

**DETAILED MICROBIOLOGY (1) CLASS SCHEDULE**  
**Summer semester, academic year 2023/24**

All course materials are available at:

[www.umw.edu.pl/pl/jednostki/katedra-i-zaklad-mikrobiologii](http://www.umw.edu.pl/pl/jednostki/katedra-i-zaklad-mikrobiologii)

Laboratory microbiology classes occur at the Department of Medical Microbiology at Chałubińskiego 4 on 2<sup>nd</sup> floor . Written final class tests (10 open questions) will be held strictly according to designated dates. The test schedule can be found in the "Important dates" section on the Department's website.

**Test dates of class tests are not subject to change.**

The student must theoretically prepare for each class based on the lecture and materials presented on our website.

<b>MONDAY</b>	<b>11.00 - 12.30</b> room 209
	<b>12.45 - 14.15</b> room 209
	<b>14.30 - 16.00</b> room 209
<b>TUESDAY</b>	<b>8.00 - 9.30</b> room 209
	<b>9.45 - 11.15</b> room 209
	<b>11.30 -13.00</b> room 209
	<b>13.15 - 14.45</b> room 209
<b>WEDNESDAY</b>	<b>7.30 - 9.00</b> room 209
	<b>9.15 - 10.45</b> room 209
	<b>12.00 -13.30</b> room 209
	<b>13.45 - 15.15</b> room 209
<b>THURSDAY</b>	<b>8.00 - 9.30</b> room 209
	<b>9.45 - 11.15</b> room 209
	<b>11.30 -13.00</b> room 209
	<b>13.15 - 14.45</b> room 209

<b>Semestr letni:</b> 15 weeks - 30h  <b>Free from classes:</b> 29.03-03.04.2024 01.05.24- 03.05.2024 23.05.2024 30.05 -31.05.2024	<b>Class 1.</b> Bacterial morphology. Staining techniques.	26.02-01.03.2024
	<b>Class 2.</b> Antimicrobials part I	04.03 -08.03.2024
	<b>Class 3.</b> Gram-positive cocci: staphylococci and streptococci	11.03 -15.03.2024
	<b>Class 4.</b> Gram-positive bacilli and rods	18.03 – 22.03.2024
	<b>Class 5.</b> Mycobacterium, Actinomyces, Nocardia	25.03 – 28.03.2024
	<b>Class 6.</b> Gram-positive bacteria resistance to antimicrobials.	08.04 -12.04.2024 <b>TEST 1</b> (CL 3-5 with selected groups of antibiotics)
	<b>Class 7.</b> Gram-negative fermentative; non-fermentative rods and obligatory anaerobic bacteria	15.04 - 19.04.2024
	<b>Class 8.</b> Gram-negative small rods and cocci.	22.04 – 26.04.2024
	<b>Class 9.</b>	06.05 – 10.05. 2024

	Gram-negative bacteria resistance to antimicrobials.	
	<b>Class 10.</b> Atypical bacteria.	13.05 – 17.05.2024 <b>TEST 2</b> (CL 6-9 with selected groups of antibiotics)
	<b>Class 11.</b> Spiral bacteria.	Thursday groups: <b>Friday</b> 17.05.2024; 20.05 – 22.05.2024
	<b>Class 12.</b> Mycology – basis of diagnosis.	Thursday groups: <b>Friday</b> 24.05.2024 27.05 – 29.05.2024
	<b>Class 13.</b> Sterilization and disinfection.	03.06 – 07.06.2024 <b>TEST 3</b> (CL 10-12 with selected groups of antibiotics)
	<b>Class 14.</b> Natural flora of human body. Endogenous and opportunistic infections	10.06 – 14.06.2024
	<b>Class 15.</b> Credit class.	17.06 – 21.06.2024

**Thursday groups - schedule for making up classes on Fridays :**

CL 3	8.00 - 9.30	room 209
CL 4	9.45 - 11.15	room 209
CL 2	11.30 - 13.00	room 209
CL 1	13.15 - 14.45	room 209

**CLASS 1**

**BACTERIAL MORPHOLOGY. METHODS OF STAINING PREPARATIONS.**

**To familiarize students with bacterial staining techniques.**

*The student knows:*

1. Differences in the structure of the cell wall of Gram-positive (GP) and Gram-negative (GN) bacteria and cell wall antigens playing a role in the pathomechanism of bacterial infections (i.e., LPS and LTA).
2. The role of the most essential bacterial cell structures (i.e., envelope, glycocalyx, adhesins (proteins and fimbriae), cilia, spores) in the pathomechanism of bacterial infections.
3. Differences between anaerobic and aerobic bacteria that influence the results of bacteriological examination.
4. Can describe the viewed microscopic preparation: whether the bacterium is GP or GN, the arrangement of bacterial cells.
5. The concepts of pathogenicity and virulence, and can describe the routes of spread of infections, know the definitions of endogenous infection, reservoir, source of infection, carriage, specific and non-specific prophylaxis, antigenemia, viremia, toxemia, bacteremia, antitoxin, and vaccine antigens.

**CLASS 2**

**ANTIBIOTICS part I. MECHANISMS OF ACTION OF ANTIBIOTICS.**

**To familiarize students with antibiotics and chemotherapeutics - their mechanism of action, groups, and antibacterial activity.**

*The student knows:*

1. Mechanisms of action of antibiotics on bacteria.
2. Division into bactericidal and bacteriostatic antibiotics and antibiotics with a narrow and broad spectrum of activity; can develop the acronyms MIC and MBC and know their meaning and importance.
3. Can list the groups of antibiotics depending on the mechanism of action: inhibiting cell wall synthesis, inhibiting protein synthesis, disturbing the synthesis of nucleic acids, inhibiting the metabolic pathways of bacteria, and list representatives of antibiotics from specific groups.

4. How to determine the sensitivity of bacteria to antibiotics and read the antibiogram.
5. The concepts of empiric and targeted antibiotic therapy and the drug of choice.

### CLASS 3

#### GRAM-POSITIVE COCCULUMS: STAFFOCOCCOCES AND STREPTOCOCCES.

To familiarize students with the role of the most important species of Gram-positive cocci in human diseases.

*The student knows:*

1. Staphylococcal species pathogenic to humans (*Staphylococcus aureus*, *S. epidermidis*, *S. saprophyticus*): epidemiology (reservoir and sources of infections, routes of spread; the most important virulence factors involved in the pathomechanism of staphylococcal infections; types of diseases/infections they cause and antimicrobials for their treatment. Knows the basis of diagnosis of staphylococcal infections.
2. Species of streptococci pathogenic to humans (*Streptococcus pyogenes*, *S. agalactiae*, *S. pneumoniae*, streptococci colonizing oral cavity): epidemiology (reservoir and sources of infections, routes of spread; the most important virulence factors involved in the pathomechanism of streptococcal infections; types of diseases/infections which they cause and antimicrobials for their treatment. Knows the basis of diagnosis of streptococcal infections. Knows the specific prevention of pneumococcal infections.
3. Species of enterococci pathogenic to humans (*Enterococcus faecalis*, *E. faecium*): epidemiology (reservoir and sources of infections, routes of spread; the most important virulence factors involved in the pathomechanism of infections caused by these bacteria; types of diseases/infections they cause and antimicrobials for their treatment. Knows the basis of diagnosis of these infections.

#### Diagnostic techniques:

- a) **Microscopy** - the student knows whether it is essential in a given infection, and if so, what biological material from the patient it refers to
- b) **Cultivation and identification (ID)** - the student knows whether a given microorganism can be cultured on artificial media and when this diagnostic method is necessary
- c) **Serology** - the student knows whether serology is helpful in a given infection or not - if not, why, if so, what serological tests can be used to detect the patient's antibody and in what biological materials
- d) **Other tests** - e.g., molecular tests (NAAT, **Nucleic Acids Amplification Test**), when they are necessary to be performed to confirm the infection when they can be performed when they are not helpful (e.g., acute systemic infections); this group also includes other specific tests performed in specific infections, e.g., ASO test, tuberculin test, tests detecting specific toxins, etc.

### CLASS 4

#### GRAM-POSITIVE BACILLI: BACILLUS, CLOSTRIDIUM, CLOSTRIDIODES, CORYNEBACTERIUM AND OTHER GRAM-POSITIVE BACILLI.

To familiarize students with Gram-positive bacilli and their role in human pathogenicity.

*The student knows:*

1. Types and species of Gram-positive aerobic bacilli pathogenic to humans (*Bacillus anthracis*, *B. cereus*). Knows the epidemiology of these infections (reservoirs and sources of infection), the transmission routes, the infections they cause in humans, and the virulence factors involved in the pathomechanism of these infections. He knows how to combat anthrax among animals. Knows diagnostic techniques for these infections.
2. Types and species of Gram-positive anaerobic bacilli pathogenic to humans (*Clostridium botulinum*, *C. tetani*, *C. difficile*, *C. perfringens*, and other species from the group of gas gangrene bacilli discussed only during the lecture: *C. sordeli*, *C. septicum*, *C. histolyticum*); know the epidemiology of the infections they cause (reservoirs, sources of infections in humans, routes through which they spread), know the diseases/infections they cause and the virulence factors that determine the development of infections. Knows antibiotics effective in treating these

infections. Knows the role of bacterial spores in the spread of diseases, especially in the hospital environment. Knows specific (vaccine and its composition) and non-specific prevention measures to combat infections caused by these microorganisms. Knows the role of specific antibodies in limiting the development of infections caused by microorganisms. Knows diagnostic techniques for infections caused by these microorganisms.

3. Types and species of Gram-positive bacilli (*Corynebacterium diphtheriae*, *C. jejuni*, *C. urealyticum*, *Listeria monocytogenes*, *Cutibacterium acnes*) pathogenic to humans. He knows their epidemiology (reservoirs, sources of infections in humans, routes by which they spread), the diseases/infections they cause, and the virulence factors that determine the development of infections. Knows the concept of lysogeny and its importance in spreading infections and antibiotic resistance and can discuss them with examples. Knows antibiotics effective in treating these infections. Knows the specific prevention of diphtheria. Knows diagnostic techniques for infections caused by these microorganisms.

## CLASS 5

### MYCOBACTERIUM, ACTINOMYCETES.

To familiarize students with acid-fast bacteria and anaerobic actinomycetes.

*Student knows:*

1. The species of mycobacteria that cause tuberculosis (*Mycobacterium tuberculosis*, *M. bovis*, *M. africanum*) and atypical mycobacteria (*Mycobacterium avium-intracellulare*, *M. ulcerans*, *M. marinum*, *M. fortuitum*, *M. chelonae*) causing opportunistic infections in humans. Knows their epidemiology (reservoirs, sources of infections, routes through which they spread), the diseases/infections they cause, and the virulence factors that determine the development of infections. Knows antibiotics and chemotherapy drugs effective in treating these infections and mechanisms of resistance. Knows specific prevention of tuberculosis. Knows diagnostic techniques for infections caused by these microorganisms and understands the role and application of the tuberculin test.
1. Species of actinomycetes (*Actinomyces israeli*) responsible for endogenous human infections. Knows the diseases/infections they cause and the pathogenic potential of these microorganisms. Knows how to diagnose and treat these infections.
2. The acid-resistant species *Nocardia asteroides* (discussed exclusively during the lecture and the infections it causes in humans). Knows the epidemiology of these infections (reservoir, sources, and routes they spread). He knows what groups of antibiotics are effective in treating infections caused by *Nocardia*. Knows diagnostic techniques for infections caused by these microorganisms.

## CLASS 6

### MECHANISMS OF RESISTANCE OF GRAM-POSITIVE BACTERIA TO ANTIBIOTICS. CLASS TEST 1.

To familiarize students with the mechanisms of antibiotic resistance in Gram-positive bacteria.

*Scope of material for the class test 1: material from lectures (including types and species of bacteria not discussed during classes) and material presented in classes 3-5 and the following groups of antibiotics: macrolides, lincosamides, streptogramins, glycopeptides, oxazolidinones,  $\beta$ -lactams: penicillins, cephalosporins, antituberculosis drugs*

*Student knows:*

1. What mechanisms of antibiotic resistance are presented by Gram-positive bacteria (staphylococci, streptococci, enterococci, pneumococci): knows the mechanisms of resistance such as MRSA, HLAR, MLSB, VRE/GRE, VISA/GISA, VRSA, PRP
2. The clinical consequences of these resistance mechanisms in treating infections caused by Gram-positive bacteria.
3. The groups of antibiotics active against resistant strains of Gram-positive bacteria.

## CLASS 7

### GRAM-NEGATIVE INTESTINAL RODS, NON-FERMENTATIVE AND ANAEROBIC RODS.

To familiarize students with groups of glucose-fermenting and non-fermenting Gram-negative rods and anaerobic rods that cause infections in humans.

*Student knows:*

1. Types and species of glucose-fermenting rods, the so-called intestinal pathogens: *Salmonella enterica*, *Shigella dysenteriae*, *S. sonnei*, *S. flexneri*, *Yersinia enterocolitica* (and the species *Y. pestis* discussed only during the lecture), pathogenic strains of *E. coli* - EPEC, EHEC, EIEC, ETEC, DEAC, EAEC, AIEC (can develop acronyms; discussed mainly during the lecture) and non-pathogenic *E. coli* and potentially pathogenic ones: *Klebsiella pneumoniae*, *Proteus mirabilis*, *Enterobacter cloacae*, *Citrobacter freundii*, *Serratia marcescens* (discussed mainly during the lecture), causing infections in humans. Knows their epidemiology (reservoirs, sources of infection, and transmission routes). Knows the virulence factors that determine their pathogenicity and understands the role of O, K, and H antigens in the pathomechanism of infections and diagnosis. Students can indicate which bacteria cause endogenous infections and which are only exogenous ones. Knows diseases and groups of antibiotics for their treatment. Knows diagnostic techniques for infections caused by these microorganisms. Knows specific and non-specific prevention means and can explain the differences between serotyping and serology.
2. Types and species of non-glucose-fermenting bacilli: *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Stenotrophomonas maltophilia*, *Burkholderia cepacia* - know their epidemiology (reservoirs, sources of infections and routes of transmission to humans), pathogenicity and antimicrobials for treating these infections. Knows the primary virulence factors of these microorganisms and bacteriological diagnostic techniques.
3. Types and species of obligate anaerobic Gram-negative bacilli: *Bacteroides fragilis*, *Prevotella* sp., *Porphyromonas* sp., and *Fusobacterium* sp., which cause endogenous infections in humans. He knows the pathogenic potential of these microorganisms, the types of infections they cause, and the antibiotics used to treat them. Knows the basics of diagnosing infections caused by obligate anaerobic bacteria.

## **CLASS 8**

### **GRAM-NEGATIVE COCCI AND GRAM-NEGATIVE SMALL RODS (COCCOBACILLI)**

**To familiarize students with the Gram-negative cocci and Gram-negative small rods (cocci and bacilli) that are pathogenic to humans.**

*Student knows:*

1. Types and species of Gram-negative cocci pathogenic to humans: *Neisseria meningitidis* and *N. gonorrhoeae*, *Moraxella catarrhalis* - their epidemiology, pathogenic potential, types of infections they cause and methods of treatment and prevention of these infections. Knows the directions for diagnosing the infections they cause.
2. Types and species of coccobacilli: *Haemophilus influenzae*, *H. parainfluenzae*, *Bordetella pertussis* (and species of bacilli responsible for zoonoses discussed only during the lecture: *Brucella*, *Pasteurella*, *Francisella*; know the term of zoonoses). Knows the epidemiology of these infections (reservoirs, sources of infection, and transmission routes), virulence factors determining their pathogenicity, groups of antibiotics active against these microorganisms, and means of specific and non-specific prevention. Knows diagnostic techniques for infections caused by these microorganisms.

## **CLASS 9**

### **MECHANISMS OF RESISTANCE OF GRAM-NEGATIVE BACTERIA TO ANTIBIOTICS.**

**To familiarize the student with the mechanisms of antibiotic resistance presented by Gram-negative bacteria.**

*Student knows:*

1. Mechanisms of resistance of Gram-negative bacteria to  $\beta$ -lactam antibiotics: ESBL, KPC, MBL, resistance to aminoglycosides, fluoroquinolones, colistin.
2. The clinical consequences of these resistance mechanisms in treating infections caused by Gram-negative bacteria.
3. The groups of antibiotics active against resistant strains of Gram-negative bacteria.

## **CLASS 10**

### **ATYPICAL BACTERIA. CLASS TEST 2.**

**To familiarize students with the group of atypical bacteria and *Legionella* bacilli.**

**Scope of material for class test 2: material from lectures (including types and species of bacteria not discussed during classes) and material presented in classes 6-9 and the following groups of antibiotics: aminoglycosides, polymyxins, nitroimidazoles,  $\beta$ -lactams (monobactams, carbapenems) and combinations of all  $\beta$ -lactams with inhibitors, phosphonates (fosfomycin).**

*Student knows:*

1. Chlamydia species: *C. pneumoniae*, *C. trachomatis* (and a species discussed only during the lecture: *C. psittaci*). The student knows the epidemiology of the infections they cause (reservoir, sources of infection, and transmission routes) and their pathogenic potential. Knows diagnostic techniques for infections caused by these microorganisms.
2. Clinically significant mycoplasma species: *Mycoplasma pneumoniae*, *M. genitalium*, *M. hominis*, and *Ureaplasma urealyticum* - know their epidemiology, pathogenicity to humans and the groups of antibiotics used to treat the infections they cause. Knows diagnostic techniques for infections caused by these microorganisms.
3. *Legionella pneumophila* species (epidemiology of infections, virulence, types of infections it causes, and antibiotics active against these microorganisms). Knows diagnostic techniques for infections caused by these microorganisms.

**CLASS 11**

**SPIRAL BACTERIA.**

To introduce students to spiral bacteria and curved bacilli.

*Student knows:*

1. Types and species of spiral bacteria from the genera *Treponema* (*T. pallidum*), *Leptospira* (*L. interrogans*), and *Borrelia* (*B. burgdorferi*, *B. recurrentis*, and a group of *Borrelia* species associated with endemic typhus (discussed only during the lecture). Knows the epidemiology of infections caused by these microorganisms (reservoirs, vectors of selected species, sources of infection, and routes of their transmission), pathogenic potential, diseases they cause, and antibiotics used in treatment. Knows diagnostic techniques for infections caused by these microorganisms and understands the importance of serology in diagnostics. Knows the principles of basic serological techniques (enzyme-linked immunosorbent assays, immunofluorescence tests, Western blot) and the clinical significance of interpreting the results of these tests. Knows the basics of molecular techniques used in bacteriological diagnostics.
2. Types and species of curved bacilli: *Helicobacter pylori*, *Campylobacter jejuni* (*Campylobacter coli*, fetus), and species discussed only during the lecture (*Vibrio cholerae*, *V. vulnificus*, *V. parahemolyticus*; *Aeromonas hydrophilia*). He knows the pathogenic potential of these microorganisms, the diseases they cause, and what antibiotics they should be treated with. Knows diagnostic techniques for infections caused by these microorganisms.

**CLASS 12**

**FUNGI PATHOGENIC TO HUMANS. BASIC METHODS OF MYCOLOGY.**

To familiarize students with the most essential fungi pathogenic to humans and the basic methods of diagnosing these infections.

*Student knows:*

1. Classification of pathogenic fungi into yeast-like, molds, and dimorphic fungi. Knows their pathogenic potential and the epidemiology of infections (reservoirs, sources of infection, and routes of spread).
2. The types and species of yeast-like fungi most often causing human infections (*Candida* and *Cryptococcus*). Basic techniques for diagnosing infections with yeast-like fungi.
3. The types and species of molds that are pathogenic to humans (dermatophytes: *Trichophyton*, *Epidermophyton*, *Microsporum*; other molds: *Aspergillus*). Understands the clinical significance of these infections in immunosuppressed people. Knows the term of aflatoxins/mycotoxins and their impact on the human body. Knows the clinical consequences of disseminating fungal spores in the hospital environment.
4. The types of dimorphic fungi (*Blastomyces*, *Coccidioides*, *Histoplasma*) and understand what dimorphism means.
5. Can give examples of local and systemic mycoses. Knows the basics of mycological diagnostics, the tests and cultures used in it, as well as the role of the microscopic slides.
6. The groups of antifungal drugs (and representatives of each group of drugs) and the mechanism of their action: polyenes (nystatin, natamycin, amphotericin B), imidazoles, triazoles, antimetabolites (5-fluorocytosine), echinocandins.

**CLASS 13**

**STERILIZATION AND DISINFECTION. CLASS TEST 3.**

To familiarize the student with basic methods of sterilization and disinfection.

**Scope of material for class test 3: material from lectures (including types and species of bacteria not discussed during classes) and material presented in classes 10-12 and the following groups of antibiotics: tetracyclines, fluoroquinolones, sulfonamides, antifungal compounds.**

*Student knows:*

1. Disinfection methods (temperature, UV, chemical preparations used to disinfect the skin and the environment) and their importance in medicine.
2. Sterilization methods (temperature, chemical preparations, radiation) of diagnostic equipment and apparatus - their importance in medicine.

#### **CLASS 14**

**PHYSIOLOGIC MICROFLORA OF HUMAN ORGANISM. ENDOGENOUS AND OPPORTUNISTIC INFECTIONS.**

**To familiarize students with the microbiota of the human body and endogenous and opportunistic infections.**

*Student knows:*

1. Types of bacteria colonizing the human body, divided into colonizing microorganisms: a) mucous membranes of the oral cavity, digestive tract, and urogenital system; b) skin;
2. Knows the role of microbiota in maintaining health and the factors influencing the microflora of the human body. Knows the concept of dysbiosis and its role in diseases.
3. Knows the concepts of colonization and carriage, endogenous and opportunistic infections, and factors influencing their development and can give examples of these infections.

#### **CLASS 15**

**COMPLETING THE SEMESTER AND COVERING BACKGROUND DUE TO ABSENCE FROM CLASSES.**

prof. dr hab. Beata Sobieszcańska,  
Head of the Department of Microbiology

### ***Student Survey***

*Thank you for participating in our classes. We tried to ensure that clinical microbiology classes were conducted as best as possible, and we put a lot of work into preparing materials for classes and lectures and preparing ourselves for classes. However, we need your opinion on our work to develop and to teach students even better. Please evaluate our work in the student survey. Your comments enable us to organize classes and lectures better and become better teachers.*

*Still, only some students complete these **anonymous surveys**, which means a lot to us and takes a while!*

***Please fill out the OZiKA surveys!***

*Thank you very much in advance - your opinion is important to us!*

*A team of teachers from the Department of Microbiology.*