Universitat Autònoma de Barcelona

Microbiology

2026/2027

Code: 100953
Credits: 6

Degree programme	Type	Course
Biotechnology	OB	2

Contact lecturer

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Group languages

You can consult this information at the end of the 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 Biotechnology degree, as well as the rest of the subjects to be studied simultaneously during the first semester.

Objectives

Course Contextualization:

- Microbiology is a compulsory subject in the Degree in Biotechnology that introduces students to the microbial world, offering a general and functional overview of microorganisms, their organisation, diversity, metabolism, genetics, growth and applications, as well as their connection with other living beings and with the different environments in which microorganisms live.
- The course is organised into five connected Learning Sections (S) that structure the contents, while also strengthening the connection with subsequent subjects in the degree, such as Molecular Microbiology, Virology and laboratory practicals, as well as with the biotechnological applications of microorganisms.

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

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

Contents

The course is organised into five connected Learning Sections (S), which include the core contents both at theoretical level and in seminars and problem-solving sessions, as follows:

S1 - The invisible world that moves the visible one

Introduction, the meaning of microbiology, and virus/cell distinction: The world of microorganisms; history and human societies; levels of organisation; differences between viruses and cellular microorganisms; prokaryotic and eukaryotic organisation; naming and degree context. General introduction to viruses and their role within microbiology.

Microscopy techniques: Light and electron microscopy applied to microorganisms. Examination of microorganisms *in vivo*. Fixation and staining. Simple, differential and specific staining techniques.

S2 - Architectures for survival

Structure and function of the prokaryotic cell: Prokaryotic size and morphology; cytoplasm and nuclear region; cytoplasmic membrane and transport; bacterial and archaeal cell walls; capsules, slime layers and S-layers; fimbriae, flagella and chemotaxis; intracellular inclusions, endospores and other forms of differentiation.

Seeding, isolation and inference techniques: Nutritional requirements of microorganisms; composition of culture media; types of culture media; isolation of microorganisms; seeding methods; methods for microorganism identification.

S3 - Genomes in motion

Bacterial genetics, mutation, mobile elements and horizontal gene transfer: Structure of the prokaryotic genome; chromosome, plasmids, transposons, prophages and other mobile elements; DNA replication, mutation and repair; mutant selection and phenotypic expression; horizontal transfer by conjugation, transformation and transduction; prokaryotic species concept, pangenome, metagenome, microbiota and microbiome.

Basic applied cases and problems in bacterial genetics: mutation/selection, plasmids, mobile elements, antimicrobial resistance and horizontal gene transfer.

S4 - Populations under pressure

Microbial growth, environmental factors and control: Cell cycle and binary fission; population growth and continuous culture; growth parameters; total and viable microbial counts; influence of temperature, pH, osmolarity and oxygen; physical, chemical and mechanical control; sterilisation, disinfection, antisepsis, chemotherapeutic agents and antimicrobial resistance.

Counting techniques and microbiological decision-making: Experimental design; concentration calculations; concepts of viable and total counts; concept of viable but non-culturable microorganisms; growth and control problems; population growth curve; calculation of growth parameters; survival curves under different treatments.

S5 - Metabolisms and microorganisms that transform the planet

Metabolism, microbial diversity and biotechnological application: Global metabolic scheme; sources of energy, carbon and reducing power; chemotrophy, phototrophy, autotrophy and heterotrophy; aerobic and anaerobic respiration; fermentation; chemolithotrophy and phototrophy; microbial diversity, origin of life, taxonomy and phylogeny; archaea; Gram-negative bacteria, Gram-positive bacteria and mycoplasmas; relationship between metabolism, diversity and biotechnological application.

Active learning activities and the MicroBiTech Challenge: Introduction to active learning activities, definition of key ideas, presentation, assessment, resolution, individual and/or collective critical discussion, and presentation of proposed problems and group presentations of the proposed activity/activities.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Personal study	50	2	CM16, CM18, KM16, KM18, SM16, SM17

Active learning activities and scientific problems seminars	15	0.6	CM16, CM18, KM16, KM18, SM16, SM17
Personal tutorial duidance sessions	3	0.12	CM16, CM18, KM16, KM18, SM16, SM17
Scientific problem resolution	20	0.8	CM16, CM18, KM16, KM18, SM16, SM17
Literature search, text reading	24	0.96	CM16, CM18, KM16, KM18, SM16, SM17
Lectures	30	1.2	CM16, CM18, KM16, KM18, SM16, SM17

The five Learning Sections that structure the contents of Microbiology are developed through different types of teaching activities, programmed in an integrated way so that students must connect the contents and scheduled activities throughout the course in order to achieve the competences indicated in section 5 of this guide:

1. Participatory classroom lectures: Students are expected to acquire the scientific and technical knowledge specific to this course by attending these classes and complementing them with personal study of the topics covered. Each learning axis will be taught through lectures in which active student participation will be encouraged. Some topics may include self-learning activities, with selected contents prepared by students, either in a guided or autonomous way, and later discussed/presented in classroom sessions through questions, flipped-classroom activities, active learning and/or short formative assessments.
2. Seminars and problem-solving classes: These sessions are intended to work on methodological aspects, train students to design basic Microbiology experiments and propose experimental protocols, design strategies to solve and interpret problems, acquire the skills needed to carry out bibliographic searches, read scientific texts and publicly present work, facilitate the understanding of the knowledge presented in theory lectures, and bridge the gap between participatory theory lectures and practical laboratory work, with the aim of integrating theoretical and practical knowledge. Students will receive problem proposals and/or scientific cases associated with each learning axis, which they will develop individually or in groups throughout the course. Attendance at seminar sessions is mandatory. Instructions for each seminar will be published on the Virtual Campus at the beginning of each learning axis or thematic block.
3. Active learning activities: These activities are intended to facilitate the understanding of the knowledge presented in theory lectures, acquire the skills needed to carry out bibliographic searches, read texts and publicly present work, and promote cooperative group work. Students will be required to prepare an oral, written and/or visual presentation of a topic, activity, scientific case or gamified version of the proposed activity/activities. The bibliography to be consulted and the relationship between each session and the topics addressed in the participatory lectures will also be indicated.

The MicroBiTech Challenge is one of the group active-learning activities that integrates knowledge of prokaryotic structure and function, bacterial genetics, horizontal gene transfer, growth and control, metabolism, microbial diversity and biotechnological applications. The activity will include a gender perspective, recognition of the role of women scientists, sustainability, biosafety and critical use of recent scientific sources. The challenges proposed by the teaching staff will be considered an initial pool, but groups may propose current and motivating challenges, provided that they meet the established scientific and teaching criteria.

Additional information

- As supervised activities, individual and group tutorials may be carried out to support the training activities described above.
- The autonomous activities of this course are: personal study, information search, reading of texts, preparation of assignments/activities and problem solving.
- Note: within the schedule established by the centre/degree programme, 15 minutes of one class will be reserved for students to complete the surveys evaluating the teaching staff's performance and the course.

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

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Evaluation theory II	30 %	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 presentations of reports	20 %	2	0.08	CM16, CM18, KM16, KM18, SM16, SM17

The assessment of the course will be individual and continuous or single through the following assessment activities:

CONTINUOUS ASSESSMENT

I. Assessment module for theory classes

- Two written midterm exams will be scheduled throughout the course to assess the theory classes. Each theory midterm exam will account for 30% of the overall grade. The final mark for this module will be the average of the two exams. In order to pass each midterm exam, eliminate the corresponding part of the theoretical content and calculate the average, each of these written exams must be passed with a mark equal to or higher than 5. To pass this part of the course, both written exams must be passed with a mark equal to or higher than 5.
- Students who do not obtain a minimum mark of 5 in one or both written midterm exams will have to take the global theory exam, which includes all theoretical content, on the date scheduled for the final assessment of the course.

II. Assessment module for problem-solving classes

- This activity will be assessed separately, taking into account attendance at seminars, the resolution of problems and practical cases or activities, and the completion of a written test at the end of the course. Altogether, this will account for 20% of the final grade. Students who do not pass the problem-solving assessment test may recover it on the date scheduled for the final assessment of the course. Attendance at seminars is mandatory. To pass the seminar component, a mark equal to or higher than 5 must be obtained.

III. Classroom assessment module for group active learning activities

- This activity will be assessed separately, taking into account the oral classroom presentations of the work carried out for each of the proposed activities, and will account for 20% of the final grade. Oral presentations will be assessed in terms of both content and organisation and communication. Students who do not pass the group active learning activities assessment may recover it on the date scheduled for the final assessment of the course.

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

Students who do not pass any of the written and/or oral tests may recover them on the date scheduled at the end of the semester. Likewise, on this same date, students who have passed the course and wish to improve their grade may take a global exam for the course, which will include questions from the three modules. Taking the grade-improvement exam implies renouncing the grade previously obtained.

General issues

- To participate in the recovery assessment, students must have previously been assessed in a set of

activities whose weight is equivalent to at least two thirds of the total grade of the course or module.
- Therefore, students will receive a "Not assessable" grade when the assessment activities completed have a weighting of less than 67% of the final grade.
- From the second enrolment in the course onwards, students will not be required to complete modules 2 and 3 if they achieved the competences corresponding to this part of the course in the previous academic year. This exemption will be maintained for a period of three additional enrolments.

SINGLE ASSESSMENT

The single assessment consists of a single synthesis test in which the contents of the entire course programme will be assessed. It will consist of three parts:

1. Assessment of the theory module: this will consist of a synthesis test covering all the contents of the theory module. The mark obtained in this test will account for 60% of the final grade for the course.
2. Assessment of the problem-solving module: the same assessment system as for continuous assessment will be applied. Attendance at seminars is mandatory. To pass the seminar component, a mark equal to or higher than 5 must be obtained. The mark obtained in this part will account for 20% of the final grade.
3. Assessment of the active learning activities module: this will consist of the submission of an activity equivalent to those proposed in class. The mark obtained in this part will account for 20% of the final grade.

The mark obtained in this synthesis test constitutes 100% of the final grade for the course.

All written tests will take place on the same day, coinciding in date and time with the second written midterm exam established for continuous assessment. To pass the course, each part of the test must be passed separately with a mark equal to or higher than 5 out of 10. If the course is not passed, the student may opt for a recovery assessment with the same characteristics, and the same recovery system described for continuous assessment will be applied. To pass the course, it will be necessary to obtain a mark equal to or higher than 5 in the parts that were not passed on the first attempt. The review of the final grade will follow the same procedure as for continuous assessment.

Use of Artificial Intelligence

For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks, such as bibliographic or information searches, text correction or translation, or other uses at the discretion of the teaching staff. Students must clearly identify which parts have been generated using this technology, specify the tools used and include a critical reflection on how these tools have influenced the process and the final result of the activity. Lack of transparency in the use of AI in assessment activities and seminars will be considered a breach of academic honesty and may result in a partial or total penalty in the activity grade, or more serious sanctions in severe cases.

Grade in the event of irregularities in an assessment activity

Any irregularity in an assessment activity -academic fraud, plagiarism or misuse of AI, unless such use is expressly authorised in the teaching guide- that may lead to a significant variation in the grade will result in that assessment activity being graded as 0. If the teaching guide establishes that obtaining a minimum mark in that assessment activity is an essential requirement to pass the course, or if several irregularities occur in assessment activities within the same course, the final grade for the course will be 0. In addition, disciplinary proceedings may be initiated against the student who commits any of these irregularities.

Bibliography

Textbooks

- Glazer, Alexander N. & Nikaido, Hiroshi. (2007). Microbial biotechnology: fundamentals of applied microbiology. (2nd ed.) Cambridge University Press Disponible en línea.
- Glazer, Alexander N. & Nikaido, Hiroshi. (2007). Microbial biotechnology:fundamentals of applied microbiology. (2nd ed.) Cambridge University Press Disponible en papel en la biblioteca.

- Lee, Yuan-Kun. (2013). Microbial biotechnology: principles and applications. (3rd ed.) World Scientific Disponible en papel en la biblioteca.
- Madigan, Michael T. (2015). Brock: biología de los microorganismos. (14ª ed.) Pearson Educación Disponible en línea.
- Madigan, Michael T. [i altres]. (2022). Brock Biology of Microorganisms. (16th global ed.) Pearson Education Limited Disponible en línea.
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- Madigan, Michael T. [i altres]. (2015). Brock biología de los microorganismos. (14ª ed.) Pearson Educación Disponible en papel en la biblioteca.
- Quesada, Emilia [i altres]. (2019). Microbiología esencial. Editorial Médica Panamericana Disponible en línea.
- Willey, Joanne M. & Sandman, Kathleen M. (2021). Prescott's principles of microbiology. (2nd international student ed.) McGraw-Hill Education Disponible en línea.
- Willey, Joanne M. & Wood, Dorothy H. & Sandman, Kathleen M. (2023). Prescott's microbiology. (12th ed.) McGraw-Hill Education Disponible en papel en la biblioteca.
- Willey, Joanne M. & Woolverton, Christopher J. & Sherwood, Linda. (2009). Microbiología. (7ª ed.) McGraw-Hill Disponible en papel en la biblioteca.

Recommended readings

- De Kruif, Paul. (2021). Cazadores de microbios: los principales descubrimientos deL mundo microscópico. Capitán Swing Disponible en papel en la biblioteca.

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

There is no specific software.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	42	Catalan	first semester	afternoon
(PAUL) Classroom practices	421	Catalan	first semester	afternoon
(PAUL) Classroom practices	422	Catalan	first semester	afternoon