# Teaching guide

## IDENTIFICATION DETAILS

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|---|---|
| Degree: | Biomedicine |
| Scope | Biology and Genetics |
| Faculty/School: | Experimental Sciences |
| Course: | INTRODUCTION TO MICROBIOLOGY |
| Type: | Compulsory |
| ECTS credits: | 4,50 |
| Year: | 2 |
| Code: | 2141 |
| Teaching period: | Third semester |
| Subject: | Biologics |
| Module: | Fundamental Sciences |
| Teaching type: | Classroom-based |
| Language: | Spanish |
| Total number of student study hours: | 112,50 |

## SUBJECT DESCRIPTION

Microbiology is the science that deals with the study of microorganisms, a large group of living beings that have in common only their small size and simple organization. Etymologically, the word Microbiology comes from the conjunction of three Greek terms: 'micros' meaning small, 'bios' meaning life and 'logos' equivalent to science or reasoning.

The course Introduction to Microbiology focuses on the study of microorganisms, for which it is necessary to know the working methodology that allows their identification and study. The course begins with a brief historical overview, analyzing the social changes that have caused the main milestones of Microbiology. Next, the methods of isolating and analyzing microorganisms, their cellular organization, their physiology, the mode of growth and their metabolic characteristics are studied. Methods of controlling microbial populations with their practical

applications will also be explained and the importance of microbial taxonomy and phylogeny will be briefly reviewed. Next, microbial genetics will be studied, delving into the mechanisms that direct and regulate gene expression in viruses and bacteria and that allow them to control their life cycle. The interaction of microorganisms with other living beings, especially with man, will also be studied, focusing not only on the mechanisms that induce microbial pathogenicity but also on the positive effects of microorganisms, without which life would not be as it is. An overview will be given of how the immune system responds to the presence of an infectious agent and also how microorganisms are able to evade this response. Knowledge of all these processes at the molecular level is essential to be able to control diseases of microbial origin and to design tools and processes for clinical application that improve the quality of life.

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. Today we know that nature as we know it would never have been possible without the existence of microorganisms. Microbiology became a solidly established discipline during the last decades of the 19th century and from this moment on and during the first half of the 20th century, the main interests of microbiologists were the characterization of infectious agents, the study of immunity and its role in the prevention and cure of diseases, the search for chemotherapeutic agents and the analysis of the chemical activity of microorganisms. Microorganisms have therefore played, and continue to play, an essential role as a model for the study of basic biological processes. Disciplines such as Biochemistry, Molecular Biology, Molecular Genetics or Physiology have been developed and understood to a large extent thanks to studies carried out with microorganisms. An important milestone that occurred in the second half of the 20th century, thanks to studies carried out with microorganisms, was the development of the first Genetic Engineering tools that made it possible to modify the genetic material of living beings. In this way, the era of Molecular Microbiology or Microbial Biotechnology began, in which the first genetically modified microorganisms were created for various purposes. Technology has continued to advance and its application has been extended to more complex organisms, until reaching the current situation in which any living being, including man, is susceptible to being genetically modified or manipulated. This is why it is necessary for men of science to be aware of the implications that their research may have on humanity. For this reason, it is essential to have anthropological and ethical knowledge that underpins scientific knowledge and is a faithful defense of the dignity and freedom of the person.

More specifically, this course prepares students for access to deeper knowledge in the areas of Medical Microbiology and Biomedical Biotechnology

## GOAL

The objective of this course is for students to know the types of microorganisms that exist, their main characteristics, working techniques in microbiology and to be aware of the relationship and importance of microorganisms in their interaction with man.

The specific aims of the subject are:

Understand the importance of microorganisms

Define and identify basic working techniques in microbiology

Identify the importance of microorganisms and their clinical application

Describe and determine methods of controlling microbial growth and their importance

Understand the fundamentals of bacterial genetics at the molecular level and their importance||Identify the basic characteristics of viruses and identify their applications||Acquire a basis for the study of microbial pathogenesis||Discover the relationship between microbiota and human health

## PRIOR KNOWLEDGE

To take the course Introduction to Microbiology, it is advisable to have a good level of knowledge in Biology, Chemistry, Genetics and Biochemistry.

## COURSE SYLLABUS

SECTION I. INTRODUCTION. Topic 1.- Importance and historical development of Microbiology.
SECTION II. OBSERVATION METHODS AND STRUCTURE OF MICROORGANISMS. Theme 2. Microscopy and cell morphology. Theme 3. The prokaryotic cell: structure and function. Topic 4. The eukaryotic cell: structure and function.
SECTION III. NUTRITION AND MICROBIAL METABOLISM. Topic 5. Microbial nutrition. Obtaining carbon and energy. Theme 6. Types of microbial metabolism. Topic 7. Introduction to phylogenetic, medical and clinical diagnostic taxonomy.
SECTION IV. MICROBIAL GROWTH AND MICROORGANISM CONTROL Theme 8. Cell cycle and microbial growth. Topic 9. Control of microbial populations: disinfection and sterilization. Topic 10. Antimicrobial agents.
SECTION V. BACTERIAL MOLECULAR BIOLOGY AND GENETICS Topic 11. The bacterial genome: gene structure, replication and expression. Topic 12. Regulation of gene expression. Topic 13. Mechanisms of genetic variation. Gene transfer methods: conjugation, transduction and transformation.
SECTION VI. VIROLOGY Theme 14. General characteristics of viruses. Topic 15. Bacterial viruses. Topic 16. Eukaryotic viruses and other acellular infectious agents.
SECTION VII. MICROORGANISM-HUMAN INTERACTION Theme 17. Introduction to the human microbiota. Topic 18. Introduction to microbial pathogenicity.

## EDUCATION ACTIVITIES

AF1. Expository and participatory classes taught by the teacher of the subject with computer support. Questions will be asked in class about what has been explained and doubts will be resolved. Tools such as wooclap will be used to make classes more interactive. AF2. Practical classes. These classes can be organized under an inverted class methodology so that the student will have to independently prepare a topic following the teacher's

instructions and, during class hours, activities and tasks will be carried out to answer questions and strengthen the knowledge acquired; or as classes for solving exercises, problems or practical cases related to the agenda that students must solve in the classroom. AF3. Individual or group tutoring. The teacher, at his own request or that of the student, and at the time established for this purpose, will answer questions or discuss the questions posed to him by the student and various activities will be carried out in order to guide him in learning the subject. Diagnostic and formative evaluation will be carried out, in addition to the summative evaluation. Attendance will be considered at activities such as practical exercises or seminars given 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. AFN1. Theoretical study, where the student must study the material taught in the expository classes and deepen it with the help of books. AFN 2. Preparation of practical classes. The student will have to prepare some part of the syllabus, provided for the teacher, in order to carry out the activities and exercises that are done in class. AFN3. Tutoring preparation.

“The teachers of the subject do not authorize the publication by the student of the material provided by the teachers of the subject in the virtual classroom, or by any other means.”

## DISTRIBUTION OF WORK TIME

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

## LEARNING RESULTS

Know the basic morphological, metabolic, physiological and genetic characteristics of both prokaryotic and eukaryotic living organisms, taking into account their morphological and functional unit.

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

Know the nature and properties of the main antimicrobial active ingredients and their effect on various microorganisms.

## SPECIFIC LEARNING RESULTS

To know the structure and composition of microorganisms

To become aware of the importance of microorganisms in their interaction with human

Differentiate the different groups of microorganisms that exist based on their morphological, physiological, genetic and biochemical characteristics

Know the bases of the mechanisms of microbial pathogenicity||Identify processes, routes, molecules present in the

microbial world that can be applied in biomedicine||Search, assimilate and present relevant information about microorganisms important in biomedicine

Acquiring knowledge of innovative biomedical application projects

## LEARNING APPRAISAL SYSTEM

"Plagiarism, as well as the use of illegitimate means in evaluation tests, will be sanctioned in accordance with the university's Evaluation Regulations and Coexistence Regulations." The final grade for this subject will be obtained from the grades obtained in the evaluation of the following modules, and it will be necessary to obtain at least 5 out of 10 of the total grade to consider the subject approved: ORDINARY EVALUATION SYSTEM (this is the default evaluation system for students in this subject). SE1.Evaluation of the theoretical content (65% of the subject grade). It is mandatory to approve this block with a minimum score of 5. This grade will come from applying the following percentages: i) 75% of a final theoretical exam (minimum score of 4.5); ii) 25% of follow-up tests for continuous evaluation. IF 2. Resolution and evaluation of practical cases and exercises (25% of the subject). To overcome this block, a minimum score of 4.5 is required. IF 3. Attendance and participation in classroom activities (10%). * 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 next ones. ALTERNATIVE EVALUATION SYSTEM. Only in the case of students in the second call and later, and students with academic exemption. Students should contact teachers to request and take advantage of this type of evaluation during the first week of class. In the alternative evaluation system, the following percentages will be applied: i) Final theory exam (75%). A minimum grade of 5 is required ii) Activities and exercises (25%), Minimum score of 4.5.

## 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


Michael T. Madigan... [et al.]. Brock [Electronic Resource]: Biology of Microorganisms/16th ed. Madrid:Pearson, 2021.

Black, Jacquelyn G. Microbiology: principles and explorations/[S. l.] :John Wiley & Sons, 2008.

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


### Additional


Stefan Riedel... [et al.]. Medical Microbiology [de] Jawetz, Melnick and Adelberg/28th ed. Mexico City: McGraw-Hill Interamericana, 2020.

Prats Pastor, Guillermo. Medical Microbiology and Parasitology/Madrid:Panamericana, 2019.
(Prats Pastor, Guillermo. Medical Microbiology and Parasitology/Madrid:Panamericana, 2019. , ||Brenda A. Wilson... [et al.]. Bacterial pathogenesis: a molecular approach/3rd ed. Washington: ASM PRESS, 2011. )