

SUBJECT	MEDICAL MICROBIOLOGY					
CREDITS	Total	9	Theory	6	Practical	3

SPECIFIC OBJECTIVES

Knowledge objectives

- To acquire a basic understanding of the objectives of microbiology in medicine, of the historical development of these sciences and of the impact they have had on humanity and the development of other sciences.
- To understand the basic morphological and structural aspects of microorganisms, their metabolic capacities and their physiology as a basis for the microbiological diagnosis of infectious diseases.
- To understand the basic genetic mechanisms which operate in the microbial world, the genetic basis of microbial diversity, and the genetic determination of both the pathogenicity and virulence of microorganisms and resistance to antimicrobial substances.
- To learn about the natural groups and taxonomic categories of the microbial world, as well as the methods used in classification.
- To acquire a basic understanding of the microbiological aspects of methods used by humans to control microorganisms: a) sterilization, disinfection and antisepsis; b) mechanism of action, resistances and basis for the clinical use of antimicrobial substances.
- To understand the basic principles of the interrelationship between host and microorganism, of the infectious process and of the factors which determine the pathogenic action of microorganisms.
- To understand the non-specific and specific defence mechanisms of the human organism and the basis of acquired immunity to infectious agents.
- To acquire individualized knowledge of the main genera and species of microorganisms of interest in human infectious pathology, and to understand their taxonomic location, pathogenic action, and the diagnosis and control of infection, the latter in the context of the treatment, epidemiology and prophylaxis of infectious diseases.

Applied objectives

- To acquire the knowledge needed to identify the main bacterial morphologies and their stain characteristics.
- To understand the morphological characteristics of bacteria in the usual culture media. To evaluate the response of various biochemical substrates.
- To apply techniques for studying the *in vitro* activity of antimicrobial substances. To be able to interpret the results correctly.
- To observe the methods of viral isolation in cell culture.
- To acquire the knowledge needed to identify the morphology of the main parasites in human pathology.
- To acquire the knowledge needed to identify the morphology of the main fungi in human pathology.
- To apply serological techniques in the diagnosis of infectious diseases.
- To apply theoretical and practical knowledge in microbiological diagnosis. Interpretation and evaluation of results.

SYLLABUS

Theory

GENERAL MICROBIOLOGY

A. GENERAL MICROBIOLOGY

1. Concept of medical microbiology and parasitology

Concept of microbiology and parasitology. Living beings. Taxonomy. Symbiosis. Historical development of microbiology and parasitology. Concept of infection, aetiological diagnosis, therapeutics, epidemiology and prophylaxis. Other aspects of microbiology.

2. Bacteria

Structure of the bacterial cell: cytoplasm, chromosomal and extrachromosomal DNA, cell membrane, bacterial wall, gram-positive bacterial wall, gram-negative bacterial wall, capsule and glycocalyx, flagella, *pili* or *fimbriae*. Bacterial antigens. Forms of resistance: spores. Morphology and visualization of bacteria. Bacterial metabolism and applied aspects derived from their study. Bacterial division. Bacterial nutrition. Culture media: description, physiochemical conditions of bacterial cultures, dynamics of bacterial growth, use of culture media. Bacterial taxonomy. Identification of bacteria. Bacteria of medical interest.

3. Fungi

General structure and reproduction of fungi: structure and morphology, fungal wall, mechanisms of reproduction. Fungal metabolism: metabolism, culture methods, isolation and propagation. Taxonomy of fungi. Main fungi of medical interest.

4. Viruses

Morphology and structure of viruses: size, genome, capsid and coating. Virus replication: adherence, penetration, replication, exit, defective virus. Viral antigens. Viral taxonomy. Visualization of viruses. Isolation and propagation of viruses: experimental animals, animal embryos, cell cultures, cytopathic action. Interference. Bacteriophage. Viroids and prions. Main viruses of medical interest.

5. Parasites: protozoa and helminths

Significance of human infection by parasites. Morphology. Taxonomy. Physiology. Life cycles, transmission and distribution. Antigen structure. Visualization, culture and identification. Main protozoa of medical interest. Main helminths of medical interest.

6. Microbial genetics

Microbial variation and inheritance. Mutation and repair. Genetic transfer: transformation, transduction, conjugation. Genetic recombination.

7. Action of physical and chemical agents on microorganisms

Sterilization: basic principles, factors which affect sterilization, sterilization by physical agents, sterilization by chemical agents. Disinfectants and antiseptics: definition and classification, mechanism of action.

B. PATHOGENY OF INFECTIOUS DISEASES AND MICROBIAL IMMUNOLOGY

8. Interrelationship between host and microorganism

Models of host/microorganism relationship. Microorganism entry routes in the human body. Normal flora: general factors that determine the distribution and confinement of normal flora in various areas of the human body, colonization, importance of normal flora. Concept of infection: specificity and Koch's postulates. Pathogenic ability and virulence. Main pathogenic microorganisms. Opportunistic microorganisms.

9. Non-specific defence mechanisms

Non-specific resistance to infection. External defences. Internal defences: inflammation, complement system and other tissue systems that facilitate the inflammatory reaction, phagocytosis. Individual variations in resistance.

10. Factors that determine pathogenic action

Colonization: trophism and the phenomenon of adherence. Penetration. Multiplication. Invasion. Lesion capacity. Models of infection.

11. Specific defence mechanisms

Microbial antigens. Kinetics of the immune response in the infectious process. Immunity in infections: natural resistance and acquired immunity.

C. BASIC PRINCIPLES IN THE DIAGNOSIS, EPIDEMIOLOGY AND PROPHYLAXIS OF INFECTIOUS DISEASES

12. Laboratory diagnosis of infectious diseases

General principles. Taking samples. Transporting samples. Direct diagnosis: direct observation techniques; culture, isolation, identification and confirmation of microorganism pathogenicity; rapid diagnostic techniques; detection of microbial antigens; detection of microbial nucleic acids. Indirect diagnosis: demonstration of specific antibodies, cellular hypersensitivity.

13. Epidemiology and prophylaxis of infectious diseases

Infection chain: reservoir, source of infection, mechanism of transmission, susceptible population. Epidemiogenesis: types of epidemic, periodicity. Hospital epidemiology; general approach to prophylaxis.

14. Immunity to infection: Vaccines and serums

Passively acquired immunity: heterologous and homologous sera. Actively acquired immunity: concept and types of vaccine, adjuvant substances. Vaccination: conditions for application and calendar of systematic vaccinations. Serovaccination.

D. CHEMOTHERAPY

15. Antibacterial and antifungal agents

Concept. Classification. Theoretical range of action. Antimicrobial associations. Mechanism of action on the following: peptidoglycan biosynthesis, the cytoplasmic membrane, protein synthesis, and nucleic acid synthesis. Mechanisms of resistance: natural resistance, chromosomal and extrachromosomal resistance. Assessment of antimicrobial activity: antibiogram and minimum inhibitory concentration (MIC).

16. Antiviral agents: antiparasitic agents

Concept, history and development. Mechanism of action. Mechanisms of resistance. Range of action.

SYSTEMATIC MICROBIOLOGY

E. SYSTEMATIC BACTERIOLOGY

17. *Staphylococcus* genus

Bacteriological characteristics and classification. *S. aureus*: pathogenic action, bacteriological diagnosis and infection control. *S. epidermidis*. *S. saprophyticus*.

18. *Streptococcus* genus and *Enterococcus* genus

Streptococcus genus: bacteriological characteristics and classification. *Streptococcus pyogenes* (*S. pyogenes* and *S. agalactiae*) and streptococci of the *viridans* group: pathogenic action; bacteriological diagnosis and infection control. *S. pneumoniae*: pneumococcal pneumonia: pathogeny, bacteriological diagnosis and infection control. *Enterococcus* genus: bacteriological characteristics and pathogenic action.

19. *Clostridium* genus and *Bacillus* genus

Clostridium genus: bacteriological characteristics and classification. *C. tetani*. Tetanus: pathogeny; bacteriological diagnosis and infection control. *C. botulinum*. Botulism: pathogeny; bacteriological diagnosis and infection control. *C. perfringens*. Gaseous gangrene: pathogeny, bacteriological diagnosis and infection control. *C. difficile*.

Pseudomembranous colitis: pathogeny; bacteriological diagnosis and infection control. *Bacillus* genus: *B. anthracis* and *B. cereus*. bacteriological characteristics and pathogenic action.

20. *Corynebacterium* genus and *Listeria* genus

Corynebacterium genus: bacteriological characteristics and classification. *C. diphtheriae*: diphtheria: pathogeny, bacteriological diagnosis and infection control. *Listeria* genus: *L. monocytogenes*. Bacteriological characteristics and pathogenic action.

21. *Neisseria* genus

Bacteriological characteristics and classification. *N. gonorrhoeae*. Gonococccic urethritis: pathogeny, bacteriological diagnosis and infection control. *N. meningitidis*. Meningococccic meningitis: pathogeny, bacteriological diagnosis and infection control.

22. *Enterobacteriaceae* family

Bacteriological characteristics and classification. *Salmonella* genus: bacteriological characteristics and classification. Gastroenteritis or enterocolitis due to food poisoning: pathogeny, bacteriological diagnosis and infection control. Bacteremic infections due to typhoid fever: pathogeny; bacteriological diagnosis and infection control. *Shigella* genus: bacteriological characteristics and classification. Bacillary dysentery: pathogeny, bacteriological diagnosis and infection control. *Escherichia* genus: *E. coli* producers of diarrhoea: bacteriological characteristics and pathogenic action. *Yersinia* genus: bacteriological characteristics and classification. *Y. enterocolitica* and *Y. pseudotuberculosis*: pathogenic action; bacteriological diagnosis and infection control. *Y. pestis*. Bubonic plague: pathogeny, bacteriological diagnosis and infection control.

23. *Vibrio* genus, *Campylobacter* genus and *Helicobacter* genus

Vibrio genus: bacteriological characteristics and classification. *V. cholerae*. Cholera: pathogeny, bacteriological diagnosis and infection control. *V. parahaemolyticus*: pathogenic action; bacteriological diagnosis and infection control. *Campylobacter* genus: bacteriological characteristics and classification. *C. jejuni*. Enterocolitis: pathogeny, bacteriological diagnosis and infection control. *Helicobacter* genus. *H. pylori*: bacteriological characteristics and pathogenic action.

24. *Haemophilus* genus and *Bordetella* genus

Haemophilus genus: bacteriological characteristics and classification. *H. influenzae*: pathogenic action, bacteriological diagnosis and infection control. *Bordetella* genus: bacteriological characteristics and classification. *B. pertussis*. Whooping cough: pathogeny, bacteriological diagnosis and infection control.

25. *Legionella* genus

Bacteriological characteristics and classification. *L. pneumophila*. Legionnaire's disease: pathogeny, bacteriological diagnosis and infection control.

26. *Brucella* genus and *Francisella*

Brucella genus: bacteriological characteristics and classification. Brucellosis: pathogeny, bacteriological diagnosis and infection control. *Francisella* genus: bacteriological characteristics and classification. *F. tularensis*. Tularèmia: pathogeny, bacteriological diagnosis and infection control.

27. Strict gram-negative aerobic bacteria and opportunistic anaerobic bacteria

Pseudomonas genus, opportunistic enterobacteria and *Moraxella* genera, *Acinetobacter*, *Aeromonas* and *Plesiomonas*. Bacteriological characteristics and classification. Ecology, pathogenic action, bacteriological diagnosis and infection control.

28. Strict opportunistic anaerobic bacteria

Gram-negative bacteria: *Veillonella*, *Bacteroides*, *Leptotrichia* and *Fusobacterium* genera. Gram-positive bacteria: *Propionibacterium*, *Eubacterium*, *Peptococcus* and *Peptostreptococcus* genera. Ecology, pathogenic action, bacteriological diagnosis and infection control.

29. Spirochaetes

Bacteriological characteristics and classification. *Treponema* genus. *T. pallidum*. Syphilis: pathogeny, bacteriological diagnosis and infection control. *Borrelia* genus. *B. burgdorferi*. Lyme's disease: pathogeny, bacteriological diagnosis and infection control. *Leptospira* genus. *L. interrogans*. Human leptospirosis: pathogeny, bacteriological diagnosis and infection control.

30. *Mycobacterium* genus, *Nocardia* genus and *Actinomyces* genus

Mycobacterium genus: bacteriological characteristics and classification. *M. tuberculosis*. Tuberculosis: pathogeny, bacteriological diagnosis and infection control. *M. leprae*. Leprosy: pathogeny, bacteriological diagnosis and infection control. Atypical mycobacteria: pathogenic action; bacteriological diagnosis and infection control. *Nocardia* genus: bacteriological characteristics, classification and pathogenic action. *Actinomyces* genus: bacteriological characteristics, classification and pathogenic action.

31. *Mycoplasma* genus and *Ureaplasma* genus

Bacteriological characteristics and classification. *M. pneumoniae*: pathogenic action, bacteriological diagnosis and infection control. *Ureaplasma* genus: bacteriological characteristics, classification and pathogenic action.

32. *Rickettsia* genus and *Coxiella* genus

Rickettsia genus: bacteriological characteristics and classification. *R. conorii*. Mediterranean spotted fever: pathogeny, bacteriological diagnosis and infection control. Other Rickettsian infections of medical interest. *Coxiella* genus: bacteriological characteristics and classification. *C. burnetii*. Q fever: pathogeny, bacteriological diagnosis and infection control.

33. *Chlamydia* genus

Bacteriological characteristics and classification. *C. trachomatis*: pathogenic action; bacteriological diagnosis and infection control. *C. psittaci*: pathogenic action; bacteriological diagnosis and infection control. *C. pneumoniae*: pathogenic action; bacteriological diagnosis and infection control.

F. SYSTEMATIC MYCOLOGY

34. Superficial, cutaneous and subcutaneous mycosis

Fungi which cause superficial mycosis: *Malassezia* genus: mycological characteristics, ecology, distribution. Pathogenic action. Mycological diagnosis. Histopathology. Infection control. *Trichosporon*, *Piedraia* and *Cladosporium* genera. Fungi which cause cutaneous mycosis: dermatophytes. *Epidermophyton*, *Microsporum* and *Tricophyton* genera: mycological characteristics, ecology, distribution. Pathogenic action. Mycological diagnosis. Histopathology. Infection control. Fungi which cause subcutaneous mycosis: *Sporothrix* genus: mycological characteristics, ecology, distribution. Pathogenic action. Mycological diagnosis. Histopathology. Infection control. Agents of chromoblastomycosis and phaeohyphomycosis.

35. Systemic mycosis

Histoplasma, *Blastomyces*, *Coccidioides* and *Paracoccidioides* genera: mycological characteristics, ecology, distribution. Pathogenic action. Mycological diagnosis. Histopathology. Infection control.

36. Opportunistic mycosis

Fungi in the form of yeast: *Candida* genus: mycological characteristics, ecology, distribution. Pathogenic action: primary infections and opportunistic infections. Mycological diagnosis. Histopathology. Infection control. *Cryptococcus* genus: mycological characteristics, ecology, distribution. Pathogenic action. Mycological diagnosis. Histopathology. Infection control. *Rhodotorula* genus. *Trichosporum* genus. Filamentous fungi: *Aspergillus* genus: mycological characteristics, ecology, distribution. Pathogenic action. Mycological diagnosis. Histopathology. Infection control. *Pseudoallesqueria* genus. *Mucor*, *Absidia* and *Rhizopus* genera.

G. SYSTEMATIC VIROLOGY

37. Herpes viruses

Virological characteristics and classification of the *Herpesviridae* family. *Alphaherpesvirinae* sub-family: *Simplex Virus* genus: herpes simplex virus types 1 and 2: pathogenic action, virological diagnosis and infection control. Varicella zoster virus: pathogenic action; virological diagnosis and infection control. *Betaherpesvirinae* sub-family: *Cytomegalovirus* genus: cytomegalovirus: pathogenic action, virological diagnosis and infection control. *Gammaherpesvirinae* sub-family: *Lymphocryptovirus* genus: Epstein-Barr virus: pathogenic action, virological diagnosis and infection control. Other unclassified herpes viruses: human herpes virus types 6, 7 and 8.

38. Respiratory viruses

F. *Orthomyxoviridae*: virological characteristics and classification. *Influenza virus* A and B genus. *Influenza virus* C genus. Flu virus A, B and C: pathogenic action. F. *Paramyxoviridae*: virological characteristics and

classification. *Paramyxovirinae* sub-family. *Paramyxovirus* genus: *parainfluenza* virus (14): pathogenic action. *Pneumovirinae* sub-family. *Pneumovirus* genus: syncytial respiratory virus: pathogenic action. F. *Adenoviridae*: virological characteristics and classification. *Mastadenovirus* genus. Adenovirus: pathogenic action. F. *Picornaviridae*. *Rhinovirus* genus. Rhinovirus. F. *Coronaviridae*. *Coronavirus* genus. Human coronavirus F. *Reoviridae*. *Orthoreovirus* genus. Rheovirus. Pathogeny and virological diagnosis of respiratory viral infections. Control of respiratory viral infections.

39. Enterovirus

F. *Picornaviridae*: virological characteristics and classification. *Enterovirus* genus. Poliomyelitis virus: pathogenic action, virological diagnosis and infection control. Enterovirus, Coxsackie virus and ECHO virus: pathogenic action, virological diagnosis and infection control.

40. Viruses which cause gastroenteritis

F. *Reoviridae*: virological characteristics and classification. *Rotavirus* genus. Rotavirus. F. *Caliciviridae*. *Calicivirus* genus. Human calicivirus and Norwalk virus. F. *Adenoviridae*: *Mastadenovirus* genus. Adenovirus: serotypes 40 and 41. Others: human coronavirus and astrovirus. Pathogeny, virological diagnosis and control of viral gastroenteritis.

41. Viral hepatitis

F. *Hepadnaviridae*: virological characteristics and classification. *Orthohepadnavirus* genus. Hepatitis B virus: pathogenic action, virological diagnosis and infection control. F. *Flaviviridae*: virological characteristics and classification. Hepatitis C genus. Hepatitis C virus: pathogenic action, virological diagnosis and infection control. F. *Picornaviridae*. *Hepatovirus* genus. Hepatitis A virus: pathogenic action; virological diagnosis and infection control. Other unclassified viruses that cause hepatitis: hepatitis delta virus and hepatitis E.

42. Mumps virus and exanthematic viruses

F. *Paramyxoviridae*. *Paramyxovirinae* sub-family. *Paramyxovirus* genus. Mumps virus: pathogenic action, virological diagnosis and infection control. *Morbillivirus* genus. Measles virus: pathogenic action, virological diagnosis and infection control. F. *Togaviridae*: virological characteristics and classification. *Rubivirus* genus. Rubella virus: pathogenic action, virological diagnosis and infection control. F. *Parvoviridae*: virological characteristics and classification. *Parvovirus* genus. Parvovirus B19. F. *Herpesviridae*. Type 6 human herpes virus.

43. Rabies virus, arbovirus and other viruses which cause zoonosis

F. *Rhabdoviridae*. Virological characteristics and classification. *Lyssavirus* genus. Rabies virus: pathogenic action, virological diagnosis and infection control. Arbovirus: F. *Togaviridae*. *Alphavirus* genus. Western equine encephalitis virus. F. *Flaviviridae*. *Flavivirus* genus. Yellow fever virus and dengue virus. F. *Bunyaviridae*. *Bunyavirus* genus. F. *Reoviridae*. *Orbivirus* and *Coltivirus* genera. *Other viruses which cause zoonosis*: F. *Arenaviridae*. *Arenavirus* genus. Lymphocytic choriomeningitis virus and lassa fever virus. F. *Filoviridae*. *Filovirus* genus: Marburg and Ebola viruses. F. *Bunyaviridae*. *Hantavirus* genus. Hantaan virus.

44. Retrovirus

Virological characteristics and classification. *Oncovirinae* sub-family: virological characteristics and classification. *Group HTLVBLV* genus. Human T-cell lymphotropic virus types 1 and 2. Pathogenic action, virological diagnosis and infection control. *Lentivirinae* sub-family: virological characteristics and classification. *Lentivirus* genus. Human immune deficiency virus types 1 and 2. Acquired immunodeficiency syndrome: pathogeny, virological diagnosis and infection control.

45. Oncogene DNA viruses

F. *Papovaviridae*. Virological characteristics and classification. *Papillomavirus* genus. Human papilloma virus: pathogenic action, virological diagnosis and infection control. Epstein-Barr virus. Hepatitis B and C viruses.

46. Non-conventional agents

Viroids and prions. Structural characteristics. Pathogenic action.

H. SYSTEMATIC PARASITOLOGY

H1. PROTOZOA

47. Intestinal protozoa

I) Amoebae. *Entamoeba* genus: parasitological characteristics and classification. *E. histolytica*. Amoebic dysentery: biological cycle, pathogeny, parasitological diagnosis and infection control. *Iodamoeba* and *Blastocystis* genera. II) Flagellates. Parasitological characteristics and classification. *Giardia* genus. *G. intestinalis*: biological cycle, pathogenic action, parasitological diagnosis and infection control. III) Ciliates. *Balantidium* genus. *B. coli*: biological cycle, pathogenic action, parasitological diagnosis and infection control. III) *Coccidia* and *Microsporidia*. Parasitological characteristics and classification. *Isospora* genus. *I. belli*: biological cycle, pathogenic action, parasitological diagnosis and infection control. *Cryptosporidium* genus. *C. parvum*: biological cycle, pathogenic action, parasitological diagnosis and infection control. *Cyclospora* genus. *C. Cayetanensis*. *Sarcocystes* genus. *Microsporidia* order.

48. Hematic protozoa

Plasmodium genus: parasitological characteristics and classification. Malaria: biological cycle, pathogeny, parasitological diagnosis and infection control.

Babesia genus. Parasitological characteristics and classification. *Babesia spp.* Biological cycle, pathogeny, parasitological diagnosis and infection control. *Leishmania* genus. Parasitological characteristics and classification. Biological cycles. *L. donovani*: pathogenic action, parasitological diagnosis and infection control. *L. tropica*: pathogenic action, parasitological diagnosis and infection control. *L. braziliensis* and *L. mexicana*: pathogenic action, parasitological diagnosis and infection control. *Trypanosoma* genus. Parasitological characteristics and classification. *T. gambiense* and *T. rhodesiense*: biological cycle, pathogenic action, parasitological diagnosis and infection control. *T. cruzi*: biological cycle, pathogenic action, parasitological diagnosis and infection control.

49. Protozoa of tissue and other localizations

I) Tissue-based. *Toxoplasma* genus. Parasitological characteristics and classification. *T. gondii*: biological cycle, pathogeny, parasitological diagnosis and infection control. *Pneumocystis* genus. Parasitological characteristics and classification. *P. carinii*: biological cycle, pathogenic action, parasitological diagnosis and infection control. II) Others. *Trichomonas* genus. *T. vaginalis*: biological cycle, pathogenic action, parasitological diagnosis and infection control. *Naegleria* genus: pathogenic action. *Acanthamoeba* genus: pathogenic action.

H2. HELMINTHS

50. Platyhelminths: Trematodes

I) Trematodes of the lungs and digestive system: parasitological characteristics and classification. *Fasciola* genus. *F. hepatica*: biological cycle, pathogenic action, parasitological diagnosis and infection control. II) Hematic trematodes: parasitological characteristics and classification. *Schistosoma* genus. Schistosomiasis: biological cycles biologicals, pathogeny, parasitological diagnosis and infection control.

51. Platyhelminths: Cestodes

I) Intestinal cestodes (parasitism by adult cestodes): parasitological characteristics and classification. *Taenia* genus. *T. solium* and *T. saginata*: biological cycle, pathogenic action, parasitological diagnosis and infection control. *Dipylidium caninum*, *Hymenolepis nana*, *Diphyllobothrium latum*. II) Tissue-based cestodes (parasitism during larval stages): parasitological characteristics and classification. Cysticercosis. *Echinococcus* genus. *E. granulosus*. Hydatid cyst: biological cycle; pathogeny, parasitological diagnosis and infection control.

52. Intestinal nematodes

Parasitological characteristics and classification. Those with an exclusively intestinal habitat: *Enterobius vermicularis* and *Trichuris trichiura*: biological cycles, pathogenic action, parasitological diagnosis and infection control. With tissue migration of larvae: *Ascaris lumbricoides*, *Strongyloides stercoralis*, *Ancylostoma duodenale* and *Necator americanus*: biological cycles, pathogenic action, parasitological diagnosis and infection control.

53. Tissue-based nematodes

Parasitological characteristics and classification. *Trichinella* genus. *T. spiralis*. Trichinosis: biological cycle, pathogeny, parasitological diagnosis and infection control. Filaria that parasitize humans: *Wuchereria*, *Brugia*, *Loa*, *Onchocerca*, *Mansonella* genera. Filariasis: biological cycles, pathogeny, parasitological diagnosis and infection control. *Dracunculus* genus. *D. medinensis*. Pathogenic action.

54. Arthropods of health interest

General morphology. Developmental cycle. Importance in terms of health and medicine. Classification. *Arachnida*: *Acarina* (mites, ticks); *Araneida* and *Scorpionida*. *Insecta*: *Diptera*; *Heteroptera*; *Siphonaptera*; *Anoplura*.

Practical

A. PRACTICAL LABORATORY WORK

1. Bacterial stains

Gram stain. Observation of different bacterial morphologies. Ziehl-Neelsen stain. Characteristics of bacilli that resistant to acid and alcohol.

2. Bacterial culture media

Characteristics and preparation. Seeding pathological products in culture media. Subcultures. Observation and description of bacterial colonies.

3. Biochemical identification of bacteria

Performing biochemical tests to identify different types of bacteria. Catalase and oxidase tests. Use of sugars for oxidation and/or fermentation. Detection of bacterial enzymes. Urease. Tryptophan deaminase. Lysine decarboxylase. Phenylalanine deaminase. Use of sodium citrate.

4. Antibigram

Performing antibiograms by the Kirby-Bauer method. Determining the minimum inhibitory concentration (MIC).

5. Isolating viruses

Observation of cell cultures.

6. Observation of parasites

Observation of parasites in faeces, blood and respiratory samples.

7. Observation of fungi

Observation and description of the macroscopic characteristics of fungal colonies in culture media. Microscopic observation. Description of morphology.

8. Serological techniques

Detection of specific antibodies in the serum of patients. Techniques of agglutination and enzyme immune assay.

B. PROBLEM SOLVING

Simple clinical microbiological problems that have been adapted to the theory and practical teaching will be presented. These will be complemented with audiovisual sessions.

LEARNING RESOURCES AND TEACHING METHODS

Teaching

Teaching will be based on theoretical classes, practical laboratory work and the discussion of clinical microbiological problems. Time will also be made available for students to raise specific questions with tutors.

LEARNING REQUIREMENTS

In order to understand the subject, students must be familiar with the content of the following subject modules: Biochemistry and Molecular Biology, Cell Biology, Developmental Biology, Biophysics and Physical Medicine, General Histology, and Structure and Function of Blood and the Immune System.