The Royal College of Pathologists

Pathology: the science behind the cure

Curriculum for specialty training in chemical pathology

Draft Curriculum - 2019

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1. Introduction

Chemical Pathology (also known as Clinical Biochemistry and Medical Biochemistry) is the specialty that uses chemical tests to diagnose disease and monitor treatment. These investigations have become essential in providing safe and effective patient care on a daily basis, in every medical specialty and in every part of the National Health Service. Chemical Pathologists provide clinical and scientific leadership to laboratory services providing investigations that are essential for safe and effective patient care, and provide clinical advice for the daily management of patients, for every medical specialty and in every part of the National Health Service. In addition, Chemical Pathology consultants provide specialised direct clinical care in secondary care for patients with a variety of common and rare metabolic disorders; in particular those conditions covered by the former subspecialty of Metabolic Medicine (now incorporated into this curriculum).

2. Purpose

2.1 Purpose Statement

Chemical Pathologists take responsibility for managing the laboratories that undertake these investigations and for providing them with clinical and scientific direction. They are heavily involved in developing guidelines and protocols for disease management. A major part of their role is to advise clinicians, both in General Practice and in all specialties of secondary care, about the appropriate use and interpretation of tests in managing individual patients. Where such tests are not provided locally, they act as a link between local clinicians and specialist laboratories, for example for rare endocrine, toxicological or genomic testing. Chemical Pathologists are involved in dealing with large amounts of data and with the Information Technology systems required to manage these; and in using these to support research and audit across the whole field of medicine. Chemical Pathologists are also involved in the screening and risk management of disease; in addition to their role in cardiovascular risk management, they have an important role in managing antenatal, neonatal and cancer screening programmes.

The purpose of the curriculum is to set the standards for attainment of the award of the CCT or CESR (CP) in chemical pathology and to ensure that trainees are fully prepared to lead a full clinical and laboratory biochemistry service at consultant level in the National Health Service (NHS).

This purpose statement has been endorsed by the GMC's 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 11 capabilities in practice (CiPs) describe the professional tasks or work within the scope of Chemical Pathology. 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 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 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.

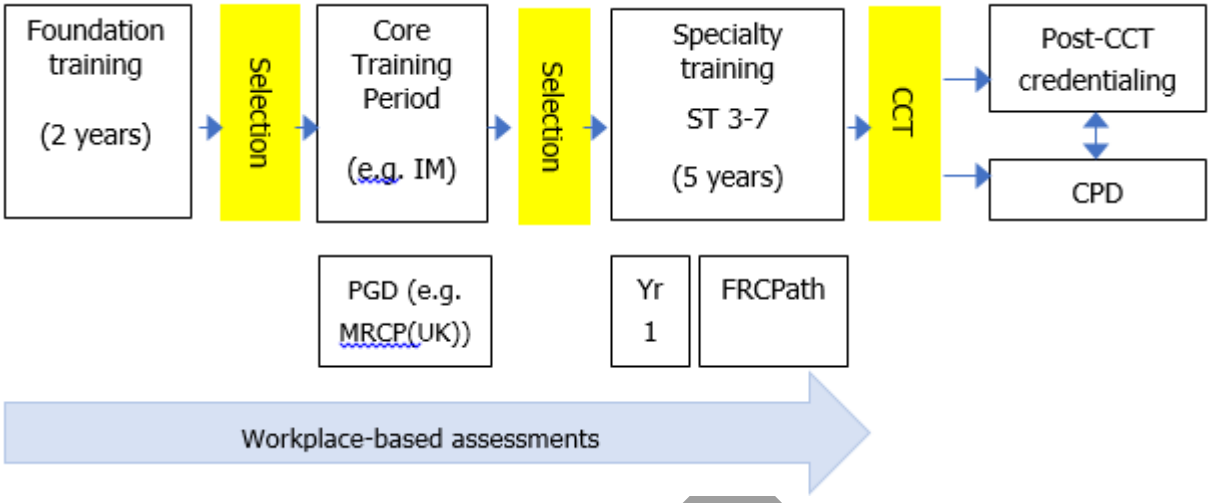
The five specialty CiPs describe the laboratory and clinical tasks or activities which are essential to the practice of Chemical Pathology. The specialty CiPs have also been mapped to the GPC domains and subsections to reflect the professional generic capabilities required to undertake the clinical tasks. 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 chemical pathology training, as defined in the curriculum.

Learning Outcomes – capabilities in practice (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 focussed on patient safety and delivers effective quality improvement in patient care. 5. Carrying out research and managing data appropriately. 6. Acting as a teacher and clinical supervisor
Specialty CiPs
1. Able to lead and manage a laboratory 2. Able to use the laboratory service effectively in the investigation, diagnosis, and management of disease processes 3. Able to manage a multi-disciplinary team effectively 4. Able to contribute effectively to the management of problems in patients in other specialties 5. Able to manage patients in an out-patient clinic, inpatient, ambulatory or community setting, including management of long term conditions

2.3 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 FRCPath Part 1 examination (typically after 18-24 months of training), they will continue to develop their skills in the laboratory (including assessment of new tests and guideline development) and in direct patient care, with greater responsibility and less direct supervision; they will also develop involvement in laboratory. After passing the FRCPath Part 2 examination, trainees will continue to develop their skills with support; they may also develop a specialist interest.

Figure 1. Structure of training in Chemical Pathology.



This curriculum will deliver a generalist medical Chemical Pathologist 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 Chemical Pathologists and Chemical Pathology services:

- 2 years of Stage 1 Internal Medicine plus MRCP(UK)
- Core paediatric training plus MRCPCH
- Core GP training plus MRCGP
- Broad Based Training plus completion of core training in one of the above specialties and the relevant postgraduate diploma.
- Acute Care Common Stem (ACCS) plus MRCP(UK)
- Core anaesthetic training plus FRCA part 1 or MRCP(UK)

The curriculum requires training to be undertaken in both the laboratory and clinical settings. As all disease processes, whether occurring in premature neonates or the very elderly, involve changes in body chemistry, the scope of Chemical Pathology covers the whole of medicine. There are some areas in which a knowledge of the underlying biochemistry is particularly relevant and trainees will be expected to attain capabilities in the following five areas, which comprised the former subspecialty of Metabolic Medicine:

- Nutrition
- Inborn errors of metabolism in adults
- Cardiovascular risk management and disorders of lipid metabolism
- Disorders of calcium and bone metabolism
- Diabetes mellitus.

Most Chemical Pathologists provide direct clinical care to patients in at least one of these areas (for example, leading clinical services for lipid clinics or nutrition), or contribute to clinical services in other areas such as endocrinology or toxicology.

2.4 Duration of training

The indicative length of training for Chemical Pathology is five years, following foundation and core training.

The CCT or CESR(CP) in chemical pathology will be awarded on the recommendation of The Royal College of Pathologists following evidence of:

- satisfactory completion of the chemical pathology curriculum and the minimum training period
- satisfactory outcomes in the requisite number of workplace-based assessments (including multi-source feedback)
- FRCPath by examination
- acquisition of Annual Review of Competence Progression (ARCP) outcome 6.

2.5 Flexibility

Chemical pathology 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 as outlined above. GPCs will promote flexibility in postgraduate training as these common capabilities can be transferred from specialty to specialty.

2.6 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 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 in order that the chemical pathology College Specialty Training Committee (CSTC) 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.

2.7 Generic Professional Capabilities and Good Medical Practice

The GMC has developed the Generic Professional Capabilities (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.

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 descriptor outlining the 'minimum common regulatory requirement' of performance and professional behaviour for those completing a CCT or its equivalent. 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 chemical pathology 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 they 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 to minimise the possibility that any deficit is identified during the final phases of training.

3. Learning and Teaching

3.1 The training programme

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

The organisation and delivery of postgraduate training is the responsibility of the Health Education England (HEE) and its Local Education and Training Boards (LETBs), NHS Education for Scotland (NES), the Wales Deanery and the Northern Ireland Medical and Dental Training Agency (NIMDTA). A training programme director will be responsible for coordinating the Chemical Pathology training programme. 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 Chemical Pathology ARCP decision aid (available on the College 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 a chemical pathology training programme following satisfactory completion of post-foundation core training programmes, whose clinical experience will closely mirror the range of clinical specialties supported by Chemical Pathologists and Chemical Pathology services:

- Two years of Stage 1 Internal Medicine plus MRCP(UK)
- Core paediatric training plus MRCPCH
- Core GP training plus MRCGP
- Broad Based Training plus completion of core training in one of the above specialties and the relevant postgraduate diploma.
- Acute Care Common Stem (ACCS) plus MRCP(UK)
- Core anaesthetic training plus FRCA part 1 or MRCP(UK)

3.3 Teaching & Learning Methods

Models of Learning

There are three broad categories of learning which trainees employ throughout run-through training: instructionalist model, 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, making use of the e-learning tool or

providing reference textbooks, etc. It is the trainee's responsibility to seek opportunity for experiential learning.

The rotations are also arranged in such a way that trainees have time available for participation in research projects as part of their training. The more academically inclined trainees will be encouraged to take time out from the 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 and graded responsibility for reporting, allowing trainees at various stages of training to acquire responsibility for independent reporting. Assessment 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 chemical pathology. 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:** Chemical pathology 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 advantage to 'read around' their subject.
- **Private study:** more systematic reading of textbooks and journals will be required in preparation for examinations.
- **Regional training courses:** these are valuable learning opportunities. Trainees should be released from service duties to attend.
- **National training courses:** these are particularly helpful during preparation for the FRCPath Part 2 examination. In addition to providing specific teaching, they also allow trainees to identify their position in relation to the curriculum and their peers.
- **Scientific meetings:** research and the understanding of research are essential to the practice of chemical pathology. Trainees should be encouraged to attend and present their work at relevant meetings.
- **Discussion with BMS:** BMS staff 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 clinico-pathological 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 inter-professional communication skills.
- **Attachment to specialist departments:** attachments of this kind will be required if a training programme cannot offer the full range of specialist experience needed to complete the curriculum. They will 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**
- **Work-based experiential learning**
- **Medical clinics including specialty clinics**
- **Multidisciplinary team meetings**
- **Practical laboratory experience**
- **Formal postgraduate teaching**
- **Independent self-directed learning**
- **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 Certificate of Completion of Training (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 of the absence, the timing and the effect of the absence on the individual's competence. Each trainee's circumstances will be considered on an individual basis and any changes to 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 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 Research

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

Research undertaken prior to entry to a chemical pathology training programme

Trainees who have undertaken a period of research that includes clinical or laboratory work directly relevant to the chemical pathology curriculum, prior to entering a chemical pathology training programme; can apply to have this period recognised towards an entry on the Specialist Register. However, as the research is unlikely to have been prospectively approved by the GMC, the route of entry to the Specialist Register will be through the CESR.

Research undertaken during a chemical pathology training programme

Trainees who undertake a period of out-of-programme research (OOPR) after entering a chemical pathology training programme and obtaining their National Training Number (NTN) may have up to 6 months accepted by the chemical pathology CSTC towards their CCT. In order to be eligible to have this period of research recognised towards the award of the CCT,

trainees must have their OOPR approved prospectively before beginning their research. However, trainees must be able to 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 inform the Training Department at The Royal College of Pathologists in order that the chemical pathology CSTC can ensure that the trainee will comply with the requirements of the CCT programme. The period of research must include clinical or laboratory work directly relevant to the chemical pathology curriculum. The documentation towards a CCT recommendation will be collected by the Training Department at the College, checked to ensure compliance and a revised provisional CCT date issued. It must be ensured that, following deanery agreement and acceptance from the chemical pathology CSTC, the GMC prospectively approve the OOPR in order that the period can count towards a CCT. 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 chemical pathology. Such trainees will normally be clinical lecturers and hold an NTN(A). It is expected that such trainees should complete the requirements of the chemical pathology 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 chemical pathology should consult the Training Department at the College on an individual basis with regard to the agreement of their provisional CCT date.

3.8 Overseas training

Some trainees may wish to spend a period of time in training outside of the UK after entering chemical pathology training as out-of-programme training (OOPT).

Overseas training undertaken prior to entry to a chemical pathology training programme

Some trainees may have undertaken a period of chemical pathology training overseas prior to entering a chemical pathology training programme in the UK. Such trainees must enter a chemical pathology training programme at ST1. Trainees can have this period recognised towards an entry on the Specialist Register but their route of entry to the Specialist Register will be through the CESR.

Overseas training undertaken during a chemical pathology training programme

Some trainees may wish to spend a period of training overseas as out of programme training (OOPT) after entering a chemical pathology training programme in the UK. Trainees can have up to one year of training overseas accepted towards their training. In order to be eligible to have this period of training recognised towards the award of the CCT, trainees must have their OOPT overseas training approved prospectively by GMC before beginning their overseas training. Prior to beginning the period of overseas training, trainees must agree the OOPT with their deanery and inform the Training Department at The Royal College of Pathologists that they will be undertaking overseas training in order that the Chemical Pathology CSTC can ensure that the trainee will comply with the requirements of the CCT programme. The documentation towards a CCT recommendation will be collected by the Training Department at the College, checked to ensure compliance and a revised provisional CCT date issued. It must be ensured that, following deanery agreement and acceptance from the Chemical Pathology CSTC, GMC prospectively approves the OOPT in order that the period can count towards a CCT. Separate guidance and an application form are available on the College website for this purpose.

Trainees must have their OOPT agreed by the relevant deanery, accepted by the Chemical Pathology CSTC and approved by GMC before beginning their overseas training.

3.9 Related clinical training

During their chemical pathology training, some trainees may wish to spend a period of training in a related clinical specialty such as paediatrics or oncology, etc. This is acceptable and should be undertaken as out-of-programme clinical experience (OOPE). However, such a period of training – although useful to the individual trainee in broadening their understanding of the relationship between chemical pathology and the clinical specialties – will not be approved by the CSTC towards the requirements of the CCT and the clinical specialties.

4. Quality Management

The curriculum outlines the minimum Chemical Pathology 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 TPD and their deanery, with the assistance of the regional STC to ensure that the programme delivers the depth and breadth of chemical pathology training outlined in the curriculum. The TPD must ensure that each post within the programme is approved by 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 GMC agreed curriculum and is provided to the standards set by the College and GMC.

It is the responsibility of GMC to quality assure training programmes and the responsibility of The Royal College of Pathologists through the Chemical Pathology CSTC 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 chemical pathology training programme. It is the trainee's responsibility to become familiar with the curriculum 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 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 ARCP decision aid are available from the Royal College of Pathologists via the website www.rcpath.org

Clinical and educational supervisors should use the curriculum and decision aid 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 College LEPT 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 LEPT 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 LEPT 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 may use the LEPT 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 LEPT. Trainees are encouraged to reflect on their learning experiences and to record these in the LEPT. Reflections can be kept private or shared with supervisors.

Reflections, assessments and other LEPT 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 assists in developing 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

The following is an extract from The Royal College of Pathologists' *Diversity and Equality Policy and approach*. 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.

7. Content of Learning

7.1 Capabilities in Practice

Capabilities in Practice (CiPs) describe the professional tasks or work within the scope of Chemical Pathology. 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 Chemical Pathologists. 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 are capable of unsupervised practice in all generic and specialty CiPs.

Satisfactory sign off at the end of Chemical Pathology training 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 internal medicine training.
This section of the curriculum details the 12 generic and specialty CiPs for Chemical Pathology 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 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.

Chemical Pathology Generic capabilities in practice (CiPs)	
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 • Practices 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
GPCs	Domain 1: Professional values and behaviours Domain 3: Professional knowledge • 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	CS/ES report ECE MSF Management & Leadership course
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

GPCs	Domain 1: Professional values and behaviours Domain 3: Professional knowledge • 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	CS/ES report MSF CbD ECE FRCPath

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 • Practices effective decision making by informing the patient, prioritising the patient's wishes, and respecting the patient's beliefs, concerns and expectations • Practices 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
GPCs	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	CS/ES report MSF CbD Mini-CEX ECE Management course

Category 3: Safety and quality	
4. Is focussed 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
GPCs	Domain 1: Professional values and behaviours 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 knowledge • 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	CS/ES report MSF CbD ECE FRCPath

Category 4: Wider professional practice	
5. Carrying out research and managing 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
GPCs	Domain 1: Professional values and behaviours Domain 3: Professional knowledge • 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	CS/ES report GPC certificate FRCPath Evidence of research activity
6. Acting 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
GPCs	Domain 1: Professional values and behaviours Domain 8: Capabilities in education and training
Evidence to inform decision	CS/ES report MSF ECE Postgraduate education qualification (certificate or higher)

7.1.2 Specialty capabilities in practice

The five specialty CiPs describe the tasks or activities which are essential to the practice of Chemical Pathology and Metabolic Medicine. These CiPs have been mapped to the nine GPC domains to reflect the professional generic capabilities required to undertake these tasks.

Satisfactory sign off will require educational supervisors to make entrustment decisions on the level of supervision required for each CiP and if this is satisfactory for the stage of training, the trainee can progress. More detail is provided in the syllabus section of the curriculum.

Specialty capabilities in practice – Chemical Pathology and Metabolic Medicine	
7. Able to lead and manage a laboratory.	
Descriptors	• Describes and explains the structure of healthcare laboratories • Describes and explains relevant legislation, including that related to Health and Safety • Demonstrates awareness of developments, both scientific and manage and delivery of Pathology services • Demonstrates awareness of the costing and financing of pathology services • Describes and explains principles of methods for biochemical analysis, and of potential interferences • Demonstrates ability to select appropriate tests and methods for clinical investigation • Demonstrates understanding of method validation • Demonstrates ability to effectively use Internal Quality Control and External Quality Assurance information to diagnose and resolve analytical problems • Describes and explains Laboratory Information Management Systems and other healthcare IT systems, including understanding the legislation surrounding information governance • Demonstrates ability to work effectively within a multidisciplinary framework within the laboratory • Demonstrates effective clinical leadership • Demonstrates ability to work effectively as a member of a multidisciplinary team within pathology, the hospital and the local healthcare economy • Demonstrates motivation for continual improvement and development of laboratory services
GPCs	Domain 1: Professional values and behaviours Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty Domain 3: Professional knowledge • 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	CS/ES report DOPS ECE FRCPath Management course

8. Able to use the laboratory service effectively in the investigation, diagnosis and management of disease.	
Descriptors	• Demonstrates professional behaviour with regard to patients, laboratory users and laboratory staff • Describes and explains normal human biochemistry and physiology, and recognises pathological deviations from this • Recognises and gives appropriate advice on pre-analytical factors which affect biochemical tests • Describes and explains national and other systems to provide advice on the use of tests and technologies • Selects appropriate repertoire of tests for the laboratory, according to clinical requirements • Indicates appropriate turnaround time for investigations, as required for management of individual patients • Demonstrates ability to effectively advise laboratory users appropriately on the choice of investigations for individual patients • Uses biochemical and other data effectively to form a differential diagnosis • Demonstrates ability to effectively advise laboratory users appropriately on the interpretation of laboratory results • Demonstrates understanding of criticality of some investigations to patient management and has ability to add clarifying tests to assist interpretation and clinical management • Describes and explains reasoning behind investigational and diagnostic advice clearly to clinicians and to laboratory staff • Recognises the need to liaise effectively with specialty services and refers where appropriate
GPCs	Domain 1: Professional values and behaviours Domain 2: Professional skills • Practical skills • Communication and interpersonal skills • Dealing with complexity and uncertainty Domain 3: Professional knowledge • 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	CS/ES report MSF ECE FRCPath

9. Able to manage a multi-disciplinary team effectively.	
Descriptors	• Demonstrates effective management and team working skills, including influencing, negotiating, continually re-assessing priorities and effectively managing complex, dynamic situations • Identifies and supports effective continuity and coordination of patient care through the appropriate transfer of information • Practises patient centred care including shared decision making • Recognises the importance of prompt and accurate information sharing with the team primarily responsible for the care of the patient
GPCs	Domain 1: Professional values and behaviours 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
Evidence to inform decision	CS/ES report MSF Mini-CEX CbD ECE
10. Contributes effectively to the management of medical problems in patients in other specialties.	
Descriptors	• Demonstrates effective consultation skills (including when in challenging circumstances) • Demonstrates provision of appropriate advice about patients under the care of other specialties • Demonstrates appropriate and timely liaison with other medical specialty services when required • Demonstrates the ability to collaborate across specialties in developing and implementing guidelines
GPCs	Domain 1: Professional values and behaviours 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 7: Capabilities in safeguarding vulnerable groups
Evidence to inform decision	CS/ES report MSF CbD ECE

11. Able to manage patients in an outpatient clinic, inpatient, ambulatory or community setting, including management of long-term conditions.	
Descriptors	• Demonstrates professional behaviour with regard to patients, carers, colleagues and others • Practises patient centred care including shared decision making • Demonstrates effective consultation skills • Formulates an appropriate diagnostic and management plan, taking into account patient preferences • Demonstrates the ability to use evidence-based medicine and remain up to date on national and international guidance in order to provide the most appropriate clinical care • Describes and explains clinical reasoning behind diagnostic and clinical management decisions to patients/carers/guardians and other colleagues • Demonstrates ability to manage comorbidities in outpatient clinic, ambulatory or community setting • Identifies patients with limited reversibility of their medical condition and determines palliative and end of life care needs • Demonstrates effective consultation skills in challenging circumstances • Demonstrates compassionate professional behaviour and clinical judgement • Demonstrates awareness of the quality of patient experience • Recognises and works within limit of personal competence, and refers to other specialties when required
GPCs	Domain 1: Professional values and behaviours 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 knowledge • Professional requirements • National legislation • The health service and healthcare systems in the four countries Domain 7: Capabilities in safeguarding vulnerable groups
Evidence to inform decision	CS/ES report MSF CbD ECE

7.2 Syllabus

The scope of Chemical Pathology is broad, covering the biochemical processes which underlie the whole of human physiology and medicine. Metabolic Medicine is a more constrained topic, covering 5 defined areas of medicine (calcium and bone, cardiovascular risk, diabetes, inherited metabolic disease in adults, and nutrition) where a knowledge of metabolic processes is particularly relevant to providing direct clinical care, but it is a developing area (especially with regard to inborn errors of metabolism). 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 Chemical Pathology and Metabolic Medicine. 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.

Knowledge	Skills	Values and behaviours
Laboratory		**CiPs: 1, 2, 3, 4, 5, 6, 7, 9**
Explains the fundamentals of effective laboratory operation, including: • Arrange sample collection, transport and storage • Describe laboratory automation • Describe IQC and EQA • Describe laboratory computerisation and information technology • Demonstrate the appropriate methods and circumstances for sharing confidential information • Describe and explain Health and Safety	• Describe and explain effectively on sample requirements and collection • Demonstrates fundamental laboratory techniques; e.g. centrifugation, pipetting • Demonstrates interpreting IQC and EQA data • Demonstrates use of computing within the laboratory, databases, spreadsheets and internet and associated information governance	• Demonstrates proactive approach to new technology • Demonstrates effective communication with staff both within and outside the laboratory • Demonstrates a critical attitude in assessing and using IQC and EQA data • Demonstrates correct methods of and circumstances for sharing of confidential information • Demonstrates concern for Health and Safety of laboratory staff and users
<u>Laboratory methods:</u> • Describes common laboratory techniques: e.g. ion-selective electrodes, osmometry, spectroscopy, enzymic assays, immunoassay, chromatography, electrophoresis • Describes specialist laboratory techniques, including: chromatography (thin-layer, gas, ion exchange, HPLC), iso-electric focussing, mass spectroscopy and spectrometry, molecular biology (blotting techniques, PCR, sequencing) • Describes the optimisation and evaluation of laboratory methods • Describes mechanisms of common interferences (e.g.	• Demonstrates performance and interpretation of common laboratory techniques • Demonstrates performance and interpretation of some specialist laboratory techniques; e.g. chromatography, mass spectroscopy • Demonstrates ability to recognise and investigate problems with assays • Discuss the effect of genetic and environmental influences	• Demonstrates a critical approach to the ongoing performance of laboratory methods

haemolysis, jaundice, substrate depletion, heterophylic antibodies, "hook effect") in assays • Describes development of reference ranges, and the factors (e.g. age, gender, menstrual cycle) on these	such as age, sex, nutrition, time of day, stress, posture, hospitalisation and therapeutic agents on biochemical results	
• Describes principles and use of point-of-care methods	• Discuss the advantages and disadvantages of point of care measurements • Advise on choice, management and safe use of POC equipment	• Demonstrates understanding of the role of POCT in patient care and the management and control of associated risks
<u>Method development and validation</u>		
• Discusses how a measurement method is developed, validated, and introduced into service use with appropriate reference intervals • Discusses the development of metrological traceability, international reference preparations, calibrants, controls with assigned values, and external quality assurance specimens with unknown values	• Demonstrates an understanding of the principles of method development and validation	
<u>Biological, pre-analytical, and analytical variability</u>		
• Describes how variability due to biological effects, and pre-analytical and analytical factors arises • Discusses how this variability affects the results of measurements in the laboratory, and what can be done to reduce, or allow for it • Discusses uncertainty of measurement • Describes how to determine the minimum clinically significant change, and how this affects the accuracy and precision required for measurement in the laboratory	• Interpret variation in results within individuals to determine whether a significant change has occurred	• Demonstrates understanding of the importance of effective liaison with lab users regarding the impact of variability on testing
<u>Laboratory management:</u>		
• Describes the organisation of		

laboratory services • Describes principles of personnel management • Describes the structure and function of a laboratory	• Demonstrates effective staff management skills	
• Describes the resourcing and finances of laboratory services	• Demonstrates ability to understand and manage a budget • Demonstrates ability to develop a business plan	• Demonstrates concern for effective use of resources
• Describes the structure and organisation of a hospital/Trust/Health Board, and a laboratory service's place within this	• Demonstrates effective interaction with colleagues in other specialties • Demonstrates ability to develop local guidelines and to apply advice from specialist and national bodies (NICE, SIGN)	• Demonstrates effective education and provision of information to laboratory staff and to clinicians
• Describes the principles of assessment and management of risk	• Demonstrates ability to undertake root cause analysis	• Demonstrates concern to continually improve laboratory service • Demonstrates ability to evaluate issues and possible solutions • Demonstrates concern for patient safety • Demonstrates honesty and candour in managing clinical incidents
• Describes principles of laboratory accreditation	• Demonstrates understanding of role of accreditation in ensuring quality of laboratory service and results	
Duty Biochemist role: • Describes the processes of technical and clinical validation	• Recognises abnormal results due to pre-analytical factors or to analytical interference • Recognises abnormal results likely to be due to disease and forms an appropriate differential diagnosis • Interpret biochemical results in the context of other clinical and investigational findings • Demonstrates the ability to use biochemical data to advise on appropriate management	• Show effective interface between clinicians and the laboratory, as part of a team
Genetics and genomics		**CiPs: 1, 2, 3, 5, 7, 8, 10**
• Describes genome organisation (e.g. chromosome structure, structure of nucleic acids and		• Demonstrates ability to relate theoretical knowledge and laboratory results to patient

the processes of meiosis and mitosis)		management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information
• Describes Mendelian and Non-Mendelian inheritance (e.g. imprinting disorders, mitochondrial inheritance, epigenetic inheritance). Able to discuss the impact of genetic variation on complex disease • Summarises protein synthesis, transcription and translation, defects in protein synthesis arising from genetic mutations, molecular pathology of single gene disorders. Recognises epigenetic defects	• Demonstrates the ability to apply Mendelian genetics and Bayes theorem to calculate pre- and post-test probabilities in genetic counselling	• Recognises issues surrounding consent for genetic testing including the need explain the possibility of unexpected findings when requesting gene panels, whole exome or whole genome sequencing
• Describes methods for targeted and whole genome sequencing e.g. PCR, Sanger, DNA arrays whole genome and whole exome sequencing • Describe and explain limitations in sequencing platforms	• Recognises the principles of genetic/genomic analysis	• Demonstrates critical evaluation of current genomic technologies and application to different clinical contexts
• Describes the process of variant classification. Awareness of functional in vivo (e.g. biochemical tests on patient samples) and in vitro (e.g. reporter gene assays to assess effect of DNA regulatory variants) techniques used to test variant pathogenicity • Describes the importance of bioinformatics in producing sequence data, the process of variant interpretation, archiving sequence information and creating information retrieval tools • Describes the clinical application of genome sequence data to areas such as metabolic disease without known single gene cause, rare disease, cancer	• Demonstrates ability to use variant classification guidelines and consideration of the issues surrounding variant reclassification • Show ability to answer laboratory users queries about classification including the relevance of the term “variant of unknown significance • Demonstrates understanding of how sequence variant data is interpreted including quality control steps	• Recognises and able to communicate the limits of certainty surrounding variant classification

• Recognise NHS Ethical governance frameworks relating to genomics. Considers optimum storage for data within NHS • Describes the use of cell free DNA including Non Invasive Prenatal Testing (NIPT) e.g. fetal DNA in maternal blood for Down screening and Non Invasive Prenatal Diagnosis (NIPD) which will be increasingly used to test the fetus for known mutations • Recognise the role of genetic data in treatments including gene therapy, pre-implantation genetic testing and pharmacogenomics	• Recognise the use and limitations of different specimen types used in genetic testing	• Demonstrate respect patient's requests for information not to be shared, unless this puts the patient, or others, at risk of harm • Demonstrate willingness to seek advice from peers, legal bodies, and the GMC in the event of ethical dilemmas over disclosure and confidentiality
Proteins and proteomics		**CiPs: 3, 5, 7, 8, 10**
• Describe principles of measurement • Outline properties and functions of the principal plasma proteins including: albumin, protease inhibitors, transport proteins, caeruloplasmin, clotting factors, complement, immunoglobulins, hormone binding proteins • Discuss the causes, investigation and management of hypoalbuminaemia, paraproteinaemias, cryoglobulinaemia • Discuss inflammatory proteins, the acute phase response, immunoglobulin deficiencies, alpha-1-antitrypsin deficiency, cytokines • Describes the pathophysiology of the acute phase response and explains how this can be assessed in the laboratory • Explains the effect of inflammation on concentrations of plasma proteins	• Demonstrates the ability to assess and appropriately interpret immunofixation and immunosubtraction • Demonstrates the ability to distinguish acute-phase changes from abnormalities due to underlying disease • Interprets laboratory tests in the context of inflammation explaining the correlation with clinical findings	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information

• Describe composition of urine proteins in health and disease • Describes use of CSF protein analysis (e.g. dementia screening) • Describe plasmapheresis • Describe and list potential uses of newer proteomic techniques (e.g. (MALDI-TOF MS and LC-ESI-MS/MS)	• Demonstrates ability to interpret common laboratory tests for proteinuria • Demonstrates the ability to critically evaluate new biomarkers	• Demonstrates proactive approach to new technology
Enzymes and metabolomics		**CiPs: 3, 8 ,10**
• Describe the mechanism and kinetics of enzyme action • Discuss stability and induction of enzymes • Describe the tissue specificity/selectivity of common enzymes • Describe the role of cofactors and vitamins in enzyme action • Describe the structural basis, separation, quantitation of isoenzymes • Compare major enzyme assays including: o amylase and lipase o alkaline phosphatase o aminotransferases o angiotensin converting enzyme o creatine kinase o lactate dehydrogenase o gamma-glutamyl transferase o cholinesterase and variants • Recognise techniques used in metabolomics and their clinical application	• Demonstrates the ability to evaluate critically new biomarkers	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates proactive approach to new technology
Endocrinology		**CiPs: 3, 8, 10**
• Describes endocrine physiology, including feedback loops, and the production, control and effects of hormones of the major endocrine glands, including the hypothalamus, pituitary, thyroid, adrenals (medulla and cortex), and gonads	• Interprets endocrine biochemical investigations, including dynamic function tests • Demonstrates selection of tests for investigation of endocrine disease and appropriate interpretation of results	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrate effective patient education and provision of

• Describes disorders involving over- and under-activity of endocrine systems • Describes the renin-aldosterone system and endocrine causes of hypertension • Describes inherited endocrine syndromes, including: multiple endocrine neoplasia, polyglandular syndrome • Describes biochemical investigations of endocrine systems, including dynamic function tests • Describes non-biochemical investigation, e.g. imaging, in endocrine disease • Explains screening for endocrine disease		information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of endocrine disorders
Diabetes mellitus		**CiPs: 1, 2, 3, 8, 10, 11**
• Describes the different types of diabetes mellitus, their pathogenesis, and presentations • Explains the criteria for the diagnosis of diabetes, including in pregnancy • Explains the available therapies for glucose control and their applicability in different clinical situations • Describes the process of haemoglobin non-enzymatic glycation and the influence of haemoglobin variants on analysis • Explains the metabolic and biochemical complications of diabetes, including diabetic ketoacidosis and hyperosmolar hyperglycaemic state • Discusses the long-term vascular, ocular, neurological and other complications of diabetes, and the role of screening	• Demonstrates assessment of glucose control • Demonstrates clinical care of patients with diabetes, including screening for long-term complications • Show ability to initiate appropriate therapy for diabetes in the acute situation, and to adjust therapy to changing circumstances • Demonstrate ability to advise on appropriate methodology for assessing glycaemic control • Demonstrates awareness of the importance of screening for long-term complications	• Demonstrate and show the ability to work as part of a multidisciplinary team for the acute and long-term care of patients with diabetes • Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of diabetes
Nutrition		**CiPs: 1, 2, 3, 4, 8, 9, 10, 11**
a. Obesity		

• Describes and explains prevalence and causes of obesity • Describes and explains the genetic causes of obesity • Describes and explains risks and co-morbidities • Describes and explains dietary, pharmaceutical and surgical management	• Demonstrates assessment of obesity • Demonstrates dietary and medical management of severe and complex obesity • Demonstrates management of patients prior to and following bariatric surgery including how patients are selected and complications managed • Demonstrates working effectively as part of a multi-disciplinary team	• Recognises obesity to be an illness and treats patients in a sympathetic manner • Recognises the psychological aspects of obesity • Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates s effective patient education and provision of information
b. Malnutrition – nutritional assessment and nutritional support		
• Describes and explains body composition, energy homeostasis, and explains the consequences of deficiency of dietary components • Explains the options for clinical and biochemical nutritional assessment • Explains the options for nutritional support • Explains the use of parenteral nutrition, including its complications and monitoring • Describes the assessment of capacity and the care of the vulnerable patient • Describes the effects and investigation of vitamin deficiency or excess • Describes the effects of systemic disease on nutritional status	• Demonstrates assessment of nutritional status • Demonstrates selection of appropriate route for nutritional support • Demonstrates working effectively as part of a multi-disciplinary team • Shows appropriate prescription of enteral and parenteral feeding regimes • Demonstrates management of feeding lines • Demonstrates management of patients with high losses of fluid or electrolytes • Demonstrates management of short bowel syndrome • Demonstrates management of refeeding syndrome and other complications of nutritional	• Demonstrates appreciation for the skills of other clinicians involved in delivering care • Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Promotes effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of nutritional disorders • Shows a willingness to assess different options for nutritional support and to discuss them with the patient, carers and other clinicians

• Describes the effect of severe acute illness on nutritional requirements • Describes the effects of micronutrient deficiency and excess in terms of specific clinical features, pathophysiology and biochemical abnormalities	support • Demonstrate taking account of fluid balance, fluid prescription, nutrient intake and drug prescriptions when prescribing nutritional support	
Inborn Errors of Metabolism		**CiPs: 1, 2, 3, 4, 5, 8, 9, 10, 11**
• Describes the biochemical basis of inborn errors of metabolism • Describes and explains adult impact of IEMs, including phenylketonuria, galactosaemia, homocystinuria, branch-chain amino acid disorders, fatty acid oxidation disorders, lysosomal, metals, mitochondrial, glycogen storage disorders, mucopolysaccharide, organic acid, peroxisomal, purine disorders, acute and cutaneous porphyrias • Describes pre-natal investigation of the fetus • Discuss analysis of amino acids, organic acids, carnitine and acylcarnitines, enzyme activity, mucopolysaccharides, tissue	• Demonstrates emergency management of common and important metabolic presentations, including hypoglycaemia, hyperammonaemia, acute porphyrias • Shows choice and interpretation of appropriate investigations • Demonstrates development of management plans with patients (and carers) for routine and emergency management • Describe and explain prescribing specialised dietary treatments and specific drug therapies • Demonstrates working effectively as part of a multi-disciplinary team • Demonstrate counselling affected families and offer advice on prevention and treatment of exacerbations of the disease in question. • Arrange experience of range of treatment options available and their potential problems e.g. enzyme replacement therapy • Recognise and sustain supportive relationships with patients with whom care will be prolonged and potentially life long • Demonstrate relevant evidenced-based information and, where appropriate, effective patient education with support of the multidisciplinary team	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Administers treatment to acutely ill patients and their families in a sympathetic way • Demonstrates involvement of patients and relatives in decision-making • Promotes effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of metabolic disorders • Demonstrates counselling techniques and advises affected families on prevention and treatment of disease exacerbations • Shows support to patients in transition from paediatric to adult care • Demonstrates appreciation for the skills of other clinicians involved in delivering care.

culture, DNA • Discuss the metabolic basis, investigation, diagnosis, monitoring of porphyria	• Demonstrate Promoting and encouraging involvement of patients in appropriate support networks, both to receive support and to give support to others • Demonstrate setting long term realistic goals	
Haemoglobin and disorders of red cell enzymes		**CiPs: 2, 4, 8, 10**
• Describe haemoglobin metabolism • Discuss anaemia and its investigation, assessment of iron, vitamin B12 and folate status, detection of abnormal haemoglobins in inherited and acquired disease • Describe red cell enzyme defects	• Describe and explain on the laboratory investigation of normality and disease	
Assessment and management of cardiovascular risk		**CiPs: 1, 2, 3, 4, 8, 9, 10, 11**
a. Lipid disorders		
• Describes and explains metabolic basis of lipid metabolism • Describes pharmacology of lipid lowering agents • Discuss the metabolic basis of inherited and acquired hyper- and hypo-lipoproteinaemias • Describe the investigation and principles of management of hyperlipidaemia • Discuss patient classification of: ○ Familial hypercholesterol-aemia ○ Familial combined dyslipidaemia ○ Type III dyslipidaemia ○ Polygenic hypercholesterolemia ○ Atherogenic lipoprotein	• Demonstrates assessment and management of cardiovascular risk • Demonstrates ability to: ○ Investigate and manage hyperlipidaemia ○ Identify patients with secondary causes ○ Screen family members in case of familial dyslipidaemia • Recognises clinical and biochemical features of genetic dyslipidaemias • Identifies features of micro- and macro-vascular disease • Demonstrates diagnosis and management of primary and secondary dyslipidaemias • Demonstrates provision of genetic counselling and cascade screening to affected families	• Demonstrate involveing patients and families in decision making • Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Show effective patient education and provision of information • Shows awareness of the need to screen and offer support to other members of the patient's family in the case of severe familial dyslipidaemias

phenotypes ○ Secondary causes		
b. Other risk factors		
• Explains the physiological basis for atheroma, coronary heart disease and associated risk factors, including chronic kidney disease and metabolic syndrome	• Summarises estimation of cardiovascular risk • Demonstrates management of factors contributing to atherosclerosis, including diabetes, obesity, renal disease and hypertension	• Demonstrates involving patients and families in decision making • Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information
• Outline the principles of primary and secondary cardiovascular disease prevention and summarise lipid treatment and pharmacology including: ○ Lipid lowering therapies ○ Appropriate adjunctive therapy • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of cardiovascular disorders • Describes the secondary causes of hypertension • Describes pharmacology of antihypertensive medications • Compare current methods of calculating cardiovascular risk and critically evaluate	• Shows provision of appropriate dietetic advice • Recognises when to refer patients for specialised investigations and management (e.g. Cardiology, Vascular surgery) • Demonstrates investigation and management of patients with hypertension	
Cardiac Disease		**CiPs: 3, 4, 8, 10**
• Explains the basis for diagnosing acute myocardial damage • Describes the assessment of cardiac dysfunction including natriuretic peptides • Describe and explain the of role of biochemical and metabolic laboratory investigations in assessing aetiology of cardiac disease	• Demonstrate setting cut-offs for acute myocardial limits	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information

Disorders of Calcium Metabolism		**CiPs: 3, 4, 8, 10, 11**
• Discuss the physiology and biochemistry and measurement of calcium, magnesium, phosphate, and their hormonal controls	Demonstrates investigation and management of patients with: • Hyper and hypocalcaemia: • Calcium sensing receptor abnormalities • Hypo- and hyper-phosphataemia • Hypo- and hyper-phosphatasia • Disorders of magnesium • Vitamin D deficiency and insufficiency • Hyperparathyroidism including those who are normocalacemic	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of disorders of calcium metabolism
• Describes the bone remodelling cycle • Describe and explain pathophysiology, causes and therapeutic options in common bone disorders including: o Osteoporosis o Renal osteodystrophy o Paget disease	• Demonstrates management of common bone disorders such as osteoporosis and Paget disease including ability to interpret bone densitometry and radioisotope scans and awareness of the limitations of such scans	
• Demonstrate knowledge of biochemistry and pathology of collagen • Describe biochemical markers of bone disease • Describe the pathogenesis, investigation and management of renal stone disease	• Demonstrates investigation and management of patients with renal stone disease	• Demonstrates effective patient education and provision of information • Demonstrate involving patients in decision making especially explaining fracture risk and therapeutic benefits and risks in osteoporosis therapy
Water and Electrolytes		**CiPs: 3, 4, 8, 10**
• Discuss distribution of water and electrolytes • Describe turnover of body fluids • Outline regulation of extracellular fluid, osmolality and volume via: o Antidiuretic hormone o Renin-angiotensin-aldosterone o Natriuretic peptides • Describe the causes, effects and management of: o Water depletion and excess o Hypo- and hypernatraemia o Hypo and hyperkalaemia o Hypophosphataemia o Hypo- and hypermagnesaemia	• Describe and explain on management of fluid balance • Describe and explain on investigation and management of acute and chronic electrolyte disturbances	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrate effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of electrolyte disorders

○ Metabolic effects of trauma/surgery/stress • Discuss the principles of intravenous fluid therapy		
Blood Gases and Acid-Base Balance		**CiPs: 3, 4, 8, 10**
• Describe the physiology of: ○ Normal respiration ○ Oxygen and carbon dioxide transport ○ Buffers • Summarise respiratory and renal mechanisms in acid-base homeostasis • Discuss ventilation and perfusion defects and their impact on gas exchange • Describe and explains causes and assessment of acid-base disturbances: ○ Measurement of H+ ○ pCO2 ○ pO2 ○ Saturation • Discuss the concepts of: ○ Actual bicarbonate ○ Standard bicarbonate ○ Base excess • Describe the determinants and assessment of tissue oxygenation • Describe the causes of acidosis, including lactic acidosis • Describe oxygen and free radical toxicity and physiological mechanisms to control these	• Describe and explain the investigation of acid-base disorders and management	• Shows awareness of the role of point-of-care testing in patient management • Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information
Respiratory System		**CiPs: 3, 4, 8, 10**
• Describe respiratory diseases biochemical markers and genetic testing involved in their diagnosis, including alpha1 antitrypsin and cystic fibrosis • Describes the role of biochemical investigation of pleural fluid and its interpretation	• Describe and explain laboratory investigation of respiratory disease	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information • Describes and explains the role of laboratory and non-

		laboratory investigations in the investigation of respiratory disorders
Liver		**CiPs: 3, 4, 8, 10**
• Describes and explains the physiology of the hepatobiliary system • Explains the causes of jaundice in neonates, children and adults • Discusses disease of the hepatobiliary system, including NAFLD, hepatitis, cirrhosis, cholestasis, gallstones and neoplasia and explains causes and options for treatment • Describes and explains how inherited disorders can cause liver disease • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of liver disease	• Interprets routine biochemistry tests in the context of liver disease • Demonstrates selection of specialised tests for investigation of liver disease and appropriate interpretation of results	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Promotes effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of disorders of the liver
Kidney and urogenital tract		**CiPs: 3, 4, 8, 10**
• Describes the structure, function and disorders of the kidneys and urogenital tract, including; the glomerular filtration system; the role and control of the tubular system; the ureters and bladder; the prostate; the urethra • Describes the endocrine functions of the kidney, including the renin-aldosterone system, vitamin D, and erythropoietin • Describes the diseases of the renal tract, including intrinsic and extrinsic disorders, and the effects of drugs and toxins,	• Interprets renal function tests, and recognises significant acute and chronic changes • Describe and explain on screening for prostate disease	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates s effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of disorders of the kidney and urogenital tract

acute kidney injury, chronic kidney disease • Describes the consequences of renal disease • Describes the biochemical tests for assessing renal function		
Gastrointestinal system		**CiPs: 3, 4, 8, 10**
• Describes and explains the physiology of digestion and absorption and explains the role of the gut as an endocrine organ • Discusses disease of the gastrointestinal tract and pancreas including peptic ulceration, malabsorption, inflammatory bowel disease, intestinal and pancreatic failure, neuro-endocrine disorders and neoplasia and explains causes and options for treatment • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of gastrointestinal disorders	• Interprets routine biochemistry investigations in the context of gastrointestinal disease • Demonstrates selection of tests for investigation of gastrointestinal disease and appropriate interpretation of results	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of gastrointestinal disorders
Screening		**CiPs: 1, 2, 3, 4, 5, 7, 8, 10**
• Describes the principles underlying screening programmes • Describes the principles of primary and secondary prevention and screening • Describes the regulation of screening programmes within the UK • Describe and explain the role of	• Demonstrate participation in appropriate disease prevention or screening programmes • Describe and explain the appropriate use and interpretation of the results of the laboratory investigations in screening for disease or inherited conditions • Advise on the investigation and	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Promotes effective patient education and provision of information

screening in primary and secondary cardiovascular disease prevention • Describe and explain the principles of newborn bloodspot screening programmes in diagnosis and management of congenital hypothyroidism, inborn errors of metabolism and haemoglobinopathies • Describe and explain antenatal and postnatal screening • Describe and explain the principles of the national bowel cancer screening programme • Discuss screening for macro- and micro-vascular complications of diabetes by means of clinical examination and investigations	management of hyperlipidaemia, identification of patients with secondary causes, screening family members in case of familial dyslipidaemia • Outline biochemical, statistical and ethical issues surrounding newborn bloodspot screening • Outline appropriate specimen collection • Outline biochemical, statistical and ethical issues surrounding antenatal screening • Outline biochemical, statistical and ethical issues surrounding bowel cancer screening	• Recognises the need to liaise effectively with specialty services and refers where appropriate
Pregnancy		**CiPs: 2, 3, 4, 8, 10**
• Outline maternal and fetal physiology • Outline complications of pregnancy and their detection • Describe the assessment of ectopic pregnancy • Discuss pre-natal investigation of inborn errors • Discuss the effect of pregnancy on co-existing biochemical and metabolic disease • Discuss the effect of biochemical and metabolic disease on the fetus • Describe the assessment and management of hyperglycaemia in pregnancy • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of complications of pregnancy	• Discuss effects of pregnancy on routine biochemical tests	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Promotes effective patient education and provision of information • Demonstrates appropriate and timely liaison with other medical specialty services when required

• Describe the assessment and management of pre-eclampsia		
Neonates and Childhood		**CiPs: 2, 3, 4, 8, 10**
• Summarise biochemical problems in the newborn including: o fluid balance o jaundice o liver disease o hypoglycaemia, hyperglycaemia o calcium and phosphate homeostasis; metabolic bone disease of prematurity o hypomagnesaemia o lactic acidaemia o hyperammonaemia o cystic fibrosis o nutrition o congenital adrenal hyperplasia (salt-losing, intersex) o congenital hypothyroidism • Summarise the physiology, pathology, investigation and management of biochemical disorders seen in childhood, including: o Disorders of growth and development o Calcium and phosphate disturbance o Hypoglycaemia o Hyperammonaemia o Reye's syndrome o Lactic acidosis o Renal disorders including Fanconi syndrome and tubular defects o Fluid balance	• Discuss factors affecting method selection and biochemical results in paediatric patients • Outline appropriate specimen collection • Discuss the effects of high haematocrit, haemolysis and severe jaundice as seen in neonates upon common biochemical tests	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of paediatric biochemical disorders • Demonstrates appropriate and timely liaison with other medical specialty services when required • Shows awareness of need to manage children in a child-friendly environment • Demonstrates practices in accordance with Child Protection
Cancer		**CiPs: 2, 3, 4, 8, 10**
• Outline the nature of malignancy and tumour growth • Outline the biochemical effects and treatment of cancer, including the use of markers for: prostate, lung, breast, ovary, gastro-intestinal, pancreas, thyroid, pituitary, adrenal, neuroblastoma, hepatoblastoma, teratoma	• Describe and explain on use of biochemical markers in diagnosis and monitoring malignancy	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information
CNS/Neuromuscular		**CiPs: 3, 4, 8, 10**
• Outline formation and	• Interprets CSF findings in	• Demonstrates ability to relate

composition of cerebro-spinal fluid (CSF) • Describe and explain the of use of nasal fluid to determine if CSF in origin • Describe and explain CSF tumour markers • Recognise CSF dementia screens • Discuss the biochemistry of psychiatric disease, especially where there are neurological features or atypical responses to antipsychotic therapy • Outline the biochemistry of muscle disease • Knowledge of the biochemical causes of chronic neurological presentations including micronutrient deficiencies, toxic metal poisonings and inborn errors of metabolism	common scenarios including possible SAH, infections within BBB and effects of tumours and spinal obstruction to CSF flow • Describe and explain on management of rhabdomyolysis • Demonstrates clinical history skills, thus allowing separation of common causes of myopathies and how to investigate • Appreciates exercise testing and its interpretation • Demonstrates willingness to consider other diagnoses and in discussion with requestors seeks information or directs them to appropriate services	theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrates effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the investigation of CSF and neuromuscular disorders
Toxicology		**CiPs: 2, 3, 4, 7, 8, 10**
• Summarise the metabolic effects of ethanol • Discuss the diagnosis and management of overdose, e.g: ○ salicylate, barbiturate, paracetamol, tri-cyclic antidepressants, benzodiazepines ○ Ethanol and other alcohols • Discuss the diagnosis and monitoring of drug addiction including: ○ opiates, amphetamine, MDMA, benzodiazepines, cocaine,	• Summarise the effects of post-mortem changes on the results of laboratory investigations • Describe and explain on legal procedure surrounding investigation of death • Discuss factors affecting method selection in identification of drugs of abuse, including different body fluids, immunoassay, MS and MS-MS methods and their limitations	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrate effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in toxicological investigation

○ Alcohol and other psychoactive agents • Discuss the diagnosis and management of poisoning, e.g. ○ lead, mercury, aluminium, carbon monoxide, paraquat ○ iron, ethylene glycol, methanol, organophosphate compounds • Outline the laboratory investigation of the unconscious and deceased patient • Describe the sources of information about drug toxicity; e.g. Pharmacist, National Poisons Information Service	• Describe and explain investigation and management of common poisonings and how specialist labs are involved in occupational screening for possible poisoning	
Therapeutic Drug Monitoring		**CiPs: 2, 3, 4, 7, 8, 10**
• Outline the principles of pharmacokinetics and its effects on half-life, dosage prediction • Describe monitoring of drug therapy, e.g: digoxin, lithium, antiepileptics, theophylline, caffeine, methotrexate, immunosuppressants, antibiotics • Describe common metabolic effects/side-effects of drugs; e.g. thyroid dysfunction with lithium or amiodarone • Describe the growing role for pharmacogenetics to identify phenotypes more likely to benefit from particular drugs • Describe assessment and monitoring tests, e.g. biochemical assessment of thiopurine therapy (for both initiation and monitoring) • Describe biological drugs and some appreciation of the assay issues around their measurement	• Describe and explain on factors affecting drug action or metabolism • Describe and explain on metabolic effects/side-effects of drugs	• Demonstrates ability to relate theoretical knowledge and laboratory results to patient management by appropriate communication with clinical colleagues • Demonstrate effective patient education and provision of information • Describes and explains the role of laboratory and non-laboratory investigations in the initiation and monitoring of therapeutic drugs

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 chemical pathology 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
- 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 chemical pathology assessment system which is mapped to Good Medical Practice is available in appendix X.

8.2 Programme of Assessment

Our 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 critical progression points in, and to demonstrate satisfactory completion of training as required by the curriculum.

The programme of assessment is comprised of several different individual types of assessment. These include the FRCPath examination, summative and formative assessments. A range of assessments is needed to generate the necessary evidence required for global judgements to be made about satisfactory performance, progression in, and completion of, training. All assessments, including those conducted in the workplace, are linked to the relevant curricular learning outcomes (e.g. through the blueprinting of assessment system to the stated curricular outcomes).

The programme of assessment emphasises the importance and centrality of professional judgment 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.

Assessment will take place throughout the training programme to allow trainees to continually gather evidence of learning and to provide formative feedback. Those assessment tools which are not identified individually as summative will contribute to summative judgements about a trainee's progress as part of the programme of assessment. The number and range of these will ensure a reliable assessment of the training relevant to their stage of training and achieve coverage of the curriculum.

Reflection and feedback should be an integral component to all WBPAs. 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.

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.

Clinical supervisors and others contributing to assessment will provide formative feedback to the trainee on their performance throughout the training year. This feedback will include a global rating in order to indicate to the trainee and their educational supervisor how they are progressing at that stage of training. To support this, workplace based assessments and multiple consultant reports will include global assessment anchor statements.

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

Towards the end of the training year, trainees will make a self-assessment of their progression for each CiP and record this in the LEPT with signposting to the evidence to support their rating.

The educational supervisor (ES) will review the evidence in the LEPT including workplace based assessments, feedback received from clinical supervisors (via the Multiple Consultant Report) and the trainee's self-assessment and record their judgement on the trainee's performance in the ES report, with commentary.

For **generic CiPs**, the ES will indicate whether the trainee is meeting expectations or not using the global anchor statements above. Trainees will need to be meeting expectations for the stage of training as a minimum to be judged satisfactory to progress to the next training year.

For **specialty CiPs**, the ES will make an entrustment decision for each CiP and record the indicative level of supervision required with detailed comments to justify their entrustment decision. The ES will also indicate the most appropriate global anchor statement (see above) for overall performance.

Entrustability scales are behaviourally anchored ordinal scales based on progression to competence and reflect a judgment that has clinical meaning for assessors.

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

8.4 Critical Progression Points

There will be two key progression points during Chemical Pathology training. The first is at entry to the specialty, and the second is at award of the CCT. The outline grid below sets out the expected level of supervision and entrustment for the specialty CiPs and the critical progression points for the whole of Chemical Pathology training.

It is anticipated that the majority of trainees entering Chemical Pathology will do so from Internal Medicine, applying to enter normally after 2 years of IM stage 1 training. Trainees will be expected to have completed all parts of the MRCP(UK) examination by the time of entry into the specialty. Similarly, those entering from other training programmes will be expected to have completed the appropriate postgraduate diploma for that programme (e.g. MRCGP) by the time of entry to Chemical Pathology training.

8.5 Outline grid of levels expected for Chemical Pathology specialty capabilities in practice (CiPs)

Levels to be achieved by critical progression points

NB: It is anticipated that the majority of entrants to the specialty with come from IM2, but recognised that some will come from other routes. The levels at IM2 are therefore included only as an indicator of the levels to be anticipated at entry to the specialty.

Level descriptors
Level 1: Entrusted to observe only – no execution
Level 2: Entrusted to act with direct supervision
Level 3: Entrusted to act with indirect supervision
Level 4: Entrusted to act unsupervised

	Stage 1 training	Selection	Chemical Pathology training					CCT
Specialty CiP	**(e.g. IM2)**		**ST3**	**ST4**	**ST5**	**ST6**	**ST7**	
Able to lead and manage a laboratory	1	**Critical progression point**	1	2	3	3	4	**Critical progression point**
Able to use the laboratory service effectively in the investigation, diagnosis and management of disease.	2		3	3	4	4	4	
Able to manage a multi-disciplinary team effectively.	2		2	3	4	4	4	
Contributes effectively to the management of medical problems in patients in other specialties.	2		2	3	4	4	4	
Able to manage patients in an outpatient clinic, inpatient, ambulatory or community setting, including management of long-term conditions.	2		3	3	3	3	4	

8.6 Evidence of Progress

Methods of assessment

Trainees will be assessed in a number of different ways during their training. Workplace-based assessment allows the trainee to be assessed at regular intervals in the workplace by an appropriately trained, qualified and experienced assessor. The MSF, amongst other things, generates candid feedback on behaviour, attitude, communication and team-working issues. The FRCPath examination provides an external, quality assured assessment of the trainee's knowledge of their specialty and their ability to apply that knowledge in the practice of the specialty. Satisfactory completion of all assessments and examinations will be monitored as part of the ARCP process and will be one of the criteria upon which eligibility to progress will be judged. A pass in the FRCPath examination is required as part of the eligibility criteria for the award of the CCT or CESR(CP).

Workplace-based assessment

Trainees will be expected to undertake workplace-based assessment throughout their training in chemical pathology. In general, workplace-based assessments are designed to be formative in nature; as such they are best suited to determine educational progress in different contexts. To this end, it is strongly recommended that workplace-based assessment be carried out regularly throughout training to assess and document a trainee's progress. However, a minimum number of 'satisfactory' workplace-based assessments should be completed during each stage of training.

These 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) (minimum of 3 during training).

Further separate guidance is provided about the method and required frequencies of these assessments.

FRCPath examination

The major summative assessments will occur during Stage B (FRCPath Part 1 examination) and Stage C (FRCPath Part 2 examination).

The expectation for medical candidates in UK GMC-approved training programmes is that they should normally pass the FRCPath Part 2 examination within seven years of passing the FRCPath Part 1. However, there will be circumstances where the guidelines will need to be applied flexibly and candidates who feel that they will not be able to comply with this timescale should contact the RCPath Examinations Department for further advice.

Examination results are evaluated after each session and an annual review of validity and reliability is undertaken and reported to the Examinations Committee.

Evidence of competence

Annual Review of Competence Progression

The ARCP is an annual opportunity for evidence gathered by a trainee, relating to the trainee's 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 Supervisors Structured Report.

Separate ARCP guidance is available on the College website. A copy of all ARCP forms issued to the trainee must be provided to The Royal College of Pathologists prior to recommendation for the award of the CCT. 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.

8.7 Decisions on Progress

The decisions made at critical progression points 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 annual review of progression (ARCP) process supports the collation and integration of evidence to make decisions about the achievement of expected outcomes.

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 section 8.5 sets out the level of supervision expected for each of the specialty CiPs. The requirements for each year of training are set out in the ARCP decision aid.

The ARCP process is described in the Gold Guide. LETBs/deaneries are responsible for organising and conducting ARCPs. The evidence to be reviewed by ARCP panels should be collected on the LEPT.

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 the possible methods of assessment for each learning outcome (competency in practice). It is not expected that every method will be used for each competency and additional evidence may be used to help make a judgement on capability.

Syllabus Area	CiPs	GPCs	ECE	CbD	FRCPath	Mini-CEX	DOPs
Laboratory	1,2,3,4,5, 6,7,9	1,2,3,4,5 6,7,8,9	✓	✓	✓	✓	✓
Genetics and genomics	1,2,3,5,7, 8,10	1,2,3,4, 5,6,7,8,9	✓	✓	✓	✓	
Proteins and Proteomics	3,5,7,8, 10	1,2,3,4, 5,6,7,9	✓	✓	✓	✓	✓
Enzymes and Metabolomics	3,8,10	1,2,3,4, 5,6,7	✓	✓	✓	✓	✓
Endocrinology	3,8,10	1,2,3,4, 5,6,7	✓	✓	✓	✓	
Diabetes Mellitus	1,2,3,8, 10, 11	1,2,3,4, 5,6,7,8,9	✓	✓	✓	✓	
Nutrition	1,2,3,4,8, 9,10,11	1,2,3,4,5 ,6,7,8,9	✓	✓	✓	✓	
Inborn Errors of Metabolism	1,2,3,4,5, 8,9,10,11 11	1,2,3,4,5 ,6,7,8,9	✓	✓	✓	✓	
Haemoglobin and Disorders of Red Cell Enzymes	2,4,8,10	1,2,3,4,5 ,6,7,8,9	✓	✓	✓		
Assessment and Management of Cardiovascular Risk	1,2,3,4,8, 9,10,11	1,2,3,4,5 ,6,7,8,9	✓	✓	✓	✓	
Cardiac Disease	3,4,8,10	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Disorders of Calcium Metabolism	3,4,8,10, 11	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Water and Electrolytes	3,4,8,10	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Blood Gases and Acid-Base Balance	3,4,8,10	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Respiratory System	3,4,8,10	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Liver	3,4,8,10	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Kidney and Urogenital Tract	3,4,8,10	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Gastrointestinal System	3,4,8,10	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Screening	1,2,3,4,5, 7,8,10	1,2,3,4,5 ,6,7,8,9	✓	✓	✓	✓	✓
Pregnancy	2,3,4,8, 10	1,2,3,4,5 ,6,7,8,9	✓	✓	✓	✓	
Neonates and Childhood	2,3,4,8, 10	1,2,3,4,5 ,6,7,8,9	✓	✓	✓	✓	
Cancer	2,3,4,8, 10	1,2,3,4,5 ,6,7,8,9	✓	✓	✓	✓	
CNS/Neuromuscular	3,4,8,10	1,2,3,4,5 ,6,7	✓	✓	✓	✓	
Toxicology	2,3,4,7,8,1 0	1,2,3,4,5 ,6,7,8,9	✓	✓	✓	✓	✓

Therapeutic Drug Monitoring	2,3,4,7,8,10	1,2,3,4,5,6,7,8,9	✓	✓	✓	✓	✓

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 procedural skills

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 appropriate 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 6 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
- keeps the STC Chair informed of any significant problems that may affect the individual's training

In order to become an educational supervisor, a consultant must have a demonstrated interest in teaching and training, 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 extensive training programmes for educational supervisor's 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 to 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 Chemical Pathology Curriculum Working Group within 2 years of publication. In reviewing the curriculum, opinions will be sought from the College's Chemical Pathology 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 GMC.

10. Transitional Arrangements

With the exception of trainees in the final year of training prior to the award of the CCT, all Chemical Pathology (Metabolic Medicine) trainees who meet the entry requirements for this curriculum will transfer to this curriculum. Chemical Pathology trainees who do not meet the entry requirements and who are not in their final year of training must transfer to the transitional curriculum.

Trainees in the final year of training will remain on their current curriculum. Such trainees would normally be expected to have already achieved FRCPath Part 2 by examination.