

## Degree Course in Dentistry and Dental Prosthetics 2022/2023

**Course:** Physiology

**CFU Number:** 10

**SSD Course:** BIO/09

**Course Coordinator:** Prof. Sergio Delle Monache; email: [sergio.dellemonache@unicamillus.org](mailto:sergio.dellemonache@unicamillus.org)

### Professors:

- Prof. Sergio Delle Monache; email: [sergio.dellemonache@unicamillus.org](mailto:sergio.dellemonache@unicamillus.org)
- Prof.ssa Giuseppina Martella; email: [giuseppina.martella@unicamillus.org](mailto:giuseppina.martella@unicamillus.org)

### PREREQUISITES

The treatment of the specific topics of the course requires detailed knowledge of Anatomy, Medical Physics, Biology and Biochemistry.

### LEARNING OBJECTIVES

The course aims to provide the knowledge of the fundamental physiological mechanisms of human functions. The course includes the acquisition of knowledge on the operating principles of the organs that compose the human body, and their dynamic integration into apparatus. The course will allow to acquire the ability to independently apply the knowledge of organ and system functioning mechanisms to situations of potential functional alteration. Students will also need to know the main indicators and normal parameters of human physiological functions, and the related measurement methods. These objectives will be achieved through lectures, seminars and interactive teaching activities, aimed at facilitating learning and improving the ability to solve simple physiological problems.

### LEARNING OUTCOMES

#### **Knowledge and Understanding**

Conceptual and methodological tools will be offered for starting up the study of human physiology, through the acquisition of knowledge and understanding of the physiological principles that govern the function of the organism's systems. To demonstrate the knowledge of organ functions and to acquire the ability for integrating physiology from the cellular and molecular level to the organ and apparatus systems. Evaluate the consequences of alterations at organ level in the overall functioning of the human body.

#### **Applying Knowledge and Understanding**

At the end of the course, the student will have a broad and thorough knowledge of human physiology that will allow him to understand the mechanisms underlying the maintenance of homeostasis. Moreover, the student will be able to apply autonomously the knowledge of the mechanisms of functioning of different organs and systems to situations of potential functional alteration.

### **Communication Skills**

To orally present the topics in an organized and coherent way, using an adequate scientific terminology and compliant with the topic of the discussion.

### **Making Judgements**

At the end of the course the student will have acquired knowledge that will enable him/her to describe the mechanisms underlying the functions dealt with and to assess independently different opinions on problematic aspects of Human Physiology. To recognize the importance of a thorough knowledge of the topics covered for an adequate medical education.

### **Learning skills**

At the end of the course, the student should have acquired independent method for studying and updating through different kind of literature or through scientific literature.

## **COURSE SYLLABUS**

**INTRODUCTION TO PHYSIOLOGY AND HOMEOSTASIS:** Description of physiological mechanisms. Structure-Function relationships of the body. Levels of organization in the body. Concept of Homeostasis. Positive and negative feedback circuits. Homeostatic Control Systems.

**CELL PHYSIOLOGY AND PLASMA MEMBRANE:** Membrane transport of ions and molecules. Membrane potential and action potentials. Synapses and neuronal integration. Intercellular communication and signal transduction. Neurotransmitters.

**MUSCLE PHYSIOLOGY:** Motor unit, neuromuscular junctions. Excitation and contraction of skeletal muscle tissue. Skeletal muscle contraction and mechanics. Physiology of skeletal, smooth and cardiac muscle.

**PHYSIOLOGY OF THE NERVOUS SYSTEM:** Functional organization of central nervous system and peripheral nervous system. The peripheral nervous system: afferent and efferent divisions. Role of glia cells. Autonomic nervous system. Integrative functions of nervous system.

**SENSORY PHYSIOLOGY:** Visual system: anatomy of the visual system, the eyes, the photoreceptors, the retina, the connections between the eye and the brain, the coding of visual information in the retina, the extrastriate visual cortex, the associative visual cortex. Auditory system: ear anatomy, auditory pathway, perception of sound characteristics. Vestibular system: anatomy of the vestibular apparatus, receptor cells, the vestibular pathway. Olfactory System: anatomy of the olfactory system, transduction of olfactory information, perception of odors. Taste system: the anatomy of gustatory buttons and taste cells, the perception of gustatory information, the gustatory pathway.

**MOTOR PHYSIOLOGY:** General organization of the motor system. Spinal reflexes, walking, posture and equilibrium. Cortical control of movement. General characteristics and functional role of basal nuclei and cerebellum in motor modulation.

**CARDIAC PHYSIOLOGY:** Anatomy and electrical activity of the heart. Mechanical events of the cardiac cycle. Cardiac output and its control. General principles of hemodynamics. Blood vessels and blood pressure. Features and functions of the blood. Plasma composition. Red blood cells and white blood cells. Blood group and Rhesus factor. Hemostasis. Coagulation phase and coagulation factors. Mechanisms of coagulation.

**PHYSIOLOGY OF ENDOCRINE SYSTEM:** General principles of endocrinology. Principles of general functioning of hormones. Central and peripheral endocrine glands and their hormones. Hypothalamic-Pituitary Axis. Control of calcium and phosphate metabolism.

**PHYSIOLOGY OF RESPIRATORY SYSTEM:** Respiratory anatomy and mechanic. Gas exchange and transport of oxygen and carbon dioxide. Control of respiration. **PHYSIOLOGY OF URINARY SYSTEM:** Elements of renal function: kidney and nephron. Glomerular filtration. Tubular reabsorption and tubular secretion. Urinary tract. Ureter, bladder and urethra. Urine excretion and plasma clearance. Urination.

**FLUID AND ACID-BASE BALANCE:** Body-fluid compartments. Control of extracellular fluid volume and osmolarity by regulating salt and water balances. Sources of protons and consequences of variations of the concentration of protons. Chemical buffer systems. Respiratory and urinary control of pH.

**PHYSIOLOGY OF DIGESTIVE SYSTEM:** Digestive tract and accessory digestive organs. General aspects of digestion. Secretory function of digestive system. Motility of digestive tract. Nutrient digestion and absorption. Hepatobiliary function.

**THERMOREGULATION AND METABOLISM:** heat production and loss, factors that regulate body temperature. Introduction to Metabolism, Nutrition, and Energetics: catabolism, and anabolism. Glycolysis and aerobic metabolism. The pathways involved in lipid metabolism, and the mechanisms of lipid transport and distribution. The main processes of protein metabolism, and the use of protein as an energy source. Differences between the absorptive and postabsorptive metabolic states. Definition of metabolic rate and individual's BMR.

## **COURSE STRUCTURE**

The course is structured in 100 hours of frontal teaching, divided into theoretical lessons of 1-3 hours based on the academic calendar. In addition, the student will be involved in critical reading, understanding and discussion of a scientific article related to the topics covered in the teaching module. The course will also provide indications on how a bibliographic search should be made and on how to read a scientific article about the human physiology.

## **COURSE GRADE DETERMINATION**

The verification of the student preparation 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 totaled at least a minimum of 18/30 points. During the oral exam, the examining Commission will assess the student's learning skills as well as the ability to apply the knowledge and ensure that the skills are adequate to support and solve problems of a physiological nature (50% of the score). It will also be assessed: autonomy of judgment (25% of the score) and communication skills (25% of the score) as indicated in the Dublin descriptors.

## **OPTIONAL ACTIVITIES**

In addition to the didactic activity, the student will be given the opportunity to attend seminars, research internships, laboratory attendance. The topics of the activities are not subject to examination. Professors will provide support during and after classes at the student's request.

## **STUDENT RECEPTION**

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

## **READING MATERIALS**

- Berne & Levy “Physiology”, 7th Edition
- Sherwood, “Human Physiology: From cells to Systems”, 9th Edition
- Guyton-Hall, “Textbook of Medical Physiology”, 14th Edition
- Purves, “Neuroscience”, 6th Edition
- Sembulingam & Prema Sembulingam, “Essentials of Physiology for Dental Students (English Edition)”, 2nd Edition.