

Microbiology

Code: 100771
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	OB	2	2

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

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

- 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.
- Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
- Develop independent learning strategies.
- Identify and classify living organisms.
- 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. Apply the methodologies needed to characterise and identify microorganisms in pure cultures and in complex samples.
2. Be able to analyse and synthesise.
3. Be able to organise and plan.
4. Describe microbial growth and the physical and chemical processes used to control it.
5. Develop critical thinking and reasoning and communicate ideas effectively, both in the mother tongue and in other languages.
6. Develop independent learning strategies.
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. Recognise the diversity of the microbial world and identify the different groups it is composed of.
10. Relate the basic microbial components and structures to their functions.

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. Interactions of the microorganisms with the human species.

Beneficial interactions of microorganisms with humans. Interactions of pathogenic microorganisms with human beings: virulence factors. Host factor in the infection. Principles of epidemiology.

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: hanging 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.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Practical classes	12	0.48	1, 4, 5, 9
Seminars	7	0.28	1, 4, 5, 9
Theoretical classes	30	1.2	4, 6, 5, 7, 8, 9, 10, 3
Type: Supervised			
Individual tutorials	4	0.16	6, 2
Type: Autonomous			
Preparation of seminars	12	0.48	6, 5, 2

Study	67	2.68	6, 2
self-learning	10	0.4	6, 2

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.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of theoretical contents	30%	3	0.12	6, 7, 8, 9, 3
Assessment of theoretical contents	30%	3	0.12	4, 6, 10, 3
Evaluation of practical contents	20%	1	0.04	1, 2, 3
Evaluation of seminars	20%	1	0.04	6, 5, 2, 3

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

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

Willey 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.org/microbiologia/archive/2007/12/23/81281.aspx>><http://weblogs.madrimasd.org/microbiologia/>

<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/>