

COURSE OUTLINE

(1) GENERAL

MD-204 Structure and function of the human body III

SCHOOL	Medical		
ACADEMIC UNIT	Basic and Clinical Sciences		
LEVEL OF STUDIES	1 st Cycle		
COURSE CODE	MD-204	SEMESTER	Year 2 / Semester 4 (Spring)
COURSE TITLE	Structure and function of the human body III		
INDEPENDENT TEACHING ACTIVITIES <i>if credits are awarded for separate components of the course, e.g. lectures, laboratory exercises, etc. If the credits are awarded for the whole of the course, give the weekly teaching hours and the total credits</i>	WEEKLY TEACHING HOURS	CREDITS	
	20	11	
<i>Add rows if necessary. The organisation of teaching and the teaching methods used are described in detail at (d).</i>			
COURSE TYPE <i>general background, special background, specialised general knowledge, skills development</i>	Core		
PREREQUISITE COURSES:	None		
LANGUAGE OF INSTRUCTION and EXAMINATIONS:	English		
IS THE COURSE OFFERED TO ERASMUS STUDENTS			
COURSE WEBSITE (URL)			

(2) LEARNING OUTCOMES

<p>Learning outcomes</p> <p><i>The course learning outcomes, specific knowledge, skills and competences of an appropriate level, which the students will acquire with the successful completion of the course are described.</i></p> <p><i>Consult Appendix A</i></p> <ul style="list-style-type: none"> • <i>Description of the level of learning outcomes for each qualifications cycle, according to the Qualifications Framework of the European Higher Education Area</i> • <i>Descriptors for Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Appendix B</i> • <i>Guidelines for writing Learning Outcomes</i>
<p>Musculoskeletal System</p> <p>Theme 1: Bone</p> <ul style="list-style-type: none"> • Describe the gross anatomical structure of bones and discuss the microscopic organization of bone tissue. • Identify elements of the skeleton on radiographs. • Outline the embryological development of bones and discuss clinical correlates. • Explain the physiological processes of bone growth, remodelling, and repair, including the roles of osteoblasts, osteoclasts, and osteocytes. • Discuss the role of parathyroid hormones, calcitonin and oestrogen in bone metabolism. • Discuss bone fracture models and their mechanical causes, analysing stresses (tensile, compressive, shear, bulk) and explaining the concepts of stress, strain, and deformation. • Briefly explain the role of the bone marrow in haematopoiesis.

- Describe the stages in red blood cell maturation from stem cell to maturity in the bone marrow.
- Describe the structure and function of the red blood cell, the synthesis of haemoglobin, and the normal breakdown and recycling of components.

Theme 2: Muscle

- Describe the gross anatomical structure of muscles and the histological characteristics of skeletal, smooth, and cardiac muscle tissue.
- Compare the function of skeletal, smooth, and cardiac muscle and relate it to the differences in structure.
- Outline the embryological development of muscle.
- Explain the molecular and cellular mechanisms of muscle contraction, including the sliding filament theory and excitation-contraction coupling.
- Discuss the key biochemical processes involved in energy metabolism within muscle cells, such as glycolysis and the Krebs cycle.
- Explain how bones, muscles, and joints work together to maintain posture and produce movement, including biomechanics of locomotion.
- Explain how the musculoskeletal system contributes to overall homeostasis, including regulating calcium and phosphate during muscular activity.

Theme 3: Joints

- Describe the histological and biochemical features of cartilage.
- Outline the embryological development of the joints
- Describe the structure of major joints and discuss relevant movements at these joints: shoulder girdle, elbow, wrist & hand, hip, knee, ankle & foot, spine.
- Identify the structures contributing to the stability of these joints and illustrate the importance by discussing the anatomic basis of common injuries.
- Describe the interpretation of joint ultrasound findings and recognize normal findings in the shoulder, hip, knee and ankle.
- Recognize effusion, synovitis, tendon rupture, and soft tissue lesions in musculoskeletal ultrasound of these joints.

Theme 4: Ligaments

- Describe the anatomical structure of ligaments and their role in joint stability.
- Identify the anatomical structures contributing to joint stability and discuss their relevance in injury mechanisms.

Theme 5: Tendons

- Describe the gross anatomical structure of tendons and their role in muscle-to-bone attachment.
- Discuss normal and abnormal findings related to tendons in diagnostic imaging, including ultrasound and MRI.

Theme 6: Integrated functions of the musculoskeletal system

- Outline the major physiological roles of the musculoskeletal system, including support, movement, protection of vital organs, and mineral storage and relate structure to function.
- Explain how bones, muscles, and joints work together to maintain posture and produce movement.
- Apply principles of physics, such as lever systems, torque, and mechanical advantage, to understand how muscles and bones function together to produce movement and generate

force.

- Explain the biomechanics of walking, running and other forms of locomotion.

Nervous System

Theme 1: Basic structure and function

- Briefly outline the embryological development of the nervous system.
- Describe the gross anatomical structure of the central nervous system (CNS), especially the brain & its blood supply, spinal cord, and peripheral nerves, as well as the microscopic organization of neurons, glial cells, and other neural tissue.
- Describe the gross anatomical & microscopic structure of the peripheral nervous system (PNS), neuromuscular junction and muscle and outline the concept of upper and lower motor neuron weakness.
- Describe the microscopic anatomy and histological characteristics of neurons, synapses, and neuroglial cells (astrocytes, oligodendrocytes, Schwann cells, ependymal cells and microglia), and relate their structure to their functional roles in the nervous system.
- Describe the role of the immune system in the central and peripheral nervous systems, including the function of microglia and the immunological role of the blood-brain barrier.
- Outline the functional roles of the structures of the central nervous system and the spinal cord.
- Discuss the major physiological roles of the nervous system, including sensory processing, motor control, and autonomic regulation, as well as higher-order functions such as cognition and memory.
- Explain the mechanisms underlying the generation and propagation of action potentials in neurons, the role of ion channels, and the process of synaptic transmission at chemical and electrical synapses.
- Discuss the key biochemical processes involved in neurotransmitter synthesis, release, reuptake, and degradation, and how they relate to the function of excitatory and inhibitory synapses.
- Apply principles of physics, such as membrane potentials, electrical conduction, and synaptic transmission, to understand how neurons communicate and process information within neural circuits.
- Describe the structure and function of the autonomic nervous system (sympathetic and parasympathetic divisions), and explain how it contributes to the maintenance of body homeostasis by regulating visceral functions such as heart rate, digestion, and respiratory rate.
- Classify the different drug categories that work in the peripheral nervous system depending on their mode of action (cholinergic, anti-cholinergic, adrenergic, anti-adrenergic drugs) and relate their indications and adverse effects to the role of the peripheral nervous system.

Theme 2: Motor Control

- Explain the descending motor pathways, including the corticospinal and corticobulbar tracts and their roles in the regulation of voluntary movement, with an emphasis on upper and lower motor neuron function.
- Describe the integration of motor control by the basal ganglia and cerebellum, including their roles in initiating, refining, and coordinating movement, and understand the impact of dysfunction in these systems as illustrated by motor disorders such as Parkinson's disease and ataxia.

Theme 3: The sensory system

- Describe the ascending sensory pathways, including the dorsal column, medial lemniscus and spinothalamic tracts, and their roles in transmitting proprioception, fine touch, temperature, and pain signals to the brain as well as the pathways involved in reflex arcs.
- Define temperature and explain the principles of heat transfer and thermodynamics. Discuss

how thermoregulation in the human body works, and explain how fever is a physiological response to infection.

- Explain the cortical processing of sensory input in the somatosensory cortex, including the concept of topographical organization, and the mechanisms by which the brain integrates sensory signals for perception of body position and changes in the environment.

Theme 4: Higher functions of the nervous system

- Explain the neural mechanisms of cognition, including attention, problem-solving, and decision-making, and correlate these functions with the roles of specific brain regions, such as the prefrontal cortex and association areas.
- Describe the processes of memory formation, consolidation, and retrieval, with an emphasis on the roles of the hippocampus, amygdala, and cerebral cortex, and explain how structural changes in these areas, such as neurodegeneration, influence memory and learning.
- Classify the different drug categories that work in the central nervous system depending on their mode of action (sedatives/hypnotics, anti-seizure drugs, opioid analgesics) and describe their indications and adverse effects.

Medical Psychology

- Define and describe the key components of memory and emotions.
- Compare and contrast major theories of emotions.
- Explain the role of the autonomic nervous system.
- Identify the functions of key brain structures in processing and regulating emotions.
- Understand Paul Ekman's theory of basic emotions.

Theme 5: Special senses

- Describe the gross anatomical & microscopic structure and histological & functional components of the visual system, including the eye and the visual pathway from the retina to the visual cortex.
- Explain the principles of normal image formation in the eye through the cornea and lens and analyse how common refractive errors, such as myopia, hyperopia, and astigmatism, alter the normal function of vision.
- Explain the physiological processes involved in phototransduction, including the role of rods, cones, and photopigments in converting light into neural signals, and those processes involved in visual perception, including colour vision, depth perception, and motion detection.
- Describe the commonly performed tests of visual function, including visual acuity, visual field assessment, and pupillary reflex testing, and explain the principles behind interpreting their results in the context of normal and pathological vision.
- Explain the behavior of light (including reflection and refraction), and discuss the application of optics in medicine, such as vision correction (glasses, contact lenses) and laser treatments used in medical procedures.
- Describe the gross anatomical & microscopic structure and histological & functional components of the auditory pathway, from the outer ear to the auditory cortex.
- Explain the process of sound transduction in the cochlea, including the role of hair cells and the basilar membrane in converting sound waves into neural signals.
- Discuss the neural mechanisms underlying the interpretation of auditory input by the brain, including frequency, volume, and localisation of sound.
- Describe the commonly performed hearing tests, including Rinne & Weber tests, audiometry, and tympanometry, and explain the principles behind their interpretation in distinguishing between conductive and sensorineural hearing loss.

Climate and Health

- Explain the general mechanism of the greenhouse effect

- Illustrate trends and sources of greenhouse gas emissions
- Analyze the drivers of climate change, including both natural and human-induced factors
- Investigate the social dimensions of climate drivers, with a focus on population growth and economic growth

Theme 6: Laboratory assessment of the nervous system

- Outline the interpretation of common neurophysiological tests, such as electroencephalography (EEG), electromyography (EMG), nerve conduction studies, and imaging techniques (MRI, CT), and their relevance in diagnosing and monitoring nervous system diseases.

General Competences

Taking into consideration the general competences that the degree-holder must acquire (as these appear in the Diploma Supplement and appear below), at which of the following does the course aim?

Search for, analysis and synthesis of data and information, with the use of the necessary technology
Adapting to new situations
Decision-making
Working independently
Team work
Working in an international environment
Working in an interdisciplinary environment
Production of new research ideas

Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment
Showing social, professional and ethical responsibility and sensitivity to gender issues
Criticism and self-criticism
Production of free, creative and inductive thinking

Others...

Knowledge

- Explain normal human structure and function at the molecular, cellular, tissue, organ and whole-body level from conception to old age.
- Explain the scientific principles underlying common and important disease processes including inflammation, infection, neoplasia and trauma.
- Describe the role of genetics in predicting the risk of disease and in personalised medicine.
- Explain the concept of ‘wellness’ and describe the importance of promoting lifestyle factors in achieving the best possible health.

(3) SYLLABUS

Musculoskeletal System Themes:

- Bone
- Muscle
- Joints
- Ligaments
- Tendons
- Integrated functions of the musculoskeletal system

Nervous System Themes:

- Basic structure and function
- Motor Control
- The sensory system
- Higher functions of the nervous system
- Special senses
- Laboratory assessment of the nervous system

(4) TEACHING and LEARNING METHODS - EVALUATION

DELIVERY <i>Face-to-face, Distance learning, etc.</i>	Face-to-face	
USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY <i>Use of ICT in teaching, laboratory education, communication with students</i>	<i>Use of ICT in teaching / Χρήση ΤΠΕ Communication with students / Επικοινωνία με Φοιτητές</i>	
TEACHING METHODS <i>The manner and methods of teaching are described in detail. Lectures, seminars, laboratory practice, fieldwork, study and analysis of bibliography, tutorials, placements, clinical practice, art workshop, interactive teaching, educational visits, project, essay writing, artistic creativity, etc. The student's study hours for each learning activity are given as well as the hours of non-directed study according to the principles of the ECTS</i>	Activity	Semester Workload
	Lectures/large-group teaching*	61
	Tutorials	24
	Small group work	24
	Laboratories**	12
	Directed self-study***	96
	Coursework	15
	Revision/assessment	45
	Total	277
STUDENT PERFORMANCE EVALUATION <i>Description of the evaluation procedure Language of evaluation, methods of evaluation, summative or conclusive, multiple choice questionnaires, short-answer questions, open-ended questions, problem solving, written work, essay/report, oral examination, public presentation, laboratory work, clinical examination of patient, art interpretation, other Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i>	<ul style="list-style-type: none"> • Final exam (80%) • Coursework (20%) 	

(5) ATTACHED BIBLIOGRAPHY

Required Textbooks/Reading:					
Authors	Title	Edition	Publisher	Year	ISBN
Arthur F. Dalley, Anne M. R. Agur	Moore's Clinically oriented anatomy	9 th Int'l Edition	Wolters Kluwer Health	2024	9781975209544
Sadler, Thomas	Langman's Medical Embryology	15th Edition	Wolters Kluwer	2024	9781975180010
Pawlina, Wojciech	Histology: A Text and Atlas with correlated cell and molecular biology	9th Edition	Wolters Kluwer	2024	9781975181574
A.R. Crossman	Neuroanatomy: an illustrated colour text	6th Edition	Elsevier	2020	9780702074622

Recommended Textbooks/Reading:

Authors	Title	Edition	Publisher	Year	ISBN
Costanzo, Linda	BRS: Physiology	8th Edition	Wolters Kluwer	2023	9781976963467
Halliday, N.L. & Chung, H. M	BRS Gross Anatomy	10 th Edition International	Lippincott Williams & Wilkins	2023	9781975181482