

Course: Microbiology with Parasitology

Course Coordinator: prof. Maja Abram, MD, PhD

Department: Microbiology and Parasitology, Faculty of Medicine, University of Rijeka

Study program: Integrated Undergraduate and Graduate University Study of Dental Medicine in English

Study year: II.

Academic year 2022/23.

SYLLABUS

Course description (a brief description of the course, general instructions, where and in what form the lessons are organized, necessary equipment, instructions for attendance and preparation for classes, student obligations, etc.):

The course Microbiology with Parasitology is a compulsory course at II. year of the Integrated undergraduate and graduate study of dental medicine, which is conducted through 30 hours of lectures, 30 hours of seminars and 15 hours of laboratory exercises, a total of 75 hours (6 ECTS). Practical (hands-on) laboratory exercises are held in the laboratory of the Department of Microbiology and Parasitology, Faculty of Medicine in Rijeka.

Classes are held in the form of lectures, seminars and exercises. Estimated duration of classes is a total of 4 weeks. During the exercises, the teacher demonstrates and supervises the active participation of students in performing the exercises. Teachers discuss with students the specifics of performing each exercise. Compulsory midterms will be held during the classes, and at the end of the classes there will be a written test and an oral final exam. By completing all teaching activities, taking the obligatory midterms and the final exam, the student acquires 6 ECTS credits.

The aim of the course is to teach students the basic biological characteristics of microorganisms that cause infections in humans, pathogenic properties of these microorganisms, their prevalence and resistance to environmental conditions and ways of their transmission, their sensitivity to antimicrobial drugs and ways to prevent and prevent spread. Particular emphasis will be placed on those microorganisms that cause infections of the oral cavity or are of importance in dental practice.

Assigned reading:

Samaranayake LP.: Essential Microbiology for Dentistry, 5th Edition, Elsevier, 2018

Optional/additional reading:

Jeremy Bagg, T. Wallace MacFarlane, Ian R. Poxton, Chris H. Miller. Essentials of Microbiology for Dental Students. Oxford University Press, 1999

COURSE TEACHING PLAN:

The list of lectures (with topics and descriptions):

L1 Introduction to the course; Bacterial taxonomy; Bacterial genetics

Learning outcomes:

- to get acquainted with the aim of the course and the historical development of microbiology
- recall the rules for naming living organisms, including microorganisms
- group bacteria and give an example of bacterial classification.
- describe the structure of prokaryotes, viruses and eukaryotes and state the main differences in structure
- state the basics of bacterial genetics and ways of gene transfer in bacteria.

L2 Antibiotics: mechanism of action and resistance

Learning outcomes:

- group and give examples of individual antimicrobial drugs depending on their activity and mechanism of action on the bacterial cell
- discuss the most important mechanisms of bacterial resistance

L3 Viruses: Viral particle structure, Virus replication; Prions

Learning outcomes:

- describe the structure of viruses and group them into families depending on the nucleic acid they contain and other characteristics
- summarize the ways in which the virus multiplies
- describe prions as infectious agents

L4 Actinomycetes, Mycobacterium; Legionella; Clostridium, Bacillus

Learning outcomes:

- state the specifics of mycobacteria and describe the pathogenesis of tuberculosis
- know the basic characteristics of sporogenic anaerobic bacteria
- describe the ecology of legionella
- list the virulence factors of Bacillus and connect them with the infection they cause

L5 Neisseria, Veillonella, Capnocytophaga and haemophilic bacteria; Pseudomonas and Acinetobacter

Learning outcomes:

- to name the most important types of hemophilic bacteria
- describe their virulence factors and link them to the infections they cause
- describe the micromorphology of the Neisseria
- list the virulence factors of the Neisseria and link them to the infections they cause

L6 Atypical bacteria (Chlamydia; Rickettsia; Mycoplasmas)

Learning outcomes:

- list the most important representatives / species from the genera Chlamydia and Chlamydophila
- describe the method of multiplication of chlamydia and discuss the differences in relation to "typical" bacteria
- describe the characteristics of mycoplasmas

L7 Mycoses and antifungals

Learning outcomes:

- list fungi of importance in dentistry and link them to the infections they cause
- give examples of the most common causes of mycoses
- list antifungals and group them according to the mechanism of action on the fungal cell

L8 Hepatitis viruses; HIV

Learning outcomes:

- group hepatitis viruses into families and list the most important characteristics and modes of transmission
- link viruses to infections that cause and possible consequences
- list diagnostic possibilities, specific therapy, and prevention
- describe the structure of HIV and state the ways of transmitting this virus

L9 Oncogenic and emerging viruses; Antiviral agents (prevention and therapy)

Learning outcomes:

- list and describe the mechanism of action of the most important antiviral drugs
- list antiviral drugs that are used in practice
- group viral vaccines and give examples of individual types of vaccines
- define oncogene and oncogenic viruses
- list seven most important oncogenic viruses
- explain why emergent and re-emergent pathogens occur

L10 Normal microbiota and ecosystem of the oral cavity; Biofilm

Learning outcomes:

- list and describe the characteristics of bacteria that make up the normal microbiota of the oral cavity and discuss their role in defense against pathogens
- interpret the term "biofilm" and connect it with various infections in humans
- list and describe the stages of biofilm development

L11 Microbiology of dental caries

Learning outcomes:

- explain the origin of caries as an infectious disease
- list the dominant microorganisms that are responsible for the development of caries
- explain the terms aciduric

L12 Dentoalveolar infections; Respiratory tract infections

Learning outcomes:

- list the characteristics of microorganisms found in dentoalveolar infections
- name the most common causes of upper respiratory tract infections and link them to the diseases they cause and samples for microbiological diagnosis of these infections
- name the most common causes of lower respiratory tract infections and connect them with the diseases they cause and samples for microbiological diagnosis of these infections

L13 Healthcare associated infections

Learning outcomes:

- describe the risk factors for nosocomial infections, the most common sources of microorganisms and ways of their spread.
- explain the prevention of the nosocomial infections.
- describe the differences among standard and specific precaution measures

L14 Medical parasitology; parasites of dental importance; blood and tissue parasites

Learning outcomes:

- describe the characteristics of *Entamoeba* and *Trichomonas*
- describe the characteristics of plasmodia, mode of transmission and life cycle; enumerate the types of plasmodia causing malaria in humans
- describe the pathogenesis of toxoplasmosis and modes of transmission and discuss the clinical significance of *T. gondii* infection

L15 Relationship between systemic and oral health

- explain the connection between microorganisms in the oral cavity and infections of distant organs and / or organ systems

The list of seminars with descriptions:**S1 Bacterial cell structure; Bacterial virulence factors; Pathogenesis of microbial disease**

Learning outcomes:

- describe the structure of bacterial cells and compare the structure of gram-negative and gram-positive bacteria
- link the structure of the bacterial cell with virulence factors
- link bacterial virulence factors with the pathogenesis of bacterial infections

S2 Antimicrobial chemotherapy

Learning outcomes:

- explain the terms antibiotic, selective toxicity, bactericidal and bacteriostatic action, broad and narrow-spectrum antibiotic
- group and give examples of individual antimicrobial drugs depending on their activity and mechanism of action on the bacterial cell
- discuss the most important mechanisms of bacterial resistance
- give examples of resistant bacteria of medical significance

S3 Gram positive cocci: staphylococci and streptococci

Learning outcomes:

- describe the micromorphology and ways of grouping gram-positive globular bacteria
- list the virulence factors of staphylococci and streptococci and link them to infections that cause
- discuss microbiological procedures for the identification of staphylococci and streptococci

S4 Lactobacilli, *Corynebacteria*; *Propionibacteria*

Learning outcomes:

- explain the basic properties of lactobacilli and their role in dental biofilm
- explain the basic properties of corynebacteria, and diseases that cause
- explain the pathogenesis of diphtheria and the role of diphtheric toxin

S5 Enterobacterales; *Campylobacter*, *Vibrio*, *Helicobacter*, *Wolinella*

Learning outcomes:

- describe the micromorphology and characteristics of enterobacteria
- the two most important pathogenic enterobacteria and link them to the infections they cause and microbiological procedures for their identification
- describe the micromorphology and methods of grouping of coiled bacteria (*Vibrios*, *Campylobacter*, and *Helicobacter*)
- state the characteristics of *Vibrio*, *Campylobacter* and *Helicobacter pylori*

S6 Nonsporogenic anaerobs

Learning outcomes:

- list and distinguish the most common non sporogenic anaerobic bacteria in oral cavity
- describe the micromorphology and characteristics of chosec nonsporogenic anaerobic bacteria

S7 Fungi important in dentistry

Learning outcomes:

- list the characteristics of yeasts and molds and identify those fungi that are the most common causes of mycoses in clinical practice
- describe the structure and multiplication of unicellular and multicellular fungi
- list the factors of fungal virulence and link them to the diseases they cause
- list the most common samples of fungal infections of the oral cavity
- list mycoses with orofacial manifestations and dermatophytes

S8 RNA viruses

Learning outcomes:

- describe the characteristics, structure and method of reproduction of selected RNA viruses and link them to the infection they cause
- list and single out the most important ways of transmitting selected RNA viruses

S9 DNA viruses

Learning outcomes:

- describe the characteristics, structure and method of DNA virus replication
- discuss pathogenetic mechanisms in the development of infections caused by DNA viruses

S10 Microbiology of periodontal disease; Nonsporogenic anaerobs; Spirochaetes

Learning outcomes:

- list the bacteria responsible for the development of periodontal disease, describe their virulence factors
- classify spiral bacteria into genera and species
- list the most important characteristics and factors of virulence and link them to the infections they cause
- discuss the specifics of laboratory diagnosis of infections caused by spirochetes

S11 Infections of oral mucosa and salivary glands

Learning outcomes:

- name the most common causes of infections of the oral cavity, salivary glands
- link bacteria to the infection they cause
- link viruses to the infection of salivary glands and oral mucosa

S12 Prevention of cross-infection - Sterilization and disinfection procedures

Learning outcomes:

- list sterilization procedures and give examples of the use of individual procedures in dental practice
- list and describe the procedures for controlling sterilization procedures
- list and group disinfectants according to their effect and use

S13 Skin and wound infections

Learning outcomes:

- list and describe the basic characteristics of the bacteria as causative agents of skin and wound infections
- list and describe the basic characteristics of the viruses causative agents of skin infections

S14 Gastrointestinal and genitourinary tract infections

Learning outcomes:

- to name obligatorily pathogenic intestinal bacteria
- link the virulence factors of individual pathogens with the infection they cause
- name the most common causes of urinary tract infections
- link the virulence factors of certain enterobacteria with the infection they cause

S15 Cardiovascular infections; Infections of the central nervous and locomotor systems

Learning outcomes:

- name the most common causes of infections of the blood, central nervous system and locomotor system
- link bacteria to the infection they cause

The list of practicals with descriptions:

Excercise1 Microbiological laboratory diagnostics

Learning outcomes:

- list and describe direct and indirect diagnostic methods in microbiology; Antimicrobial susceptibility testing

Excercise2 Microbiological diagnostics of the respiratory system; diagnostic procedures for the detection of staphylococci and streptococci

Learning outcomes:

- discuss the processing of samples from the respiratory system
- independently sample throat and nose swabs
- independently determine the type of the most common causes of the upper respiratory system, according to the microscopic preparation or other characteristics

Excercise3 Processing of samples from the digestive and urogenital systems

Learning outcomes:

- discuss the processing of samples from the digestive and urogenital systems
- independently develop co-culture and, based on morphology and biochemical tests, identify specific causes
- perform agglutination tests for salmonella serotyping
- independently process the urine sample and comment on the most common causes of urinary tract infections

Excercise4 Laboratory diagnosis of fungal infections

Learning outcomes:

- list the characteristics of yeasts and molds and identify those fungi that are the most common causes of mycosis in clinical practice
- describe the characteristics of candida and aspergillus and link them to susceptibility / resistance to available antifungals

Excercise5 Dental Biofilms: Detection and Quantification

Learning outcomes:

- define a biofilm
- describe the differences between biofilm (surface-attached) and planktonic (suspended bacterial cells) bacteria
- evaluate the amount of plaque on the teeth
- describe different methods of biofilm detection

Excercise6 Physiological microbiota and microbiological diagnosis of oral infections.

Learning outcomes:

- independently sample swabs of the oral mucosa
- grow bacteria from a used toothbrush and discuss the presence of different bacteria
- connect the normal microbiota with ecological niches in the oral cavity

Exercise7 Processing of primarily sterile samples

Learning outcomes:

- discuss the processing of primarily sterile samples
- independently make microscopic preparations and recognize the micromorphology of bacteria in positive blood cultures and cerebrospinal fluid

Students' obligations:

All planned forms of teaching (lectures, seminars, laboratory exercises) are mandatory. Each student is expected to attend all teaching units, actively participate in discussions and laboratory exercises, and regularly follow daily assignments. A student may miss 30% of classes solely for health reasons, which is justified by a medical certificate. If a student misses more than 30% of classes, he / she cannot continue to follow the course and loses the opportunity to take the final exam. He thus collected 0 ECTS credits and was graded F.

To work in the microbiological laboratory, students must wear a protective coat. All the printed materials needed to for the exercise will be available before the start of each practicals. In the first exercise, students will be introduced to the rules of laboratory work, ensuring safe work in the laboratory. Students are required to regularly perform hand hygiene by washing or alcohol rubbing according to the instructions given in the exercise book and posted in the form of posters in places for washing hands.

Records of attendance and class activities will be kept for each student. Knowledge will be continuously tested during all forms of teaching for which students are required to prepare according to the syllabus. During the course there will be 2 in-term exams and at the end of the course a final exam consisting of a written and an oral part. By completing all teaching activities, taking the obligatory in-term and the final exams, the student acquires 6 ECTS credits.

ECTS credit grading system:

Student assessment is carried out according to the current Regulations on Studies of the University of Rijeka.

Student work will be evaluated and graded during classes and at the final exam. Out of a total of 100 points, a student can achieve 50 points during classes, and 50 points at the final exam. Student assessment is performed using ECTS (A-D) and number system (1-5). Assessment in the ECTS system is performed by absolute distribution and according to graduate assessment criteria.

Of the maximum 50 grade points that can be achieved during the course, the student must collect at least 50% (25) of the grade points in order to take the final exam.

Students who collect 0-49.9% (0-24.9) of grade points during the course, gain an F grade (failed), cannot earn ECTS credits and must re-enroll in the course.

During classes, the student can achieve a maximum of 50 points. The student gains points by actively participating in classes, performing assigned tasks and taking intermediate exams as follows:

a) In-term test 1 consists of 50 questions with offered answers. Each correct answer carries 0.5 points. The pass threshold is 27 correct answers (54% or 13,5 points). Up to 25 points can be achieved on the test.

b) In-term test 2 consists of 50 questions with offered answers. Each correct answer carries 0.5 points. The pass threshold is 27 correct answers (54% or 13,5 points). Up to 25 points can be achieved on the test.

The student must pass both in-term exams. For students who, for justified reasons, did not take the in-term exams or did not collect the minimum number of points or are not satisfied with the number of points collected, make-up exams for each in-term tests will be organized.

Final exam

Students who have earned 25 or more points during the course take the final exam where they can earn a maximum of 50 points.

Students who have achieved less than 24.9 points during the course do not have the right to take the final exam (they have to re-enroll in the course in the next academic year).

The final exam consists of a written and an oral part. The student must pass at least 55% of the written test at the final exam and be positively assessed in the oral part of the exam. The method of scoring in the final exam is shown in Table 2.

Table 2. Method of scoring on the final written (pass threshold 55%) and oral exam

| Written test | Oral exam |
|-------------------------|----------------------|
| < 55%-passing threshold | sufficient = 15 - 18 |
| 55 – 59,99% = 10 | good = 19 - 22 |
| 60 – 64,99% = 11 | very good = 23 - 26 |
| 65 – 69,99% = 12 | excellent = 27 - 30 |
| 70 – 74,99% = 13 | |
| 75 – 79,99% = 14 | |
| 80 – 84,99% = 15 | |
| 85 – 89,99% = 16 | |
| 90 – 94,99% = 18 | |
| 95 – 100% = 20 | |

Grading in the ECTS system is done by absolute distribution, ie on the basis of the final achievement (points acquired during classes are added to the points from the final exam):

A = 90 - 100%

B = 75 - 89.9%

C = 60 - 74.9%

D = 50 - 59.9%

F = 0 - 49.9%

Grades in the ECTS system are translated into the numerical system as follows:

A = excellent (5)

B = very good (4)

C = good (3)

D = sufficient (2)

F = insufficient (1)

Other important information regarding to the course:

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COURSE SCHEDULE (for academic year 2022.- 2023)

| Date | Lectures (time and place) | Seminars (time and place) | Practicals (time and place) | Instructor |
|-------------|------------------------------|------------------------------|--------------------------------|----------------------|
| 13.03.2023. | L1 (12-14) Lr6 | | | Maja Abram |
| | | S1 (14-16) Lr6 | | Marina Šantić |
| 14.03.2023. | L2 (12-14) Lr9 | | | Darinka Vučković |
| | | S2 (14-16) Lr9 | | Maja Abram |
| 15.03.2023. | L3 (12,30-14) Lr3 | | | Bojana Mohar Vitezić |
| | | | Exc.1 (14-17) | Bojana Mohar Vitezić |
| 16.03.2023. | | S3 (10-12) Lr3 | | Marina Šantić |
| | | | Exc.2 (12-14) | Kristina Franjić |
| 17.03.2023. | L4 (10-12) Lr3 | | | Marina Šantić |
| | | S4 (12-14) Lr3 | | Mirna Mihelčić |
| 20.03.2023. | L5 (13-15) Lr9 | | | Ivana Gobin |
| | | S5 (15-17) Lr9 | | Ivana Gobin |
| 21.03.2023. | | | Exc.3 (9-11) | Bojana Mohar Vitezić |
| | L6 (11-13) Lr7 | | | Maja Abram |
| 22.03.2023. | L7 (10-12) Lr9 | | | Maja Abram |
| | | S6 (12,30-14,30) Lr3 | | Ivana Gobin |
| 23.03.2023. | | S7 (12-14) Lr1 | | Mirna Mihelčić |
| | | | Exc.4 (14-16) | Darinka Vučković |
| 24.03.2023. | Midterm 1 (9-10) Lr5 | | | |
| | L8 (10-12) Lr3 | | | Marina Šantić |
| | | S8 (12-14) Lr3 | | Marina Šantić |
| 27.03.2023. | L9 (9,30-11) Lr3 | | | Bojana Mohar Vitezić |
| | | S9 (11-13) Lr3 | | Maja Abram |
| 28.03.2023. | L10 (11-13) Lr3 | | | Ivana Gobin |
| | | | Exc.5 (13-15) | Ivana Gobin |
| 29.03.2023. | L11 (10-12) L9 | | | Ivana Gobin |
| | | S10 (12,30-14,30) Lr3 | | Ivana Gobin |
| 30.03.2023. | L12 (9-11) Lr3 | | | Ivana Gobin |
| | | S11 (11-13) Lr3 | | Maja Abram |
| 31.03.2023. | | S12 (8-10) Lr3 | | Marina Šantić |
| | | | Exc.6 (10-12) | Mirna Mihelčić |
| 03.04.2023. | Midterm 2 (10-11) Lr4 | | | |
| | L13 (11-13) Lr3 | | | Maja Abram |
| | | S13 (13-15) Lr1 | | Darinka Vučković |
| 04.04.2023. | L14 (11-13) Lr8 | | | Mirna Mihelčić |
| | | S14 (14-16) Lr6 | | Bojana Mohar Vitezić |
| 05.04.2023. | L15 (10-12) Lr9 | | | Maja Abram |
| | | S15 (12-14) Lr3 | | Ivana Gobin |
| | | | Exc. 7 (14-16) | Mirna Mihelčić |

List of lectures, seminars and practicals (exercises):

| | LECTURES (Topics) | Teaching hours | Location/Lecture room |
|-----|--|----------------|---|
| L1 | Introduction to the course; Bacterial taxonomy; Bacterial genetics | 2 | Lecture rooms (Lr) at Faculty of Medicine (Braće Branchetta 20) |
| L2 | Antibiotics: mechanism of action and resistance | 2 | |
| L3 | Viruses: Viral particle structure, Virus replication; Prions | 2 | |
| L4 | Actinomycetes, Mycobacterium; Legionella; Clostridium, Bacillus | 2 | |
| L5 | Neisseria, Veillonella, Capnocytophaga and haemophilic bacteria; Pseudomonas and Acinetobacter | 2 | |
| L6 | Atypical bacteria (Chlamydia; Rickettsia; Mycoplasmas) | 2 | |
| L7 | Mycoses and antifungals | 2 | |
| L8 | Hepatitis viruses; HIV | 2 | |
| L9 | Oncogenic and emerging viruses; Antiviral agents (prevention and therapy) | 2 | |
| L10 | Normal microbiota and ecosystem of the oral cavity; Biofilm | 2 | |
| L11 | Microbiology of dental caries | 2 | |
| L12 | Dentoalveolar infections; Respiratory tract infections | 2 | |
| L13 | Healthcare associated infections | 2 | |
| L14 | Medical parasitology; parasites of dental importance; blood and tissue parasites | 2 | |
| L15 | Relationship between systemic and oral health | 2 | |
| | TOTAL TEACHING HOURS | 30 | |

| | SEMINARS (Topics) | Teaching hours | Location/Lecture room |
|-----|--|----------------|---|
| S1 | Bacterial cell structure; Bacterial virulence factors; Pathogenesis of microbial disease | 2 | Lecture rooms (Lr) at Faculty of Medicine (Braće Branchetta 20) |
| S2 | Antimicrobial chemotherapy | 2 | |
| S3 | Gram positive cocci: staphylococci and streptococci | 2 | |
| S4 | Lactobacilli, Corynebacteria; Propionibacteria | 2 | |
| S5 | Enterobacterales; Campylobacter, Vibrio, Helicobacter, Wolinella | 2 | |
| S6 | Nonsporogenic anaerobs | 2 | |
| S7 | Fungi important in dentistry | 2 | |
| S8 | RNA viruses | 2 | |
| S9 | DNA viruses | 2 | |
| S10 | Microbiology of periodontal disease; Nonsporogenic anaerobs; Spirochaetes | 2 | |
| S11 | Infections of oral mucosa and salivary glands | 2 | |
| S12 | Prevention of cross-infection, Sterilization and disinfection procedures | 2 | |
| S13 | Skin and wound infections | 2 | |
| S14 | Gastrointestinal and genitourinary tract infections | 2 | |
| S15 | Cardiovascular infections; Infections of the central nervous and locomotor systems | 2 | |
| | TOTAL TEACHING HOURS | 30 | |

| | Excercises (Practicals) (Topics) | Teaching hours | Location/Lecture room |
|-------|---|-----------------------|---|
| Exc.1 | Microbiological laboratory diagnostics | 3 | Department of Microbiology and Parasitology. Faculty of Medicine Rijeka |
| Exc.2 | Microbiological diagnostics of the respiratory system; diagnostic procedures for the detection of staphylococci and streptococci | 2 | |
| Exc.3 | Processing of samples from the digestive and urogenital system | 2 | |
| Exc.4 | Laboratory diagnosis of fungal infections | 2 | |
| Exc.5 | Dental Biofilms: Detection and Quantification | 2 | |
| Exc.6 | Physiological microbiota and microbiological diagnosis of oral infections. | 2 | |
| Exc.7 | Processing of primarily sterile samples | 2 | |
| | TOTAL TEACHING HOURS | 15 | |

| | FINAL EXAM DATES |
|----|------------------------------|
| 1. | 7.04.2023. (13,15-15,00) Lr1 |
| 2. | 21.04.2023. |
| 3. | 12.05.2023. |