

**DESCRIPTION OF COURSE UNIT FOR DOCTORAL STUDIES  
AT VILNIUS UNIVERSITY**

<b>Scientific Area/eas, Field/ds of Science</b>	Medical and Health Sciences (M 000): Medicine (M 001); Dentistry (M 002); Pharmacy (M 003); Public Health (M 004); Nursing (M 005)			
<b>Faculty, Institute, Department/Clinic</b>	Faculty of Medicine Institute of Biomedical Sciences Department of Physiology, Biochemistry, Microbiology and Laboratory Medicine			
<b>Course unit title</b> (ECTS credits, hours)	<b>Medical Microbiology</b> 9 credits (243 hours)			
<b>Study method</b>	<b>Lectures</b>	<b>Seminars</b>	<b>Consultations</b>	<b>Self-study</b>
Number of ECTS credits	-	-	1 credit	8 credits
<b>Method of the assessment</b> (in 10 point system)	<p><u>Oral exam:</u> the exam consists of oral answers to three questions, covering three sections of the course unit: 1) fundamentals of medical microbiology; 2) infection, immunity, immunoprophylaxis and methodologies of microbiological diagnostics for infections; 3) causative agents of human organ system infections, their characteristics, pathogenesis of infections, microbiological diagnostics and prophylaxis. Each answer to the question is assessed using grades in the scale from 0 to 10, and then grades are averaged.</p> <p><u>Criteria for exam assessment in ten-point scale system (minimum grade to pass the exam – 5):</u></p> <p>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>			
<b>PURPOSE OF THE COURSE UNIT</b>				
<p>To provide in-depth theoretical and practical knowledge about morphology, structure, physiology and genetics of medically important microorganisms; human microbiome and its implications for health; pathogenic and opportunistic microorganisms' role in infection pathogenesis; immune response characteristics to infectious agents during infectious process; principles and methodologies for infection microbiological diagnostics; characteristics of human organ systems' infectious agents (bacteria, viruses, fungi, protozoa), diseases' pathogenesis, microbiological diagnostic methodologies, prophylaxis principles and measures. To promote interdisciplinary approach to research of medically important microorganisms, modern methodologies for infection microbiological diagnostics, in order to solve individual problems of relevant doctoral topics in different scientific areas and fields.</p>				
<b>THE MAIN TOPICS OF COURSE UNIT</b>				

1) Fundamentals of medical microbiology. Classification and nomenclature of medically important microorganisms. Bacterial morphology, structure components and their functions. Morphological and structural peculiarities of spirochetes, mycobacteria, actinomycetes, rickettsiae, chlamydiae, mycoplasmas, fungi and protozoa. Bacterial spores, their structure and biological importance. Microorganisms' nutrition and their types. Nutrients' uptake mechanisms by bacterial cell. Bacterial metabolism. Bacterial enzymes and their biological importance. Assays for determination of bacterial enzymatic activity. Bacterial respiration and energy production. Bacterial reproduction and its phases. Bacterial cultivation methods and purposes in medicine. Culture media: classification and use in medicine. Cultivation principles of aerobic and anaerobic bacteria. Effect of physical, chemical and biological factors on microorganisms. Principles of sterilization, disinfection and antisepsis in medicine, the used methods and measures. Antibiotics and their mechanisms of action. Genetics of microorganisms. Mutations and mutagenesis. Bacterial DNA repair mechanisms. Bacterial genetic recombinations – transformation, transduction and conjugation. Mechanisms of resistance development to antimicrobials in microorganisms. Viral morphology, structure, replication and cultivation methods. Characteristics of viral infection. Human microbiome, its change at different age and implication for health. Microbiome of human's individual organ systems. Dysbiosis and factors leading to its development.

2) Infection, immunity, immunoprophylaxis and methodologies of infection microbiological diagnostics. Infection and infectious process. Role of microorganisms in infectious process. Microbial pathogenicity and virulence. Virulence factors. Transmission routes and entry portals of infectious agents. Spread of infections in society and general epidemiological aspects. Spread of microorganisms and bacterial toxins in human organism. Development dynamics of infectious process. Human immunity and its types. Human immune system and its structure. Human organism's nonspecific and specific humoral and cellular defense factors against microorganisms and their functions. Antigens and superantigens. Antibodies: their structure, classes and functions. Immunological memory. Immunogenetics. Characteristics of immunity against bacteria, viruses, fungi and protozoa. Principles and measures of infection immunoprophylaxis. General principles of infection microbiological diagnostics. Microbiological diagnostics' procedures – specimen selection, collection (blood, urine, excretions, feces, etc.) and transportation. Methodologies of infection microbiological diagnostics. Preparation of smears and their staining methods. Microscopy techniques. Cultivation methods of microorganisms. Biochemical methods used for identification of microorganisms. Immunological assays used in infection diagnostics. Molecular diagnostic methods used for identification of microorganisms. Matrix-assisted laser desorption/ionization-time of flight mass spectrometry and its use for identification of microorganisms. Antimicrobial resistance determination methods.

3) Causative agents of infections in human organ systems. Skin and soft tissue infectious agents – their characteristics, infections' pathogenesis, microbiological diagnostics, prophylaxis principles and measures. Eye and ear infectious agents – their characteristics, infections' pathogenesis, microbiological diagnostics, prophylaxis principles and measures. Respiratory system infectious agents – their characteristics, infections' pathogenesis, microbiological diagnostics, prophylaxis principles and measures. Gastrointestinal system infectious agents – their characteristics, infections' pathogenesis, microbiological diagnostics, prophylaxis principles and measures. Central nervous system infectious agents – their characteristics, infections' pathogenesis, microbiological diagnostics, prophylaxis

principles and measures. Urogenital system infectious agents – their characteristics, infections’ pathogenesis, microbiological diagnostics, prophylaxis principles and measures. Bone and joint infectious agents – their characteristics, infections’ pathogenesis, microbiological diagnostics, prophylaxis principles and measures. Nosocomial infectious agents – their characteristics, infections’ pathogenesis, microbiological diagnostics, prophylaxis principles and measures.

### RECOMMENDED LITERATURE SOURCES

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<https://link.springer.com/book/10.1007/978-3-319-99921-0?page=4#toc>

### **CONSULTING LECTURERS**

1. Coordinating lecturer: Tomas Kačergius (Assoc. Prof. Dr.).

2. Agnė Kirkliauskienė (Assoc. Prof. Dr.).

3. Silvija Kiverytė (Assoc. Prof. Dr.).

### **APPROVED:**

By Council of Doctoral School of Medicine and Health Sciences at Vilnius University:  
29<sup>th</sup> of September 2022

Chairperson of the Board: Prof. Janina Tutkuvienė