# Advanced Food Technology.

## Mod.1 Microbiology

## Prof.lorenzo morelli

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

The aim of this module is to provide knowledge regarding the role and biotechnological application of microorganisms in food processes. Students will gain insight into the microbiological processes and selection of strains to be used as starter cultures for fermented food.

The use of microbes as protective cultures for the preservation of food, with a special focus on bacteriocin producers and competitive exclusion (1 ECTS); the cultivation of microorganisms at large scale to produce food ingredients, including enzymes, organic acids and amino acids, thickeners and flavoring, and of microbial biomass for food purposes (1 ECTS); the exploitation of microbial cultures as health-promoting organisms for probiotic application (1 ECTS). Students will be also introduced to the European regulatory system for microbial food cultures. Case studies will be used that addressed the above topics (Lab ECTS). At the end of the course, students will be able to design a food production involving microorganisms, from the isolation and characterization of the most suitable strains to downstream processes.

***COURSE CONTENT (Mod.1 )***

|  |  |
| --- | --- |
|  | ECTS |
| Phenotypes to be characterised to select strains for fermented food production. Safety of food-related bacteria: QPS vs GRAS approach. Antibiotic resistance in the food chain. Molecular taxonomy of bacteria and fungi involved in food and beverages fermentation. Genetic basis of bacteriocins production. Plasmids and transposons role in food microorganisms. | 1 |
| Bacterial starter production: fermentation process and freeze-drying  The phage problem. Microbes-based biotechnological products: from rennet to human oligosaccharides. | 1 |
| Health promoting bacteria: from regulation to application. How to select and put into the market a probiotic food. Patenting rules under the Budapest Treaty. | 1 |
| **Tutorials** |  |
| Lab-based activities: case studies of fermented food production | 1 |

***READING LIST***

* Kneifel,W.,Salminen,S., Probiotics and Health Claims 1st Edition, Wiley-Blackwell; 1 edition
* Matthews, K.R.,Kniel, E., Montville, T. J.

Food Microbiology: An Introduction

ASM Books; 4th edition 2019

***TEACHING METHOD***

Classroom lesson will cover 3 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. If required, the student can ask the teacher for supplementary material related to these topics. Students are also supposed to show interest towards food microbiology.

In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out through synchronous or asynchronous procedures that will be promptly notified to students

***OFFICE HOURS FOR STUDENTS***

Students are free to e-mail [lorenzo.morelli@unicatt.i](mailto:lorenzo.morelli@unicatt.i)t in order to make an individual appointment; prof. Morelli is furthermore available for meeting students at end of each lesson.

## Mod 2: Technology

## Prof. Lorenzo Pastrana

***COURSE AIMS AND EXPECTED LEARNING OUTCOMES***

The course aims to provide students with a general understanding of the scientific foundations of new and emerging technologies for processing (high hydrostatic pressures, ohmic heating, pulses of light, radiation, etc.) conservation (active packaging) and personalization (3D printing) of foods. The course will move away from academicism to focus on the perspective of industrial reality and the market through the selection of case studies of real applications in processing companies or suppliers of processing and conservation technology in different food sectors. The course will present the technologies to those currently in use and those alternatives that allow adapting to the new market trends both to extend the shelf life of fresh and refrigerated products and increase their quality and safety, as well as to make processes more efficient, develop new foods and obtain new ingredients and biomolecules with improved or functional qualities (particularly in relation to health).

At the end of the course, students will be capable to select the most suitable technology for producing healthier, safer, sustainable and affordable new food products. The students will learn how to apply different thermal and non-thermal technologies to transform raw materials in final healthy products for targeting people. Also, they will learn to design and select the most adequate food packaging solution to extend the shelf life of a particular food. Students will be capable of developing new personalized food formulations suitable to be processed by 3D printing technologies

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

|  |  |
| --- | --- |
|  | ECTS |
| **Introduction** |  |
| Introduction to the advanced and emerging food processing technologies. | 0.3 |
| **Thermal technologies** |  |
| Ohmic heating; Radio frequency; Microwave; Sous vide cooking | 0.7 |
| **Non-thermal technologies** |  |
| High Hydrostatic Pressure; Radiation; Ultrasounds; Magnetic field; Light pulses. | 1.0 |
| **Advanced packaging and preservation systems** |  |
| MAP (modified atmosphere packaging); Active packaging; Smart packaging, Edible coatings and films. | 2 |
| **Technologies for food personalization** |  |
| Self assembling process for texture modification; Oleogels and fats structuring; 3Dprinting. | 2 |
| **Tutorials** |  |
| Analysis and discussion of case studies on some of the technologies addressed in the course. | 1 |

***READING LIST***

* Da-Wen Sun, Emerging Technologies for Food Processing (Second Edition), Academic Press, 2014.
* Howard Q. Zhang, Gustavo V. Barbosa-Cánovas, V. M. Bala Balasubramaniam, C. Patrick Dunne, Daniel F. Farkas, James T. C. Yuan, Nonthermal Processing Technologies for Food, John Wiley & Sons, 2011.
* P.S. Richardson, In Woodhead Publishing Series in Food Science, Technology and Nutrition, Thermal Technologies in Food Processing, Woodhead Publishing, 2001.
* Aaron L. Brody Hong Zhuang Jung H. Han, Modified Atmosphere Packaging for Fresh‐Cut Fruits and Vegetables, Blackwell Publishing Ltd, 2011.
* Aaron L. Brody, E. P. Strupinsky, Lauri R. Kline, Active Packaging for Food Applications, CRC Press, 2001.
* Jung Han Jung Han, Innovations in Food Packaging, Academic Press, 2005.
* Charis Galanakis, Trends in Personalized Nutrition, Academic Press, 2019

***TEACHING METHOD***

The sessions, which will be taught English, will be of three types:

* Face-to-face lectures (or by videoconference). They will be based on a specific theme of the syllabus of the subject. They will be carried out through power point presentations and the participation of the students will be encouraged in discussions about the advantages and applications of the technologies that will be presented
* Tutored case studies. The teacher will propose to student teams to analyse and discuss different case studies with a critical vision. The aim is to apply the theoretical knowledge taught in the classroom. In general, bibliographic or information search exercises will be proposed. Each team will be engaged in only one case study. If possible (based on the number of students), different teams will be organized to cover the whole program

***ASSESSMENT METHOD AND CRITERIA***

For the assessment and the final qualification of the students a continuous evaluation will be performed. The attendance and active participation during the classroom will represent up to the 30% of the final mark (for students that cannot attend classes, alternative evaluation systems will have to be agreed on at the beginning of the course). The satisfactory completion of the proposed tutored case studies will represent up to the 70% of the final mark. A report with a detailed description of the cases of study will be delivered and the main conclusions will be presented in public in a ppt format.

***NOTES AND PREREQUISITES***

Food Science and Food technology students are supposed to possess a basic knowledge of food chemistry and food processing. If required, the student can ask the teacher for supplementary material related to these topics.

In case the current Covid-19 health emergency does not allow frontal teaching, remote teaching will be carried out through synchronous or asynchronous procedures that will be promptly notified to students

***OFFICE HOURS***

Students are free to e-mail [lorenzo.pastrana@unicatt.it](mailto:lorenzo.pastrana@unicatt.it) (or [lorenzo.pastrana@inl.int](mailto:lorenzo.pastrana@inl.int)) in order to make an individual appointment.