lorenzo	(2 CFU)	e-mail francesco.dilorenzo@unicamillus.org
Roberto Colangeli	(2 CFU)	e-mail roberto.colangeli@unicamillus.org
Pietro Renna	(2 CFU)	e-mail pietro.renna@unicamillus.org
Andrea Vitali	(2 CFU)	e-mail andrea.vitali@unicamillus.org

Module: **Methods and didactics of sports activities**

SSD: **M-EDF/02**

Number of credits (CFU) of the single module: 1

Lecturer: Gabriele Pallone (1 CFU) email gabriele.pallone@unicamillus.org

PREREQUISITES

The treatment of the specific topics of the subject requires sufficiently in-depth knowledge of Anatomy, Medical Physics, Biology and Biochemistry.

LEARNING OBJECTIVES

The course aims to provide in-depth knowledge of the fundamental physiological mechanisms underlying bodily functions. It focuses on teaching students the principles of how the organs of the human body operate and how they dynamically integrate into systems. The course also aims to develop the ability to autonomously apply knowledge of organ and system functioning mechanisms to situations where functional alterations may occur. Students will also be required to understand the main indicators and normal parameters of body functions, as well as the associated measurement methods. These objectives will be achieved through lectures, seminars, and interactive teaching activities designed to facilitate learning and improve problem-solving skills in System Physiology and Applied Physiology.

EXPECTED LEARNING OUTCOMES

1. Knowledge and understanding

Through the topics covered, students will be provided with both conceptual and methodological tools to begin the autonomous study of human physiology. This will involve acquiring knowledge and understanding of the physiological principles that govern the functioning of the body's systems. Students will demonstrate an understanding of organ functions and develop the ability to integrate physiological knowledge from the cellular and molecular levels to the systems of organs. They will also gain an understanding of how vital functions adapt to physical activity. Additionally, students will learn to evaluate the consequences of alterations at the organ level on the overall functioning of the human body.

2. Ability to apply knowledge and understanding

By the end of the course, students will be able to independently apply their knowledge of organ and system functioning mechanisms to situations involving potential functional alterations, specifically within the context of their future professional field.

3. Making judgements

By the end of the course students should have acquired the knowledge necessary to describe the mechanisms underlying the functions covered and be able to independently and critically evaluate different perspectives on the problematic aspects of human physiology. They should also recognize the importance of a thorough understanding of these topics for a solid medical education and identify the essential role of theoretical knowledge in clinical practice.

4. Communication skills

At the end of the course, the student must have reached an appropriate organization of his own thought, around the different topics of the course, such as to allow him to orally expose the topics in an organized and coherent way, and with appropriate scientific language.

5. Learning skills

Students should be able to identify the potential applications of the skills acquired in their future careers and develop the communication skills necessary to effectively convey what they have learned.

TEACHING PROGRAM

PHYSIOLOGY II

Sensory Physiology
Visual System: Anatomy of the visual system, the eyes, photoreceptors, retina, connections between the eye and the brain, encoding of visual information in the retina, extrastriate visual cortex, and associative visual cortex. Auditory System: Anatomy of the ear, auditory pathway, and perception of sound characteristics. Vestibular System: Anatomy of the vestibular apparatus, receptor cells, and vestibular pathway. Olfactory System: Anatomy of the olfactory apparatus, transduction of olfactory information, and perception of odors. Gustatory System: Anatomy of the taste buds and taste receptor cells, perception of gustatory information, and gustatory pathway.

Characteristics and Functions of Blood

Plasma and serum. Blood elements. Red blood cells and white blood cells: formation, characteristics and functions. Platelets: formation, characteristics and functions. Haemoglobin and blood buffer systems. Mechanism of action of Cyanocobalamin, Folic Acid and Iron. Blood groups.

Receptors involved in the function of blood elements. Haemostasis and coagulation: from physiology to clinical impact

Physiology of the Renal System and Urinary System

Development and structure of the kidney and urinary tract. Vascularization and blood pressure through the kidney. The nephron, Bowman's capsule, proximal tract, Henle's loop, distal tract, collecting tubules, collecting ducts: structure and functions. Elements of renal function: urine formation, haematopoiesis, general, hormonal and bone metabolism, electrochemical balance, blood volume, blood pressure (juxtaglomerular apparatus; intrinsic and extrinsic mechanisms on blood pressure control). Glomerular filtration rate, plasma filtration rate, and renal blood flow: from physiology to clinical impact. NET filtration pressure. Mechanism of filtration, secretion, reabsorption and elimination. Renal clearance. Tubular transport: mechanisms and measurements. Natriuretic peptides. Acid-base mechanisms and buffer systems. Acidosis and alkalosis

Physiology of the Digestive System

General principles of the function of the digestive system. Secretory functions of the digestive system. Motility. Role of the autonomic nervous system and gastrointestinal hormones. Digestion and absorption. Liver function.

Endocrine system

Hormones: mechanism of action. Pituitary hormones and their hypothalamic control. Thyroid. Adrenal gland. Growth control. Regulation of calcium and phosphate metabolism. Endocrine pancreas and glycaemic metabolism. Female reproductive system: ovarian cycle and menstrual cycle.

Thermoregulation and energy balance

Thermoregulation. Central and peripheral temperature, heat exchange mechanisms, neutral thermal zone, cold responses, heat responses, fever.
Definition of energy balance. Direct and indirect calorimetry. Protein calorie consumption deducted from urinary nitrogen. Calculation of basal and total metabolic rate. Caloric value of foods. Carbohydrate metabolism. Lipid metabolism. Protein metabolism. Metabolic actions of hormones. Basic metabolism.
Nutrition. Dietary requirements in particular conditions (pregnancy, breastfeeding, childhood, senescence, etc.). Mechanisms of hunger and satiety

Exercise-Induced Adaptations

Integrative Physiology - Homeostasis, allostasis, and functional integration in the physiological processes of the organism. Cardiovascular, respiratory, and neuromuscular adaptations to exercise and their integrative bases. Neuroendocrine regulatory mechanisms and their role in modulating the response to physical and psychological stress.

<u>METHODS AND DIDACTIC APPROACHES OF SPORTS ACTIVITIES</u>

- The “workout”; Principles of Training; Overload Components; Motor skills;
- ACSM GUIDELINES
- Energy sources: ATP production and re-synthesis: notes on muscle contraction; The anaerobic threshold and related training; The mechanisms of ATP re-synthesis. Capacity and power: limiting factors and methods of increase
- Supercompensation; Training planning;
- Train the Resistance; Train the Strength; Train the Speed; Train coordinative skills.

TEACHING METHODS

The course consists of 200 hours of lectures, organized into sessions of 2 or 4 hours, depending on

the academic calendar. The lectures include both theoretical lessons and supplementary seminars on the covered topics. Group work will also be part of the course, in which students will engage in the critical reading, comprehension, and discussion of a scientific article related to the course content. Additionally, the course will provide guidance on how to conduct a bibliographic search and effectively read and analyse scientific articles.

LEARNING ASSESSMENT METHODS

The students' preparation will be verified with a written exam followed by an oral test. The written test will consist of 30 questions with multiple choice answers, for each correct answer one point will be assigned. The final score of the written test will be given by the sum of the partial scores assigned to each correctly answered question. To access the oral exam, the student must have scored at least a minimum of 18 points. During the oral test, the Examining Committee will assess the student's learning ability as well as the ability to apply knowledge and will ensure that the skills are adequate to support and solve problems of a physiological nature (50% of the score). The following will also be evaluated: autonomy of judgment (25% of the score) and communication skills (25% of the score) as indicated in the Dublin descriptors. In particular, the exam will be evaluated according to the following criteria:

Failed: significant deficiencies and/or inaccuracies in knowledge and understanding of the topics; limited analytical and synthesis skills, frequent generalizations.
18-20: just sufficient knowledge and understanding of the topics with possible imperfections; sufficient analytical skills, synthesis and autonomy of judgment.
21-23: Knowledge and understanding of routine topics; Ability to correct analysis and synthesis with coherent logical argumentation.
24-26: Fair knowledge and understanding of the topics; good analytical and synthesis skills with rigorously expressed arguments.
27-29: Comprehensive knowledge and understanding of the topics; remarkable analytical and synthesis skills. Good autonomy of judgment.
30-30L: Excellent level of knowledge and understanding of the topics. Remarkable analytical and synthesis skills and autonomy of judgment. Arguments expressed in an original way.

RECOMMENDED TEXTS

- Guyton and Hall. MEDICAL PHYSIOLOGY. Edra Editions, 2021.
- F. Grassi, D. Negrini, C.A. Porro, P. Borroni, G. Cerri, M. Zoli. HUMAN PHYSIOLOGY. Second Edition. Poletto Editore, Gudo Visconti (MI), 2022.
- E.P. Widmaier, H. Raff, K.T. Strang VANDER – PHYSIOLOGY, Casa Editrice Ambrosiana, 2018.
- Essentials of Exercise Physiologydi William D. McArdle (Autore) , Frank I. Katch (Autore) , Victor L. Katch (Autore) Lippincott Williams and Wilkins, 2015
- Purves D.; Augustine G.J.; Fitzpatrick D; Hall W.C.; LaMantia A.-S.; White L.E. NEUROSCIENCE. (V Italian edition) Zanichelli 2021 (to be integrated for the Nervous System).
- Powers Scott K., Howley E. T., Exercise Physiology. Piccin publisher (to be integrated for M-EDF/02).
- Bazzano C, Bellucci M. PHYSICAL EFFICIENCY AND WELL-BEING: HOW TO LIVE BETTER AT ALL AGES. EMSI (to be integrated for M-EDF/02).
- AAVV – TRAINING THE ATHLETE/TEACHING SPORT – CONI/SDS (to be integrated for M-EDF/02).
- Weineck J. THE OPTIMAL WORKOUT. Calzetti and Mariucci editore (to be integrated for M-EDF/02).
- Di Giulio, Malaguti, Lorenzini;" Nutrition for sport and well-being"

SUPPORT ACTIVITIES

In addition to the teaching activity, the student will be given the opportunity to participate in Seminars, Research Internships, and laboratory attendance. The topics of the activities are not subject to examination.

OFFICE HOURS

The course teachers can be reached by appointment by e-mail.