

# Degree Course: ENVIRONMENTAL AND FOREST SCIENCES

## Subject: GENERAL MICROBIOLOGY

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### AIMS

The course of *General microbiology* aims to give, also by training activities in laboratory, specific basic knowledge on microorganism world concerning cellular organization, metabolic and genetics. Moreover, the students will learn some practical aspects of the general microbiology, among which the microorganism recognition by microscopic observation, Gram staining, correct manipulation, growth media preparation. Throughout the training in the laboratory, adequate emphasis on the strategies to use in order to operate under optimal safety conditions will be given.

### PROGRAM

Introductory lesson: presentation of the program contents, the suggested book, and the adopted evaluation modalities. The cells, its origin and evolution: generalities and life origin; cellular architecture; the life tree; re-calls on the differences between prokaryotic and eukaryotic cells. Microscopic techniques: generalities, introduction on the microscopy history; theory on the microscopic techniques; main optical microscopes; main techniques of samples preparation for their microscopic observation. Morphology and cytology of microorganisms: generalities, size and morphology of bacterial cells; cell structure: cytoplasmic membrane, cell wall and cell division, periplasmic membrane of the Gram-negative bacteria, S layer, capsule and mucous layer, appendices associated to cell wall; bacterial cell movement; cytoplasm; cellular organization in fungi domain. Nutrition and isolation of microorganisms as pure culture: generalities; nutritional groups; growth media; microorganism isolation in pure culture. Microbial growth and microorganism conservation: generalities on microbial growth curve; description and rapidity of the microbial growth; measurement of the microbial growth: direct and indirect methods; environmental requirements for the microbial growth; bacterial endospore: generalities, sporulation and germination; sporification phases; dormancy, germination and resistance of the bacterial endospore; sporification factors; environmental, sanitary, and technological implications of the spore production; applicative aspects of the sporification; secondary metabolism associated to sporulation; conservation of the microbial cultures. Microorganism control: physical, chemical, and pharmacological agents. Genetics of bacteria: genetic horizontal transfers. Virology: bacteriophages; transduction. Microorganisms as geochemical agents: generalities; soil as microorganism environment; carbon, nitrogen, and sulphur cycles. Symbiotic associations among microorganisms: generalities; mutualism; proto-cooperation; commensalism; competition; antagonism; parasitism; predation. Conclusive lesson: check on the efficacy of the lessons and discussion on related themes; execution of a written test similar to that one that will be given at the exam day; presentation of the laboratory training program.

Laboratory training - Basic microbiological methodologies and techniques useful to guarantee asepsis and antisepsis throughout the work phases in the laboratory. Basic methodologies and techniques on optical microscopy useful to guarantee the best using the available equipment. Slide technique preparation for observing pure culture of bacteria and yeasts by 10x, 40x, and 100x objectives; recognition of the structural differences between prokaryotic and eukaryotic cells by composite and contrast phase microscopes. Preparation of bacterial cultures for microscopic observation of their ability to move by Kock slide; recognition of the strains able to move. Gram staining; microscopic observation using the 100-x objective of the obtained slides; recognition of the Gram+ and Gram- bacteria; identification of the possible flaws of each slide. Sterilization of growth media by autoclave; preparation of Petri plates by pouring the sterilized media. Streaking technique on solid media by sterile loop to obtain microorganism in pure culture. Preparation of homogenates from solid food samples by Stomacher. Preparation of serial dilutions and their inoculation in Petri plates to evaluate total microbial count in a food sample. Coliform bacteria test of drinking water samples by filtration on cellulose acetate filters and inoculation on solid media.

**If someone asks, it will be given an English-language summary at the end of each lesson.**

### TEXT ADOPTED

Wessner D.R., Dupont C., Charles T.C. - Microbiologia. Prima edizione. Casa Editrice Ambrosiana (MI), 2015.

### JUDGMENT

Oral examination in Italian or English language.