

Food Microbiology

Code: 101005
ECTS Credits: 6

Degree	Type	Year	Semester
2500502 Microbiology	OB	3	1

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

There are no official prerequisites to follow the course; nonetheless it would be desirable if students review basic concepts of the microbial world previously acquired in the first courses of the Bachelor's Degree in Microbiology, and a good knowledge about the subjects coursed simultaneously in the first semester of the third course.

Objectives and Contextualisation

This is a compulsory subject, nuclear course from the degree of Microbiology, which introduces students to the Food Microbiology. The achievement of the competences of the course will allow students acquire new knowledge related to other subjects subsequently coursed in the degree of Microbiology.

The main objectives are:

- Know the ecology and activities of microorganisms in food.
- Know the current methods of analysis, and identification of micro-organisms and/or their metabolic products in food.
- Know the major infections and intoxications caused by micro-organisms and associated with the consumption of food.
- Identify different usual, disrupters and pathogenic microorganisms associated with each type of food.

Skills

- Apply suitable methodologies to isolate, analyse, observe, cultivate, identify and conserve microorganisms.
- Obtain, select and manage information.
- 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. Describe the methodologies used in the analysis of the different types of microorganisms and parasites in foods.
2. Distinguish between pathogenic microorganisms and contamination indicator microorganisms.
3. Distinguish between pathogenic microorganisms and those that spoil foods and other products.
4. Identify the different bioindicators of microbial contamination in foods and other products.
5. Identify the techniques used in the isolation, culturing and identification pathogenic microorganisms.
6. Identify the techniques used in the multiplication, detection and identification of viruses.
7. Know the different methods used to determine the microbiological content of foods, drugs and other products.
8. Know the methods used in the detection of microbial contamination indicators.
9. Obtain, select and manage information.
10. Recognise the habitual microbiota of environments, foods and other products.
11. Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
12. Work individually or in groups, in multidisciplinary teams and in an international context.

Content

Section I. Introduction to food microbiology

Unit 1. Food microbiology

Historical background. Present and future of food microbiology.

Unit 2. Microorganisms in foods

Ecology of microorganisms in food. Major microbial groups. Origins and sources of pollution. Intrinsic and extrinsic factors affecting the growth of microorganisms in food. Predictive microbiology.

Section II. Indicators of food quality and safety

Unit 3. Indicators microorganisms and microbiological criteria in food

Quality and food safety. Indicator microorganisms. Disrupters microorganisms. Pathogenic micro-organisms and metabolic products. Microbiological criteria. Sampling plans and microbiological limits. Application of microbiological criteria in food.

Section III. Analysis of microorganisms and their products in food

Unit 4. Sampling and samples preparation.

Methods of sampling. Collection and processing of solid and liquid samples.

Unit 5. Conventional microbiological methods.

Methods of counting of microorganisms. Presence / absence methods. Basic techniques of characterization and identification.

Unit 6. Advanced techniques I.

Immunological and molecular methods. Types and most important applications in food.

Unit 7. Advanced techniques II.

Rapid and automated methods. Combination of methods. Validation and accreditation methods.

Unit 8. Biosensors

Introduction to biosensors. Types and applications of biosensors in food microbiology.

Unit 9. Microbiological examination of the environment in food industries.

Analysis methods: surfaces of machinery and equipment; quality of the air and water.

Section IV. Food-borne microbial diseases

Unit 10. Microorganisms and food-borne diseases.

Pathogenic microorganisms in food. Routes of transmission, infection requirements and area of action in the human body. Formation of biofilms.

Unit 11. Food infections caused by Enterobacteriaceae.

Salmonella species. Salmonellosis. Escherichia coli enteropathogens. Yersinia enterocolitica. Species of Shigella. Shigellosis. Enterobacter sakazakii.

Unit 12. Food infections with other Gram negative bacteria.

Species of Campylobacter. Campilobacteriosi. Vibrio species. Vibriosis. Pseudomonas aeruginosa.

Unit 13. Food infections with not sporulate Gram positive bacteria.

Species of Listeria. Infection by Listeria monocytogenes. Ready-to-eat foods. Bacterial toxins. Food poisoning by Staphylococcus aureus.

Unit 14. Food poisoning caused by sporulated Gram positive bacteria.

Microorganisms sporulated. Food poisoning caused by Clostridium: Clostridium botulinum and Clostridium perfringens. Canned foods. Intoxication by Bacillus cereus. Detection of bacterial toxins.

Unit 15. Food poisoning of fungal origin.

Generalities. Species of the genera Aspergillus, Penicillium and Fusarium. Mycotoxins. Analysis and control methods. Involved food: spices, condiments and cereals and derivatives.

Unit 16. Food infections caused by viruses and prions.

Generalities. Major food-borne viruses. Sources of pollution. Prevention, detection and control. Prions.

Unit 17. Foodborne illness caused by parasites.

Generalities. Parasitic forms of transmission. Main protozoans, helminths (cestodes and trematodes) and nematodes foodborne.

Section V. Food microorganisms

Unit 18. Fresh meat and meat products.

Meat processing. Chemical composition and transformations of the meat. Initial microbiota. Sources of pollution. Types of microorganisms. Poultry meat. Refrigerated meat. Minced meat. Frozen meat. Meat derivatives. Microbiological standards.

Unit 19. Fishery products.

Fish products: fish and seafood. Composition and types. Major microbial alterations. The freshness of the fish. Technology of fish. Marine biotoxins. Processed products. Microbiological standards.

Unit 20. Products of vegetal origin.

Vegetables and fruits: characteristics, composition and type. Most common bacterial and fungal disorders. Technology of vegetable products. Processed products. Microbiological standards.

Unit 21. Milk and dairy products.

Characteristics of the milk. Microbial sources. Processing of milk. Type of milk. Major dairy derivatives. Most important microbial alterations. Microbiological standards.

Unit 22. Eggs and derivatives.

Eggs and main features. Contamination sources. Type of eggs: shell, liquid and dried. General processing. Major microbial alterations. Mayonnaise. Microbiological standards.

Methodology

The course comprises two modules: Theoretical and methodological and seminar classes. These are scheduled in an integrated way so that student must interact throughout the course content and the activities to achieve the competencies indicated previously in this guide.

Both modules are based on the following:

In **theoretical classes** student must acquire the scientific knowledge of this subject attending these classes and help with the personal study of the topics explained. A detailed timetable of the topics, as well as the bibliography should be consulted to prepare theoretical classes and for the personal study of the theoretical content of the subject, will be delivered to the student at the beginning of the course.

The **methodological and seminar classes**, they will be working in groups with a small number of students where two learning activities will work.

-Methodological classes. In these classes will be carried out complementary activities to the theoretical classes, methodological and applied aspects will mainly work.

-Seminars. The students, divided into groups, must reflect and work in an autonomous way, interesting or topical issues related to the content of the subject, subsequently will be exposed and discussed in the classroom. In this sense the first day of these methodological classes teacher will present and distribute among students the selected topics.

As a complement to these kinds of classes different questions will be realized and could be discussed by the students in the Forum of the virtual campus.

Additional information:

In order to support the training activities mentioned above, the students able to do individual tutorials on the subject in the office of the teacher Antoni Solé (C3-327), at times previously agreed by e-mail.

For a good follow-up of the subject, the student will have complementary material that the teacher considers necessary, as well as the presentation and the programme guide of the subject, in the moodle/campus virtual. Also you can consult the coordination of degree teaching space for up-to-date information concerning the degree.

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Methodological and seminar classes	15	0.6	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Theoretical classes	30	1.2	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 11
Type: Supervised			
Tutory	3	0.12	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Type: Autonomous			
Forums discussion	4	0.16	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11

Oral presentation preparing	13	0.52	9, 12, 11
Reading texts	20	0.8	9, 12, 11
Reference research	12	0.48	9, 12, 11
Study	45	1.8	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 11

Evaluation

The assessment of the course will be individual and continuous through different modules:

Theoretical classes (60 % of the final grade): Two partial exams, where each one will be worth 30 %. Each exam includes: multiple choice questions (8/10) and short questions (2/10).

Methodological and seminar classes (40 % of the final grade): Different activities will be taking into account: Methodological class activities (10 % of the global note); Oral presentation of the work done (16 % of the global note). Students should seek a scientific paper in English (see scientific journals section of the bibliography) related to the assigned topic, which is the most recent possible, preferably in the last four years; make a presentation in PowerPoint of the assigned topic, in which the treated subject is clear and refers to the article you selected. In this case will have to be: compulsory a cover page, indicating the subject, authors, date of exhibition and title of the selected article, and a sections of conclusions and bibliography; and optionally other sections such as: introduction, methodology, results and discussion (together or separates), or any other that be considered appropriate, which will be assessed positively. Students must send to the teacher the presentation via electronic mail and in pdf format two days before the corresponding exhibition. In this case the criteria to be evaluated will be: the pdf sending date, the presentation, the contents, the capacity of synthesis, used scientific vocabulary, the suitability of the selected article, the exhibition quality, the time of exposition and participation of students at the end discussion. Any change in these criteria will be reported the first day of class in this module; Questionnaire/es concerning seminar/s (14 % of the global note). This/these questionnaire/es includes: multiple choice and true or false questions about the topics exposed by students. The place and time of this questionnaire/es will be indicated by the teacher the first day of this module.

In theoretical and methodological classes and seminars are taken into account the punctuality and attitude of the student. This evaluation does not entail an increase of the note, but may mean the reduction of up to 25 % of the final grade obtained in this subject.

Students who cannot attend an individual test for certified cause (as a health problem, death of a family member of up to second grade, accident, enjoy the status of elite athlete and have a competition or sport activity of must-attend, etc) and provide official documentation to the co-ordinator of the degree (official medical certificate that is done explicitly noted the inability of an examination overcrowded police, justification of the sports authority, etc.) shall be entitled to perform the test on another date. The Coordinator will ensure the realization of the test, after asking the teacher involved.

We consider that a student will be graded as **NO VALUABLE** if the number of evaluation activities carried out has been less than 50 % of the scheduled for the course.

To pass the course students you must get at least 5 in each module. Students that do not exceed the assessments of the different modules (theoretical and/or methodological and seminar modules) of the course will be a second-chance to pass the course at the end of the semester (recovery exam). Students who do not obtain the minimum required grade will not pass the course. In this case, the maximum course final grade will be 4.

Students who wish to improve the final grade of the course (theory and/or methodological and seminars classes) must be submitted to a specific test of evaluation that will take place the same day that the recovery exam. The presentation of the student to this improving exam will involve renouncing the qualification obtained previously.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Methodological and seminar classes assessment	40	2	0.08	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Recovery evaluation	Recovery exam	2	0.08	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12
Theoretical classes assessment	60	4	0.16	7, 8, 1, 3, 2, 4, 5, 6, 10

Bibliography

Text books:-

- Frazier, WC., Westhoff, DC. 2003. Microbiología de los alimentos. 4ª Edición. Ed. Acribia, Zaragoza.
- Jay, JM., Loessner, MJ., Golden, DA. 2009. Microbiología moderna de los alimentos. 5ª edición. Editorial Acribia S.A. Zaragoza. ISBN: 978-84-200-1125-7.
- Lawley, R., Curtis, L., Davis, J. 2008. The Food Safety Hazard Guidebook. Food Safety Info, London, UK.RSC Publishing. ISBN: 978-0-85404-460-3.
- Madigan, MT., Martinko, JM., Bender, KS., Buckley, DH., Stahl, DA. 2014. Brock Biology of microorganisms.14th edition. Pearson, S.A. ISBN: 978-0-321-89739-8.
- Madigan, M., Martinko JM., Dunlap PV., Clark DP. 2009. Brock Biología de los Microorganismos. 12ª edición.Pearson Education S.A. ISBN: 978-84-7829-097-0.
- Montville, TJ., Matthews, KR. 2009. Microbiología de los alimentos. Introducción. 1ª edición. Editorial Acribia S.A. Zaragoza. ISBN: 978-84-200-1131-8.6
- Montville, TJ., Matthews, KR., Kniel, KE. 2012. Food microbiology: an introduction. 3ª edición. American Society for Microbiology. ISBN: 978-1-55581-636-0.
- Mossel, DAA., Moreno, B., Struijk, CB. 2003. Microbiología de los alimentos. 2ª edición. Editorial Acribia.Zaragoza. ISBN:84-200-0998-9.
- Pascual, MR., Calderón, V. 2000. Microbiología alimentaria. Metodología analítica para alimentos y bebidas.2ª edición. Editorial Diaz de Santos. ISBN: 978-84-7978-424-9.
- Tham, W., Danielsson-Tham, ML. 2014. Food associated pathogens. CRP Press. Taylor & Francis Group. A science publishers book. ISBN: 978-1-4665-8498-3.

Internet:

- Sociedad Española de Microbiología. Grupo de Microbiología de Alimentos (<http://higiene.unex.es/grupoali/>)
- Agencia Española de Seguridad Alimentaria y Nutrición (AESAN) (<http://www.aesan.msc.es/>)
- Agència Catalana de Seguretat Alimentària (<http://www.gencat.cat/salut/acsa/>)
- El portal de la Unión Europea. Seguridad Alimentaria (http://europa.eu/pol/food/index_es.htm)
- ICMSF The International Commission on Microbiological Specifications for Foods (ICMSF) (<http://www.icmsf.org/>)

Microbes in food and drink, Micro-Encyclopedia, Society for General Microbiology

(http://www.socgenmicrobiol.org.uk/micro_encyc/default.cfm)

Panel de Riesgos Biológicos (BIOHAZ) de la Autoridad Europea de Seguridad Alimentaria (EFSA)

(<http://www.efsa.europa.eu/en/panels/biohaz.htm>)

The European scientific journal devoted to the epidemiology, surveillance, prevention and control of communicable diseases (http://ec.europa.eu/food/food/biosafety/tse_bse/index_en.htm)

Legislación alimentaria. Agencia Española de Seguridad Alimentaria y Nutrición

(http://www.aesan.msps.es/AESAN/web/legislacion/seccion/especifica_ambito_alimentario.shtml)

Normas alimentarias del Codex Alimentarius FAO-OMS (http://www.codexalimentarius.net/web/index_es.jsp)

Compendi de peix i productes de la pesca: Processos, Riscos i Controls. National Seafood HACCP Alliance for Training and Education. USA. (<http://seafood.ucdavis.edu/haccp/compendium/compend.htm>)

Llibres online accessibles desde els ordinadors connectats a la xarxa UAB:

<http://www.knovel.com/web/portal/browse/subject/60/filter/0/>

Scientific journals:

Applied Microbiology and Biotechnology. Springer (

<http://www.springer.com/life+sciences/microbiology/journal/253>)

- European Food Research and Technology. Springer (link.springer.com/journal/217)

- Food Control. Elsevier (<http://www.journals.elsevier.com/food-control/>)

Food Microbiology. Elsevier (<http://www.journals.elsevier.com/food-microbiology/>)

International Journal of Food Microbiology. Elsevier (

<http://www.journals.elsevier.com/international-journal-of-food-microbiology/>)

- Journal of Dairy Science. ScienceDirect (<http://www.journalofdairyscience.org>)