UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Medical Microbiology

2223-2-H4101D256

Aims

Students are expected to acquire fundamental notions on the characteristics of microrganisms associated with human disease (viruses, prokaryotic and eukaryotic microrganisms), as well as on their mechanisms of pathogenicity.

Students are also expected to understand the principles of laboratory methods in clinical microbiology, the mechanisms of action of antimicrobial drugs and the strategies for the prevention of infectious diseases.

Contents

General Microbiology: Structure, organization and mechanisms of replication of human pathogens. Mechanisms of horizontal gene transfer among bacteria and viral genetics. Pathogenicity and relationship host-microorganism. Mechanisms of action of the major antimicrobial agents. Resistance to antimicrobial drugs.

Strategies for infection control and vaccine development.

Systematic Microbiology: Bacteriology, Virology, Mycology and Parasitology. General criteria for the classification of microorganisms. Microbial agents responsible for human infection and their mechanisms of pathogenicity; laboratory diagnosis and treatment/prevention of associated infectious diseases.

Detailed program

GENERAL MICROBIOLOGY

Structural, biological characteristics and relations with the host of the main groups of pathogenic microorganisms. Principles of microbial taxonomy.

Bacteria

-Differences between the structure and the existing organization in the cells of prokaryotes and eukaryotes;

-The structure and functions of the different components of the bacterial cell;

-Structure and function of the bacterial spore;

-Reproduction modality of bacteria;

-Fundamentals of bacterial metabolism and fermentation products used for the identification of bacteria;

-Methods for the isolation and identification of bacteria from pathological materials;

-Pathogenic pathogen of bacteria: infection modalities and methods of transmission of bacterial infections; bacterial virulence factors;

-Bacterial toxins: exotoxins and endotoxins (structure, biological activity, role in the pathogenesis of infectious diseases);

-Methods for the control of microorganisms (sterilization and disinfection);

-Mechanisms of action of antibacterial drugs;

-Laboratory methods for the evaluation of in vitro susceptibility of microorganisms to antimicrobial drugs;

-Mechanisms of horizontal gene transfer among bacteria (transformation, transduction, conjugation) and their association with the acquisition of virulence and antibiotic resistance factors;

-Laboratory diagnosis and prophylaxis of microbial infections;

Fungi

-Morphology, ultrastructure and function of fungal cell components;

-Reproductive processes in fungi and their implications for classification and identification;

-Fungal pathogenesis in human disease;

Protozoa

-Structure and reproduction cycles of protozoa;

-Mode of infection and vectors;

Viruses

-Structure and function of viruses;

-Virus-host cell interactions;

-Transmission of viral infections;

-Viral infection and viral pathogenesis;

-Concepts of viral acute, chronic, slow and latent infections;

-Principles of laboratory diagnostics in virology;

-Action mechanism of antiviral drugs;

-Rational bases of immunotherapy and vaccine preparation.

SPECIALISED MICROBIOLOGY

BACTERIOLOGY

The main microbial species responsible for infections in humans, with particular attention to biological characteristics in relation to their pathogenic action.

-The normal microbial flora of humans: composition and role in the human body.

-Principles of bacterial classification.

-Genus *Staphylococcus*: *Staphylococcus aureus*, *S. epidermidis* and other CoNS; virulence factors and main infections

-Genus *Streptococcus*: *Streptococcus pyogenes*, *S. agalactiae* and *S. pneumoniae*. Overview of other groups of streptococci responsible for infections in humans

-Genus *Enterococcus*

-Gram-negative cocci: *Neisseria meningitidis*, *Neisseria gonorrhoeae*, notes on other members of Neisseriaceae

-Genus*Bacillus*: *Bacillus anthracis*, notes on other bacilli

-Genus *Clostridium*: species responsible for infections in humans

-*Corynebacterium diphtheriae*: criteria of distinction from other corynebacteria, the production of diphtheria toxin and its role in the pathogenesis of diphtheria

-*Listeria monocytogenes*

-*Mycobacterium tuberculosis* morphological and cultural characteristics, pathogenesis, immunity, laboratory diagnosis, outline of treatment and prevention. Notes on M. leprae and MOTT group

-*Enterobacterales*: general characteristics and criteria of distinction and identification of *Escherichia coli*, *Shigelle* spp., *Salmonella* spp, *Proteus* spp, *Yersinia* spp. Metabolic and antigenic characteristics and virulence factors

-*Vibrio cholerae*: strains responsible for cholera epidemics; the mechanism of action of cholera toxin

-Non-fermenting Gram-negative bacilli; *Pseudomonas aeruginosa*, *Acinetobacter baumannii*

-Gram-negative aerobic bacilli: *Haemophilus*, *Bordetella pertussis*, *Brucella* spp

-*Legionella pneumophila*: pathogenicity and specific cultural characteristics

-*Treponema pallidum*: syphilis and serological diagnosis of syphilis

-Leptospires and important Borrelias in human pathology

-*Helicobacter pylori*: characteristics, pathogenesis, laboratory diagnosis

-General characteristics and main pathogenic species of *Rickettsiae* spp and *Chlamydiae* spp.

-Genus *Mycoplasma*: *M. pneumoniae* and primary atypical pneumonia

-Notes on pathogenic *Actinomycetes* for humans.

MYCOLOGY

-Fungi associated with deep or systemic mycosis: description of the morphological, cultural and pathogenic characteristics of the main species;

-Fungi associated with subcutaneous mycosis: description of the morphological, cultural and pathogenic characteristics of the main species;

-Fungi associated with superficial and cutaneous mycosis: description of the morphological, cultural and pathogenic characteristics of the main species;

-*Candida albicans* and related yeasts;

-Opportunist fungal infections: *Aspergillus* spp., etc.

PARASITOLOGY

-General principles for the classification of protozoa;

-Amoebe: morphological characteristics and reproduction of the main pathogenic species;

-Flagellates of the digestive and urogenital tract: characteristics of *Giardia* and *Trychomonas*;

-Flagellates of blood and tissues: *Trypanosoma* and *Leishmania*

-Malaria: life cycle, pathogenesis, diagnosis, epidemiology, treatment and control.

-*Toxoplasma gondii*

-Notes on Helminths: Nematodes, Trematodes and Cestodes.

VIROLOGY

-General classification of viruses

-DNA virus: Poxvirus, Herpesvirus, Hepadnavirus (hepatitis B virus), Papillomavirus, Poliomavirus, Adenovirus, Parvovirus (virus B19)

-RNA virus: Picornavirus, Calicivirus, Coronavirus, Arenavirus, Flavivirus, Togavirus, Coranavirus, Human retroviruses,

-Paramyxovirus, Ortomyxovirus, Rabdovirus.

PRINCIPLES IN CLINICAL MICROBIOLOGY

Aetiological agents and laboratory methods for the diagnosis of respiratory tract infections; infections of the central nervous system; infections of the gastrointestinal tract, infections of the genitourinary system. Infections in pregnancy, of the fetus, of the newborn and in infancy; systemic infections; heart; skin; bones; opportunistic and nosocomial joints and infections.
Evaluation of the "in vitro" sensitivity of microorganisms to antimicrobial drugs.

Prerequisites

Basic knowledge in the field of anatomy, biology and genetics

Teaching form

Frontal lectures and laboratory practicals.

Textbook and teaching resource

1. Microbiologia Medica. Giorgio Poli, Giuseppe Cocuzza, Giuseppe Nicoletti. Ed. UTET
2. Microbiologia Medica. La Placa. Ed. Esculapio
3. Principi di Microbiologia Medica. Antonelli, Clementi, Pozzi e Rossolini Ed. Casa Editrice Ambrosiana
4. Manuale di Virologia Medica. Dianzani, Antonelli, Capobianchi, DoleiEd. McGraw-Hill

Semester

II year - IV semester

Assessment method

Written and oral exam:

The written exam will consist of

- 20 multiple choice questions (a choice of 5 answers with only one correct) and
- two open questions.

The oral exam will focus mainly on the discussion of the answers to the written exam.

Office hours

Any working day following a request for an appointment.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING