

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

Code	36371
Name	Food microbiology and parasitology
Cycle	Grade
ECTS Credits	4.5
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1212 - Degree in Gastronomic Sciences	Faculty of Pharmacy and Food Sciences	2	First term

Subject-matter

Degree	Subject-matter	Character
1212 - Degree in Gastronomic Sciences	13 - Food Microbiology and Parasitology	Obligatory

Coordination

Name	Department
FALOMIR LLORENS, MARIA PILAR	275 - Microbiology and Ecology
FUENTES FERRER, MARIUS VICENT	358 - Pharmacy, Pharmaceutical Technology and Parasitology

SUMMARY

The subject Food Microbiology and Parasitology is mandatory in the second year of the Gastronomic Science Degree, which is taught at Faculty of Pharmacy of University of Valencia. This course includes a total of 4.5 ECTS credits to be taught in the first quarter of the academic year. The subject is divided in two parts: Food Microbiology and Food Parasitology.

Part of Microbiology of the course is structured around two core themes. The first part provides the student with an overview of the microbial world. It explores the various aspects of the biology of microorganisms: taxonomy, structure/function relationship, metabolism and physiology, growth and its control.



The second module, introduces students to the relationship between the human species and the microbial world, with special emphasis on the significance of microorganisms on health, nutrition and feeding of human beings. With this goal in mind, it addresses the basics of immunology and microbial pathogenesis, and explores the role of microorganisms as food producers, as responsible of food spoilage and as causative agents of foodborne infections and intoxications.

The main objectives of the Parasitology section are: to highlight the importance of food-borne contaminants, typical food parasites and food-spoiling parasites and the presentation of hygienic measures of prevention and control of food-borne parasitic diseases. To achieve these main objectives the Food Parasitology section consists of 15 items grouped into three parts: general concepts; protozoa, food-borne helminths and arthropods; and pest control and hygiene and processes.

Besides the food-borne transmission of microorganisms and parasites, the impact of the control and prevention of diseases aimed at reaching the Sustainable Development Goals (SDGs) of Agenda 2030 will also be reflected upon.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

In order to pass this course successfully, the student has to master the fundamentals of subjects such as Biochemistry and Biology.

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1212 - Degree in Gastronomic Sciences

- Know and know how to evaluate and prevent biological risks in food.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

The acquisition of the skills described above will be reflected in its practical application:

- Knowledge of the biological cycles related to food-borne parasites
- Knowledge of the contaminants, parasites and pathogens related to the deterioration of foodstuffs
- Understanding the epidemiology of food-borne parasitic diseases
- Knowledge of the preventive measures to prevent the transmission of food-borne parasitic diseases



- Sort and identify microorganisms of food interest
- Understanding the mechanisms of microbial pathogenicity
- Know the methods of controlling the growth of microorganisms
- Know the measures preventing the transmission of microbial food-borne illness

DESCRIPTION OF CONTENTS

1. BASIC PRINCIPLES OF MICROBIOLOGY

Chapter 1.- Introduction to Microbiology.

The microbial world. Concept of microbe. The science of Microbiology. The historical evolution of Microbiology. Microbiology studies of Gastronomic Sciences

Chapter 2.- Types of microorganisms: Prokaryotic cells, Eukaryotic cells , viruses, submicroscopic particles and Prions

Chapter 3.- Structure and function of the prokaryotic cell I. Basics: The Cell Envelope.

Morphology and cell size. Cytoplasmic membrane: structure, function and differences between prokaryotic domains. Cell wall architecture in the domain Bacteria: Gram positive, Gram-negative, Acid-fast. Cell wall architecture in the domain Archaea. Capsules and mucosal layers. Pili and fimbriae. Flagellum of prokaryotes: structure and mobility. Chemotaxis. Protein secretion.

Chapter 4.- Structure and function of the prokaryotic cell II. Basics: Cytoplasmic Inclusions and the cellular matrix.

The cytoplasmic matrix: inclusion bodies, gas vesicles, nucleoid, ribosomes, plasmids. Cellular microcompartments. Bacterial endospores: structure, formation and germination. Comparison between prokaryotic and eukaryotic cells.

2. NUTRITION, METABOLISM AND MICROBIAL GROWTH

Chapter 5.- Basics of microbial nutrition.

Nutritional requirements of microorganisms. Nutritional types. Culture Media. Cellular uptake of nutrients: Transport and transport systems of the cell membrane.

Chapter 6.- Basics of microbial metabolism.

Catabolic diversity of the prokaryotic world. Catabolism of chemoorganotrophic heterotrophic microorganisms. Fermentation: concept and characteristics. Alcoholic fermentation. Lactic acid fermentation. Propionic acid fermentation. Fermentation in enteric bacteria. Fermentation in *Clostridium* spp. Anaerobic respiration: general concepts. Aerobic chemoorganotrophic processes: metabolism of sugars, organic acids, amino acids and lipids.

Chapter 7.- Microbial growth.



Bacterial cell division. Growth of bacterial populations: the growth curve. Formulation of exponential growth. Continuous culture: the chemostat. Methods of measurement of microbial growth. Influence of environmental factors on growth: temperature, pH, osmotic pressure, oxygen concentration, radiation, pressure. Microbial growth in natural environments. Biofilms.

Chapter 8.- Control of microbial growth.

Definition of frequently used terms. Methods of microbial control. Kinetics of microbial death. Variables affecting the efficacy of antimicrobial agents. Physical methods of control: heat, low temperatures, radiation, filtration. Antimicrobial chemicals for external use. Evaluation of antimicrobial efficacy. Antimicrobial chemotherapeutic agents, antibiotics and synthetic antimicrobials. Origin, mechanisms and transmission of antimicrobial drug resistance.

3. MOLECULAR BIOLOGY OF MICROORGANISMS

Chapter 9.- Basics of bacterial genetics: Genetic organization and mutation

Main characteristics of the processes of DNA replication, transcription and translation in prokaryotes. Mutations: molecular basis, types, effects, mutagens, isolation of mutants. The Ames test.

Chapter 10.- Bacterial genetic recombination

Genetic exchange in prokaryotes: transformation, transduction and conjugation. Plasmids: Concept and types

4. FERMENTED FOODS

Chapter 11.- Wine, beer and other fermented beverages.

Chapter 12.- Fermentation of fish and meat products.

Chapter 13.- Fermentation of vegetable products

Chapter 14.- Fermentation of dairy products

5. MICROBIAL ROLE IN FOODBORNE DISEASES

Chapter 15.- Introduction to food microbiology. 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.

Chapter 16.- Important microorganisms in food microbiology. Molds. Yeast. Bacteria. General characteristics: morphology, growth conditions, physiological properties and major genres.

Chapter 17.- Sources of microorganisms. Contamination by: vegetables and plants, animals, waste water, soil, water and the air. Contamination during handling and treatment.

Chapter 18.- General methods of microbiological analysis of foods.

Principle of food analysis. Sampling and microbiological analysis: general. Microorganisms indicators and indices. Total count of microorganisms. Microbiological examination of surfaces.

Chapter 19.- Foodborne Diseases : toxoinfection and food poisoning . Mechanisms of action of foodborne pathogens. Prevention and prophylaxis

Chapter 20.- Gram-positive cocci: Staphylococcus aureus, Enterococcus.

Chapter 21.- Bacillus Gram positive spore-forming Bacillus cereus, Clostridium botulinum, Clostridium



perfringens.

Chapter 22- Bacillus Gram positive non-spore: *Listeria monocytogenes*, *Corynebacterium diphtheriae*.

Chapter 23.- Gram negative aerobic/microaerophilic: *Campylobacter*, *Brucella*

Chapter 24.- Facultative anaerobic gram-negative bacilli. Enterobacteriaceae: *Escherichia*, *Salmonella*, *Shigella*, *Yersinia*.

Chapter 25.- Facultative anaerobic gram-negative bacilli. Vibrionaceae: *Vibrio*, *Aeromonas*

Chapter 26.- Virus. Norovirus: Norwalk Virus, Rotavirus, Enterovirus, Hepatitis A Virus, Hepatitis E Virus, Prions

Chapter 27.- Fungi: mycotoxins

6. MICROBIAL ROLE IN FOOD SPOILAGE

Chapter 28.- Spoilage of cereals and cereal products. Spoilage of sugar and sugary products.

Chapter 29.- Spoilage of vegetables and fruits.

Chapter 30.- Spoilage of meat and meat products. Spoilage of poultry meats.

Chapter 31. Spoilage of fish and seafood.

Chapter 32.- Spoilage of eggs.

Chapter 33.- Spoilage of milk and dairy products.

Chapter 34.- Spoilage of canned foods.

7. INTRODUCTION TO FOOD PARASITOLOGY

General concepts of food parasitology: host and parasite; parasitism and parasitic diseases; types of hosts and types of parasites; parasitic contaminants, typical parasites of food and food-spoiling parasites. Systematic classification of parasites: protozoa, flukes, tapeworms, nematodes and arthropods.

Biological cycles of parasitic contaminants, food-spoiling parasites and typical parasites of food: basic concepts.

8. Parasitic contaminants in food

Protozoa contaminating of water, fruit and vegetables and other foodstuffs. Basic concepts. Epidemiology and prevention.

Flukes and tapeworms contaminating water, fruit and vegetables and other foodstuffs. Basic concepts. Epidemiology and prevention.

Nematodes contaminating water, fruit and vegetables and other foodstuffs. Basic concepts. Epidemiology and prevention.

Arthropods contaminating water, fruit and vegetables and other foodstuffs. Basic concepts. Epidemiology and prevention.



9. PARASITES TYPICALLY FOUND IN FOOD

Protozoa typical of meat products. Basic concepts. Epidemiology and prevention.

Tapeworms typical of meat products. Basic concepts. Epidemiology and prevention.

Nematodes typical of meat products. Basic concepts. Epidemiology and prevention.

Trematodes typical of fish products. Basic concepts. Epidemiology and prevention.

Cestodes typical of fish products themselves. Basic concepts. Epidemiology and prevention.

Nematodes typical of fish products. Basic concepts. Epidemiology and prevention.

10. FOOD-SPOILING PARASITES

Food-spoiling parasites. Basic concepts. Epidemiology and prevention.

11. HYGIENE OF PRODUCTS AND PROCESSES IN FOOD PARASITOLOGY

Insects. Insect treatment. Pest control. Controls and monitoring. Corrective measures.

Hygiene of products and processes: prevention in the transmission of food-borne parasitic diseases.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Study and independent work	67,50	0
TOTAL	112,50	

TEACHING METHODOLOGY

Theory (3 ECTS, 30 hours):

Lectures aimed at providing the student with basic knowledge. Attendance: 30 hours; preparation and study: 86 hours

Practical classes (workshops, problem solving) (1.5 ECTS, 15 hours):

Attendance: 15 hours; preparation and study: 4 hours



TOTAL: 135 hours: 45 hours of attendance, 90 hours out of class

EVALUATION

To evaluate the learning taking place, it is considered essential to direct observation of the level acquired by the student, which may be made at all hours of attendance, especially and primarily in regard to the observation of daily work performed. This should allow the professor directly establish a dynamic picture of the progress of each student through each part of matter.

However, the numerical grade of knowledge and skills acquired must be established based on methods that allow objective and comparable measure of the same, with record results, which means qualifying written tests.

The evaluation of each part of the course will be done through a final review of the theoretical.

The maximum score can get final is 10 points, corresponding to 64% (6,4 points) to the microbiological and the remaining 36% (3,6 points) to the parasite

To pass the whole subject must be obtained in each of the two parts of matter a minimum grade of 5.

REFERENCES

Basic

- Referència b1: Brock Biology of microorganisms. M. T. Madigan, J. M. Martinko, K.S. Bender, D.H. Buckley, T. Brock (2015) 14th edition. Pearson. ISBN: 978-0-321-89739-8
- Referència b2: Prescotts Microbiology. J. M. Willey, L. M. Sherwood y C. J. Woolverton (2011) 8th edition. McGraw-Hill. ISBN: 0073375268
- Referència b3: Sherris Microbiología Médica. . K.J. Ryan & C.G. Ray. 5ª Ed. McGraw-Hill. ISBN 9786071505545
- Referència b4: Microbe. M. Schaechter, J. L. Ingraham & Frederick C. Neidhardt. (2006). ASM Press, Washington D.C. ISBN: 978-1555813208
- Referència b5: Modern Food Microbiology. J. M. Jay, M. J. Loessner & David A. Golden. (2005) 7th edition. Springer Science + Bussiness Media, New York. ISBN: 978-0387231808
- Referència b6: Fundamental Food Microbiology. B. Ray & A. Bhunia. (2007) 4th edition. CRC Press, Taylor & Francis Group, Boca Raton. ISBN: 978-0-8493-7529-3
- Referència b7: 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
- Referència b8: Microbiologically safe foods. N. Heredia, I. Wesley & S. García. (2009). John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN: 978-0-470-05333-1
- Referència b9: Foodborne Microbial Pathogens. Mechanisms and Pathogenesis. A. K. Bhunia. (2008). Springer Science + Bussiness Media, New York. ISBN: 978-0-387-74536-7



- Referència b10: Foodborne Infections and Intoxications. Morris & Potter (2013) 4th edition. Elsevier Inc. ISBN: 978-0124160415
- Referència b11: CURS EN LÍNIA OBERT MASSIU (MOOC) Els paràsits als aliments: tan petits i desconeguts com dolents. Grup d'Investigació UV Paràsits i Salut. Servei de Formació Permanent i Innovació Educativa de la Universitat de València.
URL: <https://www.youtube.com/playlist?list=PLiPJN1xCP1u2vZsU70g2yXAQ9tvvG5dF>
- Referència b12: ACHA (P.N.) & SZYFRES (B.), 1986.- Zoonosis y Enfermedades transmisibles comunes al Hombre y a los Animales. Segunda edición. Publicación Científica No 503, Organización Panamericana de la Salud, Washington, D.C., 989 pp.
- Referència b13: EUZEBY (J.), 2001.- Los parásitos de las carnes: epidemiología, fisiopatología, incidencias zoonósicas. Editorial Acribia, Zaragoza, 430 pp.
- Referència b14: MURELL (K.D.) & FRIED (B.) edit., 2007.- Food-borne parasitic zoonoses. Fish and plant-borne parasites. World Class Parasites: Volume 11. Springer, New York, 429 pp.
- Referència b15: ORTEGA (Y.R.), 2006.- Foodborne Parasites. Springer, New York, 289 pp.
- Referència b16: ORTEGA (Y.R.) edit., 2006.- Foodborne Parasites. Springer, New York, 289 pp.
- Referència b17: XIAO (L.), RYAN (U.) & FEBG (Y.), 2015. Biology of Foodborne Parasites. CRC Press, Taylor & Francis Group, Boca Raton (FL), 507 pp.

Additional

- Referència c1: Microbiology An Introduction. G. J. Tortora, B. R. Funke & C. L. Case. (2010) 10th edition. Pearson Benjamin Cummings, San Francisco. ISBN: 978-0-321-55007-1
- Referència c2: Food Microbiology: Fundamentals and Frontiers. M. P. Doyle & L. R. Beuchat. (2013) 4th edition. ASM Press, Washington D.C. ISBN: 978-1-55581-626-1
- Referència c3: Encyclopedia of Food Microbiology. 2nd edition C. A. Batt, M.L. Tortorello. (2014). Elsevier. ISBN: 978-0-12-384730-0
- Referència c4: Food Microbiology: Principles into Practice. O. J. Erkwen, T.F. Bozoglu. (2016). Wiley. ISBN: 978-1119237761
- Referència c5: Essential Microbiology and Hygiene for Food Professionals. S. Roller. (2012). Hodder Arnold. U.K. ISBN: 978-1-444-121490
- Referència c6: Microbiología clínica. G. Prats. (2005). Panamericana. ISBN: 84-7903-971-X
- Referència c7: <http://www.asm.org/>
- Referència c8: <http://www.microbeworld.org/>
- Referència c9: http://www.aecosan.msssi.gob.es/AECOSAN/web/home/aecosan_inicio.shtml
- Referència c10: <http://www.fda.gov/Food/default.htm>
- Referència c11: <http://www.hc-sc.gc.ca/fn-an/index-eng.php>
- Referència c12: GÁLLEGO BERENGUER (J.), 1998.- Manual de Parasitología: Morfología y biología de los parásitos de interés sanitario. Edicions Universitat de Barcelona, Barcelona, 490 pp.
- Referència c13: GÁLLEGO BERENGUER (J.), 2001.- Manual de Parasitologia: Morfologia i biologia dels paràsits d'interès sanitari. Edicions Universitat de Barcelona, Barcelona, 535 pp.