# . - Biology of Microorganisms

## Prof. Alessandra Fontana

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

The course aims to provide students with the basic knowledge of microbiology needed to understand the roles and importance of microorganisms in agricultural, food and environmental systems. The course also aims to provide a general knowledge of the biochemical and genetic mechanisms that regulate the life of microorganisms, prokaryotes and eukaryotes, as well as to introduce the topics of the systems controlling their development and industrial use.

At the end of the course, students will know and understand the main topics of the microbial world, in both its positive and negative aspects. Students will be able to describe the structures that make up the microbial cells of eubacteria, archaebacteria and fungi. They will know the main microbial metabolisms, with particular reference to those relevant for the agro-food and environmental sector. Students will be able to define the main microbial groups and their role in the biosphere. They will also be able to describe the methods of antimicrobial control and to critically address the issue of antibiotic resistance.

***COURSE CONTENT***

|  |  |
| --- | --- |
|  | ECTS |
| The prokaryotic cell: morphology, size, chemical composition and structure  Movement of the bacterial cell  Bacterial endospores  Pure culture, type strain and conservation of bacterial cells  International collections | 1.0 |
| Bacterial nutrition: nutritional groups  Culture media  Transport systems  Bacterial growth, duplication mathematics and counting methods  Energy metabolism or catabolism  Biosynthetic metabolism or anabolism. | 1.0 |
| The genetics of prokaryotes  Chromosome organisation  Plasmids  Insertion sequences and transposons  Bacteriophages and phage-resistance  Horizontal genetic transfer systems: transformation, conjugation, translation  Organisation of the prokaryotic gene  Notes on gene regulation  Mutations, the Ames test and mutagenicity | 1.0 |
| Classical or phenotypic taxonomy  Taxonomy and phylogenesis  Genotypic methods for classification  Bergey's Manual and bacterial systematics  Phylogenetic classification  Bacterial identification methods  A few microbial groups | 1.0 |
| The antimicrobial struggle: principles and mathematics of cellular inactivation  Physical, chemical and pharmacological agents  Chemical methods  Antibiotic resistance | 1.0 |
| Taxonomy of fungi, with particular attention to yeasts  The genetics of yeasts  Sexual reproduction and ecology of fungi  Fungi of agro-food and environmental interest  Antifungals | 1.0 |
| Elements of microbiological ecology and food microbiology  Association of microorganisms and biofilms  Microbial ecology of food  Role of microorganisms in plant production  Microbial production of bioenergy and biopolymers | 1.0 |
| Tutorials. Classical microbiology techniques applied to the study of food: sterility, isolation, counts, microscope observations, estimation of the most probable number, indole test, Gram staining | 1.0 |

***READING LIST***

B. Biavati-C. Sorlini, *Microbiologia generale e agraria,* 2nd edition, Casa Editrice Ambrosiana, 2012.

G. Dehò'-E. Galli, *Biologia dei microrganismi*, Casa Editrice Ambrosiana, 2014.

M.T. Madigan-J.M. Martinko-D.A. Stahl- K.S. Bender- D.H. Buckley, *Brock. Biologia dei microrganismi,* Pearson, 2016.

***TEACHING METHOD***

1. Theoretical frontal lectures in which the main topics of the course will be addressed, with the support of PowerPoint presentations.
2. Laboratory tutorials on the application of classical microbiology techniques to food analysis.

***ASSESSMENT METHOD AND CRITERIA***

An interim test is scheduled on that part of the programme covered in the first three credits of the course. This test will be written in nature and will consist of 18 multiple choice questions and six open-ended questions. The result of the interim test will be expressed out of thirty and will not bar a student from undertaking the final oral exam.

At the end of the course there will be a final oral exam. This will cover the last four credits of the frontal lectures for those students who have passed the written test, or all seven credits of the frontal lectures for those who have not taken or failed to reach the minimum mark of 18/30 in the interim test.

For those students who have passed the interim test, the final mark will be based on the written test (40%) and the oral interview (60%). For all other students, the final assessment will comprise the single mark obtained in the oral interview.

The exam is aimed at ascertaining the student's level of knowledge, understanding, and linking skills regarding the topics covered. Students must demonstrate an ability to correctly use the language and scientific terminology of the discipline.

***NOTES AND PREREQUISITES***

During the course further reading indications and website information will be provided.

Basic knowledge of general chemistry and biology is required.

Information on office hours available on the teacher's personal page at http://docenti.unicatt.it/.