

سَبَّحَ لِلَّهِ مَا فِي السَّمَاوَاتِ وَالْأَرْضِ

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*This program is approved by:
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ABBREVIATIONS

CanMEDS	Canadian Medical Education framework
CAP	College of American Pathologists
DOPS	Direct Observation of Procedural Skills
FITER	Final In-Training Evaluation Report
GPT	General Professional Training
LSC	Local Supervising Committee
MBC	Minimal Bacterial Concentration
MIC	Minimal Inhibitory Concentration
OSPE	The Objective Structured Practical Examination
SCCLS	Scientific Council for Clinical Laboratory Sciences
SBMM	Saudi Board for Medical Microbiology
SC-MM	Scientific Committee for Medical Microbiology
SCFHS	Saudi Commission for Health Specialties

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INTRODUCTION

Population growth and the expansion in the provision of high-quality healthcare has been accompanied by an increase in the number of hospitals in Saudi Arabia. Infectious diseases are a major cause of morbidity and mortality and necessitate the need for equivalent growth in the numbers of highly qualified staff specialized in medical microbiology.

The Medical Microbiology program is run under the supervision and accreditation of the Saudi Council for Health Specialties, referred to hereafter as SCFHS. Therefore, the rules and regulations governing the program are developed by the SCFHS, and all parts of this training and syllabus are explained in view of the SCFHS regulations.

The purpose of this training program is to provide adequate theoretical and practical knowledge that is required for practicing medical microbiology. The major components of this program include the theoretical basis of medical microbiology, laboratory components, infection control measures, and dissertation writing. The program will span a period of four years as a joint program that involves rotations between the certified regional hospitals each year.

Educational Goals, Objectives, and Medical Microbiology Competencies

Goals and Objectives

The overall objective of the program is to train residents on medical microbiology using a well-structured comprehensive residency training program, certified by the SCFHS. The purpose of this training program is to provide adequate theoretical knowledge and practical training required for practicing medical microbiology laboratory specialties. The major components of this program include Safety, the Scientific Basis of Clinical Microbiology, Systematic and Clinical Bacteriology, Pathogenesis, Laboratory Components, Quality Control, and Dissertation Writing. The residents (trainees) will spend a significant amount of time in the laboratory, acquiring additional management skills. After the successful completion of training and if the trainees pass the final certification exam, the graduates will function as independent first specialists in this field.

They will be able to interpret submitted results efficiently and accurately and in a timely manner.

They will be competent in utilizing, whenever available, the appropriate ancillary studies, and finally convey their opinion clearly and concisely to the treating physicians.

They must demonstrate the required knowledge, skills, and attitudes for effective and safe patient-centered care for a diverse population. In all aspects of the specialist practice, the trainees must be able to address issues of gender, age, culture, ethnicity, and ethics in a professional manner.

The total duration of the training program is four academic years unless the trainees are exempted from any part of the training by the Scientific Council for Clinical Laboratory Sciences (SCCLS). The program recruits medical and non-medical (applied medical science and microbiology) graduates. Upon completion of this training program and satisfying the examiners, the graduate will be granted a certification from the Saudi Board for Medical Microbiology (SBMM), will have a degree of competency and experience considered adequate

to practice medical microbiology independently, and will become eligible for the position of scientist and consultant after the requisite years of experience. They will be consultants to clinicians on test selection and interpretation, educators of trainees and staff, researchers in developing methods and discovering microorganisms, and leaders in implementing quality patient care.

Medical Microbiology Competencies

At the completion of training, the trainees will have acquired the following competencies and function effectively according to the CanMEDS (Appendix A) physician competency framework:

Medical expert	Collaborator
Technical expert	Manager
Professional	Scholar
Communicator	Health advocate

Program Framework

General Training Requirements

- Admission into the program is in accordance with the SCFHS Training Rules and Regulations.
- Residents shall abide by the training regulations and obligations established by the SCFHS.
- Training is a full-time commitment. Residents shall be enrolled in full-time, continuous education for the entire duration of the program.
- Training is to be conducted in institutions accredited for training by the Central Accreditation Committee and the SBMM.
- Training shall be comprehensive and include the different spectrum of pathogens that cause diseases and different techniques in microbiology laboratories.
- Residents shall be actively involved in developing a patient's specimen from safe collection to diagnosis, with a gradual progression of clinical and technical responsibility.

Structure of the Training Program

The Saudi Board for Medical Microbiology is a joint program that involves rotations each year in certified regional hospitals.

Table 1 summarizes the training rotation blocks throughout each year of the residency program. In addition, the following are also applicable:

- a) This is a structured four-year post-graduate training program in Medical Microbiology (Appendix B).
- b) The junior years (first and second) are designed to provide training in a wide range of analytical techniques and are the scientific basis for clinical microbiology in addition to systematic and clinical bacteriology.
- c) In the senior (third and fourth) years, after passing the required examinations, trainees are allocated to different subspecialties in microbiology in addition to laboratory management and research skills.
- d) The residents are required to complete the allocated rotations satisfactorily for a given year and pass the end-of-year promotion exam and obtain a satisfactory end-of-year evaluation before passing from one academic year to the next. Further information on the assessments and examinations is available in the SCFHS Exam Rules and Regulations.

- e) The sequence of the rotations will be under the direction of the Local Supervising Committee (LSC).
- f) Each trainee must be trained to interpret clinical results and be involved in different technical aspects to ensure exposure to both common and uncommon conditions.
- g) After the successful completion of all program requirements throughout the four-year training period and obtaining the Final In-Training Evaluation Report (FITER), Appendix C, the trainees will receive a training completion certificate issued by the regional supervising training committee. The candidate will then be eligible to undertake the final Medical Microbiology written and oral/practical exams after submitting a dissertation (or scientific paper).
- h) Trainees that complete the “Final Certification Exam” will receive the “Saudi Board in Medical Microbiology” certificate.
- i) After completing the training program and passing the final certification exam, the candidate classification will be according to the regulations of the SCFHS.

The summary of the program is illustrated in Figure 2.

General Program Objectives

The trainees should acquire all of the necessary medical microbiology knowledge, including biology, pathogenesis, essential symptoms, and signs of diseases, principles of laboratory diagnosis, and the interpretation of lab results, treatment, prevention, and control of diseases. Moreover, they should acquire knowledge of epidemiology and host responses to the spectrum of microorganisms (bacteria, viruses, fungi, and parasites) capable of causing diseases in humans, including the immunological aspects of diseases. The aim is to produce a qualified “Clinical Scientist” who can provide specialist opinions in their clinical discipline and who should have developed the appropriate management skills to lead a department if required.

A graduate pursuing postgraduate training in the field of medical microbiology should acquire or develop:

- Specialized knowledge of the biology, pathogenesis, essential symptoms, and signs of the disease caused by different pathogens.
- Competence in the proper and safe collection, handling, and transport of clinical specimens, particularly high-risk specimens, and be able to advise others about these procedures whenever required.
- Familiarity with all aspects of health and safety requirements for microbiology laboratories.
- The capability of assessing the degrees of urgency for the processing of specimens, including the provision for an out-of-hours service and the communication of the preliminary results as applicable.
- Capabilities in laboratory diagnoses of microbial diseases by using conventional, semi-automated, and automated techniques, including media preparation and antimicrobial studies.
- Awareness of all major new technologies available in medical microbiology based on DNA techniques (e.g., PCR) and monoclonal antibodies.
- Technical knowledge gained from close acquaintance with laboratory technology so that the method appropriate for a clinical problem can be chosen, and quality control and quality assurance procedures can be implemented.
- High standard interpretative skills so that a clinically useful opinion can be derived from laboratory findings and can provide an opinion for the treating physicians about the diagnosis, management, and laboratory requirements for following up with the patient.

- First-hand experience of local infection control problems, including outbreaks of infection, and their management both in hospital and community health along with understanding the principles of patient isolation and their application.
- Competence in formulating antibiotic policies in the hospital, as a measure to minimize antimicrobial resistance.
- Research and development experience. Original thought and critical assessment of published work are important to allow the trainees to contribute as part of a team, and individually, to the development of the service.
- Life-long habits of reading, literature-searches, consultation with colleagues, attendance at scientific meetings, and the presentation of scientific work as part of continued education.
- Data management skills to evaluate information derived from the population served and technical procedures applied in the laboratory. These skills should include familiarity with the use of spreadsheets, databases, and statistical packages and be applied for the prevention, control, and management of infectious diseases in the hospital and community.
- Management and communication skills. The trainees must gain experience in planning departmental policies and developing the leadership skills necessary to implement them. The training must be under the supervision of the department.
- The capability of teaching undergraduate and graduate residents.

The graduates must also:

- Learn about laboratory procedures by daily bench work.
- Attend department weekly seminars and tutorials.
- Attend journal club meetings.
- Attend microbiology and infectious disease club monthly meetings.
- Learn about public health microbiology in the public health laboratory.

Program Supervision:

Please refer to the updated executive policy of SCFHS on admission and registration.

Website: www.scfhs.org.sa

Figure 1: Program Organizational Structure

SCCLS, Scientific Council for Clinical Laboratory Sciences; SC-MM, Scientific Committee for Medical Microbiology.

*In case of more than one region involved in the program.

**Currently Active.

^Currently not active.

Minimum Training Requirements for Medical Microbiology Residency's

The SCFHS requires four years of training before trainees are eligible for the Saudi Board for Medical Microbiology (SBMM) exam.

The general program outline is as follows:

- The first year of practical training will be directed towards acquiring a broad general experience in analytical techniques and instrumentation relevant to the clinical practice of medical microbiology under the supervision of both formal and informal teaching.
- During the subsequent two years, the trainees will cover the core aspects of Medical Microbiology (Bacteriology, Virology, Mycology, Parasitology, and Immunology), including the Clinical Interpretation of Laboratory Data, and will acquire further laboratory practice.
- In the first half of the 4th year of training, the trainees will study infection control, hospital antibiotic policy management, and laboratory management quality control and accreditation in action to interpret laboratory data.
- In addition, the trainees will pursue a research project related to medical microbiology during the 2nd half of the 4th year. The trainees are required to submit a dissertation of at least 100 pages with single-space writing.
- There should be some scope for pursuing a sub-specialization within medical microbiology. The training includes simultaneous involvement in the various activities of each medical microbiology department or training center the candidate is rotating in, and this includes the performance of the duties of a specialist as applicable to their stage in the program and in compliance with the job description available from the respective department or training center.

The details of the syllabus are provided to guide the trainees through the training program.

Candidates Acceptance Criteria

Applicants to this residency training should have completed the four-year General Professional Training (GPT) in an approved post(s), preferably in General Laboratory Practice, including Medical Microbiology. The objective is to gain experience over a wide field of clinical laboratory practice. Candidates for the residency program are selected on the basis of an interview conducted by the Local Supervising Committee (LSC).

The following are required:

- I. Three confidential reference letters.
- II. A written examination and an interview to evaluate each candidate.
- III. Graduate degree from an appropriate and recognized college of Applied Medical Sciences or equivalent.
- IV. Classified as a specialist by SCFHS.
- V. A minimum of three years' work experience in the field of medical microbiology in a recognized hospital or diagnostic laboratory.
- VI. Good command of spoken and written Arabic and English.

Table 1. Training Rotation Blocks throughout each Year of Residency

Year/R	Curriculum and duration									
Year 1 (R 1)	R 1.I General Modules			R 1.II Scientific Basis of Clinical Microbiology						
	Lab Safety	Quality control	Lab Ethics	Sterilization and Disinfection	Handling of Specimens	Microscopy	Culture Methods	Further Processing	Antimicrobial Investigations	
	48 weeks									
Year 2 (R 2)	R 2.I Systematic Bacteriology					R 2.II Clinical Bacteriology				
	48 weeks									
Year 3 (R 3)	R 3.I Environmental Microbiology (4 weeks)		R 3.II Molecular and Emerging Techniques (6 weeks)		R 3.III Virology (10 weeks)		R 3.IV Mycology (8 weeks)		R 3.V Clinical Parasitology (10 weeks)	
	48 weeks									
Year 4 (R 4)	R 4.I Infection Control			R 4.II Laboratory Management			R 4.III Research Methods and Dissertation			
	48 weeks									

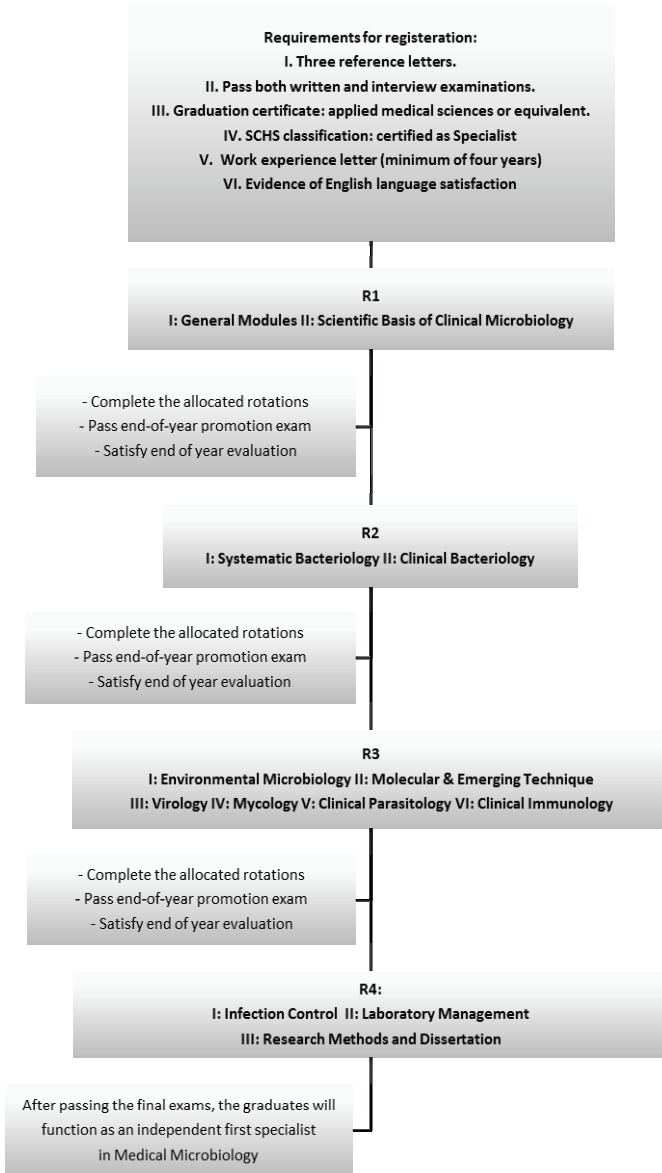


Figure 2: The summary of the Medical Microbiology program

YEAR ONE– R1 (48 WEEKS)

Rotation outline:

During this part of the training, the trainees are expected to become competent analysts with an awareness of a wide range of microbiology techniques and their performance, comparative usefulness, limitations, and applications.

In this first year, the trainees must go through two different modules, both the General and Scientific Basis of Clinical Microbiology.

The trainees should understand the principles, together with how they may be applied to clinical and research problems, of the following:

- Bacterial taxonomy, classification, and typing methods.
- Safety in Microbiology Labs.
- Microscopy.
- Bacterial cell structure and physiology.
- Bacterial genetics and gene transfer.
- Smear preparation and staining (Gram and ZN).
- Bacterial growth requirements and growth curve.
- Types of culture media and their preparation in the lab.
- Cultivation of bacteria and bacterial count.
- Normal bacterial flora and bacterial pathogenicity.
- Sterilization and Disinfection.
- Collection, transport, reception, distribution and surveillance, and control.
- Handling of specimens: collection, transport, reception, distribution, and record keeping of the specimens.
- Bacterial identification using automated and semi-automated systems.
- Antimicrobial agents, their mode of action, and mechanisms of microbial resistance.
- Epidemiology of infectious diseases; their surveillance and control.
- Introduction to safety in the diagnosis of viruses.
- Introduction to safety in the diagnosis of fungus.
- Introduction to safety in the diagnosis of parasites.

General objectives:

During this part of the training, the trainees are expected to develop a broad knowledge of the scientific basis of clinical microbiology.

The competencies of the first year are as follows:

- Develop a basic knowledge of lab safety.
- Understand quality control related to microbiology laboratories.
- Adapt to the medical profession in quality control and lab ethics.
- Develop the skills necessary for sterilization and disinfection.
- Understand how to handle specimens and follow the proper guidelines to prevent contamination.
- Understand the methods used in culture and microscopic examinations.
- Follow the proper procedures for antimicrobial investigations.

Technical Competencies:

Technical expert:

- The residents must be aware of the many lab regulations regarding safety, quality control, and ethics.
- They must become familiar with most of the common basic techniques in medical microbiology, and gain the knowledge of their principles and purpose of utilization. This will be achieved from the following objectives:
 - To demonstrate competencies in the usefulness and limitations of commonly used methods in the microbiology laboratory.
 - To recognize the technology and design of the techniques that are in use, together with their applications and limitations.

The trainees should demonstrate familiarity with each of the following topics and principles. The techniques and topics are divided into different modules, which are presented in greater detail below.

I: General Modules

Laboratory Safety

Before beginning the practical work, the trainees should be familiar with basic safety requirements including correct laboratory attire, laboratory hygiene, handling and disposal of specimens and contaminated articles (e.g., inoculating loops, pipettes) at the laboratory bench, the dangers of aerosols, and the procedures for dealing with spillages. At the end of the formal training, the trainees should be familiar with:

- I. The procedures for the safe transport of specimens or cultures locally and the national and international postal and packaging regulations for these materials.
- II. The current requirements and recommendations of the Advisory Committee on Dangerous Pathogens (ACDP), and the recommendations for specific diseases such as viral hepatitis, HIV, prion diseases, and hemorrhagic fevers.
- III. The principles and operations of microbiological safety cabinets and the procedures for their decontamination and monitoring of air flow.
- IV. The national and international postal and packaging regulations for microbiology specimens and the safe transport of specimens within the district or region that the laboratory serves.
- V. The identification of safe containers and preparation of a detailed local safety code including the collection, transport, reception, handling, spillage, and disposal of specimens and cultures.
- VI. The current requirements for the control of laboratory-acquired infections.
- VII. The principles and uses of sterilizing procedures, disinfectants and their monitoring, and the formulation of policies on their use in laboratories, hospitals, and communities.
- VIII. Ventilation methods, their application, and how they are monitored in the laboratory and clinical areas: for example, with air sampling.
- IX. How to handle and discard chemical reagents as required.

Modules and List of Lectures

- I. Introduction; the Function and Role of Clinical Laboratories.
 - Organization and management of clinical laboratories.
 - Setting goals and objectives for clinical laboratories.
 - Laboratory facilities and organization.
 - Spatial, environmental, and safety considerations.
 - Purchasing and product specifications.
 - Inventory control and ordering systems.
 - Human resources:
 - a. Policy and procedure manuals.
 - b. Job descriptions and staffing.
 - c. Recruitment and selection of staff.
 - d. Orientation.
 - e. In-service and continuing education.
 - f. Staff meetings.
 - g. Personnel records.
 - h. Evaluation of performance.
 - i. Discipline and dismissal.
- II. Financial Management of Clinical Laboratories.
 - Factors influencing financial decisions and financial tools.
 - Decision making.
 - Budgeting for laboratory services.
- III. Information Management.
 - Communication; use and application of computers in the clinical laboratories.
 - Selection of a laboratory information system.
- IV. The Laboratory Administrator.
 - Functional duties at various levels of lab administration.
 - Personality and leadership qualities.
- V. Quality Control:
 - The patient as a source of lab variation.
 - Specimen collection and lab variance.
 - Specimen processing and lab vision.
 - Types of errors encountered in the clinical lab.
 - Pre-analytical, analytical, and post-analytical sources of errors.
 - Reference intervals.
 - Quality assurance programs.
 - a. Internal QA.
 - b. QC materials.
 - c. L-J charts.
 - d. CUSUM.
 - e. Patient samples as QC.
 - f. Moving averages.
 - External quality assurance programs.
 - Quality control of instruments.

- *Method evaluation of selected analytes.*
- Development of quality assurance programs.
- Implementation of quality assurance programs.

Professionalism and Ethics

- Introduction.
- What is the medical profession?
- Professional secrecy.
- Responsibility and liability.
- The sanctity of human life.

II: Scientific Basis of Clinical Microbiology

Sterilization and Disinfection

At the end of the formal training, the trainees should understand the principles and uses of sterilization and disinfection procedures for the preparation of media and instruments and microbiological waste disposal. Trainees should be capable of formulating a policy on the use of sterilization and disinfection in laboratories, hospitals, or communities.

Handling of Specimens

At the end of the formal training, the trainees should be:

- I. Aware, for each specimen type, of the optimal methods for collection, transport (including transport media), storage, reception, processing, identification, and the documentation and issuing of a final report, including the requirements for high-risk specimens.
- II. Able to assess the degrees of urgency for the processing of specimens, including the provision for an out-of-hours service and the communication of preliminary results as applicable.
- III. Able to decide upon further testing or processing of a specimen as appropriate.
- IV. Aware of existing reference facilities and their appropriate use.

Microscopy

At the end of the formal training, the trainees should be:

- I. Able to understand the principles of light, dark ground, phase contrast, fluorescent, and electron microscopy and be able to set up a light microscope with dark ground and phase contrast facilities.
- II. Able to perform routine staining techniques, including fluorescent dyes.
- III. Familiar with the appearance of stained preparations and be able to recognize artifacts and their possible origin.

Culture Methods

At the end of the formal training, the trainees should be:

- I. Aware of the wide range of selective, enrichment, and inhibitory media available for general and specialized use, and be able to choose the relevant media in common use or in medical and environmental laboratories.

- II. Familiar with physical growth requirements of micro-organisms, including the atmosphere and optimal temperature, and have an appreciation of the growth characteristics of both solid phase and broth cultures. Also, the trainees should understand the micro-organisms and clinical situations in which detectable growth may require prolonged incubation.
- III. Familiar with the preparation of media in common use and have an understanding of internal quality control of these preparations.
- IV. Able to process all common specimens, recognize potential pathogens from a mixture of colonies on culture plates, and separate these colonies in order to achieve the pure growth necessary for further work.

Further Processing

At the end of the formal training, the trainees should:

- I. Be able to perform tests leading to the identification of all common pathogens including the use of commercially produced kits (e.g., kits for enzyme assays) and rapid diagnostic kits, ELISA, and latex agglutination.
- II. Understand the principles of identification media and be able to use them appropriately.
- III. Be aware of available reference facilities for further identification including serotyping and other typing schemes, both phenotypic and genotypic.

Antimicrobial Investigations

At the end of the formal training, the trainees should:

- I. Be able to test the antibiotic sensitivities of an isolate using the common techniques of disc testing and breakpoints, and be aware of the principles behind multipoint sensitivity technology.
- II. Be able to perform and interpret Minimal Inhibitory Concentration (MIC) and Minimal Bacterial Concentration (MBC) tests as appropriate.
- III. Be able to perform antimicrobial assays using biological and automated techniques.
- IV. Have an understanding of antimicrobial assays and their relationship to the therapeutic and toxic effects on a patient and be able to advise on dosage regimens accordingly.

Practical Training Requirements for Each Module.

The trainees will rotate in different sections of the clinical microbiology laboratory, including bacteriology, mycology, parasitology, and virology. Wherever necessary, the trainees might be attached in a different setup for training when it is not available in local labs. They will be given responsibility for the processing of different specimens and the interpretation and reporting of the results (under the supervision of the supervisor/consultant).

Communicator:

- Communicates effectively with different levels of clinical and technical colleagues in microbiology, including technicians, technologists, supervisors, clinical scientists, and consultants, verbally and through written reports.
- Develops rapport, trust, and professional relationships with different sections and departments, including laboratory safety, quality control, and other allied healthcare workers.

Collaborator:

- Works effectively with other health professionals within and outside the laboratory department to prevent, negotiate, and resolve inter-professional and intra-professional conflicts.
- Attends meetings and provides resolution to the encountered obstacles such as safety, quality control, sample processing, and workflow.

Manager:

- Manages time to maximize educational resources.
- Manages the available resources for best tests utilization in microbiology.
- Acquires general knowledge on how to allocate finite healthcare resources appropriately within the available capacity.
- Serves in administrative and leadership roles as appropriate and within the regulations of clinical laboratories and the institute of health.

Health advocate:

- Understands and follows all safety and infection precautions in the laboratory facility and strives to implement and follow all rules and regulations at all times.

Scholar:

- Maintains ongoing learning. Facilitates the learning of residents, junior technologists, residents, other health professionals, the public, and others, as appropriate.
- Contributes to the growth of the medical and technical aspects of microbiology, including safety regulations, quality control applications, and antimicrobial utilization. This can be achieved by research and other scholarly activities such as participating in journal club demonstrations, teaching schedules, and conference presentations.

Professional:

- Performs and abides by the codes of ethics.
- Demonstrates commitment to excellence and ongoing professional development.

YEAR TWO– R2 (48 WEEKS)

Rotation outline

The trainees will rotate in different sections of systematic and clinical bacteriology. Wherever necessary, the trainees will be attached in a different setup for training when they are not available in local labs. They will be given the responsibility for the processing of different specimens and techniques and the interpretation and reporting of the results (under the supervision of the supervisor/consultant):

I- Systematic Bacteriology Topics

- *Staphylococci* and other Gram-positive cocci.
- *Streptococci* and *Enterococci*.
- *Corynebacterium*.
- *Listeria*.
- *Aerococcus* and other Gram-positive cocci.
- *Bacillus* and other Gram-positive rods.
- Enterobacteriaceae.
- *Pseudomonads* and other non-fermenters.
- *Vibrio*, *Campylobacter*, and *Helicobacter*.
- Bordetella and other members of *Alcaligenaceae*.
- Anaerobic Bacteria: *Clostridia*, *Bacteroides*, and other non-sporing obligately anaerobes.
- *Mycobacteria*.
- *Acinetobacter*.
- *Moraxella*.
- *Rickettsia*.
- Spirochetes.
- *Actinomyces* and *Nocardia*.
- *Mycoplasma* and *Ureaplasma*.
- *Brucella*, *Haemophilus*, *Neisseria*, and *Chlamydia*.

II- Clinical Bacteriology Topics

- Skin, nails and soft tissues, and wound infections.
- Circulatory system and cardiovascular infection.
- Bone and joint infections.
- Food poisoning.
- Urinary tract infection (UTI) and other genitourinary system infections.
- Pyrexia of unknown origin (PUO).
- Microbiology of the gastrointestinal tract.
- Upper and lower respiratory tract infections.
- Ear infections.
- Eye infections.
- Nervous system infections.
- Sexually Transmitted Infections (STI).
- Infections in immunocompromised patients.
- Nosocomial infections.
- Bacterial pathogenesis.

General objectives:

During this part of the training, the trainees are expected to develop a broad knowledge of systematic and clinical bacteriology.

The competencies of the second year are as follows:

- Develop a basic knowledge in bacteriology, mycology, and disease pathogenesis.
- Describe the scope and value of the investigations performed in clinical bacteriology.
- Recognize the role of clinical bacteriology tests in studying, diagnosing, and monitoring different diseases.
- Develop the skills necessary to report critical laboratory results and communicate effectively with other clinicians.
- Trainees should have an understanding of the principles, together with how they may be applied to clinical and research problems, of the following:
 - Systematic and clinical bacteriology.
 - Lab techniques utilized for diagnosis.
 - Investigating types of bacteria.
 - Antibiotic sensitivity.
 - Antibiotic doses.

Clinical competencies:

Medical expert:

- Has comprehensive knowledge about different pathogens and their mechanisms in causing the disease.
- Acquires sufficient knowledge about the interpretation of bacteriology results: for example, Neisseria Meningitis and UTI.
- Demonstrates comprehensive knowledge of any additional information on the symptoms that can help in patient diagnoses.

Technical expert:

Demonstrates comprehensive knowledge of:

- Different bacteriology techniques, including their advantages and limitations and bacteria identification.
- The possibility of technical errors and contamination.
- Sample requirements.
- Any additional laboratory test that can help in patient diagnoses.

Communicator:

- Communicates effectively with other physicians (e.g., infection control) to convey critical results or to add additional tests.
- Communicates effectively with other technical staff (technician, technologists, and supervisors) to help in further laboratory investigation.
- Participates in multidisciplinary team meetings and contributes to the continuous education of physicians about advances in testing, such as new tests introduced in clinical microbiology.

Collaborator:

- Contributes effectively to other interdisciplinary team activities: for example, safety, and infection control committees.
- Collaborates with other technical and medical staff: for example, phlebotomists, nurses, and physicians, on how to prevent or minimize the risk of sample contamination.

Manager:

- Uses the resources of the laboratory and the institution appropriately.
- Allocates finite healthcare resources wisely.
- Understands the importance of quality control and statistical measures for different measures: for example, estimating the prevalence of infection, sample contamination, and the monthly number of tests.

Health advocate:

- Uses their knowledge, skills, and expertise to advance health and well-being within the community.
- Responds to healthcare needs within the community
- Researches to meet the community needs.
- Increases the awareness of the community by participating in public campaigns (e.g., HIV awareness day).

Scholar:

- Practices independent lifelong learning to stay up to date in all aspect of bacteriology by attending symposiums and conferences.
- Helps others in learning and improves knowledge for laboratory residents, patients, community, and healthcare workers.

Professional:

- Respects the health and well-being of individuals and society through ethical practice and professionalism.
- Expresses commitment to patients, profession, and society through ethical practice, which includes honesty, integrity, commitment, compassion, respect, and altruism.
- Practices commitment to providing the best possible quality of care.
- Responds quickly to urgent requests and night calls.
- Knows their limitations and seeks help when in need.
- Identifies and appropriately responds to ethical issues.
- Respects patient's rights and confidentiality.

YEAR THREE– R3 (48 WEEKS)

Rotation outline

The trainees through this third year will rotate in the different sections of the clinical microbiology laboratory, including environmental microbiology, molecular biology, virology, mycology, clinical parasitology, and immunology. In each section, the trainees will stay for a specific number of weeks. They will understand both the theoretical and practical aspects of each section. They will be given responsibility for processing different specimens in each section with the ability to interpret results and make them ready for reporting after the first specialist or consultant has revised them.

General objectives:

At the end of the formal training, the trainees should:

- Have knowledge of the main concepts underlying food and environmental microbiology.
- Be able to refer to up-to-date guidelines and statutory requirements concerning the processing and microbiological quality of food, water, and milk products.
- Have knowledge of the methods used for the microbiological examination of common types of food, water, and milk products.
- Have knowledge of the methods used for the detection of parasites and viruses from water and food samples.
- Be able to select appropriate microbiological tests to carry out on food, water, and environmental samples, both routinely and in response to an outbreak of food-borne infections.
- Be able to interpret the results of microbiological testing of food, water, and milk products, with reference to the appropriate standards.
- Be able to advise environmental health officers and others on the appropriate methods of food, water, and environmental sampling, both routinely and in response to an outbreak of food-borne infections.
- Be aware of all major new technologies available in medical microbiology based on DNA techniques (e.g., PCR) and monoclonal antibodies.
- Be aware of automated, rapid techniques available to medical microbiology.
- Be able to evaluate the need for emerging techniques within the laboratory, including cost-effectiveness and the effects of staffing levels and working practices critically.
- Be able to handle the essential routine procedures involved in laboratory diagnoses of viral, parasitic, and fungal infections.
- Be able to conduct clinical laboratory testing necessary for the accurate and rapid diagnosis of common parasitic diseases.
- Be able to correlate the modes of infection, life cycles, and major clinical aspects of human parasites.
- Be able to recognize protozoan infections: intestinal, tissue, and blood infections.
- Be able to recognize helminths infections: nematodes, trematodes, and cestodes infections.
- Be able to recognize the arthropods of medical importance.
- Be able to illustrate the common parasites globally and in Saudi Arabia and the concepts of epidemiology, prevention, and the control of parasitic diseases.
- Be able to recognize the diagnostic morphology of the causative organisms in the variant stage with their life cycles in humans and external environments.

- Be able to recognize groups of parasites, as well as different diagnostic methods. This will cover stool analysis, urine analysis, sputum, blood, and other applicable body fluids; permanent preparations of protozoan and arthropods; and special techniques: for example, biopsies, serological techniques, and culture techniques (molecular diagnosis of parasites will be covered during molecular training R3-II).
- Trainees should develop or acquire:
 - a. The fundamental principles of immunology.
 - b. The ability to recognize disease presentations and undertake the diagnosis and management of allergic and immunological diseases.
 - c. The ability to develop relevant differential diagnoses, seek appropriate consultations from others, and provide expert opinion to others.
 - d. Competencies in handling immunological diagnostic procedures such as skin tests and their interpretations.
 - e. Competencies in instituting immunotherapy such as hyposensitization procedures.
 - f. Knowledge and experience in immuno-modulation procedures.
 - g. Competencies in clinical immunology with experience in the immunological aspects of clinical transplantations.
 - h. The ability to teach undergraduate and graduate residents and conduct research to provide intensive training in clinical immunology with an emphasis on allergic and other immunological diseases, their diagnosis, management, and special immunological procedures of relevance in the control of these diseases.

Clinical competencies:

Medical expert:

- Has comprehensive knowledge of the different types of pathogens (viruses, fungi, and parasites), clinical immunology, and the mechanisms in causing diseases and infection.
- Acquires sufficient knowledge about the interpretation of results.
- Demonstrates comprehensive knowledge about environmental microbiology.
- Demonstrates comprehensive knowledge about ordered tests that can help in patient diagnosis.

Technical expert:

- Demonstrates comprehensive knowledge about different techniques in pathogen identification, including their advantages and limitations.
- Demonstrates comprehensive knowledge about molecular techniques and their utilization.
- Demonstrates comprehensive knowledge about samples requirements, pretreatment requirements, and analyses.
- Demonstrates comprehensive knowledge about any additional laboratory tests that can help in patient diagnoses.

The trainees should demonstrate knowledge about each of the following modules described below.

I. Environmental Microbiology (4 weeks)

- a. Microbiology
 - Freshwater microbiota.
 - Seawater microbiota.
 - The role of microorganisms in water quality.
 - Infections transmitted through water.
 - Water testing and indicator organisms.
 - Water treatment.
- b. Food Microbiology
 - Industrial food canning.
 - Microorganisms spoiling food.
 - Infections transmitted through food.
 - Laboratory testing of food.

II. Molecular and Emerging Techniques (6 weeks)

- Basic molecules and genetics.
- All major new technologies available in medical microbiology based on DNA techniques (e.g., PCR) and monoclonal antibodies.
- Interpretation of results.

III. Virology (10 weeks)

- Introduction to virology.
- Diagnosis of viral infections.
- Respiratory Viruses.
- Mumps and Measles.
- Rubella.
- Enteroviruses (Polio, Coxsackie, and ECHO viruses).
- Hepatitis viruses.
- Retroviruses (HIV and HTLV).
- Gastroenteritis viruses (Rota and Adeno).
- Herpes Viruses (HSV, VZA, CMV, EBV, and HHV-8).

Virology practical training includes:

- a. Principles and preparing media (2 Weeks).
 - Discussion of the principles in virology to include specimens-disease relationship, specimen collection, and suitable host systems for isolation. The residents are informed of the availability of laboratory manuals and reference books.
 - Demonstration of media and solution preparation utilizing both autoclave and filtering as a means for sterilization.
 - The students will watch the preparation of the media and solutions used in their training period.
 - Demonstration and participation in the preparation of primary cell cultures.
 - Discussion and demonstration of passing techniques employed in maintaining continuous cell cultures. This will include the preparation of equipment and supplies methods of cell cultivation, detection of contaminants, and preservation of cells by freezing.

- Demonstration and participation in preparation of different cell culture lines to maintain cells.
 - Freezing and thawing cells.
- b. Demonstration and discussion (2 Weeks).
- Demonstration and discussion of cell culture inoculation and viral cytopathic effects and the use of cytopathic effects for preliminary viral identification.
 - Demonstration and participation of inoculation of known viruses and studying their progressive cytopathic effect by microscopy examination of cell cultures.
 - Discussion and demonstration of inoculation of cell cultures for chlamydia isolation.
 - Follow-up of inoculated cultures and staining for *Chlamydia* inclusion bodies with different stains.
 - Discussion of viral titration and identification procedures. Utilization of hemadsorption, hemadsorption-inhibition, neutralization, complement fixation, and hemagglutination-inhibition is incorporated into the discussion.
 - The residents may be given unknown specimens to work on and identify.
 - Discussion of techniques employing embryonated hen's eggs and specific reference will be made to routes of information versus specific viruses.
 - Discussion and demonstration of hemagglutination and hemagglutination-inhibition assays.
 - Specific reference will be made to test procedures for rubella.
- c. Diagnosis by immunofluorescence (2 Weeks).
- Discussion and demonstration of direct and indirect immunofluorescence. Specific reference will be made to viral diagnosis using monoclonal Ab.
 - Residents will examine slides from direct IF for Ag detection: for example, measles, RSV parainfluenza, and an indirect immunofluorescence assay for Ab detection.
 - Diagnosis of congenital infection by Toxoplasmosis, Rubella, Cytomegalovirus, and Herpes simplex (TORCH).
- d. Diagnosis by ELISA (2 Weeks).
- Discussion and demonstration of the enzyme-linked immunosorbent assay (ELISA).
 - Application of the assay in the detection of Anti-HCV.
 - HBs AG.
 - Other hepatitis markers: HBeAg/ anti-HBe, anti-HBcAg, and anti-HBsAg.
 - Anti-Delta agent.
 - Anti-HIV – 1, anti-HIV – 2.
 - Anti-CMV.
 - Anti-Rubella IgG and Ig M.
 - Rotavirus.
 - Chlamydia.
 - Interpretation of hepatitis profiles.
 - Interpretation of HIV profiles.
 - Interpretation of Western blots.
 - Interpretation of line immunoassays.
- e. Quality control and administration (2 Weeks).
- Quality control of media and equipment.
 - Participation in administrative and supervisory duties with the Supervisor and Chief Technologist.

IV. Mycology (8 weeks)

1. Fungal structure, metabolism, and reproduction.
2. Fungal classification and pathogenesis.
3. Diagnosis of fungal infections.
4. Anti-fungal agents.
5. *Dermatophytes*.
6. *Candida*.
7. *Histoplasma*.
8. *Cryptococcus*.
9. *Sporotrichosis*.
10. *Aspergillus*.
11. *Fusarium*.
12. *Mucor*.
13. *Mycetoma*.

Practical Training Requirements:

- a. Laboratory Procedures.
 - Specimen Collection and transport: The trainees will be familiarized with the various types of specimens commonly submitted for diagnosis and follow-up of fungal infections. They will practice on the proper methods of specimen collection, transport, and use of appropriate specimen containers. Common specimens received in mycology laboratories include: sputum, endotracheal aspirates, bronchial brushing, bronchial lavage, swabs (from ears, eyes, genital) skin, scraping nail, hair, fungal grains, tissue biopsies, pus, blood, CSF, urine, stools, and aspirates (e.g., from pleural, pericardial cavities, cysts, and abscesses).
 - Processing of specimens: the importance of direct microscopic examination of specimens in the early diagnosis and management of fungal infections will be emphasized.
- b. Microscopic Examination.
The trainees will perform the following procedures (if available) for direct microscopy:
 - Unstained preparation: Wet preparations, KOH mounts, and India Ink mounts.
 - Stained smears: Giemsa stains and special fungal stains (Periodic Acid Schiff).
 - Stain Gomori methenamine silver stain, Wright stain, GM stain, and Z.N. stain direct microscopy. The trainees will be instructed and will gain experience in recognizing fungal elements in a particular specimen (e.g., septate hyphae, nonseptate hyphae, budding yeast cells, pseudohyphae, and others).
- c. Culturing of Specimens.
Preparation of specimens for culture: for example, the concentration of fluids (centrifugation, millipore filtration) and tissue grinding. Selection of media for culturing various specimens and incubation conditions.
- d. Fungal Identification.
 - Recognition of common fungal contaminants and opportunistic fungal pathogens.
 - Recognition of primary pathogens, namely *Dermatophytes*, agents of subcutaneous fungal infections (*Moniliaceous* and *dematiaceous*), agents of systemic infections: for

example, *Histoplasma capsulatum*, *Blastomyces*, *Coccidioides*, and *actinomycetous* agents.

- For yeast identification:
Morphology on CMA, germ tube tests, pellicle formation, nitrate utilization, urease test, actidione inhibition, sugar fermentation, and sugar assimilation (API 20C).

e. Fungal Serology.

The trainees will be instructed and will be involved in the performance and interpretation of common serological tests used for the diagnosis and follow-up of fungal infections. The serological tests employed routinely were immunodiffusion tests, counter immunoelectrophoresis (C.I.E.), and latex agglutination.

f. Antifungal.

Tutorials will be given on antifungal drugs used for the treatment of fungal infections.

V. Clinical Parasitology (10 weeks)

1. *Entamoeba histolytica* and Non-pathogenic intestinal amoebas.
2. *Giardia lamblia* and non-pathogenic intestinal flagellates.
3. *Cryptosporidium* spp. and *Isospora* spp.
4. *Trichomonas vaginalis*.
5. *Blastocystis hominis*.
6. *Toxoplasma gondii*.
7. Malaria (*Plasmodium* spp).
8. *Leishmania* spp. and *Trypanosoma* spp.
9. *Ascaris lumbricoides*, *Trichuris trichiura*, and *Enterobius vermicularis*.
10. Hookworms and *Strongyloides stercoralis*.
11. Visceral and Cutaneous larva migraines (VLM and CLM).
12. *Wuchereria bancrofti* and other filarial nematodes.
13. *Taenia* spp. and Cysticercosis.
14. *Echinococcus granulosus* (Hydatid disease).
15. *Hymenolepis nana* and *H. diminuta*.
16. *Fasciola* spp. and *Clonorchis sinensis*.
17. *Heterophyes heterophyes*.
18. *Schistosoma* spp.
19. Medically important Arthropods.

Practical Training Requirements:

- a. Fecal Examination.
 - I. Macroscopic (Gross) examination, which includes:
 - a. Identification of stool consistency (watery, loose, soft, formed, or hard) and their role as an indicator of the type of intestinal parasites and further diagnosis.
 - b. Observation of macroscopic blood and mucus.
 - c. Detection of Adult worms or segments (should be carefully washed and diagnosed).
 - II. Microscopic examination which involves:
 - a. Direct wet mount (both saline and iodine) of fresh material.
 - b. Concentration sedimentation (e.g., formalin-ether technique).
 - c. Concentration flotation (e.g., zinc sulphate technique).

- d. Kato's thick smear as an alternative for the detection of large eggs (90–150 µm).
- e. Permanent staining (e.g., trichrome for amoebas/flagellates and modified Kinyoun's for *Cryptosporidium*).

III. Immunological techniques:

Mainly depend on the rapid chromatographic immunoassay for the detection of the pathogenic intestinal protozoa such as *Cryptosporidium*, *Entamoeba histolytica*, and *Giardia lamblia* in stool samples.

IV. Special techniques such as:

Fecal occult blood, the culture of fecal samples, egg counting technique, perineal/perianal techniques, egg viability, and hatchability techniques.

b. Blood Examination:

- I. Thick and thin blood films preparation.
- II. Thick and thin blood films staining.
- III. Estimation of parasitemia levels.
- IV. Special techniques such as Knott's.

c. Urine Examination.

- Physical (color, appearance, and pinworms).
- Chemical (dipstick).
- Microscopic examination of centrifuged specimen mainly for *S. haematobium* eggs, *E. vermicularis* eggs, and *T. vaginalis* trophozoites.
- Special techniques such as Filtration techniques for *Schistosoma* eggs, culture for *T. vaginalis*, egg viability, and hatchability techniques.

d. Serological Examination.

The content of this section will be covered during clinical immunology training (R3-VI).

e. Molecular Examination.

The content of this section will be covered during molecular training (R3-II).

VI. Clinical Immunology (10 weeks)

1. Fundamental immunology.
2. Immunopathology.
3. Immunomodulation with special reference to immunopotentiality.
4. Immunosuppression, such as immunotherapy.
5. Autoimmune diseases.
6. Clinical transplantation.
7. Immunology of pregnancy.
8. Cancer immunology and applications in clinical practice and research.
9. Immunodeficiency, including AIDS.
10. Vaccines, antisera and immunizations, and vaccinations.

Practical Training Requirements:

- a. Detection of Auto-antibodies.
 - Anti-DNA using a hemagglutination test and ELISA.

- Anti-thyroid antibodies using a hemagglutination test.
 - Anti-nuclear Antibodies (ANA) using Hep-2 cell cultures in an indirect fluorescent antibody test.
 - Anti-mitochondrial antibody test (AMA) by using indirect immunofluorescence on kidney tissues substrates.
 - Anti-smooth muscle antibody test (ASMA) by using indirect immunofluorescence on rat stomach tissue substrate.
 - Detection of extractable nuclear antigen (ENA)
- b. Techniques for the Diagnosis of Allergic Diseases.
The technique of skin testing for immediate hypersensitivity and measurement of delayed-type hypersensitivity. These include:
- Skin prick test.
 - Patch test.
 - Estimation of total and specific IgE (RAST) using the CAP system.
 - Measurement of mediators by the CAP system.
- c. Bacterial and Parasitic Serology.
- Widal test for salmonella and Brucella, applying both micro and macro titration techniques.
 - Syphilis serology.
 - V.D.R.L. Rapid agglutination card test.
 - T.P.H.I. Treponema Pallidum Hemagglutination test.
 - FTA/ABS. This applies a fluorescent treponemal antibody test.
 - Toxoplasmosis: Screening test using latex agglutination or hemagglutination techniques.
 - Application of ELISA for measurement of specific antibodies; Toxo-IgG and Toxo-IgM.
 - Hydatid disease, using an indirect hemagglutination test.
 - Bilharzia, using indirect hemagglutination test.
 - Amoebiasis, using indirect hemagglutination test.
 - Leishmaniasis, using indirect hemagglutination test.
- d. Cellular Immunology and Special Procedures.
Flow cytometry for:
- T-lymphocyte counts.
 - Enumeration of T-cell subsets.
 - Enumeration of B-cells.
 - Flow cytometry for leukemia immunophenotyping.
 - Flow cytometry for lymphoma immunophenotyping.
 - Assessment of phagocyte function by flow cytometry.
- e. HLA Typing.
- HLA-ABC typing and HLA-DR tissue typing.
 - This implies isolation of T and B lymphocytes and then performing lymphocytotoxicity test procedures using Terasaki plates.
 - HLA-DR typing by PCR.
 - Basic laboratory organization regarding workflow.
 - Keeping accurate records.
 - Retrieve data.
 - Quality control procedures, including necessary information on internal and external programs.

- f. Basic procedures.
- Preparation, preservation, lyophilization, and storage of sera.
 - Inactivation or maintenance of complement.
 - Separation of cell populations using Ficoll-Hypaque.
 - Preparation of cell suspensions and tests of viability.
 - Preparation and staining of blood films, counting white blood cells, and performing differential white cell counts.
- g. General Immunology.
- This section includes routine general immunology investigations and the training of the practical application of the commonly used basic immunological reactions. This comprises the following procedures:
- Tests for the Rheumatoid factor and C-reactive protein using latex particle agglutination techniques.
 - Quantitation of Immunoglobulins IgG, IgA, IgM, and complement C3 and C4 by single radial immunodiffusion. Candidates will also be instructed on the preparation of gels for double immunodiffusion and the various applications of this method.
 - Measurement of antistreptolysin O (ASO) titer by a microtitration method.
 - Both qualitative and quantitative pregnancy testing; the method used is a highly sensitive technique using monoclonal antibodies.

Collaborator:

- Contributes effectively to other interdisciplinary team activities, committees, and task forces.
- Collaborates with other technical and medical staff, for example, phlebotomists, nurses, and physicians, to discuss new guidelines.
- Collaborate in terms of lab results consultation and further analysis.

Manager:

- Uses the resources of the laboratory and the institution appropriately.
- Allocates finite healthcare resources wisely.
- Understands the importance of quality control and statistical measures for different measures of indicators: for example, estimating the prevalence of infection, sample contamination, monthly number of tests, tests utilization, laboratory workflow, and referred tests approval.

Health advocate:

- Uses their knowledge, skills, and expertise to advance health and well-being within the community.
- Responds to the healthcare needs within the community.
- Researches to meet the community needs.
- Increases the awareness of the community by participating in public campaigns: for example, TB, HIV, and HBV awareness days.
- Public screening for infectious disease: for example, hepatitis.
- Participate in vaccine and hygiene campaigns.

Scholar:

- Practices independent lifelong learning to stay up to date in all aspects of clinical and technical aspects of microbiology and infectious diseases by attending symposiums, training courses, and conferences.
- Helps others by learning and sharing knowledge with patients, communities, and healthcare workers.

Professional:

- Respects the health and well-being of individuals and society through ethical practice and professionalism.
- Expresses commitment to patients, profession, and society through ethical practice, which includes honesty, integrity, commitment, compassion, respect, and altruism.
- Practices commitment to providing the best possible quality of care.
- Responds quickly to urgent requests and night calls.
- Knows their limitations and seeks help when in need.
- Identifies and appropriately responds to ethical issues.
- Respects patient's rights and confidentiality.
- Respects the health institute's ethics and protocols: for example, reporting HIV positive results.

YEAR FOUR– R4 (48 WEEKS)

Rotation outline

In the fourth year, the trainees will learn about infection control, laboratory management, and research. In each section, the resident's will remain with the trainees for a period, and the trainees will learn the theory and practice of each section. They will be given a project to complete during a specific time frame, and they will gain knowledge about infection control and laboratory management.

General objectives:

At the end of the formal training, the trainees should:

- Have had the first-hand experience of local infection control problems, including outbreaks of infection and their management.
- Be familiar with the workings of infection control meetings, including local and regional infection control committees.
- Be aware of the areas of hospital and community health that require infection control policies.
- Have gained experience in liaising with clinical colleagues through regular ward visits. A close relationship should be established with units.
- Have worked closely with the infection control team.
- Understand the principles of patient isolation and their application.
- Have participated in visits to clinical and non-clinical areas to advise on infection control. These should include kitchen inspections, especially those conducted by environmental health officers and personnel in the CSSD, pharmacy, and laundry.
- Be familiar with any documents relevant to infection control, such as reports of the Committees of Enquiry.
- Have had some experience of communicable disease control in the community by working with Environmental Health Officers.
- Understand quality control and quality assurance.
- Have had experience of the regular processing of specimens distributed by the NEQAS.
- Understand the existing external quality control schemes.
- Know the requirements of any existing laboratory accreditation schemes and the process whereby accreditation is conferred.
- Know how to communicate with the vendors and other departments such as logistics.
- Develop their understanding of the basic principles of scientific research through regular reading of peer-reviewed journals and participation in peer-discussions.
- Be assigned a research project that can be carried out within the clinical microbiology lab. Preferably, the project will be in association with one of the clinical departments. This will be in part as the fulfillment of the criteria for the final certifying exam.

Technical Competencies:

Technical expert:

- The trainee must be aware of the laboratory and hospital regulations for infection control and the methods of communication and collaboration.

- The trainee must have knowledge of laboratory management:
 - To manage critical situations: for example, shortage of reagents and unacceptable quality control.
 - To deal with proficiency testing and results reporting.
- The trainee must be involved in research settings and requested to perform a project in medical microbiology.

Modules and List of Lectures

Infection Control in Hospital and Community

A close relationship should be established with the available units from the following areas:

- Intensive care.
- Pediatric (including neonatal).
- Obstetrics.
- Hematology.
- Organ transplants (immunosuppressed patients).
- Orthopedic.
- Burns.
- Renal dialysis.
- Pulmonary medicine.
- Medical and surgical wards.
- Genitourinary medicine departments.

Laboratory Management

- I. Managerial Skills
- II. Quality Control and Accreditation
- III. Data Handling

Research Methods and Dissertation (or Scientific Paper)

During year 4, the trainees are expected to develop the research skills necessary to enable them to undertake analytical and clinical-based research and development projects. Each trainee is required to submit their project in the format of a scientific manuscript according to the regulations mentioned in Appendix G.

Communicator

- Understands how to communicate with infection control departments during a critical situation or a positive case.
- Understands how to manage laboratories during a technical failure: for example, a shortage of reagents.
- Understands the most common statistical methods and to be able to provide advice whenever requested.
- Understands research ethics and the channels required to undertake research.
- Understands how to set up research in clinical microbiology and how to communicate with different departments (e.g., laboratories, research offices, libraries, and research centers).

Collaborator

- Works with their research team, management, and infection control departments effectively.
- Collaborates with all members of the laboratory team, including technical, residents, administrative, training physicians, and senior colleague in order to manage laboratories effectively.
- Participates with other health care members to obtain and provide information necessary for best management with a professional attitude.
- Understands how to explain the research topic to their colleagues involved.
- Becomes involved in regular meetings with other members.
- Respects research ethics and confidentiality.

Manager

- Understands how to make decisions about research resources, laboratory materials, and budget.
- Collaborates effectively with other organizations whenever required.
- Understands how to identify who should be involved in laboratory management, infection control, and research proposals.

Health Advocate

- Understands how to use their knowledge, skills, and expertise to advance health and wellbeing within the community.
- Understands how to identify areas for improvement, promotion, disease prevention, and advocacy.
- Responds to health care needs within the community.
- Understands how to use research to meet community needs.
- Understands how to increase the awareness of the community of the need for better management and infection control, and the importance of research.

Scholar

- Recognizes the importance of scholarship.
- Recognizes the importance of research and continuous medical education.
- Demonstrates knowledge of basic and clinical research and special research techniques.
- Demonstrates the ability to objectively record results, prepare a research proposal, and prepare manuscripts.
- Recognizes personal gaps in knowledge and how to tackle them.
- Demonstrates the ability to ask appropriate questions and access appropriate resources and references.
- Recognizes both planned and opportunistic methods of learning.
- Demonstrates effective personal time management and maximizes educational opportunities.
- Capable of self-directed study using appropriate texts and information sources.
- Demonstrates the ability to mentor others and share learned information (to health care and non-health care personnel).
- Demonstrates knowledge and use of virtual libraries and online resources.

In addition, the scholar practices independent lifelong learning to stay up to date with all aspects of management, leadership, infection control, research skills, and knowledge and also attends specific related courses that can be either provided on-site at training hospitals or independently.

Professional

- Respects the health and well-being of individuals and society through ethical practice and professionalism.
- Expresses a commitment to patients, professionals, and society through ethical practice, which includes honesty, integrity, commitment, compassion, respect, and altruism.
- Practices a commitment to the best quality of care.
- Identifies and appropriately responds to ethical issues.
- Respects patient's rights and confidentiality.

SCFHS CLASSIFICATION OF THE GRADUATES

Upon completion of this training program and the satisfaction of the examiners, the graduate will be granted the Saudi Board in Medical Sciences-Medical Microbiology (SB-MM) qualification and will have a degree of competency and experience that are considered adequate to practice as a first specialist in microbiology in their job description. The trainee's classification will be according to the policy of SCFHS.

OPTIONAL ACTIVITIES

Each institution must encourage the following educational activities:

- The trainees are encouraged to present at least once a year at a local, national, or international medical microbiology meeting.
- The trainees are encouraged to review the department teaching file.
- The trainees are encouraged to attend any national educational activities (symposia, workshops, or review course).

External Educational Material

Suggested Activities (Examples)

- Quality control training programs.
- Accreditation team member inspector course online (certified CAP inspector).
- American Society for Clinical Pathology (ASCP).
- American Association for Clinical Microbiology.
- FRCPath in Medical Microbiology.
- Others.

Assessment

Proposed Assessment

The academic performance of the trainees must be evaluated with a careful and deliberate review, including documentation of the trainee's performance with respect to relevant exam scores, clinical diagnosis and judgment, medical knowledge, technical abilities, interpretation of data, patient management, communication skills, and interactions with other healthcare professionals, professional appearance, demeanor, motivation, and initiative. The trainees and supervisor must meet together to review the portfolio and logbook once every two months and for a given rotation. All recorded evaluations (Appendix H) of the trainee's performance are accessible by the trainee.

The assessment tools are summarized in the following table:

Learning Aspects	Assessment Formats R1, R2, and R3	Assessment Formats R4
Knowledge	1. Specific Academic Tasks a) Discussion sessions b) Quizzes c) Presentations 2. End-of-Year Written Exam	1. Specific Academic Tasks a) Discussion sessions b) Quizzes and exams c) Presentations
Skills	Objective Structured Practical Examination (OSPE)	1. Objective Structured Practical Examination (OSPE) 2. Research Activity
Attitude	In-Training Evaluation Reports (ITERS)	In-Training Evaluation Reports (ITERS)

Score	Less than 50%	50% – 59.4%	60% – 69.4%	More than 70%
Description	Clear Fail	Borderline Fail	Borderline Pass	Clear Pass

Research

During R4, the trainees are required to submit a dissertation for their research project and give a presentation.

Annual Promotion Examinations

Annual Promotion Examinations will be held at the end of each year, and the marking will be according to the policies of SCFHS marking (Clear pass, Borderline pass, Borderline fail, and Clear fail). Drills and mock examinations will be held during the year. Examples of examination Blue Prints for all rotations are illustrated in Appendix I.

Promotion from Junior to Senior Level

1. The trainees will be evaluated according to the regulations of the SCFHS.
2. The promotion of the trainees from junior to senior level will be determined by:
 - a) Overall performance during training.
 - b) Passing Part-1 required exams.
 - c) Approval of the local supervisor and LSC.
3. Unsuccessful trainees will be allowed a maximum number of attempts (according to SCFHS bylaws of assessment) to pass Part-1 examination before being dismissed from the program.
4. Structure and format of Part-1 examination:
 - a) One paper of 120 MCQs (3 hours)

Final Specialty Examination

1. The trainees should apply for the final examination upon completion of the approved training period.
2. The trainees will be evaluated according to the regulations of the SCFHS.
3. The trainees will be eligible to sit for the final written specialty examination after the completion of all of the program requirements and approval from the Supervisory Committee is granted.
4. The trainees can sit for the final practical examination after passing the final written specialty examination with a score of 70% or more.
5. Additional attempts to pass the examinations will be given to unsuccessful trainees (written and practical) according to the regulations of the SCFHS.
6. The structure and format of the final written specialty examination consist of two MCQs papers according to SCFHS assessment bylaws (the exam blueprint will be published).
7. The structure and format of the final practical specialty examination consist of:
 - a) Objective structured practical exam (OSPE).
 - b) Structured oral examination (SOE).
 - c) OSPE and SOE format and the number of stations will be according to SCFHS regulations.

Certification

Successful trainees will be certified by the "Saudi Board for Medical Microbiology (SBMM)" after passing their fourth-year final exams (written and OPSE).

SUGGESTED REFERENCES AND READING RESOURCES

Textbooks

The latest edition of each book is recommended:

- Manual of Clinical Microbiology, 10th Edition. James Versalovic, Karen C Carroll, Guido Funke, James H. Jorgensen, Marie Louise Landry, and David W. Warnock. 2011.
- Medical Microbiology, 8th Edition. Patrick Murray, Ken Rosenthal, and Michael Pfaller. 2016.
- Bailey and Scott's Diagnostic Microbiology, 13th Edition. Betty Forbes, Daniel Sahm, and Alice Weissfeld. 2015.
- Microbiology with Diseases by Body System, 4th Edition. Robert Bauman. 2015.
- Diagnostic Medical Parasitology, 5th Edition. Lynne Garcia. 2007.
- Basic and Clinical Immunology, 2nd Edition. Mark Peakman. 2009.

SCFHS POLICIES AND PROCEDURES

Please familiarize yourself with the SCFHS rules and regulations of residency training as follows:

1. Main page. Publications related to SCFHS regulations in Arabic

<http://www.scfhs.org.sa/Reglations/Pages/default.aspx>

2. Main page. Publications related to SCFHS regulations in English

<http://www.scfhs.org.sa/en/Reglations/Pages/default.aspx>

3. Rules and Regulation of the Scientific Council and committees, Arabic

<http://www.scfhs.org.sa/Reglations/Documents/اللائحة%20التنفيذية%20للمجالس%20والبجان%20العلمية.pdf>

4. Rules of procedures for training of Saudi Board, Arabic

<http://www.scfhs.org.sa/Reglations/Documents/اللائحة%20العامه%20للتدريب%20لبرامج%20شهادة%20الاختصاص%20السعودية.pdf>

5. Rules of procedures for training of Saudi Board, English

<http://www.scfhs.org.sa/en/Reglations/Documents/Rules%20of%20Procedure%20for%20Training%20of%20Saudi%20Board%20Specialties.pdf>

6. SCFHS examination regulations

<http://www.scfhs.org.sa/Reglations/Documents/النظم%20والقواعد%20العامه%20لامتحانات%20الهيئة%20السعودية%20للتخصصات%20الصحية.pdf>

7. Residents' rights and obligations

<http://www.scfhs.org.sa/MESPS/TrainingProgs/RegulationBoard/Documents/Saudi%20Commission.pdf>

8. Code of Ethics for Healthcare Practitioners

<http://www.scfhs.org.sa/Media/OtherPublications/Documents/%d8%a3%d8%ae%d9%84%d8%a7%d9%82%d9%8a%d8%a7%d8%aa%20%d8%a7%d9%84%d9%85%d9%85%d8%a7%d8%b1%d8%b3%20%d8%a7%d9%84%d8%b5%d8%ad%d9%8a.pdf>

9. Introduction to clinical research

[http://www.scfhs.org.sa/Media/OtherPublications/Documents/Introduction%20to%20Clinical%20Research%20for%20Residents%20\(16.9.14\)%20Hani%20Tamim%20\(FC1\).pdf](http://www.scfhs.org.sa/Media/OtherPublications/Documents/Introduction%20to%20Clinical%20Research%20for%20Residents%20(16.9.14)%20Hani%20Tamim%20(FC1).pdf)

Privacy and Confidentiality

Any personal information provided by residents to SCFHS staff is strictly confidential. It will never be disclosed to any advertisement groups or third parties. Accredited training centers, members of training programs, committees, examiners, and supervisors will be provided the necessary information for training and examinations only. Exam results will be disclosed to the candidate only through methods described under the examination section.

Please see the following for further details:

<http://www.scfhs.org.sa/Reglations/Documents/>

النظم%20والقواعد%20العامه%20لامتحانات%20الهيئة%20السعودية%20للتنصيصات%20الصحية.pdf

When applying to the program, residents are required to provide accurate information about themselves as required. It is the responsibility of each applicant to update their contact information regularly and whenever necessary. Any lack of communication or untoward results will adversely affect the trainees due to inaccurate/incomplete/outdated personal data. The program declares no responsibility towards this issue should it arise.

Registration for Training:

Please refer to the SCFHS training manual for further details:

<http://www.scfhs.org.sa/Reglations/Documents/>

اللائحة%20العامه%20للتدريب%20لبرامج%20شهادة%20الاختصاص%20السعودية.pdf

<http://www.scfhs.org.sa/en/Reglations/Documents/Rules%20of%20Procedure%20for%20Training%20of%20Saudi%20Board%20Specialties.pdf>

Monitoring of Training and Mentoring

Each trainee will have a logbook and a checklist to be reviewed by the supervisor and the program directors by the end of each rotation.

It is the responsibility of each supervisor to ensure the completeness of the training requirement each year for their allocated trainees and forward a letter to the program director confirming the completion of the training. Otherwise, rotations for the next year must be modified according to their needs.

Each local program director must review the logbook and checklist of their allocated trainees to ensure the completeness of the training for the final exam and notify the program director at least six months before the board examination date.

It is advisable for the trainees to have a mentor through their four-year training. The mentor will follow up on the completion of the required training during the five-year program and before entering the final exam. Alterations can be made as necessary and according to availability.

- Mentors, the local clinical scientist, or senior trainees in the fourth year take up a leader and mentor role for the junior trainees. They should not mentor more than 4–6 trainees.

Mentor Responsibilities:

1. Coordinates with the director to schedule rotations, involving areas of expertise and responsibility.
2. Works with the trainees to create rotation-specific objectives.
3. Interacts with laboratory personnel to facilitate the logistics of laboratory rotation.
4. As required, serves as a liaison with external partners to facilitate clinical or external aspects of the rotation.
5. Meets with the trainees regularly (at least once every four weeks). Each meeting should take 30 minutes to one hour and review progress, the trainee's needs, and rotation opportunities.
6. Available for the trainees for inquiries and guides where and how the trainees can find answers to these inquiries.
7. Ensures adequate exposure of the trainees to the required syllabus topics related to the rotation.

SCFHS guidelines for mentoring:

<http://www.scfhs.org.sa/Media/OtherPublications/Documents/%D8%AF%D9%84%D9%8A%D9%84%D8%A7%D9%84%D8%A5%D8%B1%D8%B4%D8%A7%D8%AF%20%D8%A7%D9%84%D8%A3%D9%83%D8%A7%D8%AF%D9%8A%D9%85%D9%8A.pdf>

Vacation/Leave of Absence/Educational Leave

Annual Leave

Four weeks of annual leave is permitted and can be taken during the Summer Season provided it will not affect training. The trainees should apply for their leave at least four weeks before the dates of the annual leave. The annual leave should be taken no later than the end of each academic year or as decided by the respective department or the training supervisor in coordination with the LSC. Emergency and sick leave require the submission of a special form through the supervisor to the LSC.

National Holidays

National Holidays include Eid Al Fitr, Eid AL Hajj, and the National day(s), defined annually according to the Hijra Calendar. Sick leave, maternity leave, and exceptional "emergency" leave for a period not exceeding ninety days shall be compensated for with an equivalent period of days before the trainees are awarded the certificate of training completion. Leave that is not utilized in due time within the year will not be shifted to the coming year.

<http://www.scfhs.org.sa/Reglations/Documents/اللائحة%20العامه%20للتدريب%20لبرامج%20شهادة%20الاختصاص%20السعودية.pdf>

<http://www.scfhs.org.sa/en/Reglations/Documents/Rules%20of%20Procedure%20for%20Training%20of%20Saudi%20Board%20Specialties.pdf>

Educational leave

Trainees may apply individually for one week of study leave per year subject to the approval of the LSC and the head of the department. In coordination with the chairman of the Regional Training Committee, the training program director may grant the trainees special leave for scientific purposes not exceeding seven days per training year to attend scientific conferences or seminars in the same or similar specialties provided that they present proof for attending such activities.

<http://www.scfhs.org.sa/Reglations/Documents/اللائحة%20العامه%20للتدريب%20لبرامج%20شهادة%20الاختصاص%20السعودية.pdf>

<http://www.scfhs.org.sa/en/Reglations/Documents/Rules%20of%20Procedure%20for%20Training%20of%20Saudi%20Board%20Specialties.pdf>

Withdrawal of Training

A written report should be submitted to the LSC for withdrawal from the program for periods of less than ONE (1) YEAR collectively. If a withdrawal is intended to be for more than ONE (1) YEAR, re-application for the program is mandatory:.

<http://www.scfhs.org.sa/Reglations/Documents/اللائحة%20العامه%20للتدريب%20لبرامج%20شهادة%20الاختصاص%20السعودية.pdf>

Suspension or Interruption of Training

Interruption of training will be permitted for sickness or for justifiable and convincing social reasons. Applications must be provided in writing and discussed with and approved by the LSC. The maximum permitted interruption is one year with justified reasons and supporting documents. The LSC must approve the application.

<http://www.scfhs.org.sa/Reglations/Documents/اللائحة%20العامه%20للتدريب%20لبرامج%20شهادة%20الاختصاص%20السعودية.pdf>

Transfer to and from the Program

Transfer from other training programs outside the Medical Microbiology programs is not permissible.

If a candidate from a different program wishes to apply to the Medical Microbiology program, they should follow the same policy and procedure as applying as a new candidate to the program.

<http://www.scfhs.org.sa/Reglations/Documents/اللائحة%20العامه%20للتدريب%20لبرامج%20شهادة%20الاختصاص%20السعودية.pdf>

REFERENCES

1. Saudi Board in Medical Microbiology Information Booklet.
2. SCFHS regulation manual: <http://www.scfhs.org.sa/en/Reglations/Pages/default.aspx>
3. Frank JR, Snell L, Sherbino J, editors. CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015.).

APPENDICES

APPENDIX A

ABOUT CANMEDS:

Please see the website of the Royal College of Canada for further details:

<http://www.royalcollege.ca/portal/page/portal/rc/resources/aboutcanmeds>

The CanMEDS is an educational framework that identifies and describes seven roles that lead to optimal health and healthcare outcomes: medical expert (central role), communicator, collaborator, manager, health advocate, scholar, and professional. The overarching goal of CanMEDS is to improve patient care. The model has been adopted around the world for healthcare and other professions.

APPENDIX B

Weeks	1	6	12	18	24	30	36	42	48
Year 1 (R1)	General modules in quality control, safety, and ethics in addition to the basis of clinical microbiology, including sterilization, disinfection specimen handling, microscopy examinations, and using different methods of culture and other investigations.								
Year 2 (R2)	Systematic and clinical microbiology related modules that include lab techniques in microbiology beginning with the investigation to reaching a diagnosis in addition to the use of techniques related to antibiotic sensitivity and doses.								
Year 3 (R3)	Subspecialty modules in microbiology, including environmental microbiology, molecular microbiology, virology, mycology, parasitology, and immunology.								
Year 4 (R4)	Infection and laboratory management modules in addition to research skills and dissertation.								

APPENDIX C

**SAUDI SPECIALTY BOARD IN MEDICAL MICROBIOLOGY
Final in-Training Evaluation Report (FITER)**

**Name of Resident and Identification No:
Evaluation Period:**

In the view of the Local Supervising Committee (LSC), this trainee has acquired the competencies of the specialty as prescribed in the Objectives of Training and is competent to practice independently.

YES NO

The following was used as evidence of competence:

- End of rotation evaluation
- Feedback from staff consultants
- Completion of a research project

COMMENTS

Date	Name of Program Director	Signature
------	--------------------------	-----------

Date	Name of Local Committee Chair	Signature
------	-------------------------------	-----------

Date	Name of Resident (trainee)	Signature
------	----------------------------	-----------

RESIDENT'S COMMENTS:

Note: If during the period from the date of signature of this document to the completion of training, if the Residency Local Committee determines that the trainee's performance is inadequate this document can be considered null and might be replaced with an updated FITER.

APPENDIX D

RESIDENT PRESENTATION EVALUATION BY STAFF SUPERVISOR (EXAMPLE)

Resident (Trainee) Name: _____

Level: _____

Staff Supervisor: _____

Date of Presentation: _____

Topic: _____

Scale to evaluate the presentation:

	Very weak	Weak	Acceptable	Good	Very Good
	1	2	3	4	5
Medical Expert					
Demonstrated thorough knowledge of the topic					
Presented at an appropriate level and with adequate details					
Communicator					
Provided objectives and an outline					
The presentation was clear and organized					
Used clear, concise, and legible materials					
Used an effective method/style of presentation					
Established good rapport with the audience					
Collaborator					
Invited comments from learners and led the discussion					
Worked effectively with staff supervisor in preparing the session					
Health advocate					
Managed time effectively					
Addressed preventive aspects of care, if relevant					
Scholar					
Posed an appropriate learning question					
Accessed and interpreted the relevant literature					
Professional					
Maintained patient's confidentiality, if clinical material was used					
Identified and managed relevant conflicts of interest					
TOTAL SCORE					

APPENDIX E
ACTIVITY EVALUATION FORM (EXAMPLE)

TITLE OF SESSION: _____

SPEAKER: _____

PRESENTATION OBJECTIVE(S): _____

NOTE: Please choose only one number for the evaluation score if it is applicable.

I. Evaluate the program content on these criteria:

Objectives met	very little	1	2	3	4	5	very much
Met my professional needs	minimal	1	2	3	4	5	excellent
New information gained	very little	1	2	3	4	5	very much

II. Evaluate the presenter's ability to meet these criteria:

Preparation	unprepared	1	2	3	4	5	prepared
Held my interest	very little	1	2	3	4	5	very much
Method of presentation	poor	1	2	3	4	5	excellent
Quality and use of audiovisual material	poor	1	2	3	4	5	excellent

III. Rate the overall quality of this presentation:

poor	1	2	3	4	5	excellent
------	---	---	---	---	---	-----------

Comments: _____

IV. Strengths and weaknesses:

V. Future recommended speaker/topics: _____

NOTE: Receipt of this completed and signed form is necessary for receiving CME credit.

Badge Number (required): _____

Name (optional): _____

Last

First

Saudi Council # (required): _____

Expiration Date: _____

APPENDIX F

ENTER NAME OF CENTER TO PERSONALIZE THIS FORM
Department of Medical or Clinical Laboratory
Medical Microbiology Section

TRAINING CENTER ROTATION EVALUATION (EXAMPLE)

DURATION: _____

Program Leadership

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The Residency Training Committee is effective at meeting the educational needs of the trainees.					
The Residency Training Committee is receptive to the trainee's input.					
The Program Director is available to the trainees.					
The Program Director is approachable.					

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
My annual individual meetings with the Program Director are useful.					
The Orientation to the overall program is of high quality.					
Administrative support is adequate.					
I am kept informed of issues within the Training Program (may include meetings of the Program Director with the trainee's body, meetings with the chief resident(s), and other communications from the Residency Program Committee or administrative staff).					
I can easily communicate my concerns, ideas, and suggestions to the Residency Program Committee.					

Please provide comments, particularly on areas that require improvement; examples, constructive suggestions, and ideas are very welcome!

Educational Curriculum

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The rotation effectively explains and teaches the CanMEDS Roles.					
The rotation effectively evaluates CanMEDS Roles.					
There is a good Service/Education balance in the daytime rotations.					
There is the opportunity for elective experiences.					
The formal academic program (e. g., ½ day) is useful.					
Staff participation in the teaching sessions is adequate					

Please provide comments, particularly on areas that require improvement; examples, constructive suggestions, and ideas are very welcome!

Resident (trainee) Well-being

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The well-being of the trainees is important in our program.					

Collegiality of Department

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Departmental (or divisional) consultants are helpful to the trainees.					
Informal mentoring is available from Departmental (or divisional) consultants.					
There is support from fellow trainees.					
Fellow trainees are sensitive to trainee's cultural differences.					
The Program is sensitive to the trainee's cultural differences.					
The Program allows the trainees to express their opinions and concerns without fear of retaliation.					
The Program is responsive to the trainee's issues, suggestions, and complaints.					

Please provide comments, particularly on areas that require improvement; examples, constructive suggestions, and ideas are very welcome!

--

Career Guidance and Planning

	Not applicable	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Career guidance is clearly available.						
The educational experiences prepare you well for your ongoing career development.						

Please provide comments, particularly on areas that require improvement; examples, constructive suggestions, and ideas are very welcome!

--

Professional Development

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
There are opportunities for involvement in administrative work (e.g., hospital committees and residents committees).					
There are opportunities to participate in research.					
There are opportunities to participate in teaching.					
Accessibility to the internet (not necessarily in personal office).					
Accessibility to computers (not necessarily in personal office).					
Accessibility to library services.					

Please provide comments, particularly on areas that require improvement; examples, constructive suggestions, and ideas are very welcome!

--

***Aggregate data that will not identify respondents will be presented to the training committees on an annual basis.

APPENDIX G

SCIENTIFIC PAPER TEMPLATE

Title Page:

Title: [Enter the Title of Manuscript in Title Case (the first letter of each word is capitalized)]

Authors: [List all the author names; e.g., Authors1, Author2, and Author3]

e.g., Ahmad Abdullah¹, Maram Khalid^{2*}, Saad Muneer³

¹Author name, author department, University or institute, Country, City

²Author name, author department, University or institute, Country, City

³Author name, author department, University or institute, Country, City

***Corresponding author:** Author name, contact address, city, state, country, Tel: ; Fax: ; E-mail:

Manuscript Organization:

Title: [Enter here the Title of the manuscript in Title Case.]

Abstract in English: [Less than 250 words]

Abstract in Arabic: [Less than 250 words]

Keywords: [Enter Four to five keywords here]

Abbreviations: [Enter your text here]

Introduction:

[Type your text here]

Materials and Methods:

[Type or copy/paste your text here]

Results:

[Type or copy/paste your text here]

Discussion:

[Type or copy/paste your text here]

Conclusion:

[Type or copy/paste your text here]

Acknowledgments

[List here any individuals who contributed to the work and grant details.]

References

[All references should be cited in the article in consecutive order. List here all the references in a numbered order of the citations in the text. List all authors if less than six. If more than six authors list the first six followed by "et al. "]

The general style of reference is:

[Surname First Initial Middle Initial, Surname First Initial Middle Initial. Title of Article (in Title Case). Journal abbreviated name. Year; Volume (Number): Full inclusive page numbers.]

e.g., Rha JH, Saver JL. The Impact of Recanalization on Ischemic Stroke Outcome: a Meta-Analysis. Stroke. 2007; 38: 967-973.

e.g., Hacke W, Kaste M, Bluhmki E, Brozman M, Dávalos A, Guidetti D, et al. Thrombolysis with Alteplase 3 to 4.5 Hours after Acute Ischemic Stroke. N Engl J Med. 2008; 359: 1317-1329.

Conflict of Interest

[Declare here if any financial interest or any conflict of interest exists.]

Figures

[Copy paste figure/ image here]

Figure X (1, 2,...): [Description of figures/image.]

Tables

[All tables should be double spaced. Each table on a separate page]

Table X (1, 2,...): [Type or copy/paste here a brief descriptive title of the table DO NOT use full-stop after table sentence]

APPENDIX H

**Department of Medical or Clinical Laboratory
Medical Microbiology Section**

Lecture—Academic Day-Session**Topic:****Presenter (Initial):****Date:**

1. Please rate the presenter

	N/A	1 Poor	2 Needs Work	3 Good	4 Very Good	5 Excellent
Enthusiasm						
Interaction with the audience						
Preparation of the topic						

2. Please rate the presentation

	N/A	1 Poor	2 Needs Work	3 Good	4 Very Good	5 Excellent
Information was presented in an organized manner						
Related information presented to practical problems						
Quality of audiovisual aids						

3. Please rate the content of the presentation

	N/A	1 Poor	2 Needs Work	3 Good	4 Very Good	5 Excellent
Volume and complexity of the information presented was appropriate						
Related content to current evidence in the literature						
The content was relevant to your practice						

4. Please rate the content in terms of the CanMEDS Roles

	N/A	1 Poor	2 Needs Work	3 Good	4 Very Good	5 Excellent
Medical Expert						
Scholar						
Professionalism						
Health Advocate						
Communicator						
Collaborator						
Manager						

Comments, suggestions, or feedback?

APPENDIX I

Exam Blue Print

PROMOTION EXAMS WRITTEN COMPONENT
--

R1 (120 MCQ)	Number of MCQs
<u>General Modules</u>	
- Lab safety	12
- Quality control	12
- Lab ethics	12
<u>Scientific Basis of Clinical Microbiology</u>	
- Sterilization and disinfection	12
- Handling of specimens	15
- Microscopy	5
- Culture methods	20
- Further processing	12
- Antimicrobial investigations	20
Total	120

R2 (120 MCQ)	Number of MCQs
<u>Clinical Bacteriology</u>	
- Skin, nails and soft tissues, wound infections - Circulatory system and cardiovascular infection - Bone and joint infections - Food poisoning	15
- Urinary tract infection (UTI) and other genitourinary system infections - Pyrexia of unknown origin (PUO) - Microbiology of the gastrointestinal tract	15
- Upper and lower respiratory tract infections - Ear infections - Eye infections - Nervous system infections	15
- Sexually transmitted infections (STI) - Infections in immunocompromised patients - Nosocomial infections - Bacterial pathogenesis	15

<u>Systematic Bacteriology</u>	
- <i>Staphylococci</i> and other Gram-positive cocci - <i>Streptococci</i> and <i>Enterococci</i> - <i>Corynebacterium</i> - <i>Listeria</i>	15
- <i>Aerococcus</i> and other Gram-positive cocci - <i>Bacillus</i> and other Gram-positive rods - Enterobacteriaceae - <i>Pseudomonads</i> and other non-fermenters - <i>Vibrio</i> , <i>Campylobacter</i> , and <i>Helicobacter</i>	15
- <i>Bordetella</i> and other members of <i>Alcaligenaceae</i> - Anaerobic Bacteria: <i>Clostridia</i> , <i>Bacteroides</i> and other non-sporing, obligatory anaerobes - <i>Mycobacteria</i> - <i>Acinetobacteria</i>	15
- <i>Moraxella</i> - <i>Rickettsia</i> - Spirochetes - <i>Actinomyces</i> and <i>Nocardia</i> - <i>Mycoplasma</i> and <i>Ureaplasma</i> - <i>Brucella</i> , <i>Haemophilus</i> , <i>Neisseria</i> , and <i>Chlamydia</i>	15
Total	120

R3 (120 MCQ)	Number of MCQs
- Environmental Microbiology	10
- Molecular and Emerging Techniques	15
- Virology	25
- Mycology	20
- Clinical Parasitology	25
- Clinical Immunology	25
Total	120