Syllabus

Course Description

Course Title	Molecular Methods to Investigate the Microbial Diversity and Functionality
Course Code	46091
Course Title Additional	
Scientific-Disciplinary Sector	AGRI-08/A
Language	English
Degree Course	PhD Programme in Food Engineering and Biotechnology
Other Degree Courses (Loaned)	
Lecturers	dr. Alessandra Gasparini, Alessandra.Gasparini@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/45604
Teaching Assistant	
Semester	First semester
Course Year/s	1
CP	3
Teaching Hours	30
Lab Hours	0
Individual Study Hours	45
Planned Office Hours	9
Contents Summary	This course introduces fundamental molecular techniques used for the identification of microorganisms inhabiting diverse ecosystems, with particular emphasis on fermented foods and the gut microbiota. The course also explores methods for characterizing microbial metabolic activities that influence their functional roles within these environments. Selected case studies will be examined and critically discussed, with reference to relevant scientific literature.
Course Topics	The course will start with an overview on the fundamentals DNA

	and RNA. The principal techniques and challenges associated with the isolation and purification of DNA and RNA from various biological sources will be discussed. The principles and application of gel electrophoresis analysis for DNA and RNA fragments separation will be presented, including denaturing gradient gel electrophoresis (DGGE) analysis and pulsed-field gel electrophoresis (PFGE) analysis for DNA fingerprinting and for studying the diversity of the microbial community. Gene sequencing and Polymerase Chain Reaction (PCR)-based methods will be explored, fundamentals of DNA and RNA sequences amplification along with different techniques developed will be discussed. Principles of Amplified ribosomal DNA restriction analysis (ARDRA), PCR-Restriction analysis (PRA-PCR), Random Amplified Polymorphic DNA-PCR (RAPD-PCR), and Real Time-PCR (qPCR) will be included. Through the course, case studies will be presented to show the applications of the principles and the methods discussed for the investigation of microbial diversity and functionality in various research topics.
Keywords	DNA fingerprinting, amplification, sequencing,
Recommended Prerequisites	Basic knowledge of molecular biology and microbiology
Propaedeutic Courses	no
Teaching Format	frontal lectures
Mandatory Attendance	compulsary
Specific Educational Objectives and Learning Outcomes	Knowledge and understanding of the principles, strengths, and limitations of various molecular methods for studying microbial diversity and functionality. Applying knowledge and understanding to effectively select and apply appropriate molecular techniques to address specific research questions in microbial ecology, food safety, or biotechnology. Making judgments to critically evaluate experimental designs and interpret results from molecular analyses, drawing sound conclusions regarding microbial populations and their activities. Communication skills to clearly communicate scientific findings and methodologies using language pertinent to this field.

	Learning skills to effectively master the fundamental concepts of the principal molecular techniques applied for microbial investigation.
Specific Educational Objectives and Learning Outcomes (additional info.)	N/A
Assessment	Student preparation is evaluated through an oral examination, encompassing three components: (i) the presentation of a scientific work by the students, focusing on course topics that could also be extended to other domains of food engineering or biotechnology, (ii) inquiries aimed at assessing their knowledge and understanding of the course material, and (iii) questions designed to evaluate their capacity to apply acquired skills to real-world case studies.
Evaluation Criteria	Criteria for evaluation include the clarity of responses, appropriateness of vocabulary, ability to synthesize information, relevance of addressed topics, and capacity for elaboration.
Required Readings	Molecular Biology (5th edition), Robert F Weaver, McGraw-Hill Education, 978-0073525327. Molecular Techniques in Food Biology, El Sheika AF, Levin R, Jianping X, Wiley, 978-1-119-37460-2.
Supplementary Readings	N/A
Further Information	N/A
Sustainable Development Goals (SDGs)	Quality education