

HUMAN PHYSIOLOGY

Degree in Occupational Therapy 2026-27

Code: 804145

Type of subject: Basic

Grade: First

Semester: Check calendar

Department: Physiology

Credits: 9 ECTS

TEACHING STAFF

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COMPETENCE

These correspond to the Module and Subject to which this course belongs.

General Competencies

- GC.25

Specific Competencies

- SC.M1.1
- SC.M1.2
- SC.M4.2

OBJECTIVES

The main objective of this subject is to ensure that students understand how our organism functions.

- Understand the structure and function of cells and tissues and the interdependence between the body's systems.
- Know the control of different physiological systems by the autonomic nervous system.
- Describe blood elements and their functions, as well as those of the immune system.
- Understand the functioning of the heart and

different vessels, capillary exchange, and the regulation of cardiac function and blood pressure.

- Explain the basic functions of the respiratory system to understand the relationship between the structure and function of its components, pulmonary ventilation, gas exchange, and regulation of breathing.
- Explain the basic functions of the kidney and urinary system to understand the relationship between the structure and function of its components, glomerular filtration, regulatory functions of the kidney, and micturition.
- Understand the functioning of the gastrointestinal system, studying the functions of digestion, secretion, motility, and absorption that occur in each section of the digestive system.
- Integrate the role played by the different axes of the endocrine system as regulators of many physiological processes.
- Describe the general functional organization of the nervous system as a regulatory system.

- Study the basic characteristics of nervous tissue and neurons: membrane potential and synaptic transmission.
- Understand the organization and function of sensory systems and basic perception mechanisms: sensory transduction, receptor fields, sensory threshold, and sensory maps (somatotopic, retinotopic...).
- Describe the general characteristics of different sensory modalities: somesthesia and special senses (taste, smell, hearing, balance, vision).
- Understand the general functional organization of motor control systems.
- Study the basic characteristics of muscle contraction and the motor unit.
- Describe the general characteristics of the different areas involved in somatic motor system control: spinal cord, brainstem, cerebral cortex, basal ganglia, and cerebellum.
- Study the regulatory systems of the wake-sleep cycle.
- Understand the neurobiological mechanisms of learning and memory. Know the different memory systems.

PROGRAM

THEORETICAL

DIDACTIC UNIT I: GENERAL PHYSIOLOGY

- **Topic 1.** Introduction to human physiology: Concept. Levels of organization of the human body. The internal environment. Homeostasis and control systems.
- **Topic 2.** Body fluids: Composition and distribution of body fluids. Differences between intracellular and extracellular fluid. Concept of osmolarity.
- **Topic 3.** Electric membrane potential: Difference in electric charge between the inside and outside of the cell. Role of ions and

membrane permeability.

- **Topic 4.** Nervous action potential: Phases of the action potential and its characteristics.
- **Topic 5.** Synaptic transmission: Communication between neurons or with other cells. Role of neurotransmitters.
- **Topic 6.** Autonomic nervous system: Organization of the nervous system. Structure of the autonomic nervous system. Parasympathetic and sympathetic systems. Functions of the autonomic nervous system.

DIDACTIC UNIT II: HEMATOLOGY

- **Topic 1.** Properties of blood: Functions, composition, and hematopoiesis.
- **Topic 2.** Erythrocytes: Structure and function. Erythropoiesis. Life cycle of erythrocytes. Regulation of erythropoiesis.
- **Topic 3.** Leukocytes and immunity: Types and formation of leukocytes. Functions. Innate or non-specific immunity: phagocytosis, inflammation, NK cells, fever. Specific immunity: humoral and cellular immunity. Blood groups.
- **Topic 4.** Platelets and hemostasis: Platelets. Hemostasis. Formation of the platelet plug and fibrin networks. Fibrinolysis.

DIDACTIC UNIT III: CARDIOVASCULAR SYSTEM

- **Topic 1.** Introduction to the cardiovascular system: Elements, heart valves, and functional structure. Flow in the cardiovascular system. Arrangement of systemic circulation. Differences in perfusion of various organs.
- **Topic 2.** Cardiac electrical activity: Cardiac muscle. Pacemaker cells. Propagation of cardiac electrical activity. Contraction sequence. Electrocardiogram.
- **Topic 3.** Cardiac cycle and stroke volume: Cardiac cycle. Cardiac output and its regulation.

- **Topic 4.** Arterial system: Functional structure of the arterial wall. Distensibility and elasticity. Arterioles. Blood pressure, dependent factors, and normal values.
- **Topic 5.** Venous circulation: Functional structure of veins. Venous return.
- **Topic 6.** Capillaries and lymphatic system: Structure and characteristics of capillaries. Capillary exchange. Lymphatic circulation.
- **Topic 7.** Cardiovascular regulation: Local regulation of blood flow. Short-term blood pressure regulation (arterial baroreceptors) and long-term regulation.

DIDACTIC UNIT IV: RESPIRATORY SYSTEM

- **Topic 1.** Mechanics of breathing: Pulmonary and alveolar ventilation.
- **Topic 2.** Gas exchange: Exchange of O₂ and CO₂: pulmonary and systemic circulation.
- **Topic 3.** Gas transport: Transport of O₂ and CO₂: the role of hemoglobin.
- **Topic 4.** Control of breathing: Neuronal respiratory centers.

DIDACTIC UNIT V: RENAL SYSTEM

- **Topic 1.** Introduction to the renal system: Structure of the kidney: the nephron as a functional unit.
- **Topic 2.** Basic functions of the kidney: Glomerular filtration, reabsorption, and secretion.
- **Topic 3.** Regulatory functions of the kidney: Renin-Angiotensin system and antidiuretic hormone.
- **Topic 4.** Micturition: Urinary apparatus. Collection and emission of urine. Micturition reflex.

DIDACTIC UNIT VI: DIGESTIVE SYSTEM

- **Topic 1.** General overview of the gastrointestinal tract: Components, structure, functions, and nutritional needs of the

organism.

- **Topic 2.** The oral cavity: Chewing. Components and function of saliva. Regulation of salivary secretion.
- **Topic 3.** Swallowing: Esophageal peristalsis. Regulation of the lower esophageal sphincter.
- **Topic 4.** The stomach: Composition, functions, and regulation of gastric secretion. Gastric motility. Regulation of gastric function.
- **Topic 5.** The exocrine pancreas: Composition and regulation of pancreatic secretion.
- **Topic 6.** The liver: Composition of bile. Regulation of biliary secretion.
- **Topic 7.** The small intestine: Structure. Intestinal secretion: composition and regulation. Motility and intestinal reflexes.
- **Topic 8.** Absorption of nutrients: Absorption of water, electrolytes, carbohydrates, proteins, lipids, and vitamins.
- **Topic 9.** The large intestine or colon: Secretion and absorption in the colon. Motility. Defecation.

DIDACTIC UNIT VII: ENDOCRINE SYSTEM

- **Topic 1.** Introduction to the endocrine system: Types of cellular communication. Types of hormones. Regulation of hormonal secretion.
- **Topic 2.** Endocrine pancreas: Physiological actions and regulation of insulin and glucagon secretion. Regulation of glycemia. Diabetes mellitus.
- **Topic 3.** Parathyroid hormone and Vitamin D: Physiological actions and regulation. Regulation of calcemia.
- **Topic 4.** Neurohypophyseal hormones: ADH and oxytocin. Functions and regulation of oxytocin secretion.
- **Topic 5.** Adenohypophysis: Functional structure and endocrine axes. Prolactin and

growth hormone: physiological actions and regulation. Frequent pathologies.

- **Topic 6.** Hypothalamic-pituitary-thyroid axis: Structure of the thyroid gland. Biosynthesis and biological actions of thyroid hormones. Regulation and frequent pathologies.
- **Topic 7.** Hypothalamic-pituitary-adrenal axis: Structure of the adrenal glands. Adrenal steroids. Glucocorticoids: functions and regulation. Adrenal medulla: adrenaline actions and regulation.
- **Topic 8.** Hypothalamic-pituitary-testicular axis: Male reproductive system. Spermatogenesis and testicular steroidogenesis. Androgen actions and axis regulation.
- **Topic 9.** Hypothalamic-pituitary-ovarian axis: Female reproductive system. Oogenesis and ovarian steroids. Menstrual cycle and its regulation. Actions of estrogens and progestogens. Contraception, pregnancy, lactation, puberty, and menopause.

DIDACTIC UNIT VIII: NERVOUS SYSTEM

- **Topic 1.** Introduction to the nervous system: Functional organization: sensory and motor systems.
- **Topic 2.** Nervous tissue: General characteristics of nervous tissue and neurons: membrane potential and synaptic transmission.
- **Topic 3.** Introduction to sensory physiology: Functional organization of sensory systems. Sensory modalities. Receptors: classification and transduction. Coding and perception: receptor fields, thresholds, and maps.
- **Topic 4.** The somatosensory system: Receptors and modalities. Somatosensory pathways: dermatomes and primary afferents. Thalamus. Primary and secondary somatosensory cortices (somatotopic map). Posterior parietal cortex. Exteroception (touch and temperature), proprioception, and

nociception (hyperalgesia, ascending and descending pathways).

- **Topic 5.** Special senses: Vision: Optical system (the eye). Accommodation and pupillary reflexes. Optical defects. The retina: photoreceptors. Visual field and pathways. Primary and secondary visual cortices (retinotopy). Chromatic vision.
- **Topic 6.** Special senses: Hearing and balance: Inner ear structure: cochlea and vestibular system. Sound transmission. Organ of Corti. Auditory pathway and cortex (tonotopy). Hearing loss. Otolithic organs, semicircular canals, and vestibular pathways. Vertigo.
- **Topic 7.** Special chemical senses: Taste and smell: Primary taste qualities. Taste buds and pathways. Flavor coding. Olfactory epithelium and pathways. Odor coding.
- **Topic 8.** Somatic motor system: General characteristics of motor control. Hierarchical organization. Motor unit and neuromuscular junction. Regulation of muscle contraction.
- **Topic 9.** Sensory and motor integration: Spinal cord and brainstem. Spinal reflexes. Primary motor cortex. Corticospinal and extrapyramidal pathways. Premotor cortex and supplementary motor area. Basal ganglia and cerebellum (structure, function, and related pathologies such as ataxias).
- **Topic 10.** Executive functions, language, and limbic system: Prefrontal cortex. Neuronal bases of decision making. Language regulation areas. Neuronal bases of emotion and motivation. Amygdala and fear regulation.
- **Topic 11.** Wake-sleep cycle and memory: Sleep characteristics (slow-wave and REM sleep). Regulation systems and functions of sleep. Learning and memory: types, neuronal mechanisms, systems, and brain areas involved.

PRACTICALS / SEMINARS

Practicals will be held in the laboratories of the Department of Physiology (Faculty of Medicine). Students will have manuals available on the virtual campus.

- Calculation of hematocrit value and blood groups.
- Blood pressure and heart rate at baseline and after exercise.
- Spirometry.
- Body composition.
- Neurological examination.
- Seminars: Resolution of practical problems and case studies.

TUTORIALS

Faculty will personally assist students (in-person or virtually) to supervise their training and resolve doubts. In-person tutorials require a prior appointment.

EVALUATION CRITERIA

Passing via midterms:

- Two midterm exams will be held (First midterm: Units I to V; Second midterm: Units VI to VIII) on the dates established in the official academic calendar.
- To pass the course, it is necessary to pass both midterms (minimum grade of 5.0 in each). Exceptionally, students who obtain a grade of 4.5 or higher in one midterm may compensate for it if the average grade of both midterms is 5 or higher. If this minimum is not reached in either of them, the maximum final grade on the transcript will be 4.5 (Fail).

Calls: Ordinary (May/June) and Extraordinary (June/July).

- Students who do not pass via the midterms will take the final exams for the ordinary and extraordinary sessions established in the official calendar, sitting only for the midterms they did not pass.
- Grades from passed midterms will be saved for both the ordinary and extraordinary exam sessions.

- Students who do not pass the ENTIRE course by the extraordinary session will receive a maximum grade of 4.5 (Fail) and must repeat the course.
- Students wishing to improve their grade may retake the exams during the ordinary or extraordinary sessions. The final grade will be that of the last exam taken in these final sessions, even if it is lower than the grade previously obtained in the midterm.

Exam Format and Grading

- All exams will consist of a multiple-choice test with 4 options, only one of which will be correct.
- The exams will include questions related to both theoretical and practical subjects.
- A passing grade (5 out of 10) is achieved with 62.5% correct answers. Incorrect answers do not penalize.

Continuous Assessment

- Students can increase their midterm grades through Continuous Assessment (CA) activities.
- This CA grade can be earned through attendance at practical sessions and by passing tests/quizzes conducted throughout the course, at each professor's discretion.
- The maximum CA score is 1 point per midterm, provided that the sum of the midterm grade and the continuous assessment is 5 or higher.
- The CA grade is saved for both the ordinary and extraordinary exams.

BIBLIOGRAPHY

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- Gal (2007) *Bases de la Fisiología*, 2nd ed. Editorial Tebar.
- Ganong (2020), *Review of Medical Physiology*, 26th ed., McGraw-Hill.
- Mulroney & Myers (2016), *Netter's Essential Physiology*, 2nd ed. Elsevier.
- Silverthorn, D.U. (2019). *Human Physiology: An Integrated Approach*, 8th ed. Panamericana.

- Thibodeau & Patton (2021), *Structure & Function of the Body*, 16th ed., Elsevier Mosby.
- Tortora & Derrickson (2018), *Principles of Anatomy and Physiology*, 15th ed., Panamericana.
- Tresguerres, Villanúa & López-Calderón (2009), *Anatomía y fisiología del cuerpo humano*, McGraw-Hill.
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