Universitat Autònoma de Barcelona

2019/2020

Food Microbiology

Code: 101005
ECTS Credits: 6

Degree	Type	Year	Semester
2500502 Microbiology	OB	3	1

Contact

Name: Antonio Solé Cornellá
Email: Antoni.Sole@uab.cat

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, a nuclear course from the degree of Microbiology, which introduces students to the Food Microbiology. The achievement of the competencies of the course will allow students to 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.

Competences

- 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 and rapid methods.

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

Unit 6. Advanced techniques I.
Methods of counting of microorganisms. Presence / absence methods. Basic techniques of characterization and identification.

Unit 7. Advanced techniques II.

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

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 in 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 wikiproject 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 lectures, the 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 wikiproject 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.

-Wikiproject. The students, divided into groups (4-5), must publish an informative article on the Viquipèdia open platform. The articles will be related to class themes, previously selected, that will be discussed in common and subsequently evaluated. In this sense, the first day of these methodological classes the 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 Forums.

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 (C3-337), at times previously agreed bye-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 classroom. 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 classes and Viquiproject	15	0.6	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Theoretical lectures	30	1.2	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 11
Type: Supervised			
Tutorial	3	0.12	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Type: Autonomous			
Bibliography research	12	0.48	9, 12, 11

Forums discussion	4	0.16	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Preparation of Viquiproject	20	0.8	9, 12, 11
Study	47	1.88	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 11
Text reading	15	0.6	9, 12, 11

Assessment

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 classes and wikiproject (40 % of the final grade): Different activities will be taking into account: Methodological class activities (10 % of the global mark); Informative article delivery to the Viquipèdia (20 % of the global mark). Students should: 1.-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; and 2.-create or update an informative article on the same subject to publish it on the Viquipèdia open platform. In this case, the suitability of the selected article to the awarded subject and the fulfillment of the criteria or guidelines to be followed by the students on how to do the wikiproject will be taken into account. Moreover, the contents, the capacity for synthesis and the scientific vocabulary used in the wikiproject. Any change in these criteria will be reported on the first day of class in this module; Questionnaire concerning wikiproject (10 % of the global mark). This questionnaire includes multiple choice and true or false questions about the viquipèdia articles worked and discussed in the classroom.

In theoretical and methodological classes and wikiproject are taken into account the punctuality and attitude of the student. In any case, this assessment does not entail an increase of the mark 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 coordinator 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.

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). To be able to attend this exam it is necessary that the student has been previously evaluated of continuous evaluation activities equivalent to 2/3 (67 %) of the final mark. The re-assessment of the theory module will be done in a single written test including multiple choice and short questions. On the other hand, the re-assessment of the methodological classes and wikiproject module will be done in a questionnaire with multiple choice and true/false questions. 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.

The student will be graded as "No Avaluable" if the weighting of all conducted evaluation activities is less than 67% of the final score.

Students who wish to improve the final grade of the course (theory and/or methodological classes and wikiproject) 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.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Methodological classes and Wikiproject: Informative article delivery to the Viquipèdia	20	0	0	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Methodological classes and Wikiproject: Resolution of Methodological activities	10	0	0	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Methodological classes and viquiproject: Questionnaire with multiple choice and true/false questions	10	0	0	7, 8, 1, 3, 2, 4, 5, 6, 9, 10, 12, 11
Theoretical classes: Questionnaire with multiple choice questions	48	3.2	0.13	7, 8, 1, 3, 2, 4, 5, 6, 10, 11
Theoretical classes: Questionnaire with short questions	12	0.8	0.03	7, 8, 1, 3, 2, 4, 5, 6, 10, 11

Bibliography

Text books:-

- Frazier, WC., Westhoff, DC. 2003. Microbiologia 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.

- Martín A., Béjar V., Gutierrez J.C., Llagostera M., Quesada E. 2019. Microbiología Esencial. 1ª edición. Editorial Médica Panamericana. ISBN: 9788498357868.

- 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 accesibles 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)