



DEGREE CURRICULUM

# **FOOD MICROBIOLOGY AND PARASITOLOGY**

Coordination: RAMOS GIRONA, ANTONIO JAVIER

Academic year 2017-18

## Subject's general information

<b>Subject name</b>	FOOD MICROBIOLOGY AND PARASITOLOGY			
<b>Code</b>	100610			
<b>Semester</b>	2nd Q(SEMESTER) CONTINUED EVALUATION			
<b>Typology</b>	Degree	Course	Typology	Modality
	Double bachelor's degree: Degree Physiotherapy and Degree in Human Nutrition and Dietetics	2	COMPULSORY	Attendance-based
	Bachelor's Degree in Human Nutrition and Dietetics	2	COMPULSORY	Attendance-based
<b>ECTS credits</b>	9			
<b>Groups</b>	2GG,2GG,3GM,3GM,6GP,6GP			
<b>Theoretical credits</b>	4.5			
<b>Practical credits</b>	4.5			
<b>Coordination</b>	RAMOS GIRONA, ANTONIO JAVIER			
<b>Department</b>	CIENCIES MEDIQUES BASIQUES,TECNOLOGIA D'ALIMENTS			
<b>Teaching load distribution between lectures and independent student work</b>	In class hours: 90 - Lessons 45 - Practical classes 41 - Seminars 4  In home hours: 135			
<b>Important information on data processing</b>	Consult <a href="#">this link</a> for more information.			
<b>Language</b>	Spanish and Catalan			
<b>Distribution of credits</b>	Credits received by students taught by teachers of the Department of CMB. 4.5 Credits received by students taught by teachers of the Department of TECAL. 4.5			
<b>Office and hour of attention</b>	By appointment			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BELLÍ MARTÍNEZ, GEMMA	gemma.belli@cmb.udl.cat	5,3	Request appointment via email
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## Subject's extra information

This course introduces students into the microbial world (viruses, bacteria, fungi, protozoa and helminths), presenting basics about their structure, physiology, genetics and pathogenicity, and making a special impact on microbiology and parasitology of each food group, addressing issues such as spoilage, pathogens and toxicology, prophylaxis and the effect of the main conservation methods used to control food microorganisms.

## Learning objectives

This course introduces students into the microbial world (viruses, bacteria, fungi, protozoa and helminths), firstly presenting basics about their structure, physiology, genetics and pathogenicity, and then make a special emphasis on microbiology and parasitology of each group of food, with a special interest in the way by which alterations occur, key food pathogens, toxicology, prophylaxis and the effect the main conservation methods used on microorganisms.

## Competences

### General skills

1. To know the chemical, biochemical and biological basis of application in human nutrition and dietetics.
2. To know the basic processes in the production, processing and preservation of food.
3. To know the microbiology, parasitology and toxicology of food.

### Transversal skills:

1. Communicate effectively, both orally and in writing with people, health professionals or industry and the media, knowing how to use the information and communications technology, especially in relation to nutrition and lifestyle.

In addition, the student who completes this course must:

1. To know the biology, physiology, genetics, metabolism and biochemistry of microorganisms (viruses, bacteria, fungi and protozoa).
2. To know the endogenous pathogenic flora as a natural barrier against infection and as a producer of essential nutrients for human health.
3. To know the mechanisms of action of toxins of microbial origin.
4. To know and apply the mechanisms of action of antibiotics, antimicrobials and vaccines
5. To know the main spoilage microorganisms and pathogens in food and aspects related to food toxicology.
6. To know the life cycles, symptoms, epidemiology, pathways of contamination and methods of prevention and control of parasites in food.
7. To have ability to work in a laboratory of general microbiology and identify microorganisms by microscopic, biochemical, physiological and serological tests.
8. To isolate and identify human skin and mouth saprophyte microorganisms.
9. To complete a microbiological analysis of food, including the report for results.
10. To recognize the main food parasites under microscopic observation.
11. To work in teams to solve problems related to microbiological food, human nutrition and dietetics.

## Subject contents

### PART 1. General Concepts of Microbiology (22 hours)

Unit 1.- The prokaryotic cell. Bacterial morphology and sizes. The plasma membrane. The cell wall of Gram-positive and Gram-negative bacteria. The bacterial chromosome and ribosomes. Bacterial capsule and other external structures. Bacterial movement. Reserve materials. The endospore.

Unit 2. The eukaryotic cell. Differential properties regarding the prokaryotic cell. Endosymbiont theory. The hydrogenosome. Cytoplasmic organelles. The fungal cell. The protozoan cell.

Unit 3. Bacterial genetics. The bacterial chromosome. Mutagenesis. Conjugation. Transformation. Transduction. Plasmids: concept and types. Transposons.

Unit 4. Microbial metabolism. Energy sources. Nutritional requirements. Culture media, types and preparation techniques. Breathing. Fermentations. Growth curve. Regulation of microbial metabolism: enzyme reactions, regulation final product, catabolite repression, metabolic pathways.

Unit 5. Control of microbial growth. Action of physical and chemical agents. Microbial resistance to cold and heat. Action of moisture and microbial needs. Chemicals. Antibiotics. Antifungals. Microbicides. Preservatives.

Unit 6. Virology. General characteristics. Viruses. Viral infections of the digestive tract.

Unit 7. Human Microbiology. Bases of microbial pathogenicity. Microbial flora of the human body. Opportunistic flora. Infection and disease. Invasiveness, pathogenicity and virulence. Virulence factors and pathogenic mechanisms. Exotoxins and endotoxins. Constitutive defense mechanisms.

Unit 8. Immunology. Immunity to microbial infections. Vaccines.

### PART 2. Food Microbiology (14 hours)

#### I. NATURAL SPOILAGE AND GENERAL PRINCIPLES OF FOOD MICROBIAL ALTERATION

Unit 9. Natural food contamination. Origin of microbial contamination of food and food products. The food handler as a source of contamination. Microbiological monitoring of the environment.

Unit 10. General principles of food spoilage. Intrinsic factors: water activity (aw), pH, redox potential, nutrients, antimicrobials, structure and composition of food and protective barriers. Extrinsic factors: temperature, humidity, gaseous atmosphere. Technological treatments. Implicit factors. Interaction of factors, synergisms and antagonisms.

#### II. MICROBIOLOGY OF DIFFERENT KINDS OF FOOD

Unit 11. Microbiology of drinking water. Native and non-native microbiota. Types of water. Microbiological parameters that determine water quality. Major pathogens: disease and epidemiology. Purification and distribution of water for human consumption.

Unit 12. Microbiology of plant products. Microbiological alteration of: i) cereals, flours and derivatives, ii) fruits, juices, vegetables and derivatives. Major foodborne pathogens.

Unit 13. Microbiology animal products Microbiological alteration of: i) meat and meat products, ii) poultry iii) eggs and egg products, iv) dairy products, v) fish and other foods of aquatic origin. Major foodborne pathogens.

Unit 14. Microbiology of canned foods. Canned foods: definition and types. Classification of canned foods according to their acidity. Biological sterility and commercial sterility. Major pathogens and cause alterations in canned foods. Major alterations and origin. Systematic review of preserves and microbiological analysis.

### PART 3. Food Parasitology (9 hours)

Unit 15. Introduction to Parasitology. Definition. Adaptations to parasitism. Effects of the parasite on the host. Host reaction against the parasite. Parasites and host weakened. Economic significance of contamination by parasites.

Unit 16. Main parasites transmitted by water and plants. Relationship between fecal contamination, water and plant food. *Entamoeba histolytica*, *Giardia*, *Cryptosporidium* sp, *Blastocystis hominis*, *Fasciola hepatica*, *Echinococcus* sp, *Enterobius vermicularis*, *Ascaris lumbricoides*. Taxonomy. Morphology. Life cycle. Symptomatology. Epidemiology. Routes of contamination of food. Prevention and control. Situation in Spain.

Unit 17. Main parasites transmitted by meat and fish. *Toxoplasma gondii*, *Taenia* sp., *Trichinella spiralis*, *Anisakis* sp. Life cycle. Symptomatology. Epidemiology. Routes of contamination of food. Prevention and control. Situation in Spain.

### Seminars (4 hours)

1. Applications of microbiology in human nutrition and health.
2. Vaccines.

### Laboratory practical lessons (total 41 hours):

#### PART I (19 hours)

Practice 1: Preparation of different culture media. The use and interpretation of differential culture media.

Practice 2: Making a throat swab and isolation of different living organisms. Characterization of different types of microbial colonies. Identification of hemolytic toxin producing bacteria.

Practice 3: Identifying other mechanisms of toxicity carried out by pathogenic bacteria catalase activity.

Practice 4: Identification, to species level, of two different bacteria by biochemical tests (Enterotube gallery).

Practice 5: Test of antibiotic activity.

Practice 6: Analysis of disinfectants.

Practice 7: Immunodetection of a pathogen.

Practice 8: Microbial stains.

Practice 9: Isolation of a plasmid.

Practice 10: Microbial growth curve.

#### PART II (22 hours)

Practice 11: Introduction to a Food Microbiology laboratory and sample preparation

Practice 12: General counting of microorganisms:

Aerobic plate count at 30 ° C.  
Count of molds and yeasts.  
Observation and identification of filamentous fungi.  
Enterobacteriaceae and Kligler test.

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Anaerobic microorganisms.  
Coagulase positive staphylococci.  
Enterococci counts.  
Interpretation and report of results.  
Resolution of practical cases.

Practice 13: Observation of food parasites under microscope.

## Methodology

<b>Lessons. (CM)</b>	Acquisition of basic knowledge of the topic	45 hours of classroom lessons
<b>Seminars. (Sem)</b>	Acquisition of basic knowledge of the topic	2 seminars of 2 h each on general aspects of General Microbiology
<b>Practical lessons. (PL)</b>	Acquisition of skills and capabilities in the Microbiology and Parasitology laboratories	41 hours of laboratory practices (13 practices)
<b>Exams</b>	Evaluation of acquired knowledge	6 hours

## Development plan

Bachelor's Degree in Human Nutrition and Dietetics (FIRST SEMESTER)

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SA	SU
11 SEPTEMBER DIADA	12	13 CMB 2h THEORY 15-17	14 CMB 3h THEORY 17-19	15	16	17
18 CMB 2h THEORY 15-17	19	20	21 CMB 2h THEORY 15-17	22	23	24
25 CMB 2h THEORY 15-17	26	27 CMB 2h THEORY 15-17	28 HOLIDAY UdL	29 S. MIQUEL	30	1
2 OCTOBER CMB 2h THEORY 15-17	3	4 CMB 2h THEORY 15-17	5 BUTIFARRADA	6	7	8
9 CMB 2h THEORY 15-17	10	11 CMB 2h THEORY 15-17	12 HOLIDAY	13	14	15
16 CMB Practs GA 8-12 CMB 2h THEORY 15-17	17 CMB Practs GA 8-12	18 CMB Practs GA 8-12 MA 2h THEORY 15-17 Semin. CMB- B 17-19	19 CMB Practs GA 8-12 Semin. CMB-A 17-19	20 CMB Practs GA 8-12	21	22
23 CMB Practs GB 9-13 MA 2h THEORY 15-17	24 CMB Practs GB 9-13	25 CMB Practs GB 9-13 MA 2h THEORY 15-17 Semin. CMB-A 17-19	26 CMB Practs GB 9-13 Semin. CMB- B 17-19	27 CMB Practs GB 9-13	28	29
30 MA 2h THEORY 15-17	31	1 NOVEMBER HOLIDAY	2	3	4	5
6 Exam CMB 15-17. 0.03	7	8	9	10	11	12
13 MA 2h THEORY 15-17	14	15 MA 2h THEORY 15-17	16	17	18	19

20 MA 1h THEORY 15-17	21	22 PA 2h THEORY 15-17	23	24	25	26
27	28	29	30	1 DECEMBER	2	3
4 PA 2h THEORY 15-17	5	6 INMACULADA	7 NO LECTIVO	8 CONSTITUCION	9	10
11 Exam MA 15-17. 0.02	12	13	14	15	16	17
18	19	20 PA 2h THEORY 15-17	21	22	23	24
25	26	27	28	29	30	31
1 JANUARY	2	3	4	5	6	7
8 Prac GA 9-14	9 Prac GA 9-13	10 Prac GA 9-12	11 Prac GA 9-14	12 Prac GA 9-14	13	14
15 Prac GB 9-14	16 Prac GB 9-13	17 Prac GB 9-12	18 Prac GB 9-14	19 Prac GB 9-14	20	21
22 Exam PA+Practs 15-17h. 0.03	23	24	25	26	27	28

## Note:

February 19: recovery exam (10-12h, classroom 0.03)

The practices of the weeks of October 16 and 23 are held at the Faculty of Medicine, and those on January 8 and 15 are held at the ETSEA.

## Evaluation

### Theory and practice:

The topic is evaluated continuously. To do this, 4 exams throughout the semester are made. Usually exams follow the same pattern: a test of theory and a set of short questions. The evaluation of practical lessons may include large questions and/or test questions.

Each exam has the following value:

Exam 1: questions of theory of General Microbiology. Value: 25% of the course.

Exam 2: questions of practice of General Microbiology. Value: 15% of the course.

Exam 3: questions of theory of Food Microbiology. Value: 15% of the course.

Exam 4: questions of theory of Food Parasitology + questions of practices of Food Microb. and Parasitology. Value 25% of the course

In any case, to pass the course exams 1, 3, and 4 have to get at least a 4.0 (out of 10), so they can average the marks obtained in the four tests to calculate the final mark, together with other evaluation items.

Seminars will be evaluated taking into account attendance and completion of a report (10% of the final grade).

The students must submit a memory of the practices carried out in the Microbiology and Food Parasitology part, individually or in pairs (and exceptionally in trios, with previous approval of the teacher), in which the exercises performed are recorded, as well as the critical discussion of the results. For the realization of this memory, the criteria explained in the document "Check-list y rúbrica memoria de prácticas", available in the "Resources" section of the subject space in the Virtual Campus, must be taken into account. The value of each element that forms the memory is indicated. This document must be submitted signed by the authors together with the report. In the memory it is necessary to obtain a minimum of 40 points over 100 so that the grade can be averaged with the grades obtained in the rest of the evaluation elements of the subject. Memory value: 10% of the subject.

Practices and seminars are of **compulsory attendance**. In the case of the practices, only a percentage of absences of 10% of the total hours for this concept will be allowed, provided that it is for a justified reason (in case of illness, medical evidence must be delivered).

## Bibliography

### A) BASIC BIBLIOGRAPHY

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- I.C.M.S.F. (1983). Ecología microbiana de los alimentos. Vol I.: Factores que afectan a la supervivencia de los microorganismos en los alimentos. Acribia, Zaragoza.
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- MADIGAN, M., MARTINKO, J. y PARKER, J. (2003). Brock Biología de los Microorganismos. 10ª Edición. Ed. Prentice-Hall. Madrid.
- MARKELL, E.K., VOGEL, M. y JOHN, D.T. (1990). Parasitología Médica. Editorial Interamericana-McGraw-Hill.
- PRESCOTT, L.M, HARLEY, J.P y KLEIN, D.A (2004). Microbiología. McGraw-Hill Interamericana, Madrid.

### B) COMPLEMENTARY BIBLIOGRAPHY

- ACHA, P.N. y SZYFRES, B. (1989). Zoonosis y enfermedades transmisibles comunes al hombre y a los animales. Organización Panamericana de la Salud.
- ALLAERT, C. y ESCOLÀ, M. (2002). Métodos de análisis microbiológicos de los alimentos. Díaz de Santos, Madrid.
- Jay, J.M. (2002). Microbiología moderna de los alimentos. Acribia, Zaragoza.
- MOSSEL, D.A.A., J.E.L. CORRY, C.B. STRUIJK *et al.* (1995). Essentials of the microbiology of foods. A textbook for advanced studies. John Wiley & Sons, Chichester.
- Mossel, D.A.A. y B. Moreno. (1985). Microbiología de los alimentos: fundamentos ecológicos para garantizar y comprobar la inocuidad de los alimentos. Acribia, Zaragoza.