Teaching guide

IDENTIFICATION DETAILS

Degree:	Pharmacy
Scope	Pharmacy
Faculty/School:	Experimental Sciences
Course:	MICROBIOLOGY
Type:	Compulsory
ECTS credits:	9
Year:	2
Code:	2521
Teaching period:	Fourth semester
Subject:	Biologics
Module:	Biologics
Teaching type:	Classroom-based
Language:	Spanish
Total number of student study hours:	225

SUBJECT DESCRIPTION

The subject of Microbiology encompasses the study of methods of working with microorganisms, their general characteristics and their involvement in different socioeconomic processes and sectors, focusing mainly on human and animal health. The morphology, physiology, genetics and metabolism of the different groups of microorganisms will be analyzed and a detailed overview of the main bacteria, viruses and fungi that cause disease, their pathogenicity mechanisms and the way to combat them will be given. The importance that many microorganisms have in industry and the environment will also be studied.

Microbiology, like the rest of the sciences, emerges from the amazement of men at the processes that occur in nature and the desire to know what their cause is. Specifically, for the pharmacy student, it will focus on knowing what is the cause of certain diseases that cause men and what are the mechanisms to combat them. To this end,

students in pharmacy must bear in mind that the purpose of this knowledge is to serve society in the prevention, cure and alleviation of infectious diseases that afflict men. We can say that the material object of study of Microbiology are microorganisms, very small living beings that can only be seen with the aid of the microscope as a magnifying instrument. While the formal purpose of Microbiology, in the case of students of the Degree in Pharmacy, consists of the knowledge of the microorganisms responsible for infectious diseases, the methods of prevention and cure and the application of microorganisms to obtain drugs. The course will begin with a brief overview of the history of Microbiology, looking at the most relevant contributions of this Science until reaching the current era of Microbial Biotechnology. Current possibilities and the anthropological and ethical implications of some of their applications will be discussed. All this will allow the student to understand the great complexity of the simplest living beings, something that will lead us to ask deeper questions that are difficult to solve, if we only consider the data provided by the science of Microbiology. Many of the theoretical contents will be complemented by real experiments that students will carry out in the teaching laboratory. In this way, the student will learn the basic techniques of isolation, characterization and manipulation of microorganisms, necessary for working in a microbiology laboratory.

GOAL

The final objective of the microbiology course is to make future pharmacists aware of the importance of microorganisms both in the health of patients and their use in the pharmaceutical industry to obtain new drugs or new therapies. To achieve these objectives, they will need to understand the general characteristics, morphology, physiology and metabolism of microorganisms in order to be able to assimilate the most important concepts about pathogenicity mechanisms, possible pharmaceutical targets and their use in industrial applications.

The specific aims of the subject are:

Show the advantages of antimicrobial therapy, the responsible use of antibiotics and the need to develop new drugs to combat infectious diseases.

Understand the role of the pharmacist with society, such as access to medicines for the entire population and advice to patients about drugs and diseases, in this specific case, infectious diseases.

PRIOR KNOWLEDGE

To study the subject of Microbiology, it is advisable to have a good level of knowledge of Biology, Chemistry and Biochemistry

COURSE SYLLABUS

SECTION I. INTRODUCTION. Topic 1. Generalities and historical development of Microbiology Microbiology as an Experimental Science. Origin of Microbiology and historical development. Spontaneous generation. Beneficial and harmful effects of microorganisms. Impact of Microbiology on society. Organizational models and cell types. SECTION II. OBSERVATION METHODS AND STRUCTURE OF MICROORGANISMS. Theme 2. Microscopy and cell morphology. The compound microscope. Resolution and contrast power. Brightfield microscopy. Stains. Phase contrast, fluorescence and confocal microscopes. Transmission and scanning electron microscopy. Theme

3. The prokaryotic cell: structure and function. Cell size, shape, and clustering. The cell envelope in Gram positive and Gram negative: plasma membrane, cell wall, capsules and mucous layers. Cytoplasmic structures. Appendices: flagella, fimbriae and pili. Endospore formation. Topic 4. The eukaryotic cell: structure and function. Size and morphology. The core. Membrane systems: plasma membrane, endoplasmic reticulum and Golgi apparatus. Cell wall. Cytoplasmic organelles. Ciliums and flagella. SECTION III. NUTRITION AND MICROBIAL METABOLISM. Topic 5. Microbial nutrition. Obtaining carbon and energy. Carbon and energy sources. Nutritional requirements: nitrogen, phosphorus and sulfur. Growth Factors. Nutritional types. Nutrient uptake. Theme 6. Types of microbial metabolism. Ways of obtaining energy by microorganisms. Breathing. Fermentations. Photosynthesis. Assimilation of nutrients. Synthesis of macromolecules. SECTION IV. MICROBIAL GROWTH AND MICROORGANISM CONTROL Theme 7. Cell cycle and microbial growth. Cell division mechanism. Types of growing media. Microbial growth curve. Measurement techniques. Crops. Topic 8. Control of microbial populations: disinfection and sterilization. Physical sterilization techniques: heat, radiation, filtration. Survival curves and sterilization parameters. Microbial control by chemical agents: disinfectants and antiseptics. Microbiological control of drugs Theme 9. Antimicrobial agents. Targets of action and mechanisms of resistance Bacterial, viral and fungal targets of action. Resistance mechanisms. SECTION V. MICROBIAL GENETICS Topic 10. The bacterial genome: gene structure, replication and expression. The E. coli genome: genetic map. Chromosomes and extrachromosomal elements. Structure and function of genes and operons. Replication, transcription and translation. Topic 11. Mechanisms of regulation of gene expression. Topic 12. Mechanisms of genetic variation. Gene transfer methods: conjugation, transduction and transformation. Mutation and recombination. Transposable genetic elements. SECTION VI. DIAGNOSIS OF INFECTIOUS DISEASES Topic 13. Diagnosis of infectious diseases. Microscopy and culture of microorganisms. Molecular diagnostics. Immunological diagnosis. SECTION VII. HOST MICROORGANISM INTERACTION Topic 14. Microbial pathogenicity. Pathogenicity mechanisms, toxigenicity and immune system evasion mechanisms. Topic 15. Immune response. Host defenses. Non-specific host resistance. Specific immunity. Antigens and antibodies. Topic 16. Epidemiology of infectious diseases. Terminology. Identifying an epidemic. Infectious diseases and emerging pathogens. Control. SECTION VIII. BACTERIA OF CLINICAL INTEREST Topic 17. Phylogenetic and taxonomic generalities. Microbial evolution. Taxonomic ranks. Criteria for the classification of microorganisms. Genetic probes and creation of phylogenetic trees. Classical and molecular taxonomy. Topic 18. Bacteria domain. Gram-positive bacteria Gram-positive cocci (staphylococci, streptococci and enterococci), aerobic bacilli (corynebacteria), sporulated anaerobic bacilli (clostridia), non-sporulated anaerobic bacilli. Topic 19. Bacteria domain. Gram-negative cocci Aerobic cocci (Neisseria). Topic 20. Bacteria domain. Gram-negative bacilli Fermenting bacilli (Enterobacteria and Vibrios), non-fermenting bacilli (Pseudomonas), demanding bacilli (Haemophilus, Gardnerella, Bordetella and Legionella). Topic 21. Bacteria domain. Other actinomycete bacteria, mycobacteria, spirochetes, mycoplasmas, rickettsia and chlamydias SECTION IX: FUNGI OF CLINICAL INTEREST Topic 22. Fungal mycoses. Superficial, cutaneous and subcutaneous mycoses. Systemic mycoses. SECTION X. VIRUS OF CLINICAL INTEREST Topic 23. General characteristics and taxonomy of viruses. General properties of viruses. Cultivation and purification. Viral infections. Structure and classification. Topic 24. DNA virus Poxviridae family. Herpesviridae family. Adenoviridae family. Papillomaviridae family. Parvoviridae family. Hepadnaviridae family. Topic 25. dsRNA viruses. Reoviridae family. Topic 26. ssRNA virus (+). Calciviridae family. Picornaviridae family. Coronaviridae family. Togaviridae family. Topic 27. ssRNA (+) virus with DNA intermediate. Retroviridae family. Topic 28. ssRNA virus (-). Paramyxoviridae family. Ortomyxoviridae family. Rhabdoviridae family. Bunyaviridae family. Arenaviridae family. SECTION XI. INDUSTRIAL MICROBIOLOGY Topic 29. Industrial products of microbial origin. Microorganisms of industrial interest. Drugs of microbial origin. Search for microorganisms of industrial interest. Modification and improvement of strains. SECTION XII. LABORATORY PRACTICES Practice 1. Preparation of culture media and seeding of microorganisms. Preparation of solid and liquid culture media. Sterilization. Sowing bacteria and yeasts in Petri dishes, liquid medium tubes and slanted agar tubes. Practice 2. Microscope management and observation of microorganisms. Observation of bacterial colonies on plates. Observation of bacteria and yeasts under an optical microscope: fresh preparations and stained bacteria (single stain, Gram stain, special stains). Practice 3. Microbial growth and control. Preparation of a culture of Escherichia coli bacteria. Representation of a growth curve and analysis of the effect of adding antibiotics. Practice 4. Effect of

antimicrobial agents. Study of the effect of different antibiotics on the growth of Gram-positive and Gram-negative bacteria. Preparation of qualitative and quantitative antibiograms. Practice 5. Microbial ecology. Contaminated water analysis. Counting the number of microorganisms in water samples and analyzing the type of microorganisms present. Detection of potential pathogens. Practice 6. Virology: titration of a bacteriophage. E. coli infection with lambda phage. Observation of lysis plaques and determination of the number of infectious viral particles. Practice 7. Horizontal gene transfer: transformation, conjugation. Induction of the state of competition in E. coli and transformation with a plasmid.

EDUCATION ACTIVITIES

AFP 1. Theoretical classes.- The teacher will explain new content through interactive presentations or the creation of infographics - The teacher will answer questions raised during autonomous study when the methodology applied is the inverted class.- Through cooperative work in small groups and with the guidance and help of the teacher, different practical tasks related to the contents studied will be carried out: carrying out exercises or tests, using simulators, solving practical cases, or the analysis of articles or news scientific.- Continuous evaluation exercises and tests will be carried out. AFP 2. Practical classes. There will be 5 practical sessions during which techniques and methodologies specific to experimentation in microbiology and the analysis of the results obtained will be used. The student will have an internship script and the audiovisual material previously provided in the Virtual Classroom. AFP 3. Solving exercises and problems. The teacher will prepare tasks for solving exercises and problems related to the syllabus that students must submit solved and/or solved in the classroom. AFP 4. Seminars and exhibition of works. The students will carry out, in small groups, 3 seminars in which they will delve into the resolution of practical and clinical classes. AFP 5. Tutoring, programmed by the teacher or requested by the students Tutoring may be individual or group. They may be programmed by the teacher or requested by the students. The objective is to be able to advise and tutor each student in the aspects they need most in order to obtain the highest possible performance and ensure the acquisition of the competencies associated with the subject. The tutoring schedule can be consulted in the degree coordinator and will be informed by the teacher at the beginning of the course. AFP 6. Conducting AFNP exams 1. Study of theory, exercises and problems: students will have the subject of study material available in the Virtual Classroom, such as presentations, articles, videos, links to web pages and review and self-evaluation exercises. - The teacher will mark the learning objectives of each face-to-face session and will provide the independent study material (videos, pdfs or podcasts) necessary for the correct use of this class. The students will independently study the proposed material necessary for the face-to-face class. AFNP 2. Preparation and study of practices. Students must read or view the material available in the virtual classroom and perform a task before each laboratory session. AFNP 3. Preparation of works. Students must, in groups, do work on a topic proposed by the teacher.

DISTRIBUTION OF WORK TIME

TEACHER-LED TRAINING ACTIVITIES	INDIVIDUAL WORK
96 Horas	129 Horas

Cross Skills

To be able to approach a subject by means of rigorous, profound and comprehensive thought.

To be able to assess knowledge acquired.

To be able to apply the theoretical knowledge learnt in the of solving problems and practical cases linked to the various subjects.

LEARNING RESULTS

Estimate the biological risks associated with the use of substances and processes in the laboratories involved.

Understand the relationship between the life cycle of infectious agents and the properties of active ingredients.

Know and understand the microbiological control of drugs.

Know the nature and behavior of infectious agents.

Develop skills to identify therapeutic targets and biotechnological drug production, as well as for the use of gene therapy.

SPECIFIC LEARNING RESULTS

Describes the structure and properties of cells and cell organelles of microorganisms

Relates structure and function of cellular components

Describes the possible metabolism of microbial groups

Describes the main virulence factors of infectious agents and identifies the main routes of infection of microorganisms

Lists the action targets of antimicrobial agents, identifies new possible targets of action and the mechanisms for preventing infectious diseases||Differentiate the main routes of action of antimicrobial agents resistance mechanisms of microorganisms and relates them to the importance of the rational use of antimicrobials

Describe and apply the fundamentals of microorganism diagnostic techniques

Apply knowledge about microorganisms for use as genetic manipulation tools

Organize the knowledge acquired by means of concept maps, infographics or videos||Explain the results of theoretical and practical analyses orally and/or in writing

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 final grade for this course will be obtained based on the grades obtained in the evaluation of the following modules and it will be necessary to get at least a 5 out of 10 to pass the subject. ORDINARY EVALUATION SYSTEM (this is the default evaluation system for students in this subject) SE1. Written or oral tests (55% of the subject grade). It is mandatory to pass this block (5 out of 10) to apply the rest of the percentages of the subject. It will consist of an i) final theoretical exam that will be worth 75% of this block (it is necessary to take a minimum of 4.5 out of 10). ii) Follow-up tests for continuous evaluation. Throughout the course, 3 written tests will be taken that do not release subject matter, the 2 highest will be chosen to make an average that will calculate 25% of the grade of the theoretical block. In this regard, if a student justifies his absence from two exams, he will be given the opportunity to take one more to reach the three grades with which to make an average. If excused absences affect more than two continuous evaluation tests, the student will have the final exam grade as a grade for the theoretical block. In case of unexcused absences, that day's evaluation test will be rated as 0. IF 2. Daily activities and exercises (5%). Attendance at activities of interest related to the subject that are scheduled, completing diagnostic and training evaluations, participation in practical exercises, participation in forums and activities in the Virtual Classroom and other voluntary activities, will be evaluated in this section. IF 3. Individual and group work (15%). This part will evaluate the work done by the students and the knowledge acquired, with the use of a rubric and through oral and/or written presentation and the design of an evaluation test on the subject. The works will be suggested by the teacher who will guide their completion through tutoring. SE4.Attendance and participation in face-to-face classroom activities (5%). This block will evaluate the contributions or questions that stimulate the development of classes and other activities carried out in the classroom. SE8- Attendance and participation in face-to-face activities in the laboratory (20% of the subject grade). It is necessary 5 out of 10 in this block to be able to apply the rest of the percentages of the subject. The practical part of the laboratory will be evaluated by i) carrying out a test (a minimum score of 4.5 out of 10 is required) (50%), ii) submission of the report of one of the practices carried out during the practical sessions (25%), iii) evaluation of the work done during the practical sessions and seminars (25%). Attendance at all practical sessions and seminars is mandatory. The unjustified absence of any of these sessions leads to the loss of the right to an internship evaluation in the ordinary call and a suspension of the course. Students in this situation should immediately contact the teacher * In blocks where the contrary has not been specified, it will not be necessary to obtain a minimum grade. However, if after applying all the percentages, the subject is suspended, the continuous evaluation items can be recovered, optionally, by asking some extra questions that assess these competencies in the extraordinary call. ** The blocks passed will be saved for the extraordinary call of the same academic year but not for the following. ALTERNATIVE EVALUATION SYSTEM. Only in the case of students in the second call and later, and students with an academic exemption, who request it in a reasoned manner by mail from the teachers of the subject. In the alternative evaluation system, the following percentages will be applied: SE1. Final theory exam (65%) SE2. Delivery of questions related to laboratory practices (20%) SE3. Delivery of a written work on a topic proposed by the teacher (15%). The request must be made by email to the responsible teacher during the first two weeks of class. If you do not report, continuous evaluation will be assumed, with all that this implies.

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/).
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

PRESCOTT, Lansing M. Prescott's Microbiology/11th ed. New York: McGraw-Hill, 2020.

Michael T. Madigan... [et al.]. Brock [Electronic Resource]: Biology of Microorganisms/15th ed. Madrid:Pearson, 2021.

Guillem Prats. Medical microbiology and parasitology/Madrid: Panamericana, 2019.

Additional

Patrick R. Murray, Ken S. Rosenthal, Michael A. Pfaller. Medical Microbiology [Electronic Resource]/8th ed. Barcelona:Elsevier, 2017.

Schaechter; N. Cary Engleberg, Victor J. DiRita, Terence S. Dermody; [translation, P&M, Healthcare Publishing Services, S.A. de C.V.]. Mechanisms of microbial diseases/5th edition. L'Hospitalet de Llobregat, Barcelona: Wolters Kluwer Health, 2013.