Microbiology

Code: 101025
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500502 Microbiology	OB	1

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

Although there are no official prerequisites, students are advised to review 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 Microbiology degree, as well as the rest of the subjects that are studied simultaneously during the second semester.

Objectives and Contextualisation

This is a mandatory core course in the Microbiology degree, which introduces students to the microbial world, providing a general overview of microorganisms, in connection with other living beings and the different environments in which they live.

Given its introductory nature, this course provides the most basic concepts and competencies related to Microbiology, so that students can delve deeper into subsequent courses in the rest of the subjects that form the core of the Microbiology degree.

Course objectives:

- Recognize, in broad terms, microbial diversity and distinguish the characteristics that define different microbial groups.
- Identify the different structures, as well as the composition of the prokaryotic cell.

- Describe the metabolic versatility of different microbial groups, particularly that of prokaryotes.
- Analyze the genomic variability of microorganisms and the main mechanisms of genetic information exchange in prokaryotes.
- Distinguish the main relationships of microorganisms with living beings and the physical environment they inhabit.
- Recognize the role of microorganisms in the development of human societies, as well as their future applications.
- Calculate basic microbiological parameters.
- Apply basic laboratory techniques to work experimentally with microorganisms.

Learning Outcomes

1. CM09 (Competence) Critically review the scientific contributions of women to the study of microorganisms and other sciences related to microbiology.
2. CM10 (Competence) Integrate knowledge and skills from the field of microbiology, working individually and in groups to prepare and present in writing or orally and publicly a scientific work either in English or in one's own language.
3. KM14 (Knowledge) Indicate the structural characteristics of microorganisms, paying special attention to the differences between acellular entities, prokaryotic organisms and single-cell eukaryotes.
4. KM15 (Knowledge) Describe the metabolic and functional diversity of the microbial world, distinguishing the characteristics that define the different taxonomic groups.
5. KM16 (Knowledge) Identify the main relationships established by microorganisms with each other, with other living beings, with their environment and in general with the ecosystem, and the methods for studying these interactions.
6. SM12 (Skill) Apply basic microbiological techniques in the laboratory, including the manipulation of materials and samples under aseptic conditions.
7. SM13 (Skill) Relate the basic genetic components, structures and processes of replicative microorganisms and entities with their functions and the different ecophysiological mechanisms of adaptation to their environment.
8. SM14 (Skill) Discover the role of microorganisms as causative agents of diseases in humans, animals and plants and the processes used to control them.

Content

THEORETICAL CONTENT

Unit 1. The microbial world. History and human societies and microorganisms. Discovering microorganisms. Levels of organization. Main differences between viruses and cellular organisms. Prokaryotic and eukaryotic organization. Groups and names of microorganisms.

Unit 2. Morphology, structure and chemical composition of viruses. Concept of virus. Morphology of viral particles: icosahedral, helical and complex symmetries. Structure of the viral envelope. The viral genome. Enzymes.

Unit 3. Virus-host cell relationships. Viral cycle: one-step growth. Adsorption and penetration. Genome replication. Assembly and release of the virions. Possible effects of viral multiplication on the host.

Unit 4. Diversity of viruses. Criteria for Classification of Viruses (ICVT). Nomenclature. Classification of Baltimore. Prokaryotic and eukaryotic viruses. Other subcellular infectious agents.

Unit 5. The prokaryotic cell. Size and morphology. Cytoplasm and cytoskeleton. Nuclear region. Organelles, microcompartments and inclusions

Unit 6. Cellular envelopes. Prokaryotic cytoplasmic membrane. Bacterial cell wall. S. layers. Capsules and mucous layers. Cell wall of archaea.

Unit 7. Appendixs and mobility. Forms of differentiation. Prokaryotic fimbriae and flagella. Mobility by fimbriae and flagella. Chemotaxis. Endospores, filaments and mycelium. Spores and cysts. Fruitful bodies

Unit 8. The genome of prokaryotes. Size, topology and number of chromosomes. Genomic reduction. Mobile genetic elements: plasmids, transposons, prophages, elements integrative and conjugative, chromosomal islands. Integrons: Capture of genes

Unit 9. Genetic variability in prokaryotes. Mutagenesis and vertical gene transfer. Horizontal gene transfer mechanisms.

Unit 10. Concept of species, pangenome and metagenome. Reflection on the concept of species. Exceptions. Pangenome. Concepts of metagenomics, microbiota and microbiome.

Unit 11. The cell cycle of prokaryotes. Binary division. Cell division and control. Diversity of the prokaryotic cell cycle.

Unit 12. Microbial growth and continue culture of microorganisms. Population growth. Basic concepts of continue culture. Environmental factors affecting microbial growth.

Unit 13. Control of microbial growth by physical, mechanical and chemical agents. Kinetics of death. Mechanical procedures, Physical agents. Antimicrobial agents. Differences between antiseptics, disinfectants and chemotherapeutic agents. Examples. Antimicrobial resistance.

Unit 14. Metabolism: global scheme. Sources of energy, carbon and reducing power. Metabolic classes. Processes to obtain energy. Biosynthetic strategy. Nitrogen fixation.

Unit 15. Phototrophy. Anoxigenic and oxygenic photosynthesis. Pigments and organization of thephototrophic apparatus. Cyclic photophosphorylation. External donors of electrons. Inverse flow of electrons.

Unit 16. Chemolitotrophy and Chemoorganotrophy. Inverse flow of electrons. Examples of chemolithotrophs. Organic substrats as energy donors.

Unit 17. Respiration. Respiratory chains. Aerobic respiration. Inorganic and organic compounds as final acceptors of electrons. Respiration of both facultative and obligate anaerobic prokaryotes.

Unit 18. Fermentation. General characteristics of a fermentation process. Classification of fermentations. Examples.

Unit 19. Diversity of prokaryotes. The origin of life and biological diversification. Microbial systematics: taxonomy and phylogeny. Taxonomic ranges. Phylogenetic trees. Bibliograpic references of prokaryotic systematics.

Unit 20. The archaea. Differential characteristics. *Phylum Euryarchaeota*: methanogens, extreme halophiles and hyperthermophiles. *Phylum Crenarchaeota*: hyperthermophiles and others.

Unit 21. Gram negative bacteria I. *Phylum Proteobacteria*. Differential features and examples.

Unit 22. Gram negative bacteria II. Other *phyla* of Gram negative bacteria. Differential features and examples.

Unit 23. Gram-positive bacteria and mycoplasmas. *Firmicutes*, *Tenericutes* and *Actinobacteria*.

Unit 24. Microorganisms in their environment. Concept of microenvironment. Aerial, terrestrial and aquatic environments. Trophic relationships in microorganisms.

Unit 25. Biogeochemical cycles. Microorganisms as agents of geochemical change. Example: The nitrogen cycle.

METHODOLOGY, PROBLEMS AND CURRENT TOPICS CONTENT

Session 1. Microscopic technique.

Session 2. Planting and isolation technique.

Session 3. Microscopic observations.

Sessions 4 and 5. Problems on basic Microbiology.

Session 6 and 7. Problems on microbial growth and control.

Session 8. Current topics in Microbiology

LABORATORY PRACTICES CONTENT

Practice 1. Preparation of culture media, reagents and material for Microbiology.

Practice 2. Aseptic technique and methods of culture.

Practice 3. Methods for determining microbial concentration.

Practice 4. Isolation of microorganisms.

Practice 5. Microscopic technique.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory practices	15	0.6	CM10, SM12
Lectures	30	1.2	CM09, CM10, KM14, KM15, KM16, SM13, SM14
Seminars and problems classes	8	0.32	CM09, CM10, KM15, SM13, SM14
Type: Supervised			
tutorials	4	0.16	CM09, CM10, KM14, KM15, KM16, SM12, SM13, SM14
Type: Autonomous			
Individual reading	17	0.68	CM09, KM14, KM16, SM13, SM14
Individual study	50	2	CM09, CM10, KM16, SM13, SM14
Problems resolution	20	0.8	CM10, KM15, SM13

TEACHING METHODOLOGY AND TRAINING ACTIVITIES

The subject of Microbiology consists of three modules of supervised activities, which have been programmed in an integrated way so that the student must relate throughout the course the content and activities programmed to reach the skills indicated in this guide.

The three modules are as follows:

Participatory theoretical lectures: The student must acquire the scientific-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, the student will be given a schedule of the topics to be discussed throughout the course, as well as the bibliography that should be consulted to prepare each theoretical class and for the personal study of the theoretical contents of the subject. The teaching of each subject will be based on a theoretical exposition.

Classes on methodology, problems and current topics: These classes are sessions with a reduced number of students with the aim of: a) working methodological aspects and current topics, b) facilitating the understanding of the knowledge presented in the theoretical lectures and c) bridging the theoretical lectures and practical laboratory work, with the objective of integrating theoretical and practical knowledge.At the beginning of the course the student will receive a schedule of the contents of each session, which will indicate the bibliography to be consulted and the relationship of each session with the topics covered in the theoretical lectures and in the laboratory practices. A dossier will also be given with a proposal of problems that must be developed during the course. The sessions will be held in the classroom, where different methodological issues and basic microbiology problems will be discussed. Each student will explain the steps he has followed to solve the problems.

Practical laboratory classes: At the beginning of the course the student will receive a Handbook with the practical work to be developed during the course. The objectives of these activities are: a) to facilitate the understanding of the knowledge presented in the theoretical lectures, b) to practice the experimental designs developed in the problem sessions, c) to acquire manual skills, d) to interpret the results, and e) to integrate theoretical and practical knowledge. The attendance to the practical classes is mandatory in order to acquire the competences of the subject. For attending the laboratory classes it is necessary the student to pass the biosafety and safety tests that will be find in the Moodle space and to know and accept the working rules of the laboratories of the Faculty of Biosciences. In addition, he must comply with the regulations of work in a laboratory of Microbiology that he will find indicated in the Handbook. In order to achieve a good performance and to acquire the competences corresponding to this activity it is essential that the student makes a comprehensive reading of the practices proposed before their completion.

As supervised activities of the subject, the students will be able to carry out tutorials in the teachers' office and / or through TICs. At the beginning of the course the procedure for conducting tutorials will be communicated.

The autonomous activities of this subject are: study, reading of texts and resolution of problems.

Additional information: For a good follow-up of the subject, the student will have in the Moodle space all the documentation indicated in the previous points.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Assessment of laboratory practices	20%	1	0.04	SM12
Evaluation of the methodology sessions, problems and current topics	20%	1	0.04	CM10, KM14, KM15, KM16, SM13, SM14
Theory Assessment II	36%	2	0.08	CM09, CM10, KM14, KM15, KM16, SM13, SM14

Theory assessment I	24%	2	0.08	CM09, CM10, KM14, KM15, KM16, SM13, SM14

The assessment of the subject will be individual and continuous or single through the following tests:

Continuous evaluation

The module of evaluation of theoretical classes (60% of the overall mark). During the course two written tests of this module will be programmed, which are cumulative; i.e. the second test will include all the theoretical contents of the subject.

- The first test will have a weight of 24% and the second one of 36%.

- If the student does the two tests and obtains in the second one higher mark than in the first one (provided that it is higher than 4.0), the final mark of this module will be that of the second test.

- Each test will include one or two short answer questions (with a maximum of 2 points out of 10) and a maximum of 60 multiple choice and/or true/false test questions (with a maximum value of 9 out of 10).

The module of evaluation of the classes on methodology and problems (20% of the overall mark). The evaluation of this activity will consist of the following tests:

A) Resolution of problems in the classroom

B) A written test at the end of the course that will consist of the resolution of a maximum of six problems and some test questions.

- These tests will have a weight of 3 and 7 points, out of 10, respectively. To pass this module you must obtain at least a 5 in the written test.

The module of assessment of the practical laboratory classes (20% of the overall mark). The evaluation of this activity will consist of two tests:

A) Practical skill, which will consist of the delivery of different practical results to the teacher during each laboratory session

B) Written test at the end of the practical laboratory classes consisting of a maximum of 20 test questions about the work done in the laboratory.

- These tests will have a weight of 4 and 6 points, out of 10, respectively. To pass this module the student must obtain at least 5 points in the written test.

To pass the subject the student must obtain a grade of 5 or higher in each module. Students who do not pass any of the written tests of the practical and methodology and problems modules will be able to retake them on the scheduled date for the assessment of the subject at the end of the semester. The re-assessment of the theory module will be done in a single written global test. Also on this same date, students wishing to improve their marks may present to an overall examination of the subject, which will include questions from all three modules. In this case, the presentation of the student in the re-assessment examination involves the renunciation of the qualification previously obtained.

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 weighting of all conducted evaluation activities is less than 67% of the final score.

Single assessment

The single evaluation consists of a single synthesis test in which the contents of the entire program of the subject will be evaluated. This will consist of three parts:

• Evaluation of the theory module: It will consist of a summary test of all the contents of the theory module. The test will consist of short-answer questions aimed at assessing whether the key conceptual objectives of the subject have been achieved and multiple-choice and/or true/false multiple-choice questions, which will allow a large part of the content to be assessed. The grade obtained in this test will account for 60% of the final grade for the subject.
• Evaluation of the problems and techniques module: This will be a written test with questions associated with methodological aspects and problem-solving. The grade obtained in this part will be 20% of the final grade.

• Evaluation of the practical module: based on a written test on the activities carried out during the practical sessions, which will correspond to 12% of the final grade and on the practical ability of the student, which will be 8% of the final grade. This last part will be assessed by delivering different practical results to the teaching staff during each laboratory session, so attendance is mandatory in all practical sessions.

All the written tests will take place on the same day, which will coincide in date and time with the 2nd written test established for continuous assessment.
To pass the subject, it will be necessary to pass each of the parts of the test separately with a score equal to or greater than 5 out of 10. In case of not passing the subject, the student will be able to opt for a recovery evaluation, with the same characteristics as the one described and where it will be necessary to obtain a grade equal to or greater than 5 in the parts that had not been achieved on the first attempt to pass the subject.

Bibliography

Books

Madigan, M.T., J.M. Martinko, K.S. Bender, D.H. Buckely, D.A. Stahl. 2015. Brock Biología de los Microorganismos. 14ª ed. Pearson Educación, S.A. ISBN:9788490352793. Recurso electrónico.

Madigan, M.T., K.S. Bender, D.H. Buckely, W.M. Sattley, D.A. Stahl. 2022. Brock Biology of microorganisms. 16ª ed. Pearson, S.A. ISBN-13: 978-1292404790.

Martín A., V. Béjar, J.C.Gutierrez, M. Llagostera y E. Quesada. 2019. Microbiología Esencial. 1ª edición. Editorial Médica Panamericana. ISBN: 9788498357868. Recurso electrónico.

Willey J., K.M. Sandman, D.H Wood. 2020. Prescott's Microbiology, 11th ed. McGraw-Hill Education. ISBN-13: 978-1260211887.

Library website: https://www.uab.cat/biblioteques/?suite=def

Blogs

MicroBio (https://microbioun.blogspot.com/)

Microbichitos (http://blogs.elpais.com/microbichitos/)

Esos pequeños bichitos (http://weblogs.madrimasd.org/microbiologia/)

Small Things Considered (http://schaechter.asmblog.org/schaechter/)

Curiosidades de la Microbiología (http://curiosidadesdelamicrobiologia.blogspot.com/)

El Rincón de Pasteur de Investigación y Ciencia(https://www.investigacionyciencia.es/blogs/medicina-y-biologia/43/posts)

Software

Specific programmes are not needed

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	711	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	712	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	711	Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	712	Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	713	Spanish	second semester	morning-mixed
(TE) Theory	71	Catalan	second semester	morning-mixed