# . – Food Microbiology

## Proff. Lorenzo Morelli-Daniela Bassi

## Mod. Food microbiology for food production

## Prof.lorenzo morelli

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

Course objective is to improve knowledge about the role played by microorganisms in the processing of food and beverage. The module (5 ECTS plus 1 lab-based ECTS) will be subdivided into three main parts. The first (1 ECTS) deals with microbial metabolisms involved in food fermentation, with a special attention paid to secondary metabolite supporting the organoleptic properties of fermented food and beverages.

The second part (2 ECTS) will be focused on an advanced analysis of bacteria and fungi involved in food and beverages production, including the genetic basis of their phenotypes relevant for food technology and the very recent rearrangement of taxonomy as well as molecular-based bacterial identification procedures.

The end of the course (2 ECTS) will be focused on specific fermented foods and beverages, providing specific skills to students.

***COURSE CONTENT***

|  |  |
| --- | --- |
|  | ECTS |
| * Aroma production by fermentation. Microbial secondary metabolites in food and beverages fermentation and their impact on organoleptic properties.
 | 1 |
| * Molecular identification of bacteria and fungi involved in food and beverages fermentation. Genetic basis of bacteriocins production and bacteriophage resistance. Plasmids and transposons role in food microorganisms. Antibiotic resistance in the food chain
* Yeast and moulds as active agents in bakery, dairy and beverages.
 | 2 |
| * Starters for dairy, sausages and bakery production: composition, role, interaction in multi-species starters. SWOT analysis of commercial starters for dairy, bakery and beverages production.
* Protective cultures and secondary fermentation: the case on Non Starter Lactic Acid Bacteria
 | 2 |
| * Lab-based activities: pilot plant exploitation for one dairy and one bakery products.
 | 1 |

***READING LIST***

G.Vinderola-A.C. Ouwehand-S. Salminen-A. von Wright*, Lactic Acid Bacteria: Microbiological and Functional Aspects*, CRC Pres, Taylor & Francis Group LLC, 5th edition, 2019.

K.R. Matthews-E. Kniel-T.J. Montville, *Food Microbiology: An Introduction*, ASM Books, 4th edition, 2019.

***e*- BOOKS (frre download)**

- Ending the War Metaphor: The Changing Agenda for Unraveling the Host-Microbe Relationship: Workshop Summary: https://www.ncbi.nlm.nih.gov/books/NBK57071/?term=%22food%20microbiology%22

***TEACHING METHOD***

Classroom lesson will cover 5 ECTS, while 1 ECTS will be coved by lab-based work, exploiting the use of pilot plant for dairy, bakery and sausages production. Besides, attending students will be involved in a number of meetings with experts already employed in the food industry

***ASSESSMENT METHOD AND CRITERIA***

Final exam is oral and includes open-ended questions aimed at assessing students’ ability to critically apply notions acquired during the study. Specific questions are formulated to verify learning skills on each of the ECTS.

***NOTES AND PREREQUISITES***

Students are expected to have a basic knowledge of microbiology and biochemistry. Students are also supposed to show interest towards food microbiology.

***OFFICE HOURS FOR STUDENTS***

 Students’ are free to e-mail lorenzo.morelli@unicatt.it in order to make an individual appointment; prof. Morelli is furthermore available for meeting students at end of each lesson.

## Mod. Food microbiological safety

## Prof.ssa Daniela Bassi

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The aim of the course is to provide students with the basic principles of food hygiene, the ecology and physiology of food-associated spoilage microbes and the main food-borne human pathogens; lessons will focus on new insights about microorganism metabolism and new control measures to avoid microbial contamination of foodstuffs that can be spread throughout the production chain.

The 4 ECTS (plus 1 lab-based ECTS) of the module will be subdivided in different topics. A first session will be related to the complexity of the food production systems and the future challenges of food safety in the global supply chain, with an eye on emerging risks. The second part will focus on zoonoses and foodborne pathogens and their resistance mechanisms. The third part will describe methods and risk-based approach for shelf life assessment; the two last sections will deal with novel foods and related risks and microbes responsible of food spoilage. An introduction on food alerts and EU regulation will be analysed through the RASFF system.

At the end of the course, students are expected to develop the following skills.

 **Knowledge ability**

* Know the main biological parameters that can affect food safety and understand the stress response mechanisms used by microorganisms;
* distinguish between pathogenic and alterative microorganisms and related foodborne diseases and negative effects on foods;
* Determine the shelf life of a food product from a microbiological point of view, define the source of contamination by microorganisms in food and methods of detection.

 **Know-how application**

* assess the seriousness of biological risks associated with products of animal and vegetable origin and learn about mitigation strategies;
* understand how to guarantee the organoleptic characteristics of the product together with the safety and microbiological quality, thanks to practical examples and laboratory exercises.

**Autonomy in self-assessment**

* evaluate autonomously the level of biological risk associated to foodstuffs and decide how to apply the proper control measures.

**Communications skills**

* demonstrate, both through oral or written communication, the main issues related to food safety and biological risks by using a correct technical vocabulary.

***COURSE CONTENT (Mod.2 )***

|  |  |
| --- | --- |
|  | ECTS |
| The complexity of food production systems; past and future challenges in food safety; how to recognise food safety hazards; examples and what we can learn from previous foodborne outbreaks; emerging risks. | 0.5 |
| Food productions and bacterial stressors; SOS response system; osmotic stress, acid stress, oxidative stress; adaptive mutagenesis.  | 1.0 |
| Biological hazards; zoonoses and foodborne pathogens: *Campylobacter, Salmonella, E. coli, Listeria monocytogenes*, emerging and uncommon foodborne microorganisms; methods of detection and characterization of foodborne pathogens; genome sequencing and microbiome; the Rapid Alert System for Food and Feed. | 2.0 |
| Food spoilage in the food chain: spoilage microorganisms in foods of plant and animal origin; measures to prevent and control food spoilage; future research needs to improve shelf-life. | 0.5 |
| Lab-based activities: challenge test simulations, microbiological criteria. | 1 |

***READING LIST***

* S.J. Forsythe. The Microbiology of Safe Food. Wiley Blackwell, Third edition 2019 John Wiley & Sons Ltd.
* Food Safety: The Science Of Keeping Food Safe. Ian C. Shaw. Second Edition. Wiley Blackwell.
* Yanbo Wang, Wangang Zhang, Linglin Fu. Food Spoilage Microorganisms: Ecology and Control. 1st Edition, April 25, 2017, CRC Press.
* Slides and additional materials will be provided by the lecturer.

***TEACHING METHOD***

The teaching activities will consist of:

- formal lectures by the use of power point presentations with several practical examples aimed to stimulate the overall discussion.

- laboratory classes in which students will set up practical experiences, performing the application of microbiological techniques for microorganisms detection in food.

- working groups where students learn to share opinions, collect data and discuss the final outcomes on food safety topics.

***ASSESSMENT METHOD AND CRITERIA***

Final assessment is an oral exam with open-ended questions aimed at assessing students’ ability to critically apply notions acquired during the study. In particolar, the students will be asked to choose a pathogenic microorganism of interest and to discuss its characteristics and occurrence in the food chain and stress resistance pathways together with new methods of control and present it through PowerPoint presentation (15 minutes maximum). Three additional theoretical questions, based on the topics discussed during the lessons, will be made to verify learning skills on each of the ECTS. Case study assignments and working group activities will be considered as part of the final evaluation.

***NOTES AND PREREQUISITES***

Students are expected to have a basic knowledge of microbiology and biochemistry.

***OFFICE HOURS FOR STUDENTS***

Students’ are free to e-mail daniela.bassi@unicatt.it in order to make an individual appointment; prof. Bassi is furthermore available for meeting students at end of each lesson.