

Microbiology

Code: 100771
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	OB	2	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.

Contact

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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

Teachers

Marina Luquín Fernández

Prerequisites

Although there is no official prerequisite, students are advised to review the concepts that refer to the microbial world, studied previously.

Objectives and Contextualisation

This is a compulsory subject of the degree of Biology, which introduces students to the microbial world, giving a general vision of microorganisms, in connection with other living beings and the different environments in which microorganisms live.

This subject, given its introductory approach, gives the most basic concepts and competences related to Microbiology, so that students can go into the following courses in the rest of subjects that are part of the subject called Microbiology.

Objectives of the subject:

To broadly recognize the microbial diversity and to know how to distinguish the characteristics that define the different microbial groups.

Identify the different structures, as well as the composition of the prokaryotic cell.

Understand the metabolic versatility of the prokaryotes.

To know the main mechanisms for the exchange of genetic information between prokaryotes.

Describe the microbial growth and the physical and chemical processes that are used for its control.
Understand and know how to apply basic laboratory techniques to work experimentally with microorganisms.
Understanding how microorganisms are related to humans.

Competences

- Act with ethical responsibility and respect for fundamental rights and duties, diversity and democratic values.
- Analyse and interpret the origin, evolution, diversity and behaviour of living beings.
- Be able to analyse and synthesise
- Be able to organise and plan.
- Describe and identify the levels of organisation of living beings.
- Identify and classify living organisms.
- 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.
- Understand heredity mechanisms and the fundamentals of genetic improvement.
- Understand the processes that determine the functioning of living beings in each of their levels of organisation.

Learning Outcomes

1. Analyse a situation and identify its points for improvement.
2. Apply the methodologies needed to characterise and identify microorganisms in pure cultures and in complex samples.
3. Be able to analyse and synthesise.
4. Be able to organise and plan.
5. Critically analyse the principles, values and procedures that govern the exercise of the profession.
6. Describe microbial growth and the physical and chemical processes used to control it.
7. Explain the genetic bases of microorganisms and their mechanisms of genetic transfer.
8. Identify metabolic diversity in microbes and relate it to the different groups of microorganisms.
9. Propose new methods or well-founded alternative solutions.
10. Propose viable projects and actions to boost social, economic and environmental benefits.
11. Recognise the diversity of the microbial world and identify the different groups it is composed of.
12. Relate the basic microbial components and structures to their functions.
13. 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.
14. 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.
15. Students must be capable of communicating information, ideas, problems and solutions to both specialised and non-specialised audiences.
16. Students must develop the necessary learning skills to undertake further training with a high degree of autonomy.

17. 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.
18. Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.

Content

CONTENTS THEORETICAL CLASSES

Topic 1. The world of microorganisms.

Object of study of Microbiology. The microorganisms definition and type. Discovery of microorganisms. Pasteur and the defeat of spontaneous generation. The Koch postulates. Pure culture, clone, strain and bacterial species. Taxonomy and bacterial systematics. Nomenclature of species.

Topic 2. The prokaryotic cell.

Differences between prokaryotic and eukaryotic cells. Microscope observation. Morphology and cell size. Differential characteristics of the Bacteria and Archaea domains.

Topic 3. The prokaryotic cell envelope and motility.

The cell wall of gram-positive and gram-negative bacteria. The stain of gram. Structure of the peptidoglycan. Bacteria without peptidoglycan. The external membrane of gram-negative bacteria. The cell wall of the archaea (Archaea). The layers S. Capsules and mucous layers. Fimbria, pili and flagella. Motility. The flagella of the spirochetes, the movement by sliding.

Topic 4. Intracellular inclusions and forms of bacterial differentiation.

Functional and reservation inclusions. Endospores. Spores. Fruitful bodies.

Topic 5. The cell cycle of prokaryotes.

Binary fission. Generation time. Exponential growth. Discontinuous culture. Continuous culture. Factors that affect bacterial growth.

Topic 6. Cultivation of microorganisms, methods of identification and conservation systems.

Media culture for the isolation of bacteria, viruses and fungi. Identification methods: biochemical, immunological and genetic identification. Conservation systems. International collections of microorganisms.

Topic 7. Control of microbial growth.

Physical control, mechanical control and chemical control of growth. Antimicrobials for external use and antimicrobials for internal use. The antibiogram.

Topics 8. Fundamentals of bacterial genetics.

Spontaneous and induced mutations. Selection of mutants. The Ames test. Mechanisms of genetic transfer: Conjugation, transformation and transduction.

Topic 9. Global metabolic scheme.

Metabolic diversity. The phototrophic life system: anoxygenic photosynthesis, red sulfur bacteria and other photosynthetic bacteria. Chemolithotrophy: the oxidizing bacteria of reduced sulfur compounds; Iron oxide bacteria; Nitrifying bacteria. Autotrophy: the cycle of Calvin, the reverse cycle of citric acid and the hydroxypropionate pathway. Aerobic respiration and anaerobic respiration. Chemoheterotrophy. Fermentation: fermentation of lactic acid, bacteria of lactic acid; Acid-mixed and butanediolic fermentation, enterobacteria. Nutrient cycles and microorganisms.

Topic 10. Clinical microbiology: general concepts.

Introduction. Areas of study of clinical microbiology. Groups of pathogenic microorganisms for humans. Host-parasitic relationships. Basic concepts about infectious diseases.

Topic 11. Urinary tract infections.

Introduction. Structure and function of the urinary tract. Factors that predispose the infection. Clinical manifestations. More frequent etiological agents of uncomplicated cystitis: *Escherichia coli* and other gram-negative bacilli, *Staphylococcus saprophyticus* and other gram-positive bacteria. Laboratory Diagnostics. General rules for the treatment of urinary tract infections.

Topic 12. Infections of the genital system.

Introduction. Sexually transmitted diseases. Structure and function of the genital system. Factors that predispose to the infection. Clinical manifestations. Etiologic agents. *Neisseria gonorrhoeae* and *Chlamydia trachomatis*: urethritis and cervicitis. *Candida albicans* and *Trichomonas vaginalis*: vulvovaginitis. Genital ulcers: *Treponema pallidum* and herpes simplex virus. Papillomavirus: genital warts and cancer. Laboratory Diagnostics. Treatment and prevention. Post-part endometritis: *Streptococcus agalactiae*.

Topic 13. Respiratory infections.

Introduction. Structure and function of the respiratory system. Factors that predispose to the infection. Clinical manifestations. Rhinovirus: common cold. *Streptococcus pyogenes*: Pharyngotonsillitis. *Corynebacterium diphtheriae*: diphtheria. Respiratory viruses and acute bronchitis. *Bordetella pertussis*. Pneumonia, etiologic agents. *Streptococcus pneumoniae*, *Legionella pneumophila*. Tuberculosis: *Mycobacterium tuberculosis*. Laboratory diagnosis of respiratory infections. Treatment and prevention.

Topic 14. Infections of the digestive tract.

Infection of the oral cavity. The mouth and teeth, structure and function. Factors that predispose to the infection. Clinical manifestations. Etiologic agents. *Streptococcus mutans*: dental caries. *Porphyromonas gingivalis*: periodontal disease. Structure and function of the gastrointestinal tract. Factors that predispose to the infection. Clinical manifestations. Chronic gastritis and peptic ulcer: *Helicobacter pylori*. Intestinal infection. Etiological agents of infectious gastroenteritis. Intestinal Helminthiasis. Toxicoinfection of food. Etiologic diagnosis. Treatment and prevention. Liver infection. Clinical manifestations. Etiologic agents. Laboratory diagnosis. Treatment and prevention.

Topic 15. Infections of the nervous system.

The nervous system, structure and function. Factors that predispose to the infection. Clinical manifestations. Etiologic agents of meningitis and encephalitis: *Neisseria meningitidis*, *Listeria monocytogenes*, enterovirus. Prions encephalopathies. Laboratory diagnosis. Treatment and prevention.

Topic 16. Infections of the circulatory system

Bacteremia, fungemia, viremia and parasitemia. Primary bacteremia. Secondary bacteremia. Sepsis and septic shock. Hemoculture. Causal agents of bacteremia. *Brucella*, *Francisella tularensis* and *Yersinia pestis*.

CONTENT SEMINARS

Preparation and presentation by students of current affairs in the field of microbiology.

LABORATORY PRACTICAL CONTENTS

Practice 1. Methods for determining microbial concentration.

Microorganism count: count of viable and direct or total count (Breed).

Design of dilution banks and culture on plates.

Practice 2. Observation of microorganisms.

Observation of microorganisms in vivo with optical microscopy. Motility: pending drop technique. Prokaryotic staining techniques: Simple and differential stains.

Practice 3. Isolation and identification of microorganisms.

Methods for the isolation of microorganisms. Selective and differential culture media. Obtention of isolated colonies on plate culture media. Biochemical tests to characterize and identify microorganisms.

Practice 4. Clinical Microbiology. Antibigram.

Sensitivity of microorganisms to antibiotics. Technique of diffusion in plate.

Practice 5. Ubiquity.

Observation of the presence of microorganisms in different environments.

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

Methodology

Theoretical classes The student must acquire the scientific-technical knowledge of this subject attending these classes and complementing them with the personal study of the topics explained. The teaching of each subject will be based on a theoretical exposition and in a brief discussion of the same.

Seminars. In the seminars, students will develop topical issues in the world of microbiology in working groups. They will give a written summary and an oral presentation. Attendance at the seminars is mandatory.

Practical classes of laboratory. The objectives of these activities are: a) facilitate the understanding of the knowledge exposed in the theoretical classes, b) acquire manual dexterity, c) know how to interpret results and d) acquire the ability to work with microorganisms.

Attendance at the practical classes is mandatory in order to be able to acquire the competences of the subject. To be able to attend it, it is necessary for the student to justify having passed the security tests that will be found in the Virtual Campus. In addition, you must comply with the regulations of work in a microbiology laboratory that you will find indicated in the Manual. In order to achieve a good performance and acquire the competencies corresponding to this activity, it is essential that the student make a comprehensive reading of the proposed practices before their completion.

Tutorials. The students will be able to conduct individual tutorials with the teachers of the subject whenever they want to request an appointment.

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Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	12	0.48	2, 6, 15, 11
Seminars	7	0.28	2, 6, 15, 11
Theoretical classes	30	1.2	6, 7, 8, 16, 15, 11, 12, 4

Type: Supervised

Individual tutorials	4	0.16	16, 3
Type: Autonomous			
Preparation of seminars	12	0.48	16, 15, 3
Study	67	2.68	16, 3
self-learning	10	0.4	16, 3

Assessment

EVALUATION ACTIVITIES PROGRAMMING

1) Theoretical classes. The evaluation of the theoretical contents of the subject corresponding to the knowledge acquired in the theoretical classes, will be carried out by means of the accomplishment of two written tests. Each of these written tests will have a maximum score of 3 points. To pass this part of the subject, the sum of the marks obtained in the two written tests must be equal to or greater than 3 points.

2) Practical classes. Attendance at all practice sessions is mandatory. The evaluation of the practical classes of laboratory will be carried out by means of a written test that will have a maximum score of 2 points. To pass this part of the subject, the minimum mark of the written test must be 1 point and it must have attended all the practical sessions and have performed the programmed experiments in each of them correctly.

3) Seminars. Attendance at all seminar sessions is mandatory. The oral presentation of a current topic in the field of microbiology, its discussion and the realization of a summary on the topic will be evaluated. The maximum score will be 2 points and to pass this part of the subject, the minimum score obtained must be 1 point.

To pass the subject, a minimum score of 5 points must be obtained: a minimum score of 3 points in the evaluation of the theoretical contents, a minimum score of 1 point in the evaluation of practical contents and a minimum score of 1 point in seminars.

Students who do not obtain a minimum score of 3 points in the theoretical part, will be able to do a recovery exam that will include the whole theoretical part, that is to say, all the theoretical content evaluated in the two partial tests. The maximum score that can be obtained in this recovery test will be 3 points.

Students who do not obtain a minimum mark of 1 point in the practical part, may take a recovery exam that will include the whole practical part. The maximum score that can be obtained in this exam of recovery of the practical part will be 1 point.

Students who do not obtain a minimum mark of 1 point in the seminars, may take a recovery exam that will include the entire part of seminars. The maximum score that can be obtained in this examination of recovery from the seminars will be 1 point.

To participate in the recovery, the students must have previously been evaluated in a set of activities whose weight equals to a minimum of two thirds of the total grade of the subject or module. Therefore, students will obtain the "Non-Valuable" qualification when the assessment activities carried out have a weighting of less than 67% in 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
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Assessment of theoretical contents	30%	3	0.12	18, 5, 7, 8, 17, 16, 11, 4
Assessment of theoretical contents	30%	3	0.12	18, 5, 6, 17, 16, 12, 4
Evaluation of practical contents	20%	1	0.04	1, 2, 17, 13, 3, 4
Evaluation of seminars	20%	1	0.04	18, 5, 1, 9, 10, 17, 16, 15, 13, 14, 3, 4

Bibliography

RECOMMENDED BIBLIOGRAPHY

- Martín A., Béjar V., Gutierrez J.C., Llagostera M. y Quesada E. 2019. Microbiología Esencial. 1ª edición. Editorial Médica Panamericana.

-Madigan, Martinko, Bender, Buckley, Stahl.2015. Brock. Biología de los microorganismos. 14ª ed. Pearson education.

-Madigan, Martinko, Stahl, Clark. 2014. Brock Biology of Microorganisms 13ª ed. Pearson education.

Madigan, M., JM Martinko, PV Dunlap, DP Clark. 2009. Brock Biología de los Microorganismos. 12ª ed. Pearson education.

OTHER EXCELLENT CONSULTATION BOOKS

Wiley JM., LM Sherwood, ChJ Woolverton. 2013 Prescott's Microbiology.9ª ed.McGrawHill.

Wiley JM., LM Sherwood, ChJ Woolverton. 2008. Microbiología de Prescott, Harley y Klein. 7ª ed. McGrawHill.

Schaechter M., JL Ingraham, FC Neidhardt. 2008. Microorganismes. Traducció de la primera edició nord-americana. Editorial Reverté.

Tortora GJ., BR Funke, ChL Case. 2007. Introducción a la Microbiología. 9ª ed. Editorial Médica panamericana.

Blogs

Esos pequeños bichitos

<http://weblogs.madrimasd.org/microbiologia/>

Blog *Small things considered*

<http://schaechter.asmblog.org/schaechter/>

Webs

[http://www.springerlink.com/reference-works/?sortorder=asc&mode=boolean&k=ti:\(prokaryotes\)](http://www.springerlink.com/reference-works/?sortorder=asc&mode=boolean&k=ti:(prokaryotes))

<http://www.harrisonmedicina.com/>

<http://www.microbeworld.org/>

http://weblogs.madrimasd.

<http://microbewiki.kenyon.edu/index.php/MicrobeWiki>

<http://serc.carleton.edu/microbelife/>

<http://web.mst.edu/~microbio/Bio221.html>

<http://curiosidadesdelamicrobiologia.blogspot.com/>

<http://weblogs.madrimasd.org/microbiologia/>

<http://www.topix.com/science/microbiology>

<http://microbiologybytes.wordpress.com/>

<http://www.cellsalive.com/>

<http://commtechlab.msu.edu/sites/dlc-me/>

<http://commtechlab.msu.edu/sites/dlc-me/zoo/>

<http://www.microbiologia.com.ar/>