UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Microbial Biotechnologies

2526-1-F0902D007

Aims

The course aims to: provide general knowledge on the biology and genetics of microorganisms of medical interest (bacteria, viruses, fungi and protozoa); provide an understanding of the mechanisms of microbial pathogenicity and virulence and acquire the methodologies used for their study; deliver the principles of conventional microbiological diagnostics and the use of biotechnology in molecular microbiological diagnostics, for the typing of microorganisms and for monitoring therapy; provide an understanding of the mechanisms of action of antimicrobial agents and the strategies for the development of new compounds with antimicrobial activity; provide an understanding of the mechanisms of resistance to antimicrobial drugs and the ways in which microorganisms acquire resistance by proposing the most modern strategies for overcoming these mechanisms; provide the knowledge of the molecular epidemiology of microbial infections for the study of epidemic events in nosocomial or community environments and for the molecular surveillance of antibiotic resistance and nosocomial infections; to understand the methods of prevention of infectious diseases, the vaccines in use and strategies for the preparation of new vaccines; to learn the latest technologies and practical applications of monitoring and prevention of human infections transmitted through the environment, water and food through a "One Health" approach.

Knowledge and understanding - The specific objective of the Microbial Biotechnology course will be to put the student in a position to understand the pathogenicity mechanisms that characterize the primary human pathogens, to acquire the knowledge and modern biotechnological methodologies regarding the current clinical *need*, the design, development and use of diagnostic and therapeutic systems essential for diagnosing, epidemiologically monitoring and appropriately treating transmissible diseases related to microbial pathogens in various fields starting from the clinical medical one;
Application understanding skills - At the end of the course, the student must be able to apply both diagnostic and typing, monitoring and surveillance methodologies related to the main pathologies attributable to infectious processes; This will allow the student to understand the potential of applied microbial biotechnologies that are fundamental in the medical field but not limited to this;
Autonomy of judgment - At the end of the Teaching Course, the student will be able to correctly interpret a certain number of clinical cases of infectious pathologies, analyzed through a diagnostic approach and the interpretation of laboratory results, understanding the limits of the techniques used, the evolutionary capacities of microorganisms and being able to propose new strategies;

Communication skills - The terminology acquired by the student will enable him to navigate a multidisciplinary environment through the choice of adequate scientific terminology and language properties.
Learning skills - Different approaches and tools for interpreting and evaluating the results of using Microbial Biotechnologies in the clinical medical field will be provided during the course, allowing the student to apply notions and problem-solving strategies helpful for continuing independent study beyond the course itself.

Contents

By the end of this course students will have acquired knowledge regarding major issues of clinical microbiology which will be particularly focused on microbial mechanisms of pathogenesis, diagnostic methods in microbiology, new strategies for the diagnosis, the treatment and prevention of microbial diseases as well as biotechnologies applied to epidemiological and surveillance studies of community and health-care associated infections (HCAI).

Detailed program

• Ultrastructure and classification of human pathogenic microorganisms for diagnostic and clinical medical research applications

• Replication and genetics of microbial agents

• Human-microorganism interactions and Mechanisms of microbial pathogenesis

• Regulation of bacterial virulence genes and Methods for the study of bacterial virulence

• Role of viruses in oncogenesis

• Microbial biofilms

• Mechanism of action of the main antimicrobial drugs

• Antibiotic resistance: Mechanisms and methods of acquisition and strategies for overcoming it

• Main mechanisms of antibiotic resistance in priority Gram-positive, Gram-negative and mycobacterial pathogens

• Strategies for the development of new antimicrobial agents

• Surveillance and Prevention of infectious diseases, vaccines in bacteriology and virology and new vaccination strategies

• Principles of traditional and molecular microbiological diagnostics

• Microbiological techniques applied to the analysis of water and food

• Phenotypic and genotypic microbial typing methods

• Molecular epidemiology and surveillance of microbial infections

• Viral vectors in medical biotechnology

Prerequisites

Basic knowledge in the field of biology and genetics.

Teaching form

- 20 2-hours lessons carried out in delivery mode
- 3 4-hour laboratory activities carried out in interactive mode in person

Textbook and teaching resource

- Bacterial Pathogenesis: a Molecular Approach. ASM Press Wilson et al.
- Microbiologia Medica. EMSI Sherris
- Microbiologia Medica. UTET. Poli et al
- Principi di Microbiologia Medica. Esculapio. La Placa
- Microbiologia Medica. EMSI. Murray et al
- Principi di Microbiologia Medica. Casa Editrice Ambrosiana. Antonelli et al
- Manuale di Virologia Medica. McGraw Hill. Dianzani, et al

Review and scientific articles indicated during lectures.

Semester

Second semester of the first year.

Assessment method

Written and oral test: Open questions to check the preparation on the exam program, on the ability of independent reflection, on the problem solving skills. From a choice of 4 proposed topics, 2 open questions will be elaborated by the candidates. The following oral interview will focus mainly on the completed written works. Time for the written test: 2 hours. Score assigned: up to a maximum of 15 points for each topic. There are no ongoing tests.

Office hours

To be fixed by appointment

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING | QUALITY EDUCATION | PARTNERSHIPS FOR THE GOALS