

COURSE OF STUDY *Master degree: Food Science and Technology (LM70)*
ACADEMIC YEAR *2023-2024*
ACADEMIC SUBJECT *Advanced Microbiological Methods (3 ECTS) - I.C. Methodologies for Food Quality (9 ECTS)*

General information	
Year of the course	<i>1 year</i>
Academic calendar (starting and ending date)	<i>1 semester (September 25th, 2023 – January 19th, 2024)</i>
Credits (CFU/ETCS):	<i>3</i>
SSD	<i>Agricultural 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>75</i>	<i>16</i>	<i>14</i>	<i>45</i>
CFU/ETCS			
<i>3</i>	<i>2</i>	<i>1</i>	

Learning Objectives	<i>The course aims to provide knowledge about the main molecular techniques for the identification, typing and ex-situ and in-situ monitoring of starter, spoilage, and pathogenic microorganisms in foods with the aim of monitoring the quality and safety during the transformation processes and storage.</i>
Course prerequisites	<i>the course does not include prerequisites. However, for the purposes of a more profitable learning of some course contents, the basic knowledge acquired in the three-year study course in the field of General Microbiology and Food and Genetics is necessary.</i>

Teaching strategie	To achieve the educational objectives of this teaching, theoretical lessons (about 16 hours) and laboratory lessons (about 14 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 advanced techniques and in the development of operational skills essential for the microbiology laboratory in the field of food science and technology
Expected learning outcomes in terms of	
Knowledge and understanding on:	In compliance with the educational objectives qualifying the class, at the end of the course the student must be able to: <ul style="list-style-type: none"> ● Apply advanced techniques for the study of microorganisms based on independent culturomics and culture approaches ● Set up an ex-situ and in-situ identification, typing and monitoring analysis of starter, spoilage and pathogenic microorganisms in foods ● monitor food quality and safety related to the presence of microorganisms during transformation and conservation processes ● Set up an analysis aimed at identifying the microorganisms on a phenotypic and genetic basis
Applying knowledge and understanding on:	At the end of the course the student should be able to: <ul style="list-style-type: none"> ● Apply advanced techniques for the study of microorganisms based on independent culturomics and culture approaches ● Set up an ex-situ and in-situ identification, typing and monitoring analysis of starter, spoilage and pathogenic microorganisms in foods ● monitor food quality and safety related to the presence of microorganisms during transformation and conservation processes ● Set up an analysis aimed at identifying the microorganisms on a phenotypic and genetic basis
Soft skills	<p>Judgment autonomy</p> <p>At the end of the course the student should be able to</p> <ul style="list-style-type: none"> ● Acquires the information necessary to evaluate the potential role of microorganisms in food technologies and for their determination through advanced methodologies ● Acquires the information necessary to determine the presence, number and function of microorganisms ● Acquires 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 ● correctly orient the search for classical or advanced microbiological methodologies suitable for monitoring the characteristics and quality of food products <p>Communication skills</p> <p>At the end of the course the student should be able to</p> <ul style="list-style-type: none"> ● uses terminology appropriate to the discussion of advanced methodologies in microbiology and to the description of the importance of identification, typing and monitoring of microorganisms in food systems

	<ul style="list-style-type: none"> communicate the use of advanced microbiological methodologies in quality management and food safety systems and the verification of their effectiveness. <p>Ability to learn independently At the end of the course the student should be able to:</p> <ul style="list-style-type: none"> o learns and update the cultural and operational tools necessary to evaluate the potential role of microorganisms in food technologies o update and deepen one's knowledge on methodologies for monitoring microorganisms in food by studying scientific publications in the microbiological sector
Syllabus	
Content knowledge	<p>Application of the principles of genetics and microbiology in the phylogenetic, taxonomic and identification study of starter, spoilage and pathogenic microorganisms in food.</p> <p>Strategies for the use of classical or genetic-molecular investigation methodologies in the microbiological analysis of foods</p> <p>Culture-dependent techniques</p> <p>Identification of microorganisms by phenotypic methods</p> <p>Identification of microorganisms by genotypic methods</p> <p>Extraction and quantification of nucleic acids</p> <p>Polymerase Chain Reaction</p> <p>Electrophoresis of nucleic acids</p> <p>Species-specific identification methods.</p> <p>Sequencing of the 16S rDNA gene</p> <p>Molecular hybridization and applications</p> <p>Typing methods; Ribotyping; RAPD (Random Amplified Polymorphic DNA); repPCR (Repetitive Element Sequence Based PCR).</p> <p>Non-cultivable biodiversity: culture-independent techniques.</p> <p>Study of microbial populations</p> <p>Microscopy techniques</p> <p>Real-time PCR</p> <p>Next Generation Sequencing; general information on metagenomics.</p> <p>Application examples of identification, typing and monitoring of starter, spoilage and pathogenic microorganisms in foods</p> <p>The aim of the exercises is to show the student some techniques for the identification, typing and monitoring of starter, spoilage and pathogenic microorganisms in foods through the use of advanced microbiological methods based on phenotypic and genetic tests. The laboratory equipment will be illustrated and instructions for the use of the main equipment will be provided. In the practical / laboratory activities some molecular methods will be illustrated: (a) Extraction of total DNA from microbial broth culture and food matrix, (b) PCR reaction on the 16S rRNA gene – (c) Observation of the profiles on agarose gel by running electrophoretic – (d) Analysis of the 16S rRNA gene sequences obtained, by comparison in the database.</p>
Texts and readings	<p>Lecture notes and lecture materials provided during the course.</p> <ul style="list-style-type: none"> Cocolin L., Gobbetti M., Neviani E. "Microbiologia alimentare applicata". Casa Editrice Ambrosiana. Distribuzione Zanichelli. 2022. Persing et al. MOLECULAR MICROBIOLOGY Diagnostic Principles and Practice 2nd Edition

	<ul style="list-style-type: none"> • Laboratorio didattico di microbiologia a cura di: Ann Vaughan, P. Buzzini, F. Clementi, Editore CEA • Jay, Loessner, Golden. Modern Food Microbiology. Food Science Text series. 2006
Notes, additional materials	Individual notes taken from lessons and exercises; presentations in pdf format provided on online platforms.
Repository	The teaching material is available on the Teams class and will remain available for at least three years after the delivery of the teaching

Assessment	
Assessment methods	<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 Master 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 master'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"> • Knowledge and understanding <ul style="list-style-type: none"> o Ability to discursively organize the knowledge of the main advanced methodologies used today in modern analysis and research laboratories for monitoring the microbial groups of relevance in the food sector o Describe the significance of the presence of microorganisms in food products • Applied knowledge and understanding <ul style="list-style-type: none"> o Ability to set up the use of the main molecular techniques for the identification, typing and in situ and ex situ monitoring of starter, spoilage and pathogenic microorganisms in the foods o ability to set up the microbiological analysis of a food product using advanced methodologies and interpret the analytical results • Making judgments <ul style="list-style-type: none"> o critical reasoning skills in describing the main advanced methodologies applicable for the study of the potential role of microorganisms in food technologies 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

	<p>o ability to research classic or advanced microbiological methodologies suitable for monitoring the characteristics and quality of food products presented as case studies</p> <ul style="list-style-type: none"> • Communication skills <p>o Quality of exposure, competence, and use of specialized vocabulary in describing advanced microbiological techniques, motivating the statements on the topics</p> <ul style="list-style-type: none"> • Ability to learn <p>Hypothesize an operational approach for the determination, identification, typing and monitoring of microorganisms in food systems. Knowing how to autonomously identify the sources for the search for solutions regarding the microbiological aspects of food.</p>
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 Master's degree Course in Food Science and Technology (art. 4). 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>
Further information	