

Course: Microbiology
Program of classes: 2023/2024 (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:

Wednesday	Teachers
8.00 – 10.45 (groups 1, 2, 2)	dr Krzysztof Fiedoruk, dr Urszula Wnorowska, dr Tamara Daniluk
11.00 – 13.45 (groups 4, 5, 6)	dr Krzysztof Fiedoruk, dr Tamara Daniluk, dr Urszula Wnorowska
14:45-17:30 (group 7)	dr Krzysztof Fiedoruk

Lab	Date
<p>Lab 1. Study of the microbial cell morphology under the light microscope.</p> <p><u>Tutorial :</u></p> <ol style="list-style-type: none"> 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 method). <p><u>Practical part:</u> Evaluation of microbial cell morphology under the light microscope and practice of Gram staining technique.</p> <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. <ul style="list-style-type: none"> ▪ Chapters 4, 12 </p>	21 February 2024
<p>Lab 2. Bacteria staining techniques and methods for isolation and cultivation of aerobic bacteria.</p> <p><u>Student's knowledge evaluation:</u> Topics from the 1st Lab and Lecture and the related book chapters.</p> <p><u>Tutorial:</u></p> <ol style="list-style-type: none"> 1. Division and application of microbial staining methods: <ul style="list-style-type: none"> - 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. <ul style="list-style-type: none"> - 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 <p><u>Practical part:</u></p> <ol style="list-style-type: none"> 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. 	28 February 2024

<p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ chapters 4, 12-13</p>	
<p>Lab 3. Bacteria identification methods, cultivation of anaerobic and microaerophilic bacteria.</p> <p><u>Student's knowledge evaluation:</u> Topics from Lab 2 and Lectures 2-3 and the related book chapters:</p> <p><u>Tutorial:</u> 1. Classification and characteristics of anaerobic and microaerophilic bacteria. 2. Media and methods for isolation and cultivation of anaerobic and microaerophilic bacteria.</p> <p><u>Practical part:</u> 1. Bacterial growth in liquid media. 2. Identification of microorganisms present in clinical samples on selective and 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.</p> <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ chapter 13</p>	<p>06 March 2024</p>
<p><u>TEST 1: General microbiology</u> Covers topics from Labs/Lectures 1-3 and the related book chapters</p>	
<p>Lab 4. Gram-positive bacteria</p> <p><u>Student's knowledge evaluation:</u> Topics from Lecture 3 and the related book chapters.</p> <p><u>Tutorial:</u> Classifications and characteristics of Gram+ bacteria (<i>Staphylococcus</i>, <i>Streptococcus</i>, <i>Enterococcus</i>, <i>Bacillus</i>, <i>Corynebacterium</i>, <i>Listeria</i>, etc.). <u>Practical part:</u> Physiological (biochemical) characteristics, culture and identification methods.</p> <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ chapters 14, 15, 18-21 Lecture 4</p>	<p>To be set (for all students) 13 March 2024</p>
<p>Lab 5. Gram-negative bacteria</p> <p><u>Student's knowledge evaluation:</u> Topics from Lecture/Lab 4 and the related book chapters.</p> <p><u>Tutorial:</u> Classifications and characteristics of Gram- bacteria (Enterobacteriaceae, <i>Pseudomonas</i>, <i>Neisseria</i>, <i>Haemophilus</i>, <i>Bordetella</i>, etc.). <u>Practical part</u> : Physiological (biochemical) characteristics, culture and identification methods.</p> <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ chapters 14, 15, 23-29 Lecture 5</p>	<p>20 March 2024</p>
<p>Seminar 1. Anaerobic and atypical bacteria</p> <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed.</p>	<p>27 March 2024</p>

<ul style="list-style-type: none"> ▪ chapters 22, 30-35 <p>Lecture 6</p>	
<p>Lab 6. Fungi</p> <p><u>Student's knowledge evaluation:</u> Topics from Lecture/Lab 5, and the related chapters.</p> <p><u>Tutorial:</u> Fungal classification, structure and reproductive characteristics. Medically relevant fungi and classification of human mycoses. Mycotoxins and mycotoxicoses.</p> <p><u>Practical part:</u></p> <ol style="list-style-type: none"> 1. Culture and identification of yeasts: <i>Candida</i>, <i>Cryptococcus</i>, <i>Saccharomyces</i> and other yeasts. 2. Culture and identification of moulds: <i>Aspergillus</i>, <i>Penicillium</i> and other moulds. <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed.</p> <ul style="list-style-type: none"> ▪ chapters 57-66 <p>Lecture 7</p>	<p>10 April 2024</p>
<p><u>TEST 2: Classification and characteristics of medically relevant bacteria and fungi</u></p>	<p><i>To be set (for all students)</i></p>
<p>Lab 7. Antimicrobial susceptibility testing (AST)</p> <p><u>Student's knowledge evaluation:</u> Topics from Lecture/Lab 6 and the related chapters.</p> <p><u>Tutorial:</u> Microbial growth control and measures: chemotherapy and chemoprophylaxis. Definitive and empirical chemotherapy. Antibacterial agents.</p> <p><u>Practical part</u> : Control of microbial growth in human diseases:</p> <ol style="list-style-type: none"> 1. Susceptibility test methods: <ol style="list-style-type: none"> 1.1. Dilution (MIC, MBC) and disk diffusion methods 1.2. Antibiotic gradient diffusion method (Etest) 1.3. Breakpoint susceptibility tests 2. Interpretation and reporting of results <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed.</p> <ul style="list-style-type: none"> ▪ chapter 17 <p>Lecture 8</p>	<p>17 April 2024</p>
<p>Lab 8. Resistance to antimicrobial agents</p> <p><u>Student's knowledge evaluation:</u> Topics from Lecture/Lab 7 and the related chapters.</p> <p><u>Tutorial:</u> Review of antibacterial chemotherapeutics: mechanisms of action, spectrum and activity. Bacterial mechanisms of resistance to antibacterial agents.</p> <p><u>Practical part:</u></p> <ol style="list-style-type: none"> 1. Methods of drug resistance measurement and interpretation of the results 2. Special phenotypic methods for detecting antibacterial resistance <ul style="list-style-type: none"> ▪ Resistance to β-lactams in Gram-negative bacteria (<i>Enterobacteriales</i>, non-fermentative rods, <i>Haemophilus</i> spp., <i>Neisseria</i> spp., <i>Moraxella catarrhalis</i>, etc.) <ul style="list-style-type: none"> - β-lactamases and methods of study: ESBL, AmpC, KPC and others, 2. Alert pathogens 	<p>24 April 2024</p>

<p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ Section 4 – Bacteriology, chapter 17 Article: An overview of the antimicrobial resistance mechanisms of bacteria (https://pubmed.ncbi.nlm.nih.gov/31294229/) Lecture 9</p>	
<p>Seminar 2. Resistance to antimicrobial agents, cont; Rational antimicrobial therapy</p> <ol style="list-style-type: none"> 1. Methods of drug resistance measurement and interpretation of the results: <ul style="list-style-type: none"> • Study methods of resistance to vancomycin among staphylococci (VISA, VRSA) and enterococci (VRE), • MLS_B (<i>macrolide-lincomycin-streptogramin B</i>) type of resistance, HLAR (<i>high level aminoglycoside resistant</i>) type of resistance among enterococci. • Special phenotypic methods for detecting antibacterial resistance • Assessment of resistance of <i>Staphylococcus</i> to methicillin (MRSA, MRCNS) • Assessment of resistance to penicillin or/and ampicillin among <i>Streptococcus pneumoniae</i> (PISP; PRSP) 2. Principles of rational antimicrobial therapy <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ chapter 17 Article: An overview of the antimicrobial resistance mechanisms of bacteria (https://pubmed.ncbi.nlm.nih.gov/31294229/) Lecture 9</p>	<p>08 May 2024</p>
<p>Lab 9. Sterilization, disinfection and antisepsis</p> <p><u>Student's knowledge evaluation:</u> Topics from Lecture/Lab 8 and the related chapters.</p> <p><u>Tutorial and Practical part:</u> Control of microbial growth and measures :</p> <ol style="list-style-type: none"> 1. Physical agents of disinfection and sterilization 2. Chemical agents of disinfection and sterilization 3. Monitoring and control of sterilization process 4. Sterilants and levels of disinfectants 5. Infection control epidemiology (hospital infections) and clinical microbiology <ol style="list-style-type: none"> 5.1. Microbiologic control of air and surfaces 5.2. Decontamination 5.3. Aseptic and antiseptic procedures <ol style="list-style-type: none"> 5.3.1. Antiseptic agents 5.4. Hand washing <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ chapter 3</p>	<p>15 May 2024</p>
<p><u>TEST 3: Antimicrobial therapy (antibacterial, antifungal and antiviral) and microbial growth control (disinfection, sterilization, decontamination, antisepsis)</u></p>	<p>To be set (for all students)</p>
<p>Lab 10. Urinary tract infections (UTIs) and Sexually transmitted diseases (STDs)</p> <p><u>Student's knowledge evaluation:</u> Topics from Lab 10 and the related chapters.</p> <p><u>Tutorial and Practical part:</u></p>	<p>22 May 2024</p>

<p>1. Urinary tract infections (UTI)</p> <p>1.1. Characteristics of uropathogens: <i>Escherichia coli</i> and some other Gram-negative bacilli, staphylococci, enterococci and <i>Candida</i> spp.</p> <p>1.2. Microbiological and immunological methods to diagnosis of UTI</p> <p>2. Causative agents pathogenesis and immunodiagnosis of sexual transmitted diseases \ (STD) and congenital perinatal infections</p> <p>3.1. Non-specific and specific tests for diagnosis of <i>Treponema palladium</i> infection (syphilis).</p> <p><u>Recommended reading:</u> „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</p>	
<p>Lab 11. Gastrointestinal tract infections (GTIs)</p> <p><u>Student's knowledge evaluation:</u> Topics from Lab 11 and the related chapters.</p> <p><u>Tutorial and Practical part:</u></p> <p>3. Gastrointestinal tract infections (GTI) :</p> <p>3.1. Main microbial pathogens, pathogenesis and immunity: <i>Escherichia coli</i>, <i>Salmonella</i>, <i>Shigella</i>, <i>Yersinia</i>, <i>Campylobacter</i>, <i>Helicobacter pylori</i>, <i>Clostridium difficile</i>, <i>Listeria monocytogenes</i></p> <p>3.2. Microbiological, immunological and molecular methods to diagnosis of GTI</p> <ul style="list-style-type: none"> • pathogen, antigen and /or toxin detection in stool specimens <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ chapters 5-6, 15-16, 39, 60 “Mims' Medical Microbiology and Immunology”, Goering R., 5th ed. ▪ chapter 23</p>	29 May 2024
<p>Seminar 3. Hospital infections</p> <p><u>Recommended reading:</u> “Mims' Medical Microbiology and Immunology”, Goering R., 5th ed. ▪ Chapter 37</p>	05 June 2024
<p>Lab 12. Respiratory tract and central nervous system infections</p> <p><u>Student's knowledge evaluation:</u> Topics from Lab 11 and the related chapters.</p> <p><u>Tutorial:</u> Microbial agents (bacteria, viruses and fungi) and pathogenesis of meningitis. Respiratory tract infections (RTI): characteristics of some pathogens of upper (URTI) and lower respiratory tract infections (LRTI). Community and hospital LRTI. Immunodiagnostic of infectious diseases.</p> <p><u>Practical part:</u></p> <p>1. Laboratory diagnosis of purulent and aseptic meningitis</p> <ul style="list-style-type: none"> • Microscopy and culture of cerebrospinal fluid (CSF) • Specific antigen or antibody detection in CSF or and serum • Nucleic acid amplification assays <p>2. Microbiological and immunological methods to diagnosis of RTI</p> <ul style="list-style-type: none"> • Cultures and typical microbial agents <ul style="list-style-type: none"> • <i>Streptococcus pneumoniae</i> • <i>Haemophilus influenzae</i> and others • Pathogens and diagnosis of atypical pneumonia : 	12 June 2024

<ul style="list-style-type: none"> • Viruses : <i>Influenza A virus</i>, RSV, <i>Parainfluenzavirus</i> • Bacteria : <i>Chlamydia</i>, <i>Chlamydophila</i>, <i>Rickettsia</i>, <i>Anaplasma</i>, <i>Coxiella</i>, <i>Mycosplasma</i>, <i>Legionella</i> <p><u>Recommended reading:</u> „Medical Microbiology” Murray PR, 9th ed. ▪ chapters 5-6, 15-16, 39, 60 “Mims' Medical Microbiology and Immunology”, Goering R., 5th ed. ▪ chapters 19-20 and 25-26</p>	
<p>Lab 13. Bloodstream, skin and soft-tissue infections.</p> <p><u>Student's knowledge evaluation:</u> Topics from Lab 12 and the related chapters.</p> <p><u>Tutorial :</u> Skin and soft tissue infections. Bloodstream infections: sepsis, septic and toxic shocks, <i>endocarditis infectiosa</i> and others.</p> <p><u>Practical part:</u> Major agents in blood and hospital infections and diagnostic methods: <ul style="list-style-type: none"> • classic (culture) and modern methods for the detection of antigens and/or nucleic acids for diagnosis of infectious diseases and for epidemiological analysis. </p> <p><u>Recommended reading:</u> „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</p>	19 June 2024
<u>Practical assessment</u>	26 June 2024
FINAL EXAM	<i>to be set</i>

Course: Microbiology
Program of lectures: 2023/2024 (online)

Summer semester (VI)

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

Place: Blackboard platform

Time: Tuesday at 13.45 – 15.15

Lecture	Date
1. Introduction to medical microbiology. Classifications and characteristics of cellular microorganisms (bacteria, fungi, protists) and acellular microorganisms viruses, virus-like organisms (viroids) and prions. Prokaryotic and eukaryotic microorganisms.	20 February 2024
2. Bacterial cell structures and functions.	27 February 2024
3. Bacterial metabolism and genetics.	05 March 2024
4. Introduction to mechanisms of bacterial pathogenesis: colonization, adhesion, invasion and inflammatory response. Bacterial toxins: exotoxins, endotoxins, and other virulence factors. Classification and characterization of Gram-positive bacteria.	12 March 2024
5. Classification and characterization of Gram-negative bacteria.	19 March 2024
6. Classification and characterization of anaerobic and atypical bacteria.	26 March 2024
7. Fungal classification, structure and reproductive characteristics. Medical important Fungi and classification of human mycoses. Mycotoxins and mycotoxicosis.	09 April 2024
8. Antimicrobial chemotherapy: mains groups of antibacterial drugs: mechanisms of action and spectrum. Mechanisms of resistance to antibacterial agents: emergence and spread of antibiotic resistance (alert, multidrug resistant pathogens). Part 1.	16 April 2024
9. Antimicrobial chemotherapy: mains groups of antibacterial and antifungal drugs: mechanisms of action and spectrum. Mechanisms of resistance to antimicrobial agents: emergence and spread of antibiotic resistance (alert, multidrug resistant pathogens). Part 2.	23 April 2024
10. Medical important DNA and RNA viruses: classification and characteristics. Viral immunopathogenesis and epidemiology. Interferons. HIV and AIDS. Antiviral drugs: mechanisms of action and spectrum. Oncogenic viruses.	30 April 2024

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