

Master's Degree in Dentistry and Dental Prosthetics 2023/2024

Teaching: Physiology

Scientific Disciplinary Sector: BIO/09

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Number of University Educational Credits (CFU): 10

Professors:

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PREREQUISITES

Physiology looks at functional and regulatory characteristics of our body (how it moves and interrelates). To better understand the matters of this course, basic scientific knowledge is essential, in particular organic chemistry, physics, biology, and elementary anatomy.

LEARNING OBJECTIVES

Physiology is an important subject for dentists who need to know not only the normal functioning of the stomatognathic apparatus but also all the processes that might be affected during the administration of drugs or anesthetics. It is also the dentist's job to know the patient's health status, the more they deviate from the physiological state, the more they indicate the need for a revision of possible treatments. Therefore, the course aims to provide to the students the full knowledge of the human body physiological functions. The course will guide the students through the comprehension of the molecular and cellular mechanisms underlying the various organs and systems' functions together with the description of the main processes integration, regulation and homeostatic control. Furthermore, it will be explained the relationship existing between the different anatomical structures and their function both in physiological and altered conditions will be provided.

Students will also have 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

Through the course we will provide all the conceptual and methodological resources to understand the basis of human physiology processes. Therefore students have to be able to:

- demonstrate the knowledge of basic cellular physiological functions (cell permeability, protein synthesis, homeostasis, transport,..)
- Have the ability to integrate physiology concepts to organs and apparatus systems from a cellular and molecular point of view.
- know the adaptations of the vital functions of the human body in response to metabolism, responsiveness, physical activity, and life processes.

- Evaluate the consequences of alterations at organ level in the overall functioning of the human body.
- Evaluate the consequences of alterations at cellular and organ level in a healthy 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 related to the specific field to which students will exert the professional activity.

Communication skills

At the end of the course the student must be able to orally present the topics in an appropriate organized and coherent way, using an adequate scientific language and terminology.

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: Description of physiological mechanisms. Structure-Function interactions in human body. Concept of Homeostasis and Homeostatic Control Systems. Positive and negative feedback circuits.

CELL PHYSIOLOGY AND PLASMA MEMBRANE: Cell Structure, Biomolecules, Protein Synthesis. Membrane structure and permeability. Transport of ions and molecules and membrane potential. Mechanisms of Intercellular Communication.

PHYSIOLOGY OF NERVE CELLS Neuronal cell physiology and generation of action potentials. Synapses and neuronal integration. Intercellular communication and signal transduction.

PHYSIOLOGY OF THE NERVOUS SYSTEM: Functional organization of central nervous system and peripheral nervous system. Autonomic nervous system. Integrative functions of nervous system.

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.

MOTOR PHYSIOLOGY: General organization of the motor system. Involuntary Movement Through Reflexes. Integrated CNS function: voluntary motor control: walking, posture, and equilibrium. Cortical control of movement. Role of basal nuclei and cerebellum in motor control.

SOMESTESIA: PROPRIOCEPTION AND PAIN. Classification of sensory systems. Sensory transduction: mechanoreception. Classification of receptors. Cutaneous touch receptors

SENSORY PHYSIOLOGY: Differences between special senses and ordinary senses. Visual system: anatomy of the visual system, the photoreceptors and the retina, the connections between the eye and the brain, the coding of visual information in the retina, the extra-striate 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, and 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.

BLOOD PHYSIOLOGY: Features and functions of the blood. Hematopoiesis. Plasma composition. Red blood cells and white blood cells. Blood group and Rhesus factor. Hemostasis. Coagulation phase and coagulation factors. Mechanisms of coagulation.

CARDIAC PHYSIOLOGY: Anatomy and electrical activity of the heart. Mechanical events of the cardiac cycle. Cardiac output and its control. General principles of hemodynamics. Law of hemodynamics Blood vessels and blood pressure.

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. Urine contents and examination methods.

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.

PHYSIOLOGY OF RESPIRATORY SYSTEM: Respiratory anatomy and mechanic. Gas exchange and transport of oxygen and carbon dioxide. Control of respiration.

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.

STOMATOGNATHIC SYSTEM: Function and interaction of the teeth, jaws, and associated tissues, muscles involved in chewing and swallowing, and teeth.

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.

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 student preparation will be verified with a written exam followed by an oral evaluation. 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.

The knowledge will be evaluated following the scores as indicated here below:

- Inadequate: significant deficiencies and/or inaccuracies in knowledge and understanding of subjects; wrong concepts and/or very limited analysis and synthesis skill.
- 18-20: knowledge and understanding of the topics just sufficient with imperfections; Sufficient analytical, synthesis and independent judgment skills.
- 21-23: knowledge and understanding main topics; analysis and synthesis skills correct with coherent logical argument.
- 24-26: fair knowledge and understanding of the topics; good analytical skills and summary with rigorously expressed arguments.
- 27-29: complete knowledge and understanding of the topics; remarkable analytical skills, synthesis. Good independent judgement.
- 30-30L: excellent level of knowledge and understanding of the topics. Remarkable capabilities analysis and synthesis and independent judgement. Arguments expressed in an original way.

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

- Sherwood, "Human Physiology: From cells to Systems", 9th Edition
- Guyton-Hall, "Textbook of Medical Physiology", 14th Edition
- Purves, "Neuroscience", 6th Edition
- Stanfield, Principle of Human Physiology, 5th Edition
- Netter's Atlas of Human Physiology, Sanunders Edition
- Essential Neuroscience 3rd Edition by Siegel, Allan (Author), Ph.D. Sapru, Hreday N. (Author), M.D. Siegel, Heidi E. (Contributor), Lipincott Edition
- Paterson. Author. Levick's Introduction to Cardiovascular Physiology. 6th Edition. CRC press.