Microbiology

Code: 100953
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biotechnology	OB	2

Contact

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Teaching groups languages

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

Prerequisites

There are no official prerequisites to follow the course successfully, but it is assumed that the student has previously acquired basic knowledge on contents and concepts that refer to the microbial world, starting the course having revised them will prove useful.

It is also advisable to have a good knowledge of the subjects studied during the first year of the degree of Biotechnology as well as the rest of the subjects to be studied simultaneously during the first semester.

Objectives and Contextualisation

Objectives and Contextualization:

- It is a compulsory subject of the degree of Biotechnology that introduces students to the microbial world, giving an overview of microorganisms in connection with other living beings and the different environments in which microorganisms live.
- This subject, given its introductory nature, gives the most basic concepts and competencies referred to Microbiology, so that students can deepen the following courses in the other subjects that are part of the core of Biotechnology.

In this context, the
educational objectives and
specific learning outcomes (RAs) of the course are:

1. Describe the world of microorganisms:

- Understand the history, organization and classification of microorganisms, as well as the main differences between viruses and cellular organisms (RA: KM16, SM17).

2. Understand the characteristics of viruses:

- Analyze the structure, replication and diversity of viruses (RA: KM16).

3. Analyze the composition and function of the different structures of prokaryotic cells:

- Identify the cellular parts and the mechanisms of motility, transport and differentiation (RA: SM17).

4. Understand the genomic variability of microorganisms and know bacterial genetics:

- Study the bacterial genome, the mechanisms of mutation and the main mechanisms of genetic transfer (RA: KM16).

5. Examine microbial growth and control:

- Assess the cell cycle, influencing environmental factors and control methods of microorganisms (RA: KM18).

6. Explore bacterial physiology and metabolic versatility:

- Understand metabolic and respiratory processes, fermentation, chemolithotrophy and phototrophy (RA: CM16, SM17).

7. Broadly recognize microbial diversity:

- Know how to distinguish the characteristics that define the different microbial groups (RA: SM17).
- Classify and describe the diversity of prokaryotes, archaea and gram-positive and gram-negative bacteria (RA: SM17).

8. Apply knowledge of microbiology:

- Recognize the main relationships ofmicroorganisms with living beings and with the physical environment they inhabit (RA: KM16, KM18, CM16, CM18).
- Know the role of microorganisms in the development of human societies, as well as their current and future applications (RA: KM16, KM18, CM16, CM18).
- Analyze the use of microorganisms in the food, health and biotechnology industry, taking into account the environmental impact and inequalities due to sex/gender (RA: KM16, KM18, CM16, CM18).

9. Know how to perform basic calculations to determine microbiological parameters (RA: KM16, SM17).

10. Understand basic laboratory techniques to work experimentally with microorganisms (RA: KM16, SM17).

Learning Outcomes

1. CM16 (Competence) Compare microbial metabolic diversity and important processes for the manufacture and processing of foodstuffs.
2. CM18 (Competence) Judge sex/gender inequalities in the field of microbiology.
3. KM16 (Knowledge) Describe the genetic and metabolic potential of microorganisms in the generation of substances of industrial interest.
4. KM18 (Knowledge) Critically analyse the environmental impact of the use of microorganisms in biotechnological production.
5. SM16 (Skill) Apply the main techniques associated with the use of micro-organisms.
6. SM17 (Skill) Identify microbial groups and physiological processes responsible for transformation processes of industrial interest.

Content

I. Theory Contents

1. INTRODUCTION

- The world of microorganisms: The history and human societies and microorganisms. Discovering microorganisms. Levels of organization. Main differences between viruses and cellular microorganisms. Prokaryotic and eukaryotic organization. Groups and names of microorganisms.

2. VIRUSES

- Introductory overview and general characteristics of viruses: Concept of viruses. Structure of viruses. Viral replication. Principles of taxonomy and viral diversity.

3. STRUCTURE AND FUNCTION OF PROKARYOTES

- The prokaryotic cell: Size and morphology. The cytoplasm. The nuclear region. Cytoplasmic membrane. Transport and nutrient transport systems.

- Envelopes of the prokaryotic cell: Prokaryotic cytoplasmic membrane. Bacterial cell wall. Archaeal cell wall. S layers. Capsules and mucous layers.

- Appendages and main mechanisms of motility: Prokaryotic appendages and flagella. Motility by fimbriae and flagella. Chemotaxis.

- Intracellular inclusions and forms of differentiation: Functional and reserve inclusions. Endospores, filaments, and mycelia. Spores and cysts. Fruiting bodies.

4. BACTERIAL GENETICS

- The prokaryotic genome: Genome structure. Genetic information. Prokaryotic chromosome. DNA replication, DNA transcription, and mRNA translation. Extrachromosomal genetic material and mobile elements: plasmids, transposons, prophages, integrative and conjugative genes.

- Genetic variability in prokaryotes: Mutagenesis and vertical gene transfer: Spontaneous and induced mutations. Mutant selection and phenotypic expression. The significance of DNA repair mechanisms. Horizontal gene transfer mechanisms: Conjugation, transformation, and transduction.

- Species concept in prokaryotes, Pangenome, and Metagenome: Reflection on the species concept. The pangenome. Concepts of metagenomics, microbiota, and microbiome.

5. MICROBIAL GROWTH AND CONTROL

- The prokaryotic cell cycle: Binary fission. Cell division and control. Diversity of the prokaryotic cell cycle.

- Microbial growth and continuous culture of microorganisms: Population growth. Concepts of continuous culture of microorganisms.

- Influence of environmental factors on microbial growth: Influence of temperature, pH, osmotic effects, and oxygen concentration on microbial growth.

- Control of microbial growth by physical and chemical agents: Mechanical procedures, physical agents, and antimicrobial chemical agents. Differences between antiseptics, disinfectants, and chemotherapeutic agents. Examples. Antimicrobial resistance.

6. BACTERIAL PHYSIOLOGY AND METABOLISM

- Global metabolic scheme: Energy, carbon, and reducing power sources. Biosynthetic strategy. Chemotrophy and phototrophy. Autotrophy and heterotrophy. Types of microorganisms according to their nutrition. Energy production processes.

- Phototrophy: Anoxygenic and oxygenic photosynthesis. Pigments and organization of the phototrophic apparatus. Cyclic photophosphorylation. External electron donors. Reverse electron flow.

- Chemolithotrophy and chemoorganotrophy: Inorganic energy donors. Reverse electron flow. Examples of chemolithotrophic groups. Organic substrates as an energy source.

- Respiration: Respiratory chains. Aerobic respiration. Respiration of inorganic and organic compounds by facultative anaerobes. Respiration of obligate anaerobes.

- Fermentation: General characteristics of a fermentation process. Classification of fermentations. Examples.

7. MICROBIAL DIVERSITY

- Prokaryotic diversity: The origin of life and biological diversification. Microbial systematics: taxonomy and phylogeny. Taxonomic ranks. Phylogenetic trees. References in prokaryotic systematics.

- ***Archaea***: Differential characteristics. *Phylum Euryarchaeota*: Methanogens, extreme halophiles, and hyperthermophiles. *Phylum Crenarchaeota*: Hyperthermophiles and others.

- Gram-negative bacteria I: Taxonomic groups of *Proteobacteria*. Differential characteristics and examples.

- Gram-negative bacteria II: Taxonomic groups of non-Proteobacteria. Differential characteristics and examples.

- Gram-positive bacteria and mycoplasmas: *Phyla Firmicutes*, *Tenericutes*, and *Actinobacteria*.

8. APPLIED MICROBIOLOGY

- Microbiology for the food industry: Growth of microorganisms in food. Food spoilage. Control of spoilage in food. Foodborne illnesses. Detection of foodborne pathogens.

- Microbiology for the healthcare industry: Industrial microorganisms and their products. Primary and secondary metabolites. Production of vitamins, amino acids, and antibiotics. Microbial biotransformations. Enzymes

- Biotechnology: Basic principles of biotechnology. Products of genetic engineering. Expression of cloned genes. Protein production in bacteria. Protein production in yeast. Obtaining vaccines through genetic engineering. Microbial biopolymers. Gene therapy in humans. Transgenic organisms.

II. Problem content

- Microscopic technique: Light and electron microscopy applied to microorganisms. Examination of microorganisms in vivo. Fixation and staining. Simple, differential, and specific stains.

- Seeding and isolation techniques: Nutritional requirements of microorganisms. Composition of culture media. Types of culture media. Isolation of microorganisms. Seeding methods. Methods for identifying microorganisms.

- Problems on basic microbiology: Experimental design. Calculation of concentrations. Concepts of viable and total counts. Concept of viable but non-culturable microorganisms.

- Problems on microbial growth and control: Experimental design. Population growth curve. Calculation of parameters. Survival curves for different treatments.

- Problems on basic virology: Virus counting. Virulent bacteriophages and attenuated bacteriophages.

- Presentation, assessment, resolution, individual and/or group critical discussion, and presentation of proposed problems.

- Introduction to active learning activities, definition of key ideas, assessment, presentation, and presentation of group presentations of the proposed activity(ies).

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Active learning activities and scientific problems seminars	15	0.6	CM16, CM18, KM16, KM18, SM16, SM17, CM16
Lectures	30	1.2	CM16, CM18, KM16, KM18, SM16, SM17, CM16
Type: Supervised			
Personal tutorial duidance sessions	3	0.12	CM16, CM18, KM16, KM18, SM16, SM17,

			CM16
Type: Autonomous			
Literature search, text reading	24	0.96	CM16, CM18, KM16, KM18, SM16, SM17, CM16
Personal study	50	2	CM16, CM18, KM16, KM18, SM16, SM17, CM16
Scientific problem resolution	20	0.8	CM16, CM18, KM16, KM18, SM16, SM17, CM16

The subject of Microbiology consists of three modules, which have been programmed in an integrated way to reach the competencies indicated in section 5 of this guide.

The modules are as follows:

1. Participatory classroom lectures: Lectures will address the main ideas of the different topics. Students should expand and confront autonomously as a personal work. At the beginning of the course the content of the different topics will be explained by the professor, as well as the bibliography that should be consulted to prepare each theory lecture and for personal study of the topics explained. Each topic taught will be based on a theoretical presentation and a brief discussion. Some topics can be prepared by students, guided or autonomously, and then discussed in the lecture sessions through questions (flipped classroom).

2. Scientific problem seminars: These seminars are sessions with the mission of: a) working methodological aspects, b) training the student to design basic microbiology experiments and to propose experimental approaches, c) designing strategies for solving and interpreting scientific problems, d) acquiring the skills necessary to perform literature research, text reading and oral presentations, e) to facilitate the understanding of the knowledge presented in the theory lectures and f) to bridge the gap between theory lectures and laboratory practices, with the objective of integrating the theoretical and the practical knowledge. The student will receive proposals for problems and/or scientific cases that will be developed during the course in class both individually and in a group.

3. Active learning activities: These activities are sessions with the mission of: a) facilitating the understanding of the knowledge presented in the theory lectures, b) acquiring the necessary skills to perform literature research, text reading and active self-study learning and c) encourage cooperative teamwork, coordination of activities and rational presentation of work plans and results. The student will perform oral, written and/or visual presentation of an issue, activity, gamification or scientific case. The professor will indicate the bibliography to be consulted and the relationship of each session with the topics discussed in the theory lectures.

Additional Information

In those sessions, students will have the opportunity to have individual guidance according to their needs. To follow adequately the course, the student will have access to all the materials used in the Campus Virtual.

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: personal study, literature searching, reading of texts, preparation of different types of academic work/activities and resolution of problems.

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
Evaluation public oral presentations of reports	20 %	2	0.08	CM16, CM18, KM16, KM18, SM16, SM17
Evaluation scientific problems and seminars	20%	2	0.08	CM16, CM18, KM16, KM18, SM16, SM17
Evaluation theory I	30 %	2	0.08	CM16, CM18, KM16, KM18, SM16, SM17
Evaluation theory II	30%	2	0.08	CM16, CM18, KM16, KM18, SM16, SM17

The evaluation of the course will be done individual and continued or single through the following tests:

I. Continuous evaluation

1. Evaluation of classroom lectures competencies

During the course two midterm exams, to evaluate the theory contents, will be scheduled. Each midterm exam to evaluate the theory contents will have a weight of 30% of the overall grade. The final mark of this evaluation form will be average of the two midterm exams. To pass this part of the subject, the notes obtained in each written tests must be equal to or greater than 5 points. If the average of the midterm exams is equal to or greater than 5 students will not have to do the final exam (or Remedial exam) of the subject. In the case of obtaining a lower mark of 5 in one or both midterm exams, students will be presented at the Final exam (or Remedial exam) on the date scheduled for the final evaluation of the course.

2. Evaluation of scientific problem and seminars

The evaluation of this activity will be done separately from evaluation of classroom lectures competencies considering the attendance at the seminars, the resolution of problems and practical cases or activities and the realization of a written exam at the end of the course. All of that will have a weight of 20% of the overall grade. Students who fail the evaluation of scientific problems and seminars can retrieve it on the date scheduled for the final exam of the course.

3. Evaluation of active learning activities

This activity is assessedseparately from evaluation of classroom lectures competencies and seminars and scientific problems evaluation considering oral presentations of the proposed activities and will have a weight of 20% of the final mark. Students will present the reports of the assigned active learning activitiesinclassroom sessions. Oral presentations will be evaluated oncontent, organization and communicative skills. Students who fail the evaluation of the group activities can retrieve the active learning activities onthe date scheduled for the final exam of the course.

To pass the course, students must obtain a mark of 5 or greater than 5 in each module.

Students who do not pass any of the written and/or oral tests may retrieve them at the scheduled date at the end of the semester. Likewise, on the same date, students who have passed the subject and want to improve their mark may submit to a global examination of the subject, which will include questions from the three evaluation modules. The presentation of the student to the examination of improvement of note implies the renunciation of the qualification obtained previously.

General questions:

- To participate in the recovery of the different assessment activities, students must have previously been assessed in a set of activities whose weight is equivalent to a minimum of two thirds of the total grade of the subject or module.

- Therefore, students will obtain the grade of "Not Assessable" when the assessment activities carried out have a weighting of less than 67% in the final grade.

- From the second registration for the subject, the student will not need to complete modules 2 and 3 if they achieved the competencies of this part of the subject in the previous year. This exemption will be maintained for a period of three additional registrations.

- Use of Artificial Intelligence (AI) technologies:

- For this subject, the use of AI is allowed exclusively in support tasks, such as bibliographic or information searches, text correction or translations, or others at the discretion of the teacher.
- The student must clearly identify which parts have been generated with this technology, specify the tools used and include a critical reflection on how these have influenced the process and the final result of the activity.
- The lack of transparency in the use of AI in this assessable activity will be considered a lack of academic honesty and may lead to a partial or total penalty in the grade of the activity, or greater sanctions in serious cases.

II. Unique assessment

The unique assessment 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:

1. Evaluation of the theory module: It will consist of a summary test of all the contents of the theory module. The grade obtained in this test will account for 60% of the final grade for the subject.

2. Evaluation of the problems and techniques module:The same avaluation system will be applied as for the continuous assessment. Attendance at the seminars is mandatory. To pass the seminar part, a grade equal to or higher than 5 must be obtained, the grade obtainedin this part will be 20% of the final grade.

3. Evaluation of the active learning module: This last part will be assessed by delivering a report of the assigned active learning activities similar of those done in classroom sessions. The grade obtained in this part will be 20% of the final grade.

The grade obtained in this synthesis test is 100% of the final grade of the subject.

The single assessment test will coincide with the same date fixed in the calendar for the last continuous assessment test and the same recovery system will be applied as for the 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 firstattempt to pass the subject. The review of the final grade follows the same procedure as for continuous assessment.

Bibliography

Textbooks

- Martín A., Béjar V., Gutierrez J.C., Llagostera M. y Quesada E. 2019. Microbiología Esencial. 1ª edición. Editorial Médica Panamericana. ISBN: 9788491102427 (en línia)

https://bibcercador.uab.cat/permalink/34CSUC_UAB/1eqfv2p/alma991009862179706709

- Madigan, M, JM Martinko, K. Bender, D. Buckely, DA Stahl. 2015. Brock Biología de los Microorganismos. 14ª ed. Pearson. ISBN: 9788490352793 [Recurs electrònic]

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- Madigan, M, JM Martinko, K. Bender, D. Buckely, DA Stahl. 2022. Brock Biology of Microorganisms. 16 ed. Pearson. ISBN: 9781292412368

https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjcib/alma991010692017906709

- Willey,J, LM Sherwood, CJ Woolverton. 2013. Prescott, Harley y Klein microbiología. 7ª ed. McGraw-Hil. ISBN: 978844819120

- Willey,J, LM Sherwood, CJ Woolverton. 2020. *Prescott's microbiology. 11th ed.* Mcgraw-Hill. ISBN : 1-260-59755-5 (en línia)

https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjcib/alma991010721335606709

- Glazer, AN, H Nikaido. 2007. Microbial Biotechnology: Fundamentals of Applied Microbiology. 2ond edition. Cambridge University Press. ISBN: 9780521842105 (cart.)

- Lee Yuan Kun. 2006. Microbial Biotechnology: Principles and Applications. 2ond edition.New Jersey. World Scientific. ISBN: 9789814366816 (cart.)

Recommended readings

De Kruif, P. 1926. Los cazadores de microbios. Ediciones Nueva Fénix. ISBN: 9789700768045

Recommended blogs

- Curiosidades de la Microbiología

http://curiosidadesdelamicrobiologia.blogspot.com/

- Microbichitos

https://www.madrimasd.org/blogs/microbiologia/

- Microbio

https://microbioblog.es/

Recommended websites

- Centros para el Control y la Prevención de Enfermedades

https://www.cdc.gov/spanish/index.html

- hhmi BioInteractive

https://www.biointeractive.org/

- Microbial Society

https://microbiologysociety.org/

- Small things considered

http://schaechter.asmblog.org/schaechter/

- Sociedad Española de Microbiología (SEM)

https://www.semicrobiologia.org/

- Sociedad Española de Enfermedades Infecciosas y Microbiología Clínica

https://seimc.org/

Software

To follow adequately the course, the student will have access to all the materials used in the Campus Virtual.

There is no specific software.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	421	Catalan	first semester	afternoon
(PAUL) Classroom practices	422	Catalan	first semester	afternoon
(TE) Theory	42	Catalan	first semester	afternoon