Universitat Autònoma de Barcelona

2020/2021

Industrial Microbiology

Code: 101014
ECTS Credits: 6

Degree	Type	Year	Semester
2500502 Microbiology	OB	3	2

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

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

The student must have completed with success the subject Microbiology of the Microbiology degree, or some subject of equivalent content.

Objectives and Contextualisation

The aim of this subject is to train the student in the different aspects microbiology which have particular relevance in the industry field, particularly those in which microorganisms participate as active production agents. A series of initial lectures deals with aspects such as the manipulation and use of microbial cultures as starters in production processes, as well as with the sterilization and control procedures required to ensure that these processes are successful. A second more specific set of lectures analyses the role of microorganisms in different specific processes, making particular emphasis on the composition of the microbial communities involved, as well as on the most relevant metabolic activities.

Competences

- Apply knowledge of theory to practice
- Apply microorganisms or their components to the development of products of interest in health, industry and technology.
- Apply suitable methodologies for taking samples and characterising and manipulating microbial populations and communities in natural and artificial ecosystems, and establish the relationships between these and those with other organisms.
- Apply the principles of risk assessment and prevention in the laboratory, and biosafety regulations on microorganisms and manipulation of different biological systems.
- Design and use disinfection and sterilisation treatments and also methods for assessing their effectiveness.
- Identify and solve problems.
- Know and apply safety and quality regulations in microbiology.
- Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
- Work individually or in groups, in multidisciplinary teams and in an international context.

Learning Outcomes

1. Apply knowledge of theory to practice
2. Apply suitable sampling strategies and techniques for different types of environments.
3. Characterise populations and communities of microorganisms from environmental and industrial samples.
4. Describe and calculate thermal disinfection procedures to ensure reaching the required level of sterilisation inside tanks and reactors.
5. Describe the microorganisms that participate in production processes.
6. Evaluate levels of microbial contamination in samples of air and on surfaces.
7. Evaluate the impact of different types of microorganisms on the final characteristics of the product.
8. Identify and evaluate microbiological risks in production processes.
9. Identify and solve problems.
10. Identify the origin of the principal microorganisms of importance in the industrial environment.
11. Implement and manage measures to ensure the quality of the final product.
12. Know and apply safety and quality regulations in microbiology.
13. Know and apply the different methods for using biocide products in microbiology.
14. Know and apply the different procedures for sterilising and reducing microbial load in industrial, clinical and experimental environments.
15. Know the products aimed at the environmental, clinical, and agrofood control of microorganisms, and the corresponding regulations.
16. Know the role of microorganisms in different production processes in order to improve these processes and ensure their success.
17. Understand the required operations and processes for obtaining products in which microorganisms intervene.
18. Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
19. Work individually or in groups, in multidisciplinary teams and in an international context.

Content

1. Introduction to Industrial Microbiology

2. Groups of microorganisms of industrial interest.

3. Problems caused by microorganisms

4. Microbial control strategies

5. Assessment of environmental microbial contamination

6. Cleaning and disinfection of industrial facilities

7. Reduction of microbial load in raw materials and products

8. Limitation of microbial growth

9. Production of cell biomass

10. Lactic fermentations on vegetables

11. Fermentation in meat

12. Production of alcoholic beverages

13. Microbiological aspects in the manufacture of dairy products

14. Production of energy using microorganisms

15. Fuel desulfurization

16. Biodegradable plastics of microbial origin

17. Microbial biosensors

**Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.*

Methodology

Teaching of the subject is organized in theory lectures and problem-solving sessions.

Theory lectures. The theory classes are designed to allow the student to progressively incorporate the necessary elements to achieve a structured knowledge of the functioning of prokaryotic cells. The contents are taught in the classroom using teaching resources that are available to the student through the virtual campus.

Problem-solving sessions. Problem-solving sessions are strictly dedicated to work interactively with the teacher, in small size groups. These sessions will be devoted both to the resolution of numerical exercises and to the discussion and resolution of practical cases. Both the exercises and the practical cases require the realization of personal work by the student outside the classroom.

**The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.*

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problem-solving sessions	15	0.6	1, 12, 9, 8, 11, 4, 19, 18
Theory lectures	30	1.2	2, 17, 16, 15, 12, 14, 13, 5, 8, 10, 11, 4, 6, 7
Type: Autonomous			
Literature search	20	0.8	
Problem solving	30	1.2	
Study	32	1.28	
Text readings	20	0.8	

Assessment

Assessment will be carried out through two exams each contributing 45% of the final grade. Each of the exams will cover theory (30% of the global grade) and problem-solving (15% of the global grade) contents. The remaining 10% of the grade will complement the exam scores only if both exams have been successfully passed, and will be based on the level of participation in the problem-solving sessions, requiring the completion of the assigned tasks within the established deadlines. To pass the subject the student must obtain 5 or higher in each exam. If the event of failing to pass any of the exams, a reassessment exam is scheduled at the end of the semester. To participate in the reassessment exam, students must have been previously assessed in a set of activities the weight of which equals a minimum of two thirds of the total grade of the subject or module. Students will obtain the "Not Evaluable" qualification when the evaluation activities carried out have a weight lower than 67% of the final grade. Students that, having passed the exams, want to improve

their grades may also take the reassessment exam. In the event of taking the reassessment exam, students implicitly renounce to their previously obtained grades.

**Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.*

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exam 1. Theory (30%) + Problems (15%)	45%	1.5	0.06	1, 2, 3, 17, 16, 15, 12, 14, 13, 5, 9, 8, 10, 11, 4, 19, 18, 6, 7
Exam 2. Theory (30%) + Problems (15%)	45%	1.5	0.06	1, 2, 3, 17, 16, 15, 12, 14, 13, 5, 9, 8, 10, 11, 4, 19, 18, 6, 7
Participation in class activities	10%	0	0	1, 2, 3, 17, 16, 15, 12, 14, 13, 5, 9, 8, 10, 11, 4, 19, 18, 6, 7

Bibliography

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Carlberg DM. 2005. Cleanroom microbiology for the non-microbiologist. CRC Press

Denyer SP, Hodges NA, Gorman SP. 2004. Hugo and Russell's Pharmaceutical Microbiology 7th ed. Blackwell Publishing

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

Jay JM, Loessner MJ, Golden DA. 2005. Modern food microbiology. Springer