Microbiology

Code: 100875
ECTS Credits: 6

2025/2026

Degree	Type	Year
Biochemistry	OB	1

Contact

Name: Jose Luis Corchero Nieto

Email: joseluis.corchero@uab.cat

Teaching groups languages

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

Prerequisites

Although there is no official prerequisites, students are advised and encouraged to review the scientific-theoretical contents related to the concepts of the microbial world, studied beforehand and on which this subject is based.

It is convenient to have a good knowledge of the subjects already studied during the first semester of the first course of the Biochemistry degree, as well as of the subjects simultaneous studied during the second semester of the course.

Objectives and Contextualisation

Microbiology is a compulsory course/subject of the Biochemistry degree, which introduces students to the microbial world, giving a general view of the microorganisms, in connection with other organisms, and with the different environments in which microorganisms live.

This subject gives basic concepts and skills in Microbiology, so that the students can dig deeper in the following courses that form part of the nucleus of the Biochemistry degree.

Detailed objectives of the course

1 Recognize the huge microbial biodiversity and know how to distinguish the characteristics that define different microbial groups.

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

3 To know the metabolic versatility of the different microbial groups, particularly that of the prokaryote.

4 To know the genomic variability of microorganisms and the main mechanisms for genetic information exchange in prokaryotic cells.

5 Recognize the main relationships of microorganisms with the other organisms and with the physical environment they inhabit.

6 To know the role of microorganisms in the development of human societies, as well as their current and future applications.

7 Know how to perform basic calculations to determine microbiological parameters.

8 Understand basic laboratory techniques to work with microorganisms.

Learning Outcomes

1. CM10 (Competence) Propose innovative applications using microorganisms to meet societal needs.
2. CM11 (Competence) Interpret experimental results obtained using microorganisms and their applications in the field of biochemistry.
3. CM12 (Competence) Justify the properties of microorganisms with potential applications in biotechnological processes.
4. KM17 (Knowledge) Identify the social, economic, and environmental impact of the use of microorganisms.
5. KM18 (Knowledge) Describe the genetic, physiological and metabolic characteristics of microorganisms.
6. SM13 (Skill) Use the main techniques for handling and using microorganisms.
7. SM14 (Skill) Observe safety procedures when handling microorganisms.

Content

I Theoretical topics

INTRODUCTION

Unit 0. Introduction to the subject: practical aspects. Microbiology and the world of microorganisms. The history of human societies and microorganisms. Our perception of microorganisms and their influence in human societies.

Unit 1. History of microbiology. First contacts with microorganisms. Stages in the history of microbiology. First microscopists. The Golden Age of microbiology: spontaneous generation and Koch's postulates. Emancipated sciences of microbiology.

STRUCTURE AND FUNCTION OF PROKARYOTAS

Unit 2. Levels of cellular organization. Main differences between viruses and cellular organisms. Prokaryotic and eukaryotic organization. Groups and names of microorganisms. The prokaryotic cell. Size and morphology.

Unit 3. The cytoplasm. The nuclear region. Cytoplasmic membrane. Transport systems across the cell membrane.

Unit 4. Structure and function of the cell wall. Capsules and mucous layers. Main mechanisms of motility. Biofilms. Intracellular inclusions and forms of differentiation. Functional and storage inclusions. Endospores.

MICROBIAL GROWTH AND ITS CONTROL

Unit 5. The cell cycle of prokaryotes. Population growth: growth curve and phases. Influence of environmental factors on cell growth.

Unit 6. Cell growth and binary fission. Mechanisms involved in the development and control of binary fission.

Unit 7. Control of bacterial growth by chemical agents. Antimicrobial agents. Differences between antiseptics, disinfectants and chemotherapeutic agents. Sterilization and sterilization mechanisms. Resistance to antimicrobial agents.

BACTERIAL PHYSIOLOGY AND METABOLISM

Unit 8. Global metabolic scheme. Energy sources, carbon and reducing potential. Types of microorganisms according to nutrition. Lithotrophy, organotrophy and phototrophy. Autotrophy and heterotrophy. Redox reactions and electron transport chains.

Unit 9. Respiration. Respiratory chains. Aerobic respiration. Respiration of inorganic and organic compounds. Anaerobic respiration.

Unit 10. Fermentation. General characteristics of fermentations. Final products and classification of fermentations. Fermentations without phosphorylation at the substrate level. Photosynthesis. Photosynthetic pigments and organization of the photosynthetic apparatus. Photophosphorylation. Differences between oxygenic and anoxygenic photosynthesis.

BACTERIAL GENETICS

Unit 11. The prokaryotic genome. Genome structure. Measurement, topology and chromosome. Extrachromosomal genetic material: plasmids. Mobile elements: insertion sequences, transposons and integrons.

Unit 12. Mutations and mutagenesis: spontaneous and induced mutations. Mutant selection and phenotypic expression. DNA repair. Mechanisms of gene transfer. Conjugation, transformation and transduction.

MICROBIAL DIVERSITY

Unit 13. Diversity of prokaryotes. The origin of life and biological diversification. Concept of species in prokaryotes. Taxonomy of prokaryotes: classical and molecular. Basis of phylogenetic organization. The major bacterial groups.

Unit 14. Microbial ecology. Microbial environments. Importance of primary producers. Role and importance of microorganisms in biochemical and geological cycles. The carbon cycle. The nitrogen cycle: nitrification and denitrification processes.

EPIDEMIOLOGY AND MICROBIAL DISEASES

Unit 15. Host-pathogen relationships. Concept of normal microbiota. Distribution of microbiota. Pathogens. Types of pathogens and mechanisms of microbial pathogenicity.

Unit 16. Pathogenesis and toxins. Pathogenicity and virulence. Exotoxins versus endotoxins. Infection versus intoxication. Host defense mechanisms. Adaptive or specific immunity mechanisms. Active or passive acquired immunity.

Unit 17. Bioterrorism. Possible agents and classification. Methods of dissemination. History and some examples: anthrax and smallpox.

Unit 18. Epidemiology of microbial diseases. Epidemiological terminology: incidence, prevalence and mortality.

Unit 19. Transmission routes: vectors, reservoirs and pathogens. Emerging and re-emerging pathogens.

APPLIED MICROBIOLOGY

Unit 20. Microbiology for the food industry. Growth of microorganisms in food and their control. Foodborne diseases. Detection of foodborne pathogens. Food preservation methods. Fermented foods.

Unit 21. Microbiology for the health industry. Industrial microorganisms and their products. Primary and secondary metabolites. Production of vitamins, amino acids and antibiotics. Microbial biotransformations. Microbial enzymes as industrial products.

Unit 22. Biotechnology. Basic principles of biotechnology. Expressing heterologous genes. Production of recombinant proteins in bacteria. Obtaining vaccines through genetic engineering.

VIRUSES

Unit 23. Introductory view and general characteristics of the virus. Concept of virus. Structure of the virus. Viral replication. Principles of taxonomy and viral diversity.

II- Seminars and problems.

Topic 1. Microscopic techniques. Optical and electronic microscopy applied to microorganisms. Examination of microorganisms in vivo. Fixation and staining. Simple, differential and specific stains.

Topic 2. Microscopic observations. Analysis of microscopic images. Identification ofmorphologies and microbial structures.

Topic 3. Techniques of sterilization of microorganisms. Basic principles and different sterilization techniques.

Topic 4. Seeding and isolation techniques. Nutritional requirements of microorganisms. Composition of the culture media. Types of culture measures. Isolation of microorganisms. Seeding methods. Methods for the identification of microorganisms.

Topic 5. Basic microbiology problems. Experimental design. Concentrations calculation. Concepts of viable and total cells counting. Concept of viable but not cultivable microorganisms.

Topic 6. Problems related to growth and microbial control. Experimental design. Growth curve. Calculation of parameters. Survival rates to different treatments.

Topic 7. Basic virology problems. Virus counting. Virulent bacteria and temperature-regulated bacteria.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problems in class	5	0.2	CM10, CM11, CM12, KM17, KM18, SM13, SM14, CM10
Seminars	10	0.4	CM10, CM11, CM12, SM13, SM14, CM10
Theoretical classes	30	1.2	CM10, CM11, CM12, KM17, KM18, SM13, SM14, CM10
Type: Supervised			
Tutorial classes (individual or in groups)	4	0.16	
Type: Autonomous			
Individual study	60	2.4	CM10, CM11, CM12, KM17, KM18, SM13, CM10
Problems resolution	20	0.8	CM10, CM11, CM12, KM17, KM18, SM13, SM14, CM10
Text reading	15	0.6	CM10, CM11, CM12, KM17, KM18, SM13, SM14, CM10

The Microbiology subject consists of THREE modules , which have been programmed in an integrated way so that the student will have to relate, throughout the course, the content and the programmed activities in order to achieve the skills indicated in section 5 of this guide.

The modules are the following:

Theoretical classes: The student must acquire the scientific-technical knowledge specific to 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 detailed calendar of the topics that will be covered throughout the course, as well as the bibliography that he will have to consult to prepare for each theoretical class and for the personal study of the topics explained. Each topic taught will be based on a theoretical presentation and a brief discussion of it.

Problem classes: These classes are clearly active and participatory sessions, with the mission of: a) working on methodological aspects, b) training the student to design basic Microbiology experiments and propose experimental protocols, c) designing strategies to solve and interpret problems. The student will receive proposals for problems and/or scientific cases that they will have to develop during the course in class both individually and in groups.

Seminar classes: These classes are clearly active and participatory sessions, with the mission of: a) working on methodological aspects, b) acquiring the necessary skills to carry out bibliographic research, reading texts and public presentation of works, c) facilitating the understanding of the knowledge presented in the theoretical classes and d) acting as a bridge between the participatory theoretical classes and the practical laboratory work, with the aim of integrating theoretical and practical knowledge. The student will receive proposals for scientific cases that they will have to develop during the course in class both individually and in groups. An oral and/or written presentation/exhibition of a topic, activity or scientific case of the proposed activities may be scheduled.

Additional information

In order to support the training activities indicated above, the student can contact the teacher at any time during the course to resolve doubts. For this reason , tutoring sessions may be scheduled throughout the course (individually, or with a small number of students) to prepare for the different scheduled activities and resolve doubts that arise as the course progresses. The place where these tutorials will be held will be defined at the time of scheduling them, which can be done by speaking directly with the teacher or via e-mail.

To ensure proper follow-up of the subject, the student will have all the documentation indicated in the previous points available on the subject's Virtual Campus.

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 of problems and seminars: Writen exam with 2 parts s) seminars and b) problems	35 % of final grade	1	0.04	CM11, SM13, SM14
Evaluation of seminar and problems. Oral exposition	5 % of final grade	1	0.04	CM10, CM11, CM12, KM17, KM18
Evaluation of theoretical classes (questions multiple choice and/or shorts): 2 examns, 30% of final grade each.	60 % of final grade	4	0.16	CM10, CM11, CM12, KM17, KM18

This subject/module does not have a single assessment/evaluation system. The assessment of the subject will be individual and continuous through the following tests:

Evaluation module of theoretical classes (60% of the overall grade).

Two written midterm exams will be scheduled throughout the course. Each midterm exam will count for 30% of the final grade for the course. The final grade for this module will be the average of the two exams. In order to pass each midterm exam and make an average, the student must obtain a minimum grade of 5 in each exam. Those students who do not pass BOTH written midterm exams, or those students who, having passed the two midterm exams, wish to obtain a better grade, will have to take the final exam (which includes the ENTIRE subject, that is, only one midterm cannot be taken again). For those students who decide to improve their grade by taking the final exam, the grade obtained in this exam will be used to calculate the final grade for this module.

Evaluation module for problem classes and seminars (40% of the overall grade).

The evaluation of this activity will be carried out separately taking into account:

- A written test with questions related to the seminars worked on in class, at the end of the course. Students who do not pass this evaluation test will be able to retake it on the date scheduled for the retake evaluation of the subject. This part will correspond to 17.5% of the overall final grade of the subject. The student must achieve a minimum grade of 5 in this test.

- A written test with problems similar to those worked on in class, at the end of the course. Students who do not pass this problem assessment test will be able to retake it on the date scheduled for the retake assessment of the subject. This part will correspond to 17.5% of the overall final grade for the subject. The student must achieve a minimum grade of 5 in this test.

Seminars and problems tests MUST be passed by separate with a minimum grade of 5 for each.

- Oral presentations in the classroom, performed in groups, related to the proposed activities and themes. The oral presentations will be evaluated with respect to content, organization and communication skills. This part will correspond to 5 % of the overall final grade of the subject . This activity IS MANDATORY AND cannot be repeated.

To pass the microbiology course, you must obtain a grade of 5 or higher in EACH module.

All assessment activities will be written in Spanish (the language in which the subject is taught), although students may complete them in Spanish, Catalan or English.

To participate in final exams, 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 for 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.

Bibliography

Recomended bibliography

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

Wiley, J, LM Sherwood, CJ Woolverton. 2008. Microbiología de Prescott, Harley y Klein. 7ª ed. MacGraw-Hill.ISBN: 978-8448168278.

Glazer, AN, H Nikaido. 2007. Microbial Biotechnology: Fundamentals of Applied Microbiology. 2ond edition. Cambridge University Press

Lee Yuan Kun. 2006. Microbial Biotechnology: Principles and Applications. 2ond edition. New Jersey. World Scientific

Jennifer Louten. 2016. Essential human virology. Elsevier Ed. ISBN: 978-0-12-800947-5

Other readings

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

Blogs recomended

Esos pequeños bichitos

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

Blog *Small things considered*

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

Webs recomended

http://www.microbeworld.org/

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

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/

Software

No especial software will be needed.

In this subject, the use of Artificial Intelligence (AI) technologies is not allowed in any of its phases. Any work including fragments generated with AI 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.

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	311	Spanish	second semester	afternoon
(TE) Theory	31	Spanish	second semester	afternoon