

Medical Microbiology

Course objectives

The aim of *Medical Microbiology* course is to introduce basic principles and application relevance of clinical disease for students who are in preparation for physicians. The content of rigorous course includes many etiological agents responsible for global infectious diseases. It covers all biology of bacteria, viruses and other pathogens related with infectious diseases in humans. The course will provide the conceptual basis for understanding pathogenic microorganisms and particularly address the fundamental mechanisms of their pathogenicity. It will also provide opportunities for a student to develop diagnostic skills in microbiology, including the practical application and interpretation of laboratory tests for the diagnosis of infectious diseases.

BACTERIOLOGY

Bacterial Morphology and Structure-Metabolism & Growth

1. Basics of bacterial cell wall structures and properties associated with bacterial cell walls (Gram positive/negative cell wall, staining, Peptidoglycan, LPS, pathogenesis, and targets of antibiotics)
2. Structures of the bacterial cell and the genetic makeup of bacteria (Ribosome, Plasmid, Chromosome, target of antibiotics, roles in pathogenesis or drug resistance)
3. Morphology of bacteria and the versatility of bacteria (in clinical diagnosis)
4. Bacterial appendages, bacterial spores, capsules, etc., and their related with clinic practice.
5. Bacterial growth, survival and death, cultivation of bacteria, growth curve, bacterial metabolism, classification of bacteria.

Bacterial Heredity & Variation

1. Genetic material of bacteria (Chromosome, plasmid, transposable element, and phage genome).
2. Bacterial phages, virulent phage and lysogenic phage
3. Mechanisms of transfer and recombination of bacterial genes (transformation, transduction, conjugation and lysogenic conversion); gene mutation.
4. The significance of bacterial genetic variation (in drug resistance, pathogenesis or virulence and variation, diagnosis, and vaccination), and manipulation of cloned DNA.

Bacterial Infection & Pathogenesis

1. Normal human microbiota (Role of the resident microbiota, and locations in the human body)
2. Virulence of bacteria, bacterial virulence factors and their regulation (exotoxin, endotoxin, and their contribution to pathogenesis)
3. Infection process (development, and outcomes)

Antimicrobial Chemotherapy, drug resistance and its prevention, Laboratory Diagnosis, Control of bacterial diseases

1. Antimicrobial Chemotherapies and their targets
2. Drug resistance, drug-bacteria relationship, clinical implications, and prevention
3. Diagnostic medical microbiology (collect samples, culture, identification, rapid diagnosis, immunologic or molecular diagnostic tests)
4. Prevention of bacterial infection (active immunization, vaccines, and passive immunization)

Specific bacterial pathogens and the diseases they cause

(Morphology, culture, biological characteristics, virulence factors and their effects, diagnostic laboratory tests, and the principles of controlling infections).

Staphylococcus. Streptococcus. Neisseria. Enterobacteriaceae (Escherichia, Klebsiella, Enterobacter, Proteus, Salmonella, and Shigella). Campylobacter and Helicobacter. Vibrio cholera. Clostridia (sporeforming anaerobic bacteria). Pseudomonas. Mycobacteria. Brucella. Hemophilus species. Treponema. Leptospira. Legionella. Chlamydia. Mycoplasmas

VIROLOGY

Viral Classification, Structure & Multiplication

1. General properties of viruses
2. Principles of virus structure and function (genome, capsid, envelope)
3. Reaction to physical and chemical agents
4. Viral Multiplication and stages of replication (adhesion, entry, uncoating, synthesis, assembly and release)

Viral Heredity & Variation

1. Genetics of animal viruses
2. Mechanisms of viral gene mutation
3. Classification of viruses

Mechanisms of Viral Pathogenesis

1. Viral infection and transmission
2. Mechanism of viral pathogenesis: cytopathic effect, immune pathogenesis and immune escape
3. Forms of viral infection, viral persistent infection (viral horizontal transmission and vertical transmission; the characteristics of chronic virus infection and latent virus infection)
4. Viral infection and tumours

Laboratory Diagnosis of Virus Infection, Control of viral diseases & Antivirus Therapy

1. Laboratory Diagnosis of Virus Infection
2. Prevention and treatment of viral infection
3. Principles of viral vaccine design and development
4. Anti-viral chemotherapy and mechanisms

Specific virus families.

(Main structural and biological characteristics, transmission cycle, pathogenesis and clinical profiles, diagnostic laboratory tests, prevention and control).

Orthomyxoviridae, Paramyxoviridae, Picornaviridae, Herpesviridae, Papillomaviridae, Polyomaviridae, Retroviridae, Adenoviridae, Hepadnaviridae, Hepatitis C Virus and other Flaviviridae, Hepatitis D (Delta) virus, Togavirus, Reovirus, and Rotavirus.

PROTOZOOLOGY

Major medically important parasitic protozoa and associated diseases.

Giardia intestinalis, Trichomonas vaginalis, Trypanosomes, Leishmania, Entamoeba histolytica, Plasmodium malariae, Toxoplasma gondii, Pneumocystis carinii.

MYCOLOGY

Major medically important fungi and associated diseases.

Basic biology of fungi. Yeast-like fungi, filamentous fungi (mold) and dimorphic fungi. Spectrum of superficial, cutaneous and deep mycoses.

Practical training

Preparation of bacterial cultures from throat swab, Gram and Ziehl - Neelsen staining

Optional activities

From the third year of the course, students have the opportunity to attend the Molecular Virology laboratory (Training period of at least 2 weeks).

Course materials

Lectures' slides will be available to the students.

Required textbooks / Bibliographic resources

- Patrick R. Murray, Ken S. Rosenthal. "Microbiologia Medica" 7a edizione
- Kenneth J. Ryan, C. George Ray. "Sherris.Medical Microbiology" 6th edition
- M. La Placa "Principi Di Microbiologia Medica" 14th edition , EdiSES
- David M. Knipe, Peter Howley. "Fields Virology" 6th edition

Methods of evaluation

Written examination (6 open questions) followed by an oral discussion.