

COURSE OUTLINE

(1) GENERAL

MD-104 Molecules, cells, tissues and organs II

SCHOOL	Medical		
ACADEMIC UNIT	Basic and Clinical Sciences		
LEVEL OF STUDIES	1 st Cycle		
COURSE CODE	MD-104	SEMESTER	Year 1 / Semester 2 (Spring)
COURSE TITLE	Molecules, Cells, Tissues and Organs II		
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	
	13	15	
<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:	Molecules, Cells, Tissues and Organs I		
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>Theme 1: Membranes, vesicle and cellular traffic</p> <ul style="list-style-type: none"> • Describe the structural components and functional properties of biological membranes. • Compare and contrast active and passive transport process across biological membranes. • Describe the mechanisms involved in movement of water and solutes across biological membranes. • Define osmolality and tonicity and the relevance of these concepts to cellular environments. • Briefly describe the clinical applications of isotonic, hypotonic and hypertonic solutions. • Describe the various body fluid compartments and their ionic composition (intracellular, extracellular – interstitial/plasma) • Describe the processes by which material is transported in and out of the cell. • Describe the general principles of drug action, including pharmacodynamics and pharmacokinetics.

- Briefly explain how endogenous transport mechanisms facilitate drug action and how these affect the pharmacokinetic parameters of drugs.
- Explain how proteins are targeted to different cellular locations.
- Discuss post-translational modifications and their role in protein function and targeting.

Theme 2: Cellular communication

- Describe paracrine, autocrine and endocrine signalling and provide examples.
- Describe the different types of receptor classes (ligand-gated, G-protein coupled, kinase and nuclear receptors) and their functions.
- Discuss major signalling pathways such as G-protein coupled receptor signalling, enzyme coupled receptors and cytokine signaling.
- Explain how drugs have been designed to affect molecular targets, including receptors.
- Define the terms agonist, antagonist, efficacy, potency and affinity, and understand their significance in pharmacodynamics.
- Discuss the communication amongst neuronal cells.

Theme 3: Cellular movements

- Describe the structure and function of the extracellular matrix of eukaryotic cells.
- Describe the components of the cytoskeleton and their functions.
- Describe the role and impact of cytoskeletal reorganization in cell migration.
- Describe the different types of intercellular junctions and their function.
- Describe the structure and function of muscle fibres and how actin and myosin filaments interact to produce muscle contraction.
- Discuss the neuromuscular junction and its role in muscle contraction.
- Explain how Newton's laws of motion and forces affect movement in the human body.
- Define inflammation and name its main characteristics.
- Discuss the mechanisms by which immune cells migrate to sites of infection or inflammation.
- Describe the differences between acute and chronic inflammatory responses (in terms of cells recruited and effector functions).

Theme 4: An introduction to embryology and cellular differentiation

- Describe the processes of gamete formation in humans.
- Discuss the first week of development; the ovarian cycle, cleavage and blastocyst formation.
- Discuss examples of birth defects that can arise during the first week of development.
- Describe the key events and changes that take place during the second week of gestation.
- Describe the differentiation and roles of the embryoblast and trophoblast in early development.
- Discuss what abnormal implantation and ectopic pregnancy are and their implications.
- Explain gastrulation and vasculogenesis and their importance in embryonic development.
- Outline the formation of the notochord and the establishment of axes and their significance.
- Briefly discuss developmental disruptions associated with laterality.
- Discuss the advantages and disadvantages of the use of animal models, such as zebrafish embryos, in medical sciences.
- List the cellular components of the immune cell and their basic functions.
- Outline the development of immune cells from haematopoietic stem cells in the bone marrow.

Theme 5: Epithelial tissue

- Describe the characteristics and functions of epithelial tissues and the various types (apical, lateral, basal).

- Describe the histological and anatomical features of the integumentary components.
- Describe the organization and components of the skin and the different types of skin cells.
- Describe the protective and immune functions of the skin and mucous membranes acting as the first lines of immune defence.
- Describe the role of the skin in sensory perception.

Theme 6: Connective tissue

- Describe the classification of connective tissue and the major histological characteristics of the different types.
- Briefly describe the characteristics and functions of special connective tissue.
- Discuss how the extracellular matrix contributes to structural and functional properties of connective tissue.

Theme 7: Muscle tissue

- Describe and contrast the structure and function of smooth, skeletal and cardiac muscle.
- Describe the principles of muscle excitation and contraction (the E-C coupling) and the sliding filament theory
- Describe the cellular structure and histological features of skeletal, smooth and cardiac muscle.
- Discuss the repair and regenerative abilities of skeletal, smooth and cardiac muscle.
- Discuss the types of muscle fibres and explain how physiological adaptation occurs depending on the different types of external stimulation (e.g. during exercise)
- Discuss motion and statics of the body and how kinematics, dynamics and energetics are relevant to human motion.

Theme 8: Nervous tissue

- Describe the structure and function of neurons and glial cells.
- Briefly describe embryological formation of the spinal cords.
- Discuss basic physical principles applied to neuronal cells and their communication.
- Explain electrical signalling of the body and how it can regulate cardiac function.
- Analyse the signals seen in an electrocardiogram (ECG) with a focus on understanding the underlying physics of electrical conduction in the heart.
- Explain the resting and action potential by ion channels and concentration gradients.
- Explain the mechanisms of nerve signal transmission.
- Discuss the function of synapses and how they facilitate communication between neurons.
- Describe the organization and structure (pre- and post-synaptic neurons) of the peripheral nervous system, its functions, receptors and neurotransmitters involved.
- Explain how drugs have been designed to target the peripheral and central nervous system.
- Briefly outline the structural arrangement and functional regions of the central, autonomic and peripheral nervous systems.
- Briefly explore the role of the nervous and endocrine systems and how they can control organ activities.

Theme 9: Organs of the body and an introduction to systems of the body.

- Recognize and locate the major organs of the human body
- Outline the anatomical positions and relationships between major organs.
- Explain the primary functions of each organ.
- Discuss the concept of organ systems; for each of the body systems identified, outline its principle role(s) and outline the type of problems that might result when a serious malfunction occurs with each of these body systems.

Theme 10. Introduction to the immune system

- Define and give characteristics of active and passive immunity.
- Compare and contrast innate and adaptive immunity, including their fundamental roles in the immune response, with specifications on humoral and cell-mediated immunity.
- Indicate the main differences between a primary and a secondary immune response in what these responses entail and their timelines.
- Describe the stages in lymphoid cell maturation from stem cells to maturity and describe the specific membrane markers for each stage.
- Name the primary and secondary lymphoid organs and differentiate between their roles.
- Describe normal lymph node morphology and discuss the function of its various compartments and constituent cells.
- Describe the cellular components of the innate and adaptive immune system including macrophages, granulocytes, NK cells, T cells, B cells, and dendritic cells, alongside their specific functions.
- Define naive, effector and memory lymphocytes.
- Outline the first lines of immune defence, barriers and initial responses that prevent pathogen entry.
- Describe the main killing mechanisms employed by immune cells during phagocytosis.
- Define inflammation and name its main characteristics, as well as the roles macrophages, neutrophils, and dendritic cells play during this response.
- Describe the mechanisms of how leukocytes enter tissues during inflammation.
- Define cytokines, modes of action and specific roles of IL-1, IL-6, TNF and Interferons in the immune response.
- Name the main pattern recognition receptor families and their significance in immunity.
- Briefly describe the three different pathways of complement activation and effector functions.
- Outline the role of regulatory proteins in the complement system (properdin, C1INH, DAF, factor I, CD59).
- Explain the generation of disease through immune deregulation, providing specific examples.

Theme 11: History of Medicine and Medical Practice

- Outline the major milestones in the development of medical knowledge from ancient practices to modern advancements.
- Discuss the evolution of medical practices from traditional remedies to evidence-based practices.
- Discuss the social, cultural and scientific contexts that shaped the history of medicine.
- Recognize the contributions of various scientific disciplines to medical advancements.
- Discuss the impact of future innovations and technology in healthcare.

Climate change and health

- Define the concept of 'climate change'.
- Explore the foundations of and intersections between climate change, public health, One Health, and Planetary Health.
- Describe the key indicators and impacts of climate change on global weather patterns and ecosystems.

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*

*Project planning and management
Respect for difference and multiculturalism
Respect for the natural environment*

Decision-making Working independently Team work Working in an international environment Working in an interdisciplinary environment Production of new research ideas	Showing social, professional and ethical responsibility and sensitivity to gender issues Criticism and self-criticism Production of free, creative and inductive thinking Others...
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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 basic pharmacological principles together with the pharmacology of commonly used medications, including their modes of action, pharmacokinetics, medication interaction and side effects.
- 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.
- Discuss the role of nutrition in health and illness.

(3) SYLLABUS

Themes:

- Membranes, vesicle and cellular traffic
- Cellular communication
- Cellular movements
- An introduction to embryology and cellular differentiation
- Epithelial tissue
- Connective tissue
- Muscle tissue
- Nervous tissue
- Organs of the body and an introduction to systems of the body
- Introduction to the immune system
- History of Medicine and Medical Practice

(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.</i>	<table border="1"> <thead> <tr> <th>Activity</th> <th>Semester Workload</th> </tr> </thead> <tbody> <tr> <td>Lectures/large-group teaching*</td> <td>78</td> </tr> <tr> <td>Tutorials</td> <td>36</td> </tr> <tr> <td>Small group work</td> <td>36</td> </tr> <tr> <td>Laboratories</td> <td>6</td> </tr> </tbody> </table>	Activity	Semester Workload	Lectures/large-group teaching*	78	Tutorials	36	Small group work	36	Laboratories	6
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	Lectures/large-group teaching*	78									
	Tutorials	36									
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Laboratories	6										

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	Directed self-study**	144
	Coursework	30
	Revision/assessment	45
	Total	377
<p align="center">STUDENT PERFORMANCE EVALUATION</p> <p><i>Description of the evaluation procedure</i></p> <p><i>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</i></p> <p><i>Specifically-defined evaluation criteria are given, and if and where they are accessible to students.</i></p> <ul style="list-style-type: none"> • Midterm exam (30%) • Final exam (50%) • Coursework (10%) 		

(5) ATTACHED BIBLIOGRAPHY

Required Textbooks/Reading:					
Authors	Title	Edition	Publisher	Year	ISBN
N.A. Campbell, L.A. Urry, M.L. Cain, S.A. Wasserman, P.V. Minorsky, J.B. Reece	Biology: A Global Approach	12th Edition	Pearson	2020	9781292341637
T.W. Sadler	Langman's Medical Embryology	15th Edition	Wolters Kluwer	2020	9781496399991
Pawlina, Wojciech; Ross, Michael H.	Histology: A Text and Atlas with Correlated Cell and Molecular Biology	9th Edition	Wolters Kluwer	2018	9781496347906
John E. Hall, Michael E. Hall Guyton and Hall	Textbook of Medical Physiology	14 th Edition	Elsevier	2021	9780323597128
Recommended Textbooks/Reading:					
Authors	Title	Edition	Publisher	Year	ISBN
Bruce Alberts, Alexander Johnson, Julian	Molecular Biology of the Cell	7th Edition	Norton & Company	2022	9780393884852

Lewis, David Morgan, Martin Raff, Keith Roberts, Peter Walter						
Ronald W. Dudek	BRS Embryology	6th Edition	Lippincott Williams & Wilkins	2016	9781496309359	
Geraldine O'Dowd, Sarah Bell, Sylvia Wright	Wheater's Functional Histology: A Text and Colour Atlas	7th Edition	Elsevier	2014	9780702045975	