The Royal College of Pathologists

Pathology: the science behind the cure

CURRICULUM FOR SPECIALTY TRAINING IN **MEDICAL MICROBIOLOGY**

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1. Introduction

Medical microbiology (MM) is a specialty that provides diagnostic and clinical advice essential for the delivery of clinical care across all areas of the health service and all specialties. A medical microbiologist is involved in the prevention of infections and at all stages of the diagnosis and management pathway in patients with infections (or suspected infections), including sepsis. Every GP and hospital has access to a medical microbiologist for clinical advice 24 hours a day, seven days a week.

Training is possible in medical microbiology as a mono-specialty or with infectious diseases (also see infectious diseases curriculum).

2. Purpose

2.1 Purpose statement

Medical microbiologists provide direct bedside diagnostic and clinical advice for patients with complex infections. There are increasing numbers of patients with compromised immune systems (e.g. bone marrow and solid organ transplant patients and cancer patients) or with orthopaedic or other internal devices (e.g. prosthetic joints, artificial heart valves or intravascular lines); these patients present difficult diagnostic and management issues. Medical microbiologists participate daily in intensive care departments managing patients with severe community-acquired infections, including sepsis and complex trauma or surgical cases. They participate in the multidisciplinary team management of patients across many other specialties such as orthopaedics and other surgical and physicianly specialties such as respiratory medicine and infectious diseases. They also work closely with their physician colleagues on the rapid assessment of patients with imported fevers. For the returning traveller this may include suspected high-consequence infections such as viral haemorrhagic fevers (e.g. Ebola or Lassa) or respiratory agents such as Middle Eastern respiratory syndrome (MERS) or avian influenza. They provide emergency infection prevention and control advice and facilitate rapid (often overnight) diagnostics.

Medical microbiologists work closely with general practitioners (GPs) and across all hospital specialties, with public health experts, epidemiologists, infection control nurses, pharmacists and laboratory staff. They provide advice about infection prevention and control, management of outbreaks, appropriate diagnostic tests and their interpretation when infection is suspected, and the clinical management of infected patients. Medical microbiologists provide regular and direct input into the management of patients across the clinical spectrum, especially those on the intensive care unit or special care baby units and patients with infected sterile fluids, e.g. blood culture, cerebral spinal fluids (CSF), joint aspirates, etc. They also work closely with laboratory staff to ensure their safety in the case of high-risk organisms, and to advise on the further work-up of potential pathogens. They provide clinical leadership and support to the laboratory on a daily basis and also strategically, advising on quality improvements and service developments.

With the major changes in molecular diagnostics, medical microbiologists lead on validation, approval and quality control of new tests and rapid point-of-care testing (POCT) in their organisations. There are increasing numbers of privatised off-site laboratories, moves towards networked hub and spoke models of laboratory service delivery, and increasing automation. Medical microbiologists will be required to provide both on-site clinical and quality support to such laboratories and as broad clinical infection specialists who manage hot labs and clinical services in National Health Service (NHS) trusts.

The purpose of the curriculum is to set the standards for attainment of the award of the Certificate of Completion of Training (CCT) or Certificate of Eligibility for Specialist Registration (CESR) through the Combined Programme (CP) in medical microbiology and to

ensure that trainees are fully prepared to lead a full clinical and laboratory microbiology service at consultant level in the NHS.

This purpose statement has been endorsed by the General Medical Council's (GMC) Curriculum Oversight Group and confirmed as meeting the needs of the health services of the countries of the UK.

2.2 High-level curriculum outcomes: capabilities in practice

The 13 capabilities in practice (CiPs) describe the professional tasks or work within the scope of medical microbiology. Six CiPs are generic, with applicability to doctors in all specialties, and seven are specific to specialists in infection. Each CiP has a set of descriptors associated with that activity or task. Descriptors are intended to help trainees and trainers recognise the minimum level of knowledge, skills and attitudes which should be demonstrated for an entrustment decision to be made. By the completion of training and award of the CCT, the doctor must demonstrate that they are capable of unsupervised practice in all generic and specialty CiPs.

The six generic CiPs cover the universal requirements of all specialties as described in the generic professional capabilities (GPC) framework. Assessment of the generic CiPs will be underpinned by the GPC descriptors. Satisfactory sign-off will indicate that there are no concerns before the trainee can progress to the next part of the assessment of clinical capabilities.

The seven specialty CiPs describe the laboratory and clinical tasks or activities which are essential to the practice of medical microbiology. The specialty CiPs have also been mapped to the GPC domains and subsections to reflect the generic professional capabilities required to undertake the clinical tasks. Satisfactory sign-off requires demonstration that, for each of the CiPs, the trainee's performance meets or exceeds the minimum expected level of performance expected for completion of this stage of medical microbiology training, as defined in the curriculum.

The generic and specialty CiPs are common across all the infection curricula. However, the entrustment levels (1–4) for each CiP required to gain a CCT vary and are specified for each curriculum. See tables 5 and 6 in section 8.2 and 8.3 for descriptions of the entrustment levels and the levels required in MM, medical virology (MV), dual medical microbiology/infectious diseases (MM/ID) and dual medical virology/infectious diseases (MV/ID) training.

Please see section 8 for more details of the assessment programme.

Table 1: The six generic and seven specialty capabilities in practice

Learning outcomes – CiPs
Generic CiPs
1. Able to function successfully within NHS organisational and management systems. 2. Able to deal with ethical and legal issues related to clinical practice. 3. Communicates effectively and is able to share decision making, while maintaining appropriate situational awareness, professional behaviour and professional judgement. 4. Is focused on patient safety and delivers effective quality improvement in patient care. 5. Able to carry out research and manage data appropriately. 6. Acts as a teacher and clinical supervisor.

Specialty CiPs
7. Able to provide clinical leadership and support to the laboratory. 8. Able to use the laboratory service effectively in the investigation, diagnosis and management of infection. 9. Able to advise on infection prevention, control and immunisation. 10. Able to manage and advise on important clinical syndromes where infection is in the differential diagnosis. 11. Able to lead and advise on treatment with and stewardship of antimicrobials. 12. Able to provide continuity of care to inpatients and outpatients with suspected or proven infection. 13. Able to manage and advise on imported infections.

2.3 Generic professional capabilities and good medical practice

The GMC has developed the GPC framework with the Academy of Medical Royal Colleges (AoMRC) to describe the fundamental, career-long, generic capabilities required of every doctor. The framework describes the requirement to develop and maintain key professional values and behaviours, knowledge, and skills, using a common language. GPCs also represent a system-wide, regulatory response to the most common contemporary concerns about patient safety and fitness to practise within the medical profession. The framework will be relevant at all stages of medical education, training and practice.

Figure 1. The nine domains of generic professional capabilities.

Good medical practice (GMP) is embedded at the heart of the GPC framework. In describing the principles, duties and responsibilities of doctors, the GPC framework articulates GMP as a series of achievable educational outcomes to enable curriculum design and assessment.

The GPC framework describes nine domains with associated descriptors outlining the 'minimum common regulatory requirement' of performance and professional behaviour. These attributes are common, minimum and generic standards expected of all medical practitioners achieving a CCT or its equivalent.

The 20 domains and subsections of the GPC framework are directly identifiable in the medical microbiology curriculum. They are mapped to each of the generic and specialty CiPs, which are in turn mapped to the syllabus and to the assessment blueprints. This is to emphasise those core professional capabilities that are essential to safe clinical practice and

that must be demonstrated at every stage of training as part of the holistic development of responsible professionals.

This approach will allow early detection of issues most likely to be associated with fitness to practise and aims to minimise the possibility that any deficit is identified during the final phases of training.

2.4 Training pathway

Trainees in the specialty will initially develop knowledge of laboratory work, together with supervised clinical liaison and validation of results, and direct clinical care. Following completion of the Fellowship Examination of the Royal College of Pathologists (FRCPath) Part 1 examination, they will continue to develop their skills in the laboratory (including assessment of new tests and guideline development) and in clinical management/advice, with greater responsibility and less direct supervision. After passing the FRCPath Part 2 examination, trainees will continue to develop their skills with support; they may also develop a specialist interest.

Figure 2a. Structure of training in medical microbiology, including indicative training time.

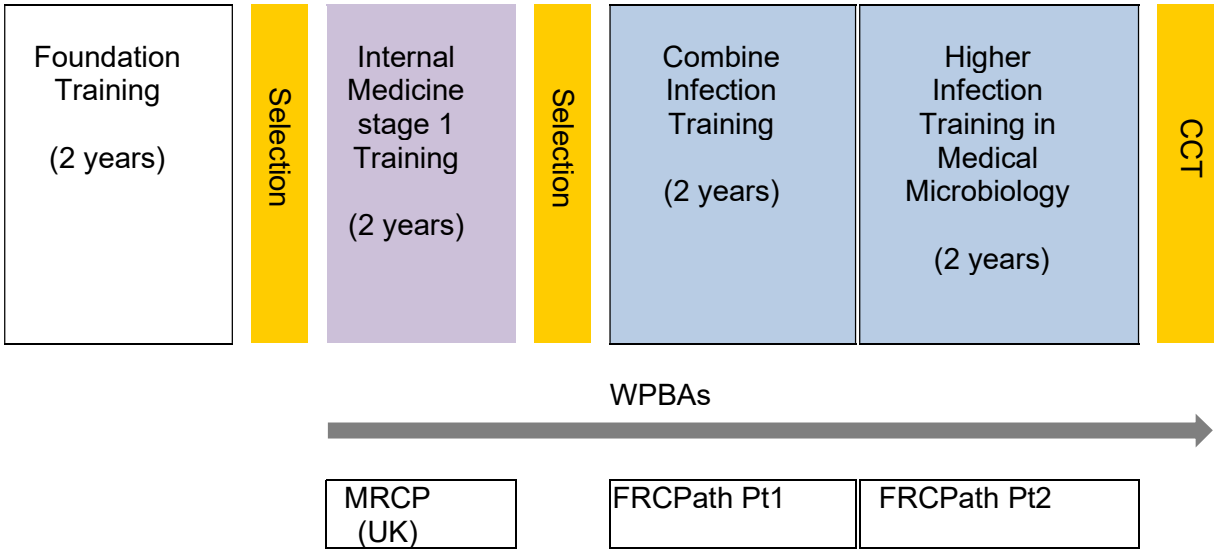
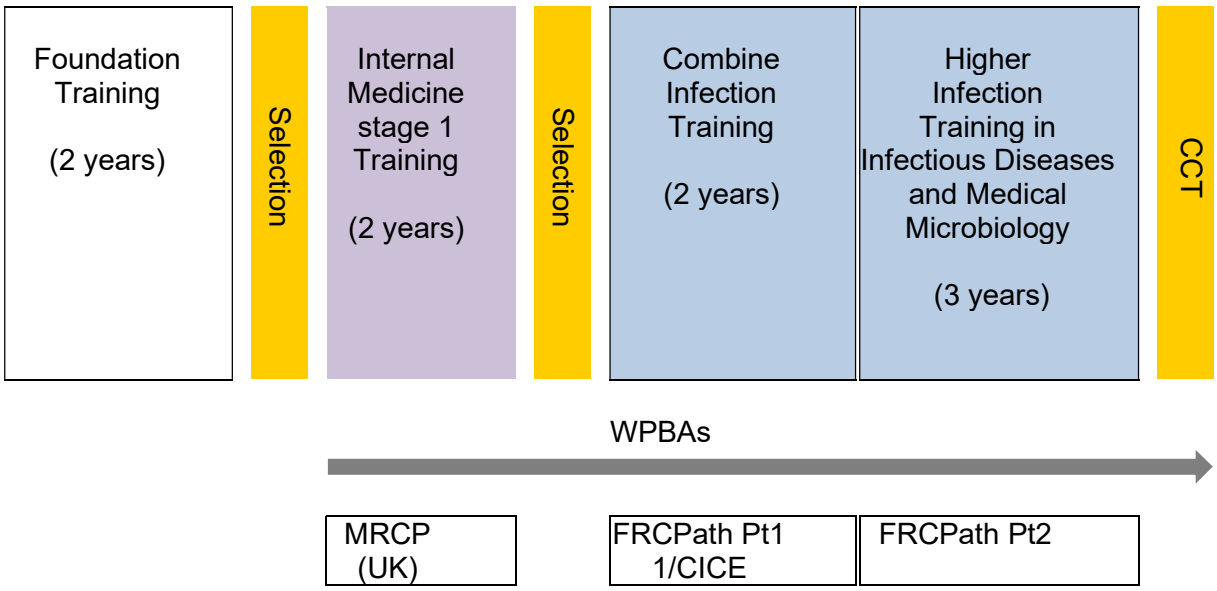


Figure 2b Structure of training in infectious diseases with medical microbiol



This curriculum will deliver a generalist medical microbiologist who can integrate into the local structure and be flexible enough to complement other staff and cooperate to deliver the required service. Therefore, the proportion of clinical and laboratory work will vary widely according to local need, but trainees should have the capability and readiness for either.

This curriculum supports a flexible approach to training, with broad entry routes from post-foundation core training programmes, whose clinical experience will closely mirror the range of clinical specialties supported by medical microbiologists and medical microbiology services.

2.5 Duration of training

The Royal College of Pathologists anticipates that four years would normally be required to satisfactorily complete the medical microbiology curriculum to the required depth and breadth. It is anticipated that two years would normally be required to satisfactorily complete the combined infection training section of the curriculum, and two years to complete higher infection training in medical microbiology.

Training in dual medical microbiology and infectious diseases is anticipated to require an indicative duration of two years combined infection training, followed by three years of higher infection training in medical microbiology and infectious diseases. Dual training is run by the JRCPTB (Joint Royal Colleges of Physicians Training Board).

The CCT in medical microbiology will be awarded on the recommendation of the Royal College of Pathologists, following:

- evidence of satisfactory completion of the requirements of the medical microbiology curriculum
- satisfactory completion of the requisite number of workplace-based assessments (including multi-source feedback)
  1. FRCPath by examination
- Acquisition of Annual Review of Competence Progression (ARCP) outcome 6.

Dual trainees are governed by the JRCPTB and have the same criteria as above for a medical microbiology CCT.

2.6 Flexibility

Medical microbiology training offers excellent opportunities to contribute to research and service development across the whole field of medicine, as well as providing opportunities for training in other related specialties, and in a range of settings. GPCs will promote flexibility in postgraduate training, as these common capabilities can be transferred from specialty to specialty.

2.7 Less than full-time training

Less than full-time training is the term used to describe doctors undertaking training on a basis that is not full time – normally between five and eight sessions per week. In exceptional circumstances, trainees may be allowed to undertake training at less than 50% of full time. These circumstances should be considered by trainee's deanery and should have the support of the Postgraduate Dean or their Deputy. A placement at less than 50% of full time should be for a maximum of 12 months and should be subject to regular review.

The aim of less than full-time training is to provide opportunities for doctors in the NHS who are unable to work full time. Doctors can apply for less than full-time training if they can provide evidence that "training on a full-time basis would not be practicable for well-founded individual reasons".

Less than full-time trainees must accept two important principles:

- part-time training shall meet the same requirements (in depth and breadth) as full-time training
- the total duration and quality of the part-time training of specialists must be not less than those of a full-time trainee.

In other words, a part-time trainee will have to complete the minimum training time for their specialty pro rata.

Prior to beginning their less than full-time training, trainees must inform the Training Department at the Royal College of Pathologists or JRCPTB so that the Medical Training Committees can ensure that their less than full-time training programme will comply with the requirements of the CCT. The documentation towards a less than full-time training application will be collected and checked to ensure compliance, and a revised provisional CCT date issued. It must also be ensured that the less than full-time training post is approved as part of a GMC-approved training programme. Separate guidance and an application form are available on the College website for this purpose.

3. Learning and teaching

3.1 The training programme

This section of the curriculum outlines the training regulations for medical microbiology. In line with GMC guidance, this reflects the regulation that only training that has been prospectively approved by the GMC can lead towards the award of the CCT. Training that has not been prospectively approved by the GMC can still be considered, but the trainee's route of entry to the Specialist Register changes to the CESR (CP) route.

The organisation and delivery of postgraduate training is the responsibility of Health Education England (HEE) and its Local Education and Training Boards (LETBs), NHS Education for Scotland (NES), the Health Education and Improvement Wales (HEIW) and the Northern Ireland Medical and Dental Training Agency (NIMDTA). A training programme director will be responsible for coordinating local infection training programmes. In England, the local organisation and delivery of training is overseen by a school of medicine.

Progression through the programme will be determined by the ARCP process and the training requirements for each indicative year of training are summarised in the combined infection training ARCP decision aid (see JRCPTB or RCPath websites) and the higher infection training medical microbiology ARCP decision aid (available on the RCPath website). The successful completion of the programme will be dependent on achieving the expected level in all CiPs and GPCs. The programme of assessment will be used to monitor and determine progress through the programme. Training will normally take place in a range of district general hospitals and teaching hospitals.

The sequence of training should ensure appropriate progression in experience and responsibility. The training to be provided at each training site is defined to ensure that, during the programme, the entire syllabus is covered, and also that unnecessary duplication and educationally unrewarding experiences are avoided. However, the sequence of training should ideally be flexible enough to allow the trainee to develop a special interest.

3.2 Entry requirements

Trainees are eligible for entry to combined infection training following satisfactory completion of post-foundation core training programmes:

- two years of Stage 1 Internal Medicine plus MRCP(UK)
- Acute Care Common Stem (ACCS) plus MRCP(UK).

3.3 Teaching and learning methods

Models of learning

There are three broad categories of learning which trainees employ throughout run-through training: the instructionist model, the constructionist model and the social learning model. The models of learning can be applied to any stage of training in varying degrees. Most of the curriculum will be delivered through work-based experiential learning, but the environment within the department should encourage independent self-directed learning and make opportunities for relevant off-the-job education by making provision for attendance at local, national and, where appropriate, international meetings and courses. Independent self-directed learning should be encouraged by, for example, providing reference textbooks. It is the trainee's responsibility to seek opportunity for experiential learning.

The more academically inclined trainees will be encouraged to take time out from their training time to include a more sustained period of grant-funded research, working towards an MSc, MRes/MD or PhD.

Learning for knowledge, competence, performance and independent action will be achieved by assessment, which will be set by the Royal College of Pathologists in the form of workplace-based assessment including multi-source feedback and the FRCPath examination.

The principles of Bloom's taxonomy have been applied to the knowledge, skills and behaviours outlined in the curriculum to indicate the trainees' learning journey from the initial acquisition of knowledge and comprehension through to application and analysis and resulting in the synthesis and evaluation required to achieve mastery in the specialty of medical microbiology. In using this model, it is acknowledged that there are many different versions of the taxonomy. The achievement of mastery in this curriculum requires the trainee to demonstrate a combination of detailed knowledge in the associated political context, with the ability to do independent clinical work, and to lead and organise services.

Learning experiences

The following teaching/learning methods will be used to identify how individual objectives will be achieved:

- **Routine work:** the most important learning experience will be day-to-day work.
- **Textbooks and online resources:** medical microbiology is a subject requiring a great deal of background learning and reading, as well as the practical experience gained within day-to-day working, and trainees should take every opportunity to 'read around' their subject.
- **Regional training courses:** these are valuable learning opportunities. Trainees should be released from service duties to attend.
- **Other training courses:** Individual training programmes may recommend particular external training courses to supplement local and regional training.
- **Scientific meetings:** research and the understanding of research are essential to the practice of medical microbiology. Attendance at scientific meetings is one of the ways to achieve this and trainees should be encouraged to attend and present their work at relevant meetings.
- **Discussion with biomedical scientists (BMS):** BMS staff and laboratory managers can provide excellent training, particularly in relation to laboratory methods, health and safety, service delivery, procurement and human resources.
- **Multidisciplinary team meetings (MDTs):** attendance at and contribution to MDTs and clinicopathological conferences offers the opportunity for trainees to develop an understanding of clinical management and appreciate the impact of laboratory diagnosis on patient care. The MDT is also an important arena for the development of interprofessional communication skills.
- **Attachment to specialist departments:** attachments of this kind may be required within a training programme, at the discretion of each deanery. They may also be beneficial for those trainees in their final year of training who wish to develop a special interest before taking up a consultant post.
- **E-learning**
- **Learning with peers**
- **Medical clinics including specialty clinics**
- **Practical laboratory experience**
- **Formal postgraduate teaching**
- **Formal study**

It must be ensured that the appropriate teaching and learning methods are employed for each area of the curriculum.

3.4 Time out of training

The GMC has provided guidance on the management of absences from training and their effect on a trainee's CCT date. The GMC guidance states that within each 12-month period where a trainee has been absent for a total of 14 days or more (when a trainee would normally be at work), a review to determine if the trainee's CCT date should be extended is triggered. The absence includes all forms of absence such as sickness, maternity, compassionate paid/unpaid leave, etc., but does not include study or annual leave or prospectively approved out-of-programme training/research. The administration of the absence and any extension to training will be undertaken by the relevant deanery in consultation with the relevant College/Faculty where necessary. The GMC supports the deaneries implementing this guidance flexibly to reflect the nature and timing of the absence and its effect on the individual's competence. Each trainee's circumstances will be considered on an individual basis and any changes to the CCT date will reflect the trainee's demonstration of competence.

3.5 Acting up as a consultant (AUC)

A doctor in training can apply to the Dean to take time out of programme for up to 3 months and credit the time towards CCT/CESR (CP) as an AUC. Where the AUC is in the same training programme, then prospective approval is not needed from the GMC. If it is a different training programme, the usual out-of-programme (OOP) process applies. When you are acting up as a consultant, there will need to be appropriate supervision in place and approval will only be considered if the acting up placement is relevant to gaining the competences, knowledge, skills and behaviours required by the curriculum. AUC posts can only be taken in the final year of specialty training.

3.6 Out-of-programme research (OOPR)

Some trainees may wish to spend a period of time in research after entering medical microbiology training as out-of-programme research (OOPR).

Research undertaken prior to entry to a medical microbiology training programme

Trainees who have undertaken a period of research prior to entering a medical microbiology training programme can apply to have this period recognised towards a CCT or CESR (CP), if it includes clinical or laboratory work directly relevant to the medical microbiology curriculum and there is prospective approval from the GMC.

Research undertaken during a medical microbiology training programme

Trainees who undertake a period of OOPR after entering a medical microbiology training programme and obtaining their National Training Number (NTN) may have a period of research recognised towards the award of the CCT or CESR (CP). Trainees must ensure that their OOPR is approved prospectively before beginning their research, which must include clinical or laboratory work directly relevant to the medical microbiology curriculum and demonstrate that they have achieved, or will be able to achieve, all requirements of the curriculum.

Prior to beginning the period of research, trainees must agree the OOPR with their deanery and apply to the Training Department at the Royal College of Pathologists or the JRCPTB (dual trainees) in order that the Medical Microbiology College Specialty Training Committee (CSTC) can ensure that the trainee will comply with the requirements of the CCT programme, and issue a revised provisional CCT date if necessary. It must be ensured that, following deanery agreement and acceptance from the Medical Microbiology and Virology CSTC, the GMC prospectively approve the OOPR in order that the period can count towards a CCT or CESR (CP).

Separate guidance and an application form are available on the College website for this purpose.

3.7 Academic training

Trainees who intend to pursue a career in academic or research medicine may undertake specialist training in medical microbiology. Such trainees will normally be clinical fellows or lecturers and hold an academic NTN. It is expected that they should complete the requirements of the medical microbiology (or dual) curriculum in addition to their academic work. However, the content of their training, while meeting the requirements of the curriculum, will have to take into account their need to develop their research and the provisional CCT date should be amended accordingly. NTN (A) holders in medical microbiology or ID/MM should consult the training department at the relevant College on an individual basis with regard to the agreement of their provisional CCT date.

3.8 Out-of-programme training (OOPT)

The GMC must prospectively approve clinical training out of programme if it is to be used towards a CCT or CESR (CP) award. This could include posts inside or outside the UK that are not already part of a GMC-approved programme in the same specialty. Further approval from the GMC is not required if the OOPT is already part of a GMC-approved programme in the same specialty.

Trainees can have up to one year of OOPT recognised towards the award of the CCT. Prior to beginning the period of OOPT, trainees must agree the OOPT with their deanery and inform the Training Department at the Royal College of Pathologists or JRCPTB (ID/MM trainees) that they will be undertaking OOPT, so that the Medical Microbiology and Virology CSTC can ensure that the trainee will comply with the requirements of the CCT programme.

The Postgraduate Dean is required to submit an application for prospective GMC approval for any OOPT that is to count towards a CCT or CESR (CP) on behalf of the trainee, and this application is required to include support from the Royal College of Pathologists. If prospective approval for OOPT is not sought from the GMC, then it cannot count towards a CCT or CESR (CP). Where the OOPT is in a GMC-approved programme in the same specialty, an application for further GMC approval is not required.

Trainees must have their OOPT agreed by the relevant deanery, accepted by the Medical Microbiology and Virology CSTC and approved by GMC before beginning their OOPT.

Separate guidance and an application form are available on the College website for this purpose.

3.9 Out-of-programme clinical experience (OOPE)

Trainees may seek agreement for OOP to undertake clinical experience that has not been approved by the GMC and that will not contribute to award of a CCT or CESR (CP). In these circumstances, it is likely that the CCT date will need to be extended. Trainees should contact the relevant College for further guidance.

4. Quality management

The curriculum outlines the minimum medical microbiology training requirements for delivery in a training programme. It guides educational supervisors as to what is required to deliver the curriculum, and trainees in the learning and assessment methods required for satisfactory completion of training.

It is the responsibility of the training programme director (TPD) and their deanery, with the assistance of the regional STC to ensure that the programme delivers the depth and breadth of medical microbiology training outlined in the curriculum. The TPD must ensure that each post within the programme is approved by the GMC. Heads of Pathology School (HOPS) have a strategic overview of training in the Pathology specialties. They are responsible for ensuring that the delivery of education and training meets the College's and the GMC's agreed curriculum and is provided to the standards set by the College and the GMC.

It is the responsibility of the GMC to provide quality assurance for training programmes and the responsibility of the Royal College of Pathologists and the JRCPTB through the Combined Infection Training committees, the Medical Microbiology and Virology CSTC and the Infectious Diseases SAC to ensure training programmes across the UK are able to deliver a balanced programme of training.

It is the responsibility of the educational supervisor of a particular post or attachment within a programme to ensure that the training delivered in their post meets the requirements of the

relevant section(s) of the curriculum. The educational supervisor must undertake regular educational appraisal with their trainee, at the beginning, middle and end of a section of training, to ensure structured and goal-oriented delivery of training.

Trainees must register with the college on appointment to a medical microbiology (RCPath) or ID/MM (JRCPTB) training programme. It is the trainee's responsibility to become familiar with the curriculum, inclusive of the generic and specialty CiPs, and assessment requirements both for the satisfactory completion of each stage of training and the award of the CCT or CESR (CP). They must be familiar with all aspects of the assessment system; workplace-based assessment including multi-source feedback (MSF) and the FRCPath examination. It is the trainee's responsibility to ensure that they apply in good time for any assessments and examinations that demand an application. Trainees must also make appropriate use of the electronic portfolio.

5. Intended use of curriculum by trainers and trainees

This curriculum and that for combined infection training are available from the Royal College of Pathologists website. The infectious diseases curriculum is available on the JRCPTB website.

Clinical and educational supervisors should use the curriculum as the basis of their discussion with trainees, particularly during the appraisal process. Both trainers and trainees are expected to have a good knowledge of the curriculum and should use it as a guide for their training programme.

Each trainee will engage with the curriculum by maintaining an ePortfolio via the relevant college ePortfolio system. The trainee will use the curriculum to develop learning objectives and reflect on learning experiences.

The trainee's main responsibilities are to ensure the ePortfolio is kept up to date, arrange assessments and ensure they are recorded, prepare drafts of appraisal forms, maintain their personal development plan, record their reflections on learning and record their progress through the curriculum.

The supervisor's main responsibilities are to use ePortfolio evidence, such as outcomes of assessments, reflections and personal development plans to inform appraisal meetings. They are also expected to update the trainee's record of progress through the curriculum, write end-of-attachment appraisals and supervisor's reports.

Deaneries, training programme directors, college tutors and ARCP panels will use the ePortfolio to monitor the progress of trainees for whom they are responsible.

All appraisal meetings, personal development plans and workplace-based assessments (including MSF) should be recorded in the ePortfolio. Trainees are encouraged to reflect on their learning experiences and to record these in the ePortfolio. Reflections can be kept private or shared with supervisors.

Reflections, assessments and other ePortfolio content should be used to provide evidence towards acquisition of curriculum capabilities. Trainees should add their own self-assessment ratings to record their view of their progress. The aims of the self-assessment are to:

- provide the means for reflection and evaluation of current practice
- inform discussions with supervisors to help both gain insight and create personal development plans.

- identify shortcomings between experience, competency and areas defined in the curriculum so as to guide future clinical exposure and learning.

6. Equality and diversity

Trainees in medical microbiology will be governed by the *Diversity and equality policy and approach* set out by the Royal College of Pathologists. A full copy of the policy is available on the College website.

The Royal College of Pathologists is committed to the principle of diversity and equality in employment, membership, academic activities, examinations and training. As part of this commitment we are concerned to inspire and support all those who work with us directly and indirectly.

Integral to our approach is the emphasis we place on our belief that everyone should be treated in a fair, open and honest manner. Our approach is a comprehensive one and reflects all areas of diversity, recognising the value of each individual. We aim to ensure that no one is treated less favourably than another on the grounds of sex, race, age, sexual orientation, gender reassignment, disability, pregnancy, maternity, religion and belief and marriage and civil partnership. Our intention is to reflect not only the letter but also the spirit of equality legislation.

Our policy will take account of current equality legislation and good practice as outlined in the Equality Act 2010 which supersedes/includes all previous legislation.

The Training Department collects information about the gender and ethnicity of trainees as part of their registration with the College. This information is recorded by the College and statistics published on an annual basis in the annual report. Further information about the monitoring activities of the College trainees, candidates and Fellows are available in the College policy.

Dual medical microbiology/infectious diseases trainees will be governed by the Equality and diversity policy of the Royal College of Physicians. An extract from this policy is below. The full policy is available on the College website.

The Royal Colleges of Physicians will comply, and ensure compliance, with the requirements of equality and diversity legislation set out in the Equality Act 2010.

The Federation of the Royal Colleges of Physicians believes that equality of opportunity is fundamental to the many and varied ways in which individuals become involved with the Colleges, either as members of staff and Officers; as advisers from the medical profession; as members of the Colleges' professional bodies or as doctors in training and examination candidates.

Quality assurance by LETBs and deaneries will ensure that each training programme complies with the equality and diversity standards in postgraduate medical training as set by the GMC. They should provide access to a professional support unit or equivalent for trainees requiring additional support.

7. Content of learning

7.1 Capabilities in practice

Capabilities in practice (CiPs) describe the professional tasks or work within the scope of medical microbiology. CiPs are based on the format of entrustable professional activities, which are a method of using the professional judgement of appropriately trained, expert

assessors as a key aspect of the validity of assessment and a defensible way of forming global judgements of professional performance.

Each CiP has a set of descriptors associated with that activity or task. Descriptors are intended to help trainees and trainers recognise the minimum level of knowledge, skills and attitudes which should be demonstrated by medical microbiologists. Trainees may use these capabilities to provide evidence of how their performance meets or exceeds the minimum expected level of performance for their year of training. The descriptors are not a comprehensive list and there are many more examples that would provide equally valid evidence of performance.

Many of the CiP descriptors refer to patient-centred care and shared decision-making. This is to emphasise the importance of patients being at the centre of decisions about their own treatment and care, by exploring care or treatment options and their risks and benefits and discussing choices available.

Additionally, the specialty CiPs repeatedly refer to the need to demonstrate professional behaviour with regard to patients, carers, colleagues and others. Good doctors work in partnership with patients and respect their rights to privacy and dignity. They treat each patient as an individual. They do their best to make sure all patients receive good care and treatment that will support them to live as well as possible, whatever their illness or disability. Appropriate professional behaviour should reflect the principles of GMP and GPC.

In order to complete training and be recommended to the GMC for the award of CCT and entry to the specialist register, the doctor must demonstrate that they have achieved the required levels for the relevant curriculum in all generic and specialty CiPs.

Satisfactory sign-off at the end of medical microbiology training requires demonstration that, for each of the CiPs, the trainee's performance meets or exceeds the minimum level of performance expected for completion (see table in section 8.3).

This section of the curriculum details the 13 generic and specialty CiPs for medical microbiology with expected levels of performance, mapping to relevant GPCs and the evidence that may be used to make an entrustment decision.

7.1.1 Generic capabilities in practice

The six generic CiPs cover the universal requirements of all specialties as described in GMP and the GPC framework. Assessment of the generic CiPs will be underpinned by the descriptors for the nine GPC domains and evidenced against the performance and behaviour expected at that stage of training. Satisfactory sign-off will indicate that there are no concerns before the trainee can progress to the next part of the assessment of clinical capabilities. It will not be necessary to assign a level of supervision for these non-clinical CiPs.

In order to ensure consistency and transferability, the generic CiPs have been grouped under the GMP-aligned categories used in the foundation programme curriculum plus an additional category for wider professional practice:

- Professional behaviour and trust
- Communication, team-working and leadership
- Safety and quality
- Wider professional practice

For each generic CiP, there is a set of descriptors of the observable skills and behaviours which would demonstrate that a trainee has met the minimum level expected. The descriptors are not a comprehensive list and there may be more examples that would provide equally valid evidence of performance.

Table 2: Generic CiPs and descriptors

Category 1: Professional behaviour and trust	
1. Able to function successfully within NHS organisational and management systems.	
Descriptors	• Demonstrates awareness of and adherence to the GMC professional requirements • Demonstrates recognition of public health issues including population health, social detriments of health and global health perspectives • Demonstrates effective clinical leadership • Practises promotion of an open and transparent culture • Demonstrates up-to-date practice through learning and teaching • Demonstrates engagement in career planning • Demonstrates capabilities in dealing with complexity and uncertainty • Demonstrates awareness of the role and processes for commissioning
Generic professional capabilities	Domain 1: Professional knowledge Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the four countries Domain 9: Capabilities in research and scholarship
Evidence to inform decision	MCR MSF ECE Active role in governance structures Management course End of placement reports ES report

2. Able to deal with ethical and legal issues related to clinical practice.	
Descriptors	• Demonstrates awareness of national legislation and legal responsibilities, including safeguarding vulnerable groups • Demonstrates behaviour in accordance with ethical and legal requirements • Demonstrates ability to offer apology or explanation when appropriate • Demonstrates leadership of the clinical and laboratory team in ensuring that medical legal factors are considered openly and consistently • Demonstrates ability to advise clinicians and other health

	professionals on medico-legal issues related to pathology
Generic professional capabilities	Domain 1: Professional knowledge Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the four countries Domain 4: Capabilities in health promotion and illness prevention Domain 7: Capabilities in safeguarding vulnerable groups Domain 8: Capabilities in education and training Domain 9: Capabilities in research and scholarship
Evidence to inform decision	MCR MSF CbD DOPS Mini-CEX ALS certificate End of life care and capacity assessment End of placement reports FRCPath ECE

Category 2: Communication, team-working and leadership	
3. Communicates effectively and is able to share decision making, while maintaining appropriate situational awareness, professional behaviour and professional judgement.	
Descriptors	• Demonstrates effective communication with clinical and other professional colleagues • Demonstrates clear communication with patients and carers in a variety of settings • Identifies and manages barriers to communication (e.g. cognitive impairment, speech and hearing problems, capacity issues, cultural issues) • Demonstrates effective consultation skills including effective verbal and nonverbal interpersonal skills • Practises effective decision making by informing the patient, prioritising the patient's wishes, and respecting the patient's beliefs, concerns and expectations • Practises effective decision making with children and young people • Demonstrates effective management and team working skills appropriately, including influencing, negotiating, re-assessing priorities and effectively managing complex, dynamic situations
Generic professional capabilities	Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty • Clinical skills (history taking, diagnosis and medical management; consent; humane interventions; prescribing medicines safely; using medical devices safely; infection control and communicable disease) • The health service and healthcare systems in the four countries Domain 5: Capabilities in leadership and team working
Evidence to inform decision	MCR MSF PS CbD Mini- CEX Management course End of placement reports ES report

Category 3: Safety and quality	
4. Is focused on patient safety and delivers effective quality improvement in patient care.	
Descriptors	• Identifies patient safety as a priority in clinical practice • Raises and escalates concerns where there is an issue with patient safety or quality of care • Demonstrates commitment to learning from patient safety investigations and complaints • Applies good practice appropriately • Contributes to and delivers quality improvement • Identifies basic Human Factors principles and practice at individual, team, organisational and system levels • Recognises the importance of non-technical skills and crisis resource management • Recognises and works within limit of personal competence
Generic professional capabilities	Domain 1: Professional knowledge Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty • Clinical skills (history taking, diagnosis and medical management; consent; humane interventions; prescribing medicines safely; using medical devices safely; infection control and communicable disease) Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the four countries Domain 4: Capabilities in health promotion and illness prevention Domain 5: Capabilities in leadership and team working Domain 6: Capabilities in patient safety and quality improvement • Patient safety • Quality improvement
Evidence to inform decision	MCR MSF ECE FRCPath End of placement reports

Category 4: Wider professional practice	
5. Able to carry out research and manage data appropriately.	
Descriptors	• Describes and explains principles of research and academic writing • Describes and explains legal and ethical frameworks underlying research in the UK • Describes and explains structures supporting health service research • Demonstrates awareness of sources of finance to support research • Demonstrates ability to manage clinical information/data appropriately • Demonstrates ability to carry out critical appraisal of the literature • Demonstrates ability to design and perform a research project • Demonstrates ability to follow guidelines on ethical conduct in research and consent for research • Identifies public health epidemiology and global health patterns
Generic professional capabilities	Domain 1: Professional knowledge Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the four countries Domain 7: Capabilities in safeguarding vulnerable groups Domain 9: Capabilities in research and scholarship
Evidence to inform decision	MCR MSF GCP certificate (if involved in clinical research) Evidence of literature search and critical appraisal of research Use of clinical guidelines Quality improvement and audit Evidence of research activity FRCPath End of placement reports

6. Acts as a teacher and clinical supervisor.	
Descriptors	• Demonstrates effective teaching and training to medical students, junior doctors, laboratory staff and other healthcare professionals • Demonstrates ability to deliver effective feedback to trainees, with appropriate action plan • Demonstrates ability to effectively supervise healthcare professionals, including medical staff, in earlier stages of training • Demonstrates ability to act as a clinical supervisor to healthcare professionals, including medical staff, in earlier stages of training
Generic Professional	Domain 1: Professional knowledge

Capabilities	Domain 8: Capabilities in education and training
Evidence to inform decision	MCR MSF TO ECE Relevant training course End of placement reports

7.1.2 Specialty capabilities in practice

The seven specialty CiPs describe the tasks or activities which are essential to the practice of medical microbiology. These CiPs have been mapped to the nine GPC domains to reflect the professional generic capabilities required to undertake these tasks.

Table 3: Specialty CiPs for medical microbiology and their descriptors

7. Able to provide clinical leadership and support to the laboratory.	
Descriptors	• Demonstrates awareness of developments, both scientific and managerial, that may affect the delivery of diagnostic microbiology (bacteriology, virology, mycology and parasitology) services • Understands legislation relevant to diagnostic microbiology laboratories including that related to health and safety • Demonstrates knowledge and understanding of methods of microbiological investigation • Demonstrates ability to select and advise on appropriate microbiological tests for clinical investigation and to oversee appropriate turnaround times • Demonstrates knowledge and understanding of microbiological (bacteriology, virology, mycology and parasitology) method validation and verification, and the concepts of sensitivity and specificity as applied to microbiological tests • Demonstrates ability to effectively use and oversee internal quality control (IQC) and external quality assurance (EQA) data to assure the overall quality of microbiological diagnostics • Demonstrates knowledge and understanding of laboratory information management systems (LIMS) and other healthcare information systems Technology systems, including understanding relevant information governance legislation • Demonstrates ability to work effectively and provide clinical leadership in a multidisciplinary team within the diagnostic microbiology laboratory • Able to evaluate and oversee the introduction of novel laboratory tests
Generic professional capabilities	Domain 1: Professional knowledge Domain 2: Professional skills • Practical skills • Communication and interpersonal skills

	• Dealing with complexity and uncertainty Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the four countries Domain 5: Capabilities in leadership and team working Domain 6: Capabilities in patient safety and quality improvement
Evidence to inform decision	CbD Mini-CEX ECE QIPAT TO MCR ES report FRCPath Part 1 DOPs FRCPath Part 2

8. Able to use the laboratory service effectively in the investigation, diagnosis and management of infection.	
Descriptors	• Demonstrates understanding of the biology of micro-organisms that may cause diseases in humans and the principles of the host-pathogen interaction • Demonstrates ability to effectively advise on appropriate microbiological (Bacteriology, Virology, Mycology and Parasitology) investigations • Demonstrates an understanding of the human microbiome, colonising organisms, and the features of pathological infection • Demonstrates ability to effectively use microbiological and other data, to form an appropriate differential diagnosis • Demonstrates knowledge and understanding of national and international microbiological guidelines • Demonstrates ability to liaise effectively with other specialty diagnostic services • Able to inform and develop local guidelines and standard operating practice (SOPs)
Generic professional capabilities	Domain 1: Professional knowledge Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the four countries Domain 4: Capabilities in health promotion and illness prevention Domain 5: Capabilities in leadership and team-working Domain 6: Capabilities in patient safety and quality improvement Domain 7: Capabilities in safeguarding vulnerable groups

Evidence to inform decision	CbD Mini-CEX ECE QIPAT TO MCR ES report FRCPath Part 1 FRCPath Part 2

9. Able to advise on infection prevention, control and immunisation.	
Descriptors	• Demonstrates knowledge and understanding of Standard Precautions in Infection Prevention and Control (IPC) and ability to advise on the appropriate use of Personal Protective Equipment (PPE) • Demonstrates knowledge and understanding of Transmission-based Precautions in IPC, including appropriate patient isolation and cohorting • Demonstrates knowledge and understanding of microbiological surveillance including patient screening methods, organism typing and genome sequencing methodologies • Applies knowledge and understanding of microbiological surveillance to prevention and control of healthcare-associated infection (HCAI) • Demonstrates ability to participate in managing outbreaks or significant cross-infection incidents in the healthcare setting • Demonstrates knowledge and understanding of the healthcare environment and equipment as potential sources of infection • Demonstrates knowledge and understanding of public health implications of specific communicable diseases and the importance of appropriate public health notification and intervention • Demonstrates knowledge and understanding of the public health aspects of vaccine-preventable infections and the benefits of vaccination • Demonstrates ability to advise appropriately on the use of active and passive immunisation, including in immunocompromised patients and in outbreaks
Generic professional capabilities	Domain 1: Professional knowledge Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty • Clinical skills (history taking, diagnosis and medical management; consent; humane interventions; prescribing medicines safely; using medical devices safely; infection control and communicable disease) Domain 3: Professional values and behaviours Domain 4: Capabilities in health promotion and illness prevention Domain 5: Capabilities in leadership and team-working

Evidence to inform decision	CbD Mini-CEX ECE QIPAT TO MCR ES report FRCPath Part 1 DOPs FRCPath Part 2

10. Able to manage and advise on important clinical syndromes where infection is in the differential diagnosis.	
Descriptors	• Demonstrates ability to take a comprehensive patient history, including when appropriate, travel, occupational, contact, drug, transfusion and sexual history, and ensures history is accurately recorded • Demonstrates ability to perform an accurate clinical examination and to clearly record examination findings • Demonstrates ability to form an appropriate differential diagnosis based on patient history, clinical examination findings and investigations • Demonstrates ability to formulate and advise on, or implement a safe and appropriate management plan • Demonstrates ability to assess, investigate, diagnose and advise on, or directly manage all aspects of suspected or proven community-acquired infection • Demonstrates ability to assess, investigate, diagnose and advise on, or manage all aspects of suspected or proven healthcare-associated infection • Demonstrates ability to assess, investigate, diagnose and advise on, or directly manage all aspects of suspected or proven infection in immunocompromised patients, including those infected with HIV
Generic professional capabilities	Domain 1: Professional knowledge Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty • Clinical skills (history taking, diagnosis and medical management; consent; humane interventions; prescribing medicines safely; using medical devices safely; infection control and communicable disease) Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the four countries Domain 4: Capabilities in health promotion and illness prevention Domain 5: Capabilities in leadership and team working Domain 6: Capabilities in patient safety and quality improvement

	Domain 7: Capabilities in safeguarding vulnerable groups
Evidence to inform decision	CbD Mini-CEX ECE QIPAT TO MCR ES report FRCPath Part 1 PS DOPs ACAT FRCPath Part 2

11. Able to lead on and advise on treatment with and stewardship of antimicrobials.	
Descriptors	• Demonstrates appropriate use and ability to advise on the appropriate use and stewardship of antimicrobials, including antibiotics, antivirals, antifungals, anti-protozoal and anti-parasitic agents • Demonstrates ability to provide leadership and education on the appropriate use and stewardship of antimicrobials, including use and implementation of evidence-based empiric and pathogen-specific antimicrobial guidelines • Demonstrates understanding of the global problem of increasing antimicrobial resistance (AMR) • Demonstrates ability to advise and lead on the appropriate use of an outpatient parenteral antimicrobial therapy (OPAT) service
Generic professional capabilities	Domain 1: Professional knowledge Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty • Clinical skills (history taking, diagnosis and medical management; consent; humane interventions; prescribing medicines safely; using medical devices safely; infection control and communicable disease) Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the four countries Domain 4: Capabilities in health promotion and illness prevention Domain 5: Capabilities in leadership and team working Domain 6: Capabilities in patient safety and quality improvement
Evidence to inform decision	CbD Mini-CEX ECE QIPAT TO MCR

	ES report FRCPath Part 1 PS FRCPath Part 2

12. Able to provide continuity of care to inpatients and outpatients with suspected or proven infection.	
Descriptors	• Demonstrates ability to assess, investigate, diagnose, advise on, or directly manage patients with suspected or proven infection in the inpatient, ambulatory and outpatient settings • Demonstrates ability to assess, investigate, diagnose, advise on, or directly manage chronic infections • Demonstrates expertise in the management of Tuberculosis (TB), including drug-resistant TB, HIV, chronic hepatitis B and C and travel-related conditions • When clinically appropriate, refers to alternative specialty inpatient or outpatient services • Managing patient at all stages, including end of life care
Generic professional capabilities	Domain 1: Professional knowledge Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty • Clinical skills (history taking, diagnosis and medical management; consent; humane interventions; prescribing medicines safely; using medical devices safely; infection control and communicable disease) Domain 5: Capabilities in leadership and team working Domain 7: Capabilities in safeguarding vulnerable groups
Evidence to inform decision	CbD Mini-CEX ECE QIPAT TO MCR ES report FRCPath Part 1 DOPs PS ACAT FRCPath Part 2

13. Able to manage and advise on imported infections.	
Descriptors	• Demonstrates the ability to assess, investigate, diagnose, advise on, and directly manage patients with imported infections • Demonstrates the ability to provide leadership in clinical care, governance and service development for patients with imported

	infections • Demonstrates comprehensive knowledge and skills in pre-travel health advice • Demonstrates the ability to manage and advise on suspected imported high-consequence infections • Demonstrates a knowledge and understanding of the epidemiology, lifecycle, diagnosis, clinical presentation and management of parasitic diseases
Generic professional capabilities	Domain 1: Professional knowledge Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty • Clinical skills (history taking, diagnosis and medical management; consent; humane interventions; prescribing medicines safely; using medical devices safely; infection control and communicable disease) Domain 3: Professional values and behaviours • Professional requirements • National legislative requirements • The health service and healthcare systems in the resource poor setting Domain 4: Capabilities in health promotion and illness prevention Domain 5: Capabilities in leadership and team working Domain 6: Capabilities in patient safety and quality improvement Domain 7: Capabilities in safeguarding vulnerable groups Domain 9: Capabilities in research and scholarship
Evidence to inform decision	MCR MSF PS QIPAT ACAT CbD ECE DOPS TO Mini-CEX Tropical medicine course (e.g. DTM&H) Travel medicine course Publications Presentation at a meeting

KEY

ECE	Evaluation of clinical/management events
CbD	Case-based discussion
FRCPath	Fellowship examination of the Royal College of Pathologists
Mini-CEX	Mini clinical evaluation exercise
DOPs	Direct observation of practical skills
MSF	Multi-source feedback
PS	Patient survey
QIPAT	Quality improvement assessment tool
TO	Teaching observation
ACAT	Acute Care assessment tool
MCR	Multiple consultant report

7.2 Syllabus

The scope of medical microbiology is broad. Any attempt to list all relevant methods, presentations, conditions and issues would be extensive, but would inevitably be incomplete and would rapidly become out of date.

The table below details the key areas of medical microbiology. These are described in more detail in appendices 1 and 2. Each of these areas should be regarded as a context in which trainees should be able to demonstrate CiPs and GPCs. Trainees will need to become familiar with the relevant knowledge, skills and values/attitudes related to these areas. The patient should always be at the centre of knowledge, learning and care.

Table 4: Overview of the syllabus for combined infection training

SECTION	COMBINED INFECTION TRAINING	
A	**Basic biology of bacteria, viruses, fungi and parasites**	**CiPs: 3, 7, 8, 9**
B	**Laboratory practice**	
	1. Pre-analytical phase	**CiPs: 3, 7, 8**
	2. Analytical phase	**CiPs: 3, 4, 7, 8**
	3. Post-analytical phase	**CiPs: 3, 4, 7, 8**
	4. Laboratory management and quality assurance	**CiPs: 1, 4, 7**
	5. Health and safety	**CiPs: 4, 7, 9**
C	**Principles of public health in relation to infection**	**CiPs: 1, 3, 9**
D	**Infection prevention and control**	**CiPs: 1, 2, 3, 4, 8, 9, 11**
E	**Important clinical syndromes**	**CiPs: 3, 8, 9, 10**
F	**Use of antimicrobial agents**	**CiPs: 3, 9, 11**
G	**Vaccination**	**CiPs: 1, 2, 8**
H	**Management of HIV infection**	**CiPs: 1, 2, 3, 9, 12**
I	**Travel and geographical health**	**CiPs: 1, 2, 7, 8, 9, 10**

Table 5: Overview of the syllabus for higher infection training in microbiology

	HIGHER INFECTION TRAINING IN MEDICAL

	MICROBIOLOGY	
J	Scientific basis of bacterial, viral, fungal and parasitic infection	CiPs: 3, 7, 8, 11, 12, 13
K	Microbiology laboratory practice Health and safety	CiPs: 1, 2, 3, 4, 5, 6, 7, 8, 9, 13
L	Important clinical syndromes	CiPs: 1, 3, 4, 8, 10, 12, 13
M	Management of the immunocompromised patient	CiPs: 3, 8, 10, 12
N	Management of infections and the use of antimicrobial agents (including adjunctive anti-infective therapy)	CiPs: 3, 4, 5, 8, 11, 12, 13
O	Infection prevention and control	CiPs: 1, 2, 3, 4, 9, 11, 13
P	Principles of public health in relation to communicable diseases	CiPs: 1, 3, 4, 7, 8, 9, 13
Q	Vaccination	CiPs: 1, 2, 9, 13
R	Research and development in medical microbiology	CiPs: 5

8. Programme of assessment

8.1 Purpose of assessment

The Royal College of Pathologists' mission is to promote excellence in the practice of pathology and to be responsible for maintaining standards through training, assessments, examinations and professional development.

The purpose of the Royal College of Pathologists' assessment system in medical microbiology is to:

- indicate suitability of choice at an early stage of the chosen career path
- indicate the capability and potential of a trainee through tests of applied knowledge and skill relevant to the specialty
- demonstrate readiness to progress to the next stage(s) of training having met the required standard of the previous stage
- provide feedback to the trainee about progress and learning needs
- support trainees to progress at their own pace by measuring a trainee's capacity to achieve competencies for their chosen career path
- help to identify trainees who should change direction or leave the specialty
- drive learning demonstrated through the acquisition of knowledge and skill
- enable the trainee to collect all necessary evidence for the ARCP
- allow the trainee to gain Fellowship of The Royal College of Pathologists
- provide evidence for the award of the CCT
- assure the public that the trainee is ready for unsupervised professional practice.

A blueprint of the medical microbiology assessment system which is mapped to good medical practice can be viewed under 8.7.

8.2 Programme of assessment

The programme of assessment refers to the integrated framework of exams, assessments in the workplace and judgements made about a learner during their approved programme of training. The purpose of the programme of assessment is to robustly evidence, ensure and clearly communicate the expected levels of performance at each stage of training, and to demonstrate satisfactory completion of training as required by the curriculum.

Each of the six generic and seven specialty CiPs has descriptors which align to the medical microbiology syllabus (appendix 1). During their training, trainees should gather a range of evidence for each CiP, picked from the options listed in tables 2 and 3. Other evidence may be allowable at the discretion of the educational supervisor and ARCP panel. On the basis of this evidence the educational supervisor can make a judgement as to the entrustability of that trainee to perform each capability.

Table 6: Level descriptors for specialty CiPs

Level	Descriptor
Level 1	Entrusted to observe only – no provision of clinical care.
Level 2	Entrusted to act with direct supervision: The trainee may provide clinical care, but the supervising physician is physically within the hospital or other site of patient care and is immediately available if required to provide direct bedside supervision.
Level 3	Entrusted to act with indirect supervision: The trainee may provide clinical care when the supervising physician is not physically present within the hospital or other site of patient care, but is available by means of telephone and/or electronic media to provide advice, and can attend at the bedside if required to provide direct supervision.
Level 4	Entrusted to act unsupervised.

8.3 Assessment of CiPs

Assessment of CiPs involves looking across a range of different skills and behaviours to make global decisions about a learner's suitability to take on particular responsibilities or tasks, as do decisions about the satisfactory completion of presentations/conditions and procedural skills set out in this curriculum. The outline grid in table 7 sets out the level of supervision expected for each of the specialty CiPs.

Table 7: Outline grid of levels expected for medical microbiology specialty CiPs

		Combined infection training		Medical microbiology		Dual option (MM/ID)		
		CIT year 1	CIT year 2	HIT year 3 MM	HIT year 4 MM	HIT year 3 ID/MM	HIT year 4 ID/MM	HIT year 5 ID/MM
1.	Able to provide clinical leadership and support to the laboratory	2	2	3	4	3	3	4
2.	Able to use the laboratory service effectively in the investigation, diagnosis and management of infection	2	2	3	4	3	3	4
3.	Able to advise on infection prevention, control and immunisation	2	2	3	4	3	3	4
4.	Able to manage and advise on important clinical syndromes where infection is in the differential diagnosis	2	3	3	4	3	3	4
5.	Able to lead and advise on treatment with and stewardship of antimicrobials	2	3	3	4	3	3	4
6.	Able to provide continuity of care to inpatients and outpatients with suspected or proven infection	2	3	3	3	3	3	4
7.	Able to manage and advise on imported infections	2	2	2	2	3	3	4

8.4 Methods of assessment (evidence)

There are several types of assessment. These include summative and formative workplace-based assessments and the FRCPath examination. A range of assessments is needed to generate the evidence required for global judgements to be made about satisfactory performance, entrustment levels and completion of training.

Workplace-based assessment (WPBAs)

The programme of assessment emphasises the importance and centrality of professional judgement in making sure learners have met the learning outcomes and expected levels of performance set out in the approved curricula. Assessors will make accountable, professional judgements. The programme of assessment includes how professional judgements are used and collated to support decisions on progression and satisfactory completion of training.

The assessments will be supported by structured feedback for trainees. Assessment tools will be both formative and summative and have been selected on the basis of their fitness for purpose.

Reflection and feedback should be an integral component to all workplace-based assessments (WPBAs). In order for trainees to maximise benefit, reflection and feedback should take place as soon as possible after an event. Every clinical encounter can provide a unique opportunity for reflection and feedback and this process should occur frequently. Feedback should be of high quality and should include an action plan for future development for the trainee. Both trainees and trainers should recognise and respect cultural differences when giving and receiving feedback.

In general, workplace-based assessments are designed to be formative in nature; as such they are best suited to determining educational progress in different contexts. To this end, it is strongly recommended that workplace-based assessments be carried out regularly throughout training to assess and document a trainee's progress.

WPBAs will indicate to the trainee and their educational supervisor how they are progressing in relation to that stage of training. To support this, workplace-based assessments and multiple consultant reports will include global assessment anchor statements as follows.

Global assessment anchor statements**:**

- Below expectations for this year of training; may not meet the requirements for critical progression point.
- Meeting expectations for this year of training; expected to progress to next stage of training.
- Above expectations for this year of training; expected to progress to next stage of training.

A minimum number of 'satisfactory' workplace-based assessments should be completed during each stage of training (see ARCP decision aid) but they should also be used as additional evidence to inform assessments of progress in entrustment levels.

WPBAs will include:

- case-based discussion (CbD)
- directly observed practical skills (DOPS)
- evaluation of clinical events (ECE)
- mini clinical evaluation exercise (Mini-CEX)
- multi-source feedback (MSF)
- Acute Care Assessment Tool (ACAT)
- Quality Improvement Project Assessment Tool (QIPAT)
- teaching observation (TO).

Further guidance is provided in the ARCP decision aid about the method and required frequencies of these assessments.

FRCPath examination
The FRCPath examination is the major summative assessment of competence in medical microbiology. FRCPath Part 1 is the same examination as the combined infection certificate examination (CICE).

FRCPath Part 1

- It is recommended, for all infection trainees, that FRCPath Part 1 is attempted for the first time during Year 2 of combined infection training or at the beginning of the first year of higher infection training.
- For mono-specialty medical microbiology trainees, FRCPath Part 1 should be obtained by the end of the first year of higher infection training. If the trainee were to fail the FRCPath Part 1 examination at this time, progression would still be permitted subject to evidence of satisfactory progress otherwise, as assessed at ARCP.
- For dual specialty trainees (medical microbiology/infectious diseases), FRCPath Part 1 should be obtained by the end of the second year of HIT in order to progress to the third (final) year of training.

FRCPath Part 2

- It is recommended that FRCPath Part 2 is attempted for the first time towards the end of the first year of higher infection training.
- The FRCPath Part 2 examination must be passed before completion of the training programme.

The precise timing for each trainee should be based on their individual progress and agreed with educational and clinical supervisors.

8.5 Critical progression points

There will be two critical progression points during medical microbiology training. The first is at entry to combined infection training and the second is at award of the CCT.

The outline grid (table 7) sets out the **expected** level of supervision and entrustment for the specialty CiPs at each stage of medical microbiology training and is used as a guide to inform ARCP decisions (see section 8.6 below).

8.6 Evidence of progress

Evidence of competence
Annual review of competence progression
The ARCP is an annual opportunity for evidence gathered by a trainee, relating to their progress in the training programme, to document the competencies that are being gained. Evidence of competence will be judged based on a portfolio of documentation, culminating in an Educational Supervisor's Structured Report (ESSR).

Lack of progress, identified by the issue of an ARCP outcome 3 or 5 and necessitating repeat training to rectify deficiencies, will lead to the extension of training. Training leading to the issue of an ARCP 3 or 5 and necessitating repeat training will not be recognised towards the award of the CCT. Evidence of ARCP outcome 6 is required as part of the evidence for the award of the CCT.

The responsibilities of the trainee, educational supervisors and ARCP panels are summarised below.

Responsibilities of trainees

Towards the end of the training year, trainees will make a self-assessment of their progression for each CiP and record this in their ePortfolio with signposting to the evidence to support their rating. In advance of the ARCP, trainees will then need to obtain an ESSR. For this they will need to show the following on their ePortfolio:

1. Evidence that they have completed the minimum requirements for the specialty, including workplace- and knowledge-based assessments for the preceding clinical year (see the ARCP decision aid for further guidance). These need to be completed contemporaneously during each training module during the year. They should be done pro rata for those who are only in-programme for part of the year or are less than full time.
2. Sufficient evidence that they are reaching the expected entrustment level (see table 7) for that year of training for each of the six generic and seven speciality capabilities in practice. See tables 2 and 3 for evidence that can be used to inform this decision. Evidence to inform entrustment levels can be selected with a 'pick and mix' approach from these tables, but should be sufficient to demonstrate an entrustment level to the educational supervisor and ARCP panel.

Responsibilities of educational supervisors
Educational supervisors should meet with trainees regularly to check progress. In advance of the ARCP they should do the following:

1. Check that trainees have achieved the minimum requirements for the relevant decision aid(s).
2. Review the ePortfolio to ensure there is sufficient additional evidence (including workplace-based assessments, feedback received from clinical supervisors via the multiple consultant report, and the trainee's self-assessment) to make a recommendation for the entrustment level for each generic and speciality CiP.
3. Decide a recommendation for the entrustment level (1–4) (see table 7) for each CiP.
4. Complete an ESSR on the ePortfolio.

All trainees will need an ESSR to inform the ARCP. For trainees who are dual training in infectious diseases/medical microbiology or infectious diseases/medical virology, this can be with a single report covering both specialties or, when there are separate educational supervisors, with two reports – one for medical microbiology and one for infectious diseases.

Failure to reach the expected entrustment levels in every CiP can still allow progression at the discretion of the ARCP panel, taking into account the individual and the programme. For an outcome 6 (final outcome leading to the award of a CCT), all required entrustment levels must be met, as this is a critical progression point.

Completed ARCP outcome forms are needed for each specialty. Dual trainees will require two ARCP outcome forms each year.

8.7 Decisions on progress

The decisions made at ARCPs and upon completion of training should be clear and defensible. They must be fair and robust and make use of evidence from a range of assessments, potentially including exams and observations in practice or reflection on behaviour by those who have appropriate expertise or experience. They can also incorporate commentary or reports from longitudinal observations, such as from supervisors, or formative assessments demonstrating progress over time.

Periodic (at least annual) review should be used to collate and systematically review evidence about a doctor's performance and progress in a holistic way and make decisions

about their progression in training. The ARCP process supports the collation and integration of evidence to make decisions about the achievement of expected outcomes.

LETBs/deaneries are responsible for organising and conducting ARCPs. The evidence to be reviewed by ARCP panels should be collected in the ePortfolio.

In order to guide trainees, supervisors and the ARCP panel, the College has produced an ARCP decision aid, which sets out the requirements for a satisfactory ARCP outcome at the end of each training year and critical progression point. The ARCP decision aid is available on the College website.

8.8 Assessment blueprint

The table below shows some of the possible, indicative methods of assessment that may be used to judge the level of capability (1–4) for each CiP. It is neither expected nor required that every method will be used to inform judgement for each CiP, and additional relevant evidence not listed here may also be used to help make a judgement on level of capability for any of the specialty CiPs.

The relevant ARCP decision aid for the specific training programme states the minimum number and type of satisfactorily completed WBPAs (e.g. CbD, Mini-CEX, ECE, ACAT, MSF) required during each full-time equivalent year of training. Trainees and trainers should refer to the relevant decision aid for these minimum requirements.

KEY

ECE	Evaluation of clinical/management events
CbD	Case-based discussion
FRCPath	Fellowship examination of the Royal College of Pathologists
Mini-CEX	Mini clinical evaluation exercise
DOPs	Direct observation of practical skills
MSF	Multi-source feedback
PS	Patient survey
QIPAT	Quality improvement assessment tool
TO	Teaching observation
ACAT	Acute care assessment tool
MCR	Multiple consultant report

Table 8: Evidence that can be used to inform each CiP

Capabilities in practice (CiPs)	ACAT	CbD	ECE	DOPS	MCR	Mini -CEX	MSF	PS	QIPAT	TO	FRCPath Pt 1	FRCPath Pt 2
Generic CiPs												
Able to function successfully within NHS organisational and management systems			✓		✓		✓					
Able to deal with ethical and legal issues related to clinical practice		✓	✓	✓	✓	✓	✓					✓
Communicates effectively and is able to share decision making, while maintaining appropriate situational awareness, professional behaviour and professional judgement		✓			✓	✓	✓	✓				
Is focused on patient safety and delivers effective quality improvement in patient care			✓		✓		✓					✓
Carrying out research and managing data appropriately					✓		✓		✓			✓
Acting as a clinical teacher and clinical supervisor			✓		✓		✓			✓		
Specialty CiPs												
Able to provide clinical leadership and support to the laboratory		✓	✓	✓	✓	✓			✓	✓	✓	✓
Able to use the laboratory service effectively in the investigation, diagnosis and management of infection		✓	✓		✓	✓			✓	✓	✓	✓
Able to advise on infection prevention, control and immunisation		✓	✓	✓	✓	✓			✓	✓	✓	✓
Able to manage and advise on important clinical syndromes where infection is in the differential diagnosis.	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Able to lead and advise on treatment with and stewardship of antimicrobials		✓	✓		✓	✓		✓	✓	✓	✓	✓
Providing continuity of care to inpatients and outpatients with suspected or proven infection	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Able to manage and advise on imported infections	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

8.9 Supervision and feedback

Specialty training must be appropriately delivered by the senior medical and scientific staff on a day-to-day basis, under the direction of a designated educational supervisor and a Specialty Training Committee that links to the appropriate Postgraduate Deanery.

Educational supervision is a fundamental conduit for delivering teaching and training in the NHS. It takes advantage of the experience, knowledge and skills of educational supervisors/trainers and their familiarity with clinical situations. It ensures interaction between an experienced clinician and a doctor in training. This is the desired link between the past and the future of medical practice, to guide and steer the learning process of the trainee. Clinical supervision is also vital to ensure patient safety and the high quality service of doctors in training.

The College expects all doctors reaching the end of their training to demonstrate competence in clinical supervision before the award of the CCT. The College also acknowledges that the process of gaining competence in supervision starts at an early stage in training, with foundation doctors supervising medical students and specialty registrars supervising more junior trainees. The example provided by the educational supervisor is the most powerful influence upon the standards of conduct and practice of a trainee.

The role of the educational supervisor is to:

- have overall educational and supervisory responsibility for the trainee in a given post
- ensure that the trainee is familiar with the curriculum relevant to the year/stage of training of the post
- ensure that the trainee has day-to-day supervision appropriate to their stage of training
- ensure that the trainee is making the necessary clinical and educational progress during the post
- ensure that the trainee is aware of the assessment system and undertakes it according to requirements
- act as a mentor to the trainee and help with both professional and personal development
- agree a training plan (formal educational contract) with the trainee and ensure that an induction (where appropriate) has been carried out soon after the trainee's appointment
- discuss the trainee's progress with each trainer with whom a trainee spends a period of training
- undertake regular formative/supportive appraisals with the trainee (two per year, approximately every six months) and ensure that both parties agree to the outcome of these sessions and keep a written record
- regularly inspect the trainee's training record, inform trainees of their progress and encourage trainees to discuss any deficiencies in the training programme, ensuring that records of such discussions are kept
- keep the STC Chair informed of any significant problems that may affect the individual's training
- prepare for the ARCP (see section 8.6).

In order to become an educational supervisor, a consultant must have a demonstrated interest in teaching and training and appropriate access to teaching resources, be involved in and liaise with the appropriate regional training committees and be involved in annual reviews and liaise closely with the TPD. The deaneries organise training programmes for educational supervisors' development. Educational supervisors are expected to keep up to date with developments in postgraduate medical training (e.g. by attending deanery and national training the trainer courses), have access to the support and advice of their senior colleagues regarding any issues related to teaching and training, and keep up to date with their own professional development.

9. Curriculum review and updating

The curriculum will be evaluated and monitored by the Royal College of Pathologists as part of continuous feedback from STCs, TPDs, trainers and trainees.

The curriculum will be formally reviewed in the first instance by the Medical Microbiology Curriculum Working Group within two years of publication. In reviewing the curriculum, opinions will be sought from the College's Combined Infection Training SAC, its related subspecialty sub-committees, the Trainees Advisory Committee, the Lay Governance Group, and its Fellows and Registered Trainees.

Any significant changes to the curriculum will need the approval of the Royal College of Pathologists' Council and the GMC.

10. Transitional arrangements

With the exception of trainees in the final year of training prior to the award of the CCT, all medical microbiology trainees who meet the entry requirements for this curriculum will transfer to this curriculum.

Trainees in the final year of training will remain on their current curriculum.

Appendix 1: Syllabus

The scope of medical microbiology is broad, including laboratory diagnostics (bacteriology, virology, parasitology, mycology), laboratory support and leadership, the ability to deliver high quality clinical advice, infection prevention and control, and antimicrobial stewardship. Complex infections can occur in any healthcare setting, so the role of the medical microbiologist spans primary, secondary and tertiary care. Medical microbiologists need to be able to manage complex infections such as those in immunocompromised hosts (e.g. haematology-oncology and transplant patients, those with diabetes, and frail patients), in device-related infections (such as infected lines, orthopaedic devices or prosthetic heart valves), and those due to multi-drug-resistant organisms and imported/emerging infections. They need to have an understanding of antiviral treatments (e.g. in HIV, viral hepatitis, influenza). They need to be able to provide leadership in the effective use of the laboratory, clinical infection services, rational antimicrobial prescribing and guideline development. The syllabus aims to provide broad training in all areas within the scope of practice of a consultant medical microbiologist.

The table below details the key areas of medical microbiology. Each of these areas should be regarded as a context in which trainees should be able to demonstrate CiPs and GPCs. Trainees will need to become familiar with the relevant knowledge, skills, values and attitudes related to these areas.

COMBINED INFECTION TRAINING (CIT)	
A. Basic biology of bacteria, viruses, fungi and parasites	**CiPs: 3, 7, 8, 9**
Knowledge	**Skills**
• Describes and explains basic biology, including structure, function, genetics, and pathogenesis of major bacterial, viral, fungal and parasitic agents • Explains the principles of microbiological and clinical classification of micro-organisms • Explains local and global epidemiology of major infectious agents and their disease associations • Explains the principles of the immune response to infection and the role of innate and adaptive immunity • Explains the basis of different types of host-parasite relationships, e.g. the importance and evolution of normal flora, viral latency and quasispecies evolution • Explains the principles of active and passive immunisation	• Demonstrates application of knowledge of basic biology and host-pathogen relationship to inform clinical management of infection
B. Laboratory practice	**CiPs: 3, 4, 7, 8, 9**
Knowledge	**Skills**

Pre-analytical phase • Explains the range of investigation and diagnostics available in different clinical scenarios, the optimal samples to send and the conditions in which to send them • Describes the repertoire of investigations available for a given clinical scenario, and understand their merits and limitations • Demonstrates the ability to refer to the local laboratory standard operating procedures (SOPs) for guidance on the nature of the sample and the tests performed • Explains the correct sample type, volume (where relevant) and optimal conditions for storage and transport that are required for the individual test	• Demonstrates the ability to select the most appropriate investigations for the individual patient
Analytical phase • Demonstrates the ability to understand and appreciate the advantages, limitations and use of investigations and diagnostics, and the role and use of reference laboratories • Describes health and safety aspects of laboratory diagnostic procedures and bio-safety level classification when dealing with pathogens • Explains the principles, uses and limitations of laboratory diagnostic procedures (manual, automated and point-of-care) – including microscopy, culture, sensitivity testing, European Committee on Antimicrobial Susceptibility Testing (EUCAST) guidelines, protein/nucleic acid-based tests, serological/other assays of host-response, and more novel diagnostics • Explains the repertoire and use of reference laboratories when dealing with pathogens	• Demonstrates the ability to follow an SOP/examination procedure and use time effectively and efficiently to achieve an optimal turnaround time • Demonstrates the ability to perform a wide range of routine practical laboratory procedures
Post-analytical phase • Explains the importance of keeping concise, accurate, confidential, and legible records of laboratory investigations • Demonstrates the ability to interpret laboratory investigations and their results accurately • Explains results comprehensively, and	• Demonstrates producing a laboratory report containing correct results and appropriate interpretative comments, using appropriate IT systems

demonstrates the ability to integrate with results from other specimens and other investigations, such as radiology, biochemistry and haematology	
Laboratory management and quality assurance • Explains the principles of internal and external quality assurance, and laboratory accreditation • Explains research methods relevant to service development • Demonstrates the ability to identify and investigate laboratory errors • Demonstrates an in-depth understanding of health and safety (H&S) issues both locally and nationally in order to practise safely in a laboratory and in a clinical or other setting, and to advise on safe practice • Demonstrates an understanding of risk assessment for dealing with category 3 and 4 pathogens and is familiar with the requirements for the handling of such pathogens and of patients potentially infected with them • Demonstrates knowledge of current legislative framework underpinning H&S at work • Explains basic laboratory hazards and precautions against them • Explains principles of universal precautions, hazard groups and containment levels	• Demonstrates performing horizontal, vertical, and examination audits, as appropriate to level of training • Explains the importance of good record-keeping • Explains the principles of validation/verification of new laboratory tests • Explains infection prevention and control risk assessment procedures • Demonstrates the ability to work safely in a laboratory at the appropriate Advisory Committee on Dangerous Pathogens (ACDP) level, including the use of appropriate sterilisation, disinfection and waste disposal techniques
C. Principles of public health in relation to infection	**CiPs: 1, 3, 9**
Knowledge	**Skills**
• Describes public health issues related to infectious diseases, including identifying and describing the key communicable disease threats, their aetiology, how these diseases spread, and how they are prevented • Describes modes of transmission, incubation period, period of communicability of common agents with public health importance • Describes basic epidemiological methods	• Demonstrates the ability to notify infectious disease (statutory requirements and 'good practice' notifications) when required • Demonstrates the provision of appropriate vaccine advice

• Describes the requirements for statutory and 'good practice' notification of infectious disease • Explains the function of health protection and environmental health officers (or their equivalents), and their relationship with key infection control personnel in the hospital and community • Explains the role of the UK's health protection agencies and other NHS and governmental organisations at local, national and international levels in the control of, and emergency planning for, outbreaks of infection • Explains the role of vaccination in vaccine-preventable communicable diseases	
D. Infection prevention and control (IPC)	**CiPs: 1, 2, 3, 4, 8, 9, 11**
Knowledge	**Skills**
Legislative and organisational frameworks • Explains the responsibilities of healthcare institutions for IPC under relevant legislations and guidelines • Describes the roles and responsibilities of individual members of healthcare institutions in monitoring, responding to, and resourcing IPC needs • Explains the role of public health bodies as well as reference laboratories in relation to the management of healthcare-associated infections (HCAIs) • Demonstrates an understanding of the benefits of adhering to scientifically sound practices of IPC to patients and staff, as well as the adverse outcomes resulting from failure to comply with them	• Demonstrates complying with current national legislation and guidance on IPC • Demonstrates awareness of and involvement in the complaints process • Demonstrates recognition of potential for transmission of infection in clinical settings • Demonstrates counselling patients on matters of infection risk, transmission, and control
Principles of Infection prevention and control • Explains the basic biology of common agents implicated in HCAIs and their pathogenesis • Explains the mode of spread and optimum prevention and control strategies of HCAIs	• Demonstrates following local IPC procedures • Demonstrates performing practical clinical procedures using aseptic technique • Demonstrates prescribing antibiotics

Explains the concept of 'the chain of infection':
- pathogen or infectious agent
- reservoir (patient, healthcare worker, environment)
- portal of exit
- portal of entry
- mode of transmission
- susceptible host risk factors.

- Explains the concepts of colonisation, infection and disease

- Explains the mechanisms by which organisms acquire antimicrobial resistance and how to use this knowledge to inform appropriate antimicrobial prescribing

Explains the concepts of:
- universal precautions
- protecting healthcare workers from infection in the workplace, including prevention of sharps/splash incidents
- source and protective isolation
- antibiotic stewardship
- aseptic non-touch technique (ANTT)
- single-use items.

- Describes specific control measures employed to prevent transmission of infection to include hand hygiene, PPE and isolation and cohorting strategies

- Explains the basic principles of environmental control measures, to include cleaning, disinfection, sterilisation of patient care equipment and environmental cleaning (housekeeping)

- Explains the basic principles of food hygiene in relation to catering, food production and distribution in the hospital setting, and associated aspects e.g. hazard analysis and critical control point (HACCP)

- Demonstrates understanding of the role of the hospital laundry service in the prevention and management of outbreaks

- Explains the role of the local authority in relation to infection control

- Explains the role of the occupational health department in managing staff screening during outbreaks, pre-employment screening, according to local antibiotic guidelines

- Demonstrates IPC practices

- Demonstrates critical evaluation of disinfectants, cleaning products and equipment as part of making an informed choice for an organisation

selection of PPE items and handwashing products, and in the reporting of injuries, diseases, and dangerous occurrences regulations (RIDDOR) process **Management and reporting HCAIs** • Describes the important clinical syndromes of HCAIs, risk factors, organisms involved, clinical presentation, diagnosis, treatment, prevention and control • Explains the principles of root cause analysis (RCA) and reporting infection-related adverse events including 'serious untoward incidents' (SUI) • Explains the principles of infection control audits and their importance to maintaining good medical practice **Outbreaks and surveillance** • Describes the role of the laboratory in investigating disease outbreaks • Describes the key principles underpinning outbreak investigation, control, and reporting	• Interprets and reports IPC surveillance data accurately • Demonstrates undertaking an IPC-related audit • Able to advise on appropriate PPE and demonstrate effective donning and doffing of PPE • Demonstrates utilising laboratory resources appropriately when investigating an outbreak
E. Important clinical syndromes	**CiPs: 3, 8, 9, 10**
Knowledge	**Skills**
Demonstrates a detailed knowledge (incorporating epidemiology, predisposition, presentation, clinical features, investigations, differential diagnosis, management and prognosis) of key clinical syndromes including community-acquired and healthcare-associated infections, such as: • pyrexia of unknown origin • sepsis syndromes • multisystem infections • paediatric infections • pregnancy-associated infections • blood-borne virus infections (e.g. HIV, viral hepatitis) • needlestick injuries • tuberculosis and other mycobacterial infections • cardiovascular infections • skin and soft tissue infections • bone and joint infections • device-associated infections • upper and lower respiratory tract infections • gastro-intestinal, hepatic, pancreatic and biliary infections	• Demonstrates the ability to take relevant clinical/infection history, perform a clinical examination, and use relevant investigations (including imaging) to establish a differential diagnosis • Interprets and recommends appropriate investigations and subsequently interprets the results to guide the management of infection • Demonstrates the ability to use relevant local, regional and national guidelines, especially those from specialty societies, to manage infection • Demonstrates the ability to adjust management plans in light of progress and developments • Demonstrates an understanding of acute and chronic pain management, palliative care and end of life pathways • Demonstrates how to have 'do not attempt

• urinary tract and genital infections, including sexually transmitted infections (STIs) • neurological infections • ocular infections • zoonotic infections • exanthemata. • Explains how to assess infection risk and recommends appropriate prophylactic or pre-emptive therapy Explains the nature of infection in special populations including the complexities associated with their management, including: • pregnant and postpartum women • children • neonates • those with primary and secondary immunodeficiencies • those with alcohol abuse • in persons who inject drugs (PWIDs). • Explains the types of immunodeficiency, including primary immunodeficiencies, HIV, and immunodeficiency in haematology/oncology patients and solid organ transplant patients • Understands how immunodeficiency affects susceptibility to infectious agents • Explains prevention and control of infections in immunodeficiency	cardiopulmonary resuscitation' discussions and how to document decisions
F. Use of antimicrobial agents	**CiPs: 3, 9, 11**
Knowledge	**Skills**
Properties of antimicrobial agents • Explains the concept of broad and narrow spectrum antibiotics Explains 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. • Explains mechanisms of resistance to	• Demonstrates appropriate prescribing and/or advice on prescribing antimicrobial drugs • Demonstrates adherence to evidence-based guidance • Demonstrates participation in hospital antimicrobial stewardship rounds and antimicrobial advice committee

antimicrobial agents • Explains the mechanism of action and role of monoclonal antibodies, antitoxins, and immunoglobulins in prophylaxis and treatment of infections • Describes the pharmacodynamics and pharmacokinetics of antimicrobials, and how these affect the choice and dosing of antimicrobials. Understands the differences in some patient groups, including in children, pregnancy, and burns patients. • Explains in vitro methods used to detect antimicrobial resistance and their limitations **Use of antimicrobial agents in clinical management** Explains: • the principles of empirical use of antimicrobials for common infections and syndromic presentations, before laboratory results are available • the selection of optimal antimicrobials, including combination therapy, for treatment of infection, based on susceptibility report, the clinical scenario, hypersensitivities, and potential interactions • the optimal duration of appropriate therapy and when to escalate/ de-escalate • the importance of measuring blood levels of certain antimicrobial agents to ensure clinical efficacy and reduce toxicity • contraindications to antimicrobial use **Safe use of antimicrobial agents** Explains: • the importance of the safe use of antimicrobial agents in adults and children • symptoms and signs of antimicrobial toxicity • the adverse consequences of antimicrobials, including effects on normal microbial flora, toxicity, and interactions with other drugs • Describes the importance of measuring blood levels of certain antimicrobial agents	• Demonstrates appropriate use of local antibiotic polices and national guidelines • Demonstrates audit of the use of antimicrobial agents and adherence to local and national guidance • Demonstrates the use of the most effective and non-toxic antimicrobial regimes • Demonstrates caution for potential side effects and monitors appropriately • Demonstrates prescribing to inpatients, particularly in relation to allergy, in

to avoid toxicity **Antimicrobial stewardship and control** • Describes and explains Department of Health and other regulatory bodies' requirements for antimicrobial stewardship Explains: • the importance of antimicrobial formularies, and prescribing control policies and processes • how local antimicrobial resistance patterns should be used to direct antimicrobial usage • the role of the Medicines Management Committees (or equivalent) and antimicrobial pharmacist.	pregnancy, in children and in individuals with deranged liver or kidney function • Demonstrates communicating effectively on antibiotic policy and stewardship with the antimicrobial pharmacist
G. Vaccination	**CiPs: 1, 2, 8**
Knowledge	**Skills**
Explains: • the use of licensed vaccines in prevention of disease caused by viral infection, bacterial infection and bacterial toxins • the advantages and disadvantages of live attenuated, inactivated and recombinant vaccines and conjugate vaccines • the UK and the WHO schedules for immunisation against infectious diseases • recommendations for the immunisation of healthcare workers • the immunisation protocols for patients with reduced splenic function • the use of vaccines in post-exposure prophylaxis, e.g. rabies, hepatitis A, hepatitis B, tetanus • the use of vaccines to boost pre-existing immunity e.g. VZ • the safety of vaccines and their adverse effects • testing for immunity pre- and post-vaccination, the methods available for measuring this and their limitations • the effects of vaccination on a population, e.g. herd immunity, age shifts in natural infection • how diseases can be eradicated by vaccination.	Demonstrates the ability to: • select and interpret laboratory tests for immunity • explain clearly the advantages and disadvantages of vaccination, including assessment of safety profiles • advise appropriately on the use of active and passive immunisation in prevention of infection, including in the management of outbreaks • apply national guidance on vaccination relevant to common clinical scenarios.
H. Management of HIV infection	**CiPs: 1, 2, 3, 9, 6**
Knowledge	**Skills**

Explains: • the function of the intact immune system • the pathophysiology of HIV infection • the epidemiology and natural history of HIV. • Demonstrates providing relevant counselling to patients, carers and relatives, and to individuals potentially exposed to HIV • Demonstrates knowledge of therapeutic options in HIV management • Explains the risk/benefit analysis of therapies for HIV and for prophylaxis against HIV and opportunistic infection • Recognises the clinical features of infections and other disease processes in the HIV-infected host • Recognises the relevance of specific aspects of history and specific physical signs (and their absence) • Explains the utility of appropriate laboratory investigations	• Demonstrates recognising clinical and laboratory manifestations of immune deficiency • Demonstrates interpreting test results relating to the direct management of HIV infection and explains their significance to the patient • Demonstrates advising regarding risk reduction for opportunistic infections in the HIV-infected individual, through behavioural change, chemoprophylaxis and vaccination • Demonstrates communication skills that allow patients, relatives/carers and others, including those at HIV risk, to participate in management decisions • Demonstrates providing information on HIV transmission and strategies for risk reduction
Specific HIV diagnostics and therapies • Explains current diagnostic techniques • Explains antiretroviral drugs including: • pharmacokinetics, modes of action, interactions, side effects of the commonly used agents • indications for and use of antiretroviral drugs in treating HIV infection • laboratory tests used in monitoring response and in informing the use of certain drugs • mechanisms of resistance and cross resistance • current treatment guidelines • post-exposure prophylaxis of HIV • anti-retroviral agents in the prevention of mother-to-child transmission • indications for and use of pre-exposure prophylaxis (PrEP).	• Demonstrates appropriate use of current diagnostic techniques • Demonstrates applying guidelines and recommends appropriate treatment and interventions • Recognises and monitors side effects and drug interactions • Demonstrates engaging patients to support adherence and facilitate treatment decisions • Participates in HIV MDT discussions
I. Travel and geographical health	**CiPs: 1, 2, 7, 8, 9, 10**
Knowledge	**Skills**
Recognition and treatment of imported infections	

• Explains clinical and epidemiological features of imported diseases, including viral haemorrhagic fevers and other high-consequence infections • Describes availability and limitations of specialised diagnostic tests • Demonstrates familiarity with current guidelines and availability of tertiary care and information resources • Describes management of malaria and other imported infections	• Demonstrates the ability to record appropriate travel history, and develop a differential diagnosis • Interprets and selects appropriate diagnostic tests • Demonstrates managing malaria and other common imported infections • Recognises when tertiary level care/advice is needed and how to seek it • Demonstrates dealing with suspected and confirmed high-consequence infections (e.g. viral haemorrhagic fevers) and their infection control issues • Demonstrates recording accurate pre-travel medical and travel history
Provision of health advice for travellers • Describes and explains the geographical patterns of disease, risk factors for their acquisition, and the availability of paper, electronic and other resources (e.g. vaccination guides, websites, the National Travel Health Network and Centre (NaTHNaC), the Imported fever service) • Describes and explains the use, availability, efficacy and safety of vaccines • Describes and explains the use, efficacy and safety of antimalarial prevention measures	• Demonstrates performing risk assessment appropriate to the traveller, including consideration of specific groups (e.g. the elderly, immunosuppressed patients) and the hazards of specific types of travel • Demonstrates formulating and communicating appropriately verbal and written advice for traveller, and motivating them to apply the advice • Demonstrates prescribing and administering immunisations as appropriate • Demonstrates the ability to prescribe antimalarials as appropriate
Infection-related problems of immigrants • Outlines health needs of particular populations, e.g. ethnic minorities, and recognises the impact of health beliefs, culture and ethnicity in presentations of physical and psychological conditions • Explains epidemiological and clinical features of imported infection in immigrant groups	• Recognises barriers to effective communication • Recognises both acute and chronic infections, including those that are asymptomatic, in immigrants • Demonstrates knowledge of new entrant screening programmes for TB and blood-borne virus infections

<table>
<tr><th colspan="2">HIGHER INFECTION TRAINING IN MEDICAL MICROBIOLOGY</th></tr>
<tr><td colspan="2">J. Scientific basis of bacterial, viral, fungal and parasitic infection — CiPs: 3, 7, 8, 11, 12, 13</td></tr>
<tr><th>Knowledge</th><th>Skills</th></tr>
<tr><td>• Demonstrates how basic biology and antimicrobial resistance mechanisms relate to host immune response, diagnostic laboratory testing and antimicrobial therapy

• Describes in detail the epidemiology of important human pathogens and their impact on public health

• Describes the epidemiology of major antimicrobial resistance determinants in important human pathogens and assesses the likelihood of such resistance mechanisms being present in a variety of clinical infection scenarios

• Describes the impact of veterinary and agricultural use of antimicrobials on resistance in human pathogens</td><td>• Selects appropriate laboratory tests for pathogen detection/identification and selects appropriate anti-infective therapies for a wide range of important infections

• Demonstrates expertise in assimilating infection-related differential diagnoses, informed by epidemiological factors, when patients present with complex clinical histories

• Demonstrates expertise in patient management, both in terms of antimicrobial and infection prevention practice, taking account of the likelihood of important antimicrobial resistance determinants being present in a variety of clinical situations</td></tr>
<tr><td colspan="2">K. Microbiology laboratory practice — CiPs: 1, 2, 3, 4, 5, 6, 7, 8, 9, 13</td></tr>
<tr><th>Knowledge</th><th>Skills</th></tr>
<tr><td>Pre-analytical phase
• Identifies the range of appropriate diagnostic tests available for investigating a wide range of clinical scenarios, including awareness of their basic methodology and limitations

• Identifies appropriate sample type/volume, and collection/storage/transport techniques</td><td>• Appraises clinicians and other laboratory users of appropriate test selection for different clinical situations

• Demonstrates the ability to design and critique protocols for test selection

• Demonstrated the ability to design, negotiate and institute a demand-management strategy for diagnostic services

• Recognises the workload and financial pressures on diagnostic services, and illustrates methods for managing demand</td></tr>
<tr><td>Analytical phase
• Describes and explains the laboratory methods used to diagnose common or important infections – including microscopy, culture, sensitivity testing, serological/immunological assays, antigen detection, nucleic acid detection, and also including manual and automated techniques</td><td>• Demonstrates competent performance of basic laboratory techniques, including Gram-staining, culture, organism identification, and antimicrobial susceptibility testing

• Supports and guides laboratory colleagues in solving technical problems, and is able to</td></tr>
</table>

• Recognises the limitations of such tests, and potential sources of error • Explains the methods, strengths and limitations of novel techniques such as automated bacteriology systems, whole-genome sequencing and microbiome analysis (see also sections on health and safety, and use of antimicrobials)	manage any clinical risks associated with such technical problems • Demonstrates ability to develop and critique evidence-based laboratory standard operating procedures with laboratory colleagues
Post-analytical phase • Identifies the clinical implications of laboratory results, including implications for individual patients, IPC, and public health • Demonstrates the need for confidential handling of patient data, with relevance to appropriate guidance and law such as GMC standards and the Data Protection Act • Demonstrates an appreciation of the precision of diagnostic tests and their performance in different populations	• Demonstrates guidance of laboratory staff in appropriate further test selection (including identification techniques, susceptibility testing, and use of reference laboratory facilities) when dealing with complex clinical cases • Interprets specific laboratory results, in the context of management of a particular patient or clinical problem • Demonstrates the ability to prioritise results and identify critical results that need more urgent discussion with clinicians, and/or bedside assessment of the patient • Recognises and acts on results that have potential infection control, public health or forensic significance • Demonstrates ability to handle confidential patient data sensitively and securely, and work with colleagues ensuring that patient confidentiality is maintained
Laboratory management • Explains how microbiology laboratory services are organised and managed, and explains pressures for change in the configuration of microbiology services • Describes the role of the medical microbiologist in modernising pathology services • Understands the principles of management of a laboratory budget, including charges for tests, block contracts, equipment purchase vs rental and return on investment	• Demonstrates effective clinical leadership to a microbiology service • Demonstrates the ability to effectively work with senior laboratory staff to ensure the laboratory is run in an efficient, safe and cost-effective way • Demonstrates the ability to effectively work with senior laboratory colleagues to deal with staffing or financial problems • Demonstrates leadership in the management and investigation of errors or adverse events

• Understands the principles of how to prepare a business case • Describes the process of laboratory accreditation and understands the relevant bodies responsible for this • Describes the theory and practice of quality assurance in laboratory practice • Describes the role of Information Technology in the laboratory, from sample requesting to issuing of reports; summarises the problems and limitations of IT in laboratory services • Describes the role of appraisal and medical revalidation • Describes the nature and importance of clinical governance in microbiology Demonstrates familiarity with external organisations that provide regulation or guidance on medical and laboratory practice, for example: • the British Society of Antimicrobial Chemotherapy • the National Institute of Clinical Excellence • the Care Quality Commission • the Food Standards Agency • Public Health England • equivalent bodies in Scotland, Wales and Northern Ireland • the Royal College of Pathologists, Scottish Intercollegiate Guidelines the Network, British Infection Association • Advisory Committee on Dangerous Pathogens. • Summarises legal and regulatory issues relevant to clinical and laboratory practice in microbiology, including (at the time of writing): • the Data Protection Act 1998 • the Human Tissue Act 2004 • the Health and Safety at Work Act 1974 • the Health & Social Care Act 2008 • the Public Health (Control of Infectious Diseases) Act 1984 • equivalent legislation in Scotland, Wales and Northern Ireland.	in the laboratory, especially when these may pose a clinical risk • Demonstrates clinical leadership on service development/improvement, including making and presenting a business case, and evaluation of new techniques or practices • Demonstrates the ability to train, appraise and mentor staff, and to deal with staff in difficulty • Demonstrates the ability to audit existing laboratory or clinical practices in order to improve services • Demonstrates good presentation, speaking and negotiation skills
Health and safety	

• Demonstrates ability to locate new legislative documents relating to health and safety at work • Demonstrates an up-to-date knowledge of health and safety issues and how this can be translated into local best practice	• Prepares IPC written risk assessments • Generates both vertical and horizontal audits to identify health and safety issues within both laboratory and clinical settings • Uses incident reporting and corrective actions in response to health and safety issues
L. Important clinical syndromes	**CiPs: 1, 3, 4, 8, 10, 12, 13**
Knowledge	**Skills**
Describes and explains the epidemiology, aetiology, pathogenesis, laboratory diagnosis, clinical investigation and treatment of a broad range of complex infection syndromes to enable expert, independent practice as a medical microbiologist. These include: • 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 • neurological infection • infection of the urogenital system, including sexually transmitted infection • infection of the eye, sinuses, and ear • infection involving medical devices. • Describes and explains the relationship between co-morbidities and infection Describes and explains the diagnosis and management of infection syndromes arising in special patient groups. Such groups include: • critically-ill adults • pregnant women (with focus on infections particularly important in, or unique to, pregnancy) – including pregnant women exposed to individuals with significant transmissible infections • antenatal and perinatal infections associated with congenital infection in neonates • premature neonates • children • febrile returned travellers.	• Demonstrates diagnosis of complex infection syndromes through assimilation of relevant history and the findings of clinical examination, enabled by the judicious selection and interpretation of laboratory tests and clinical investigation • Demonstrates ability to select, appropriately dose, and monitor antimicrobial drug regimens, taking account of the specific clinical circumstances of patients with complex infections and those belonging to special patient groups • Demonstrates the ability to develop evidence-based protocols for the investigation and management of complex infections • Demonstrates the ability to prioritise workload according to clinical risk and attend to time-critical aspects of patient care promptly • Demonstrates the ability to communicate effectively with patients and relatives

M. Management of the immunocompromised patient	**CiPs: 3, 8, 10, 12**
Knowledge	**Skills**
Describes the predominant immune defect and infection risk in each of the principal groups of immunocompromised patients, including: • HIV patients • oncology/solid organ tumour patients • haematology malignancy patients • solid organ transplant patients • patients with haematopoietic stem cell transplant chronic organ diseases (e.g. liver, renal, rheumatology, respiratory) • those on immunomodulating therapies • those with primary immunodeficiencies • those with co-morbidities such as diabetes and chronic renal failure • frail/elderly patients. • Describes and explains the presentation, diagnosis and clinical management of infection in the different groups of immunocompromised patients, including potential complications of treatment	• Demonstrates competence in preventing and managing infection in the patient groups listed above
N. Management of infections and the use of antimicrobial agents (including adjunctive anti-infective therapy)	**CiPs: 3, 4, 5, 8, 11, 12, 13**
Knowledge	**Skills**
Describes and explains important aspects of a wide range of antimicrobial agents, including: • mechanism of action • spectrum of activity • dose and route of administration pharmacokinetic and pharmacodynamic properties • adverse effects and interactions • prevalence of and mechanisms of resistance • need for therapeutic drug monitoring • resource issues. • Explains the mechanism of action and indications for use of adjunctive anti-infective therapy, including antitoxins, monoclonal antibodies, steroids and immunoglobulins • Identifies the appropriate antimicrobial agents for a wide range of clinical scenarios • Describes and explains the principles underlying antimicrobial prophylaxis	• Demonstrates the ability to independently manage, or advise others on the management of, common and/or important clinical infections – in particular complex or difficult-to-treat infections • Demonstrates the use of therapeutic drug monitoring to reduce toxicity and optimise therapy • Recognises when other interventions in addition to (or instead of) antimicrobial agents are required to manage an infection – for example surgical intervention, topical treatments, or adjunctive therapies • Recognises, by integrating clinical and laboratory information, those situations that do not merit antimicrobial treatment • Demonstrates ability to escalate and de-escalate antimicrobial treatment appropriately and safely

• Describes and explains the principles underlying the choice of antimicrobial agents for complex infections, or in cases of drug allergy • Summarises the limitations of antimicrobial agents in the management of infection, and when to advise other modalities of treatment • Summarises national/international guidance on the management of infections, and locates such information • Describes the pathway of antimicrobial drug discovery, development, marketing and post-marketing surveillance	• Recognises, manages and advises on adverse drug reactions to antimicrobial agents • Develops and critiques evidence-based guidelines on the use of antimicrobial agents to treat or prevent infection • Demonstrates performance of basic laboratory resistance testing, including disc-testing and MIC determination • Demonstrate inferred resistance mechanisms • Demonstrates ability to work with laboratory staff to further evaluate resistant organisms, including use of reference laboratories where appropriate • Demonstrates management or advice on management of infections due to multi-resistant organisms • Recognises and acts on resistant organisms that have infection control or public health significance
Antimicrobial resistance • Describes and explains common or important resistance mechanisms for antimicrobial agents used in routine practice • Explains current laboratory methods for detecting antimicrobial resistance • Explains the epidemiology and public health significance of antimicrobial resistance and significant multi-resistant organisms	• Demonstrates ability to design and implement measures to control antimicrobial use, in collaboration with colleagues, including in infection control and pharmacy • Explains and justify such measures to hospital management • Demonstrates ability to influence colleagues in other disciplines in order to change behaviour and safely limit antimicrobial use
Antimicrobial stewardship and control • Explains the rationale behind antimicrobial stewardship, and the regulatory requirements for this • Explains, compares and contrasts the possible methods of controlling antimicrobial use, including guidelines, formulary restriction, audits of prescribing, and antimicrobial stewardship ward rounds	• Demonstrates active contribution to the work of the drug and therapeutic committee or equivalent, including presenting and evaluating evidence for the introduction of antimicrobial or anti-infective agents
Outpatient parenteral antibiotic therapy (OPAT) • Summarises the concept of OPAT services, including advantages, risks, costs,	• Explains the benefit of an OPAT service to colleagues in hospital and primary care

contraindications, operational aspects, and clinical governance/patient safety issues	• Demonstrates the ability to draft a business case to introduce such a service • Demonstrates the ability to oversee and deliver an OPAT service, including patient selection, antibiotic selection, liaison with colleagues in other specialties and community nursing providers as appropriate, and provision of effective and safe follow-up arrangements for patients on the service • Demonstrates ability to audit the effectiveness of the OPAT service
O. Infection prevention and control (IPC)	**CiPs: 1, 2, 3, 4, 9, 11, 13**
Knowledge	**Skills**
Organisation of infection prevention and control responsibilities • Evaluates and assesses the responsibilities of healthcare institutions and primary care for IPC under the Health and Social Care Act 2012 • Describes and explains the roles and responsibilities of staff in the institution involved in delivering an IPC programme • Describes the political context of an IPC programme within an institution • Recognises the interactions between different organisations in relation to the management of healthcare-associated infections (HCAIs) • Describes the role of infection control in the procurement of new equipment and facilities • Describes and explains the principles and processes of IPC in community settings, such as in general practice and general dental practice, in nursing homes, hospices, mental health institutions, etc. **Principles of infection prevention and control** • Describes and explains the science and evidence base that underpins IPC	• Applies national legislation and guidance to IPC to contribute to evaluating and changing practice if indicated • Develops appropriate leadership skills in preparation for a leadership role in IPC on completion of training • Develops policy documents related to common and important aspects of IPC in hospital- and community-based healthcare systems • Develops evidence-based policy documents and guidance in the event of infections with novel or imported agents • Demonstrates knowledge of surveillance methods to make effective judgements on advantages and disadvantages before making a recommendation on the most appropriate surveillance methodology • Demonstrates suggestions of appropriate interventions based on surveillance data interpretation • Develops, leads, analyses and disseminates results of in-depth audits of policies and practices related to IPC • Demonstrates the ability to undertake IPC inspections, analysing the findings and providing a judgement on the quality of the processes adopted by the institution

• Describes and explains various surveillance methodologies, data extraction, analysis and reporting of HCAIs (including mandatory reporting) • Describes and explains the processes involved in undertaking IPC inspections and their interpretation • Explains engineering and design concepts relevant to IPC as published by the Department of Health (health building notes and health technical memoranda) Demonstrates a working knowledge of how to evaluate infection control risks associated with: • operation theatre design and ventilation • ventilation in augmented care areas • design and ventilation of source and protective isolation facilities • design of central sterile services departments, including evaluation and assessments of the processes of sterilisation and disinfection • water safety standards, including those related to Legionella and Pseudomonas • endoscopy design, maintenance and monitoring, including the use of appropriate high-level disinfecting agents • assessing and commissioning new and refurbished facilities in a healthcare environment • safe injection practices, including recommendations on choice of product • management of sharps and splash injuries and the principles of post-exposure prophylaxis • laboratory safety in the event of suspected Creutzfeldt–Jakob disease (CJD), including dealing with equipment and endoscopes, and patient and staff exposure. **Management of healthcare-associated infections (HCAIs)** • Describes how to risk-assess and manage cases of complex HCAIs in vulnerable patient groups, including those in augmented care environments • Describes how to manage day-to-day situations in the event of HCAIs, e.g. in the event of insufficient side-rooms, where there is more than one HCAI present, or where patients cannot be moved from an open	• Demonstrates good report and policy writing skills • Appraises evidence critically when creating policy documents • Demonstrates organisational, leadership and mentoring skills in taking a project to completion • Demonstrates maintenance of accurate and detailed clinical records • Demonstrates in-depth audits of clinical practice • Demonstrates high standards of clinical governance • Demonstrates skills related to teaching, training and mentoring • Demonstrates the ability to lead and chair root cause analyses (RCAs) and infection-related adverse events including ‘serious untoward incidents’ (SUIs) • Demonstrates the ability to tackle complex problems and provide clear, evidence-based guidance and advice in managing HCAIs or related incidents

ward • Describes and explains device-related infections and the importance of infection control and antibiotic stewardship in the prevention, management and control of such infections • Describes and explain the implications of antimicrobial drug resistance for IPC, in particular, emerging and imported complex multi-drug-resistant organisms	
P. Principles of public health in relation to communicable diseases	**CiPs: 1, 3, 4, 7, 8, 9, 13**
Knowledge	**Skills**
Principles of public health in relation to infection • Explains the key principles of outbreak investigation in the community • Describes the principles of hypothesis-generation and testing when investigating an outbreak • Demonstrates basic statistical methods and describes the concepts of mathematical modelling in designing interventions during an outbreak • Describes and explains public health aspects of vaccine-preventable infections and the benefits of vaccination • Explains the concepts of herd immunity in relation to vaccine failure • Describes and explains microbiology and epidemiology of food- and water-borne infections • Describes how to provide microbiology support in a public health emergency • Describes the features of agents of deliberate release in terms of clinical presentation, potential for spread and methods for detection and control	• Demonstrates provision of leadership on the microbiological investigation and management of community outbreaks including chairing outbreak or incident meetings as appropriate • Demonstrates the ability to work with relevant authorities in organising an emergency response • Analyses data and provides daily updates and situation reports • Writes clear and concise briefing notes as an aide to communication with colleagues in the wider healthcare environment • Demonstrates provision of clear and evidence-based specialist microbiology advice to Public Health and other clinical colleagues including GPs
Outbreak management • Describes and explains the steps involved in recognising, investigating and controlling outbreaks of infection	• Demonstrates the ability to lead the investigation of an outbreak, ensuring utilisation of expertise and resources

• Describes and explains the current laboratory, including molecular, epidemiological methods used for outbreak investigations and how to access them • Explains statistical methods used in outbreak recognition, investigation and management	• Interprets statistical data and makes recommendations for interventions for outbreak control • Demonstrates provision of guidance to the diagnostic laboratory and utilises the reference laboratory and other expert resources appropriately when investigating an outbreak • Demonstrates clear and concise report writing skills
Q. Vaccination	**CiPs: 1, 2, 9, 13**
Knowledge	**Skills**
Describes and explains: • the role of the UK Joint Committee on Vaccination and Immunisation (JCVI) in assessing information and setting vaccination policy • reporting of vaccine-related incidents to appropriate bodies e.g. the Medicines and Healthcare products Regulatory Agency (MHRA) • surveillance programmes and their role in vaccine preparedness e.g. global influenza A networks • the use of ring vaccination in outbreak control • immunisation use and efficacy in the immunocompromised • the mechanisms underlying vaccine-induced pathology.	• Demonstrates the ability to advise appropriately on the use of active and passive vaccination in the prevention of infection, including in the management of outbreaks • Demonstrates participation in surveillance programmes for vaccine-preventable infections • Demonstrates participation in initiatives in the healthcare setting to set and to meet targets for vaccination
R. Research and development in medical microbiology	**CiPs: 5**
Knowledge	**Skills**
Demonstrates understanding of: • research methods • study design and execution • research governance including ethical approval and standards of good clinical practice • dissemination of research findings.	Demonstrates the ability to: • undertake a literature review and critically appraise publications • critically appraise and interpret study results including statistical data • contribute to a publication (e.g. case report, conference poster or abstract).