Medical Microbiology Postgraduate Training in Malaysia

TRAINING CURRICULUM

VERSION 1, 2023

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PREFACE

This document is the National Postgraduate Medical Curriculum (NPMC) for Pathology, and is part of the NPMC Project which is intended to cover the development of curricula for all clinical medical specialists in Malaysia. It is to ensure that the training is consistent and competency based, and meets the standards required by the respective national bodies and the National Specialist Register (NSR).

The National Postgraduate Medical Curriculum for Pathology

The development of the Curricula for Pathology is the joint and collaborative effort of the institutional members of the Jawatankuasa Bersama Sarjana Perubatan – Patologi (JBSP-Patologi) which is the National Conjoint Specialty Committee overseeing Pathology, appointed by Jawatankuasa Bersama Ijazah Lanjutan Perubatan (JBILP). JBSP-Patologi comprises of members from all the universities offering the Master of Pathology programmes, the Ministry of Health (MOH) and College of Pathologists, Academy of Medicine Malaysia (CPath-AMM). This body has collaboratively established a common and standard training and examination system for the Master of Pathology programmes since 1995. It therefore draws on a wealth of experience and goodwill in the creation of these National Postgraduate Medical Curricula for Pathology, and took direction and guidance from the Master of Pathology Curriculum Review Workshop held at the Universiti Malaya in August 2019. Arising from this, it was agreed that, going forward, the training of mono-discipline Pathology specialists will be consolidated, and that separate curricula will be developed for the disciplines of Anatomical Pathology, Haematology, Chemical Pathology, Medical Microbiology, Forensic Pathology and Medical Genetics.

The Single Curriculum for Medical Microbiology

The National Postgraduate Medical Curriculum for Medical Microbiology, aims to be applicable to the training of training Medical Microbiologists in Malaysia, for all postgraduate programmes however named. It serves as the guide for all University programmes (e.g. Master of Pathology), and the training centres involved in the delivery of these programmes. It is envisaged that training through parallel pathways which will be developed, will utilise, incorporate and echo the principles and philosophy of Medical Microbiology training embodied in this document.

The Writers

The Medical Microbiology curriculum was written by a team of specialists from the establishments named above, appointed and supported by the Medical Microbiology Conjoint Board. Members of the Curriculum Committee writing group are acknowledged below:

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OVERVIEW

Specialty Introduction

Pathology comes from the Greek words “pathos (suffering)” and “logos (study)”, and translates as the study of suffering. When applied to modern medicine, Pathology is the study of disease at structural (organ), cellular (tissues and cells), and molecular (genes and proteins) levels and provides the understanding of the manifestations and complications of disease, on which therapeutic decisions are based. Thus, Pathology has aptly been described as the “foundation of medicine” and “the science behind the cure.” In Malaysia, as in many countries adopting the Western practice of Medicine, the field of Pathology has evolved into a number of specialties, such as Anatomical Pathology (study of disease in tissues and cells), Forensic Pathology (determination of cause and manner of death for legal purposes), Haematology (study of blood disorders), Chemical Pathology (study of the biochemical basis of disease), Medical Microbiology (study of disease due to infective agents), and more recently Medical Immunology (study of the immunological basis of disease) and Medical Genetics (study of the genetic basis of diseases and heritable conditions).

Pathology in Malaysia

When the country gained independence, there was a major shortage of medical specialists to deliver healthcare services to the people of Malaysia. The Medical Faculty of the University of Malaya (UM) was given the mandate in 1973 to train medical specialists to meet national needs. The first three programmes created were (1) Master of Pathology (MPath), (2) Master of Psychological Medicine and (3) Master of Public Health. The original MPath programme was a 2-year course. In 1987, it was converted to a 4-year programme with specialisation in various specialties to cater for developments and advancements in medical practice. Similar MPath programmes were then started in Universiti Kebangsaan Malaysia (UKM) in 1988 and Universiti Sains Malaysia (USM) in 1992. In 1995, a common conjoint curriculum and examination was established under the Jawatankuasa Bersama Sarjana Perubatan – Patologi [JBSP-Patologi] and Ministry of Higher Education (MOHE), to ensure a common standard in the training and qualification of Pathologists. The membership of this committee was composed of representatives from University of Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM), Ministry of Health (MOH) and College of Pathologists, Academy of Medicine Malaysia (CPath-AMM). In 2007 and subsequently 2012, Universiti Putra Malaysia (UPM) and Universiti Teknologi MARA (UiTM) respectively started their MPath programmes and joined the conjoint system.

The MPath programmes contribute to the national commitment for Universal Health Coverage. Implicit in that is the training of a sufficient number of competent medical specialists to deliver quality and comprehensive Pathology laboratory services in conjunction with the development of the public health and medical services of Malaysia.

Size of the Specialty

As of January 2022, there were a total of 780 pathologists registered on the NSR. Of these, Clinical Microbiologists comprise 22% (172), of all NSR-listed pathologists in Malaysia. The recent occurrence of infectious disease outbreaks has emphasised the need for Clinical Microbiologists throughout the country. In addition, the major increase in the number of teaching, private and Ministry of Defence hospitals and laboratories has definitely increased the shortage of clinical microbiologists. The advances in knowledge and cutting edge technologies in the detection of

diseases have significantly increased the scope and pivotal roles of this specialty further contributing to the demand for Clinical Microbiologists.

Why choose Pathology?

Sir William Osler, a famous physician, underscored the importance of Pathology in his often quoted remark: “As is your Pathology, so is your Medicine.” Surveys have indicated that about 70% of medical decisions are dependent on Pathology tests. It is gratifying to know that good Pathology contributes very significantly and is essential to clinical care of patients.

The typical day of a Pathologist is a varied one that takes them from bench to bedside, often interacting with medical colleagues from a large variety of specialties. It can be said that the Pathologist has a finger on the pulse of institutional practice. One of the best aspects of a career in Pathology is the wide variety of cases seen, which never ceases to be interesting and challenging.

The specialty of Pathology provides a strong scientific basis to understanding the disorders and diseases that afflict patients, and being able to understand in depth is itself rewarding. In addition, by virtue of its strong scientific base, Pathology is usually amongst the first to adopt and adapt new scientific advancements into medical practice (e.g. genomics, microarrays, etc.). This is the specialty that is very much at the forefront of medical science research. Many new advances and innovations in medicine have arisen from research by Pathologists, such as vaccines against disease, discovery of novel disease aetiologies, safe blood transfusion, organ transplantation, genetics and forensic advancements. These various aspects keep the specialty vibrant and constantly developing, and both intellectually and clinically attractive.

Medical Microbiology

Medical Microbiology, an exciting speciality at the forefront of patient diagnostics, is mainly concerned with the diagnosis of infectious diseases based on the application of various diagnostic modalities to detect the aetiological agent. Clinical microbiologists support and oversee the prevention, diagnosis and treatment of illness caused by microorganisms (viruses, fungi and parasites). They identify the best treatment for particular infectious diseases and monitor patients throughout and following treatment.

They give advice on the best samples to collect to diagnose an infection, such as a swab, blood test or urine test. They then work with scientists in the laboratory to discover what is causing the infection. This might be a bacterium (e.g. MRSA), a fungus (e.g. thrush), or a virus (e.g. influenza). Once the cause of the infection has been identified, and often before, the clinical microbiologist gives advice on how to treat it.

Clinical microbiologists also play a key role in making sure antibiotics are prescribed and used appropriately, by advising on patient management and producing treatment guidelines for a variety of conditions. They do this partly to minimise the emergence and spread of antimicrobial resistance.

Medical Microbiology diagnostic services include bacteriology, virology, mycology, parasitology and clinical immunology. This is the only Pathology specialty that works closely with the hospital infection control unit, surveillance and antimicrobial stewardship teams. They also promote measures to prevent and control the spread of diseases, both in hospitals and amongst the general public.

Apart from clinical duties, clinical microbiologists also work closely with scientific and technical staff in the supervision and management of the laboratory.

Unique Features of Medical Microbiology

The specialty of Medical Microbiology requires both laboratory skills and clinical acumen. It is a progressive discipline with the rapid evolution of new technologies in diagnostics. Emergence and re-emergence of infectious diseases add interesting and exploratory dynamics to the speciality as the likelihood of the occurrence of a new infectious disease can never be predicted. The major role carried out by clinical microbiologists in outbreak management emphasises the importance of this specialty. It provides an opportunity for interaction and engagement with other clinical specialties in a patient's management.. A clinical microbiologist plays a pivotal role in antimicrobial stewardship and in the prevention and control of healthcare-associated infections both in the hospitals and in the community.

Clinical microbiologists work closely with many healthcare professionals such as biomedical scientists, pharmacists, general practitioners and infection control nurses, and often attend clinical multidisciplinary team meetings. They also work with non-clinical colleagues, e.g. estates managers, to make sure buildings are designed and maintained to reduce the risk of infection.

Clinical microbiologists are actively involved in research, spanning molecular biological investigations to clinical trials and implementation science. The global spread of infections means that some microbiologists need to work collaboratively with colleagues abroad, identifying and helping to contain any global infectious threat.

Why choose Medical Microbiology as a career?

As a Clinical Microbiologist you will be amongst the few who will be engaged in/have the opportunity for:

- A close collaboration with a range of agencies and individuals as well as government and non-government organisations, the state department of health, medical practitioners, and public organisations.
- Serve as a consultant for physicians providing the identification of pathogens and suggesting treatment options and infection control methods.
- Working both with individuals but also wider ranging across communities.
- A fast-developing field of medicine with rapidly progressing knowledge that integrates laboratory and clinical medicine.
- Cutting edge work can span both academic and clinical, especially with the advancement in clinical laboratories and research, and the development of antibiotics or other treatment methods.
- Research on the vast amount of archived case material in Medical Microbiology.

Purpose of this Document

The overall aim of the National Postgraduate Curriculum in Medical Microbiology is to standardise the teaching, learning and assessment methods for both the trainers and trainees. This curriculum has been developed to meet the critical and growing need for Specialists in Medical Microbiology in Malaysia and to prepare trainees with the required knowledge, skills competencies and professional values to provide safe, expert and independent care.

The purpose of this curriculum document is to:

1. Provide an introduction to the field of Pathology in general and Medical Microbiology specifically.
2. Articulate the content, structure and process for training in Medical Microbiology in Malaysia.

3. Provide a common structure and process for training in Medical Microbiology in Malaysia.
4. Improve the quality of training in Medical Microbiology in Malaysia and ensure the uniformity of outcome.
5. Establish common standards and the effectiveness of assessments.
6. Ensure the ongoing quality of clinical Medical Microbiology through effective high quality training so as to deliver relevant and competent Medical Microbiology services in conjunction with the development of the public health and medicolegal services of the country.

Curriculum Overview

The training for the specialty of Medical Microbiology in Malaysia is almost exclusively through the Master of Pathology (MPath) programmes for Medical Microbiology, currently offered by training Universities and governed by the Ministry of Higher Education-based Jawatankuasa Bersama Sarjana Perubatan – Patologi [JBSP-Patologi] to ensure uniformity in training and assessments. Currently, these are 4-year, fulltime, fully-supervised programmes, designated here as the MOHE pathway. Alternative (parallel) pathways of training (such as for the FRCPath or FRCPA), have not been formalised with Institutional training providers, although individual arrangements may be made on an adhoc basis. Therefore, this document will focus on the MPath programmes (MOHE pathway).

Training is available only to medically-qualified practitioners. They should preferably be in the early stage of their medical careers after having acquired clinical experience that will allow them to appreciate the relevance of Medical Microbiology in the wider arena of medical specialist services. Such clinical experience is a more important entry criterion than actual hands-on experience in Medical Microbiology.

The Structure of Medical Microbiology Training

Medical Microbiology training is of the apprenticeship type (characterised by workplace-based teaching and assessments), with spiral progression (characterised by the acquisition of increasing competence over time in dealing with real-life clinical scenarios).

During Stage 1 of the programme, trainees undergo introductory courses in basic medical microbiology which encompasses basic knowledge in bacteriology, virology, parasitology, mycology and clinical immunology.

In Stage 2, the training is primarily focused on highly-specialised medical microbiology and the various deeper ramifications of its practice. Apprenticeship-type service-orientated training is supplemented by lectures, seminars, conferences and case-based discussions.

During both stages of training, trainees briefly undergo an introduction to the various specialties of Pathology under supervision, which include; Anatomic Pathology, Chemical Pathology and Haematology. Trainees are expected to read widely, not only the literature of Medical Microbiology itself but also related subjects such as biochemistry, genetics, molecular biology and statistics. All trainees are also required to attend orientation and intensive courses as well as other relevant courses (e.g. in research methodology), and continuous professional development activities.

At the end of Stage 1 (after 1 year of training), the trainee will sit for a formal examination and must pass this examination as an indication of fitness to continue specific training in Medical Microbiology. The Final (exit) examination is normally held in May at the end of 4 years of training.

The MPath curriculum conforms with the following Education and Learning outcomes:

Programme Educational Objectives (PEO)

Programme Educational Objectives are broad statements that describe the career and professional accomplishments that the programme is preparing the graduates to achieve:

PEO 1	Deliver effective, person-centred and value-based care by applying evidence informed medical knowledge and clinical skills to problem solve, manage and coordinate care.
PEO 2	Demonstrate ethical conduct, professionalism, and commitment towards personal development and lifelong learning.
PEO 3	Be leaders in the field and contribute to education, research and the promotion and improvement of health in the local, national and international setting.

Programme Learning Outcomes (PLO)

The Postgraduate medical training programme must be accredited by the Malaysian Qualifying Agency (MQA) through the implementation of the Malaysian Qualifications Framework (MQF). The MQF sets the levels of learning and five clusters of learning outcomes to be achieved. The Programme Learning Outcomes (PLO) for postgraduate medical training in Medical Microbiology are described in accordance with MQF Level 8 standards (PLO 1 to PLO 8):

PLO 1	**Demonstrate** a comprehensive and systematic approach to solve complex and current healthcare issues using medical knowledge, concepts and principles to provide safe, effective and evidence-based patient care. **Corresponds to MQF Cluster 1: Knowledge and Understanding**
PLO 2	**Contribute** substantially to the area of specialisation through the creation of new knowledge/ theories/ solutions/ practice through originality and independent research, which satisfies peer reviews and international standards. **Corresponds to MQF Cluster 2: Cognitive skills**
PLO 3	**Demonstrate** competency in practical and technical skills in relevant areas of specialisation and continually develop new skills and techniques to resolve emerging problems in Medical Microbiology. **Corresponds to MQF Cluster 3: Functional work skills – Practical skills**
PLO 4	**Communicate** effectively, ethically and professionally with all stakeholders including patients, peers, (pathology, scientific and medical), members of the care team and the community at large. **Corresponds to MQF Cluster 3: Functional work skills - Interpersonal and Communication skills**
PLO 5	**Apply** existing technological tools effectively to enhance patient care and undertake research to improve practise in Medical Microbiology. **Corresponds to MQF Cluster 3: Functional work skills – Digital and Numeracy skills**
PLO 6	**Demonstrate** leadership, autonomy and advocacy in Medical Microbiology in contributing to decision making practices for patient management, training, research and health systems improvement. **Corresponds to MQF Cluster 3: Functional work skills – Leadership, Autonomy and Responsibility skills**
PLO 7	Continually **integrate** new knowledge in Medical Microbiology for personal advancement and lifelong learning through ongoing academic and/or professional development. **Corresponds to MQF Cluster 4: Personal and Entrepreneurial skills**
PLO 8	**Demonstrate** commitment to professional values, attitudes and ethical conduct in patient management and research in Medical Microbiology. **Corresponds to MQF Cluster 5: Ethics and Professionalism**

SELECTION AND RECRUITMENT

This section outlines the qualifications and experience a trainee requires in order to enter training in the specialty of Medical Microbiology. Applicants generally fall into the following groups:

1. Ministry of Health (MOH) sponsored.
2. Non-MOH, government sponsored (e.g. Ministry of Defence).
3. Other sponsored trainees (e.g. sponsored by University or private institutions).
4. Private – self funded trainees.
5. International - non-Malaysian foreign trainees who may be self-funded or sponsored by a variety of agencies or government.

The entry requirements for candidates for all the Pathology specialities are generally the same with additional requirements for international candidates.

Entry Requirements

Candidates who wish to pursue postgraduate training in Medical Microbiology have to fulfil the following requirements:

1. A valid, basic medical degree registrable with the Malaysian Medical Council (MMC).
2. At least THREE (3) years of clinical experience after attainment of the basic medical degree, comprising of:
    a. Satisfactory completion of TWO (2) years housemanship, *and*
    b. post-housemanship clinical experience of at least ONE (1) year duration.
3. Full registration and a valid Annual Practising Certification (APC) with the MMC during training.
4. Pass an entrance evaluation demonstrating the knowledge and aptitude to undertake Pathology training e.g. entrance examination and/or interview for the Master of Pathology (MPath) Programmes in Malaysia.

For international candidates, the following are required:

1. A valid, basic medical degree registrable with the MMC.
2. At least THREE (3) years of clinical experience after attainment of the basic medical degree, comprising of:
    a. Satisfactory completion of TWO (2) years housemanship, *and*
    b. post-housemanship clinical experience of at least ONE (1) year duration.
3. A letter of good standing from the Medical Council of the country of current practice.
4. A Temporary Practicing Certificate (TPC), issued by the MMC before starting training in Malaysia.
5. Undergo a clinical or laboratory attachment for a minimum of THREE (3) months before joining the Pathology training programme, with satisfactory supervisor reports.
6. Pass an entrance evaluation demonstrating the knowledge and aptitude to undertake Pathology training e.g. entrance examination and/or interview for the MPath Programmes in Malaysia.
7. If the basic degree is from an institution of higher learning, where the medium of instruction for that degree is not English language, to show proficiency in written and spoken English language by achievement of:
    a. a score of 600 for a paper-based total (PBT); a score of 250 for a computer-based total (CBT) or a score of 100 for an internet-based total (IBT) for the Test of English as a Foreign Language (TOEFL); or
    b. band of 6 for the International English Language Testing System (IELTS)

Candidates with existing qualifications or training in Pathology may be exempted from certain components of the training programme based on the Regulations of the MPath Programmes. Examples are Master of Medical Science in Clinical Pathology (UM), FRCPath Part 1, FRCPA Part 1 (refer to MPath Regulations).

Entry Essential Learning Activities (Entry ELAs)

Entry ELAs are activities that prospective trainees should be able to perform in a trustworthy manner by the time they enter postgraduate training in Medical Microbiology. The Entry ELAs have been selected to represent appreciation of the role of Medical Microbiology in patient care. They indicate the knowledge, skills and attitudes that are essential for all candidates to demonstrate. They also serve as learning opportunities for prospective trainees when they are tasked to undertake the activities and then receive feedback regarding their performance.

The objective of each ELA is to identify and describe key areas in three domains – knowledge, skills and attitudes (KSA), that collectively determine whether a clinical task has been completed successfully. To this end, they also illustrate some examples of positive and negative behaviours of relevance and attention for the given clinical task. For entry assessment, candidates are expected to demonstrate some basic clinical competency in the following Entry ELAs for Medical Microbiology, the full description of Entry ELAs can be found in Appendix 1.

ELA 1	Sample collection and handling (pre-analytical variables)
ELA 2	Requesting appropriate laboratory investigations
ELA 3	Laboratory investigation in a patient with infectious diseases

*The list of entry ELAs is not exhaustive and may be updated according to programme requirements

The Entrance Examination for the Master of Pathology Programmes

The entrance evaluation to demonstrate adequacy in the knowledge and aptitude to undertake Pathology training is carried out with an entrance examination. This is common to all the Pathology Specialties and is conducted at the same time as entrance examinations for the other Medical Specialties. This is organised through the MedEX (Medical Specialist Pre-Entrance Examination), established by the Medical Deans Council of Malaysia as a standardised system of pre-entrance examinations, conducted jointly with the Malaysian Examinations Council (MEC), under Act 225. Details are provided in Appendix 2.

Entry Process

Overview

Candidates apply online either to the university of their choice (non-MOH candidates), or through the Ministry of Health of Malaysia (MOH sponsored candidates). Candidates who have shown evidence of satisfactory experience, adequacy in knowledge and aptitude are shortlisted and called for an interview, following which they are informed by the relevant university of their success or otherwise.

Ministry of Health sponsored candidates

To be eligible for sponsorship from Ministry of Health (MOH), candidates must be currently serving in MOH and free from any disciplinary action by any health regulatory bodies. An updated evidence of clinical service in MOH must be supplied along with the evidence of satisfactory job performance (i.e. achieving a minimum of 85% in their Annual Appraisal Report for three successive years).

Applications for the MPath programme will be advertised in mainstream newspapers and the MOH website in July each year or otherwise determined. Ministry's candidates are advised to refer to the Training Management Division (Bahagian Pengurusan Latihan – BPL, ehlp.moh.gov.my) of MOH for updated information on application for all Masters Specialty training programmes. Applications for pre-entrance evaluation are available at http://apps.mpm.edu.my/medex/public/register. The entry quota for candidates from the MOH is the highest, comprising of 80-90% of the total intake each year.

Private / overseas candidates, Non-MOH sponsored candidates

For other candidates e.g. Non-MOH candidates, Private / Overseas candidates, applications should be made directly to individual universities offering the MPath programme through the university's website at any time throughout the year. Candidates may apply to more than one university. Sponsorship into the MPath programme will have to fulfil the requirements of the sponsoring employer of the applicant.

Application processing

Applications are processed by the respective organisations and candidates are informed of their success in the shortlisting process by the MOH and/or University. Successfully shortlisted candidates are informed of their interview arrangements by the Ministry of Health and/or University.

Interviews

Interviews are conducted by the MOH and/or University.

Induction Process

The applicant will be informed by the MOH and/or University (depending on the application pathway), of the outcome of their application.

An Orientation/Induction course, usually of one-week duration, will normally be conducted by the respective university. Trainees will be provided with a University and Pathology Postgraduate handbook, and other essential documents.

The induction course will provide a brief overview of the curriculum, including the Stages of the training programme, the learning and assessment systems, and standards of professional behaviour required. An example is shown in Appendix 3.

QUALITY ASSURANCE AND ACCREDITATION

Statutory Bodies

Malaysian Medical Council

Medical Education Committee

The Medical Education Committee (MEC) of the Malaysian Medical Council (MMC) was formed under the provisions of Regulation 22 of the Medical (Amendment 2012) Act 1971. The MEC recognises specialties, specialty training institutions and programmes, as well as the qualifications awarded.[1]

Evaluation Committee for Specialist Medical Qualifications

The Evaluation Committee for Specialist Medical Qualifications, (ECSMQ), of the MMC, assisted by Specialty Sub-Committees, (SSCs), reviews applications by applicants to be recognised as specialists.[2]

National Specialist Register

The National Specialist Register, (NSR), is a database of specialist medical practitioners in Malaysia, formed by the MMC. Following the enforcement of the Medical Regulations 2017 of the Medical Act 1971, (Amendment 2012), in July 2017, all doctors wishing to practise as specialists in Malaysia must be registered with the NSR. Applications are reviewed by the ECSMQ.[2]

Malaysian Qualifications Agency

The Malaysian Qualifications Agency (MQA) was formed in 2007 by the merging of the National Accreditation Board (LAN) and the Quality Assurance Division of the Ministry of Higher Education (QAD). It is governed by the Malaysian Qualifications Agency Act 2007. The MQA is in place to quality assure higher education institutions and programmes, benchmarked against the Malaysian Qualifications Framework (MQF).[3]

Recognition of New Specialties

Proposals for new specialties, defined as those not in existence prior to 1 July 2017, must be submitted to the MEC for review, to make the recommendation to MMC for provisional approval.[1] Strong justification must be provided, including the rationale, relevance, demand, capacity for training, and absence of overlap with existing specialties.

Following provisional approval, the MEC will form a Specialty Education Sub-Committee to develop the specialty specific standards, propose training competencies, and recognise training centres.

Accreditation of Programmes

MMC recognises training programmes on the recommendation of MEC. Accreditation of programmes is benchmarked against the Malaysian Standards for Specialist Training of the MMC (see the Section: Compliance and Mapping). Programmes with degrees awarded by Malaysian institutions of higher education must also be accredited by MQA, based on the MQF.

As of 1 June 2020, there are five accredited Pathology programmes in Malaysia namely: Anatomical Pathology, Haematology, Chemical Pathology, Medical Microbiology and Forensic Pathology. A further programme, Medical Genetics, is under consideration.

Re-Accreditation of Programmes

Programmes must apply to MMC, (and MQA, if run by institutes of higher education), for re-accreditation every FIVE (5) years, or as determined by the accrediting body.

Quality Assurance of Programmes

Quality assurance ensures each training programme meets and maintains the desired level of performance in its planning and implementation. This is a continuous process, and occurs at multiple levels, through many activities. These activities culminate in the curriculum review, which takes place every FIVE (5) years. Curricula are reviewed for compliance to standards, relevance, and currency, taking input from all stakeholders.

In Pathology, the review of the various curricula occurs at an institutional and national level. Each institution must satisfy its own internal quality assurance processes. National reviews are conducted by the National Conjoint Specialty Committee for Pathology (CSC-Path), to ensure the alignment and standardisation of all programmes.

Accreditation and Quality Assurance of the Medical Microbiology Programmes

<table>
<tr><th colspan="3">Accreditation</th><th>Quality Assurance</th></tr>
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<tr><td colspan="4">Programmes – Medical Microbiology</td></tr>
</table>

Accreditation of Individuals

Trainers

All trainees in the MOHE pathway will have an Educational and a Clinical Supervisor who may or may not be the same person appointed by their respective universities. The Educational and Clinical Supervisors are specialist Medical Microbiologists registered on the NSR of Malaysia. For the parallel pathways, the trainee must have a Clinical Supervisor. Trainers must be appointed by the institution offering the programme, based on the requirements of the curriculum, please refer to the Contributors section for details.

Trainees

Trainees must be credentialed and privileged to perform clinical activities in their training centres. They will need to provide evidence of a recognised undergraduate medical qualification, full registration with MMC, and acceptance into the training programme. Some hospitals may also require a letter of good standing from the MMC. Referees will be required to provide testimony of trainees' performance and character.

Specialists

Trainees who successfully exit training must apply to the NSR to be recognised as specialists, at a minimum of ONE (1) year after exit. During this interim period, they may be privileged to function as a specialist by their hospital.

External Experience

Trainees may occasionally undertake part of their Pathology training outside of Malaysia. Any such training experience requires review by the National Conjoint Specialty Committee for Pathology to determine its relevance within the Malaysian training programme.

External Qualifications

External qualifications are those conferred by overseas awarding bodies. Qualifications may be entry or exit level. Training for these qualifications may have taken place in, or outside of Malaysia.

Any training and qualifications at entry level, outside of those stated in this document, require review by the National Conjoint Specialty Committee for Pathology, and approval at institutional level.

Training and qualifications at exit level must be reviewed by the ECSMQ, to determine if criteria for registration in the NSR have been met.

References:

[1]Specialty Education Committee of the Malaysian Medical Council (2020). Guidelines for the Recognition of New and Existing Specialties by the Malaysian Medical Council. Updated 26 February 2020.

[1]*https://mmc.gov.my/wp-content/uploads/2020/03/26-Feb-2020-Guidelines-For-The-Recognition-Of-A-New-Existing-Medical-Specialty-By-Malaysian-Medical-Council-Approved-by-Council-on-16-July-2019.pdf*

[2]*https://www.nsr.org.my/About-NSR.html*

[3]*https://www.mqa.gov.my/pv4/profil_MQA.cfm*

CONTRIBUTORS

Administration and Governance

There are various administrative and governance stakeholders involved in the MPath (Medical Microbiology), programme. Individuals, committees and groups are appointed at national and local levels by the following organisations to ensure the success of the training programme.

The Jawatankuasa Bersama Ijazah Lanjutan Perubatan (JBILP) i.e. Conjoint Committee for Postgraduate Medical Degrees, oversees the training of all the specialists under the Master programmes for the MOHE pathway. In this document, it is also referred to as the "National Conjoint Board." Each National Conjoint Speciality Committee overseeing their respective discipline is guided and answerable to the National Conjoint Board.

The Jawatankuasa Bersama Sarjana Perubatan – Patologi (JBSP-Patologi), which is the National Conjoint Specialty Committee overseeing Pathology, is appointed by JBILP and comprises members from all the participating universities, Ministry of Health (MOH) and College of Pathologists, Academy of Medicine Malaysia (CPath-AMM). In this document, the Jawatankuasa Bersama Sarjana Perubatan – Patologi is referred to as the "National Conjoint Specialty Committee – Pathology."

In the event of a parallel MOH pathway training programme being set up, which is in partnership with one of the international colleges of Pathologists, candidates will be registered with the training division of the MOH. Training will be overseen by a committee, which will comprise of senior consultant Pathologists and the Malaysian representative of the respective international college.

The above committees will certify the trainee's completion of training in the programme and their eligibility to sit for the summative examinations.

The above committees will certify the trainee's completion of training in the programme and their eligibility to sit for the summative examinations.

Training Centres

Training will be carried out in centres which are accredited for training according to the guidelines of the National Conjoint Specialty Committee - Pathology (refer to Appendix 4: Master of Pathology – Guidelines for accreditation of training centres). Appendix 5 lists the accredited centres as of 31 December 2020.

Programme Director

The Programme Director is the Head of Pathology services, however named, of the centres accredited for training of the MPath programme. In the Universities, this would usually be the Head of Department of Medical Microbiology, and in MOH this would be the Head of Pathology Services. They will be responsible for the overall coordination, selection and placement of candidates in accredited hospitals and the appointment of supervisors for the trainees. They will also act as the liaison between the various universities and the MOH.

Programme/Course Coordinator

The Programme/Course Coordinator is in-charge of running the programme, including ensuring the teaching and learning aspects are fulfilled, and assessments and exit examinations are conducted. The Coordinator is a senior academic staff member of the Department of Medical Microbiology in the respective universities (MOHE pathway), or a senior specialist, Clinical Microbiologist, in a parallel pathway.

Trainers

All primary trainers are registered specialist in Medical Microbiology on the NSR. However, adjunct trainers can be allocated and need not be Clinical Microbiologist, but should have the relevant expertise to provide value added training experiences for trainees. All trainees on the MOHE pathway must have an Educational and a Clinical Supervisor, and/or Research Supervisor who may or may not be the same person. For parallel pathways, the trainee must have a Clinical Supervisor.

All supervisors are expected to be in regular contact with the candidate and will submit regular progress reports on the trainee. For trainees training outside of the University, the Educational Supervisor will liaise with the Clinical Supervisor in the external centre on a regular basis to keep track of the trainee's progress.

Educational Supervisor

For the MOHE pathway, the Educational Supervisor must be a member of the Department of Medical Microbiology from the respective universities. They will be the trainee's primary supervisor and the mentor/Educational advisor in matters relevant to academic performance and career development. They will also act as liaisons between the trainee and the Programme/ Course Coordinator as well as the Programme Director. An Educational Supervisor should not supervise more than TWO (2) candidates who are in the same year of training.

Clinical/Co-Supervisor

The Clinical Supervisor is a Clinical Microbiologist from the respective university and is allocated to the trainee (MOHE pathway), or a specialist Medical Microbiologist of a MOH hospital or any other centre that is accredited for training. The Clinical Supervisor co-supervises the trainee with the Educational Supervisor. A Clinical Supervisor should not supervise more than TWO (2) candidates who are in the same year of training.

All trainees on the MOHE pathway must have an Educational and a Clinical Supervisor who may or may not be the same person. For parallel pathways, the trainee must have a Clinical Supervisor.

Adjunct or Co-Supervisor

An Adjunct or Co-Supervisor who has the relevant expertise to provide value added training experience for trainees can be allocated. These may be Educational or Clinical Supervisors.

Research Supervisor

The research supervisor can be the same person as the Educational supervisor or a non-Pathologist (PhD) from the respective training university. They will be the research advisors to the trainees in matters relevant to the research project.

Training the Trainers

Trainers should undergo the train-the-trainer courses provided by the respective training institutions (Universities and MOH). National level and joint train-the-trainers courses may also be organised.

Assessors

Formative Assessment

Formative assessments are carried out by the Educational, Clinical or Research Supervisors who are fully trained Clinical Microbiologists and possess the necessary skills in the relevant area. They should have skills in appraisal and feedback and have undergone training in accordance with the accredited training centre's requirement.

Summative Assessment

Summative assessment for the MOHE pathway trainees is carried out by internal and external examiners who are experienced Clinical Microbiologists. External examiners should preferably be invited from overseas and be of professorial status or equivalent. Internal examiners should be lecturers or honorary lecturers of the Department of Medical Microbiology of the training universities and Clinical Microbiologists from MOH. An examiner for the exit level should have at least FIVE (5) years' experience as a Clinical Microbiologist after graduation from the MPath programme (or its equivalent).

SYLLABUS

Description

The Master of Pathology (Medical Microbiology), of the MOHE pathway is a postgraduate programme which involves supervised apprenticeship training in diagnostic medical microbiology for a duration of a minimum of FOUR (4) years. It is a clinical coursework programme in which the research component comprises of less than 30% of the whole programme of study. Other (parallel) pathways (e.g. training towards the Fellowship of the Royal College of Pathologist, UK or the Royal College of Pathologists of Australasia), may require additional year(s) of training in accredited laboratories. The rest of this document will focus on the 4-year training programme leading to the Master of Pathology (Medical Microbiology), of the MOHE pathway.

Syllabus Structure

Topics

The syllabus defines the generic and specialty-specific breadth of knowledge, skills and attitudes that a trainee needs to attain and apply to patient care. Trainees in Medical Microbiology will encounter a wide range of cases. To reflect this, the topics and relationships between the domains in the syllabus are described in the water uptake and plant transpiration figure as below.

Candidates are referred to training guidebooks of the Master of Pathology Programmes and the Royal Colleges of Pathologists of Australasia and United Kingdom for details (Appendix 6 and 7).

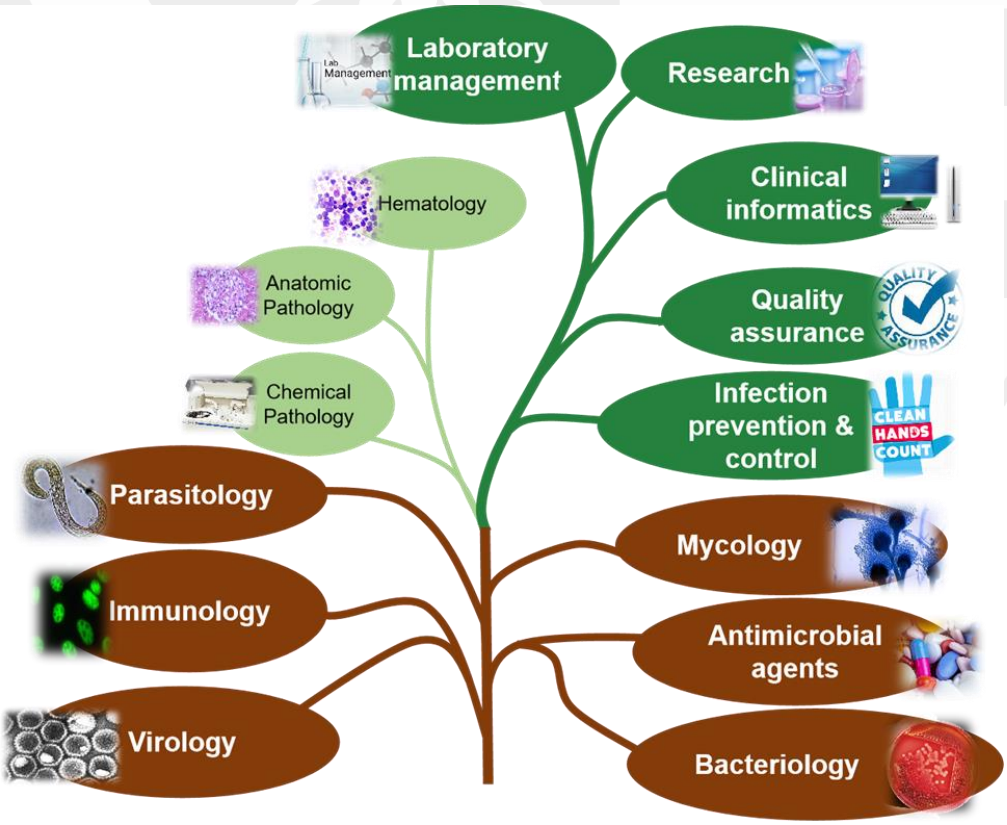


Figure: Syllabus Overview Diagram. A ‘Tree of Life’ illustrating the relationship between the various elements in Medical Microbiology training programme, incorporating core (roots), and complementary areas (branches).

General Guidelines to Learning

While guided learning sets the framework and captures the essentials that a trainee must acquire during the training, independent self-learning is highly encouraged. Trainees must take responsibility for their own learning to enhance their knowledge and skills and to embrace early in their careers, the concept of continuing medical education.

In Stage 1 training, the teaching components include a series of lectures, benchwork, seminars, case-based discussions related to the subject of medical microbiology, and infection control. For bench rotations in the laboratory, students are required to achieve specified level of competency.

In Stage 2, guided self-learning is a major component of the medical microbiology module. The need for the self-learning experience is provided in the form of seminar/journal club presentations, validating laboratory results, clinical consultations and ward visits. Bench-working provides a vehicle for acquiring competency in conducting laboratory work and understanding the procedures of specimen handling and processing, as well as enabling students to critically review and comment on laboratory processes especially in cases of non-conformities. Throughout the module, students are also encouraged to participate in quality management system, hospital/community infection control activities, continuous medical education activities, and undergraduate teachings. By the end of the Stage 2 training, the objective is to produce fully-rounded specialists in clinical microbiology that are confident in their knowledge and skills which will enable them to function effectively in a clinical management team.

Assessments and Monitoring of Progression

Assessment and monitoring of the trainee is the mainstay to ensure progressive acquisition of knowledge, skill and conduct to achieve the competence level required of a medical microbiologist. This will take the form of formative assessments (such as workplace-based assessments), and summative assessments. Monitoring of progress by supervisors are conducted regularly and are documented through logbooks and reports.

Please refer to the Assessments Section for details of assessments and monitoring.

Stages of Training

The medical microbiologist 4-year programme is divided into two stages: Stage 1 and Stage 2. The programme focusses on the spiral acquisition of specialised knowledge and practical skills in medical microbiology through the handling of increasingly complex clinical cases. Concurrent with this is the development of professional behaviour, conduct and character to achieve the required competence level of a medical microbiologist.

Stage 1 is of ONE (1) year in duration and focusses on foundational knowledge and practical skills in medical microbiology, which must be sound enough for the trainee to build upon as they enter into the more patient-centred and practice-focussed training of Stage 2. All trainees will start with the attendance an Orientation programme. At the end of Stage 1, the trainee who has satisfactorily completed training will sit for an examination in Medical Microbiology (Part 1 Examination).

Stage 2 is of THREE (3) years duration, (years 2, 3 and 4). This stage of the programme focusses on the spiral acquisition of specialised knowledge and practical skills in medical microbiology through the handling of increasingly complex clinical cases. Concurrent with this is the development of professional behaviour, conduct and character to achieve the competence level of a medical microbiologist.

In Stage 2, the trainee will also be introduced to research methodology, data analysis and writing a research report/dissertation. With the guidance of the supervisors (academic/clinical/adjunct),

the trainee will plan and undertake a research project and write up a research report/dissertation. To facilitate understanding of research methodology, all training universities will conduct a research methodology course and all trainees are required to attend the course.

After satisfactory completion of training in Stage 2, the trainee sits the Final (exit) examination.

Competence Progression

The syllabus is designed such that the trainee undergoes a spiral progression of competence achievement in Medical Microbiology and is expected to progressively acquire a range of knowledge, skills and values during the 4-year period of training. This progression starts at Level 1 up to Level 5 when the trainee who has satisfactorily completed training is ready to present themselves for the Final (exit) examination.

The competence levels are shown below. These reflect the achievement of a combination of knowledge and skills. At each level, knowledge would precede and usually exceed skills but should always be appropriate and adequate to support skills competence.

Level	Description
1	Observer status only
2	Assistant status
3	Able to perform under close and direct supervision
4	Able to perform under indirect supervision
5	Able to perform unsupervised

It is expected that the trainee will retain and build on what has been achieved earlier as they reach the new targets set for the next stage in the chart.

The knowledge and skills syllabi will support the development of the trainee in the various modalities of Medical Microbiology throughout the training programme.

Learning Outcomes

The knowledge and skills syllabi charted assumes that the Medical Microbiology knowledge cuts through and supports all the various modalities that the trainee has to undergo through the training programme. Only specific knowledge entities for the specific modality will be outlined in the chart.

Objectives:

Stage 1

1. To apply basic theoretical knowledge in the selection, interpretation and reporting of laboratory tests for “non-complex” cases.
2. To apply standard operating procedures in laboratory management including laboratory organisation, quality assurance, laboratory safety and infection control.
3. To demonstrate an understanding of medico-legal implications of Medical Microbiology reports.

Stage 2

1. To develop the appropriate competencies in the selection and utilisation of routine and specialised techniques and assays.
2. To demonstrate the appropriate competencies in interpretation and reporting of results in order to optimise patient care.
3. To develop the appropriate competencies in the management of laboratory services, including implementation of quality assurance system.
4. To apply the basic understanding of other specialties i.e., Haematology, Chemical Pathology and Anatomical Pathology in relation to infectious diseases.
5. To acquire the appropriate competencies in developing and undertaking research.

Progressive Knowledge and Skills Syllabi in Medical Microbiology

BACTERIOLOGY			
	Stage 1	Stage 2	Assessment Methods**
Competence Level	1-2	3-5	
Content			
	Knowledge		
Various classes, morphology, characteristics of bacteria • Bacterial classification, structure and replication • Bacterial metabolism and genetics • Mechanisms of bacterial pathogenesis • Bacterial pathogens including (but not limited to): *Staphylococcus* and related Gram-positive cocci *Streptococcus* *Enterococcus* *Bacillus* Coryneform bacteria, *Listeria* and *Erysipelothrix* *Nocardia, Actinomyces* and related bacteria *Mycobacterium* *Neisseria* and related bacteria Enterobacterales *Vibrio* and *Aeromonas* *Campylobacter* and *Helicobacter* *Pseudomonas, Burkholderia* and related bacteria *Haemophilus* and related bacteria *Bordetella* *Francisella* and *Brucella* *Legionella* Miscellaneous Gram-negative rods *Clostridium* Other anaerobic bacteria *Treponema, Borrelia, Leptospira* *Mycoplasma* and *Ureaplasma* *Rickettsia* and *Orientia*	Describe biology, virulence, disease and epidemiology of different bacteria	Demonstrate a progressive increase in knowledge commensurate with practical experience Apply current evidence-based information to support the knowledge Outline the strategies to reach bacterial identification	CBD SA-1 SA-2

BACTERIOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
Ehrlichia, Anaplasma and *Coxiella* *Chlamydia* and *Chlamydophila*			
Knowledge on the aetiology, epidemiology, pathogenesis, clinical manifestation, laboratory diagnosis, principles of management, prevention and control of bacterial infections • Bacterial infections by body system / Important clinical syndromes Systemic inflammatory response syndrome, sepsis and septic shock, including bloodstream infection with a broad range of pathogens Fever of unknown origin Infection of the heart and vascular system Infection involving mucosal surfaces, skin, soft tissue, and muscle, including those associated with surgery or trauma systemic infection syndromes presenting with rash Infection of bone and joint infection of the respiratory tract Intra-abdominal and hepatobiliary infection infection of the central nervous system Infection of the urogenital system, including sexually transmitted infections Infection of the eye, sinuses, and ear Infection associated with medical devices • Principles and applications principles of molecular techniques in diagnosis of infectious diseases	Describe common bacterial infections of the organ systems Explain the aetiology, epidemiology, pathogenesis, clinical manifestation, laboratory diagnosis, principles of management, prevention and control of bacterial infections	Demonstrate a progressive increase in knowledge commensurate with practical experience to cope with progressive complexity of cases Demonstrate a progressive increase in knowledge and able to provide a microbiological opinion with due consideration of its contribution to clinical care	CBD SA-1 SA-2
	Skills		
Clinical and environmental specimens	Identify different clinical and environmental specimens. Outline the principles of specimen reception, screening and labelling	Apply the principles and practice of specimen reception, screening and labelling	DOPS ECE CBD SA-1

BACTERIOLOGY			
	Stage 1	Stage 2	Assessment Methods**
Competence Level	1-2	3-5	
Content			
		Justify the criteria for specimen rejection and the implications Plan corrective and preventive actions to be taken	SA-2
Microscopy techniques • proper use of the light microscope • proper use of the UV microscope	Identify the various components and function of the light and UV microscope Display the ability to operate light and UV microscope	Display the competency to perform and interpret using light and UV microscopy	DOPS SA-1 SA-2
Microscopic examination and staining methods that include: • direct examination e.g. wet mount, India ink • differential stains e.g. Gram stain • acid-fast stains e.g Ziehl-Neelsen, Kinyoun, modified acid-fast, auromine-rhodamine • spore stains • fluorescent stains e.g. Auromine-rhodamine, direct fluorescent antibody stain	Demonstrate the ability to perform, read and interpret common staining methods Demonstrate the ability to identify common bacterial morphology	Demonstrate the ability to perform, read and interpret common and specialised staining methods	DOPS SA-1 SA-2
Culture, identification and antimicrobial susceptibility test for common bacterial pathogens • types of culture media • biochemical tests • commercial kits e.g. API, Vitek®, MALDI-TOF • antimicrobial susceptibility testing methods	Perform/observe (where appropriate), bacterial culture, biochemical tests, other identification methods and antimicrobial susceptibility test Identify different culture media, biochemical tests, identification methods and their uses	Display competency in performing bacterial culture, biochemical tests, other identification methods and antimicrobial susceptibility test Analyse microscopy, culture and non-microscopy characteristics to achieve identification Analyse antimicrobial susceptibility testing and able provide clinical interpretation	DOPS ECE CBD SA-1 SA-2

BACTERIOLOGY			
	Stage 1	Stage 2	Assessment Methods**
Competence Level	1-2	3-5	
Content			
Serologic diagnosis • rapid serological test and their interpretation (e.g. dipstick/ICT/LA/RPR/TPPA) • enzyme/chemiluminescence immunoassay and their interpretation	Observe and interpret serological test	Analyse serological test and validate the results	DOPS ECE CBD SA-1 SA-2
Molecular methods and their interpretation	Describe molecular tests	Display competency in interpreting molecular test for species identification and antimicrobial resistance	DOPS ECE CBD SA-1 SA-2
Laboratory automation and information system	Demonstrate ability to navigate the LIS		DOPS

VIROLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
	Knowledge		
Structure and function of recognised, new and potentially medically-important viruses - morphology, replication, transmission	Demonstrate knowledge of virus structure & function Describe replication of viruses Describe and explain the routes of transmission of viruses		SA-1
Aetiology, epidemiology, pathogenesis (including host susceptibility and immune response), and clinical manifestation of common viral infections.	• Describe pathogenesis of virus infection and disease • Describe & explain the role of the immune response in pathogenesis of viral disease	• Discuss in detail the important viral infection, especially in relation to virulence mechanisms • Demonstrate a detailed knowledge of key clinical syndromes including community-acquired and healthcare-associated infections • Explain the types of immunodeficiency and how they affect susceptibility to & control of infections	ECE CBD SA-1 SA-2
Understand how pharmaceutical agents affect virus replication and disease processes	Identify the mechanisms of activity of antiviral agents	• Critically discuss the management of important viral infections • Justify the treatment modalities, antimicrobial resistance and implications, based on clinical presentations and test findings • Explain how to assess infection risk and recommend appropriate prophylactic or pre-emptive therapy	ECE CBD SA-1 SA-2

Pre-Analytical Phase Analytical phase - Immunoassays - Direct virus detection Post-analytical phase	Identify: • range of tests for diagnosis of important clinical syndromes. • sample types, collection, transport & storage requirements • specimen acceptance and rejection criteria & management of rejected samples Describe the principles and performance characteristics of immunoassays for antigen and antibody detection Understanding of cell culture techniques including: • types of cell lines & virus susceptibility • cytopathic effects • HA • neutralisation	Identify: • the ways in which service users can be involved in establishing the test repertoire • the ways in which workload and financial pressures on the laboratory can be managed • criteria for safe collection of specimens together with appropriate categorisation of risk, packaging, and transportation Describe and explain: • the advantages and disadvantages of different immunoassay formats e.g. direct, indirect, capture • the effect of different antigen types e.g. recombinant, whole virus lysate • the problems of interpretation of assays e.g. factors that influence IgM assay results, prozone, hook effect, edge effect Describe and explain the need for confirming: - antigen, antibody and combined antigen/antibody detection assay results - reproducibility of a significant result on additional samples	ECE CBD SA-1 SA-2

VIROLOGY			
	Stage 1	Stage 2	Assessment Methods**
Competence Level	1-2	3-5	
Content			
		Describe and explain the need for additional tests to aid interpretation of initial results Identify the principles & practice of direct immunofluorescence in virus detection Identify the principles & practice of the range of qualitative and quantitative nucleic acid amplification techniques employed in the diagnosis and management of viral infections Identify the principles & practice of genome sequencing in virus identification and genotyping Describe the potential for new approaches to virus detection and the principles behind them e.g. multiarray assay Identify: • the clinical implications of laboratory results for the individual, for infection prevention and control, and for public health • the need for confidential handling of patient data	

VIROLOGY			
	Stage 1	Stage 2	Assessment Methods**
Competence Level	1-2	3-5	
Content			
	Skills		
	• Communicate with users of laboratory services of appropriate test selection and specimens for different clinical scenario • Communicate clearly requirements of the laboratory including transport of samples	• Communicate with users of laboratory services of appropriate test selection and specimens for different clinical scenario • Communicate clearly requirements of the laboratory including transport of samples • Engage with users and encourage their involvement in maintaining and expanding the existing test repertoire according to need	DOPS CBD SA-1 SA-2
	Perform (where appropriate) or observe, and interpret: • EIA, CLIA • IFA, PA • Immunoblot • Immuno chromatographic assays Recognise in IF staining of viral infected cells Observe nucleic acid amplification tests for virus detection Interpret laboratory results and communicate this information clearly and promptly Be familiar with reporting mechanisms and how to use them securely and confidentially	Interpret results of : • neutralisation tests for confirmation e.g. HBsAg, HIV p24Ag • confirmation by additional tests e.g. multiple serological assays, PCR • immunoblot assays Interpret results of nucleic acid amplification tests and data obtained by genome sequencing Explain the types of assay controls and how they are used in a laboratory setting • Provide sound management of clinical	DOPS CBD SA-1 SA-2

VIROLOGY			
	Stage 1	Stage 2	Assessment Methods**
Competence Level	1-2	3-5	
Content			
		problems guided by laboratory results • Prioritise result reporting, identifying critical results that need urgent discussion with other clinicians • Ensure chain of evidence is maintained for medicolegal specimens • Recognise and act on results that have potential infection prevention and control implications, or are of public health or medicolegal significance	

MYCOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
	Knowledge		
Knowledge on various types of medically important fungi - morphology, cultural characteristics	Describe fungal structures and morphology	Describe in detail fungal morphology Outline strategy to reach fungal identification	ECE CBD SA-1 SA-2
The aetiology, epidemiology, pathogenesis, clinical manifestation and laboratory diagnosis of fungal infections Important mycoses	Describe important fungal infections in clinical setting	Discuss in detail the important mycoses Support the knowledge with updated, evidence-based information	
Laboratory diagnosis of fungal infections - culture, non-culture methods	Describe modalities in fungal diagnostics	Critically discuss methods for diagnosis of fungal infections Evaluate the advantages and limitations of diagnostic methods	
Antifungal susceptibility testing	Describe antifungal susceptibility testing methods	Critically discuss methods for antifungal susceptibility testing Evaluate the advantages and limitations of antifungal susceptibility testing methods	

MYCOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
	Skills		
Culture and identification of fungi • Culture media for fungal isolation • Microscopy techniques for identification of fungal pathogen • Non-microscopy techniques for identification of fungal pathogen (e.g automated identification, MALDI-TOF)	Demonstrate the ability to identify common fungal structures	Demonstrate the ability to perform microscopic and culture methods Analyse microscopy, culture and non-microscopy characteristics to achieve identification	DOPS CBD SA-1 SA-2
Non-culture methods for diagnosis of fungal infections • Antigen detection e.g cryptococcal Ag, galactomannan assay • Molecular method e.g ribosomal RNA gene PCR and sequencing for specific fungal identification	Identify and read antigen detection test/molecular test	Analyse and interpret antigen detection test Analyse and interpret molecular identification method for species identification	
Select the most appropriate investigations for the individual patient/ conditions	Discuss the appropriateness of the selected test	Evaluate the need for specific test based on clinical presentation Communicate with managing team with regards to investigations and result interpretation	

PARASITOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
	Knowledge		
Knowledge on various types of parasites causing human infections, their morphology and life cycle	Describe important parasitic infections in human	Describe in detail various types of parasites causing human infections, their morphology and life cycle	CBD SA-1 SA-2
Knowledge on the aetiology, epidemiology, pathogenesis, clinical manifestation and laboratory diagnosis of common parasitic infections Knowledge on other modality for diagnosis of parasite infections such as histopathology tissue section, culture techniques and radio imaging Knowledge on specimen collection and handling (including preservation of stool samples) for diagnosis of parasitic infection Principles of management, prevention and control of common parasitic infections	Describe the aetiology, epidemiology, pathogenesis, clinical manifestation and laboratory diagnosis of common parasitic infections	Describe in detail the aetiology, epidemiology, pathogenesis, clinical manifestation and laboratory diagnosis of common parasitic infections Identify other modalities for the diagnosis of parasite infections such histopathology tissue section, culture techniques and radio imaging	
	Describe the principles of management of common parasitic infections	Discuss the management of important parasites infections, vector control and public health measures related to parasitic infections	
	Skills		
Specimen collection and handling, including preservation of stool samples. Perform routine and specialised microscopy techniques for detection and identification of intestinal parasites Perform microscopy technique for detection and identification of blood parasites	Identify various procedures for stool preservation Demonstrate the ability to identify various stages of intestinal parasites Demonstrate the ability to identify various methods for detection	Demonstrate the ability to perform concentration techniques, routine and specialised microscopic staining methods from faecal and related samples Analyse parasitic stages based on characteristics to achieve identification	DOPS SA-1 SA-2

PARASITOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
	and identification of intestinal parasites		
	Demonstrate the ability to identify various stages of blood parasites Demonstrate the ability to identify various methods for detection and identification of blood parasites	Demonstrate the ability to perform routine and specialised microscopic, staining methods from blood and bone marrow samples Analyse parasitic stages based on characteristics to achieve identification	
Serological tests for diagnosis of common parasitic infections.	Identify and interpret available serological test for parasitic infections	Analyse and interpret serological test for parasitic infections Critically discuss role of serology test in parasitic infection	
Molecular diagnostic tests for parasites diseases and their interpretation	Identify available molecular tests for parasitic infections	Analyse and interpret molecular identification method for species identification and anti-malarial drug resistance	

IMMUNOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
	Knowledge		
Knowledge on the organisation of immune system, innate and adaptive immunity. Aberrations of immune responses Knowledge of clinical immunologic disorders, their laboratory diagnosis and management	Describe the organisation of immune system and mechanisms of immune response	Discuss in detail the organisation of immune system and mechanisms of immune response	ECE CBD SA-1 SA-2
	Describe the basic mechanism of Hypersensitivity, Allergy, Immunodeficiency, Autoimmune disease and Transplantation	Discuss the wide range of immune response disorders	
	Describe immunologic disorders, laboratory investigations and principle of management	Discuss immunopathology-related problems, methods of laboratory diagnosis and management.	
	Skills		
Interpretation of routine immunological tests e.g. RF, ANA, anti ds DNA Interpret specialised immunological tests e.g. ASMA, AMA, ANCA, ENA etc. Consultation on immunological diagnostic tests	Observe and interpret basic immunology laboratory tests with clinical information Briefly discuss regarding specialised immunological tests. Discuss the result of immunological tests based on clinical presentation	Analyse and interpret laboratory investigations for routine immunological tests Evaluate the need for specific test based on clinical presentation Analyse and interpret specialised immunological tests Analyse and interpret immunological diagnostic tests related to clinical information Involve the managing team in communication of results and advise on further investigation when indicated	DOPS SA-1 SA-2

INFECTION PREVENTION AND CONTROL			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
	Knowledge		
Legislative and organisational frameworks of infection prevention and control (IPC) • Explain the responsibilities of healthcare institutions for IPC according to the national guideline • Describe the roles and responsibilities of individual members of Hospital Infection and Antibiotic Control Committee (HIACC) in monitoring, responding to, and resourcing IPC needs	Describe the need, organisation and responsibilities of IPC	Justify the responsibilities of institutional IPC authorities according to national requirement Assess the need for individual members of HIACC in order to suit IPC requirements and ensure effective IPC activities	ECE CBD SA-1 SA-2
Epidemiological and clinical aspects of healthcare-associated infections (HCAIs) • Surgical site infections • Catheter-associated urinary tract infection • Hospital-acquired pneumonia • Central-line associated bloodstream infection • Concept of ‘bundles’ in the prevention of common HCAIs	Describe various types HCAIs	Analyse the epidemiology, clinical aspects and impact of HCAIs Apply and analyse the concept of ‘bundles’	
Principles of infection prevention and control of HCAIs • Basic biology of common agents implicated in the various HCAIs and their pathogenesis • Mode of spread and optimum prevention and • control strategies of HCAI • Concept of the following in the prevention and control of HCAIs: • Standard precaution - Hand Hygiene - Personal Protective Equipment (PPE) - Environmental Hygiene - Waste Management - Linen Management - Spillage Management	Explain common agents in HCAIs including their pathogenesis, spread and principles of prevention and control	Analyse the clinical implications of HCAIs and evaluate the concepts of HCAIs prevention and control Plan and justify the types of precautions appropriate for different HCAIs threat in clinical settings	

INFECTION PREVENTION AND CONTROL			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
- Injection safety & Sharps management - Respiratory Hygiene & Cough Etiquette • Transmission-based precaution - Contact - Droplet - Airborne • Aseptic non-touch technique (ANTT) • Single use items			
Principles of Environmental Infection Control • Infection Control During Construction & Renovation • Operation Theatre Commissioning • Environmental Cleaning Engineering aspect of Isolation Rooms • Protective Environment Room • Airborne Infection Isolation Room Principles of disease outbreak management in the hospital • Role of the laboratory in the investigation of outbreaks including molecular, epidemiological methods utilised for outbreak investigations and how to assess them • Steps involved in recognising, investigating and controlling outbreaks of infection • Statistical methods used in outbreak recognition, investigation and management	Demonstrate an understanding of environmental infection control Demonstrate an understanding in the principles of outbreak management	Apply the principles of environmental infection control in preventing HCAIs following construction and renovation in clinical settings Justify the need and application of isolation rooms in clinical settings Apply the principles of outbreak management in various clinical settings Plan and justify steps in outbreak recognition, investigation and management	
Infection Control requirement in specialised areas/units. **Occupational Safety and Health for Healthcare Workers** • Sharps and Splash injuries • Post exposure prophylaxis in blood borne infections • Exposure to patients with tuberculosis		Demonstrate an understanding on the requirement aspect of infection control in the following areas: • Intensive Care Unit • Neonatal Unit	ECE CBD SA-2

INFECTION PREVENTION AND CONTROL			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
• Vaccination in Healthcare workers **Principles of Public Health Management in matters related to prevention and control of communicable diseases** • Key principles of outbreak investigation in the community • Principles of hypothesis-generation and testing when investigating an outbreak • Microbiology and epidemiology of food and waterborne infections • Microbiology and epidemiology of respiratory infections (airborne and droplet infections) • Microbiology laboratory support in a public health emergency • Features of agents of deliberate release in terms of clinical presentation, potential for spread and methods for detection and control **Principles of Antimicrobial Stewardship (AMS)** • Regulatory bodies' requirements for antimicrobial stewardship • Importance of antimicrobial formularies, and prescribing control policies and processes • Application of local antimicrobial resistance patterns to direct antimicrobial usage • Role of the Medicines Management Committees (or equivalent) and the clinical pharmacist in AMS		• Burn Unit • Nephrology Haemodialysis Unit • Operation Theatre • Scope Room • Mortuary • Laboratory Demonstrate understanding in principles of outbreak management in community Demonstrate understanding in principles and implementation of antimicrobial stewardship	

QUALITY ASSURANCE IN MEDICAL MICROBIOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1**	**2-5**	
Content			
	Knowledge		
Quality management system in medical microbiology laboratory Quality assurance and quality control	Describe the principles of quality management system in medical microbiology laboratory	Evaluate the salient elements in quality management system and apply relevant elements to ensure adequate and reliable performance of diagnostic tests Apply elements of quality management system in laboratory activities e.g. • Quality assessment on culture media and reagents • Quality assessment on cell culture and preparation • Validating and reporting results (infectious and immunological diseases) • Solving technical problems in the laboratory • Activities relating to accreditation and QA	ECE CBD SA-1 SA-2

ANTIMICROBIAL AGENTS			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
	Knowledge		
The key properties of the classes of antimicrobial agents active against bacteria, fungi, parasites and viruses, including: • mechanism of action • spectrum of activity • route of administration • dosing regimen • penetration • side-effects • resistance patterns • cost Concept of broad and narrow spectrum antibiotics Concept of bactericidal and bacteriostatic Mechanism of action and role of monoclonal antibodies, antitoxins, and immunoglobulins in prophylaxis and treatment of infections Pharmacodynamic and pharmacokinetics of antimicrobials, and how these affect choice and dosing of antimicrobials Mechanisms of resistance to antimicrobial agents *In vitro* methods used to detect antimicrobial resistance and their limitations	Describe the factors that influence the choice of antibiotics Describe the mechanism of actions of common antimicrobial agents in clinical practice Describe the common mechanism of resistance to antimicrobial agents	Evaluate the key properties of the classes of antimicrobial agents active against bacteria, fungi, parasites and viruses to formulate antimicrobial usage guide, including: • Mechanism of action • Spectrum of activity • Route of administration • Dosing regimen • Penetration • Cost Evaluate the host factors that influences selection of antimicrobial agents and the antimicrobial alternation/ management accordingly • Renal impairment patient • Hepatic impairment • Allergic reactions • Adverse effects Describe in detail the pathogen factors in selection of antimicrobial agents, their detection methods and management, including • Resistance patterns • Heteroresesistant subpopulation	ECE CBD SA-1 SA-2

ANTIMICROBIAL AGENTS			
	Stage 1	Stage 2	Assessment Methods**
Competence Level	1-2	3-5	
Content			
		• Inducible, including repressed and derepressed, resistance • Borderline resistance Describe in detail the concept of broad and narrow spectrum antibiotics, their uses and limitations Evaluate the advantages and limitation of selective targeted therapy. Describe in detail the concept of bactericidal and bacteriostatic, their uses and limitations Describe in detail the mechanism of actions and roles of monoclonal antibodies and immunoglobulins in prophylaxis and treatment of infections infectious diseases Describe in detail the mechanism of actions and roles of antitoxins in prophylaxis and treatment of infections Describe the clinical microbiology advice for MDR pathogens and/or persistent infection management beyond ‘susceptible’, ‘intermediate’ and ‘resistant’	

ANTIMICROBIAL AGENTS			
	Stage 1	Stage 2	Assessment Methods**
Competence Level	1-2	3-5	
Content			
		Describe the selection of antimicrobial agents based on the pharmacokinetics and pharmacodynamic profiles of antimicrobial agents Describe the differences of pharmacokinetics profiles according to different mode of administrations Explain the association of MIC with PK/PD indices Apply the best indices for pharmacology effects of antimicrobial agents according to their classes Apply the strategy of dosing regimens based on PK/PD indices Describe in detail the common and other potential mechanisms of resistant of antimicrobial agents Describe common gene mutations encoded for resistant development Apply the use of molecular epidemiology and continuous surveillance in antimicrobial management Describe the phenotypic methods to detect antimicrobial resistance and their limitations	

ANTIMICROBIAL AGENTS			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**	**3-5**	
Content			
		Describe the inhibitors/ antagonists of the bacterial resistance mechanisms	
	Skills		
Methods for antimicrobial susceptibility testing (AST) Interpretation of AST and breakpoints determination Therapeutic drug monitoring and clinical antimicrobial management support	Progressive competency in applying antimicrobial susceptibility testing (AST) methods i.e. • Agar-based AST • Broth dilution and microdilution Demonstrate progressive skills in: • Interpreting AST and analysing breakpoints • In vitro synergy test of antimicrobial combination for MDR organism • Interpret therapeutic drug monitoring for vancomycin and aminoglycoside • Serum bactericidal test		DOPS SA-1 SA-2

FOUNDATION HAEMATOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level		**1-2**	
Content			
Basic understanding • Red cell disorders: Anaemias Thalassaemia and common haemoglobinopathies • White cell disorders: Leukaemoid reactions White cell disorders: Leukaemoid reactions Acute and chronic leukaemias, multiple myeloma, myeloproliferative neoplasms, myelodysplastic syndromes and lymphoproliferative disorders • Bleeding disorders –vascular and platelet abnormalities, coagulation disorders • ABO, Rh and other clinically important blood group systems • Compatibility testing • Preparation, storage and use of blood components • Complications of blood transfusion		Analyse common haematological disorders with regard to their pathophysiology, clinical presentation, diagnosis and principles of management	ECE CBD
Practical understanding of use of haematology techniques and tests • Automated full blood count • Peripheral blood film • Bone marrow examination • Reticulocyte count • ESR measurement • Haemoglobin analysis – Hb electrophoresis, HPLC, HbH preparation • Coagulation test – PT, APTT, Mixing tests, TT, D-dimer, fibrinogen, bleeding time • ABO, Rh grouping • Crossmatching • Molecular methods in haematology		Apply and interpret routine and specialised haematological diagnostic tests	DOPS CBD

FOUNDATION ANATOMIC PATHOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level		**1-2**	
Content			
Basic understanding **General pathology** Cell injury and necrosis. Inflammation and repair Cellular adaptive mechanisms Haemodynamic disorders Neoplasia Nutritional disorders Disorders related to environment. Inborn errors of metabolisms. Genetic disorders **Systemic pathology** Congenital, inflammatory, degenerative, vascular, metabolic and neoplastic disorders of the organ systems: cardiovascular, respiratory, genitourinary, gastrointestinal, hepatobiliary, lympho-reticular, reproductive, musculoskeletal, nervous, dermatology, endocrine, ophthalmology and otorhinolaryngology systems		Describe in detail and analyse general and systemic pathological conditions	ECE CBD
Practical understanding of Anatomic Pathology techniques and tests 1. Pre-examination of surgical specimens • Receiving of specimen (adequacy, labelling) 2. Examination of surgical specimen • Principles of specimen fixation. • Macroscopic description of surgical specimens, trimming and selection of blocks, embedding of all common tissues. • Principle of tissue processing from tissue grossing to slide preparation • Understand the principle and the application of Haematoxylin and Eosin (H & E) staining.		Apply and interpret routines and specialised diagnostic tests performed in Anatomic Pathology laboratory	DOPS CBD

FOUNDATION ANATOMIC PATHOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level		**1-2**	
Content			
• Histochemistry e.g.; Ziehl Neelson, fungi, iron, mucin, fat, muscle fibres, reticulin, elastin and collagen. • Immunohistochemistry • Enzyme histochemistry • Immunofluorescence 3. Post-examination of surgical specimens • Record keeping and disease indexing; familiarity with a widely used system e.g. SNOMED. • Liaison with other clinical specialties; Participation in regular 4. Clinicopathological meetings and patient-care discussion. 5. Laboratory safety precautions 6. Understand the principle of laboratory management system.			

FOUNDATION CHEMICAL PATHOLOGY			
	Stage 1	**Stage 2**	**Assessment Methods****
Competence Level	**1-2**		
Content			
Basic understanding • Biological variability • Chemical pathology of gastrointestinal tract • Hepatobiliary system • Renal system, cardiovascular system • Acid-base imbalance • Water and Electrolytes • Proteins • Lipid • Diabetes mellitus and abnormalities in glucose metabolism • Endocrinology – pituitary, thyroid, adrenal, reproductive system. • Calcium, magnesium, phosphate and metabolic bone disorders • Biochemistry of haematological disorders • Clinical enzymology • Toxicology • Cancer markers	Describe in detail and analyse disorders related to biochemical, endocrine and toxicological derangement		ECE CBD
Practical understanding of use of Chemical Pathology techniques and tests • Basic laboratory techniques • Factors influencing laboratory results • Laboratory instrumentation • Automated analysers • Spectrometric methods • Osmometry • Electrometric methods • Electrophoresis • Chromatography • Molecular methods in Chemical Pathology	Apply and interpret routine and specialised diagnostic tests performed in Chemical Pathology laboratory		DOPS ECE CBD MSF

BEHAVIOURS			
Elements	**Stage 1**	**Stage 2**	**Assessment Methods****
Effective communication and rapport	Demonstrate effective communication and good interpersonal relationships; respecting diversity in communicating with colleagues, superiors, staff and other healthcare personnel Demonstrate the ability to communicate results verbally, electronically, and in written form Demonstrate an increasing clinical involvement including attending rounds & provision of consults, & support in the management of patient care		ECE MSF
Professional conduct and attitude	Display professional conduct and attitude as a competent clinical microbiologist in-training Appreciate integrity, accountability and compassion which supersedes self- interest towards patient care as well as relationship with society and other health care professionals		
Enthusiastic approach to learning.	Demonstrate enthusiasm and willingness to learn from members of a multidisciplinary team and accept constructive feedback Attend training & CPE/CME sessions.		
Independent learning and continuous medical education	Demonstrate the ability as an independent learner and continuous medical education Integrate ethical principles of medicine, leadership, organisational management, digital literacy and ability to reflect transparently towards sound self-improvement and lifelong learning		

Guidance Notes:

For Research, Patient Safety and Professional Values & Behaviours, refer to the Core Curriculum documents.

Research

The research project is a compulsory requirement for Medical Microbiology, carried out in Stage 2 of the programme, and trainees must submit their research report SIX (6), months prior to the Final (Exit) examination. A pass in the research project report is a prerequisite for being eligible to sit the Final (Exit) Examination.

The purpose of the research project report is to facilitate the assessment of the trainee's practical ability, and their proficiency in reporting and assessing the significance of their findings. It is a test of their ability to analyse, criticise and present raw data. The overall standard of the project should be at a level that it is suitable for publication in a professional scientific journal.

The project involves the preparation of; a proposal describing the background, the research questions (to be addressed), the objectives of the intended study, the details of the proposed experimental work, and the expected outcomes. The project and the writing of the research project report should be carried out under the supervision of a designated supervisor. Out-campus candidates may have additional co-supervisor from their respective hospitals.

The research project report must be written in English. The candidate can submit the research project report in traditional format or manuscript-ready format (for publication in peer-reviewed journals).

Guidance Notes:

For Research, Patient Safety and Professional Values & Behaviours, refer to the Core Curriculum documents.

LEARNING OPPORTUNITIES

Introduction

The MPath programme provides trainees with learning opportunities through various platforms and means which cater for guided as well as independent, self-learning. While guided learning sets the framework and captures the essentials that a trainee must acquire during the training, independent self-learning is highly encouraged. Trainees must take responsibility for their own learning and embrace the concept of continuous medical education whilst in the programme and throughout their careers. The strategies suggested for student-directed independent self-learning include; reading, discussion with peers, observation of techniques used in the laboratory, study and learning from previously reported cases, access to digital material, attending seminars, workshops etc.

A list of reference textbooks may be used to form the core of their knowledge base but trainees are also encouraged to read recent journal articles, and to use online resources to supplement their learning. Centres accredited for training will be responsible for providing the above learning opportunities to the trainees. Appendices 6 and 7 list recommended reference textbooks, academic journals and online resources.

Workplace-based Training

Trainees are assigned to the Department of Medical Microbiology of university, and Microbiology Units of MOH hospitals, and private healthcare facilities, all of which must be accredited for training by the National Conjoint Board - Pathology.

Learning at the workplace is centred on diagnostic work related to patient care and trainees work as apprentice clinical microbiologists under direct supervision of registered specialists (clinical microbiologists). Trainees are progressively guided to develop competence in determining appropriate specimens and testing a wide array of modalities in diagnosing infectious diseases, and the reporting of results and consultations. Trainees are also exposed to their future role in antimicrobial resistance surveillance, antimicrobial stewardship programmes, as well as the prevention and control of hospital infections.

Communication and leadership skills, interprofessional collaboration and understanding laboratory management and accreditation are essential attributes to be developed during the course of training.

Teaching Programme

Accredited centres conduct their own teaching programmes the contents of which remain in line with the conjoint curriculum. These can include lectures, seminars, practicals, clinico-pathological case presentations, and tutorials. Some centralised teaching programmes are also carried out e.g., intensive courses prior to major summative assessments, courses in research methodology, scientific writing, and biostatistics.

External opportunities

There are many local and international scientific meetings, conferences, seminars, workshops and teaching courses in Medical Microbiology, which trainees can attend to broaden their skills and knowledge. Trainees are encouraged to participate in these events.

Accreditation

Training centres to which trainees are assigned are accredited by the National Conjoint Specialty Committee - Pathology (MOHE pathway), and the MOH, and partner training bodies must be compliant with these requirements to qualify as centres for training.

ASSESSMENTS

Introduction

Medical Microbiology encompasses the areas of bacteriology, virology, mycology, parasitology, immunology and training in infection control practices. The eligibility for placement on the National Specialist Register of Malaysia will be evaluated against this curriculum.

Demonstration of the knowledge, skills and attitudes required for independent practice is a requirement of the curriculum, and the relevant competencies must be achieved before completion of the training programme.

The assessment system in Medical Microbiology aims to fulfil the following objectives:

1. Demonstrate the trainee's achievement of the knowledge and skills as appropriate to each phase of training.
2. Identify and ensure that trainees are making suitable progress in training in Medical Microbiology.
3. Provide the trainee with feedback on their progress.
4. Ensure the trainee is ready to progress to next stage of training.
5. Ensure that at the end of the training programme the trainee can practice as an independent clinical microbiologist.
6. Demonstrate the development of the skills for effectively training and teaching undergraduate and postgraduates in the field of Medical Microbiology.
7. Demonstrate the development of research skills in Medical Microbiology.
8. Demonstrate managerial skills in the laboratory.
9. Demonstrate familiarity with laboratory accreditation processes.
10. Demonstrate the ability to act professionally at all times.

Methods of Assessment

Trainees will be subject to formative and summative assessments.

The formative assessments in Medical Microbiology training will be mostly by workplace based assessments (WBAs). This is the appraisal of the trainee's professional skills and attitudes that evidences the trainee's actual performance in the workplace. The assessment methods for WBAs include Direct Observed Practical Skills (DOPS), Case-Based Discussions (CBD), Evaluation of Clinical Events (ECE), as well as Multisource Feedback (MSF). The WBA methods (adapted from the Royal College of Pathologists, UK) are purposed as below:

1. DOPS are used to assess the trainee's ability to demonstrate the skills required for the different stages of training. The assessor provides immediate feedback to the trainee and further develops the trainee's strengths as well as identifying areas for improvement.
2. ECE are used to assess the trainee's ability to perform tasks which involve teamwork and interacting with other professional colleagues.
3. CBD is used to assess the trainee's ability to apply their medical knowledge in decision-making for patient care, and running a safe, efficient and reliable Medical Microbiology service.
4. MSF is used to assess the trainee's behavioural characteristics. Generally, the supervisor's report provides the main feedback. The supervisor may also take into consideration comments from other staff who have had the opportunity to work with the trainee. The

trainee may conduct a self-appraisal and discuss this with their supervisor, with the objective of ensuring the trainee is guided to reach the conduct level required at the professional level of a medical specialist.

These WBAs are used to ensure the trainee reaches the expected standard before progression to the next stage of training. They also provide regular feedback to the trainee on their progress.

For the MOHE programme summative assessments are made up of two examinations, the Part I examination and the Final (exit) examination.

The Part I examination taken at the end of ONE (1) year of training aims to identify the trainee's suitability to continue training in Medical Microbiology.

The Final (exit) examination is to ensure the trainee has achieved a level such that they are able to practice unsupervised as a Clinical Microbiologist. The formative assessments in the parallel pathway essentially tests the same concepts as that of the MOHE programme. The summative assessment will follow the requirements of the respective bodies granting the qualifications of the parallel pathway.

The remainder of this section will focus on the assessments for the training programme leading to the MPath (Medical Microbiology) of the MOHE pathway.

Formative Assessment (WBA)

In Medical Microbiology, the formative assessment of trainees is carried out in the workplace. The trainee is expected to undergo regular WBAs, which will chart and monitor the trainee's educational progress throughout the training programme. Recognition of any weakness in the trainee's education should be quickly remedied. In general, the trainee should demonstrate "satisfactory" progression before progressing to the next stage of training.

Formative assessments must be documented in the trainee's Portfolio, in their Logbook, (refer to the Documentation section), and should include:

- Logs of apprenticeship achievement using the Chart of Assessment Activities which is certified by an in-house Pathologist(s)/trainer.
- Evidence of attendance at the Orientation programme of the university.
- Evidence of attendance at programme prescribed intensive course on basic subject matters (such as routine chemical pathology and laboratory quality systems), which is conjoined with other training institutions.
- Evidence of attendance at research methodology training.
- Evidence of attendance at any other mandatory courses as determined by the respective training centres.
- Evidence or certificates of attendance at conferences, workshops, seminars, clinicopathological discussions, teaching courses and all other relevant teaching activities.

Other evidence of formative assessments (mandatory reports), to reflect the range and complexity of cases appropriate to stage of training:

Stage 1

Satisfactorily completed as described by the specific programme

- Validation and interpretation of test results assisted by senior trainee or supervising pathologist:
  - Bacteriology
  - Virology
  - Mycology
  - Parasitology
  - Immunology
- Interpretation of internal quality control (IQC), data assisted by a senior trainee or supervising pathologist

Stage 2

Spiral progression of competence achievement in the validation, interpretation and consultation of test results:

- Bacteriology
- Virology
- Mycology
- Parasitology
- Immunology
- Infection Control

Throughout the programme

- Review and feedback provided to trainee by the trainer after each supervised data interpretation of laboratory tests and reporting session.
- Review and feedback provided to trainee by the trainer after each supervised application session in analytical techniques and assays.
- Educational or Clinical Supervisors reports (at least twice per year).
- All other learning assignments as determined by the respective training centres

Other evidence

Involvement in workplace practices, which should be made available on request

- Case Mix in MPath(Medical Microbiology) Stage 2, per year per trainee must include (cases of varying complexities):
  - Bacteriology
  - Virology
  - Mycology
  - Parasitology
  - Immunology
  - Infection Control

Multi-source feedback (MSF)

The reports from the Educational and Clinical Supervisors as well as other staff who have experience of working with the trainee whenever appropriate, will form the multi-source feedback on the trainee.

The Log Book, which encapsulates all the activities that are integral to the trainee's education will form an important part of the assessment. Please refer to the Syllabus section to correlate the achievement levels for each year of training.

The level attained by the trainee for each of the assessments will be graded on a scale of 1-6.

Level/Grade	Description
1-2	Below expectations
3	Borderline
4	Meets expectations
5-6	Above expectations

Finally, the assessor will make a holistic assessment as to whether a trainee has achieved the "satisfactory" standard expected for progression to the next stage of training. An "unsatisfactory" standard will mean the trainee has to repeat the assessment activity and be reassessed.

Trainees must maintain a comprehensive and complete Portfolio of training evidence, which must include all the items above, with feedback and reflection. A satisfactory Annual Review of the Portfolio by a statutory committee is required to progress to subsequent training stages.

Summative Assessment (SA)

The Master of Pathology (Medical Microbiology), examinations provide the external quality assured assessments of the trainee's knowledge and skills and ability to apply those attributes in the practice in Medical Microbiology. Trainees who have satisfactorily completed training will sit for an examination in Medical Microbiology (Part I Examination) at the end of Stage 1 (end of Year). After satisfactory completion of training in Stage 2 (end of Year 4), the trainee sits the Final (exit) examination.

Although the trainee is expected to pass the Part I examination at the first attempt after ONE (1) year of training, they are permitted TWO (2) resits of the examination at SIX (6) monthly intervals in Year 2.

A trainee is normally expected to pass the Final (exit) after FOUR (4) years of training. The trainee who has failed the Final examination at the first attempt is permitted up to a maximum of FOUR (4) resits, to be completed within the maximum period of SEVEN (7) years of the whole training programme.

The trainee is only permitted to sit for the Final (exit) examination on satisfactory completion of training having fulfilled all prerequisites as outlined in the curriculum, and certified to have fulfilled all prerequisites by the Programme Director of the Training University.

Examinations are outlined as follows:

Part I Examination (SA-1)

The Part I examination comprises of (i) Theory and (ii) Practical components.

To pass the Part I examination, the trainee must satisfactorily pass both the theory and practical components of the examination. The trainee must achieve:

- an overall score of 50% AND
- a pass (50%) in BOTH theory and practical components

Repeat Examination:

1. A trainee who has failed may be allowed to repeat the examination after SIX (6) months.
1. A trainee is allowed a maximum of TWO (2) repeat examination to pass the Part I examination.
2. The components of the repeat examination and their weightings shall be as in the main Part I examination.

Final (Exit) Examination (SA-2)

The Final examination comprises of (i) Theory, (ii) Practical and (iii) Viva Voce. The trainee must achieve:

- an overall score of 50%
- AND a pass (50%) in BOTH theory and practical
- AND attend the viva voce

A trainee who has failed the Final examination must repeat the examination as follows:

Repeat examination:

1. Repeat examination for candidates who have obtained an overall score of less than 50% OR failed to attend the viva voce.
    - After satisfactorily completing a further ONE (1) year of training the candidate will be examined in theory and practical components as well as having to attend a compulsory viva voce.
    - The components of the examination and their weightings will be as in the main examination.
    - To pass this Repeat examination, the candidate must achieve;
        - an overall score of 50%
        - AND a pass (50%) in BOTH theory and practical
        - AND attend the viva voce
2. Repeat examination for candidates who have obtained an overall score of 50% or more but have failed in either the theory or practical component.
    - After satisfactorily completing a further SIX (6) months of training the candidate will be examined in the failed component as well as attend a compulsory viva voce.
    - To pass this repeat examination, the candidate must obtain a pass mark of at least 50% in the theory or practical component that they have sat for AND obtain an overall score of at least 50%.

    The candidate is only allowed to repeat the examination of the failed theory or practical twice consecutively. If the candidate fails on the second repeat attempt, the candidate will repeat BOTH theory and practical components and viva-voce after 6 months or after 1 year based on the recommendation of the Board of Examiners. The components and weighting of the repeat examinations will be as in 1 and 2 above.
3. A candidate is allowed a maximum of four repeat examinations.
4. The maximum duration permitted for the completion of the entire programme is SEVEN (7) years

Summary of the Assessment Strategy for all Medical Microbiology Trainees:

Element	Details	End of attachment	End of year	End of training	Comments
Portfolio	Record of professional learning, WBAs, supervisor reports, reflections, and development activities	N/A	Satisfactory completion of the year (at Annual Review)	Satisfactory completion of training (at Annual Review)	The Portfolio is a record of all training activities and forms an integral part of the evidence to demonstrate professional development. Subsequently used for NSR registration
Research / Audit	Evidence of project management	N/A	Conducted throughout years 2-4. Progress to be demonstrated	Submitted as part of the evidence for completion of training	Application of a scientific approach including formulating an idea, literature review, interpretation and analysis OR an audit/ quality improvement exercise
Workplace-based assessments	DOPS CBD ECE MSF	Minimum 1 DOPS every 3 months Minimum 1 CBD and 1 ECE every 4 months	Minimum 4 DOPS every year (years 2-4) Minimum 3 CBDs and 3 ECEs every year 1 MSF every year (more frequently if needed)	Minimum 12 DOPS Minimum 9 CBDs and 9 ECEs Minimum 4 MSF Evidence of 1 consultation to a clinician in managing/resolving a case	WBAs provide an opportunity for feedback and reflection. They will also be used as part of the evidence for the end of year / training Portfolio review.
Educational and Clinical Supervisor Reports	Summary of progress through postings and learning sessions	Satisfactory completion of attachment			Part of the Portfolio
Courses, Workshops and Conferences	Developing knowledge and skills				Part of the Portfolio

Summary of the Examinations for all Medical Microbiology Trainees:

Part	Examinations	When	Components	Occurrence	Comments
SA-1	Medical Microbiology Part I Examination	End of Stage 1 (end of Year 1)	MCQ, Essay and OSPE	Once per year Refer to Appendix 8 for repeat examination	A trainee is allowed a maximum of two (2) repeat examinations to pass the Part I examination
SA-2	Medical Microbiology Final (exit) Examination	End of Stage 2 (end of Year 4)	Essay, Practical and Viva Voce	Once per year Refer to Appendix 8 for repeat examination	A trainee is allowed a maximum of four (4) repeat examinations The maximum duration permitted for the completion of the entire programme is seven (7) years

Assessment Blueprinting

All assessments are based on the curriculum syllabus. Blueprinting ensures that the breadth of the syllabus is assessed using a variety of assessment methods. Important topics may be given a greater weighting, as defined by the level of knowledge and skills required within the curriculum.

Mapping of Assessment Objectives with Methods of Assessments

Assessment Objectives	DOPS	ECE	CBD	MSF	SA-1	SA-2
Demonstrate the trainee's achievement of knowledge and skills as appropriate to each phase of training.	✓		✓		✓	✓
Identify and ensure the candidates' suitability for progression in training in Medical Microbiology.					✓	
Provide the trainee with feedback on their progress.	✓	✓	✓	✓		
Ensure the trainee is ready to progress to the next stage of training.	✓	✓	✓			
Ensure the trainee at the end of the training programme can practice as an independent general Clinical Microbiologist.	✓	✓	✓	✓		✓
Demonstrate the development of the skills for effectively training and teaching undergraduate and postgraduates in the field of Medical Microbiology.	✓	✓		✓		
Demonstrate the development of research skills in Medical Microbiology.	✓	✓				
Demonstrate managerial skills for the laboratory.	✓	✓	✓	✓		
Demonstrate familiarity with laboratory accreditation.			✓			
Demonstrate the ability to act professionally at all times.		✓		✓		

DOCUMENTATION

Documentation is important to provide evidence of learning experience, training progress and competency. Trainees are required to build and maintain a full Portfolio of documentation covering the entire duration of the programme. These documents constitute the formal Portfolio of the evidence of academic standing and must cover the following broad categories:

- satisfactory entry requirements of the trainee
- prior work experience
- progress and milestones achieved during the training programme

It is essential that the training process and outcomes are fully documented and ratified within the Portfolio. The detailed list of required documents is shown below.

The trainee and the supervisors are responsible for ensuring the Portfolio is updated regularly and assessed. The trainee will not be allowed to present themselves for the summative examinations without completion of the Portfolio.

The trainee's Portfolio may in be hard or soft copy and shall be a permanent record of the training department. Relevant training records will be accessible to the Programme Director, Programme Coordinator, supervisor(s) and trainers as relevant.

Required Documents

Documentation prior to commencing the training programme

- Sijil Pelajaran Malaysia (SPM) or its equivalent and any other pre-university certificates as evidence of education level
- Medical degree
- Certificate of registration with the Malaysian Medical Council
- Curriculum vitae with details of work experience
- Evidence of previous training records

Documents of Milestone achievements

These provide the documented evidence that the trainee has undergone training in the essential areas which brings the trainee through the required levels of competence from level 0 or "no skill" through 5 levels of increasing competence (1: observer status only; 2: assistant status; 3: able to perform under close supervision and direct supervision; 4: able to perform under indirect supervision and 5: able to perform unsupervised).

Documented evidence of training

- Logbook documentation of apprenticeship achievements and workplace-based achievements certified by in-house pathologist(s) (refer to the Assessments section)
- Evidence of attendance at the Orientation programme of the university
- Evidence of attendance at intensive courses
- Evidence of attendance at a research methodology course
- Evidence of attendance at all other mandatory courses as determined by the respective training centres
- Evidence or certificates of attendance at conferences, workshops, seminars, clinicopathological discussions, teaching courses and all other relevant teaching activities
- Documentation of case-based discussion, teaching courses and all other relevant teaching activities

Evidence of Formative Assessments

These are mandatory and must reflect the range and complexity of cases appropriate to the stage of training.

- Log book documentation in both Stage 1 and Stage 2
- Case reports
- Review and feedback to trainee by the trainer after each supervised session
- Educational and Clinical Supervisors reports (at least twice per year)
- All other learning assignments as determined by the respective training centres

Evidence of summative assessments

- Transcripts of performance at Part I examination and repeat examinations (if relevant).
- Transcripts of performance at Final (exit) examination and repeat examinations (if relevant).

Other documents

- Annual leave records
- Medical leave records
- Show cause letters
- Disciplinary inquiries

Purpose of the Portfolio

The portfolio provides documented and ratified evidence of the progress of the trainee throughout the training programme.

The Portfolio is reviewed periodically by the MPath Programme Coordinator in the respective training centres. Problems encountered during the training period are quickly identified. These are discussed at the departmental level, feedback is provided to the trainee and remedial action is quickly initiated. Matters which require further action can be highlighted at the National Conjoint Specialty Committee – Pathology or at the respective university levels, depending on the issue.

The documents in the portfolio provide the evidence of the SATISFACTORY COMPLETION OF TRAINING. The trainees are only permitted to present themselves for the Final (exit) examination after certification as having satisfactorily completed the training by the Department Programme Director.

The culmination of the satisfactory and successful completion of the specialist training according to designated standards of the appropriate governing bodies (e.g. the Malaysian Medical Council), would be the admittance to the National Specialist Register of Malaysia (NSR), (Medical Microbiology).

DISCIPLINE AND SUPPORT

Discipline and support are normally guided by the rules and regulations of individual training universities or professional bodies.

LINKS TO OTHER CURRICULA

The training of a Clinical Microbiologist is a holistic one that does not occur in professional silos. From the outset, the basic foundation lies with knowledge and skills gained in medical school and the subsequent pre-specialisation experience. Training in Medical Microbiology also requires functional interaction with other clinical specialties as well as healthcare service providers. Following the completion of training in the MOHE pathway, there are further linkages with overseas Colleges which open the path for international fellowship. This section considers these various linkages.

Contribution of other curricula and services to Medical Microbiology training

The relationship of the Medical Microbiology training programme with other training programmes and services is shown in the table below.

The knowledge and skills gained through these pre-training and in-training interactions and experiences are invaluable to the moulding of a patient-centric and functional Clinical Microbiologist.

Contribution of other curricula/training programmes/services to training in Medical Microbiology (MM).

Other curricula/training programmes/ services	Nature of our Relationship to other curricula/training programmes/ services	Expectations of MM from the other curricula/training programmes/ services	Anticipated Problems	Strategies & Solutions to overcome anticipated problems
Pre-training				
Undergraduate Medical	Dependent	Knows pathophysiology of common infectious diseases. Able to appreciate diagnostic laboratory tests.	Unable to influence the quality of training, especially overseas graduates.	Establish clarity on entry ELAs in MM curriculum.
House Officer	Dependant	Manage simple inpatient care of patients. Organise collection and handling of various samples types to the MM laboratory. Trace MM test results and relate results to the care of patients.	Unable to influence quality of HO training.	Pathology departments to brief HOs on the pre-analytic requirements of MM services and role of MM services in patient care.
Medical Officer	Dependent	Manage in- and outpatients including medical and surgical emergencies. Utilise MM results for the care of their patients. Take informed consent from	Lack of supervision to understand MM services. Unclear of how to advance oneself to enter MM training programme	Provide guidance on MM contributions through multidisciplinary meetings. Make the entry criteria clear in the MM curriculum so future applicants will

Other curricula/training programmes/ services	Nature of our Relationship to other curricula/training programmes/ services	Expectations of MM from the other curricula/training programmes/ services	Anticipated Problems	Strategies & Solutions to overcome anticipated problems
		patients and/or next of kin for invasive procedures. Explain cause of death and empathise with kin upon demise of patients.		be aware of the requirements and will know how to proceed.
In-training				
Haematology Services	Dependent	Knows common Haematological conditions. Understands the role and basis of haematological tests in the management of haematological disorders.	Lack of focus due to overwhelming specialisation training.	Establish clarity in MM curriculum.
Chemical Pathology Services	Dependent	Understands the role and basis of Chemical Pathology tests in the patient management.	Lack of focus due to overwhelming specialisation training.	Establish clarity in MM curriculum.
Anatomic Pathology Services	Dependent	Understands the role and basis of Anatomic Pathology tests in the patient management .	Lack of focus due to overwhelming specialisation training.	Establish clarity in MM curriculum.
Surgical based services (e.g. general surgery, orthopaedic surgery, O&G, neurosurgery)	Interdependent	Understand the role and contribution of medical microbiology tests in the surgical management of patient.	Busy surgical departments. Inadequately filled MM request forms. Inadequate communications over expectations.	Establish clarity to clinicians regarding pre-analytical and post-analytic aspects of MM services. Enhance communication with surgical colleagues. Enhance participation of MM trainee in multidisciplinary team management of patients.

Other curricula/training programmes/ services	Nature of our Relationship to other curricula/training programmes/ services	Expectations of MM from the other curricula/training programmes/ services	Anticipated Problems	Strategies & Solutions to overcome anticipated problems
Medical-based services (Internal medicine, paediatrics)	Interdependent	Understand the role and contribution of MM tests in the medical management of patient.	Busy clinical departments. Inadequately filled MM request forms. Inadequate communications over expectations.	Establish clarity to clinicians regarding pre-analytical and post-analytic aspects of MM services. Enhance communication with medical colleagues. Enhance participation of MM trainee in multidisciplinary team management of patients.
Technological Development Services	Semi-dependent	Development and maintenance pf Laboratory information system and its linkages to HIS and financial systems. Development of digital pathology. Introduction and maintenance of new technology and devices.	Inadequate communication about planning and procurement resulting in devices/ technology problems: • Not user friendly • Expensive • Unsatisfactory maintenance and upgrades	Participate and provide timely input to device procurement, and staff training. Participate in Healthcare planning.

Linkages giving exemptions to components of the Master of Pathology programme

Candidates with existing qualifications or training in Pathology may be exempted from certain components of the Master of Pathology training programme based on the Regulations of the training Universities. Examples are: Master of Medical Science in Clinical Pathology (UM), FRCPath Part I, FRCPA Part 1 which are granted exemption from Stage 1 training and the Part 1 examination of the MPath Programme at the University of Malaya.

Linkages to further training in Medical Microbiology

Candidates considering extension of training towards the Royal College of Pathologists, United Kingdom and the Royal College of Pathologists of Australasia fellowships are referred to the following curricula:

1. Royal College of Pathologists (UK) Curriculum for Specialty training in Medical Microbiology
   https://www.rcpath.org/trainees/training/training-by-specialty/medical-microbiology.html
2. The Royal College of Pathologists of Australasia Trainee Handbook
   https://www.rcpa.edu.au/getattachment/09f1abf9-0bea-4e3d-b6c3-7a89b9d936c6/Microbiology-Trainee-Handbook.aspx

EXIT CRITERIA

Introduction

This section describes the training outcomes and exit process from programmes for Medical Microbiology. Conceptually, the outcomes and processes for both the MOHE and parallel pathways follow similar principles, although details in the format of processes may differ. The MPath (Medical Microbiology), programme of the MOHE pathway is described below.

A graduate of the programme is expected to have acquired the knowledge, skills and professional attributes required to practice as a safe and competent Medical Microbiologist after exiting the programme.

Outcome of training

By the end of training programme, the trainee is expected to have successfully completed the learning objectives in the syllabus (refer to the Syllabus section), and fulfilled the various levels of assessments (refer to the Assessments section). They will therefore be equipped to practice as a safe and competent medical microbiologist during the subsequent gazettement (or probation), period and beyond. The gazettement period is a 6-month process in which the graduate works under the supervision of a senior colleague(s), who provide evidence to the graduate's fitness for independent practice at the end of the gazettement period. Following satisfactory gazettement and completion of required post-gazettement practice experience (as determined by the Malaysian Medical Council (MMC), the graduate would be suitable for inclusion in the National Specialist Register (NSR) of the MMC.

The general outcomes of training are:

1. Acquisition and demonstration of the knowledge, skills and attitudes to act in a professional manner as a Clinical Microbiologist at all times.
2. Appropriate communication skills required for the practice of Medical Microbiology.
3. Able to practice appropriate time management and task prioritisation in the practice of Medical Microbiology.
4. Able to demonstrate good working relationships with colleagues.
5. Able to demonstrate basic management skills in the running of a Medical Microbiology laboratory.
6. Familiarity with the health and safety requirements of a Medical Microbiology service.
7. Able to provide teaching in Medical Microbiology to undergraduates, allied health professionals and postgraduate trainees in Pathology and other medical specialties.
8. Able to conduct and participate in research in Medical Microbiology within the broader context of medical research.
9. Able to conduct and participate in audits in Medical Microbiology in the broader context of clinical governance.
10. Able to pursue life-long learning and continuing professional development in Medical Microbiology.

Exit Essential Learning Activities (ELAs)

The minimum ELAs for exit for a safe and successful practice as a Medical Microbiologist must include the following:

ELA 1	Knowledge and skills on laboratory procedures in medical microbiology, including bacteriology, virology, mycology, parasitology and immunology.
ELA 2	Reporting of medical microbiology tests and results.
ELA 3	Advise on antimicrobial treatment.
ELA 4	Advise on healthcare-associated infections (including Infection Prevention and Control).
ELA 5	Quality management in the medical microbiology laboratory.
ELA 6	Basic skills in research methodology and audit.

Exit ELAs are detailed in the Appendix 9.

General Requirements

Throughout the training programme, trainees will be provided with the appropriate training opportunities to facilitate learning, complete their required logbooks and research project, and pass the formative and summative assessments. Trainees must successfully complete their training Portfolio and demonstrate satisfactory progression in their training and learning before they are deemed suitable to sit the exit examination.

The maximum duration to complete training in the programme is SEVEN (7) years, after which training will be terminated unless there are exceptional reasons as accepted by the Senate of the respective training Universities.

The responsibilities of the various players in the training of a trainee are shown below:

Trainee	Trainers	Supervisor(s)	Programme/ Course Coordinator	Programme Director
Maintain own logbook Achieve the learning objectives/ targets of the syllabus Fulfil the submissions and requirements of the formative assessments Understand and meet the regulatory requirements of the programme	Provide opportunities and mentorship for the trainee to achieve learning objectives Provide workplace-based assessments of the trainee Provide appropriate remedial intervention to training	Ensure satisfactory completion of the trainee's Portfolio Evaluate and report on training progression Provide appropriate remedial intervention in the event of unsatisfactory progression Supervise the research project	Monitor the trainee's Portfolio Determine progression to subsequent phases of training Initiate remedial or regulatory action in the event of unsatisfactory progression Coordinate formative and summative assessments	Determine eligibility to sit for summative assessments Determine eligibility to sit for the Final examination Liaise with the training institution governance body Liaise with the National Conjoint Board -Pathology

Evidence of Training

Training must be documented in the trainee's Portfolio. This Portfolio should include training schedules (e.g., laboratory postings and duty rosters), log books of learning objectives (refer to the Syllabus section), supervisor reports, and results of formative and summative assessments (refer to the Assessments section), which serve as evidence that the curriculum coverage and standards have been met. The training Portfolio may in be hard or soft copy and will held as a permanent record by the training department. Relevant training records will be accessible to the Programme Director, Programme Coordinator, supervisor(s) and trainers.

Exit Process

Trainees may only sit for the Final (exit) examination on completion of a minimum of FOUR (4) years of supervised training in Medical Microbiology, in a diagnostic laboratory accredited for Medical Microbiology training by the local governing body for postgraduate training (e.g., National Conjoint Specialty Committee – Pathology).

Training will lead to the progressive competence of the trainee to reach the level of unsupervised practice as a clinical microbiologist. Training will facilitate progressive acquisition of:

1. Medical and scientific knowledge relevant to Medical Microbiology
2. Medical Microbiology practice-based skills
3. Interpersonal and communication skills
4. Professionalism and ethical principles in practice
5. Confidence in providing patient care as a clinical microbiologist and effectiveness in a systems-based practice
6. Laboratory management skills such as with regards to laboratory information systems, safety, quality assurance and laboratory accreditation
7. Ability to appraise the scientific literature and conduct research

Research Experience

Research experience is an integral part of Pathology training and is mandatory in the MPath Programmes in Malaysia. Training includes the satisfactory completion of a research project as evidenced by a peer-reviewed publication, or a pass assessment of a research report. The research project may be descriptive, audit-based, a technology-evaluation or in fundamental science relevant to the practice of Medical Microbiology.

Prerequisites for admission to the exit examination

Satisfactory progression in the training programme is a training prerequisite for admission to the Final (exit) examination.

Satisfactory progression encompasses all of the following:

	Components of the Training Portfolio	Level of Achievement	Note
1	Attendance at the training programme	At least 85% attendance	The trainee should not be absent from the training programme beyond an allowable period each academic year, as stipulated by the regulations of the training institutions. Absence beyond that period will lead to instatement of remedial training.

	Components of the Training Portfolio	Level of Achievement	Note
2	Formative assessments	100% at least at satisfactory level	A satisfactory re-assessment after remedial action can replace an unsatisfactory initial assessment.
3	Supervisor reports	100% at least at satisfactory level	A satisfactory re-assessment after remedial counselling action can replace an unsatisfactory initial report.
4	Part I examination	Pass	A pass at a repeat examination is acceptable.
5	Conduct a research project and submit the project report	Pass evaluation	A pass re-evaluation after remedial action can replace an unsatisfactory/failed initial evaluation.

Exit Examination

Trainees are required to pass the Final (exit) examination in Medical Microbiology at the end of training, with mandatory theory (written), and practical and viva voce components. Further details on the exit examination and its components are described in the Assessment section.

Examiners

The panel of **internal examiners** for the Final examination will be drawn from Clinical Microbiologist trainers in the programme's conjoint training Universities and the Ministry of Health. In addition, there will be an external examiner appointed by the Senate. The external examiner should be an experienced Clinical Microbiologist who is not serving in any of the programme's training centres and may be from overseas.

Termination of training without award of Degree

The termination of training of a trainee with exit from the programme without the award of the degree of Master of Pathology (Medical Microbiology), may occur under the following circumstances:

1. Withdrawal by the trainee from the programme.
2. Failure at the Part I barrier examination after the maximum allowable number of attempts.
3. Failure at the Final (exit) barrier examination after the maximum allowable number of attempts.
4. Duration of training has exceeded the maximum of SEVEN (7) years.
5. Poor progression of training based on formative assessments, and any other parameters as determined by the training Department and Institution.
6. Termination of candidature by the training institution (university) due to candidate misconduct.

Gazettement

The gazettement period is a 6-month probation process during which the graduate works under the supervision of a senior colleague(s), who provides evidence to the graduate's fitness for independent practice at the end of the gazettement period. Following satisfactory gazettement and completion of required post-gazettement practice experience (as determined by the Malaysian Medical Council (MMC), the graduate would be suitable for inclusion in the National Specialist Register (NSR) of the MMC.

COMPLIANCE AND MAPPING

Compliance and Mapping to Malaysian Medical Council Standards

In Malaysia, standards for postgraduate training of medical practitioners are set by the Malaysian Medical Council, (MMC), under its Medical Education Committee. Postgraduate programme compliance to these standards is vetted by the Specialty and Sub-Specialty Education Committees. Compliance to standards in the implementation of these programmes is monitored by the National Conjoint Board, Conjoint Specialty and Sub-Specialty Training Committees. The conduits for discussions between MMC and these committees are the Joint Committees on Postgraduate Medical Education and Training (refer to the Contributors section).

The areas of the MMC standards can be mapped to the following components of this National Curriculum, as summarised in the table below.

Mapping to MMC standards[1]

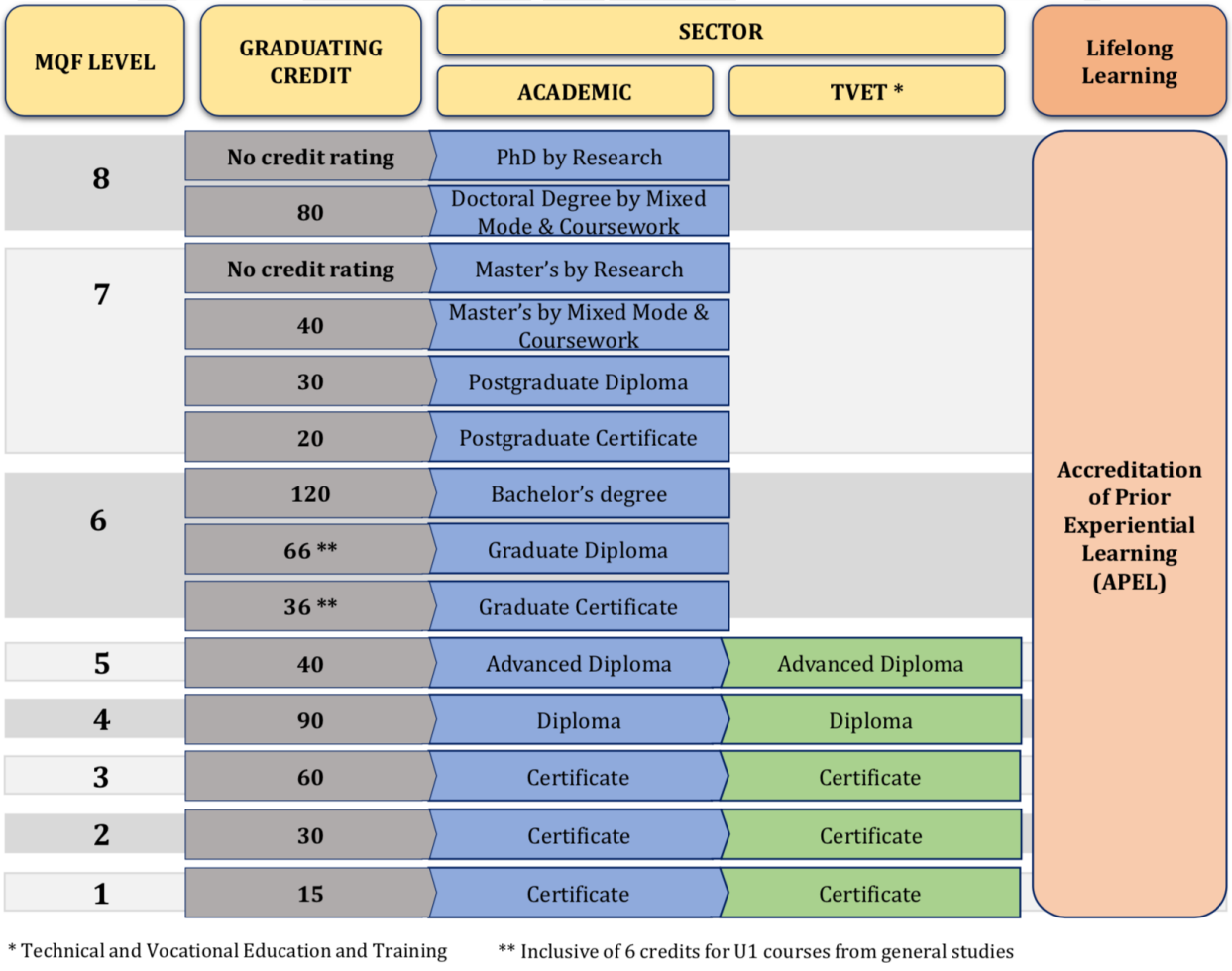
Area	Purpose & Scope	National Curriculum section(s)
1	Programme development and delivery	Overview Contributors
2	Assessment of trainee learning	Exit criteria Assessment
3	Trainee selection and support services	Selection and recruitment Discipline and support
4	Trainers	Contributors Discipline and support
5	Educational resources	Syllabus Learning opportunities Documentation
6	Programme management	Contributors
7	Programme monitoring, review and quality improvement	Quality assurance and accreditation

[1]*Specialty Education Committee of the Malaysian Medical Council. (2020). Malaysian Standards for Medical Specialist Training. Updated 26 February 2020. https://mmc.gov.my/wp-content/uploads/2020/03/26-Feb-2020-Malaysian-Standards-for-Medical-Specialist-Training-Approved-by-Council-18-June-2019.pdf*

Compliance and Mapping to Malaysian Qualifications Framework

The Malaysian Qualifications Agency, (MQA), was officially established in 2007, and developed the Malaysian Qualifications Framework, (MQF) as a basis for quality assurance and accreditation of Malaysian higher education programmes. Higher education programmes are assigned an MQF level according to their purpose, learning outcomes, credits, discipline, type of programme, minimum entry requirement and typical duration, as summarised in the figure below. MPath (Medical Microbiology) programmes are currently designated as Level 7, similar to non-clinical Master's programmes. However, the duration and learning outcomes of the Clinical Masters programmes, in line with the National Curriculum, are more in keeping with Level 8 programmes, (see Figure below). The MQF learning outcomes clusters are mapped against the National Curriculum in table below.

Malaysian Qualification Framework Levels.[2]



[2]*Malaysian Qualifications Framework (MQF) 2nd Edition, updated 2 October 2019*

Table 12: Mapping to MQF Learning Outcome Clusters.[2]

MQF LO Cluster	National Curriculum section (s)
Knowledge and understanding	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus: ▪ Knowledge syllabus ▪ Assessment
Cognitive skills	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus ▪ Professional behaviours syllabus ▪ Research syllabus Assessment Learning opportunities
Functional work skills	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus ▪ Professional behaviours syllabus ▪ Research syllabus Assessment Learning opportunities
Practical skills	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus: ▪ Skills syllabus Assessment
Interpersonal skills	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus ▪ Professional behaviours syllabus ▪ Research syllabus Assessment Learning opportunities
Communication skills	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus ▪ Professional behaviours syllabus ▪ Research syllabus Assessment Learning opportunities

MQF LO Cluster	National Curriculum section (s)
Digital skills	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus ▪ Research syllabus Assessment Learning opportunities
Numeracy skills	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus ▪ Research syllabus Assessment Learning opportunities
Leadership, autonomy and responsibility	Exit criteria ▪ Required courses ▪ Essential Learning Activities Assessment Learning opportunities
Personal and entrepreneurial skills	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus ▪ Professional Behaviours Syllabus ▪ Research syllabus Assessment Learning opportunities
Ethics and professionalism	Exit criteria ▪ Required courses ▪ Essential Learning Activities Syllabus ▪ Professional Behaviours Syllabus ▪ Research syllabus Assessment Learning opportunities

Compliance to Institutional Requirements

Individual institutions offering training programmes may have additional internal requirements which are not stated in this National Curriculum. Programme directors should ensure that these requirements are met.

APPENDICES

Appendix 1: Entry Level ELAs

Entry Essential Learning Activity 1		
Activity	Sample collection and handling (pre-analytical variables)	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Lists the causes of pre-analytical errors. Recognises the importance of providing complete and correct information on the request form. Recognises the correct technique and containers used for sample collection. Explains the safety and infection control measures to be taken during sample collection. Explains the appropriate sample transportation.	Performs appropriate venepuncture. Follows appropriate procedures for collection of various specimens. Chooses appropriate containers for sample collection. Adheres to the safety procedure during sample collection. Transports the sample to the laboratory as per the requirement.	Recognises knowledge limits and asks for assistance when necessary. Talks to the patient in a polite manner explaining the procedure. Communicates with the patient with empathy and respect especially if complications occur.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do
Systematic approach in collecting samples and giving instructions to the patient. Understands the gravity of non-adherence to the above, which can affect patient management and safety.	Failing to recognise the importance of pre-analytical variables. Not knowing the importance of safety procedure.	Failing to know the importance of providing complete and correct information on the request form.
Assessment/Evidence		
Logbook Report from the supervisor at the hospital where they were working prior to entering the programme		

Entry Essential Learning Activity 2		
Activity	Requesting appropriate laboratory investigations	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Describes how to request investigations for microbiological samples. Explains the necessity for correct sample labelling Explains the necessity for appropriate relevant clinical history to be filled into the request form. Demonstrates the safety measures to be taken in transport of the samples.	Able to complete request forms or order on LIS for microbiological tests. Ensure correct sample labelling. Ensures appropriate relevant clinical history to be filled into the request form/LIS. Apply safety measures in handling and transport of the samples.	Informs the clinician/nurses about inappropriate tests requests. Recognises the importance of communication between the laboratory and the clinician regarding appropriate tests request. Recognises the limitations of knowledge and seeks guidance appropriately.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do
Demonstrate an ability to undertake life-long learning. Knows the indications for microbiology laboratory investigations.	Failing to follow procedures on requesting microbiology laboratory investigations.	Failing to know the importance of communication with laboratory regarding test indications.
Assessment/Evidence		
Logbook Report from the supervisor at the hospital where they were working prior to entering the programme		

Entry Essential Learning Activity 3		
Activity	Laboratory investigation in a patient with an infection	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Describes the pathophysiology of infectious diseases caused by bacteria, viruses, fungi etc. Describes clinical presentations of various infectious diseases. Describes the laboratory diagnostic modalities for any infectious diseases.	Recognises clinical presentations in patients with infectious diseases. Interprets microbiology laboratory results.	Informs the managing team about the pertinent findings. Recognises the importance of communication between the laboratory and the managing team in the management of the infection. Recognises the limitations of knowledge and seeks guidance appropriately.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do
Applies the knowledge on pathogenesis and pathophysiology of infectious diseases in relation to clinical presentations. Considers the factors that can affect the results.	Failing to recognise common clinical findings in infectious diseases. Failing to recognise or act upon abnormal/alarming results.	Failing to recognise abnormal/alarming results. Failing to discuss abnormal results with managing team which jeopardise the patient's management.
Assessment/Evidence		
Logbook Report from the supervisor at the hospital where they were working prior to entering the programme		

Appendix 2: The Medical Specialist Pre-Entrance Examination (MedEx) – Pathology component

The salient features of the MedEx - Pathology entrance examination are:

1. TWO (2) True/False Multiple Choice Question (MCQ) papers relating to the understanding of basic Anatomical Pathology, Haematology, Chemical Pathology, Forensic Pathology, Medical Microbiology and Medical Genetics and Immunology.
2. Marking system: A computerised marking system is used. There is negative marking (marks deducted for wrong answers) within each question and the minimum score for each question is ZERO (0) i.e. there will be no carryover of negative marks.
3. The selection of candidates for entry into the Master of Pathology programme will be based on the best performing candidates of the year's applicants .

Please refer to the MedEx website for updates on the examination:
https://www.mpm.edu.my/en/medex/scope-of-knowledge

Appendix 3: Orientation/Induction Course

Introduction

The orientation course is usually held during the first week of the Medical Microbiology training programme. The objective is to introduce the trainee to the training environment and facilities (at the university, hospital and Department of Medical Microbiology), and to provide a roadmap of the training programme and the philosophy of teaching and learning. The following is an example based on the MPath programme (MOHE pathway).

Level	Activities
The University Introduction of university's vision and mission, facilities available, logistics and rules and regulations in general.	Welcoming speech by the Dean and Deputy Deans from Faculty of Medicine. Introduction to the various Clinical (Master) Postgraduate Programmes. Introduction to facilities available in the university such as the library, laboratories and research facilities. General orientation such as student cards, library cards, research ethics, staff clinics, student welfare etc.
The Training Hospital Introduction of hospital's vision and mission, facilities available and general orientation on their usage in patient care and postgraduate training.	Welcoming speech by the Hospital Director. Introduction to the organisation and various departments/units of the hospital. Introduction of the facilities available in the hospital such as wards, clinics, operation theatres, laboratories, imaging and research facilities. General orientation on hospital disease control measures, waste management, electronic medical record (EMR) and blood products usage.
The Department of Medical Microbiology Introduction to department, facilities available and Postgraduate (Master) Pathology Programme	Welcoming speech by the Head of Department. Introduction to the organisation of the department and the various categories of staff. Introduction and overview to the Postgraduate (Master) Pathology Programme and various postings by the programme coordinator. Specific orientation and briefing on professional ethics, use of light and IF microscopes, lab and department safety and security, lab information system and EMR.

Appendix 4: Accreditation of Training Centres For Medical Microbiology

Introduction

Centres for training of Medical Microbiologists should be accredited for training by the National Specialty Conjoint Committee for Pathology, according to guidelines and procedures developed by the Committee. Accreditation is valid for FIVE (5) years and reaccreditation should be sought by the training centre at least SIX (6) months prior to the expiry of accreditation status. The minimum criteria for training in Medical Microbiology developed by the Malaysian Medical Council's Specialty Education Subcommittee for Medical Microbiology (MMC-SSC-EDU-FP) serves as the reference Malaysian Standards.

Qualifications, Experience and Adequacy of Trainers

1. Malaysian MPath degree with specialisation in Medical Microbiology or an equivalent qualification recognised by the MMC, *and*
2. Registrable on the Malaysian NSR in the discipline of Medical Microbiology, *and*
3. At least TWO (2) years of working experience as a Pathologist in the field of Medical Microbiology, *and*
4. Has attended Trainer Course(s) determined by Programme Training Committee or has prior trainer experience in Medical Microbiology.
5. As an overall for the training centre, the trainer: trainee ratio should not exceed a ratio of ONE (1) full time equivalent trainer to FOUR (4) trainees.

Educational Resources

The diagnostic facilities and equipment requirement of the programme training centres must collectively be able to accommodate the following minimum requirements:

i. Physical facilities

a) Infrastructure for electronic communication
b) Seminar/ tutorial rooms
c) Trainee workspace
d) Computer room
e) Library of reference books or journals (physical and/or virtual)

ii. Service areas and laboratory facilities

Areas	Services
Laboratory	Microscopy and staining methods (e.g. Gram stain, acid-fast stains, India ink, spore stains), cell counts
	Culture and identification tests: -Aerobic and anaerobic cultures for clinical specimens -Bacterial identification methods using biochemical tests, immunological tests and identification kits -Automated blood culture systems - Automated identification systems (optional)

Areas	Services
	Antimicrobial susceptibility tests (AST) e.g. disc diffusion method, E-test, broth dilution, automated AST.
	Serological tests for important infectious diseases including Hepatitis B, Hepatitis C, HIV, Dengue, Syphilis. Serology diagnostic methods for antigen and antibody detection including -Rapid diagnostic tests -Immunoassays e.g. enzyme (EIA), chemiluminescence (ECLIA)
	Viral culture method (optional)
	Immunofluorescence / UV microscopy
	Molecular diagnostic techniques
	Molecular / viral load tests by real-time-PCR e.g. HIV, Hepatitis B and C
	Immunology tests -routine tests e.g. RF, ANA, anti-dsDNA -specialised tests e.g. ASMA, AMA, ANCA, ENA -immunoglobulins, complements -tests for primary immunodeficiency (optional)
	Mycology -Microscopy for fungal identification -Culture and identification tests -Non-culture methods e.g. antigen detection, molecular, automated identification methods. -Anti-fungal susceptibility testing
	Parasitology tests for infections such as malaria, filariasis, intestinal helminths, intestinal protozoa
	Cultures and other tests for environmental specimens with regard to the control of hospital infection.
	Sterilisation and disinfection
	Media preparation (optional)
	Laboratory Information System
Others	Hospital infection prevention and control programme

* If a centre is not able to provide the range of services required, training should be extended to other centres accredited for Medical Microbiology training.

Equipment

Equipment	Minimum quantity
Biosafety Cabinet Class II	1
Microscope	1
Incubator	1
Laboratory grade refrigerators for specimen and reagent storage	2
Freezers -20°C, -70°C	1
Automated blood culture system	1
Automated identification system (optional)	1
Densitometer (optional)	1
Autoclave and sterilizers	1
Fume hood	1
pH meter	1
Pipettors	1
Spectrophotometer	1
Automated analyser for serological tests	1
Molecular / PCR set-up	1
Centrifuge	1
Vortex	1
Balance (optional)	1
Shakers / rotator (optional)	1
Electrophoresis apparatus (optional)	1
Water bath (optional)	1
UV-viewer (optional)	1

Case-load

The case load of the programme training centres must collectively be able to accommodate the following minimum requirements for each trainee:

Areas	Minimum Quantity (cases/ trainee/ year)
Cultures	1000
Serological tests	500

Case-mix (per trainee per year)

The case mix shall include bacteriology, virology, immunology, mycology and parasitology cases.

Areas	Minimum Quantity (cases/ trainee / year)
Case discussions or consultations	200

Note: Specimens and cases may be shared among trainees

Appendix 5: Accredited Training Centres

The list of training centres accredited for Medical Microbiology Training by the National Conjoint Specialty Committee – Pathology (as of 31 December 2021)

University Centres

Pusat Perubatan Universiti Malaya

Pusat Perubatan Universiti Kebangsaan Malaysia

Hospital Universiti Sains Malaysia

Hospital Pengajar UPM

Hospital Pengajar UiTM

Ministry of Health

Hospital Kuala Lumpur

Hospital Sultanah Aminah, Johor Bahru

Hospital Tengku Ampuan Afzan, Kuantan

Hospital Sultanah Nur Zahirah, Kuala Terengganu

Hospital Raja Perempuan Zainab II, Kota Bharu

Hospital Sultanah Bahiyah, Alor Setar

Hospital Raja Permaisuri Bainun, Ipoh

Hospital Selayang

Hospital Tuanku Ja'afar, Seremban

Hospital Melaka

Hospital Serdang

Hospital Tengku Ampuan Rahimah, Klang

Hospital Tuanku Fauziah, Kangar

Hospital Pulau Pinang

Hospital Sungai Buloh

Appendix 6: References to Medical Microbiology Trainee Guides

1. Master of Pathology Guidebooks

2. Malaysian Standard for Specialist Training

   https://mmc.gov.my/wp-content/uploads/2020/03/26-Feb-2020-Malaysian-Standards-for-Medical-Specialist-Training-Approved-by-Council-18-June-2019.pdf

3. Royal College of Pathologists (UK) Curriculum for Specialty training in Medical Microbiology/Virology

   https://www.rcpath.org/trainees/training/training-by-specialty/medical-microbiology.html

4. The Royal College of Pathologists of Australasia Trainee Handbook

   https://www.rcpa.edu.au/getattachment/09f1abf9-0bea-4e3d-b6c3-7a89b9d936c6/Microbiology-Trainee-Handbook.aspx

Appendix 7: List of Recommended Materials and Resources

The following textbooks or their equivalents are recommended for use throughout the master of Pathology (Medical Microbiology) training (latest edition preferable):

1. Mandell, Douglas & Bennet. Principles and Practice of Infectious Diseases.
2. Stephen D Allen, MD, William M Janda. Koneman Color Atlas of Diagnostic Microbiology. Washington C Winn
3. Jawetz, Melnick & Adelberg's. Medical Microbiology.
4. Richard Goering, Hazel M Dockrell, Mark Zuckerman, Derek Wakelin,
5. Ivan Roitt, Cedric Mims, Peter L Chiodini. Mim's Medical Microbiology.
6. Patrick R Murray, Ellen Jo Baron, James H Jorgensen, Michael A Pfaller, Robert H Yolken. Manual of Clinical Microbiology.
7. Larry M. Baddour, Sherwood L Gorbach. Therapy of Infectious Diseases.
8. Michael Loeffelholz, Richard L. Hodinka, Benjamin Pinsky, Stephen Young. Clinical Virology Manual
9. Monica Cheesbrough. District Laboratory Practice in Tropical Countries

Recommended Journals

1. American Journal of Infection Control
2. BMC Infectious Diseases
3. Clinical and Experimental Immunology
4. Clinical infectious diseases
5. Current Opinions in Infectious Diseases
6. Emerging infectious diseases
7. Journal of Clinical Microbiology
8. Journal of hospital infection
9. Journal of Immunology
10. Journal of Clinical Virology
11. Lancet Infectious Diseases
12. Reviews in Clinical Microbiology

Recommended Guidelines

1. Relevant Clinical and Laboratory Standards Institute (CLSI) or other reference laboratory documents e.g. Performance Standards for Antimicrobial Disk Susceptibility Tests
2. Malaysian clinical practice guidelines (CPG)
3. IDSA, CDC, WHO guidelines

Appendix 8: The Master of Pathology Part I and Final Examination Regulations and Components

The Master of Pathology Part I Examination Regulations and Components

The Part I examination will comprise:

Examination component	Weighting (%)	Requirement to pass the examination
Theory	50%	50% of overall theory marks
Practical	50%	50% of overall practical marks
Total (Overall)	100%	50% of overall marks

To pass the Part I examination, the candidate must obtain, at least:

- an **overall** score of 50% AND
- a pass (50%) in BOTH theory and practical components

Repeat Examination:

1. A candidate who has failed may be allowed to repeat the examination after SIX (6) months.
2. A candidate is allowed a maximum of TWO (2) repeat attempts to pass the Part I examination
3. The components of the repeat examination and their weightings will be as in the main Part I examination.

The Master of Pathology Final Examination Regulations and Components

The Final Examination will comprise of:

Examination component	Weighting (%)	Requirement to pass the examination
Theory	45%	50% of overall theory marks
Practical	45%	50% of overall practical marks
Viva voce	10%	Mandatory attendance
Total (Overall)	100%	50% of overall marks

To pass the Final examination, the candidate must obtain, at least:

- an **overall** score of 50% AND
- a pass (50%) in BOTH theory and practical
- AND attend the viva voce

Repeat examination

1. **Repeat examination attempts for candidates who have obtained an overall score of less than 50% OR failed to attend the viva voce**

   After satisfactorily completing a further 1 (ONE) year of training the candidate will be examined on the theory and practical components as well as having to attend a compulsory viva voce.

   The components of the examination and their weightings will be as in the main examination.

   To pass the repeat examination, the candidate must obtain, at least:

   - an **overall** score of 50% AND
   - a pass (50%) in BOTH theory and practical
   - AND attend the viva voce

2. **Repeat examination attempts for candidates who have obtained an overall score of 50% or more but have failed in either the theory or practical component.**

   After satisfactorily completing a further SIX (6) months of training the candidate will be examined in the failed component as well as having to attend a compulsory viva voce.

   The components and weighting of the 6-month repeat examination are as follows:

Examination component	Weighting (%)	Requirement to pass the examination
Theory or Practical	90%	50% of overall theory or practical marks
Viva voce	0%	Mandatory attendance
Total (Overall)	100%	50% of overall marks

   To pass this repeat examination, the candidate must obtain a pass mark of at least 50% in the theory or practical component that they have sat for, AND obtain an overall score of at least 50%.

   The candidate is only allowed to repeat the examination of the failed theory or practical twice consecutively. If the candidate fails on the second repeat attempt, the candidate must repeat BOTH the theory and practical components and viva-voce after SIX (6) months, or after ONE (1) year based on the recommendation of the Board of Examiners. The components and weightings of the repeat examinations will be as in 1 and 2 above.

3. A candidate is allowed a maximum of FOUR (4) repeat examination attempts throughout the duration of the programme

4. The maximum duration permitted for the completion of the entire programme is SEVEN (7) years.

Appendix 9: Exit Level ELAs

Exit Essential Learning Activity 1		
Activity	Knowledge and skills on laboratory procedures in medical microbiology, including bacteriology, virology, mycology, parasitology and immunology	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Describes the appropriate specimen collection, handling and transport. Describes various laboratory procedures in routine and specialised microbiology tests. Describes advantages and limitation of tests. Describes the interpretation of the tests results.	Identifies appropriate specimen for diagnosis of specific infections. Demonstrates the ability to identify errors and near-misses in laboratory procedures (based on current SOP/STM). Demonstrates the ability to give consultation on appropriate tests. Demonstrates the ability to correctly interpret laboratory results.	Demonstrates effective communication with laboratory staff and users (doctors, nurses etc.) to resolve problems with specimen collection and test requests. Demonstrates team-working ability with staff and colleagues.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong, omissions that constitute substandard care	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do which constitutes substandard care
Demonstrates skills in correctly interpreting laboratory tests results	Fails to recognise lack of knowledge in interpreting laboratory results. Validates laboratory results without giving due consideration to correct procedures(SOP/STM). Fails to seek help from senior colleagues or supervisor when facing problem in processing and interpretation.	Fails to communicate with laboratory staff performing the tests. Fails to refer to SOP/STM to ensure correct procedures.
Assessment/Evidence		
DOPS MSF		

Exit Essential Learning Activity 2		
Activity	Reporting of medical microbiology tests and results	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Describes the proper procedures for reporting results according to different types of tests. Describes procedures regarding the amendment of results.	Demonstrates the ability to validate laboratory results. Demonstrates the ability to effectively and correctly communicate laboratory results to the requesting doctors.	Consults senior colleagues and/or clinical microbiologists before making decisions in problematic cases.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong, omissions that constitute substandard care	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do which constitutes substandard care
Demonstrates skills in correctly validating test results. Demonstrates the ability to communicate with requesting doctors in appropriate manner.	Fails to recognise errors before validating results. Fails to ensure accurate results before releasing them to requesting doctors.	Omits pertinent details in validating and reporting results.
Assessment/Evidence		
DOPS MSF		

Exit Essential Learning Activity 3		
Activity	Advise on antimicrobial treatment	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Describes the factors that influence the choice of antimicrobial agents. Describes the different procedures of antimicrobial susceptibility testing, their advantages and limitations. Describes the breakpoints applied for interpretation of AST.	Demonstrates skills in reading and interpreting antimicrobial susceptibility test (AST) and analysing breakpoints. Demonstrates skills in reporting AST results. Demonstrates the ability to communicate AST results to managing doctors. Demonstrates the ability to give advice on appropriate antimicrobial treatment based on clinical presentation and AST results.	Discusses with senior colleagues/Clinical Microbiologists on problematic cases.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong, omissions that constitute substandard care	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do which constitutes substandard care
Corrects readings and interpreting AST results. Reports appropriately results of AST (in form or LIS). Advises appropriately on the choice of antibiotics.	Makes errors in reading and interpretation of AST results. Fails to recognise factors contributing to errors in AST results. Releases AST results with errors.	Omits pertinent details in troubleshooting.
Assessment/Evidence		
DOPS MSF		

Exit Essential Learning Activity 4		
Activity	Advise on healthcare-associated infections (including Infection Prevention and Control) management	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Demonstrates understanding on various healthcare-associated infections (HCAIs). Demonstrates understanding on the requirement aspect of infection control in various clinical settings. Demonstrates the ability to apply the principles of outbreak management in various clinical settings. Demonstrates understanding on the principles and practices of Antimicrobial Stewardship (AMS)	Demonstrates the ability to recognise potential outbreak. Demonstrates the ability to respond to potential outbreak situation, under supervision of clinical microbiologist. Demonstrates the ability to advise on HCAIs diagnosis and management, under supervision of clinical microbiologist.	Demonstrates team-working ability with laboratory colleagues, infection control unit and clinical colleagues.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong, omissions that constitute substandard care	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do which constitutes substandard care
Ability to recognise HCAIs based on clinical presentation and laboratory results. Recognises potential outbreak based on trend of organism isolation.	Failing to recognise potential outbreaks following increasing trend of organism isolation.	Failing to demonstrate team working with laboratory staff and infection control team.
Assessment/Evidence		
DOPS MSF		

Exit Essential Learning Activity 5		
Activity	Quality management in the medical microbiology laboratory	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Describes the principles of quality management system (QMS) in medical microbiology laboratory.	Recognises important elements in QMS to ensure adequate performance of diagnostic tests. Demonstrates the ability to perform relevant quality control for microbiology diagnostics. Demonstrates the ability to be actively involved in quality assurance activities.	Demonstrates team work with staff and colleague.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong, omissions that constitute substandard care	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do which constitutes substandard care
Actively participates in quality assurance activities.	Fails to recognise the importance of quality control in microbiology laboratory.	Fails to demonstrate team work.
Assessment/Evidence		
DOPS MSF		

Exit Essential Learning Activity 6		
Activity	Basic skills in research methodology and audit	
Description (if necessary)		
All items on the table below are examples, they do not constitute an exhaustive list in any aspect		
Knowledge Know, Facts, Information	**Skill** Do, Practical, Psychomotor, Techniques	**Attitudes + Values** Feel, behaviours displaying underlying values or emotions
Demonstrates understanding on the principles of conducting good research. Demonstrates understanding on the importance of critical appraisal.	Demonstrates skills on performing sound research methodology. Demonstrates the ability to analyse, criticise and present raw data. Demonstrates the ability to report and assess the significance of the research findings.	Appreciates the contributions of staff, colleagues and supervisors in completing research projects/audits.
BEHAVIOURAL MARKERS		
Positive Things that should be done, correct techniques or practices, things a trainee might do right	**Negative** Things that should not be done, incorrect techniques or practices, things a trainee might do wrong, omissions that constitute substandard care	**Negative Passive** Things that may be forgotten or omitted that constitute incorrect or substandard care, things a trainee forgets to do which constitutes substandard care
Utilises sound methodology to achieve objectives of the research project/audit. Ability to select good, reliable studies as references.	Fails to recognise errors and flaws in research methodology.	Fails to appreciate team efforts in completing research project.
Assessment/Evidence		
DOPS MSF		

GLOSSARY

Term	Description
APC	Annual Practicing Certificate
BPL	Bahagian Pengurusan Latihan (Training Management Division)
CBD	Case-Based Discussion
CPath-AMM	College of Pathologists, Academy of Medicine of Malaysia
DOPS	Directly Observed Practical Skills
ECE	Evaluation of Clinical Events
ECSMQ	Evaluation Committee for Specialist Medical Qualifications
ELA	Essential Learning Activities
FRCPA	Fellow of the Royal College of Pathologists of Australasia
FRCPath	Fellow of the Royal College of Pathologists, United Kingdom
HO	House Officer
MCQ	Multiple Choice Questions
MEC	Medical Education Committee
MedEx	Medical Specialist Pre-Entrance Examination
MMC	Malaysian Medical Council
MO	Medical Officer
MOH	Ministry of Health
MOHE	Ministry of Higher Education
MQA	Malaysian Qualifications Agency
MQF	Malaysian Qualifications Framework
MSF	Multi-source Feedback
NPMC	National Postgraduate Medical Curriculum
NSR	National Specialist Register
OSPE	Objective Structured Practical Examination
PEO	Programme Educational Objectives
PLO	Programme Learning Outcomes
QA	Quality assurance
QAD	Quality Assurance Division of the Ministry of Higher Education
SA	Summative Assessment
SPM	Sijil Pelajaran Malaysia
SA-1	Summative assessment 1 e.g. Part 1 Professional Examination
SA-2	Summative assessment 2 e.g. Final (Exit) Examination
SSCs	Specialty Sub-Committees
ST	Specialty Training
UKM	Universiti Kebangsaan Malaysia
UM	Universiti Malaya
UPM	Universiti Putra Malaysia
USM	Universiti Sains Malaysia
UiTM	Universiti Teknologi MARA
WBA	Workplace-based assessment

ISBN

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