Syllabus Master's Degree Course in Medicine and Surgery

BODY FUNCTIONS 1

Second year, first semester (11 academic credits [CFU])

Teachers

Subject	Academic credits (CFU)	Lecturer
Human physiology	6	VICARIO Nunzio
Organ structure	3	LEONFORTE Francesco
Biochemistry	2	AMORINI Angela Maria

Learning outcomes

Subject	Learning outcomes
Human physiology	By the end of the course, students are expected to: • Describe electrophysiological and functional mechanisms of the central, peripheral, vegetative nervous system, and endocrine system. • Understand the foundations of motor function and integrated overall motor control. • Demonstrate solid neurobiological knowledge of behavioural, cognitive and emotional interactions between the subject and the environment. • Know the classification of hormones and endocrine control, to describe mechanisms of hormone action and homeostasis of hormonal regulation. At the end of the course the student will understand the physiological processes at the basis of sensory and motor functions, integration of signals, brain activity and behaviour.
Organ structure	By the end of the course, students are expected to: • Describe the anatomy and functional mechanisms of the cardiovascular system • Understand the structural organization of the lymphatic circulatory system and its integration with the cardiovascular system • Demonstrate solid knowledge of the lymphoid and hematopoietic organs and their roles in immune function • Explain the structure and functional dynamics of the respiratory system At the end of the course, the student will understand the topography, structural organization, and functional integration of the

	cardiovascular, lymphatic circulatory, and respiratory systems, as well as the spatial relationships of organs within these systems.
Biochemistry	By the end of the course, students are expected to: • Understand the assumption, conversion and utilization of sugars in normal and pathological conditions. • Understand the assumption, conversion and utilization of storage lipids in normal and pathological conditions • Understand the assumption, conversion and utilization of amino acids in normal and pathological conditions At the end of the course, the student will understand the main processes of conversion of macromolecules, in terms of chemical reactions, energetic balance and molecular interactions dependent on the needs of the healthy organism and the deviations of metabolic pathways in pathological conditions.

Prerequisites

Subject	Prerequisites
Human physiology	Attainment of the educational objectives set by prerequisite courses.
Organ structure	
Biochemistry	

Course contents

Subject	Course contents
Human physiology	**Central Nervous system** • Organization of the Nervous System, Basic Functions of Synapses, and Neurotransmitters • Sensory Receptors, Neuronal Circuits for Processing Information • Somatic Sensations: General Organization, the Tactile and Position Senses • Pain, Headache, and Thermal Sensations • Foundations of vision, hearing, taste and smell • Motor Functions of the Spinal Cord; the Cord Reflexes • Cortical and Brain Stem Control of Motor Function • Contributions of the Cerebellum and Basal Ganglia to Overall Motor Control • Cerebral Cortex, Intellectual Functions of the Brain, Learning, and Memory • Behavioural and Motivational Mechanisms of the Brain • Brain Activity, Sleep, Brain Waves, Epilepsy, Psychoses, and Dementia • The Autonomic Nervous System and the Adrenal Medulla • Cerebral Blood Flow, Cerebrospinal Fluid, and Brain Metabolism **Endocrine system** • Hormone Overview: Definition and classification of hormones. Hormone biosynthesis, secretion, and transport. Hormonal activation and inactivation. Mechanisms of hormone action. Homeostasis of hormonal regulation.

	Hormonal interactions. Neuroendocrinology. Functional anatomy of the hypothalamus, pituitary gland, and ependymal organs of the third ventricle. Brief notes on pathophysiology. • Thyroid Gland: Functional anatomy. Iodine metabolism. Regulation of thyroid function. Thyroid hormones and their physiological effects. Interaction of the thyroid with other endocrine systems. Brief notes on pathophysiology. • Adrenal Cortex: Functional anatomy. General steroid biosynthesis. ACTH. Glucocorticoids. Mineralocorticoids. Adrenal sex steroids. Brief notes on pathophysiology. • Calcium and Phosphate Metabolism: Calcium, phosphate, and other skeletal ion metabolism. Bone physiology. Parathyroid hormone (PTH). Calcitonin. Vitamin D. Other hormones influencing mineral and bone homeostasis. Brief notes on pathophysiology. • Endocrine Pancreas: Functional anatomy. Beta cells and insulin. Insulin functions. Alpha cells and glucagon. Mechanism of action of glucagon. Relationships between pancreatic glucagon and enteroglucagon. Delta cells and somatostatin. Brief notes on pathophysiology. • Prostaglandins: Endocrine role.
Organ structure	• Overview of the Cardiovascular System: Structure and function of blood and lymph circulation. Classification of blood and lymphatic vessels. Detailed anatomy of the mediastinum. Heart: location, size, shape, and external configuration; internal cavities and valves. Structural components of the heart walls, including the fibrous skeleton, atrial and ventricular musculature, epicardium, and endocardium. Cardiac conduction system. Vascularization and innervation of the heart. Anatomy and function of the pericardium. • Systemic Circulation: Aorta and its branches, including distribution patterns and anastomoses. • Pulmonary Circulation and Venous Return: Superior vena cava and associated structures, including deep and superficial veins of the upper limb, jugular veins, dural venous sinuses, azygos veins, and collateral circulation. Inferior vena cava, deep and superficial veins of the lower limb, and afferent roots. • Organization of the Lymphatic Circulatory System: Functional roles and topographic classification of lymphatic vessels. • Lymphoid and Hematopoietic Organs: Structure and function of the thymus, spleen, lymph nodes, mucosa-associated lymphoid tissue, and bone marrow. • Respiratory System: Anatomy of the external nose, nasal cavity, and paranasal sinuses. Pharynx, larynx, trachea, bronchi, lungs, and pleurae.
Biochemistry	METABOLIC BIOCHEMISTRY (PART 2) • Gluconeogenesis. Mechanism of action of adrenaline, glucagon and insulin. Metabolism of fructose, lactose and galactose. Pentose phosphate pathway: role of NADPH in metabolism. Malic enzyme and NADP+ reduction. Favism. • Glycogen synthesis and degradation. Regulation of hepatic and muscular glycogen metabolism.

	• Lipid digestion; pancreatic lipase; bile salts; micelles and intestinal absorption of lipids; composition of pancreatic juice; composition of bile; Oxidation of fatty acids (role of carnitine, chemical reactions, energy yield, oxidation of fatty acids with odd numbers of carbon atoms and role of vitamin B12, oxidation of unsaturated fatty acids, peroxisomal beta-oxidation, alpha-oxidation). Lipolysis, adilytic lipase and its regulation. Biosynthesis of ketone bodies; utilization of ketone bodies; diabetic ketoacidosis. • Protein digestion: mechanism of HCl secretion in the stomach; protease gastric (pepsin); pancreatic proteases (trypsin, chymotrypsin, elastase, carboxypeptidase); intestinal peptidases (aminopeptidases, tripeptidases, dipeptidases); intestinal absorption of amino acids Essential and non-essential amino acids. Nitrogen balance, minimum protein requirement daily, biological value of proteins Catabolism of amino acids: oxidative desamination and transamination of amino acids; glutamine synthetase, glutaminase and glutamine functions; alanine and cycle "muscle-liver"; elimination of nitrogen in various animal species; urea cycle; correlation between the urea cycle and the tricarboxylic acid cycle; glucogenic amino acids e ketogenic.

Assessment methods

Subject	Assessment methods
Human physiology Organ structure Biochemistry	The assessment of acquired knowledge is carried out through a written exam consisting of 60 true/false questions covering 15 topics from the curriculum. Each correct answer is awarded 1 point, each incorrect answer deducts 1 point, and unanswered questions receive zero points. The minimum score to be admitted to the oral exam is 27 out of 60. This score is then converted on a scale of thirty, up to a maximum of 30/30 cum laude (with honours) upon oral assessment. The final assessment of acquired knowledge is conducted by an oral examination. The grade is expressed on a scale of thirty, up to a maximum of 30/30 cum laude (with honours). The final grade is determined by the weighted average of the scores obtained in the course subjects. The oral examination consists of an interview during which questions will cover at least three different topics from the course curriculum. The assessments aim to evaluate: i) the level of knowledge in the disciplines; ii) the ability to apply this knowledge to solve specific problems related to the disciplines (autonomous problem-solving); iii) clarity of expression; iv) proficiency in medical-scientific language. The assessment of learning can also be conducted remotely if the conditions necessitate it. For the assignment of the final grade, the following parameters will be considered: • Score 29-30 with honours: The student demonstrates an in-depth knowledge of the topics, promptly and correctly integrates and critically analyses presented situations, independently solving even highly complex problems. They possess excellent communication skills and command medical-scientific language proficiently.

	• Score 26-28: The student has a good understanding of the topics, is able to integrate and critically and logically analyse presented situations, can fairly independently solve complex problems, and presents topics clearly using appropriate medical-scientific language. • Score 22-25: The student has a fair understanding of the topics, although it may be limited to the main areas. They can integrate and critically analyse presented situations, although not always in a linear fashion, and present topics fairly clearly with moderate language proficiency. • Score 18-21: The student has minimal knowledge of the topics, possesses modest ability to integrate and critically analyse presented situations, and presents topics sufficiently clearly, although their language proficiency may be underdeveloped. • Exam not passed: The student lacks the minimum required knowledge of the core content of the course. Their ability to use specific language is minimal or nonexistent, and they are unable to independently apply acquired knowledge. The final grade is determined by the weighted average of the scores obtained in Human physiology, Biochemistry and Organ structure.

Examples of common questions and/or exercises

Subject	Examples of common questions and/or exercises
Human physiology	• Describe how sensory receptors transduce stimuli into neural signals • Discuss the components and function of a basic reflex arc • Describe biosynthesis, secretion, and transport of thyroid hormones
Organ structure	• Describe the external morphology and key anatomical features of the heart • Explain the macroscopic and microscopic structure of lymph nodes • Describe the macroscopic and microscopic structure of the spleen and its functional significance
Biochemistry	• Control points and regulation in metabolism • Dysmetabolism in nutrients utilization • Main reactions of catabolic pathways

Reference texts

Subject	Textbooks
Human physiology	• Kandel ER et al. Principles of Neural Science, The McGraw-Hill Companies, Inc. • Hall, J. E. Guyton and hall textbook of medical physiology. W B Saunders. Any additional educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons. Any additional educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons.
Organ structure	• Anastasi et al., Human Anatomy, edi-ermes • Richard Drake A. Wayne Vogl Adam Mitchell. Gray's Anatomy for Students - Elsevier.

	• Susan Standring. Gray's Anatomy - The Anatomical Basis of Clinical Practice - Elsevier. Any additional educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons.
Biochemistry	• Devlin, T. M. Textbook of Biochemistry With Clinical Correlations, John Wiley and Sons. • David L. Nelson; Michael M. Cox. "Lehninger Principles of Biochemistry", W. H. Freeman & Co. • Voet D, Voet JG, Pratt CW. "Voet's Principles of Biochemistry, Global Edition", Wiley. Any additional educational material (slides, videos, handouts, etc.) will be distributed or indicated during the lessons.

Course format

Subject	Course format
Human physiology	The teaching will primarily be conducted through in-person lectures with a blend of theory and practical exercises. In the event that teaching is delivered in a blended or remote mode, necessary adjustments may be introduced compared to what has been previously stated, in order to adhere to the planned program as outlined in the Syllabus.
Organ structure	
Biochemistry	

Attendance

Subject	Attendance
Human physiology	Mandatory attendance.
Organ structure	
Biochemistry	

Course schedule

Subject	Course schedule
Human physiology	Program topics from recommended textbooks and handouts provided by the teachers.
Organ structure	
Biochemistry	