Syllabus

Descrizione corso

Titolo insegnamento	Starter and functional microbes for innovation, authenticity and healthy status
Codice insegnamento	44761
Titolo aggiuntivo	
Settore Scientifico-Disciplinare	
Lingua	Inglese
Corso di Studio	Corso di laurea magistrale in Scienze degli alimenti per l'innovazione e l'autenticità
Altri Corsi di Studio (mutuati)	
Docenti	prof. Marco Gobbetti, Marco.Gobbetti@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/32209 prof. Andrea Polo, Andrea.Polo@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/36646 prof. Raffaella Di Cagno, Raffaella.DiCagno@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/37608 dr. Olga Nikoloudaki, Olga.Nikoloudaki@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/38535
Assistente	
Semestre	Secondo semestre
Anno/i di corso	1st
CFU	12
Ore didattica frontale	72

Ore di laboratorio	48
Ore di studio individuale	180
Ore di ricevimento previste	42
Sintesi contenuti	The natural microbial starters for innovation and authenticity: criteria and tools for selecting and use microbial starters in food fermentations; examples of spontaneous fermentation and drivers affecting the fermentation; type of natural and commercial starters; examples of uses of selected microbial starters in cheeses, baked goods, fermented fruits/vegetables and functional foods. Computational analysis in food microbiomes: the module provides an introduction to the use of sequencing and data integration to study microbial ecosystems in food fermentations. The course covers the principles of 16S rRNA gene sequencing and shotgun metagenomics, alongside physicochemical measurements such as pH, acidity, and metabolite content. Using accessible platforms like MicrobiomeAnalyst, students will gain hands-on experience in microbiome profiling, diversity analysis, functional annotation, and integration of multi-source data. By the end of the course, they will be able to interpret and communicate results linking microbial communities to fermentation quality and functionality. The food: human axis for driving the gut microbiome: principles on the digestive system; gut microbiota composition and functionality; omics for investigating the gut microbiota/microbiome; observational and intervention studies on the effect of diet, fibres, polyphenols and food intolerances on the gut microbiota composition and functionality; gut-brain axis and cases of study on autism; how to carry out an intervention study on the gut microbiota/microbiome.
Argomenti dell'insegnamento	The topics of the modules are described in the section of each module
Parole chiave	The keywords of the modules are listed in the section of each module
Prerequisiti	
Insegnamenti propedeutici	None
Modalità di insegnamento	Traditional teaching in classroom; discussion and analyses of cases

	of study (scientific articles). Lab exercises will be in didactic laboratories and include the use of advanced analytical methods, and group activities among participants with collaborative solving of experimental questions.
Obbligo di frequenza	No
Obiettivi formativi specifici e risultati di apprendimento attesi	Knowledge and understanding: Knowledge of analytical methods for determining the authenticity, functionality, and microbiological safety of food products, as well as the related methodological tools for risk assessment. These knowledge areas will be developed through an educational program that integrates theoretical teaching activities with practical activities, such as laboratory exercises, computer simulations, simulations of food processes using pilot plants, and company visits. Ability to apply knowledge and understanding: Ability to manage the technological, microbiological, biochemical, chemical, and physical processes that drive food transformation and the main issues related to the stability and shelf life of food products. Ability to plan and develop analytical techniques, innovative products, and processes using a multidisciplinary approach, with particular attention to local food productions. Making judgements: Independent judgement is developed through a training programme designed to stimulate critical analysis in students. This includes the use of case studies, simulations using spreadsheets and videos, the reading and critical discussion of scientific articles, as well as specialist seminars held by experts in the food sector. The assessment of the independent judgement acquired by students is entrusted to the individual teachers responsible for the training activities, who will assess it through oral and/or written reports on specific topics and/or through exams. Communication skills: Use of the English language, both written and spoken, at a B2 level, with a command of technical and scientific vocabulary related to food science.

	Structure and draft scientific and technical documentation describing project activities. Learning skills: The degree course provides graduates with the cognitive skills, logical tools and familiarity with new information technologies necessary to ensure continuous updating of knowledge, both in their specific professional field and in the field of scientific research.
Obiettivi formativi specifici e risultati di apprendimento attesi (ulteriori info.)	
Modalità di esame	The assessment of the student preparation is through an oral exam. The oral assessment includes questions to assess the knowledge and understanding of the course topics and questions designed to assess the ability to transfer these skills to case studies and practical applications. Questions on practical applications also assess the ability of the student to apply the knowledge and understanding of the course topics, the ability to make judgments and finally, the student communication skills.
Criteri di valutazione	The evaluation criteria are described in the section of each module
Bibliografia obbligatoria	The required readings are indicated in the section of each module
Bibliografia facoltativa	
Altre informazioni	
Obiettivi di Sviluppo Sostenibile (SDGs)	Buona salute, Utilizzo responsabile delle risorse, Innovazione e infrastrutture

Modulo del corso

Titolo della parte costituente del corso	The natural microbial starters for innovation and authenticity
Codice insegnamento	44761A
Settore Scientifico-Disciplinare	AGRI-08/A
Lingua	Inglese
Docenti	prof. Raffaella Di Cagno, Raffaella.DiCagno@unibz.it

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Assistente	
Semestre	Secondo semestre
CFU	3
Docente responsabile	
Ore didattica frontale	18
Ore di laboratorio	12
Ore di studio individuale	45
Ore di ricevimento previste	9
Sintesi contenuti	The natural microbial starters for innovation and authenticity: criteria and tools for selecting and use microbial starters in food fermentations; examples of spontaneous fermentation and drivers affecting the fermentation; type of natural and commercial starters; examples of uses of selected microbial starters in cheeses, baked goods, fermented fruits/vegetables and functional foods.
Argomenti dell'insegnamento	The course will cover the following topics: - General criteria for starter selection and tools for selecting microbial starters (e.g., phenomics) - Spontaneous fermentation (sauerkrauts): advantages and limits - Natural starter (milk kefir), commercial and autochthonous starters - Case studies dealing with the use of starters in cheeses, fermented vegetables, functional foods, probiotics, and recycling of food by-products
Modalità di insegnamento	Traditional teaching in classroom; discussion and analysis of cases of study (scientific articles); lab activities and one external visit. Lab exercises will be in didactic laboratories and include the use of advanced analytical methods, and group activities among participants with collaborative solving of experimental questions.
Bibliografia obbligatoria	Slides of lesson provided by the lecturer and scientific articles
Bibliografia facoltativa	

Modulo del corso

Titolo della parte costituente del corso	Computational analysis in food microbiomes
Codice insegnamento	44761B
Settore Scientifico-Disciplinare	AGRI-08/A
Lingua	Inglese
Docenti	dr. Olga Nikoloudaki, Olga.Nikoloudaki@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/38535
Assistente	
Semestre	Secondo semestre
CFU	3
Docente responsabile	
Ore didattica frontale	18
Ore di laboratorio	12
Ore di studio individuale	45
Ore di ricevimento previste	9
Sintesi contenuti	Computational analysis in food microbiomes: the module provides an introduction to the use of sequencing and data integration to study microbial ecosystems in food fermentations. The course covers the principles of 16S rRNA gene sequencing and shotgun metagenomics, alongside physicochemical measurements such as pH, acidity, and metabolite content. Using accessible platforms like MicrobiomeAnalyst, students will gain hands-on experience in microbiome profiling, diversity analysis, functional annotation, and integration of multi-source data. By the end of the course, they will be able to interpret and communicate results linking microbial communities to fermentation quality and functionality.
Argomenti dell'insegnamento	Introduzione ai microbiomi degli alimenti fermentati e all'ecologia microbica Fondamenti del sequenziamento del DNA: amplicone 16S rRNA vs. metagenomica shotgun (panoramica teorica) Progettazione sperimentale e strategie di campionamento negli studi sul microbioma alimentare Flusso di lavoro dell'elaborazione dei dati dell'rRNA 16S (controllo qualità, ASV, assegnazione

	tassonomica) Analisi della diversità alfa e beta e interpretazione ecologica Analisi statistica e test di abbondanza differenziale Previsione funzionale dai dati 16S e limitazioni Integrazione dei dati del microbioma con i parametri fisico-chimici Visualizzazione dei dati, interpretazione e insidie analitiche comuni
Modalità di insegnamento	Le lezioni frontali (18 ore) e le attività di laboratorio (12 ore) comprenderanno solo la bioinformatica (basata sull'uso del computer).
Bibliografia obbligatoria	Introduzione alla bioinformatica in microbiologia Henrik Christensen (https://link.springer.com/content/pdf/10.1007/978-3-319-99280-8.pdf) **Bioinformatica: un'introduzione** Jeremy Ramsden (Ramsden, J. (2023). Bioinformatica: un'introduzione. Springer Nature.)
Bibliografia facoltativa	Callahan, B., McMurdie, P., Rosen, M. *et al.* DADA2: Inferenza ad alta risoluzione dei campioni dai dati degli ampliconi Illumina. *Nat Methods* **13**, 581–583 (2016). https://doi.org/10.1038/nmeth.3869

Modulo del corso

Titolo della parte costituente del corso	The food - human axis for driving the gut microbiome
Codice insegnamento	44761C
Settore Scientifico-Disciplinare	AGRI-08/A
Lingua	Inglese
Docenti	prof. Marco Gobbetti, Marco.Gobbetti@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/32209 prof. Andrea Polo, Andrea.Polo@unibz.it https://www.unibz.it/en/faculties/agricultural-environmental-food-sciences/academic-staff/person/36646
Assistente	
Semestre	Secondo semestre

CFU	6
Docente responsabile	
Ore didattica frontale	36
Ore di laboratorio	24
Ore di studio individuale	90
Ore di ricevimento previste	24
Sintesi contenuti	The Food – Human Axis for Driving the Gut Microbiome: principles on the digestive system; gut microbiota composition and functionality; omics for investigating the gut microbiota/microbiome; observational and intervention studies on the effect of diet, fibres, polyphenols and food intolerances on the gut microbiota composition and functionality; gut-brain axis and cases of study on autism; how to carry out an intervention study on the gut microbiota/microbiome.
Argomenti dell'insegnamento	Use of omics techniques and most advanced methods for investigating the gut microbiota composition and functionality; observational and intervention cases of study (publications) to modulate the gut microbiota composition and functionality; food intolerances; effects of fibers and polyphenols on the gut microbiota; gut-brain axis as mediated by the the diet and other factors; cases of study dealing with the autism; how to restore transient and permanent dysbiosis; how to carry out an intervention study on the gut microbiota/microbiome.
Modalità di insegnamento	Traditional teaching in classroom; discussion and analyses of cases of study (scientific articles). Lab exercises will be in didactic laboratories and include the use of advanced analytical methods, and group activities among participants with collaborative solving of experimental questions.
Bibliografia obbligatoria	Scientific articles and slides of lesson provided by the lecturers.
Bibliografia facoltativa	