

# Teaching guide

## IDENTIFICATION DETAILS

Degree:	Biomedicine		
Scope	Biology and Genetics		
Faculty/School:	Experimental Sciences		
Course:	MEDICAL MICROBIOLOGY		
Type:	Compulsory	ECTS credits:	4,50
Year:	3	Code:	2153
Teaching period:	Fifth semester		
Subject:	General Principles of Disease		
Module:	Foundations of Biomedicine		
Teaching type:	Classroom-based		
Language:	Spanish		
Total number of student study hours:	112,50		

## SUBJECT DESCRIPTION

Biomedical Sciences are related to aspects that affect society as a whole, in subjects ranging from personal health to political or cultural decision-making. The application of basic science in medicine is necessary for the development of knowledge and new strategies for the diagnosis and treatment of human diseases. Currently, Clinical Microbiology constitutes an important area of research, because in the 21st century there are infectious diseases that are still difficult to combat and new threats are emerging that pose a challenge.

The subject Clinical Microbiology will focus on the study of the different pathogens that affect humans. An introduction will be made to the general characteristics of microorganisms and parasites. Each of the groups of pathogens with importance in medical microbiology and parasitology will be studied in detail, focusing on their general characteristics, pathogenic action, diagnostic methods and the chemotherapeutic agents for their prophylaxis and/or cure.

Health is one of the strategic sectors for the development of society and biomedical professionals must have multidisciplinary training that encompasses knowledge of the pathophysiological mechanisms of human diseases and training to promote competitive research that allows the development of new procedures for the prevention, diagnosis and treatment of diseases. This will allow for the scientific and technological progress necessary for the development of quality healthcare. For this reason, it is essential to have anthropological and ethical knowledge that underpins scientific knowledge and contributes to the defense of the dignity and freedom of the person.

A diverse population composed of bacteria, viruses, fungi and other microorganisms is in close relationship with man. Knowledge of this ecosystem has increased significantly in recent decades, revealing its involvement in health states, but also the key role it plays in multiple diseases, from depression to obesity. In addition, this microbiota largely determines the immune response to infectious processes caused by pathogens. Medical microbiology teaches us today that infectious diseases are based on an equilateral triangle whose upper vertex is the etiological agent and, at the base, the host, and the environment; which are closely interconnected and cannot be treated independently. This triad will determine the set of factors that will define the dynamics of infectious processes, and with this their knowledge will allow us to design an effective treatment. Thus, in-depth knowledge of man in all his dimensions, knowledge of the molecular basis of the functioning of the pathogen and the environment in which both the host and the pathogen are found, are key to the development of diagnostic and therapeutic tools to prevent and combat infectious diseases.

In addition, the development and therapeutic application of products of microbial origin is a booming field of biomedical research. The purpose of the subject of Medical Microbiology is to make students aware of the place that microorganisms occupy in this area. Also, the latest advances in biomedical research involving microorganisms such as phage therapy or microbiota transplants, among other strategies to combat infections caused by multidrug-resistant bacteria, will be discussed.

The student will acquire knowledge and develop competencies aimed at studying the biological and molecular bases of diseases caused by microorganisms. The main microbial groups of clinical interest, their general characteristics, pathogenic action, virulence factors, diagnostic methods and chemotherapeutic agents for prophylaxis and/or treatment will be described.

The main objective pursued in this course is to provide students with tools so that they know in depth the pathogenicity mechanisms of the main pathogens, and based on them, they can identify potential molecular targets to design effective treatments. It is important to remember that the ultimate goal of biomedical research is to serve society in the prevention, cure and alleviation of infectious diseases that afflict men and students must also bear in mind that it is not about curing diseases but about people.

## GOAL

The study of this subject is intended for students to acquire theoretical and conceptual knowledge that allows them to understand the relationship between microbial activity and the environment in which it develops, as well as the different factors that condition it. In particular, it is intended that the student understand how microorganisms come to cause diseases and what are the molecular mechanisms of pathogenicity. Based on this acquired knowledge, the student will be able to come up with suggestions for potential therapeutic targets for treatment and control.

The specific aims of the subject are:

The specific purposes of the course are:

- To know the impact of microorganisms on human health and biomedical research.

- Apply the benefits of microorganisms to human health and daily life.
- Know the mechanisms of host-pathogen interaction to understand their involvement in the development of infectious diseases.
- Know the main mechanisms of microbial pathogenicity, virulence factors and their molecular bases.
- Know the specific nature of infectious agents (including the main causes for which they generate pathologies and the immune response they trigger).
- Know the fundamentals of the main therapeutic strategies, the basic principles of antimicrobial therapy and the problem of resistance to treatments.

## PRIOR KNOWLEDGE

To study the subject of Medical Microbiology, it is highly recommended to have a good level of knowledge in Biology, Biochemistry, Genetics and Basic Microbiology.

## COURSE SYLLABUS

### SECTION I INTRODUCTION

Topic 1. Microorganisms and their relationship with man in the state of health and disease. Human microbiota and its relationship with health status. Effect of antibiotics on the microbiota. Probiotics and prebiotics.

Theme 2. Infectious diseases. Types and patterns of microbial diseases. Epidemiology: Reservoir and transmission of pathogens. Strict, opportunistic and emerging pathogens.

Theme 3. Microbiological diagnosis of infectious diseases. General principles of clinical diagnosis. Direct, indirect, and molecular diagnostics. Emerging technologies for molecular identification of pathogens.

### SECTION II CLINICAL BACTERIOLOGY

Topic 4. Bacterial pathogenesis. How bacteria cause disease. Mechanisms and stages of bacterial pathogenesis. Virulence factors. Virulence factors in the early and late stages of infection. Damage and toxigenicity. Survival and escape from host defenses.

Topic 5. Regulation of virulence factors and their dissemination. Regulation of gene expression. Types of regulation. Quorum sensing. Horizontal transfer.

Theme 6. Antimicrobial agents. Antibiotics. Types of antibiotics depending on their function. Classification and targets. Mechanisms of action in bacteria. Bacterial mechanisms of antibiotic resistance. Bacterial coevolution with antimicrobials. Multiresistant bacteria. Phage therapies. Vaccine development. Antibiotic resistance as a global problem for human health.

Topic 7. Clinical bacterial taxonomy. Gram-positive and Gram-negative bacteria of clinical interest. Other bacteria of clinical interest.

### SECTION III: CLINICAL PARASITOLOGY

Topic 8. Parasites. Host, parasite, vector. Biological adaptations of parasites. Role of parasites in disease

Topic 9. Unicellular parasites: protozoa of clinical interest Protozoan infection mechanisms. Antiprotozoal diagnosis and therapy.

Topic 10. Multicellular parasites Helminths and arthropods of clinical interest Infection mechanisms. Design of antiparasitic therapies

### SECTION IV. FUNGI OF CLINICAL INTEREST

Topic 11. Fungal pathogenesis. General characteristics of fungi as infectious agents. Fungal mycoses. Antifungal therapies.

### SECTION V. VIRUS OF CLINICAL INTEREST

Topic 12. Viral pathogenesis. Virulence factors and viral pathogenicity. Virus-host interaction. Disease patterns.

Response mechanisms to viral infections. Antiviral chemotherapy: strategies and main agents.

Topic 13. DNA viruses of clinical interest Specific strategies for cell multiplication and localization. dsDNA virus without envelope (Adenovirus and Papillomavirus) and with envelope (Herpesvirus, Poxvirus Hepadnavirus: Hepatitis B virus and Baculovirus). Non-enveloped ssDNA virus (Parvovirus)

Topic 14. RNA viruses of clinical interest. Specific strategies for cell multiplication and localization. Non-enveloped virus (Picornavirus: Enterovirus, Rhinovirus, Hepatovirus: Hepatitis A virus). RNA envelope virus (Retrovirus (HIV), Orthomyxovirus (influenza), Paramyxovirus (measles) and Coronavirus. Other RNA viruses

Topic 15. Oncovirus. Mechanisms of viral oncogenesis. Oncogenes. Viruses implicated in cancer. Advances in tumor therapies. Immunotherapy and oncolytic viruses.

## EDUCATION ACTIVITIES

### \* FACE-TO-FACE:

AFP1. Theory expository classes

Masterclasses given by the teacher of the subject with digital support. The schemes designed by the teacher of the different subjects are projected, including figures obtained from books and publications.

During the exhibition classes, questions will be asked about what has been explained and doubts will be resolved, encouraging participation and debate among students.

AFP2. Collaborative and participatory work, in groups, in classes and seminars.

Students will carry out activities and group work in which they study and develop specific aspects of microorganisms of clinical importance and/or of current and social interest.

AFP3. Tutoring.

Through tutoring (individual or group), the teacher, at the request of the student and at the established time for this purpose, will answer questions or discuss the questions posed to him by the student, in order to guide him in learning the subject.

AFP4. Conducting exams. Evaluation.

AFP5. Practical activities

Activities such as practical exercises and participatory work will be proposed in seminars, which may be taught by researchers from other institutions that allow us to delve into topics of interest and that serve to bring our science into dialogue with other disciplines.

### \* NOT IN PERSON

AFNP1.- Study of theory, exercises and problems

AFNP2.- Preparation of participatory activities, group work and seminars

AFNP3.- Tutoring preparation

AFNP4.-Preparation of practical classes

## DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
45 Horas	67,50 Horas

## LEARNING RESULTS

To know the general mechanisms of the disease and its associated molecular, structural and functional alterations, its syndromic expression and the therapeutic tools to restore health.

To know the changes in cellular and systemic physiology that take place in the most prevalent diseases in our society.

Know the specific nature of infectious agents (including the main causes for which they generate pathologies and the immune response they trigger).

## SPECIFIC LEARNING RESULTS

To know the main microbial agents of interest in human infectious pathology

Understand the pathogenic action of microorganisms, the diagnosis and control of infection, referring, the latter, to the treatment, epidemiology and prophylaxis of infectious diseases

Select the main virulence factors of infectious agents and the mechanisms of resistance of prokaryotes to adverse factors.

Understand the fundamentals of microorganism diagnostic techniques

Apply theoretical and practical knowledge in microbiological diagnosis, interpretation and evaluation of results.

Apply knowledge from the microbial world to the design of innovative biomedical application projects.

Justify the results of biomedical research and transfer it to their therapeutic application

## LEARNING APPRAISAL SYSTEM

Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with those established in the Evaluation Regulations and the University's Coexistence Regulations.

The students' learning outcomes will be evaluated using a varied methodology, taking into account the different activities carried out during the course. Thus, written tests will be proposed throughout the semester, tasks consisting of case studies, papers, presentations and evaluation or self-evaluation questionnaires.

### ORDINARY EVALUATION SYSTEM:

IF1. Written theory exam (70%): It is mandatory to pass this block (5 out of 10) to apply the rest of the percentages of the subject. The main objective of the exam will be to verify that the basic concepts worked on during classes have been assimilated and understood. Therefore, the exam will consist of a theoretical part based on test-type questions. It could also include short questions and/or development questions, and/or problem solving (clinical cases).

SE2: Evaluation of works (15%): The knowledge acquired and embodied in various group tasks proposed in class and developed during autonomous time will be evaluated. The instructions for carrying out will be specified in each

of the cases. The completion of work will be mandatory. In case of not carrying out these activities, this activity will be rated 0. The delivery of late work will be penalized by subtracting 20% of the value of the qualification obtained. SE3: Continuous evaluation (15%) Conducting and presenting seminars, case studies, debates, presentation of articles. The students will hold, in small groups, seminars in which there will be a presentation and discussion in class of the scientific articles indicated by the teachers or chosen by the students, within the subject matter of the subject.

The continuous evaluation will consist of participation in the classroom, carrying out work and questions raised. The formative approach of continuous evaluation aims to promote the active participation of the student throughout the teaching-learning process, so in this section continuous evaluation includes class attendance, behavior in the classroom and participation during expository classes, attendance at activities of interest related to the subject that are programmed, participation in practical exercises, contributions or questions that stimulate the development of classes, participation in forums, questionnaires and activities in Virtual Classroom and other activities that may arise during the course.

\*\* If the theoretical part has not been passed, this part must be recovered and the note of the other activities (SE2 and SE3) is kept until the extraordinary call, and not beyond, it being understood that all activities must be re-evaluated again if a new call is granted after the extraordinary call

#### ALTERNATIVE EVALUATION SYSTEM

Students in second and subsequent enrollment or with academic exemption can choose to take advantage of the ordinary evaluation system specified previously (in which case they must meet all the requirements, including class attendance) or to take advantage of the alternative system in which the following percentages will be applied: SEA1: Final written theory exam (80%).

SEA2: Carrying out and defending a work (20%) whose guidelines will be established and communicated by teachers.

To be able to average both parts, it is essential to obtain a score equal to or greater than 5 in SE1.

The decision to take advantage of the alternative evaluation system must be communicated by email to the responsible teacher during the first two weeks of class. If you do not report, the evaluation will be taken over by the ordinary system.

## ETHICAL AND RESPONSIBLE USE OF ARTIFICIAL INTELLIGENCE

1.- The use of any Artificial Intelligence (AI) system or service shall be determined by the lecturer, and may only be used in the manner and under the conditions indicated by them. In all cases, its use must comply with the following principles:

- a) The use of AI systems or services must be accompanied by critical reflection on the part of the student regarding their impact and/or limitations in the development of the assigned task or project.
- b) The selection of AI systems or services must be justified, explaining their advantages over other tools or methods of obtaining information. The chosen model and the version of AI used must be described in as much detail as possible.
- c) The student must appropriately cite the use of AI systems or services, specifying the parts of the work where they were used and describing the creative process followed. The use of citation formats and usage examples may be consulted on the Library website([https://www.ufv.es/gestion-de-la-informacion\\_biblioteca/](https://www.ufv.es/gestion-de-la-informacion_biblioteca/)).
- d) The results obtained through AI systems or services must always be verified. As the author, the student is responsible for their work and for the legitimacy of the sources used.

2.- In all cases, the use of AI systems or services must always respect the principles of responsible and ethical use upheld by the university, as outlined in the [Guide for the Responsible Use of Artificial Intelligence in Studies at UFV](#). Additionally, the lecturer may request other types of individual commitments from the student when deemed necessary.

3.- Without prejudice to the above, in cases of doubt regarding the ethical and responsible use of any AI system or service, the lecturer may require an oral presentation of any assignment or partial submission. This oral evaluation shall take precedence over any other form of assessment outlined in the Teaching Guide. In this oral defense, the student must demonstrate knowledge of the subject, justify their decisions, and explain the development of their work.

## BIBLIOGRAPHY AND OTHER RESOURCES

### Basic

Lasing M. Prescott, John P. Harley, Donald A. Klein. Microbiology/4th edition. Madrid:McGraw-Hill Inter-American, 1999

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