Course: Microbiology
Program of classes: 2025/2026 (stationary)

Summer semester (VI) - 17 weeks

- Labs - 53 didactic hours (stationary)
- Seminars - 10 didactic hours (stationary)

Place: Classroom at the Department of Medical Microbiology and Nanobiomedical Engineering (Collegium Universum, Mickiewicza 2c Street).

Time:

Monday	
14:30-17:15 (group 7)	dr Krzysztof Fiedoruk, dr Tamara Daniluk
Wednesday	**Teachers**
8.00 – 10.45 (groups 1, 2, 3)	dr Krzysztof Fiedoruk, dr Tamara Daniluk, dr Urszula Wnorowska,
11.00 – 13.45 (groups 4, 5, 6)	dr Krzysztof Fiedoruk, dr Urszula Wnorowska, dr Sylwia Chmielewska-Deptuła

Lab	Date
Lab 1. Study of the microbial cell morphology under the light microscope. Tutorial: 1. Organizational matters. 2. Safety precautions in microbiology laboratory. 3. Microscopy and various types of microscopes. 4. Bacterial cell morphology and bacterial staining methods (Gram staining). Practical part: Evaluation of the microbial cell morphology using a light microscope and the Gram staining technique. Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ Chapters 4, 12	**23 February 2026** (Monday) **25 February 2026** (Wednesday)
Lab 2. Bacteria staining techniques and methods for isolation and cultivation of aerobic bacteria. Student's knowledge evaluation: Topics from the 1st Lab and Lecture and the related book chapters. Tutorial: 1. Division and application of microbial staining methods: - simple vs. differential staining; positive vs negative techniques - special staining techniques (Neisser´s, Dorner´s, Maneval´s, Ziehl-Neelsen stain, etc.) 2. Microbiological media and methods for isolation and cultivation of aerobic bacteria. - liquid and solid media, simple and enriched media, differential and selective media - microbial cultures (mixed vs. pure) and growth conditions - microbial colony and cultural appearances Practical part: 1. Microscopic observation of bacterial capsules, spores and granules. 2. Isolation of microorganisms from clinical specimens on solid media (the practice of the quadrant streak method). 3. Gram staining and microscopic observation of preparations from clinical specimens. 4. Morphology of bacterial colonies. Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapters 4, 12-13	**02 March 2026** (Monday) **04 March 2026** (Wednesday)

Lab 3. Bacteria identification methods, cultivation of anaerobic and microaerophilic bacteria. Student's knowledge evaluation: Topics from Lab 2 and Lectures 2-3 and the related book chapters: Tutorial: 1. Classification and characteristics of anaerobic and microaerophilic bacteria. 2. Bacteriological media and methods used for isolation and cultivation of anaerobic and microaerophilic bacteria. Practical part: 1. Types of bacterial growth in liquid media. 2. Isolation and presumptive identification of microorganisms present in clinical samples on selective and selective/differential media (continuation of the experiment from the previous lab). 3. Macroscopic observation (colony morphology) of bacterial cultures, including anaerobic and microaerophilic bacteria. 4. Gram staining of anaerobic and microaerophilic bacteria. Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapter 13	**09 March 2026** (Monday) **11 March 2026** (Wednesday)
TEST 1: General microbiology Covers topics from Labs 1-3 and Lectures 1-2 and the related book chapters	***See Blackboard for details.***
Lab 4. Gram-positive bacteria Student's knowledge evaluation: Topics from Lecture 3 and the related book chapters. Tutorial: Classifications and characteristics of Gram-positive (Gram+) bacteria *(Staphylococcus, Streptococcus, Enterococcus, Bacillus, Corynebacterium, Listeria*, etc.). Practical part: Physiological (biochemical) characteristics, culture, and identification methods. Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapters 14, 15, 18-21 Lecture 3	**16 March 2026** (Monday) **18 March 2026** (Wednesday)
Lab 5. Gram-negative bacteria Student's knowledge evaluation: Topics from Lecture/Lab 4 and the related book chapters. Tutorial: Classifications and characteristics of Gram-negative (Gram-) bacteria (Enterobacterales, *Pseudomonas, Neisseria, Haemophilus, Bordetella*, etc.). Practical part: Physiological (biochemical) characteristics, culture, and identification methods. Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapters 14, 15, 23-29 Lecture 4	**23 March 2026** (Monday) **25 March 2026** (Wednesday)
Seminar 1. Anaerobic and atypical bacteria **In the seminar students present PowerPoint presentations on earlier designated topics.** Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapters 22, 30-35 Lecture 5	**30 March 2026** (Monday) **01 April 2026** (Wednesday)

Lab 6. Fungi Student's knowledge evaluation: Topics from Lecture/Lab 5, and the related chapters. Tutorial: Fungal classification, structure, and reproductive characteristics. Medically relevant fungi and classification of human mycoses. Mycotoxins and mycotoxicoses. Practical part: 1. Culture and identification of yeasts: *Candida, Cryptococcus, Saccharomyces,* and other yeast and yeast-like fungi. 2. Culture and identification of molds: *Aspergillus, Penicillium,* and other molds. Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapters 57-66 Lecture 6	**13 April 2026** (Monday) ***(Eastern Orthodox holiday - to be arranged with the students)*** **15 April 2026** (Wednesday)
TEST 2: Classification and characteristics of medically relevant bacteria and fungi Covers topics from Labs 4-6, Lectures 3-6, Seminar 1 and the related book chapters	***See Blackboard for details.***
Lab 7. Antimicrobial susceptibility testing (AST) Student's knowledge evaluattion: Topics from Lecture/Lab 6 and the related chapters. Tutorial: Antimicrobial susceptibility testing (AST) methods, definitive and empirical antibiotic therapy, antibiotic breakpoints: antibiotic minimum inhibitory (MIC) and bactericidal (MBC) concentrations Practical part: Control of microbial growth in human diseases: 1. Antibiotic Susceptibility Tests (ASTs): - antibiotic dilution methods and gradient diffusion method (Etest) - demonstration of VITEK 2 - the automated system for AST - disk diffusion (Kirby-Bauer) method 2. Interpretation and reporting of AST results (EUCAST guidelines) Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapter 17 Lecture 8	**20 April 2026** (Monday) **22 April 2026** (Wednesday)
Lab 8. Mechanisms of resistance to antimicrobial agents Student's knowledge evaluation: Topics from Lecture/Lab 7 and the related chapters. Tutorial: Review of antibacterial agents: mechanisms of action, spectrum and activity, mechanisms of resistance to antibacterial agents. Practical part: 1. Detection of mechanisms of resistance to antibacterial agents and interpretation of the results 2. Demonstration of specific phenotypic/genotypic/serologic methods for detecting antibacterial resistance ▪ Beta-lactamases as a major mechanism of resistance to β-lactams in Gram-negative bacteria (Enterobacterales, non-fermentative rods, *Haemophilus* spp., *Neisseria* spp., *Moraxella catarrhalis*, etc.) - Types of β-lactamases and detection methods: ESBL, AmpC, NDM, KPC, etc. 2. Alert pathogens Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ Section 4 – Bacteriology, chapter 17	**27 April 2026** (Monday) **29 April 2026** (Wednesday) ***(day off - to be arranged with the students)***

Article: An overview of the antimicrobial resistance mechanisms of bacteria (https://pubmed.ncbi.nlm.nih.gov/31294229/) Lecture 6-8	
Seminar 2. Mechanisms of resistance to antimicrobial agents, cont; Rational antimicrobial therapy **In the seminar students present PowerPoint presentations on earlier designated topics.** Tutorial: Review of antibacterial agents: mechanisms of action, spectrum and activity, mechanisms of resistance to antibacterial agents. 1. Detection of mechanisms of resistance to antibacterial agents in Gram+ bacteriaand interpretation of the results ▪ resistance to vancomycin among staphylococci (VISA, VRSA) and enterococci (VRE), ▪ MLS_B (*macrolide-lincomycin-streptogramin* B) type of resistance, ▪ HLAR (*high level aminoglycoside resistant*) type of resistance among enterococci. ▪ Methicillin-resistant Staphylococci (MRSA, MRCNS) ▪ Resistance to penicillin in *Streptococcus pneumoniae* (PISP; PRSP) 2. Principles of the Rational Antimicrobial Therapy Recommended reading: „Medical Microbiology" Murray PR, 9th ed. 3. chapter 17 Article: An overview of the antimicrobial resistance mechanisms of bacteria (https://pubmed.ncbi.nlm.nih.gov/31294229/) Lecture 6-8	**04 May 2026** (Monday) **06 May 2026** (Wednesday)
Lab 9. Sterilization, disinfection, and antisepsis Student's knowledge evaluation: Topics from Lecture/Lab 8 and the related chapters. Tutorial and Practical part: Control of microbial growth: 1. Physical, chemical and mechanical methods of disinfection and sterilization 2. Chemical agents of disinfection and sterilization 3. Monitoring and control of the sterilization processes 4. Sterilants, disinfectants, and levels of disinfection 5. Antiseptics and antiseptic procedures 6. Types of hygienic hand washing 7. Critical and semi-critical medical equipment/devices 8. Microbiological control of air and surfaces Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapter 3	**11 May 2026** (Monday) **13 May 2026** (Wednesday)
TEST 3: Antimicrobial therapy (antibacterial, antifungal and antiviral) and microbial growth control (disinfection, sterilization, decontamination, antisepsis) Covers topics from Labs 7-9, Lectures 7-8, Seminar 2, and the related book chapters	***See Blackboard for details.***
Lab 10. Urinary tract infections (UTIs) and Sexually transmitted diseases (STDs) Student's knowledge evaluation: Topics from Lab 10 and the related chapters. Tutorial and Practical part: 1. Urinary tract infections (UTI) - characteristics of uropathogens: *Escherichia coli* and other Gram-negative rods, staphylococci, enterococci and *Candida* spp. - microbiological diagnosis and antimicrobial therapy of UTIs 2. Characteristics of sexually transmitted pathogens (*Chlamydia trachomatis, Neisseria gonorrhoeae, Treponema pallidum*, *Mycoplasmas,* etc.) and diagnosis and treatment of STDs 3. Congenital (TORCH group), perinatal and postnatal infections 4. Analysis of clinical cases Recommended reading:	**18 May 2026** (Monday) **20 May 2026** (Wednesday)

„Medical Microbiology" Murray PR, 9th ed. ▪ chapters 5-6, 15-16, 39, 60 "Mims' Medical Microbiology and Immunology", Goering R., 5th ed. ▪ chapters 21-22 and 24 ▪ Lecture 9	
Lab 11. **Gastrointestinal tract infections (GTIs)** Student's knowledge evaluation: Topics from Lab 11 and the related chapters. Tutorial and Practical part: 1. Gastrointestinal tract infections (GTI): - characteristics of enteropathogens: pathotypes of *Escherichia coli (EHEC, EPEC, EIEC, EAEC), Salmonella, Shigella, Yersinia, Campylobacter, Helicobacter pylori, Clostridioides difficile, Listeria monocytogenes* - microbiological diagnosis and treatment of GTIs • pathogen, antigen and toxin detection in stool specimens 2. Analysis of clinical cases Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapters 5-6, 15-16, 39, 60 "Mims' Medical Microbiology and Immunology", Goering R., 5th ed. ▪ chapter 23	**25 May 2026** (Monday) **27 May 2026** (Wednesday)
Seminar 3. Hospital infections **In the seminar students present PowerPoint presentations on earlier designated topics.** Recommended reading: "Mims' Medical Microbiology and Immunology", Goering R., 5th ed. ▪ Chapter 37 ▪ Lecture 9-10	**01 June 2026** (Monday) **03 June 2026** (Wednesday)
Lab 12. **Respiratory tract infections and central nervous system infections** Student's knowledge evaluation: Topics from Lab 11 and the related chapters. Tutorial: **1.** Etiological agents (bacteria, viruses and fungi) and pathogenesis of meningitis, encephalitis, and other CNS infections. **2.** Respiratory tract infections (RTIs): characteristics of some pathogens of upper (URTI) and lower respiratory tract infections (LRTI). Community and hospital LRTI. Immunodiagnostic of infectious diseases. Practical part: 1. Laboratory diagnosis of purulent and aseptic meningitis • Microscopy and culture of cerebrospinal fluid (CSF) • Specific antigen or antibody detection in CSF • Nucleic acid amplification assays (NAAT) 2. Microbiological, immunological, and genetic (NAAT) methods in the diagnosis of RTIs • Cultures and typical microbial agents • *Streptococcus pneumoniae* • *Haemophilus influenzae* and others • Pathogens and diagnosis of atypical pneumonia: • Viruses: *Influenza A virus*, RSV, *Parainfluenzavirus* • Bacteria: *Chlamydia, Chlamydophila, Rickettsia, Anaplasma, Coxiella, Mycosplasma, Legionella, etc.* • Demonstration of BIOFIRE System panels test (automated multiplex genetic pathogen detection system) 3. Analysis of clinical cases Recommended reading: „Medical Microbiology" Murray PR, 9th ed.	**08 June 2026** (Monday) **10 June 2026** (Wednesday)

▪ chapters 5-6, 15-16, 39, 60 "Mims' Medical Microbiology and Immunology", Goering R., 5th ed. ▪ chapters 19-20 and 25-26 ▪ Lecture 9	
Lab 13. Bloodstream, skin, and soft-tissue infections. Student's knowledge evaluation: Topics from Lab 12 and the related chapters. Tutorial: Skin and soft tissue infections. Bloodstream infections: sepsis, septic and endotoxic shock, *endocarditis infectiosa,* etc. Etiological agents of bloodstream infections and treatment methods. Practical part: Microbiological diagnosis of bloodstream infections: - blood collection, blood culture bottles, and blood cultures - analysis of clinical cases Recommended reading: „Medical Microbiology" Murray PR, 9th ed. ▪ chapters 5-6, 15-16, 39, 60 "Mims' Medical Microbiology and Immunology", Goering R., 5th ed. ▪ chapters 27 and 30 ▪ Lecture 9	**15 June 2026** (Monday) **17 June 2026** (Wednesday)
PRACTICAL ASSESSMENT	**22 June 2026** (Monday) **24 June 2026** (Wednesday)
FINAL EXAM	***See Blackboard for details.***

Test 1-3 dates (*to be scheduled*):

#	Topic	Date/Time/Place
Test 1	**General microbiology.** Covers topics from Labs/Lectures 1-2 and the related book chapters.	1st term:
Test 2	**Classification and characteristics of medically relevant bacteria and fungi.** Covers topics from Labs 4-6, Lectures 3-6, Seminar 1 and the related book chapters.	1st term:
Test 3	**Antimicrobial therapy (antibacterial, antifungal and antiviral) and microbial growth control (disinfection, sterilization, decontamination, antisepsis).** Covers topics from Labs 7-9, Lectures 7-8, Seminar 2, and the related book chapters.	1st term:

Extra credits (*to be scheduled*):

#	Credit	Date/Time/Place
1.	**Make-up dates for students absent from any of tests 1–3** (1st term) **will be scheduled after the tests are completed.**	2nd term: 3rd term:
2.	**Pre-exam** (after all scheduled tests and after #1).	2nd term: 3rd term:
3.	**An additional date for students who failed "Practical assessment"** (1st term)	2nd term:

The course coordinator: dr hab. Krzysztof Fiedoruk
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Course: Microbiology
Program of lectures: 2025/2026 (online)

Summer semester (VI)
(20 hours, 10 weeks, lecture duration - 1.30 clock hours)

Place: Blackboard platform (Subject: Microbiology 2025_2026.ED.LE.J.2.28.A)
Time: Tuesday at 16.45 – 18.15
Lecturer: Prof. Robert Bucki (email: buckirobert@gmail.com)

Lecture	Date
1. Introduction to medical microbiology. Classification of medically relevant bacteria. Structure and functions of the bacterial cell.	**24 February 2026**
2. Etiopathogenesis and epidemiology of infectious diseases (bacterial, viral, and fungal), including the immunopathogenesis and virulence factors related to invasion and inflammation. Metabolism and genetics of pathogenic bacteria.	**03 March 2026**
3. Classification and characteristics of Gram-positive bacteria.	**10 March 2026**
4. Classification and characteristics of Gram-negative bacteria.	**17 March 2026**
5. Classification and characteristics of anaerobic and atypical bacteria.	**24 March 2026**
6. Yeasts and molds fungi: structure and biological properties, classification, pathogenicity, and epidemiology. Mycotoxins. Antifungal chemotherapeutics.	**31 March 2026**
7. Overview of DNA and RNA viruses pathogenic to humans: characteristics, immunopathogenesis, epidemiology, prevention, and antiviral therapy. Interferons. HIV and AIDS. Oncogenic viruses.	**14 April 2026**
8. Antimicrobial therapy. Overview of antibacterial, antifungal, and antiviral chemotherapeutic agents. Planning of the rational antimicrobial therapy based on identification of causative agents and their drug resistance. Strategies for discovering new antimicrobial agents.	**21 April 2026**
9. Selected invasive infections (bloodstream infections, sepsis, meningitis). Biofilm-associated infections.	**28 April 2026**
10. Sexually transmitted infections. Microbiology in medical practice.	**05 May 2026**