

**COURSE DATA****Data Subject**

<b>Code</b>	34006
<b>Name</b>	Food Microbiology
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	6.0
<b>Academic year</b>	2022 - 2023

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1103 - Degree in Food Science and Technology	Faculty of Pharmacy and Food Sciences	3	First term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1103 - Degree in Food Science and Technology	18 - Food microbiology	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
HERNANDEZ RODRIGUEZ, CARMEN SARA	275 - Microbiology and Ecology
RICO VIDAL, HORTENSIA	275 - Microbiology and Ecology

**SUMMARY**

The subject **Food Microbiology** is mandatory in the third year of the Degree of Science and Food Technology, which is taught in the Faculty of Pharmacy, University of Valencia. This course includes a total of 6 ECTS credits to be taught in the first quarter of the academic year.

The main objective of this subject is to deepen in the study of the role of microorganisms as causative agents of infections and food-borne intoxication and their participation in food spoilage.

The knowledge of the harmful potential of microorganisms, both in terms of health and economy, is an extraordinarily important part of the list of competences required by professionals involved in food science, so that they can devise strategies that lead to the production and preservation of safe food.



On the other hand the subject also tackles, from a practical standpoint, the most important techniques for the isolation and identification of the major groups of microorganisms that cause disease in humans.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

Basic module subjects, mainly Biology and Microbiology

## OUTCOMES

### 1103 - Degree in Food Science and Technology

- Apply preventive measures against the transmission of foodborne microbial diseases.
- Conocer y manejar las fuentes de información básica relacionadas con la Microbiología.
- Know food-contaminating microorganisms.
- Know food-spoiling microorganisms.
- Know about foodborne pathogenic microorganisms.
- Know and understand the epidemiology of foodborne microbial diseases.
- Dominio de las técnicas de muestreo, su diagnóstico e identificación de microorganismos en alimentos.
- Master the use of sampling techniques for the microbiological analysis of food.
- Master the techniques of cultivation, isolation and identification of microorganisms in food.

## LEARNING OUTCOMES

The result of the acquisition of the skills described above will be reflected in a range of abilities and skills that will make the student self-sufficient to:

- Developing and reasoning the theoretical and practical arguments about the role of microorganisms as causative agents of food-borne diseases and food spoilage
- Designing and carrying out experiments for detection, isolation and identification of microorganisms in food.



- Understanding the present and future developments in the field of food microbiology.

## DESCRIPTION OF CONTENTS

### 1. PART I. INTRODUCTION

UNIT 1. Food as a substrate for microorganisms. Concentration of hydrogen ions. Moisture needs moisture. Redox potential. Nutrients. Inhibiting substances. Combined effects of these factors on growth.

UNIT 2. Important microorganisms in food microbiology. Molds. Yeast. Bacteria. General characteristics: morphology, growth conditions, physiological properties and major genres.

### 2. PART II. CONTAMINATION OF FOOD

UNIT 3. Sources of microorganisms. Contamination by: vegetables and plants, animals, waste water, soil, water and the air. Contamination during handling and treatment.

UNIT 4. General principles underlying the alteration of food. Suitability of food for consumption. Causes of spoilage. Classification of foods by the ease with which they are spoilt and factors that influence the number, type and rate of multiplication of microorganisms in it.

### 3. PART III. METHODOLOGY

UNIT 5. Detection of microorganisms or their metabolites in food. Direct isolation of pathogens. Direct and indirect counts. Classical methods and new methods adapted to food analysis. Sampling protocol

### 4. PART IV. FOOD-BORNE DISEASES

UNIT 6. Introduction. Types of diseases. Associated factors. Pathogenic and toxigenic microorganisms in food. Determinants of pathogenicity.

Diseases caused by bacteria I. Key genera and species of gram-positive bacteria: Staphylococcus, Clostridium, Bacillus, Listeria and others.

UNIT 7. Diseases caused by bacteria II. Key genera and species of Gram-negative bacteria: Salmonella, Shigella, Escherichia, Vibrio, Coxiella, Brucella, Francisella, Aereomonas and others.

UNIT 8. Introduction. Diseases and intoxications not caused by bacteria I. Virus. Major genera: Hepatitis A virus, Norwalk Virus, Echo Virus, Rotavirus and others. Prions.

UNIT 9. Diseases and intoxications not caused by bacteria II. Toxin-producing fungi. Types of toxins. Foods that can be contaminated by fungi. Aflatoxins. Detection of fungal toxins and methods used to



control the contamination by and the proliferation of fungi.

## 5. PART V. FOOD SPOILAGE

UNIT 10. Spoilage of cereals and cereal products.

UNIT 11. Spoilage of sugar and sugary products.

UNIT 12. Spoilage of vegetables and fruits.

UNIT 13. Spoilage of meat and meat products. Spoilage of poultry meats.

UNIT 14. Spoilage of fish and seafood.

UNIT 15. Spoilage of eggs.

UNIT 16. Spoilage of milk and dairy products.

UNIT 17. Spoilage of canned foods.

## 6. PART VI. RESISTANCE TO ANTIBIOTICS

UNIT 18. Transmission of resistance to antibiotics through food. Current data. Importance of its control in livestock and agriculture. Consequences for human health.

## 7. PART VII. PRACTICALS

1. Aerobic plate count
2. Detection and counting of lactose positive Enterobacteriaceae
3. Detection and counting of Escherichia coli
4. Detection of Salmonella
5. Detection and counting of sulphite-reducing Clostridium
6. Detection and counting of Staphylococcus aureus
7. Detection and counting of Enterococcus
8. Detection of antibiotic residues in milk
9. Identification of microorganisms using miniaturized methods

## WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Laboratory practices	15,00	100
Seminars	2,00	100
Tutorials	2,00	100
Development of group work	4,00	0
Development of individual work	5,00	0
Study and independent work	70,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	1,00	0



Preparation of practical classes and problem	5,00	0
<b>TOTAL</b>	<b>147,00</b>	

## TEACHING METHODOLOGY

### **Theory (4.56 ECTS, 114 hours):**

Lectures aimed at providing the student with basic knowledge. Attendance: 38 hours; Preparation and study: 76 hours

### **Practical Classroom (workshops, problems) (0.44 ECTS, 11 hours):**

There will be two seminars on topics provided by the teacher and related to the module. The seminars will be submitted in writing and orally presented by students. Following the oral presentation the work will be opened for discussion among students, and moderated by the teacher. Attendance is mandatory. Attendance: 2 hours; Preparation and study: 9 hours

### **Laboratory Sessions (0.8 ECTS, 20 hours):**

They will be conducted in small groups and attendance is mandatory. Attendance: 15 hours; Preparation and study: 5 hours

### **Tutorial Sessions (0.08 ECTS, 2h):**

They will be structured in small groups and attendance is mandatory for first-year students and recommended for repeating students. Students will have the opportunity to ask questions about the course, and / or answer questions raised by the teacher

### **Examinations (0.12 ECTS, 3 hours):**

Attendance: 3 hours

**TOTAL:** 150 hours: 60 hours of attendance, 90 hours out of class

The competences and learning outcomes to be achieved in this subject integrate the Sustainable Development Goals (SDGs) promoted by the United Nations (Agenda 2030). Among others, the one referred to the reduction of the communicable and noncommunicable diseases (especially those mediated by water and food) and the development of vaccines to combat them (Objective 3: Health and Well-being) together with that of a Quality Education model (Objective 4)

## EVALUATION





Students will be assessed on their theoretical knowledge through a test / exam representing 70% of the final grade. The minimum grade to pass the course will be 5 out of 10. **In addition, the exam must be balanced and without serious deficiencies in concepts or important parts of the subject.**

The assessment of laboratory sessions will contribute to the final grade by 20% and it is required at least to obtain a score of 5 out of 10 to pass the course. The mark for laboratory sessions will include a test / exam and mandatory attendance.

If the student does not pass the theoretical part of the course but has passed the practical part will save the note for the next two academic years

Conducting and attendance the seminars is compulsory and its assessment will contribute to the final grade by 10%.

## REFERENCES

### Basic

- Sherris Microbiología Médica. K.J. Ryan & C.G. Ray. 2021. 7ª Ed. McGraw-Hill. ISBN 9786071505545
- Microbiología de Prescott, Harley y Klein. J. M. Willey, L. M. Sherwood y C. J. Woolverton. (2009) 7ª edición. Editorial: McGraw-Hill-Interamericana de España, S.A.U. ISBN: 978-84-481-6827-8
- Fundamental Food Microbiology. B. Ray & A. Bhunia. (2007) 5th edition. CRC Press, Taylor & Francis Group, Boca Ratón. ISBN 9781466564435
- Pathogens and Toxins in Foods. Challenges and Interventions. V. K. Juneja & J. N. Sofos. (2010). ASM Press, Washington D.C. ISBN: 978-1-55581-459-5
- Foodborne Microbial Pathogens. Mechanisms and Pathogenesis. A. K. Bhunia. (2008). Springer Science + Business Media, New York. ISBN: 978-0-387-74536-7
- Food Microbiology: Fundamentals and Frontiers. M. P. Doyle & R.L Buchanan. (2019) 5th edition. ASM Press, Washington D.C. ISBN: 978-1-683-67289-0
- Microbiology. A Laboratory Manual. J. Cappucino & N. Sherman. (2020) 12th edition. Pearson, ISBN13: 9780137546527
- Microbiologically safe foods. N. Heredia, I. Wesley & S. García. (2009). John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN: 978-0-470-05333-1
- Benson's Microbiological Applications. Laboratory Manual in General Microbiology. Short Versión. A. E. Brown. (2022) 15th edition. McGraw-Hill Education. ISBN-13: 9781260258981
- Microbiología clínica. G. Prats. (2005). Panamericana. ISBN: 84-7903-971-X
- Food Microbiology: Principles into Practice. O. J. Erkwen, T.F. Bozoglu. (2016). Willey. ISBN: 978-1119237761



#### **Additional**

- <http://www.semicro.es/>
- <http://www.microbeworld.org/>
- <http://www.asm.org/>
- <http://www.who.int/foodsafety/es/>
- [http://www.aecosan.msssi.gob.es/AECOSAN/web/home/aecosan\\_inicio.shtml](http://www.aecosan.msssi.gob.es/AECOSAN/web/home/aecosan_inicio.shtml)