

Basic Microbiology and Virology

Code: 101933
ECTS Credits: 3

Degree	Type	Year	Semester
2501230 Biomedical Sciences	OB	1	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

Although there are no official prerequisites, students are advised to review the concepts that refer to the microbial world previously studied. Likewise, it is convenient to have a good knowledge of the subjects studied during the first semester of the Biomedical Sciences degree, as well as of the other subjects that are simultaneously taught during the second semester.

Objectives and Contextualisation

This is a compulsory subject of the Biomedical Sciences degree that introduce students to the microbial world, giving a general vision of microorganisms in connection with the rest of the living organisms, and the different environments in which microorganisms live.

This subject, given its introductory approach, providing the most basic concepts and competences related to Microbiology. Students can therefore deepen in the following courses the rest of subjects that are part of the nucleus of the Biomedical Sciences degree.

Objectives of the subject:

1. To broadly recognize the microbial diversity and to know how to distinguish the characteristics that define the different microbial groups.
2. Identify the different structures, as well as the composition of the prokaryotic cell.
3. To know the metabolic versatility of the different microbial groups, particularly that of prokaryotes.
4. To know the genomic variability of microorganisms and the main mechanisms for the exchange of genetic information in prokaryotes.
5. Recognize the main relationships of microorganisms with living beings and the physical environment they inhabit.
6. To know the role of microorganisms in the development of human societies, as well as their current and future applications.

7. To know how to perform basic calculations to determine microbiological parameters.
8. To understand basic laboratory techniques to work experimentally with microorganisms.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Display knowledge of the bases and elements applicable to the development and validation of diagnostic and therapeutic techniques.
- Display knowledge of the basic life processes on several levels of organisation: molecular, cellular, tissues, organs, individual and populations.
- Display knowledge of the concepts and language of biomedical sciences in order to follow biomedical literature correctly.
- Display theoretical and practical knowledge of the major molecular and cellular bases of human and animal pathologies.
- Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
- Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
- Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
- Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
- Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.
- Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Learning Outcomes

1. Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
2. Describe the most important groups of pathogenic microorganisms .
3. Identify the techniques used in the detection and identification of pathogens.
4. Make changes to methods and processes in the area of knowledge in order to provide innovative responses to society's needs and demands.
5. Recognise the diversity of the microbial world and identify the different groups it is composed of.
6. Recognise the role of microorganisms as agents of disease or toxicological problems in human beings, animals and plants.
7. Students must be capable of applying their knowledge to their work or vocation in a professional way and they should have building arguments and problem resolution skills within their area of study.
8. Students must be capable of collecting and interpreting relevant data (usually within their area of study) in order to make statements that reflect social, scientific or ethical relevant issues.
9. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
10. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.

11. Students must have and understand knowledge of an area of study built on the basis of general secondary education, and while it relies on some advanced textbooks it also includes some aspects coming from the forefront of its field of study.
12. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
13. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
14. Understand the concepts and language of microbiology and consult the scientific literature in the area of microbiology.
15. Work as part of a group with members of other professions, understanding their viewpoint and establishing a constructive collaboration.

Content

INTRODUCTION

Topic 1. The world of microorganisms: The history of Microbiology: human societies and microorganisms. Discovering microorganisms. Levels of organization. Main differences between viruses and cellular organisms. Prokaryotic and eukaryotic organization. Groups and denomination of microorganisms.

STRUCTURE AND FUNCTION OF PROCARIOTES

Topic 2. The prokaryotic cell: Size and morphology. The cytoplasm. The nuclear region. Cytoplasmic membrane

Topic 3. Surrounded by the prokaryotic cell and mobility: Structure and function of the cell wall. Capsules and mucous layers. Main motility mechanisms.

Topic 4. Intracellular Inclusions and differentiation Forms: Functional and reservation inclusions. Endospores-Filaments and micelia. Spores and cysts.

GROWTH AND MICROBIAL CONTROL

Topic 5. The cell cycle of prokaryotes: Binary fission. Cell division and control.

Topic 6. Microbial growth and continuous cultivation of microorganisms: Cell growth and population growth. Influence of environmental factors on cell growth. Concepts of the continuous cultivation of microorganisms.

Topic 7. Control of microbial growth by chemical agents: antimicrobial agents. Differences between antiseptics, disinfectants and chemotherapeutic agents. Resistance to antimicrobials.

MICROBIAL PHYSIOLOGY

Topic 8. Global metabolic scheme: Energy sources, carbon and reducing power. Biosynthetic strategy. Processes for obtaining energy.

Topic 9. Types of microorganisms according to their nutrition: Organotrophic litotrophy and phototrophy. Autotrophy and heterotrophy. Respiration, fermentation and photosynthesis

BACTERIAL GENETICS

Topic 10. The genome of prokaryotes: Structure of the genome. Size and topology. Extrachromosomal genetic material.

Topic 11. Mechanisms of genetic transfer: Conjugation, transformation and transduction.

VIROLOGY

Topic 12. Concept of virus. Structure and morphology of viral particles. Classification and diversity.

APPLIED MICROBIOLOGY

Topic 13. Environmental, medical and industrial microbiology: Environmental microbiology: aerial, terrestrial and aquatic environments, main features. Host-microbe relationship. Industrial and food microbiology. Microbial biotechnology.

CONTENT PROBLEMS AND TECHNIQUES

Session 1. Microscopic technique

Optical and electronic microscopy applied to microorganisms. In vivo observation of microorganism. Fixing and staining. Simple, differential and specific stains.

Session 2. Microscopic observations

Analysis of microscopic images. Identification of morphologies and microbial structures.

Session 3. Culture and isolation techniques

Nutritional requirements of microorganisms. Composition of the culture media. Types of culture media. Isolation of microorganisms. Culturing methods. Methods for the identification of microorganisms.

Sessions 4 and 5. Problems about basic microbiology

Experimental design. Calculation of concentrations. Viable and total counting concept. Concept of viable but non-cultivable microorganisms.

Session 6 and 7. Problems on microbial growth and control

Experimental design. Population growth curve. Calculation of parameters. Survival curves for different treatments.

Session 8. Resolution and presentation of proposed problems

Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

Methodology

The subject of Fundamentals of Microbiology and Virology consists on two modules which have been programmed in an integrated way. The student will have to relate throughout the course the content and programmed activities to achieve the competences indicated in section 5 of this guide.

The two modules are the following:

Participatory theoretical classes: The student must acquire the scientific and technical knowledge of this subject by attending these classes and complementing them with the personal study of the topics explained. At the beginning of the course, students will receive a detailed calendar of the topics that will be dealt with throughout the course, as well as the bibliography that they will have to consult to prepare each theoretical class, and for the personal study of the topics explained. The teaching of each subject will be based on a theoretical exposition and on a brief discussion of the same. In addition, for each topic, the student will have a series of questions that will allow him/her to reflect and work personally on the topics covered.

Classroom practices: These classes are sessions aiming to:

- A) work on methodological aspects,
- B) facilitate the understanding of the knowledge exposed in the theoretical classes,
- C) to train the student to design basic experiments on Microbiology and,

D) make a bridge between the participatory theoretical classes and the practical work of the laboratory, with the aim of integrating the theoretical knowledge with the practical classes.

The student will receive proposals of problems that will have to be developed during the course both in class and individually. In addition, the bibliography that will be consulted and the relation of each session with the subjects treated in the participative theoretical classes will also be indicated.

The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classroom practices	7	0.28	12, 2, 11, 10, 9, 7, 8, 6, 5, 15
Theoretical classes	17	0.68	14, 2, 3, 6, 5
Type: Supervised			
Individual supervision	1	0.04	14, 2, 3, 6, 5
Type: Autonomous			
Problems resolution	5	0.2	14, 3, 10
Seminars preparation	11	0.44	14, 10, 15
Study	30	1.2	14, 2, 3, 6, 5

Assessment

The evaluation of the subject will be individual and continued through the following tests:

Assessment module for theoretical classes (50% of the overall score).

A written multiple-choice test in which the student must demonstrate their degree of achievement of theoretical concepts. In order to approve this module, the student must get at least 5 in this test.

Evaluation module for classroom practices (50% of the overall score).

The evaluation of this activity will consist of the following tests:

- Written and oral presentation of a work related to a microorganism proposed by the teaching staff (15%)
- A written multiple-choice test corresponding to the works proposed by the teaching staff (15%)
- A written multiple-choice test corresponding to the practical problems done during the classroom practices (20%)

These tests will have a weight of 5 out of 10 points each one. To pass this module the student must obtain at least 5 in each of the tests.

The written and oral presentation will be carried out the last week of classes. All the written multiple-choice tests will be carried out the scheduled date for the evaluation of the subject.

The student who, due to justified cause (providing the corresponding documentation) cannot do the evaluation test, will have the right to do it on another date according to the teacher.

To pass the subject, the student must obtain a qualification of 5 or higher in each module. Otherwise, the student will have to complete the retrieval test scheduled at the end of the semester and pass it with a mark equal to or greater than 5.

The students that have passed the subject have the option to improve the mark by doing an exam, at the end of the semester, in the date programmed for the retrieval test. The presentation to the examination to improve the mark implies the resignation of the qualification previously obtained and, in this case, the final mark of the subject will be the one obtained in this test. This exam will consist of an overall test of all the content of the subject and to overcome it, it will be necessary to obtain a mark equal to or greater than 5.

To be eligible for the retake process, the student should have been previously evaluated in a set of activities equaling at least two thirds of the final score of the course or module. Thus, the student will be graded as "No Avaluable" if the weighthin of all conducted evaluation activities is less than 67% of the final score.

Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Multiple choice test (proposed works)	15%	0.5	0.02	14, 2, 3, 11, 7, 6, 5
Multiple choice test (theoretical concepts)	50%	1.5	0.06	14, 2, 3, 11, 10, 6, 5
Multiple-choice test (classroom practices)	20%	1	0.04	14, 2, 3, 11, 10, 8
Written and oral presentation	15%	1	0.04	1, 13, 12, 14, 2, 3, 4, 11, 10, 9, 7, 8, 6, 5, 15

Bibliography

Textbooks:

Madigan, M., JM Martinko, PV Dunlap, DP Clark. 2015. Brock Biology of Microorganisms. 14th ed. Prentice Hall.

Willey, J, LM Sherwood, CJ Woolverton. 2009. Microbiology of Prescott, Harley and Klein. 7th ed. MacGraw-Hill.

Prats, G. 2013. Microbiology and Parasitology Medical. Ed. Pan American Medical.

Martin González, A; Béjar Luque, V. 2019. Microbiología Esencial. Editorial Médica Panamericana.

Recommended reading:

De Kruif, P. 1926. The hunters of microbes. Ediciones Nueva Fénix.

Recommended blogs

Those little bugs

[Http://weblogs.madrimasd.org/microbiologia/](http://weblogs.madrimasd.org/microbiologia/)

Blog Small things considered

[Http://schaechter.asmblog.org/schaechter/](http://schaechter.asmblog.org/schaechter/)

Pages

[Http://www.sem microbiologia.org](http://www.sem microbiologia.org)