# **Applied Agro-Food Microbiology**

## Prof. Edoardo Puglisi

***COURSE AIMS AND EXPECTED LEARNING SKILLS***

The course aims at providing students a general understanding of Microbiology base principles, and how these principles have direct practical implications for the agro-food sector. At the end of the course the students:

* will know the structure and function of the cell components of bacteria, archaea, fungi and viruses
* will learn and be able to apply ISO methods for cultivating microorganisms and count them with direct and indirect methods
* will learn the basic principles of microbial metabolism that are necessary to understand the roles played by microorganisms in ensuring soil fertility and in the production of fermented foods and beverages
* will acquire practical competences for identifying microorganisms with phenotypic and genotypic methods
* will be able to describe microorganisms that are involved in food production, soil fertility and in the promotion of the health of humans, animals and plants.
* will learn the methods for microbial growth control, they will know the main classes of antibiotics and the risks related to antibiotic-resistances, with a focus on the agro-food
* will be able to apply laboratory techniques for the isolation, counting and microscope observation of bacteria, and they will also learn to work under sterile conditions.

***COURSE CONTENT***

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|  | ECTS CREDITS |
| The prokaryotic cell: morphology, size, chemical composition and structure. Bacterial cell movement. Bacterial endospores and their relevance for food safety. Pure culture, type strain and preservation of bacterial cells. International collections: practical examples. | 1.0 |
| Bacterial nutrition: nutritional groups. Methods for cultivation and counting of microorganisms of agro-food interest, with practical examples. Microbial metabolism, with a focus on fermentations and their roles in the food industries: wine, fermented meats, cheese, yogurt, cocoa. Hints on the starter cultures.  | 1.0 |
| Genotypic and phenotypic methods for microorganisms’ classification. 16S gene and its implications for the identification of bacteria. Bergey’s manual and bacterial systematics. Phylogenetic classifications. Some microbial groups of agro-food interest: fermenting microorganisms, starters, spoilage agents, probiotics, human, animal and plant pathogens, plant biostimulants. | 1.0 |
| Antimicrobial defense: principles and mechanisms of cell inactivation, with practical examples. Physical, chemical and pharmacological agents. The antibiotics and the issue of antibiotic resistance diffusion, with a focus on agriculture and food systems.  | 1.0 |
| Taxonomy of fungi with particular emphasis on yeasts. Yeasts genetics. Sexual reproduction and ecology of fungi. Some fungal groups of agro-food interests. Antimycotics.  | 1.0 |
| Tutorial: Microbiological techniques with practical examples from food microbiology: sterility, isolation, counts, microscopy, most probable number assessment, indole test, Gram staining | 1.0 |
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#### *READING LIST*

M. Madigan-J.S Martinko, K.S. Bender, D.H. Buckley, D.A. Stahl, *Brock Biology of Microrganisms,* 16th edition, Pearson, 2022.

***TEACHING METHOD***

The teaching method will embrace the following activities:

1) Indoor class where main course topics will be covered along with several applied examples. Teaching methos will use high interactivity between teacher and students to stimulate discussion and also help breaking the barrier of shyness.

2) Laboratory activities where the students will leanr laboratory methods to isolate, count and charachterize microroganisms from food matrizes such as milk and yoghurt. Students will also vissit the electron microscopy facilities of the Faculty.

***ASSESSMENT METHOD AND EVALUATION CRITERIA***

Final assessment will be made through an oral exam. At the middle of the course students have also the possibility of making a written exam covering the first three credits. The written exam will be made up of 18 multiple choice tests (1 point per each correct tests) and 6 open questions (2 points per each correct answer) totaling a maximum of 30 points. If a score above 18 is reached, the result of the written exam will have a validity of one year. During the oral exam, students who have passed the written exam can decide to be interrogated only on the remining credits, and an average between the two grades will be made.

The evaluation criteria will be based on the levels of topics knowledge, comprehension and ability to make conceptual links between the different topics. The student must also demonstrate to be able to correctly use the technical language of the discipline.

## ***OTHER INFO AND PRE-REQUISITES***

There are no formal pre-requisites for the course. Students are however strongly encouraged in acquiring knowledges on metabolism and genetics that are provided by the Biochemistry course in the preceding semester.

Prof. Edoardo Puglisi receive students after class or by appointment at the Department for Sustainable Food Systems (DiSTAS)