

**Food Microbiology**

Code: 103259  
ECTS Credits: 6

Degree	Type	Year	Semester
2501925 Food Science and Technology	OB	3	1
2502445 Veterinary Medicine	OT	5	0

**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

**Teachers**

Maria Lourdes Abarca Salat  
Francisco Javier Cabañes Sáenz  
Gemma Castella Gómez

**Prerequisites**

There are no official prerequisites, but students are advised to review the basic concepts of Microbiology.

**Objectives and Contextualisation**

This is a compulsory third-year subject in Food Science and Technology (CTA) degree and a non-compulsory fifth-year subject in Veterinary Medicine (VET) degree. Students will acquire the knowledge and practical skills of Food Microbiology. Topics covered include the concept and significance of Microbiology related to foods, conditions that influence the development of microorganisms, microorganisms associated with food, techniques and basic methods for studying microorganisms, and analytical techniques used in food microbiology.

The training offered by the subject is based on previous knowledge acquired in compulsory subjects as Microbiology and Parasitology (CTA) and Microbiology (VET). It is also oriented to its applications in other subjects as Food Safety and Public Health.

The specific training objectives are:

- To introduce the student to the basic concepts of Food Microbiology.
- To provide knowledge of microbiological techniques and methods in foods.
- To recognize and understand the role of microorganisms associated with foods across many aspects (normal microbiota, causative agents of disease, spoilage, and those of industrial, biotechnological and ecological use) and the control of microorganisms.

## Competences

- Food Science and Technology
- Analyse, summarise, resolve problems and make professional decisions.
  - Apply the principles of processing techniques and evaluate their effects on the quality and safety of the product.
  - Apply the scientific method to resolving problems.
  - Communicate effectively with both professional and non-professional audiences, orally and in writing, in the first language and/or in English.
  - Identify food hazards, their nature (physical, chemical, biological and nutritional), their origin or causes, their effects, and suitable methods for controlling them throughout the food supply chain so as to reduce risks to consumers.
  - Identify pathogenic, spoilage, and industrially-useful microorganisms, along with the conditions that are favourable or unfavourable to their growth in foods and in industrial and biotechnological processes.
  - Select the appropriate analytical procedures (chemical, physical, biological and sensory) in accordance with the objectives of the study, the characteristics of the analytes and the fundamental principles of the technique.
  - Show understanding of the mechanisms by which raw materials deteriorate and the reactions and changes that take place during storage and processing, and apply the methods for controlling this.

## Learning Outcomes

1. Analyse, summarise, resolve problems and make professional decisions.
2. Apply the scientific method to resolving problems.
3. Characterise the principal biotic agents of food-transmitted diseases.
4. Communicate effectively with both professional and non-professional audiences, orally and in writing, in the first language and/or in English.
5. Describe the role of microorganisms as agents of food spoilage.
6. Evaluate the effect of technological treatments applied to biological agents and toxic compounds, and ways to control this effect.
7. Evaluate the effect of the intrinsic, extrinsic and implicit properties of foods on the survival and growth capacity of biological agents.
8. Identify and apply suitable microbiological methods to the study of bacteria, fungi and viruses in foods.
9. Identify and describe the properties of the principal biotic hazards in foods and determine their origin and the factors that determine their presence.
10. Recognise and distinguish between pathogenic, spoilage, and industrially-useful microorganisms.
11. Recognise the specific mechanisms for controlling microorganisms in each food.
12. Select suitable microbiological analysis procedures in keeping with the objectives of the study.
13. Select, collect and send samples for microbiological and toxicological analysis, and write the corresponding report for the receiving laboratory.
14. Use the basic preparatory and analytic techniques of a toxicology and microbiology laboratory, always applying the basic safety regulations, and write the corresponding expert report.

## Content

The subject is structured into the following sections:

Section a. Introduction to Food Microbiology: concept and evolution. Factors affecting the growth of microorganisms in food: intrinsic and extrinsic factors (chemical, physical and biological factors).

Section b. Microorganisms associated with foods: bacteria, fungi, viruses, other organisms. Sources of food contamination. Spoilage microorganisms. Indicator microorganisms. Foodborne pathogenic microorganisms: Infections, toxi-infections, foodborne intoxications. Useful microorganisms.

Section c. Analytical methods in food microbiology: essential and conventional methods, immunological methods, molecular methods, rapid and automated methods, physical methods.

Section d. Foods: Introduction, initial microbiota, effects of processing, spoilage microorganisms, Foodborne pathogenic microorganisms and its control

- Meat and meat products
- Fish, seafood and fish food
- Milk and dairy foods
- Eggs and egg products
- Other foodstuffs: vegetables, fruits, cereals and derivatives, prepared foods, canned foods, water for human consumption, beverages.

The laboratory practical contents are:

- Aseptic technique and culture methods. Observation of microorganisms and main staining methods.
- Techniques for enumeration and isolation of microorganisms.
- Methods for bacterial identification.
- Microbiological analysis of food products (traditional and molecular methods)

## Methodology

This subject applies the following methodology:

- Lectures: These lectures allow the acquisition of the basic scientific-technical knowledge of the subject; this knowledge must be complemented with a fuller study of the topics covered. Attendance and participation will be assessed.
- Laboratory sessions: practical sessions in the laboratory aim to enhance and apply the theoretical and conceptual knowledge acquired in the lectures. These sessions encourage students to improve technical skills, and reinforce theory with practice. Students will be issued with a Manual of Laboratory-Practical Sessions at the beginning of the course. To ensure satisfactory performance and acquire the skills corresponding to this subject, it is essential that students read this manual in detail, familiarizing themselves with the practical work to be carried out in each session, as well as with the methodology that should be applied in the various sessions. Students will work individually or in pairs.
- Small group work and seminar presentation: this activity aims to encourage group work, as well as to enhance the ability to synthesize, communicate and argue for a case of scientific problem. All necessary material for this activity (real cases) will be provided in advance. Students will prepare a presentation in the classroom. An open discussion and an assessment of the acquired knowledge will be held in the seminar room.
- Tutorials: these are informative sessions on the content, development and objectives of the different activities. In tutorials, students have the opportunity to clarify any doubts about the course.

All teaching materials used during the course will be posted on the Campus Virtual platform. Before each session, students will find the presentations (in pdf format) used in class by the teacher, as a support for taking notes. Students must inform themselves of the news and information published on the Campus Virtual.

## Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			

Laboratory sessions	19	0.76	1, 2, 3, 14, 8, 10, 12, 13
Lectures	29	1.16	1, 2, 3, 5, 14, 8, 9, 11, 10, 12, 13, 7, 6
Seminar	3	0.12	1, 2, 4, 11, 10, 12, 7
Type: Supervised			
Tutorials	2	0.08	3, 5, 14, 8, 9, 11, 10, 12, 13, 7, 6
Type: Autonomous			
Cases/problem solving	15	0.6	1, 2, 3, 4, 5, 8, 11, 10, 12, 13, 7, 6
Study	79	3.16	3, 5, 8, 9, 11, 10, 12, 7, 6

## Assessment

Assessment is individual and continuous through different activities:

- Laboratory sessions (20% of the overall grade): a continuous assessment will be carried out during the laboratory sessions. Maximum score: 20 points.

- Small group work and seminar presentation (20% of the overall grade, 10% each one): Two types of small group work will be done, one in the classroom and one in a seminar format. The maximum score of each: 10 points.

- Written exams (60% of the overall grade): Midterm exam 1: sections a, b and c (30% of the overall grade). Maximum score: 30 points. Midterm exam 2: section d (30% of the overall grade). Maximum score: 30 points. For an average grade for assessment activities to be applicable, the minimum grade from the scores obtained in each written exam should be 14 points.

- To pass the subject, a global score of at least 50 points/100 is required.
- Students who do not meet the minimum-grade requirements for the written exams or who fail to take the written exams, will be able to retake them on the date scheduled for subject reassessment.
- If students do not submit any of the written exams, they will be graded as Non-assessable.

## Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Classroom case	10%	0	0	1, 4, 8, 12
Laboratory sessions	20%	0	0	1, 2, 3, 14, 8, 12
Seminar presentation	10%	0	0	1, 2, 4, 5, 9, 11, 10, 12, 7, 6
Written tests	60%	3	0.12	1, 2, 3, 4, 5, 8, 9, 11, 10, 12, 13, 7, 6

## Bibliography

### Textbooks

- Adams MR & Moss MO. 2007. 2a edició. Food Microbiology. Royal Society of Chemistry. [Recurs Electrònic]. ISBN: 978-1-84755-088-0.

- Blackburn CW & McClure PJ. 2009. 2a edició. Foodborne Pathogens - Hazards, Risk Analysis and Control. CRC Press. [Recurs Electrònic]. ISBN: 978-1-84569-633-7.
- ICMSF. 2001. Microorganismos de los Alimentos 6. Ecología microbiana de los productos alimentarios. Ed. Acribia. ISBN: 84-200-0934-2.
- Jay JM. 2000. 7a edició. Modern Food Microbiology. Springer. [Recurs Electrònic]. ISBN: 978-1-59124-813-2.
- Liu D. 2009. Molecular detection of foodborne pathogens. CRC Press. [Recurs Electrònic]. ISBN: 978-1-4200-7644-8.
- Pascual Anderson MR, Calderón y Pascual V. 2000. 2a edició. Microbiología alimentaria. Metodología para alimentos y bebidas. Ed. Díaz de Santos. ISBN: 978-8-47978-424-9.
- Soriano del Castillo JM *et al.* 2007. Micotoxinas en alimentos. Ed. Díaz de Santos. ISBN: 978-84-7978-808-7.

#### Websites

- <http://www.aesan.msc.es>
- <http://www.efsa.europa.eu/en.html>
- <http://www.foodhaccp.com>
- <http://www.gencat.cat/salut/acsa/>