

Syllabus

Course Description

Course Title	Biology of Microorganisms and Secondary Metabolites
Course Code	40455
Course Title Additional	
Scientific-Disciplinary Sector	
Language	Italian
Degree Course	Bachelor in Food and Enogastronomy Sciences
Other Degree Courses (Loaned)	
Lecturers	Prof. Raffaella Di Cagno, Raffaella.DiCagno@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/37608 Prof. Youry Pii, Youry.Pii@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33704
Teaching Assistant	
Semester	Second semester
Course Year/s	1st
CP	8
Teaching Hours	48
Lab Hours	32
Individual Study Hours	120
Planned Office Hours	24
Contents Summary	Biology and Biotechnology of Food Microorganisms (6 credits EN): The part of the course dealing with the biology of food related microorganisms covers the elements of biology, cytology and biochemistry of microorganisms, the more technical aspects of cultivation, growth, isolation and identification of microorganisms and their taxonomic classification; The part of the course dealing with the biotechnology of food

	microorganisms covers aspects of microbial ecophysiology, the determination and control of microorganisms in food, as well as the distribution of microorganisms in food as well as the distribution of spoilage and pathogenic microorganisms in plant- and animal based food. Secondary metabolites (2 credits EN): This course deals with the definition and role of secondary metabolites in food, considering, mainly focusing on their functions in terms of health benefits. Emphasis will be placed on understanding key classes of metabolites, including alkaloids, flavonoids, terpenes, glucosinolates, and tannins, with examples from plant and fungal sources. Case studies will illustrate how these metabolites enhance product quality and offer functional health benefits.
Course Topics	Biology of Microorganisms 1. Principles of prokaryotic cell biology: morphology, genome organization and expression, cytology, chemotaxis. Cell structure of eukaryotes. 2. Viruses, in particular bacteriophages. 3. Biochemical and bioenergetic bases of microbial metabolism. Primary and secondary metabolic processes. Respiration, fermentation and regulation of microbial metabolism. 4. Basic methods in microbiology. Microbial growth kinetics. 5. Principles of microbial taxonomy. Biotechnology of Microorganisms 1. Ecophysiology of microorganisms: intrinsic and extrinsic factors in food that influence microbial growth. 2. Microorganisms in food (e.g. meat and poultry, eggs, milk, fresh plant products) 3. Basic methods for determining microorganisms in food. 4. Control of microorganisms in food: (e.g. use of chemicals, low and high temperatures)
Keywords	Cell biology; Food microorganisms; Ecophysiology; Determination of the number of microorganisms; Control of microorganisms
Recommended Prerequisites	
Propaedeutic Courses	None
Teaching Format	Lectures and laboratory activities. Recording of lectures. Group activities among participants (collaborative problem solving).

Mandatory Attendance	No
Specific Educational Objectives and Learning Outcomes	Knowledge and understanding: Upon completion of their studies, graduates with a bachelor's degree in Food and Enogastronomy Sciences will have acquired a solid foundation of scientific knowledge in disciplines such as chemistry, physics, biology, mathematics, computer science, and law, specifically applied to the food and gastronomic sector. They will gain technological skills for managing production and transformation processes, along with an integrated view of the quality, safety, and sustainability of food supply chains and systems. In addition, graduates will understand the principles related to waste reduction, resource optimization, and the reconciliation of economics and ethics, which are central elements for addressing the modern challenges of the agri-food system. The knowledge and understanding skills mentioned above are acquired through participation in lectures, practical exercises, seminars, and through guided personal study and individual study as provided by the activated educational activities. The verification of the achievement of learning outcomes is mainly carried out through exams and any interim tests. The tests may be written and/or oral, and may also consist of reports and oral presentations of projects or seminars. Ability to apply knowledge and understanding: Students will be able to practically apply the knowledge they have acquired, developing the ability to solve complex problems in the food and gastronomic sector. Thanks to a wide range of practical activities, such as laboratories, internships, workshops, and seminars, they will be able to use chemical, physical, sensory, and microbiological analysis methods to evaluate the quality and safety of food and production processes. The achievement of the ability to apply knowledge is accomplished through critical reflection on the texts proposed for individual study, stimulated by classroom activities, the study of research and application cases presented by the professors, the performance of practical laboratory exercises, fieldwork, bibliographic research, the completion of individual and/or group projects included in the core and elective courses of the curriculum, as well as during internships and the preparation of the final exam. The

	assessments, carried out through written and/or oral exams, reports, and exercises, involve the completion of specific tasks in which the student demonstrates mastery of tools, methodologies, and critical autonomy. During internships, the assessment is conducted through the presentation of a report by the student to the supervising professor. Making judgements: Evaluate and critically analyze the quality, safety, and sustainability of production processes and food products, considering scientific, technological, economic, and cultural aspects. Students will be able to make informed decisions based on scientific data and the analysis of production contexts to ensure the excellence of the final product. Apply ethical and sustainable approaches, reconciling economic needs with environmental and social requirements. Graduates will be able to identify solutions to reduce waste, enhance by-products, and optimize resource use, proposing food production models in line with the principles of the circular economy. Communication skills: Communicate effectively and appropriately with both technical and non-technical interlocutors, including professionals in the food and gastronomic sector, public and private institutions, and the general public. This includes the ability to adapt the communication style based on the audience, using the specific technical language of the food and gastronomic sector when necessary. Present and discuss the results of their analyses and research in both written and oral form, using technological and multimedia tools. Graduates will be able to draft technical reports, research papers, and scientific documents, as well as present their results clearly and structured, for example during conferences, seminars, or business meetings. Actively participate in discussions and group work in multidisciplinary and international contexts, demonstrating active listening, negotiation, and collaboration skills. Practical experiences and internships will provide students with the abilities to work effectively in teams and contribute to solving complex problems in the sector. Use the three languages of instruction of the course (Italian,
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	German, and English) fluently and confidently, both for written and oral communication. Thanks to the trilingual approach of the Free University of Bozen-Bolzano, graduates will be able to face international work contexts, participate in global networks, and contribute to the development of international cooperation projects to address the challenges of the food and gastronomic sector. Learning skills: At the end of the degree program, graduates will have developed strong learning skills, essential for successfully continuing academic studies and entering the workforce. In particular, they will be able to: Learn autonomously and continuously, keeping up to date with scientific and technological advancements in the food and gastronomic sector. Graduates will have acquired study methods and research tools that will allow them to independently update their skills, critically interpreting new knowledge. Effectively manage the learning of complex concepts by integrating the various scientific and technical disciplines covered in the degree program, such as chemistry, biology, food technologies, economics, and law. They will be able to identify the most relevant sources, understand and apply new methodologies, and adapt to sector developments. Develop collaborative learning strategies, thanks to the experience gained through group work, internships, and laboratory activities. Graduates will be able to share their knowledge and learn from others, demonstrating adaptability and teamwork skills. Continue their studies independently in Master's degree programs (such as the LM-70 class, Food Science and Technology, currently offered at the same university) or in other related fields, using the skills and methods acquired during the bachelor's degree to tackle new learning challenges, even in high-level academic and professional contexts.
Specific Educational Objectives and Learning Outcomes (additional info.)	
Assessment	The assessment consists of two separate written tests, one for each module, including questions designed to assess the

	knowledge and skills acquired during the course, including those developed through laboratory activities. The final grade will be calculated as the credit-weighted average of the grades obtained in the two modules.
Evaluation Criteria	Clarity of responses and appropriate vocabulary, ability to summarize, relevance of topics covered and ability to elaborate.
Required Readings	The lecturer will provide specific material (PowerPoint presentations) for each topic covered in the course. Lecture notes are strongly recommended as study material.
Supplementary Readings	BROCK, Biologia dei Microrganismi - Microbiologia generale, ambientale e industriale. XIV edizione (Eds. M.T. Madigan, J.M. Martinko, K.S. Bender, D. H., Buckley, D. A. Stahl). Microbiologia dei Prodotti Alimentari. G.A. Farris, M. Gobbetti, E. Neviani e M. Vincenzini, Casa Editrice Ambrosiana (2012).
Further Information	
Sustainable Development Goals (SDGs)	Responsible consumption and production, Good health and well-being

Course Module

Course Constituent Title	Biology and Biotechnology of Food Microorganisms
Course Code	40455A
Scientific-Disciplinary Sector	AGRI-08/A
Language	Italian
Lecturers	Prof. Raffaella Di Cagno, Raffaella.DiCagno@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/37608
Teaching Assistant	
Semester	Second semester
CP	6
Responsible Lecturer	
Teaching Hours	36
Lab Hours	24
Individual Study Hours	90

Planned Office Hours	18
Contents Summary	The part of the course dealing with the biology of food related microorganisms covers the elements of biology, cytology and biochemistry of microorganisms, the more technical aspects of cultivation, growth, isolation and identification of microorganisms and their taxonomic classification. The part of the course dealing with the biotechnology of food microorganisms covers aspects of microbial ecophysiology, the determination and control of microorganisms in food, as well as the distribution of microorganisms in food as well as the distribution of spoilage and pathogenic microorganisms in plant- and animalbased food.
Course Topics	
Teaching Format	As reported in general course description
Required Readings	As reported in general course description
Supplementary Readings	

Course Module

Course Constituent Title	Secondary Metabolites
Course Code	40455B
Scientific-Disciplinary Sector	CHEM-07/B
Language	Italian
Lecturers	Prof. Youry Pii, Youry.Pii@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/33704
Teaching Assistant	
Semester	Second semester
CP	2
Responsible Lecturer	
Teaching Hours	12
Lab Hours	8
Individual Study Hours	45
Planned Office Hours	6

Contents Summary	This course deals with the definition and role of secondary metabolites in food, considering, mainly focusing on their functions in terms of health benefits. Emphasis will be placed on understanding key classes of metabolites, including alkaloids, flavonoids, terpenes, glucosinolates, and tannins, with examples from plant and fungal sources. Case studies will illustrate how these metabolites enhance product quality and offer functional health benefits.
Course Topics	Definition of secondary metabolites Basics of secondary metabolism Main categories of secondary metabolites: Alkaloids; Flavonoids; Terpenes; Glucosinolates; and Tannins Traditional vs. biotechnological methods for the production of secondary metabolites Application in food industry
Teaching Format	The course combines lectures, and laboratory activities: Lectures: frontal lessons in which the main topics are presented and discussed. Lectures are highly participatory, and students are expected to engage actively through questions, discussions, and in-class exercises. Practical and laboratory sessions : hands-on activities aimed at applying and consolidating theoretical knowledge. Teaching materials will be presented mainly through PowerPoint slides. All slides will be uploaded in advance on the Microsoft Teams platform, ensuring that students can access them before class. All the frontal lectures will be recorded and made available on the Microsoft Teams platform.
Required Readings	Power Point slides used for the frontal lectures and scientific literature supplied by the teacher during the course
Supplementary Readings	