

**At the end of 12 months in the UK the resident is expected to pass**

**Final OMSB and/or Part 2 MRCPPath examination.**

### **ASSESSMENT**

Each tutor involved in training will submit annual report about the performance of residents attached to his/her unit.

At the end of the general professional training (R1) the residents will sit for OMSB core examination.

After completing one year of *Phase 1* residents will be assessed before moving to R3

At the end of *Phase 1* residents will be assessed by Part 1 OMSB and/or Part 1 MRCPPath examination.

At the end of the first part of *Phase 2*, residents will be assessed for their suitability to proceed to the UK for the second part of *Phase 2*.

### **AIM OF TRAINING**

The aim of training is to provide the Resident with both the theoretical foundation and the practical, technical, clinical and managerial skills necessary for the independent specialist practice of Medical Microbiology in a clinical environment and for the advancement of the subject. The laboratory work and clinical experience must be closely integrated; therefore laboratory associated clinical duties are essential components of the training programme.

### **OBJECTIVES OF TRAINING IN MEDICAL MICROBIOLOGY**

Medical microbiology is a branch of medicine concerned with the diagnosis, treatment and prevention of infectious diseases. The profession of medical microbiology consists primarily of four major spheres of activity:

1. Scientific and administrative direction of clinical microbiology.
2. The establishment and direction of a clinical infection control program.
3. Provision of clinical consultation on the investigation, diagnosis and treatment of patients suffering from infectious diseases.
4. Public health and communicable disease epidemiology and prevention.

Microbiology training should provide residents with knowledge which is up to date. Microbiology residents shall be prepared to conduct their practices in an ethical, cost effective manner. Emphasis is placed on effective communication in partnership with laboratory technologists, physicians and other health care providers, patients, and the community.

Residents must demonstrate the knowledge, skills, and attitudes relating to gender, culture, and ethnicity pertinent to medical microbiology.

In addition to these primary activities, medical microbiologists are often responsible for teaching of undergraduate and postgraduate medical students, students in other health disciplines, postgraduate science students and other residents. They also provide continuing education to medical and other health care professionals.

At the end of training, the Resident should have achieved competence in all the objectives specified in Medical Microbiology training record and as part of the assessment process should also have passed part 1 and 2 of the MRCPATH and /or OMSB specialist examination and attained a series of successful Record of In-Training Assessment.

### **REQUIREMENTS FOR ADMISSION**

The applicant should have the required qualifications to be eligible to practice medicine in Oman.

He/She should satisfy the selection committee in terms of knowledge, attitude, aptitude and performance in his/her medical studies and previous jobs held.

### **SUPERVISION**

All Residents must have cover of a certified trainer at all times. Every Resident will have a designated trainer who will be personally responsible for day-to-day training and who will be accountable to the Programme Director.

Residents are required to keep a training record detailing their training experience (Log Book). Their trainer will inspect this regularly. Residents will be regularly informed of their progress and, in addition, must be encouraged and given every opportunity to discuss any deficiencies in their training programme. The Programme Director should discuss the resident progress with each trainer and should keep

Administrative and management skills are developed in parallel with other aspects of training. Aspects of management, strategic planning, preparation of a business plan, contracting processes, service level agreements, departmental and directorate budgeting etc. – should be part of training after obtaining the OMSB (Part 1) and/or MRCPATH (Part 1). Attendance at local or national management courses should be strongly encouraged. Trainees may, as ‘colleagues’, be permitted to sit in on departmental, directorate and other local committee meetings as observers. The aims and objectives of this should be to provide them with some experience of committee procedures, aspects of confidentiality, decision making at a local level and the importance of maintaining good inter-personal relationships.

#### **18. *Tutorials / Journal clubs:***

Residents are encouraged to read Microbiology and Infectious Diseases journals (appendix 1) regularly. Also they should read and learn the main Microbiology and Infectious Diseases textbooks (appendix 1). There will be weekly sessions of journal clubs or tutorials where residents present an article or a current topic to audience of other residents and tutors. These presentations should generate useful discussions and comments

#### **19. *Research:***

The resident is advised to take up a research project, which he/she should plan, undertake and write with minimum supervision by the trainer.

#### **20. *In the United Kingdom (R5):***

After completing 12-18 months of phase 2, the resident will be attached to a clinical microbiology laboratory in the UK. There he/she should learn areas not available in Oman, such as molecular technology, advanced virology and mycology. He/she should also get familiarized with microbiology problems particular to the UK and Europe.

- b. Interpretation of results, both for clinical and infection control purposes;
- c. Virology policies in relation to health care workers, pregnancy, transplantation and immunization;
- d. When to refer to or request specialist virological expertise.

**14. Quality control:**

At the end of formal training, the trainee should:

- a. have an understanding of quality control and quality assurance;
- b. have had experience of the regular processing of the QC specimens;
- c. have an understanding of the existing external quality control schemes and the processing of data by these schemes.

**15. Audit:**

At the end of formal training, the trainee should:

- a. have an understanding of the principles of audit;
- b. have participated in microbiological audit of clinical specialties.
- c. The trainee should have also participated in clinical audit led by other specialties.

**16. Accreditation:**

At the end of formal training, the trainee should have knowledge of the requirements of any existing laboratory accreditation schemes and the process whereby accreditation is conferred.

**17. Management:**

the Chairman of the Scientific Committee informed. A meeting involving the Programme Director, trainers and residents should be held every six months to discuss the progress of training and plan for the next six months. A report of this meeting should be forwarded to the Chairman of the Scientific Committee.

**GENERAL PROFESSIONAL TRAINING (R1)**

During their first year, residents shall do clinical rotations in disciplines relevant to Medical Microbiology. They should spend 2 months in Adult Infectious diseases and one month in each of Paediatric Infectious Diseases, Haematology/Oncology, Gastroenterology, Respiratory Medicine and Intensive Care Unit. They should be exposed to presentation, investigation and management of diseases, particularly microbial diseases. This is followed by a four months of Basic Microbiology. During this period residents are familiarized with laboratory organization and safety, preparation of media, Gram and ZN stains, culture, microbial morphology and identification as well as basic virology, immunology and mycology. During the four months of Basic Microbiology, trainees should have an understanding of the principles of the following, together with how they may be applied to clinical and research problems:

- a. microbial structure, physiology and genetics
- b. microbial taxonomy, classification and typing methods
- c. host defense mechanisms, the immune system and immunity to infection
- d. microbial pathogenicity
- e. epidemiology of infectious disease
- f. antimicrobial agents, their mode of action and mechanisms of microbial resistance

At the end of the first year residents will sit for OMSB core examination. When they pass they move to R2.

## SPECIALIZED TRAINING (R2 – R5)

Residents will get specialized training for three and half years in Oman, followed by one year in the United Kingdom. Laboratory responsibilities are escalated according to the progress and experience of the resident. Prior to their training, all Residents should attend an induction course at each training site. This is organized by their trainer in the respective site and will include key local information.

This will be supervised by the clinical microbiologist. During their first microbiology rotation, the resident will be able to respond to basic technical problems and fairly routine clinical inquiries. During their subsequent rotations the resident should be more autonomous within the laboratory and will be able to issue directions to technologists and to respond to the majority of clinical problems with less detailed supervision. The resident will demonstrate an ability to review the daily activities of the microbiology lab, including the daily records and ability to handle quality control problems. The resident will be able to act as a resource to the infectious disease consultation service to deal with specific patient diagnostic issues.

### I. PHASE; 1 R2 - R4 (24 MONTHS):

Core training in Medical Microbiology consists of training and rotations over 24 months at the Royal Hospital, SQUH and the Public Health Laboratory. It includes training in Clinical Microbiology, Infection Control, Bacteriology, Food and Water (PHL), Mycobacteriology, Virology, Mycology, and Parasitology. By the end of 24 months, Residents should have done the following:

Clinical Microbiology	= 16 months
Virology	= 3 months

- f. have an understanding of the principles of patient isolation and their application;
- g. be familiar with any documents relevant to infection control and also have a knowledge of any existing working party recommendations (e.g. MRSA, Shigella, Clostridium difficile);
- h. gained some experience of public health microbiology with secondment if necessary to the Public Health Laboratory;
- i. have had some experience of communicable disease control in the community.

### **12. Public Health:**

At the end of their training in the Public Health Laboratory, residents should:

- a. understand the principles microbiological examination of water, milk and food
- b. be able to perform microbiological examination of water by different methods
- c. know the classification of mycobacteria
- d. be able to examine clinical specimens for acid fast bacilli
- e. know the principles and be able to do cultivation, identification and susceptibility testing of mycobacteria
- f. know the principles and be able to do molecular techniques such as PCR, PFGE, immunoblotting etc.

### **13. Virology:**

The resident should spend not less than six months in virology (in Oman and UK) to learn clinical and diagnostic virology. This is done at departments of Microbiology, College of Medicine, SQU and the Public Health Laboratory. At the end of formal training, the trainee should have knowledge of:

- a. basic diagnostic virology methodology.

- a. have gained experience of liaison with clinical colleagues through regular ward visits. In particular, a close relationship with high dependency unit (e.g. ICU, SCBU) and specialist units (e.g. haematology, paediatrics, transplantation).
- b. have gained experience of liaison with general practitioners in particular by providing telephone advice when requested.
- c. have participated in on-call rotas (including weekends) with consultant cover.
- d. have participated in postgraduate education meetings such as Hospital Grand Rounds.
- e. be able to provide informed advice on vaccination and immunization.

### **11. Infection Control in hospital and community:**

Experience in dealing with infection control problems and writing relevant policies must be obtained. At the end of formal training, the trainee should:

- a. have had first hand experience of local infection control problems, including, outbreaks of infection and their management;
- b. be familiar with the workings of infection control meetings including local and regional infection control committees;
- c. be aware of those areas of hospital and community health that require infection control policies.
- d. Have worked closely with the infection control nurse both in day- to- day duties and in the education of those involved with infection control issues.
- e. Have participated in visits to clinical and non-clinical areas to advise on infection control. These should include kitchen inspections. Relationships should be developed with key personnel in the CSSD, pharmacy and laundry;

Mycobacteriology / PHL	= 2 months
Parasitology/Mycology	= 1 month
Infectious Diseases	= 2 months

Residents start with an initial 8-week orientation period, where they do weekly bench rotations between the various sections of the Microbiology laboratory e.g. Urine, blood culture, respiratory samples, genital specimens, wound swabs and tissues, fluids including cerebrospinal fluid, faeces and sensitivity testing.

Following the initial rotation two to four weeks should be spent in each section, depending on the workload. During this time, tutorials and private study is aimed at basic organism morphology and identification with an introduction to the clinical syndromes associated with infection with each organism. During this stage the resident will be introduced to principles of laboratory safety, sterilization and disinfection, handling of specimens, microscopy, culture methods, and antimicrobial investigations.

### ***Bench Rotations:***

The following are objectives for Bench Rotations. These objectives should form guidelines for the rotations. At the end of rotations, the residents are expected to independently do the assigned bench work.

#### **1. Blood Culture**

The resident will have the knowledge of:

- a. The pathogenesis and laboratory diagnosis of blood stream infections.
- b. The principles by which the automated and manual blood culture systems operate.
- c. The criteria to identify blood culture isolates as likely pathogens or contaminant.

The resident will be able to:

- a. advise users regarding the appropriate collection method and number of blood cultures
- b. needed to diagnose a blood stream infection.
- c. to operate the blood culture system and to perform appropriate sub-culturing .

## **2. Wound specimens**

The resident will have knowledge of the normal flora for the different sites on the human body and the bacterial pathogens that cause skin and soft tissue infections.

The resident will be able to:

- a. Read Gram's smears from various body sites.
- b. Identify the intrinsic pathogen of skin and soft tissue infections.

## **3. Body fluids**

The resident will have the knowledge of:

- a. The collection methods for various body fluids and how they be handled.
- b. The processing methods for various body fluid specimens.
- c. The sensitivity and specificity of antigen detection in CSF.

The resident will be able to identify CSF pathogens.

## **4. Urine**

The resident will have the knowledge of:

- a. The concept of significant bacteriuria.
- b. Semi-quantitative urine culture methods

The resident will be able to:

- a. Quantify urine cultures results and predict clinical significance.

- e. 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.

## **8. Emerging technologies:**

At the end of formal training, the trainee should:

- a. be aware of all major new technologies available in medical microbiology based on DNA techniques (e.g. PCR) and monoclonal antibodies;
- b. be aware of automated, rapid techniques available to medical microbiology;
- c. be able to evaluate critically the need for emerging techniques within the laboratory including cost effectiveness and effects on staffing levels and working practices.

## **9. Data handling:**

At the end of formal training, the trainee should:

- a. have a basic understanding of information technology and in particular, computerized data handling. He/she should have an appreciation of the advantages and disadvantages of such systems and a basic understanding of the need for data protection and the Data Protection Act;
- b. be aware technologies for data broadcasting (e.g. EPINET).

## **10. Clinical experience:**

Clinical training continues with increasing degrees of responsibility being given. The trainer should ensure that a comprehensive range of clinical problems is being encountered. At the end of formal training, the trainee should:

and have an appreciation of the growth kinetics of both solid phase and broth cultures. It is important in this context to know those micro-organisms and clinical situations in which detectable growth may require prolonged incubations;

- d. be familiar with the preparation of media in common use and have an understanding of internal quality control of such preparations;
- e. be able to process all common specimens, recognize potential pathogens from a mixture of colonies on culture plates, separate such colonies in order to achieve the pure growth necessary for further work.

#### **6. Further processing of cultures:**

At the end of formal training, the trainee should:

- a. 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, ELIS, latex agglutination;
- b. understand the principles of identification media and be able to use them appropriately;

#### **7. Antimicrobial investigations:**

At the end of formal training, the trainee should:

- a. be aware of available reference facilities for further identification including serotyping and all other typing schemes both phenotypic and genotypic;
- b. be able to test the antibiotic sensitivities of an isolate using the common techniques of disc testing and break points;
- c. be able to perform and interpret MIC and MBC tests as appropriate;
- d. be able to perform antimicrobial assays using biological and automated techniques;

- b. Identify the typical urinary pathogens based on standard biochemical tests.

#### **5. Genitourinary specimens**

The resident will have the knowledge of:

- a. The appropriate methods for collection of genital specimens.
- b. The sensitivity and specificity of direct Gram's stains for urethral and endocervical specimens in symptomatic patients.
- c. Serological tests used for the diagnosis of syphilis.
- d. The appropriate investigations for *Chlamydia trachomatis* and *Mycoplasma* infections.

The resident will be able to:

- a. Identify, based on the microscopic appearance, the presence of *Trichomonas vaginalis* and *Candida spp.* in a vaginal specimen, and *Neisseria gonorrhoeae* in urethral and endocervical specimens.

#### **6. Respiratory specimens**

The resident will have the knowledge of:

- a. The proper collection of throat and nasopharyngeal swabs for bacterial and viral investigations.
- b. The serological tests used to diagnose bacterial pathogens of the upper and lower respiratory tracts.
- c. The principle of direct fluorescent antibody assay.
- d. The handling of different types of bronchoscopy specimens.
- e. The value of serological studies in the investigations for different types of fungal infections.
- f. The diagnosis of legionella infections.

The resident will be able to:

- a. Determine respiratory specimens that are appropriate and those that are inappropriate for culture.
- b. Identify the common respiratory pathogens.

## 7. *Anaerobic Bacteriology*

The resident will have the knowledge of:

- a. Collection and transport of specimens for anaerobic culture.
- b. The methods of anaerobic culture and antibiotic susceptibility testing.
- c. The current susceptibility profiles of common anaerobic pathogens.

The resident should be able to identify the typical anaerobic bacterial pathogens.

## 8. *Gastro-intestinal specimens*

The resident will have the knowledge of:

- a. The virulence features of the various enteric pathogens.
- b. The appropriate samples that must be submitted for investigations of suspected food poisoning and gastroenteritis.
- c. Laboratory diagnosis of *Clostridium difficile* infection.

The resident will be able to:

- a. Isolate and identify enteric bacterial pathogens.
- b. Determine which enteric bacterial pathogens should have susceptibility results reported.

## 9. *Antibiotic susceptibility testing*

The resident will have knowledge of:

- a. The reference methods of susceptibility testing.
- b. The methods used to determine antimicrobial levels in body fluids.
- c. The methods used to perform MIC and MBC testing.
- d. The mechanism of action for various antimicrobial agents and the mechanism of resistance for common resistant pathogens.
- e. The concepts of synergy and antagonism.

where this continuity may fail and be able to minimize the risk of this.

- c. be able to assess degrees of urgency for the processing of specimens, including the provision of out of hours service and the communication of preliminary results as applicable.
- d. be able to decide upon further testing or processing of a specimen as appropriate.
- e. be aware of existing reference facilities and their appropriate use.

## 4. *Microscopy:*

At the end of formal training, the trainee should:

- a. 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;
- b. be able to perform routine staining techniques including fluorescent dyes;
- c. be familiar with the appearance of stained preparations and be able to recognize artifacts and their possible origin.

## 5. *Culture methods:*

At the end of formal training, the trainee should:

- a. have a basic understanding of the diversity of microbial metabolism;
- b. be aware of the wide range of selective, enrichment and inhibitory media available for general and specialized use and be able to choose relevant media in common use or in medical and environmental laboratories;
- c. be familiar with physical growth requirements of micro-organisms including atmosphere and optimal temperature

At the end of formal training the resident should be familiar with:

- a. local procedures for the safe transport of specimens or cultures and also for postal and packaging regulations for such material.
- b. current requirements and recommendations of the Advisory Committee on Dangerous Pathogens (ACDP), Control of Substances Hazardous to Health (COSHH) and DHSS/DoH recommendations for specific diseases e.g. Viral hepatitis, HIV, prion diseases, haemorrhagic fevers.
- c. the principles and operation of microbiological safety cabinets and the procedures for their decontamination and monitoring of air flow.

### **2. Sterilization and Disinfection:**

At the end of training, the resident should understand the principles and uses of sterilization and disinfection procedures for the preparation of media and instruments and for microbiological waste disposal. Residents should be familiar with methods of monitoring and be capable of formulating a policy on the use of sterilizing and disinfection in the laboratory, hospital and community.

### **3. Handling of specimens:**

At the end of training the resident should:

- a. be aware for each specimen type, of the optimal methods for collection, transport, storage, reception, identification and documentation, including the requirements for high risk specimens.
- b. the resident should develop a sense of the continuity of identification of specimens from collection through culture and further testing to the issuing of a final report. He/she needs to be aware of critical points in processing

The resident will be able to:

- a. Set up disk diffusion and the automated susceptibility testing system
- b. Interpret the  $\beta$ -lactamase test.
- c. Setup and interpret MIC/MBC.

### **10. Parasitology**

The resident will have knowledge of:

- a. Proper collection methods for stool examination of parasites.
- b. Collection of specimens and examination for tissue and blood parasites.
- c. The life cycle of the clinically important parasites

The resident will be able to identify the frequent enteric and blood pathogens.

### **11. Mycobacteriology**

The resident will understand:

- a. Which specimens are appropriate for investigation of mycobacterial disease.
- b. The basis of acid fastness and the principle of AFB staining.
- c. The various methods used for culture, species identification (including DNA probes /PCR) and susceptibility of mycobacteria.

### **12. Mycology**

The resident will be able to:

- a. Recognize the presence of fungal elements in direct specimens.
- b. Perform identification of clinically significant yeasts.
- c. Identify the typical features of common pathogenic fungi.

### **13. Virology**

The resident will have knowledge of:

- a. Classification of Medically important viruses
- b. Virus structure and replication
- c. Methods of virus isolation and identification
- d. General knowledge of antiviral drugs
- e. Principles, application and limitations of various molecular microbiology methods (eg DNA /RNA extraction, detection and amplification of DNA, RT-PCR, nested PCR.....ect )

#### ***DUTY ROTA***

Once judged to be suitable experienced the resident should be included in the on-call Microbiology Rota and should cover weekends and official holidays.

#### ***CLINICAL LIAISON***

During this phase residents should check and discuss and report laboratory results. They should identify significant results and discuss with the clinicians further investigation and or management. They should participate in infection control activities and conduct investigation of outbreaks.

#### ***RESEARCH***

Exposure to research is started at this stage. The trainer identifies a project suitable for investigation and guides the resident through the process of designing, undertaking and writing up the study. Residents, at this stage, should also participate in training others e.g. junior residents or medical students.

#### ***EXPOSURE TO INTERNATIONAL EXPERTISE***

Residents are encouraged to attend an International Microbiology/Infectious Diseases Conference e.g. ECCMID every year in order to be abreast with developments in Microbiology and to broaden their knowledge and experience.

After completing 12 months of Phase 1, residents will be assessed and if found satisfactory, they move to R3.

At the end of this phase the residents are expected to pass Part 1 OMSB and/or MRCPPath examination. If they do so, they move to *Phase 2*; R4.

Until OMSB examination is organized, those residents who pass Part 1 MRCPPath examination will be granted Part 1 OMSB.

### **II. PHASE 2; R4 – R5 (30 MONTHS)**

The aims of this phase are to fulfill the requirements of the independent stage of training and should culminate the knowledge and experience for obtaining the OMSB qualifying examination and/or MRCPPath Part 2 examination. Eighteen months of this phase are spent in Oman. Residents shall spend 15 months in Microbiology and 3 months in Virology. During their training in Microbiology residents will attend Infectious Diseases Clinic, including HIV clinic once every week.

If residents complete their training in Oman satisfactorily, they shall move to R5 and proceed to the United Kingdom for advanced training.

During *Phase 2* training residents will culminate knowledge and experience as follows:

#### **1. Laboratory safety:**