

**COURSE OF STUDY** Bachelor degree: Food Science and Technology (L-26)

**ACADEMIC YEAR** 2023-2024

**ACADEMIC SUBJECT** Ecophysiology and Control of food-related microorganisms (6 ECTS) - I.C. Biology and Ecophysiology of Food-related microorganisms (9 ECTS)

General information	
Year of the course	<i>Il anno</i>
Academic calendar (starting and ending date)	<i>Il semester 26/02/2024 – 21/06/2024</i>
Credits (CFU/ETCS):	<i>6</i>
SSD	<i>Agri-food microbiology AGR/16</i>
Language	<i>Italian</i>
Mode of attendance	<i>facultative</i>

Professor/ Lecturer	
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Department and address	<i>University Campus Ernesto Quagliariello Department of Soil Plant and Food Sciences via Amendola 165/a, Bari (ex-Agricultural Faculty) III floor, Room 16</i>
Virtual room	<i>Microsoft Teams 6getx1g (for tutoring)</i>
Office Hours (and modalities: e.g., by appointment, online, etc.)	<i>From Monday to Friday 9:00 to 18:00 by appointment agreed by telephone or by e-mail or Teams</i>

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
<i>150</i>	<i>32</i>	<i>28</i>	<i>90</i>
CFU/ETCS			
<i>6</i>	<i>4</i>	<i>2</i>	

<b>Learning Objectives</b>	<i>The course aims to provide knowledge on the aspects of microbial ecophysiology and on the control of food microorganisms, as well as on the main laboratory techniques for the determination of the microorganisms of interest in food (beneficial, pathogens and spoilages) knowing how to interpret the analytical result.</i>
<b>Course prerequisites</b>	<i>The course does not include prerequisites. However, for the purposes of a more profitable learning of some contents of the course, the basic knowledge acquired in the first year of the course of study in mathematics and chemistry and those of the second year of C.I. General and food biochemistry are required</i>

<b>Teaching strategie</b>	<i>To achieve the educational objectives of this teaching, theoretical lessons (about</i>
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	32 hours) and laboratory lessons (about 28 hours), also in the form of exercises, are used. The lessons use illustrative material proposed in the classroom in the form of slides, all made available to students. Short videos will also be screened, the references of which are included in the teaching material provided. The teaching course is not delivered in "e-learning" mode. The laboratory activities are designed to guide students in the acquisition of basic and advanced techniques and in the development of operational skills essential for the microbiology laboratory in the field of food science and technology
<b>Expected learning outcomes in terms of</b>	
<b>Knowledge and understanding on:</b>	In compliance with the educational objectives qualifying the class, at the end of the course on "Ecophysiology and control of microorganisms in food" the student must be able to: <ul style="list-style-type: none"> <li>• describe the influence of environmental factors on the development, survival, death, and distribution of microorganisms in foods.</li> <li>• know the main strategies for the control of microorganisms.</li> <li>• describe the main methods of investigation of microbiology in the field of food science.</li> <li>• know and evaluate the significance of the presence of microorganisms in food products</li> </ul>
<b>Applying knowledge and understanding on:</b>	At the end of the course the student should be able to: <ul style="list-style-type: none"> <li>• Apply the fundamental techniques of studying microorganisms based on microbial cultivation and isolation.</li> <li>• Set up a microbial quantitative analysis starting from the sampling phase up to the expression of the number of microorganisms per sample unit.</li> <li>• Apply strategies to control the growth, survival, and mortality of microorganisms.</li> <li>• evaluate the potential role of microorganisms in food technologies</li> </ul>
<b>Soft skills</b>	<p><b>Judgment autonomy</b> At the end of the course the student should be able to</p> <ul style="list-style-type: none"> <li>○ Acquire the information necessary to evaluate the potential role of microorganisms in food technologies and for their determination.</li> <li>○ Propose interventions aimed at optimizing microbial functions in systems of food interest.</li> <li>○ Acquire the information necessary to determine the presence and number of microorganisms.</li> <li>○ Acquire information on the distribution of microorganisms, in order to evaluate their implications in a production and market context and to implement interventions aimed at improving the quality and efficiency of food production.</li> </ul> <p><b>Communication skills</b> At the end of the course the student should be able to</p> <ul style="list-style-type: none"> <li>○ uses a terminology appropriate to the discussion of the fundamental issues of microbiology and to the description of the importance of microbial functions in food systems</li> <li>○ communicates information on microbiological aspects in relation to food transformation processes and global quality management</li> <li>○ describes the most important growth and survival control methods, the role of ecophysiological parameters, and the main methods of investigation in microbiology in the field of industrial technologies</li> </ul> <p><b>Ability to learn independently</b></p>

	<p>At the end of the course the student should be able to:</p> <ul style="list-style-type: none"> <li>o learns and update the cultural and operational tools necessary to evaluate the potential role of microorganisms in food technologies</li> <li>o update and deepen one's knowledge on the aspects of ecophysiology and control of microorganisms in food by studying scientific publications in the microbiological sector</li> </ul>
<b>Syllabus</b>	
<b>Content knowledge</b>	<p>Ecophysiology of microorganisms in foods          Intrinsic, extrinsic, and implicit factors that influence the growth, survival, and death of microorganisms. Responses of environmental adaptation          The control of microorganisms in foods          Use of chemicals, heat treatments, high pressures, microfiltration, electric fields, irradiation, intermediate humidity, and enzymes. Hurdle theory          The determination of microorganisms in foods          Direct and indirect methods for the enumeration of microorganisms in foods          Sources of microbial contamination in food          Microbial ecology of unfermented foods of animal and vegetable origin.</p> <p>The aim of the exercises is to show the student some techniques of microbial analysis of a food matrix. The laboratory equipment will be illustrated and instructions for the use of the main equipment in the microbiology laboratory will be provided. In the lab/practical activities, plate microbial count techniques using generic media for the enumeration and isolation of microorganisms will demonstrate, assays to analyse microbial growth in tubes and plates, and culture preservation methods. Furthermore, methods to carry out a preliminary identification of microorganisms will be presented. Optical microscopy for the analysis of cell morphology and cell staining techniques will be presented.</p>
<b>Texts and readings</b>	<ul style="list-style-type: none"> <li>• Lecture notes and lecture materials provided during the course.             <ul style="list-style-type: none"> <li>• Coccolin L., Gobbetti M., Neviani E. “Microbiologia alimentare applicata”. Casa Editrice Ambrosiana. Distribuzione Zanichelli. 2022.</li> <li>• Brock. Biologia dei microrganismi. Microbiologia generale, ambientale e industriale. Editore Pearson</li> <li>• Laboratorio didattico di microbiologia a cura di: Ann Vaughan, P. Buzzini, F. Clementi, Editore CEA</li> <li>• Jay, Loessner, Golden. Modern Food Microbiology. Food Science Text series. 2006</li> </ul> </li> </ul>
<b>Notes, additional materials</b>	Individual notes taken from lessons and exercises; presentations in pdf format provided on online platforms.
<b>Repository</b>	The teaching material is available on the Teams class and will remain available for at least three years after the delivery of the teaching
<b>Assessment</b>	
<b>Assessment methods</b>	<p>The exam consists of an oral dissertation on the topics developed during the hours of theoretical and theoretical-practical lessons in the classroom and in the laboratory as reported in the Educational Regulations of the Degree Course in Food Science and Technology (art. 9) and in the study plan (attachment A).</p> <p>The exam consists of three or four questions posed to each candidate. The exam has a total duration of about 30 minutes. The final evaluation is expressed in thirtieths. The profit exam for foreign students can be carried out in English.</p> <p>Students enrolled in the year of the course in which the teaching is carried out, have a middle-term preliminary exam, consisting of a written test, relative to the first part of the program, which will concur to the final evaluation and will be considered valid for one academic year (Art. 4 of the Didactic Regulations of the</p>

	<p>bachelor's degree Course in Food Science and Technology). The middle-term preliminary exam consists of a written test (multiple choice questions and open questions) on topics developed by the date of the test. The result of the mid-term exam is communicated by publication and contributes to the assessment of the profit examination by means of calculation of the weighted average. The exam will be evaluated out of thirty and in case of a positive outcome, in the final oral exam the interview will focus on the remaining part of the teaching contents. Ongoing test models of previous sessions will be made available to students.</p>
Assessment criteria	<ul style="list-style-type: none"> <li>• Knowledge and understanding <ul style="list-style-type: none"> <li>o Ability to discursively organize the knowledge of the main growth control strategies and of the basic techniques of microbiology</li> <li>o Describe the meaning of the presence of microorganisms in food products as well as their distribution in foods of plant and animal origin treated in class</li> </ul> </li> <li>• Applied knowledge and understanding <ul style="list-style-type: none"> <li>o ability to discursively organize the knowledge of the potential of microorganisms in relation to the aspects of microbial ecophysiology and the main techniques for the determination and control of food microorganisms</li> <li>o ability to describe the microbiological analysis of a food product and interpret the analytical result</li> </ul> </li> <li>• Making judgments <ul style="list-style-type: none"> <li>o critical reasoning skills in describing the potential role of microorganisms in food technologies</li> <li>o ability to evaluate the implications of microorganisms in a production and market context to implement interventions aimed at improving the quality and efficiency of food production</li> </ul> </li> <li>• Communication skills <ul style="list-style-type: none"> <li>o Quality of exposure, competence, and use of specialized vocabulary in describing microbial growth and the factors that influence and control it, the main microbiological aspects of foods and basic microbiological techniques justifying the statements on the topics.</li> </ul> </li> </ul>
Final exam and grading criteria	<p>The assessment of the student's preparation is based on predetermined criteria in accordance with the Didactic Regulations of the bachelor's degree Course in Food Science and Technology (art. 4).</p> <p>The Examination Committee has a score ranging from a minimum of 18 to a maximum of 30 points for a positive assessment of the student's performance. By unanimous vote of its members, the Board may award honours in cases where the final mark is 30.</p>
<b>Further information</b>	
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