



COURSE UNIT (MODULE) DESCRIPTION

Course unit (module) title	Code
General Microbiology and Immunology	MMIK2115

Lecturer(s)	Department(s) where the course unit (module) is delivered
Coordinator: Prof. Dr. Tomas Kačergius Other(s): Lecturers of the Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine, Institute of Biomedical Sciences	Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine, Institute of Biomedical Sciences, Faculty of Medicine, Vilnius University, M. K. Čiurlionio str. 21, LT-03101 Vilnius, Lithuania

Study cycle	Type of the course unit (module)
Integrated studies (I and II levels)	Compulsory

Mode of delivery	Period when the course unit (module) is delivered	Language(s) of instruction
Face-to-face (lectures and seminars; laboratory works in microbiology and immunology laboratory)	3rd semester	Lithuanian, English

Requirements for students	
Prerequisites: A student must have completed the following courses: human biology and genetics; human anatomy; human histology; biochemistry.	Additional requirements (if any): None

Course (module) volume in credits	Total student's workload	Contact hours	Self-study hours
5 credits	135 hours	66	69

Purpose of the course unit (module): programme competences to be developed		
<p>To learn classification, morphology, structure, physiology and genetics of the microorganisms; to understand the interactions between microorganisms and human, contribution of pathogenic microorganisms to the pathogenesis of infectious disease. To acquire systemic knowledge of immunology, to understand the mechanisms of immune response and its consequences and significance in the immunopathogenesis of diseases.</p>		
Learning outcomes of the course unit (module)	Teaching and learning methods	Assessment methods
Generic competences After successful completion of the course unit (module), student will be able:		
To act honestly and follow ethical obligations; to apply the principles of good medical practice in the work; to be emphatic; to be capable for thinking critically and self-critically; to be creative and initiative; to know how to pursue the purpose; to be capable for communicating with others.	Lectures, seminars and laboratory works	Assessment of the tasks and self-study work.
To analyze and synthesize; to learn during the further studies and learn independently during the lifetime; to be capable for application of the knowledge in the practice; to be capable for teaching others; to be capable for carrying out the scientific investigations.	Lectures, seminars and laboratory works.	Assessment of the tasks and self-study work.
Subject specific competences After successful completion of the course unit (module), student will be able:		
To select, analyze and systemize microbiology literature as well as scientific publications in the field of microbiology and immunology.	Lectures, seminars and laboratory works as well as self-study	Continuous assessment of the laboratory works and oral quizzes during

	using library and internet resources.	seminars. Evaluation of the written quizzes. At the end of course unit – exam in the written form.
To understand and know the methodology of microbiological investigation – to make the plan of microbiological investigation, choose correctly and implement microbiological methods of the investigation.	Lectures, seminars and laboratory works as well as self-study using library and internet resources.	Continuous assessment of the laboratory works and oral quizzes during seminars. Evaluation of the written quizzes. During the second quiz – practical task in the oral form. At the end of course unit – practical task in the oral form and exam in the written form.
To understand the interactions between microorganisms and human, contribution of microorganisms to the pathogenesis of infectious disease.	Lectures, seminars and laboratory works as well as self-study using library and internet resources.	Continuous assessment of the laboratory works and oral quizzes during seminars. Evaluation of the written quizzes. At the end of course unit – practical task in the oral form and exam in the written form.
To understand the importance of the human immune system, the mechanisms of immunopathology, and the principles of immune testing.	Lectures, seminars and laboratory works as well as self-study using library and internet resources.	Evaluation of the written quiz. At the end of course unit – exam in the written form.

Content: breakdown of the topics	Contact hours						Self-study work: time and assignments		Assignments
	Lectures	Tutorials	Seminars	Exercises	Laboratory work	Internship/work placement	Contact hours	Self-study hours	
Course: General Microbiology									
1. Classification, morphology, structure and examination methods of microorganisms.	6		4		4		14	14	To be prepared for the seminars and laboratory works about the classification, morphology, structure and examination methods of microorganisms.
2. Physiology of microorganisms. Nutrition of microorganisms. Metabolism, energy production and reproduction of bacteria. Human normal microbiota. Ecology of microorganisms. Effect of environmental factors on microorganisms.	4		5		5		14	12	To be prepared for the seminars and laboratory works about the physiology of microorganisms; nutrition of microorganisms; metabolism, energy production, reproduction, cultivation of bacteria; human normal microbiota; ecology of microorganisms; effect of the environmental factors (physical, chemical, biological) on microorganisms.
3. Genetics of microorganisms. The mechanisms of antimicrobial resistance.	2		1		1		4	3	To be prepared for the seminars and laboratory works about the organization of genome and types of genetic variability of microorganisms; the main groups of antimicrobial agents and mechanisms of antimicrobial resistance.
4. The infectious process. The role of microorganisms and	2						2	2	To be prepared for the topic about the infectious process, interaction

human in the infectious process.								between microorganisms and human; microbial virulence factors and their role in the infectious process.
5. Morphology and structure viruses. Replication of viruses. Examination and cultivation methods of viruses.	2					2	2	To be prepared for the topic about the morphology, structure, replication, examination and cultivation methods of viruses.
Total: "General Microbiology"	16		10		10		36	33
Course: Immunology								
1. Introductory lecture: the components of the immune system	2					2	2	Definition of immunity. Humoral and cellular immune responses. Primary and secondary lymphoid organs. CD molecules. Innate and adaptive immunity: properties, dynamics. Receptors of innate and adaptive immune response, their differences. Mucosal immunity.
2. Components of innate immunity and their functions	2					2	3	Components of innate immunity, their functions. Recognition of pathogens and their elimination by the components of innate immunity. Pattern recognition receptors (PRRs). Epithelial barrier. Neutrophils, monocytes/macrophages; their properties and functions. Mechanism of phagocytosis. NK cells, their properties and functions. Complement system, its activation and outcomes. Acute phase proteins, cytokines, their role in the immune response. Acute and chronic inflammation. The inflammasome. Disorders of innate immunity. Autoinflammatory diseases.
3. MHC (HLA) genes and molecules, their structure and functions, immune mechanisms of graft rejection	2		4			6	6	MHC (HLA) gene system. Polymorphism of MHC genes. Structure, expression and functions of MHC class I or II molecules. Antigen processing and presentation by MHC class I and II molecules. Antigen presenting cells, their properties and functions. The role of HLA system in practical medicine and organ transplantation. Immune mechanisms of graft rejection. Alloantigens, xenoantigens. Methods of HLA testing.
4. Cells of adaptive immunity, their properties and functions	2					2	3	T and B lymphocytes, their receptors, differences in antigen recognition. Genes encoding T and B lymphocyte receptors. Formation of lymphocyte repertoire, V(D)J recombination. Maturation of T and B lymphocytes. Properties of naive T and B lymphocytes. Primary immunodeficiencies, their causes.
5. Cellular immune response; properties and functions of T lymphocytes	2					2	2	Activation of T lymphocytes by the antigens. The role of MHC molecules in T cell activation. Dendritic cells, their properties and functions.

								Activation of naïve T cells. Properties of effector T cells (T _H 1, T _H 2, T _H 17, CTL), their differentiation and functions. Regulatory T cells (Tregs), their properties and functions. Memory T cells.
6. Humoral immune response; properties and functions of B lymphocytes	2					2	2	Activation of B lymphocytes by the antigens. Immunoglobulins, their structure and properties. Effector functions of immunoglobulins of different classes. T cell dependent and independent antigens. Primary and secondary immune responses. Molecular mechanisms of affinity maturation and class switching.
7. Immune tolerance and autoimmunity; mechanisms of hypersensitivity reactions	2		4			6	6	Mechanisms of immune tolerance. Central and peripheral B and T cell tolerance. Autoimmune reactions and their causes. Damage of cells and tissues by the immune reactions, their classification. Mechanisms of type I, II, III and IV hypersensitivity reactions. Detection of autoantibodies in different pathologies, their diagnostic value.
8. Antitumor immune response	2					2	2	Properties of antitumor immune response. Tumor specific antigens. Humoral and cellular immune response against tumors. The role of Tregs in antitumor response. Modern approaches in cancer immunotherapy. Dendritic cell vaccines. Biopharmaceutical antibodies for cancer therapy. Immune checkpoint inhibitors. The principle of CAR T cell therapy.
9. Immunoassays and immunotechnologies	2		2		2	6	10	Methods for studying the activity of the immune system, their application in laboratory medicine. The principles of an enzyme-linked immunosorbent assay (ELISA), Western blot, immunofluorescence microscopy. Immunohistochemistry, flow cytometry. Serologic assays for the diagnostics of infectious diseases. Polyclonal and monoclonal antibodies. Recombinant antibodies. Chimeric and humanized antibodies. Technologies for vaccine development.
Total: “Immunology”	18		10		2	30	36	
Total: course unit (module) “General Microbiology and Immunology”	34		20		12	66	69	

Assessment strategy	Weight, (%)	Deadline	Assessment criteria
Course: General Microbiology			
Quizzes	10%	During semester	There are two written quizzes in autumn semester, during which the student reports for the defined sections of the course "General Microbiology" in written form. The quizzes consist of the closed and/or opened type questions. The written quizzes are evaluated using grades in the scale of ten-point system, and they are recognized as positive, when the obtained grades are in the scale from 5 to 10 points.
Final exam	90%	During session	<p>The final exam of the course "General Microbiology" consists of: 10% – practical task; 80% – written answers to the closed and/or opened type questions, covering whole information provided in lectures, seminars and laboratory works of the course "General Microbiology". During the practical task, the general microbiology practical knowledge and skills are evaluated by giving the answers to opened type questions in oral form, including fullness, consistency and correctness of each answer. The final exam is evaluated using grades in the scale of ten-point system, and it is considered to be passed positively, when the obtained grade is in the scale from 5 to 10 points. In the case of failure to pass the final exam of the course "General Microbiology", it is retaken separately from the final exam of the course "Immunology".</p> <p>The final cumulative grade consists of: 90% – positive grades of the final exam; 10% – positive grades obtained from the written quizzes during autumn semester.</p> <p>The meaning of grades of the ten-point system: 10 (excellent) – excellent performance, outstanding knowledge and skills; 9 (very good) – strong performance, good knowledge and skills; 8 (good) – above the average performance, knowledge and skills; 7 (highly satisfactory) – average performance, knowledge and skills with unessential shortcomings; 6 (satisfactory) – below average performance, knowledge and skills with substantial shortcomings; 5 (sufficient) – knowledge and skills meet minimum criteria; 4, 3, 2, 1 (insufficient) – knowledge and skills do not meet minimum criteria/below minimum criteria.</p>
Course: Immunology			
Quiz	20%	During semester	There is one written quiz in autumn semester, during which the student reports for the material of seminars and laboratory works of the course "Immunology" in written form. The quiz consists of the closed and/or opened type questions. The written quiz is evaluated using grades in the scale of ten-point system, and it is recognized as positive, when the obtained grade is in the scale from 5 to 10 points.
Final exam	80%	During session	<p>The final exam of the course "Immunology" consists of the written answers to closed and/or opened questions, covering whole information provided in lectures, seminars and laboratory works of the course "Immunology". The final exam is evaluated using grades in the scale of ten-point system, and it is considered to be passed positively, when the obtained grade is in the scale from 5 to 10 points. In the case of failure to pass the final exam of the course "Immunology", it is retaken separately from the final exam of the course "General Microbiology".</p> <p>The final cumulative grade consists of: 80% – positive grades of the final exam; 20% – positive grades obtained from the written quiz during autumn semester.</p>

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<p>The final grade of the module “General Microbiology and Immunology” in the ten-point scale system is calculated by deriving the average of final cumulative grades of the courses “General Microbiology” and “Immunology”.</p>			

Author	Year of publication	Title	Issue of a periodical or volume of a publication	Publishing place and house or web link
Compulsory reading				
P. R. Murray, K. S. Rosenthal, M. A. Phaller	2020	Medical Microbiology	9th edition	Philadelphia, Elsevier Inc.
J. G. Black, L. J. Black	2017	Microbiology: Principles and Explorations	10th edition	New Jersey, Willey
A. K. Abbas, A. H. Lichtman, S. Pillai	2017	Cellular and Molecular Immunology	9th edition	Elsevier/Saunders
Optional reading				
K. C. Carroll, J. A. Hobden, S. Miller, S. A. Morse, T. A. Mietzner, B. Detrick, T. G. Mitchell, J. H. McKerrow, J. A. Sakanari	2016	Jawetz, Melnick, & Adelberg’s Medical Microbiology	27th edition	New York, McGraw-Hill Education, AccessMedicine: http://accessmedicine.mhmedical.com/content.aspx?bookid=1551&sectionid=94104942
P. J. Deives, S. J. Martin, D. R. Burton, I. M. Roitt	2017	Roitt’s Essentials Immunology	13th edition	Wiley-Blackwell Publ.
Eds. R. R. Rich, T. A. Fleisher, W. T. Shearer, H. W. Schroeder, A. J. Frew, C. M. Weyand	2019	Clinical Immunology: Principles and Practice	5th edition	Elsevier/Saunders