

MICROBIOLOGY — M D

PREAMBLE

The main aim of this course is to train students of Medicine in the field of Medical Microbiology. Theoretical as well as practical training is imparted to the candidates in the subspecialities viz. Bacteriology, Virology, Parasitology, Immunology and Mycology so that they can participate in good patient care and prevention of infectious diseases in the community. They are introduced to basic research methodology so that they can conduct fundamental and applied research. They are also imparted training in teaching methods in the subject which may enable them to take up teaching assignments in Medical Colleges/Institutes.

AIMS & OBJECTIVES

At the end of the course the students should be able to :

1. Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology .
2. Plan, execute and evaluate teaching assignments in medical microbiology and
3. Plan, execute, analyse and present the research work in medical microbiology.

Course contents (Syllabus)

Desirable

PAPER-I GENERAL MICROBIOLOGY AND IMMUNOLOGY

PAPER-II BACTERIOLOGY + MYCOLOGY

PAPER-III VIROLOGY AND PARASITOLOGY

PAPER-IV APPLIED MICROBIOLOGY & RECENT ADVANCES

General Microbiology

1. History of microbiology
2. Microscopy
3. Bio-safety including universal precautions
4. Physical and biological containment

5. Sterilization and disinfection
6. Morphology of bacteria and other microorganisms
7. Nomenclature and classification of microorganisms
8. Normal flora of human body
9. Growth & nutrition of bacteria
10. Bacterial metabolism
11. Bacterial toxins
12. Bacteriocins
13. Microbiology of hospital environment
14. Microbiology of air, milk and water
15. Host-parasite relationship
16. Antibacterial substances and drug resistance
17. Bacterial genetics & bacteriophages
18. Molecular genetics relevant for medical microbiology
19. Quality assurance & quality control in microbiology
20. Accreditation of laboratories

Immunology

1. Components of the immune system
2. Innate and acquired immunity
3. Cells involved in immune response
4. Antigens
5. Immunoglobulins
6. Mucosal immunity
7. Complement
8. Antigen & antibody reactions
9. Hypersensitivity
10. Cell mediated immunity
11. Cytokines
12. Immunodeficiency
13. Auto-immunity
14. Immune tolerance
15. MHC complex
16. Transplantation immunity
17. Tumor immunity
18. Vaccines and immunotherapy
19. Measurement of immunological parameters

20. Immunological techniques
21. Immunopotential & immunomodulation

Systematic bacteriology

1. Isolation & identification of bacteria
2. Gram positive cocci of medical importance including Staphylococcus, Micrococcus, Streptococcus, anaerobic cocci etc.
3. Gram negative cocci of medical importance including Neisseria, Branhamella, Moraxella etc.
4. Gram positive bacilli of medical importance including Lactobacillus, Coryneform organisms, Bacillus & aerobic bacilli, Actinomyces, Nocardia, Actinobacillus and other actinomycetales, Erysipelothrix, Listeria, Clostridium and other spore bearing anaerobic bacilli etc.
5. Gram negative bacilli of medical importance including Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Bruce/la, Gardnerella, Pseudomonas & other non-fermenters, Pasture/la, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.
6. Helicobacter, Campylobacter & Spirillum
7. Enterobacteriaceae
8. Mycobacteria
9. Spirochaetes
10. Chlamydiae
11. Mycoplasmatales: Mycoplasma, Ureaplasma, Acholeplasma and other Mycoplasmas.
12. Rickettsiae, Coxiella, Bartonella etc.

Virology

1. General properties of viruses
2. Classification of viruses
3. Morphology: Virus structure
4. Virus replication
5. Isolation & identification of viruses
6. Pathogenesis of viral infections
7. Genetics of viruses
8. DNA viruses of medical importance including Poxviridae, Herpesviridae, Adenoviridae, Hepadna virus, Papova and Parvo viruses etc.
9. RNA viruses of medical importance including Enteroviruses, Togaviridae, Flaviviruses, Orthomyxoviruses, Paramyxoviruses, Reoviridae, Rhabdoviridae, Arenaviridae, Bunyaviridae, Retroviridae, Filoviruses, Human immunodeficiency virus, Arboviruses, Coronaviridae, Calci viruses etc.
10. Slow viruses including prions
11. Unclassified viruses
12. Hepat.

13. Virioids
14. Vaccines & anti-viral drugs

Parasitology

1. General characters & classification of parasites
2. Methods of identification of parasites
3. Protozoan parasites of medical importance including *Entamoeba*, Free living amoebae, *Giardia*, *Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma*, *Sarcocystis*, *Cryptosporidium*, *Microsporidium*, *Cyclospora*, *Isospora*, *Babesia*, *Balantidium* etc.
4. Helminthology of medical importance including those belonging to Cestoda (*Diphyllobothrium*, *Taenia*, *Echinococcus*, *Hymenolepis*, *Dipylidium*, *Multiceps* etc.), Trematoda (*Schistosomes*, *Fasciola*, *Fasciolopsis*, *Gastrodiscoides*, *Paragonimus*, *Clonorchis*, *Opisthorchis* etc.) and Nematoda (*Trichiuris*, *Trichinella*, *Strongyloides*, *Ancylostoma*, *Necator*, *Ascaris*, *Toxocara*, *Enterobius*, *Filarial worms*, *Dracunculus* etc.)
5. *Entomology*: common arthropods & other vectors viz. mosquito, sandfly, ticks, mite, cyclops, louse, myasis.
6. Antiparasitic agents.

Mycology

1. General characteristics & classification of fungi
2. Morphology & reproduction of fungi
3. Isolation & identification of fungi
4. Tissue reactions to fungi
5. Yeasts and yeast like fungi of medical importance including *Candida*, *Cryptococcus*, *Malassezia*, *Trichosporon*, *Geotrichum*, *Saccharomyces* etc.
6. Mycelial fungi of medical importance including *Aspergillus*, *Zygomycetes*, *Pseudoallescheria*, *Fusarium*, *Piedra*, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.
7. Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium marneffei* etc.
8. Dermatophytes
9. Fungi causing mycetoma, keratomycosis & otomycosis.
10. *Pythium insidiosum*
11. *Prototheca*
12. *Pneumocystis carinii* infection
13. *Rhinosporidium seeberi* & *Loboa loboi*
14. Actinomycetes & *Nocardia*.
15. Common laboratory contaminant fungi
16. Mycetismus & mycotoxicosis
17. Antifungal agents & invitro antifungal susceptibility tests.

Applied Microbiology

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Management of hospital waste
4. Investigation of an infectious outbreak
5. Infections of various organs and systems of human body viz. respiratory tract infections, urinary tract infections, central nervous system infections, congenital infections, reproductive tract infections, gastrointestinal infections, hepatitis, pyrexia of unknown origin, infections of eye, ear & nose, septicaemia, endocarditis, haemorrhagic fever etc.
6. Opportunistic infections.
7. Sexually transmitted diseases
8. Vaccinology: principle, methods of preparation, administration of vaccines information technology (Computers) in microbiology
9. Gene cloning
10. Molecular techniques as applicable to microbiology
11. Automation in Microbiology
12. Statistical analysis of microbiological data and research methodology
13. Animal & human ethics involved in microbiological work

Psychomotor Skills for Postgraduates Students in M.D. (Microbiology)***Bacteriology - Must acquire***

1. Collection/transport of specimens for microbiological investigations
2. Preparation, examination & interpretation of direct smears from clinical specimens
3. Plating of clinical specimens on media for isolation, purification, identification and quantitation purposes.
4. Preparation of stains viz. Gram, Albert's, capsules, spores, Ziehl Neelsen (ZN) Silver impregnation stain and special stains for capsule and spore etc.
5. Preparation and pouring of media like Nutrient agar, Blood Agar, Mac-conkey agar, Sugars, Serum sugars, Kligler iron agar, Robertson's cooked meat broth, Lowenstein Jensens medium, Sabouraud's dextrose agar etc.
6. Preparation of reagents -oxidase, Kovac etc.
7. Quality control of media, reagents etc.
8. Operation of autoclave, hot air oven, distillation plant, filters like Sietz and membrane filters
9. Care and operation of microscopes
10. Washing and sterilisation of glassware (plugging and packing)
11. Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators etc.
12. Aseptic practices in laboratory and safety precautions

13. Sterility tests
14. Identification of bacteria of medical importance upto species level (except anaerobes which could be upto generic level).
15. Techniques of anaerobiosis
16. Tests for Motility: hanging drop, Cragie's tube, dark ground microscopy for spirochaetes
17. In-vitro toxigenicity tests- Elek test, Naegler's reaction
18. Special tests-Bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for Mycobacterium, satellitism, CAMP test, catalase, slide & tube agglutination tests.
19. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing, eg. Kirby-Bauer, Stoke's method, Estimation of Minimal Inhibitory/Bactericidal concentrations by tube/plate dilution methods
20. Tests for Beta-lactamase production
21. Inoculation of infective material by different routes in animals
22. Bleeding techniques of animals including sheep
23. Performance of autopsy on animals & disposal of animals
24. Animal pathogenicity/toxigenicity tests for C.diphtheriae, C.tetani, S.pneumoniae, S.typhimurium, K.pneumoniae etc.
25. Care and breeding of laboratory animals viz. mice, rats, guinea pigs, rabbits etc.
26. Testing of disinfectants -Phenol coefficient and "in use" tests
27. Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteriuria
28. Disposal of contaminated materials like cultures
29. Disposal of infectious waste
30. Bacteriological tests for water, air and milk
31. Maintenance & preservation of bacterial cultures

Bacteriology - Desirable to acquire

1. Conjugation experiments for drug resistance
2. Serum antibiotic assays e.g. gentamicin
3. Phage typing for Staphylococci, S.typhi, etc.
4. Bacteriocin typing viz. Proteocin, etc.
5. Enterotoxigenicity tests like rabbit ileal loop, intragastric inoculation of infant mouse, Sereny's test.
6. Serologic grouping of Streptococci
7. Mouse foot pad test for M leprae
8. Antimicrobial susceptibility tests for Mycobacteria
9. Molecular typing methods
10. Special staining techniques for Mycoplasma, Treponemes, Gardnerella.

Immunology - Must acquire

1. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods
2. Preparation of antigens from bacteria or tissues like Widal, Weil Felix, VDRL, SLO and group polysaccharide of Streptococcus etc. and their standardisation.
3. Raising of antisera in laboratory animals
4. Performance of serological tests viz. Widal, Brucella tube agglutination, indirect hemagglutination, VDRL, ASO, Rose Waaler test, IFA.
5. Immunodiffusion in gel (Ouchterlony), counter-immunoelectrophoresis.
6. Enzyme linked immunosorbent assay
7. Latex agglutination tests
8. Preparation & preservation of complement & complement titration

Immunology - Desirable to acquire

1. Radial immunodiffusion for estimation of serum Immunoglobulins
2. Immunoelectrophoresis
3. Crossed immunoelectrophoresis
4. Neutrophil phagocytosis
5. Immunoblotting
6. Performance of serological tests viz. Weil Felix, cold agglutination, Paul Bunnell test
7. Leukocyte migration test
8. T - cell rosetting
9. Separation of lymphocytes by centrifugation, gravity sedimentation etc.

Mycology - Must acquire

1. Collection and transport of specimens
2. Processing of samples for microscopy and culture
3. Direct examination of specimens by KOH, Gram's, Acid fast, Giemsa, Lactophenol cotton blue & special fungal stains
4. Examination of histopathology slides for fungal infections
5. Isolation and identification of medically important fungi & common laboratory contaminants
6. Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture
7. Maintenance of stock cultures
8. Animal pathogenicity tests viz. intravenous, intracerebral and intra peritoneal inoculation of mice for fungal pathogenicity study

Mycology-desirable to acquire

1. Antigen preparation -viz. from Candida, Aspergillus, Histoplasma, Sporothrix
2. Antibody detection in candidiasis, aspergillosis, histoplasmosis, blastomycosis, Cryptococcosis,

zygomycosis, coccidioidomycosis

3. Antigen detection in cryptococcosis, aspergillosis, candidiasis
4. Skin test using aspergillin, candidin, histoplasmin, sporotrichin
5. Isolation and identification of actinomycetes .
6. Calcofluor staining & examination under fluorescent microscope

Parasitology - Must acquire

1. Collection and transport of specimens for diagnosis of parasitic diseases
2. Examination of faeces for parasite ova and cysts etc. by direct and concentration methods (salt floatation and formol-ether methods)
3. Egg counting techniques for helminths micrometry and mounting of slides
4. Examination of blood for protozoa and helminths by wet mount, thick and thin stained smears
5. Examination of blood for microfilariae including concentration techniques
6. Examination of other specimens eg. Urine, CSF, Bone marrow etc. for parasites
7. Histopathology sections -examination and identification of parasites
8. Preparation & performance of stains -Leishman, Giemsa, Lugol's iodine
9. Micrometry
10. Identification of medically important adult worms
11. Preparation of media -NIH, NNN etc.
12. Copro-culture for larvae of hook worms
13. Identification of common arthropods and other vectors viz. mosquito, sandfly, ticks, mites, cyclops
14. Preservation of parasites-mounting, fixing, staining etc.

Parasitology - Desirable to acquire

1. Maintenance of parasites in laboratory either in vivo in animals or by in-vitro cultures
2. Permanent staining techniques like iron hematoxylin
3. QBC for alaria & filaria .
4. In-vitro culture of parasites like Entamoeba, Leishmania, p falciparum, Acanthamoeba etc.
5. Antigen preparation -viz. Entamoeba, filaria, Toxoplasma, hydatid for serological tests for IRA, ELISA and skin tests like Casoni ' s

Virology - Must acquire

1. Preparation of glassware for tissue cultures (washing, sterilisation).
2. Preparation of buffers like PBS, Hank's
3. Preparation of clinical specimens for isolation of viruses
4. Collection & transport of specimens
5. Recognition of CPE producing viruses
6. Serological tests -ELISA for HIV & HBsAg, Haemagglutination Inhibition test for Influenza, Measles

7. Chick Embryo techniques-inoculation and harvesting
8. Handling of mice, rats and guinea pigs for collection of blood, pathogenicity tests, etc.
9. Special staining procedure for viruses

Virology - desirable to acquire

1. Electron microscopy of virus -TEM, SEM
2. Preservation of viruses
3. Preparation of viral antigens.
4. Molecular techniques in virology
5. Preparation of monkey kidney cells (primary) and maintenance of continuous cell lines by subculture. Preservation in -70°C and liquid nitrogen
6. Performance of haemadsorption for Parainfluenza, Haemagglutination of Influenza, Immunofluorescence, Neutralisation for Enteroviruses and Respiratory viruses. Identification tests on tissue cultures and supernatants etc.
7. Serological tests: haemadsorption for Parainfluenza