SPECIALTY TRAINING CURRICULUM

FOR

NUCLEAR MEDICINE

Approved 13 August 2014
(updated October 2016)

Joint Royal Colleges of Physicians Training Board

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1 Introduction

Nuclear Medicine is the specialty responsible for the administration of unsealed radioactive substances to patients for the purposes of diagnosis, therapy or research. Nuclear medicine trainees will be expected to combine their skills as a physician with that of a physiological imager to solve diagnostic problems. They will provide a unique insight into the pathophysiology of disease and where appropriate offer a radionuclide therapeutic option for treatment. Trainees will require appropriate instruction in the clinical, scientific and legal aspects of the specialty. Specialists in Nuclear Medicine have ultimate responsibility for Nuclear Medicine services and must hold the appropriate certificate from Health Ministers to administer radioactive substances. In the last 10 years there have been significant developments in hybrid imaging which combines functional imaging using radionuclides and radiological anatomic imaging. Technology now allows machines to be built which combine functional and anatomic imaging techniques - these machines include SPECT/CT, PET/CT and PET/MR. Hence this curriculum is structured in such a way that trainees in Nuclear Medicine will obtain core level Clinical Radiology training and then further specialist training in Nuclear Medicine.

The trainee in Nuclear Medicine needs to gain a broad view of the needs of the community he or she serves. This requires not only the acquisition of certain knowledge and skills but also the development of appropriate attitudes enabling the trainee to look after the interests of patients, to work with other relevant health care professionals, to keep up with developments in the field and to bring these developments into the clinical arena. The trainee will have to demonstrate a good understanding of the pathophysiology and molecular basis of the diseases they are imaging or treating. They will need to maintain skills in taking competent histories, relevant clinical examination and the care of both in-patients and out-patients. They will need to learn how they, as medical practitioners, should interact with other clinicians and non-medically trained professional groups. They will need to develop the confidence to present their opinion on patient management as necessary.

2 Rationale

2.1 Purpose of the Curriculum

The purpose of this curriculum is to train a specialist in Nuclear Medicine. The curriculum describes the competencies required for the award of a Certificate of Completion of Training (CCT) and to be included on the Specialist Register in Nuclear Medicine. As this training scheme will also include a significant portion of the Clinical Radiology syllabus and the Knowledge Based Assessment (KBA) for Clinical Radiology (the FRCR), the successful trainee may also choose to apply for specialist registration in Clinical Radiology through the CESR route. The registered specialist will be able to work as a consultant specialist within the National Health Service and will have the knowledge, skills and attitudes required to do this. It is expected that the trainee at the time of completion of training will be competent in the understanding of the scientific knowledge base of Clinical Radiology and Nuclear Medicine and in the practice of diagnostic and therapeutic nuclear medicine and core level Clinical Radiology.

The curriculum covers training for all four nations of the UK.

2.2 Development

This curriculum was developed by a subcommittee of the Specialty Advisory Committee for Nuclear Medicine under the direction of the Joint Royal Colleges of Physicians Training Board (JRCPTB). It replaces the previous version of the curriculum dated August 2010. Changes to the curriculum were recommended after wide consultation with cross-specialty stakeholders, Deaneries, patient representatives, the Royal Colleges of Physicians, of Radiologists and of Clinical Oncologists, the Specialist Society of Nuclear Medicine (British Nuclear Medicine Society - BNMS), trainees, and trainers.

The majority of the SAC members are teachers, trainers and trainees in the specialty - the committee includes representatives from the Royal College of Radiologists.

2.3 Entry Requirements and Training Pathway

Specialty training in Nuclear Medicine consists of core and higher speciality training. Core training provides physicians with the ability to investigate, treat and diagnose patients with acute and chronic medical symptoms, and with high quality review skills for managing inpatients and outpatients. Higher speciality training then builds on these core skills to develop the specific competencies required to practise independently as a consultant in Nuclear Medicine.

Acute Care Common Stem (ACCS) or Core Medical Training (CMT) programmes are designed to deliver core training for specialty training by acquisition of knowledge and skills as assessed by workplace based assessments and the MRCP. Programmes are usually for two years and are broad based consisting of four to six placements in medical specialties. These placements over the two years must include direct involvement in the acute medical take. Trainees are asked to document their record of workplace based assessments in an ePortfolio which will then be continued to document assessments in specialty training. Trainees completing core training will have a solid platform of common knowledge and skills from which to continue into Specialty Training at ST3, where these skills will be developed and combined with specialty knowledge and skills to lead to the award of a certificate of completion of training (CCT). Some doctors may have gained the competencies required for entry into specialty training at ST3 in posts that were not approved by the GMC for training in nuclear medicine. Doctors in this position can be appointed into specialty training, and upon successful completion of the remainder of the programme, they will be eligible for the award of a CESR (CP) in Nuclear Medicine and entry onto the specialist register, rather than a CCT.

There are common competencies that should be acquired by all physicians during their training period starting within the undergraduate career and developed throughout the postgraduate career. These are initially defined for CMT and then developed further in the specialty. This part of the curriculum supports the spiral nature of learning that underpins a trainee's continual development. It recognises that for many of the competences outlined there is a maturation process whereby practitioners become more adept and skilled as their career and experience progresses. It is intended that doctors should recognise that the acquisition of basic competences is often followed by an increasing sophistication and complexity of that competence throughout their career. This is reflected by increasing expertise in their chosen career pathway.

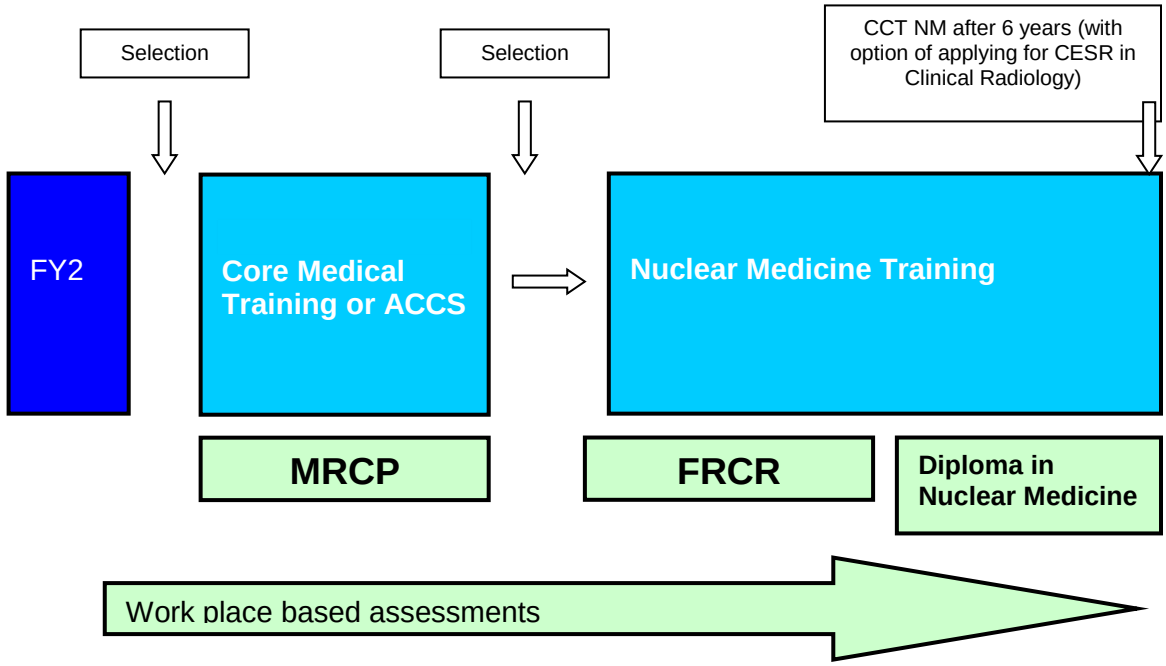
In view of the multi-disciplinary nature of Nuclear Medicine, the specialty is considered to be strengthened by inclusion of practitioners from a variety of clinical backgrounds. Thus, this curriculum allows for entry into specialty training not only from a

background in clinical medicine but also from Clinical Radiology and other specialties such as surgery and paediatrics. Depending on the process of assessment used in this training they may be issued with a CCT or CESR (CP) but in both cases will be eligible for specialist registration.

Entry from Clinical Medicine
Applicants for Specialty Training year 3 should have successfully completed Foundation training and either a) successfully completed approved core medical training (ST1 and ST2) or b) provide other evidence of achievement of core medical competencies. They must hold the full MRCP (UK).
Core training may be completed in either a Core Medical Training (CMT) or Acute Care Common Stem (ACCS) programme. The full curriculum for specialty training in Nuclear Medicine for trainees entering the specialty through core training therefore consists of the curriculum for either CMT or ACCS plus this specialty training curriculum for Nuclear Medicine.

The approved curriculum for CMT is a sub-set of the Curriculum for General Internal Medicine (GIM). A "Framework for CMT" has been created for the convenience of trainees, supervisors, tutors and programme directors. The body of the Framework document has been extracted from the approved curriculum but only includes the syllabus requirements for CMT and not the further requirements for acquiring a CCT in GIM.

Figure 1.0 shows the training pathway for a trainee entering through Clinical Medicine.



The precise method by which the programme is delivered will depend on local circumstances. However over the 6 years it will be necessary to deliver the Royal College of Radiologists' Clinical Radiology curriculum to core level taking just over three years then Nuclear Medicine training will be delivered which exceeds and satisfies the level 2 competency required in Radionuclide Radiology.

However it is important that the trainee maintains training in Nuclear Medicine and Clinical Radiology throughout the 6 year period. We would recommend that at ST3 the content of the training should comprise 80% Clinical Radiology and 20% Nuclear Medicine. This may be done on a sessional basis or as a series of training blocks. By ST6 the ratios should be reversed so that 20% of the training is in Clinical Radiology and 80% in Nuclear Medicine. Throughout training the trainee should take part in radiology on-call rotas as appropriate.

Entry from Radiology

This process is designed as run through training but it is recognised that the level and content of training in the first 36 months of Clinical Radiology includes acquiring similar competencies in general radiology and Radionuclide Radiology to Nuclear Medicine Trainees. Therefore it is possible that a trainee who can demonstrate foundation competencies, satisfactory completion of a minimum of 2 years appropriately supervised and relevant Core Training, and who has completed Core Radiology and attained their FRCR may apply competitively for a training place on the Nuclear Medicine Training Scheme. The point at which an individual would be placed on this scheme would depend upon competencies completed to date. However, it should be noted that trainees will be required to complete the Diploma in Nuclear Medicine (Specialty KBA) in order to be recommended for specialist recognition. This is best taken during year 4 (ST6) or year 5 (ST7) of higher professional training.

Candidates admitted in this way would relinquish their Radiology Training number and be issued with a new Nuclear Medicine Training number. Upon successful completion of the remainder of the nuclear medicine training programme, they will be eligible for the award of a CESR (CP). Any additional competencies that would need to be obtained to gain a CESR (CP) in Nuclear Medicine would be assessed at their first ARCP and if required a personalized training scheme set out.

Entry from other Clinical Backgrounds

Applicants without the full MRCP (UK) or FRCR who compete for specialty training year 3 posts must provide evidence of appropriate knowledge, training and experience. Applicants coming from non-CMT/ACCS training schemes who are in the UK training and can demonstrate foundation competencies and either MRCPCH with level 1 competencies in paediatrics or MRCS and core competencies in surgery may apply competitively for a training place on the Nuclear Medicine Training Scheme at ST3 level. In such cases applicants will be eligible for specialist registration on successful completion of training via the award of a CESR (CP) in Nuclear Medicine.

Applicants from overseas who are accepted onto the nuclear Medicine programme will require full MRCP, MRCPCH or MRCS, and must provide evidence of satisfactory completion of appropriately supervised general professional training. In such cases applicants will be eligible for specialist registration on successful completion of training via the award of a CESR (CP) in Nuclear Medicine.

The Nuclear Medicine Specialty Curriculum builds on the general competencies delivered in core medical training and other training pathways. Nuclear medicine trainees are expected to be involved in a range of clinical activities. They must also show that they can perform as physicians of the highest clinical and ethical standard. They should show knowledge of how society shapes disease and the role of nuclear medicine within that disease. They must show they can work within a multi-disciplinary team but be able to take a clinical lead role within that team. They should recognise an understanding of the concerns and fears of their patients including the special requirements of children, the vulnerable and those from different ethnic backgrounds.

They must demonstrate, through participation, that they know the importance of audit and research.

2.4 Enrolment with JRCPTB

Trainees are required to register for specialist training with JRCPTB at the start of their training programmes. Enrolment with JRCPTB, including the complete payment of enrolment fees, is required before JRCPTB will be able to recommend trainees for a CCT/CESR (CP). Trainees can enrol online at www.jrcptb.org.uk. Trainees are also required to register for specialist training with Royal College of Radiologists.

2.5 Duration of Training

Although this curriculum is competency based, the duration of training must meet the European minimum of 4 years for full time specialty training adjusted accordingly for flexible training (EU directive 2005/36/EC). There is significant overlap between the Clinical Radiology and Nuclear Medicine curricula. Nevertheless, it is expected that it would take 6 years to complete the full training in Nuclear Medicine (core level Clinical Radiology training and higher specialty training in Nuclear Medicine) and be awarded specialist registration in Nuclear Medicine. In light of the significant overlap, successful trainees may choose to utilise their Clinical Radiology knowledge, skills and experience to apply for a CESR in Clinical Radiology. Trainees in this position will need to demonstrate that they have achieved all of the competencies required by the clinical radiology curriculum. The SAC has advised that training from ST1 will usually be completed in 8 years in full time training (2 years core plus 6 years specialty training).

It is recommended that in year 4 (ST6) and year 5 (ST7) trainees concentrate on higher nuclear medicine training attaining the specialty KBA and completing all level 1 and level 2 competencies.

In year 6 of training (ST8) if such competencies have been achieved along with the KBA the candidate may take on a specialised field of study. These specialised fields could include:

- Paediatric nuclear medicine
- PET/CT and PET/MR
- Therapeutic nuclear medicine
- Research

There are a limited number of Training Departments in the UK (around 20) most of which have active research programmes and are used to supervising trainee research. Trainees expressing an interest in research would be placed/directed to those departments that have trainers in place with the appropriate supervision skills.

Research projects in ST8 may comprise clinical improvement projects such as assessments of new tracers/imaging protocols/therapies for specific clinical indications, likely based upon evaluation of clinically indicated image data. Projects requiring ARSAC and Ethics Committee approval which are likely to involve acquisition of prospectively acquired image data may be possible where there is trainee aspiration for involvement in more cutting edge research but are not mandated.

If agreed by the National Training Programme Directors it may be possible for part of this training to take place outside the UK - time out of programme (OOP) either for clinical training (OOPT) or research (OOPR). This is not compulsory and would need

to be agreed prospectively for individual trainees via the GMC out of programme process. Quality management would be the responsibility of the Specialist Advisory Committee (SAC) Nuclear Medicine.

2.6 Less than Full Time Training (LTFT)

Trainees who are unable to work full-time are entitled to opt for less than full time training programmes. EC Directive 2005/36/EC requires that:

- LTFT shall meet the same requirements as full-time training, from which it will differ only in the possibility of limiting participation in medical activities.
- The competent authorities shall ensure that the competencies achieved and the quality of part-time training is not less than those of full-time trainees.

The above provisions must be adhered to. LTFT trainees should undertake a pro rata share of the out-of-hours duties (including on-call and other out-of-hours commitments) required of their full-time colleagues in the same programme and at the equivalent stage.

EC Directive 2005/36/EC states that there is no longer a minimum time requirement on training for LTFT trainees. In the past, less than full time trainees were required to work a minimum of 50% of full time. With competence-based training, in order to retain competence, in addition to acquiring new skills, less than full time trainees would still normally be expected to work a minimum of 50% of full time. If you are returning or converting to training at less than full time please complete the LTFT application form on the JRCPTB website www.jrcptb.org.uk.

Funding for LTFT is from LETBs and these posts are not supernumerary. Ideally therefore 2 LTFT trainees should share one post to provide appropriate service cover.

Less than full time trainees should assume that their clinical training will be of a duration pro-rata with the time indicated/recommended, but this should be reviewed during annual appraisal by their TPD and chair of the Training Programme Management Committee (TPMC) As long as the statutory European Minimum Training Time (if relevant), has been exceeded, then indicative training times as stated in curricula may be adjusted in line with the achievement of all stated competencies.

3 Content of Learning

Nuclear Medicine trainees will be expected to maintain and extend the clinical skills required in obtaining relevant clinical assessment of patients. As nuclear cardiology may represent a significant workload the trainee will need to develop competency in forms of safe cardiac stressing and maintain ALS skills throughout their training and beyond. The trainee will also have significant exposure to patients with chronic and life threatening illness and they will be expected to manage these patients in an empathetic and professional way. Unlike many physicians they will also need to interact with children and will need to develop the requisite skills in working with children as well as being aware of the legal framework for the care of children in the NHS.

Nuclear medicine is unusual in that the nuclear medicine physician is often part of a highly professional and educated team which may involve senior scientists and technical staff. They will need to develop the skills to work as part of a multi-disciplinary team but learn how to provide clinical leadership within that group. Nuclear

medicine interacts with a large number of clinicians including surgeons, paediatricians, psychiatrists etc. The trainee therefore should retain and develop an interest in a wide range of medical conditions, their presentation, complications and treatment. They need to develop the confidence in their abilities within the multi-disciplinary team setting.

Nuclear medicine does not exist in isolation from society and as physicians we should be aware of opportunities of providing appropriate health advice to our patients. This could include smoking cessation advice to a patient having a cardiac stress test and life style advice to a patient with osteoporosis. The trainee should also be aware of the cultural diversity of patients and fellow staff and be aware of how and when this may conflict with the practice for nuclear medicine and determine solutions that allow the dignity of colleagues and staff to be maintained.

The detailed syllabus is included below in section 10 of this document.

3.1 Specific Skills to be acquired during Speciality Training - Radiology

The trainee would be expected to achieve core level competencies in Clinical Radiology and level 2 competencies in Radionuclide Radiology as set out in the Clinical Radiology curriculum found at www.rcr.ac.uk.

3.2 Specific skills to be acquired during Specialty Training – Nuclear Medicine

1. **Basic radiation safety:**
   The trainee will be able to ensure the safe handling of radiopharmaceuticals both as administered to patients, with respect to him/herself, other staff members and the patient's family and others in whom they are in close contact. Special note will be taken of women who may be or who are pregnant and lactating mothers. The trainee will learn and apply the principles of ALARP (as low as reasonably practical) as defined as lowest radiation dose to the patient to achieve a diagnostic image or therapeutic response. Competency should be obtained by the end of year 1 with consolidation over the training period.

2. **Understanding of the legal requirements for safe handling of radioisotopes**:
   The trainee will be taught the legal framework for the safe administration of radiopharmaceuticals including the general instructions for ionising radiation (IR(ME)R 2000) and those specific to the practice of nuclear medicine (MARS and ARSAC regulation) Competence will be obtained by the time of their CCT/CESR (CP) in Nuclear Medicine.

3. **Basic science underpinning safe practice of nuclear medicine**:
   The trainees should acquire an understanding of the different forms of radioactive decay, their effects on human tissue, how basic nuclear medicine imaging devices work and the factors which effect image quality. This should be achieved within the first year of the trainee's appointment with further in depth knowledge gained before CCT/CESR (CP) in Nuclear Medicine.

4. **Assessment of patient's condition and appropriateness of diagnostic test**: An understanding of why nuclear medicine tests are required and how

the patient's condition can affect the interpretation of the diagnostic image. These skills will be acquired throughout the course

5. **An understanding of how to conduct nuclear medicine tests and the skills to report those tests accurately and understand how these results fit into the patient's ongoing management**: These will include interaction with referring clinicians both informally and through formal MDTs.

   Training in these areas will be delivered in a method that shows progression from the simplest procedures defined as level 1 in the first 4 years of training to the most complex studies and therapies performed in the last 2 years of training (level 2 and 3) studies. However these are not isolated and the competencies gained in performing level 1 procedures will be essential for progression to level 2 and 3 competencies.

6. **To understand the appropriate and safe administration of radionuclide therapy and relevant patient aftercare for the patient and their families**: This will include the indications for radionuclide therapy, patient preparation, radiation protection for both nuclear medicine and other hospital staff and the patient's family as well as the legal framework for the safe administration of radionuclide therapy. The mechanisms required for administration, expected side effects and effective follow-up following therapy. Training in these aspects will be delivered throughout the 6 years but will be a main focus of years 4-6.

7. **Communication with patients and other members of the nuclear medicine team**: These skills will also be strengthened through the generic curriculum but with special emphasis on the uses of radionuclides for diagnosis and therapy

8. **Understanding the inter-relationship of nuclear medicine studies and other diagnostic tests**: Training in these aspects will occur both throughout the course but also with special reference to cross-sectional radiology as a specific rotation.

9. **Building skills in communicating results of investigations with clinicians**: This will be occurring throughout the course aided by the generic training and skills learnt in Foundation years and core medical training or equivalent.

10. **Safe and appropriate uses of interventions such as cardiac testing**: This will include both physical and pharmacological stress and maintaining skills in cardiac resuscitation again building on skills gained in Foundation and Core Medical Training.

11. **Understanding the role of the Nuclear Medicine Physician as a medical profession in the health service**

12. **Promoting personal and professional development**.

13. **To integrate competencies acquired in clinical radiology and nuclear medicine to enhance patient management**

3.2 Levels of Competence

As Nuclear Medicine contains discrete quanta of knowledge and competency, a trainee cannot be 'half' competent in reading a scan. All nuclear medicine procedures in the syllabus below have been divided into 3 levels of competencies with the trainees making a step wise progression from the simplest (level 1) to the most complex (level 3).

3.3 Good Medical Practice

Good medical practice is the GMC's core guidance for doctors. It sets out the values and principles on which good practice is founded.

The guidance is divided into four domains:

- Knowledge, skills and performance
- Safety and quality
- Communication, partnership and teamwork
- Maintaining trust

Good medical practice is supported by a range of explanatory guidance which provides more detail on various topics that doctors and others ask us about.
The "GMP" column in the syllabus defines which of the 4 domains of Good Medical Practice are addressed by each competency.

4 Learning and Teaching

4.1 The Training Programme

The organisation and delivery of postgraduate training is the statutory responsibility of the General Medical Council (GMC) which devolves responsibility for the local organisation and delivery of training to Local Education and Training Boards (LETBs). Nuclear Medicine Training pan London (including KSS programmes) is currently managed by UCL Partners. Training Programmes external to London are managed by the local LETBs. The Nuclear Medicine Training Programme Management Committee (TPMC) provides oversight of Nuclear Medicine Training nationally, includes representatives of the various Training Programmes and maintains a reporting line to the School of Medicine hosted by Health Education South London (formerly known as London Deanery). One or more National Training Programme Directors coordinate the training programme in the specialty. Health Education South London is responsible for coordinating and administering national processes for the specialty including recruitment, ARCP Panels and management of trainees in difficulty.

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 curriculum 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. It is foreseen that in the first 3 years training will primary be within the School of Radiology and then the latter 3 years within the School of Medicine.

Acting up as a consultant (AUC)

"Acting up" provides doctors in training coming towards the end of their training with the experience of navigating the transition from junior doctor to consultant while maintaining an element of supervision.

Although acting up often fulfills a genuine service requirement, it is not the same as being a locum consultant. Doctors in training acting up will be carrying out a consultant's tasks but with the understanding that they will have a named supervisor at the hosting hospital and that the designated supervisor will always be available for support, including out of hours or during on-call work. Doctors in training will need to follow the rules laid down by the Deanery / LETB within which they work and also follow the JRCPTB rules which can be found at www.jrcptb.org.uk/trainingandcert/Pages/Out-of-Programme.

4.2 Teaching and Learning Methods

The curriculum will be delivered through a variety of learning experiences. Trainees will learn from practice clinical skills appropriate to their level of training and to their attachment within the department.

Trainees will achieve the competencies described in the curriculum through a variety of learning methods. There will be a balance of different modes of learning from formal teaching programmes to experiential learning 'on the job'. The proportion of time allocated to different learning methods may vary depending on the nature of the attachment within a rotation.

This section identifies the types of situations in which a trainee will learn.

Learning with Peers - There are many opportunities for trainees to learn with their peers. Local postgraduate teaching opportunities allow trainees of varied levels of experience to come together for small group sessions. The taught programme encourages group learning. Examination preparation encourages the formation of self-help groups and learning sets.

Work-based Experiential Learning - The majority of the curriculum is suited to delivery by work-based experiential learning and on-the-job supervision. Where it is clear from trainees' experience that parts of the curriculum are not being delivered within their work place, appropriate off-the job education or rotations to other work places will be arranged. This will be administered locally but with oversight via the National Training Programme Directors. The key will be regular workplace-based assessment by educational supervisors who will be able to assess, with the trainee, their on-going progress and whether parts of the curriculum are not being delivered within their present work place. These will show a progression of skills from the most simple (level 1) to the most complex (level 3).

The content of work-based experiential learning is decided by the Local Faculty for Education but includes active participation in the following, remembering that nuclear medicine has imaging as its primary role and trainees will not be involved in general out-patients or acute medical 'takes'. As almost all procedures are done as out patients the traditional model of learning including from acute assessment, admission and management of patients is not relevant.

Therefore the main work based teaching experiences will be:

- The majority of work based learning will take place in the Radiology and Nuclear Medicine departments where patients will be assessed to determine if the correct scan has been requested and if they have any co-morbidities or are on medication that will affect the outcome of the scan. This will initially be under direct supervision but the degree of autonomy will increase with the trainees' competence.
- The trainee will learn by first observing image interpretation and reporting skills of a specialist in nuclear medicine but as confidence and competence increases will be expected to report scans under supervision and then with more autonomy. It would be expected that the trainee will gain competence in less complex scan reading (level 1) within the core clinical radiology course however, if that has not been proved possible these competencies will be achieved by the end of ST6, medium complexity (level 2) studies by the end of ST7 and complex (level 3) studies by the end of the training course
- Specialist out-patient clinics such as thyroid and neuroendocrine clinics. After initial induction, trainees will review patients in such clinics, under direct supervision. The degree of responsibility taken by the trainee will increase as competency increases. As experience and clinical competence increase trainees will assess 'new' and 'review' patients and present their findings to their clinical supervisor. It is thought likely these clinics will mainly occur in the latter 3 years of training ST6-ST8
- Personal ward rounds if there are any in-patients and provision of ongoing clinical care on specialist medical wards. The only patients that will be seen as in-patients are those receiving radionuclide therapy. Every patient seen, on the ward or in out-patients, provides a learning opportunity, which will be enhanced by following the patient through the course of their treatment and possible side effects. Also there should be a proper understanding of the information required by the patients referring clinician to ensure continuing care. Patients seen should provide the basis for critical reading and reflection of clinical problems.
- Multi-disciplinary team meetings. There are many situations where clinical problems are discussed with clinicians in other disciplines. These provide excellent opportunities for observation of clinical reasoning. Trainees will be encouraged to attend MDTs throughout training and take a leadership role in ST7 and ST8
- Attachments to other training departments will be organised to supplement the learning experiences as required. Some centres have local arrangements for rotating trainees to other departments for training in specialised areas of Radiology and in Nuclear Medicine, for example paediatrics, therapy and specialist PET-CT. However it is expected that most trainees will spend their first 3-4 years within a single Nuclear Medicine department though they may rotate through different Radiology departments in ST3-ST5 as determined by the School of Radiology

Formal Postgraduate Teaching – The content of these sessions are determined by the local faculty of medical education and will be based on the curriculum. There are many opportunities throughout the year for formal teaching in local postgraduate teaching sessions and at regional, national and international meetings. Trainees will be encouraged to attend the Annual Meeting of the British Nuclear Medicine Society and, in ST7/8, international meetings such as those run by the European Association of Nuclear Medicine and Society of Nuclear Medicine.

The most important teaching will be the externally delivered Postgraduate Diploma in Nuclear Medicine. See below

In addition trainees can take part in other learning activities such as those indicated below – which are available locally will depend upon local training programmes:

- A programme of formal bleep-free regular teaching sessions to cohorts of trainees (e.g. a weekly core training hour of teaching within a Trust)
- Case presentations
- Journal clubs
- Research and quality improvement/audit projects
- Lectures and small group teaching
- Grand Rounds
- Clinical skills demonstrations and teaching
- Critical appraisal and evidence based medicine and journal clubs
- Joint specialty meetings
- Attendance at training programmes organised by LETBs or on a regional basis, which are designed to cover aspects of the training programme outlined in this curriculum.

Where a trainee is in a geographically isolated scheme, they can be involved in learning activities from associated specialties such as Radiology and Oncology.

Independent Self-Directed Learning -Trainees will use this time in a variety of ways depending upon their stage of learning. These methods will supplement the knowledge based learning Suggested activities include:

- Reading, including web-based material
- Maintenance of personal portfolio (self-assessment, reflective learning, personal development plan)
- Quality improvement, audit and research projects
- Reading journals
- Achieving personal learning goals beyond the essential, core curriculum

Formal Study Courses - Time to be made available for formal courses is encouraged, subject to local conditions of service. Examples include management courses and communication courses.

Externally Delivered Education – The Knowledge Based Assessment (KBA) for Nuclear Medicine, the Postgraduate Diploma in Nuclear Medicine, is the equivalent of the Specialty Certificate Examination (SCE) characteristic of other medical specialties. It is delivered on a national level by Kings College London. The taught lecture programme is delivered via 38 days of face to face lectures in London and teaching materials are also available via an electronic learning platform. This course will supplement locally delivered knowledge focused training, usually occurring after the student has obtained their FRCR, therefore in ST6 or ST7. Future development of blended learning will be guided by feedback from students, the teaching faculty and College Education Leads.

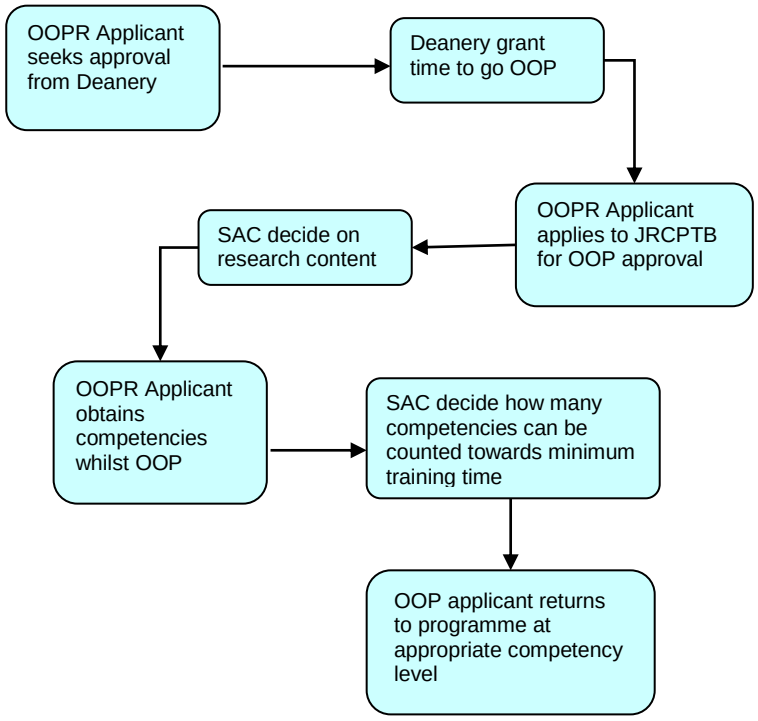
4.3 Research

Trainees who wish to acquire research competencies, in addition to those specified in their specialty curriculum, may undertake a research project as an ideal way of obtaining those competencies. For those in specialty training, one option to be considered is that of taking time out of programme to complete a specified project or research degree. Applications to research bodies, the deanery (via an OOPR form) and the JRCPTB (via a Research Application Form) are necessary steps, which are the responsibility of the trainee. The JRCPTB Research Application Form can be

accessed via the JRCPTB website. It requires an estimate of the competencies that will be achieved and, once completed, it should be returned to JRCPTB together with a job description and an up to date CV. The JRCPTB will submit applications to the relevant SACs for review of the research content including an indicative assessment of the amount of clinical credit (competence acquisition) which might be achieved. This is likely to be influenced by the nature of the research (eg entirely laboratory-based or strong clinical commitment), as well as duration (eg 12 month Masters, 2-year MD, 3-Year PhD). On approval by the SAC, the JRCPTB will advise the trainee and the deanery of the decision. The deanery will make an application to the GMC for approval of the out of programme research. All applications for out of programme research must be prospectively approved.

Upon completion of the research period the competencies achieved will be agreed by the OOP Supervisor, Educational Supervisor and communicated to the SAC, accessing the facilities available on the JRCPTB ePortfolio. The competencies achieved will determine the trainee's position on return to programme; for example if an ST3 trainee obtains all ST4 competencies then 12 months will be recognised towards the minimum training time and the trainee will return to the programme at ST5. This would be corroborated by the subsequent ARCP.

This process is shown in the diagram below:



Funding will need to be identified for the duration of the research period. Trainees need not count research experience or its clinical component towards a CCT programme but must decide whether or not they wish it to be counted on application to the deanery and the JRCPTB.

A maximum period of 3 years out of programme is allowed and the SACs will recognise up to 12 months towards the minimum training times.

4.4 Academic Training

Nuclear Medicine training can be made sufficiently flexible that it can be part of an Academic Clinical Fellow (ACF) programme. At least two such programmes exist and run parallel with the training in ST3 –ST5. Care will need to be taken to ensure enough training time is retained to allow the trainee to complete FRCR in the expected time scale. Academic Clinical Lectureship programmes can only be offered after completion of an MD/PhD.

For those contemplating an academic career path, there are well-defined posts at all levels in the Integrated Academic Training Pathway (IATP) involving the National Institute for Health Research (NIHR) and the Academy of Medical Sciences (AMS). For full details see http://www.nihrtcc.nhs.uk/intetacatrain/. Academic trainees may wish to focus on education or research and are united by the target of a consultant-level post in a university and/or teaching hospital, typically starting as a senior lecturer and aiming to progress to readership and professor. A postgraduate degree will usually be essential (see "out of programme experience") and academic mentorship is advised (see section 6.1). Academic competencies have been defined by the JRCPTB in association with AMS and the Colleges and modes of assessment have been incorporated into the Reference Guide for Postgraduate Specialty Training in the UK (Gold Guide).

Academic integrated pathways to CCT are a) considered fulltime CCTs as the default position and b) are run through in nature. The academic programmes are CCT programmes and the indicative time for academic trainees to achieve the CCT is the same as the time set for non-academic trainees. If a trainee fails to achieve all the required competencies within the notional time period for the programme, this would be considered at the ARCP, and recommendations to allow completion of clinical training would be made (assuming other progress to be satisfactory). An academic trainee working in an entirely laboratory-based project would be likely to require additional clinical training, whereas a trainee whose project is strongly clinically oriented may complete within the "normal" time (see the guidelines for monitoring training and progress) www.academicmedicine.ac.uk/careersacademicmedicine. Extension of a CCT date will be in proportion depending upon the nature of the research and will ensure full capture of the specialty outcomes set down by the Royal College and approved by GMC.

All applications for research must be prospectively approved by the SAC and the regulator, see www.jrcptb.org.uk for details of the process.

5 Assessment

5.1 The Assessment System

The purpose of the assessment system is to:

- Enhance learning by providing formative assessment, enabling trainees to receive immediate feedback, measure their own performance and identify areas for development;
- Drive learning and enhance the training process by making clear what is required of trainees and motivating them to ensure they receive suitable training and experience;
- Provide robust, summative evidence that trainees are meeting the curriculum standards during the training programme;
- Ensure trainees are acquiring competencies within the domains of Good Medical Practice*;*

- Assess trainees' actual performance in the workplace;
- Ensure that trainees possess the essential underlying knowledge required for their specialty;
- Inform the Annual Review of Competence Progression (ARCP), identifying any requirements for targeted or additional training where necessary and facilitating decisions regarding progression through the training programme;
- Identify trainees who should be advised to consider changes of career direction.

The integrated assessment system comprises workplace-based assessments and knowledge–based assessments. Individual assessment methods are described in more detail below.

Because trainees will achieve competencies at different rates, it is not possible to stipulate the numbers of nuclear medicine procedures that should comprise the work-based experiential learning.

The curriculum is blueprinted so that key competencies will be delivered, and the various assessments of knowledge, skills, behaviours and attitudes will be fit for purpose and give coverage across the domains of the curriculum by a process of sampling. All assessments will be appropriate to the training level of the trainee and will be valid, reliable, systematically collected, judged against pre-determined criteria and appropriately weighted. Feedback will be given confidentially to each trainee with suggestions for improvements where appropriate.

Workplace-based assessments will take place throughout the training programme to allow trainees to continually gather evidence of learning and to provide trainees with formative feedback. They are not individually summative but overall outcomes from a number of such assessments provide evidence for summative decision making. 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.

5.2 Assessment Blueprint

In the syllabus (Section 10) the "Assessment Methods" shown are those that are appropriate as **possible** methods that could be used to assess each competency. It is not expected that all competencies will be assessed and that where they are assessed not every method will be used.

5.3 Assessment Methods

The following assessment methods are used in the integrated assessment system:

Examinations and Certificates

- FRCR
- The Post Graduate Diploma in Nuclear Medicine (PGD) – the KBA for Nuclear Medicine
- Advanced Life Support Provider Certificate (ALS)

At present all trainees must complete the FRCR and Post Graduate Diploma in Nuclear Medicine as a requirement for achieving a CCT/CESR (CP). The present Diploma is run by the post graduate education department of Kings College London, which ensures appropriate external review and quality assurance. Alternate diplomas can be provided as long as they can demonstrate equivalence and are approved by the Nuclear Medicine SAC and the GMC.

Information about the present Diploma, including guidance for candidates, is available on the Kings College website www.kcl.ac.uk.

The programme consists of 6 modules of which 4 (Modules 1- 4) are taught.

Module 1 – Clinical Practice of Nuclear Medicine
Module 2 – Radiopharmaceutical and Regulatory Issues in Nuclear Medicine
Module 3 – Scientific Basis of Nuclear Medicine
Module 4 – Diagnostic Nuclear Oncology and Radionuclide Therapy
Module 5 – Nuclear Medicine Practical
Module 6 – Nuclear Medicine Research

Diploma in Nuclear Medicine students complete 3 taught modules and choose either Module 5 or Module 6.

Modules 1 – 4 are assessed by in course essays and unseen written examinations
Module 5 is assessed with a portfolio containing a logbook of in-course studies, audit and practical experiments, and by a clinical PowerPoint examination
Module 6 is assessed by submission of a research report and by oral examination.

Whilst not obligatory trainees have the option, and are encouraged to, complete all 6 modules for the award of an MSc in Nuclear Medicine.

Marking is performed by a University Appointed Examination Committee with 2 external examiners. Retakes are allowed and there is an appeal mechanism for candidates regulated by Kings College London and the University of London.

The Programme Director for the PG Diploma in Nuclear Medicine is a member of the Nuclear Medicine SAC. This ensures that the Diploma/MSc meet the needs of trainees in Nuclear Medicine with regard to content and standard, and enables regular dialogue with committee members about possible changes to programme specification.

Details concerning the FRCR are available from the Royal College of Radiologists on their website www.rcr.ac.uk.

Workplace-Based Assessments (WPBAs)/Supervised Learning Events (SLEs)

- mini-Imaging Interpretation Exercise (mini-IPX)
- mini-Clinical Evaluation Exercise (mini-CEX)
- Case-based Discussion (CbD)
- Direct Observation of Procedural Skills (DOPS)
- Multi-Source Feedback (MSF)
- Patient Survey (PS)
- Audit Assessment (AA)
- Teaching Observation (TO)
- Multiple Consultant Report (MCR)

These methods are described briefly below. More information about these methods including guidance for trainees and assessors is available in the ePortfolio and on the JRCPTB website www.jrcptb.org.uk. Assessments should be recorded in the trainee's ePortfolio. WPBA methods include feedback opportunities as an integral part of the assessment process; this is explained in the guidance notes provided for the tools.

mini-Imaging Interpretation Exercise (mini-IPX)
Because of the imaging nature of about 70% of nuclear medicine practice, mini-IPX is the most common form of assessment. This method of assessment has been developed by the Royal College of Radiologists and is designed to assess a trainee's skills in interpreting an image and to provide rapid and prompt feedback to a trainee in a particular area of diagnostic imaging. More information concerning how to use this assessment is available on www.rcr.ac.uk

mini-Clinical Evaluation Exercise (mini-CEX)
This tool evaluates a clinical encounter with a patient to provide an indication of competence in skills essential for good clinical care such as history taking, examination and clinical reasoning. The trainee receives immediate feedback to aid learning. The mini-CEX can be used at any time and in any setting when there is a trainee and patient interaction and an assessor is available.

Case based Discussion (CbD)
The CbD assesses the performance of a trainee in their management of a patient to provide an indication of competence in areas such as clinical reasoning, decision-making and application of medical knowledge in relation to patient care. It also serves as a method to document conversations about, and presentations of, cases by trainees. The CbD should include discussion about a written record (such as written case notes, out-patient letter, discharge summary). A typical encounter might be when presenting newly referred patients in the out-patient department.

Direct Observation of Procedural Skills (DOPS)
A DOPS is an assessment tool designed to assess the performance of a trainee in undertaking a practical procedure, against a structured checklist. The trainee receives immediate feedback to identify strengths and areas for development

Multisource Feedback (MSF)
This tool is a method of assessing generic skills such as communication, leadership, team working, reliability etc, across the domains of Good Medical Practice. This provides objective systematic collection and feedback of performance data on a trainee, derived from a number of colleagues. 'Raters' are individuals with whom the trainee works, and includes doctors, administration staff, and other allied professionals. The trainee will not see the individual responses by raters; feedback is given to the trainee by the Educational Supervisor.

Patient Survey (PS)
Patient Survey addresses issues, including behaviour of the doctor and effectiveness of the consultation, which are important to patients. It is intended to assess the trainee's performance in areas such as interpersonal skills, communication skills and professionalism by concentrating solely on their performance during one consultation.

Audit Assessment Tool (AA)
The Audit Assessment Tool is designed to assess a trainee's competence in completing an audit. The Audit Assessment can be based on review of audit documentation OR on a presentation of the audit at a meeting. If possible the trainee should be assessed on the same audit by more than one assessor.

Teaching Observation (TO)
The Teaching Observation form is designed to provide structured, formative feedback to trainees on their competence at teaching. The Teaching Observation can be based on any instance of formalised teaching by the trainee who has been observed by the

assessor. The process should be trainee-led (identifying appropriate teaching sessions and assessors).

Multiple Consultant Report (MCR)
The Multiple Consultant Report (MCR) captures the views of consultant supervisors on a trainee's clinical performance. The MCR year summary sheet summarises the feedback received, outcomes for clinical areas and comments which will give valuable insight to how well the trainee is performing, highlighting areas of excellence and areas of support required. MCR feedback will be available to the trainee and included in the educational supervisor's report.

5.4 Decisions on Progress (ARCP)

The Annual Review of Competence Progression (ARCP) is the formal method by which a trainee's progression through her/his training programme is monitored and recorded. ARCP is not an assessment – it is the review of evidence of training and assessment. The ARCP process is described in A Reference Guide for Postgraduate Specialty Training in the UK (the "Gold Guide" – available from www.mmc.nhs.uk). The evidence to be reviewed by ARCP panels should be collected in the trainee's ePortfolio.

The ARCP Decision Aid is included in section 5.5, giving details of the evidence required of trainees for submission to the ARCP panels.

During ST3-ST5 the assessment of the trainee will be undertaken though the local arrangements for Clinical Radiology - WPBAs and ARCP will be performed exactly as for Clinical Radiology Trainees.

During ST6-ST8 the trainee will complete WPBA as per the ARCP Decision Aid included (see below but refer to JRCPTB website for most up to date version) and will have their ARCP undertaken by a panel comprising Nuclear Medicine representatives which will usually include the Chair of the TPMC and National Training Programme Directors. Lay involvement will be provided at ARCP. It is expected that a trainee use the RCR e-portfolio for the first 3 years of training and the RCP e-portfolio for the last 3 years of training.

There is a clear progression from basic level 1 competencies which should normally be attained during core Clinical Radiology training but may be completed by the end of ST6 to more complex level 2 competences attained in ST7 and advanced competencies attained in ST8 along with any specialist fields which could include:

- Paediatric nuclear medicine
- PET/CT and PET/MR
- Therapeutic nuclear medicine
- Research

5.5 ARCP Decision Aid

The ARCP decision aid below sets out the targets that have to be achieved for a satisfactory ARCP outcome at the end of each training year. This document applies to trainees on the 2014 curriculum but is subject to change. Please refer to the JRCPTB website for the most up to date version.

		ST3-5 led by Clinical Radiology	ST6 led by Nuclear Medicine NTPDs and TPMC Chair	ST7 led by Nuclear Medicine NTPDs and TPMC Chair	ST8 led by Nuclear Medicine NTPDs and TPMC Chair
Examination		FRCR passed			Post Graduate Diploma in Nuclear Medicine passed to obtain CCT/CESR (CP) Nuclear Medicine
mini-IPX		As per Clinical Radiology Curriculum	Trainees should demonstrate all of level 1 competencies completed (4 minimum)	Trainees should demonstrate all level 2 competencies completed (8 minimum)	Trainees should demonstrate all level 3 competencies completed (8 minimum)
Supervised learning events (SLEs)	mini-CEX	As per Clinical Radiology Curriculum	Trainees should complete all level 1 competencies (1 minimum)	Trainees should complete all level 2 competencies (1 minimum)	Trainees should complete all level 3 competencies (1 minimum)
	CbD	As per Clinical Radiology Curriculum	Trainees should complete a minimum of 4 CbDs related to less complex studies (level 1)	Trainees should complete a minimum of 4 CbDs related to medium complex studies (level 2)	Trainees should complete a minimum of 4 CbDs related to the most complex studies (level 3)
DOPS		As per Clinical Radiology Curriculum	Trainees must complete all level 1 competences (2 minimum)	Trainees must complete all level 2 competences (1 minimum)	Trainees should complete all level 3 competencies (1 minimum)
MSF		As per Clinical Radiology Curriculum	satisfactory		satisfactory
Quality improvement project		As per Clinical Radiology Curriculum		Design and undertake 1 quality improvement	Design and undertake 1 quality improvement

			project (which may include audit) with presentation at a local audit meeting	project (which may include audit) with presentation at a local audit meeting
Patient survey	As per Clinical Radiology Curriculum	Satisfactory		Satisfactory
ALS	Valid	Valid	Valid	valid
Research	As per Clinical Radiology Curriculum	Should show awareness of research methods as taught in PGD course	Should undertake at least one research project which may comprise a clinical improvement project such as assessments of new tracers / imaging protocols /therapies for specific clinical indications.	As a minimum, should have presented one research project at a national conference either as a poster or oral presentation.
Radiation and society	As per Clinical Radiology Curriculum	Must show by DOPS, CbD and direct conversation knowledge and application of rules governing safe handling and use of radioisotopes	Must show by DOPS, CbD and direct conversation knowledge and application of rules governing safe handling and use of radioisotopes	Must show by DOPS, CbD and direct conversation knowledge and application of rules governing safe handling and use of radioisotopes
ES Report	Satisfactory	Satisfactory	Satisfactory	Satisfactory
MCR		2	2	2
Passage to next stage	As per Clinical Radiology Curriculum	Completion of all ST6 competencies as assessed by ARCP panel	Completion of all ST7 competencies as assessed by ARCP panel	Completion of all ST8 competencies as assessed by ARCP panel leading to CCT

Some flexibility in the timing of competency achievement is required as the number of training centres is very limited for specialist training in PET-CT, therapy and paediatric nuclear medicine

5.6 Penultimate Year Assessment (PYA)

The penultimate ARCP prior to the anticipated CCT date will include an external assessor from outside the training programme. JRCPTB and LETBs will coordinate the appointment of this assessor. This is known as “PYA”. Whilst the ARCP will be a review of evidence, the PYA will include a face to face component. Further information is available on the JRCPTB website.

5.7 Complaints and Appeals

Kings College London has complaints procedures and appeals regulations documented in its website which apply to the Postgraduate Diploma in Nuclear Medicine. If any other KBA is adopted as part of the curriculum they will also need to have an approved appeals mechanism.

All workplace-based assessment methods incorporate direct feedback from the assessor to the trainee and the opportunity to discuss the outcome. If a trainee has a complaint about the outcome from a specific assessment this is their first opportunity to raise it.

Appeals against decisions concerning ARCP outcomes will be managed using procedures described in “A reference guide to postgraduate specialty training in the UK – The Gold Guide”.

6 Supervision and Feedback

6.1 Supervision

All elements of work in training posts must be supervised with the level of supervision varying depending on the experience of the trainee and the clinical exposure and case mix undertaken. Outpatient and referral supervision must routinely include the opportunity to personally discuss all cases if required. As training progresses the trainee should have the opportunity for increasing autonomy, consistent with safe and effective care for the patient.

Trainees will at all times have a named Educational Supervisor and Clinical Supervisor, responsible for overseeing their education. Depending on local arrangements these roles may be combined into a single role of Educational Supervisor. Each trainee would have an Educational Supervisor and Training Programme Director from Clinical Radiology and Nuclear Medicine who will share responsibilities with Clinical Radiology taking the lead during ST3-ST5 and Nuclear Medicine during ST6-8. Clinical tutors will also be provided as required by local training schemes

The responsibilities of supervisors have been defined by GMC in the document “Operational Guide for the PMETB Quality Framework”. These definitions have been agreed with the National Association of Clinical Tutors, the Academy of Medical Royal Colleges and the Gold Guide team at MMC, and are reproduced below:

All trainers will be trained and appraised as required by the GMC.

Educational Supervisor
A trainer who is selected and appropriately trained to be responsible for the overall supervision and management of a specified trainee’s educational progress during a

training placement or series of placements. The Educational Supervisor is responsible for the trainee's Educational Agreement.

Clinical Supervisor
A trainer who is selected and appropriately trained to be responsible for overseeing a specified trainee's clinical work and providing constructive feedback during a training placement. Some training schemes appoint an Educational Supervisor for each placement. The roles of Clinical and Educational Supervisor may then be merged.

The Educational Supervisor, when meeting with the trainee, should discuss issues of clinical governance, risk management and any report of any untoward clinical incidents involving the trainee. The Educational Supervisor should be part of the clinical specialty team. Thus if the clinical directorate (clinical director) have any concerns about the performance of the trainee, or there were issues of doctor or patient safety, these would be discussed with the Educational Supervisor. These processes, which are integral to trainee development, must not detract from the statutory duty of the trust to deliver effective clinical governance through its management systems.

Academic trainees are encouraged to identify an academic mentor, who will not usually be their research supervisor and will often be from outside their geographical area. The Academy of Medical Sciences organises one such scheme (information via this link) but there are others and inclusion in an organised scheme is not a pre-requisite. The Medical Research Society organises annual meetings for clinician scientists in training (information via this link) and this type of meeting provides an excellent setting for trainees to meet colleagues and share experiences.

Opportunities for feedback to trainees about their performance will arise through the use of the workplace-based assessments, regular appraisal meetings with supervisors, other meetings and discussions with supervisors and colleagues, and feedback from ARCP.

6.2 Appraisal

A formal process of appraisals and reviews underpins training. This process ensures adequate supervision during training provides continuity between posts and different supervisors and is one of the main ways of providing feedback to trainees. All appraisals should be recorded in the ePortfolio

Induction Appraisal

The trainee and educational supervisor should have an appraisal meeting at the beginning of each post to review the trainee's progress so far, agree learning objectives for the post ahead and identify the learning opportunities presented by the post. Reviewing progress through the curriculum will help trainees to compile an effective Personal Development Plan (PDP) of objectives for the upcoming post. This PDP should be agreed during the Induction Appraisal. The trainee and supervisor should also both sign the educational agreement in the e-portfolio at this time, recording their commitment to the training process.

Mid-Point Review

This meeting between trainee and educational supervisor is mandatory (except when an attachment is shorter than 6 months), but is encouraged particularly if either the trainee or educational or clinical supervisor has training concerns or the trainee has been set specific targeted training objectives at their ARCP. At this meeting trainees should review their PDP with their supervisor using evidence from the e-portfolio.

Workplace-based assessments and progress through the curriculum can be reviewed to ensure trainees are progressing satisfactorily, and attendance at educational events should also be reviewed. The PDP can be amended at this review.

End of Attachment Appraisal

Trainees should review the PDP and curriculum progress with their educational supervisor using evidence from the e-portfolio. Specific concerns may be highlighted from this appraisal. The end of attachment appraisal form should record the areas where further work is required to overcome any shortcomings. Further evidence of competence in certain areas may be needed, such as planned workplace-based assessments, and this should be recorded. If there are significant concerns following the end of attachment appraisal then the programme director should be informed.

Attachments longer than one year

Where the trainee is based within a nuclear medicine department for several years it is recommended that appraisal take place at the beginning, middle and end of each section of training, normally marked by the Annual Review of Competence Progression Process so in effect 6 monthly.

7 Managing Curriculum Implementation

7.1 Intended Use of Curriculum by Trainers and Trainees

This curriculum and ePortfolio are web-based documents which are available from the Joint Royal Colleges of Physicians Training Board (JRCPTB) website www.jrcptb.org.uk and the Royal College of Radiology www.rcr.ac.uk.

Educational supervisors and trainers can access the up-to-date curriculum from the JRCPTB website and will be expected to use this as the basis of their discussion with trainees. 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 a portfolio. The trainee will use the curriculum to develop learning objectives and reflect on learning experiences.

7.2 Recording Progress

On enrolling with JRCPTB trainees will be given access to the ePortfolio for Nuclear Medicine. The ePortfolio allows evidence to be built up to inform decisions on a trainee's progress and provides tools to support trainees' education and development. Enrolment with Royal College of Radiologists with give access to the eportfolio for Radiologists.

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

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

LETBs, Training Programme Directors, College Tutors and ARCP panels may use the ePortfolio to monitor the progress of trainees for whom they are responsible.

JRCPTB will use summarised, anonymous ePortfolio data to support its work in quality assurance.

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

Reflections, assessments and other ePortfolio content should be linked to curriculum competencies in order to provide evidence towards acquisition of these competencies. Trainees can 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
- To inform discussions with supervisors to help both gain insight and assists in developing personal development plans.
- To identify shortcomings between experience, competency and areas defined in the curriculum so as to guide future clinical exposure and learning.

Supervisors can sign-off and comment on curriculum competencies to build up a picture of progression and to inform ARCP panels.

8 Curriculum Review and Updating

The specialty curriculum will be reviewed and updated with minor changes on an annual basis. The curriculum should be regarded as a fluid, living document and the SAC will ensure to respond swiftly to new clinical and service developments. In addition, the curriculum will be subject to regular review within the SAC. This will be informed by curriculum evaluation and monitoring. The SAC will have available:

- The trainees' survey, which will include questions pertaining to their specialty (GMC to provide)
- Specialty-specific questionnaires (if applicable)
- Reports from other sources such as educational supervisors, programme directors, service providers and patients.
- Trainee representation on the TPMC and the SAC of the JRCPTB
- Informal trainee feedback during appraisal.

Evaluation will address:

- The relevance of the learning outcomes to clinical practice
- The balance of work-based and off-the-job learning
- Quality of training in individual posts
- Feasibility and appropriateness of on-the-job assessments in the course of training programmes
- Availability and quality of research opportunities
- Current training affecting the service

Evaluation will be the responsibility of the JRCPTB and GMC. These bodies must approve any significant changes to the curriculum.

Interaction with the NHS will be particularly important to understand the performance of specialists within the NHS and feedback will be required as to the continuing needs for that specialty as defined by the curriculum. It is likely that the NHS will have a view as to the balance between generalist and specialist skills, the development of generic competencies and, looking to the future, the need for additional specialist competencies and curricula. In establishing specialty issues which could have implications for training, the SAC will produce a summary report to discuss with the NHS employers and ensure that conclusions are reflected in curriculum reviews.

Trainee contribution to curriculum review will be facilitated through the involvement of trainees in Local Faculties of Education and through informal feedback during appraisal and College/TPMC meetings.

The SAC will respond rapidly to changes in service delivery. Regular review will ensure the coming together of all the stakeholders needed to deliver an up-to-date, modern specialty curriculum. The curriculum will indicate the last date of formal review monitoring and document revision.

9 Equality and Diversity

The impact of the 2014 revisions to the curriculum on different groups has been carefully considered throughout the review process. The longer training programme may disproportionally effect female trainees who may wish to train flexibly, but the SAC/JRCPTB have determined that the extension to training is necessary for educational reasons as well as to meet the needs of the service and workforce.

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

The Federation of the Royal Colleges of Physicians believes that equality of opportunity is fundamental to the many and varied ways in which individuals become involved with the Colleges, either as members of staff and Officers; as advisers from the medical profession; as members of the Colleges' professional bodies or as doctors in training and examination candidates. Accordingly, it warmly welcomes contributors and applicants from as diverse a population as possible, and actively seeks to recruit people to all its activities regardless of race, religion, ethnic origin, disability, age, gender or sexual orientation.

LETB quality assurance will ensure that each training programme complies with the equality and diversity standards in postgraduate medical training as set by GMC.

Compliance with anti-discriminatory practice will be assured through:

- monitoring of recruitment processes;
- ensuring all College representatives and Programme Directors have attended appropriate training sessions prior to appointment or within 12 months of taking up post;
- LETBs must ensure that educational supervisors have had equality and diversity training (for example, an e learning module) every 3 years
- LETBs must ensure that any specialist participating in trainee interview/appointments committees or processes has had equality and diversity training (at least as an e module) every 3 years.
- ensuring trainees have an appropriate, confidential and supportive route to report examples of inappropriate behaviour of a discriminatory nature. LETBs and Programme Directors must ensure that on appointment trainees are made aware of the route in which inappropriate or discriminatory behaviour can be

reported and supplied with contact names and numbers. LETBs must also ensure contingency mechanisms are in place if trainees feel unhappy with the response or uncomfortable with the contact individual.
- monitoring of College Examinations;
- ensuring all assessments discriminate on objective and appropriate criteria and do not unfairly disadvantage trainees because of gender, ethnicity, sexual orientation or disability (other than that which would make it impossible to practise safely as a physician). All efforts shall be made to ensure the participation of people with a disability in training.

10 Syllabus

In the tables below, the "Assessment Methods" shown are those that are appropriate as **possible** methods that could be used to assess each competency. It is not expected that all competencies will be assessed and that where they are assessed not every method will be used. See section 5.2 for more details.

"GMP" defines which of the 4 domains of the Good Medical Practice Framework for Appraisal and Assessment are addressed by each competency. See section 3.2 for more details.

The syllabus itself covers 4 distinct areas these are:

- The good Nuclear Medicine Physician
- Basic Science and Regulations
- Diagnostic skills
- Therapy with radioisotopes

10.1 Progression

There is clear progression throughout the syllabus with basic skills being recorded as level 1. These should normally be obtained during core Clinical Radiology training but may be completed by the end of ST6. Level 2 and 3 competencies go beyond that described in the core clinical radiology curriculum. Level 2 competencies should be completed before the end of ST7 and level 3 competencies by the end of ST8. The PYA will be used to guide the trainee through the final months to help ensure all level 2 and level 3 competencies are attained.

Syllabus Contents

The Good Nuclear Medicine Physician

Level 1-3 Competencies

Trainees would be expected to be competent at a simple level at the end of ST6. Retesting during ST7 and ST8 would be expected to demonstrate an ability to deal with increasingly complex situations and increased knowledge.

The trainee will understand the role of the physician within nuclear medicine. They will understand the skills of other craft groups and their role in clinical leadership		
Knowledge	**Assessment Methods**	**GMP**
Definition of Nuclear Medicine	CbD, PGD	1,2,3,4
Understand the skills and knowledge required to perform the role of clinical lead in Nuclear Medicine	CbD, PGD	1,2,3,4
To understand the role of the radiation protection supervisor and subsequent legal relationship	CbD, PGD, MSF	1,2,3,4
Be aware of the need to work in a safe way understanding the concerns of the colleagues within the department	CbD, PGD, MSF	1,2,3,4
Understand the need for close working relationships with non-medically qualified staff	CbD, PGD, MSF	1,2,3,4
Skills		
Requirement to learn the legislative framework under which nuclear medicine operates	PGD	2,3
Ability to both learn from non-medically qualified staff	PGD, TO	2,3
Behaviours		
Understand and accept the roles and limitations of the team delivering nuclear medicine services	MSF	3

The trainee will understand the role of radioisotopes in society and their use of production and delivery to the patient		
Knowledge	**Assessment Methods**	**GMP**
Definition of Radioactivity	PGD, MSF	1,2
Understand constraints of use of radioisotopes such as half life	PGD	1,2
Understand that the general public may be fearful of the use of radioisotopes and have sufficient knowledge to discuss and refute those fears	PGD, MSF	1,2
Understand the factors that affect that restrict the access of radio-isotopes to patients	PGD, MSF	1,2
Understand the security requirements in the holding and disposal of radio-isotopes including the possibility of terrorist misuse of radioisotopes	PGD, MSF	1,2
Ability to understand the physical basis of radiation and radioisotopes	MSF	1,2
Skills		

Ability to understand the physical basis of radiation and radioisotopes	PGD	1,2
Establish a rapport with the patient and any relevant others (eg carers) Utilise open and closed questioning appropriately	CbD, Mini-CEX, Patient Survey	1, 3
Listen actively and question sensitively to guide the patient and to clarify information	Mini-CEX, PS	1, 3
Identify and manage communication barriers, tailoring language to the individual patient and others and using interpreters when indicated	CbD, Mini-CEX, PS	1, 3
Establish a rapport with the patient and any relevant others (eg carers) Utilise open and closed questioning appropriately	CbD, Mini-CEX, PS	1, 3
Behaviours		
Good communication skills with patient	MSF, PS	1,2
Maintains a high level of safety awareness and consciousness at all times	CbD, mini-CEX	2
Be willing to provide patients with a second opinion	CbD, mini-CEX, MSF, PS	1, 3
Be confident and positive in one's own values	CbD, mini-CEX	1, 3

The trainee shall be able to take an appropriate clinical history		
Knowledge	**Assessment Methods**	**GMP**
Recognises the importance of different elements of history	CbD, mini-CEX, MSF	1,2
Recognises that patients do not present history in structured fashion	CbD, mini-CEX, MSF	1,2
Knows likely causes and risk factors for conditions relevant to mode of presentation	CbD, mini-CEX, MSF	1,2
Recognises that history should inform examination and investigation and advice given to the referring clinical concerning the patients management plan	CbD, mini-CEX, MSF	1,2
Skills		
Focuses on relevant aspects of history	CbD, mini-CEX, MSF	1,2,3
Identifies and overcomes possible barriers to effective communication	CbD, mini-CEX, MSF	1,2,3
Assimilates history from the available information from patient and other sources	CbD, mini-CEX, MSF	1,2,3
Recognises and interprets the use of nonverbal communication from patients and carers	CbD, mini-CEX, MSF	1,2,3
Manages alternative and conflicting views from family, carers and friends	CbD, mini-CEX, MSF	1,2,3
Supplements history with standardised instruments or questionnaires when relevant	CbD, mini-CEX, MSF	1,2,3
Manages time and draws consultation to a close appropriately	CbD, mini-CEX, MSF	1,2,3
Behaviours		
Shows respect and behaves in accordance with Good Medical Practice	mini-CEX, MSF	3

The trainee shall be able to perform a relevant clinical examination of the patient		
Knowledge	**Assessment Methods**	**GMP**
Understands the need for a valid clinical examination	CbD, mini-CEX, MSF	1,2
Understands the basis for clinical signs and the relevance of positive and negative physical signs	CbD, mini-CEX, MSF	1,2
Recognises constraints to performing physical examination and strategies that may be used to overcome them	CbD, mini-CEX, MSF	1,2
Skills		
Performs an examination relevant to the presentation and risk factors that is valid, targeted and time efficient	CbD, mini-CEX, MSF	1,2,3
Recognises the possibility of deliberate harm in vulnerable patients and reports to appropriate agencies	CbD, mini-CEX, MSF	1,2,3
Actively elicits and records important clinical findings	CbD, mini-CEX, MSF	1,2,3
Behaviours		
Shows respect and behaves in accordance with Good Medical Practice	mini-CEX, MSF	3

The trainee shall learn to deal with the conflicting calls upon their time and learn how to prioritise work, especially being aware of the constraints caused by isotope decay and camera time		
Knowledge	**Assessment Methods**	**GMP**
Understand that organisation is key to time management	MSF	2
Understand that some tasks are more urgent or more important than others	MSF	2
Understand the need to prioritise work according to urgency and importance	MSF	2
Understand that some tasks may have to wait or be delegated to others	MSF	2
Outline techniques for improving time management	CbD	2
Understand the importance of delivering promptly the results of nuclear medicine investigations in disease management	MSF	2
Skills		
Estimate the time likely to be required for essential tasks and plan accordingly	MSF	2,3
Group together tasks when this will be the most effective way of working	MSF	2,3
Recognise the most urgent/important tasks and ensure that they managed expediently	MSF	2,3
Regularly review and re-prioritise personal and team work load	MSF	2,3
Organise and manage workload effectively	MSF	2,3
Behaviours		
Ability to work flexibly and deal with tasks in an effective fashion	MSF	3

Recognise when you or others are falling behind and take steps to rectify the situation	MSF	3
Communicate changes in priority to others	MSF	3
Remain calm in stressful or high pressure situations and adopt a timely, rational approach	MSF	3

The trainee will be able to critically assess research in the field of nuclear medicine and radiology

Knowledge	Assessment Methods	GMP
The trainee shall have the basic skills to be able to understand the following parameters used in assessing research and apply them critically to any relevant scientific paper: • ethical basis of research • prospective or retrospective • sample size • appropriate methodology • how the data is assessed • appropriate use of statistics and their meaning • the use of the terms phase 1, phase 2 and phase 3 trials • understanding the requirements and limitations of randomized controlled trials	CbD, PGD	1
How results may affect practice or determine the need for further research	CbD, PGD	1
The importance of looking at levels of evidence such as the Cochrane method	CbD, PGD	1
Skills		
Be able to understand both strengths and weaknesses of research	PGD, TO	2
Understand the particular limitations which occur in research in imaging	PGD, TO	2
Behaviours		
An open and enquiring mind	MSF	3,4
Not accepting the status quo without supporting evidence	MSF	3,4

The trainee shall show a correct approach to looking after patients and their families and friends in the context of nuclear medicine

Knowledge	Assessment Methods	GMP
Understand the concerns of patients with potentially serious and life threatening disease	PGD, MSF	2,3,4
Understand patient's fears about their disease	PGD, MSF	2,3,4
Understand why patients may refuse a test including fear of radiation and be able to explain the science behind why these tests are needed and the safety issues involved	PGD, MSF	2,3,4

Understand the special requirements and legal framework for dealing with the young, the old and the vulnerable and their guardians/parents/carers	PGD, MSF	2,3,4
Skills		
Demonstrate ability to communicate with patients	MSF, PS	2,3
Ability to look at the patient holistically and see their disease within a wider context for their individual health	MSF, PS	2,3
Show an ability to explain the dangers and benefits of radiation to the patient and society as a whole as appropriate	MSF, PS	2,3
Behaviours		
Show that the trainee is able to listen to and comprehend the fears and worries of patients and their families/friends/carers	MSF	3

The trainee shall be able to give injections of radiopharmaceutical in a way which is safe for themselves, their patients and staff colleagues

Knowledge	Assessment Methods	GMP
Understand the concepts of sterile injection	PGD, DOPS, MSF	1,2
Understand the concepts of maintaining both sterility and radiation safety especially where this results in variance from normal clinical practice	PGD, DOPS, MSF	1,2
Able to communicate to the patient the reason for the test and obtain the required written and/or verbal consent	PGD, MSF	1,2
Able to explain to the patient the risks and benefits of radiation for their particular situation in particular reference to IR(ME)R	PGD, MSF	1,2
Understand the importance of avoiding radiation during pregnancy and the exceptions to this rule for the diagnosis of pulmonary embolism	PGD, DOPS, MSF	1,2
To understand the special requirements and constraints when administering a radiopharmaceutical including: • Via a central venous catheter • In a patient with lymphoedema/vascular fistula • Tc-99m MAA for lung scanning • Tl-201 • Biological which may cause an allergic reaction	PGD, DOPS, MSF	1,2
Skills		
Able to communicate to the patient the reason for the test and obtain the required written and/or verbal consent	PGD, DOPS, mini-CEX, MSF	2,3
Deal with the concerns of the patient and their friends and family in relation to the administration of radioactivity	PGD, DOPS, mini-CEX, MSF	2,3
Behaviours		
Demonstrate willingness to take advice from non-clinical staff	MSF	3
To empathise with the concerns of the patient and their family and friends	MSF, PS	3

The trainee shall learn how to deal with a complaint, either against themselves, a colleague or the department		
Knowledge	**Assessment Methods**	**GMP**
Define the local complaints procedure	CbD	3,4
Recognise factors likely to lead to complaints (poor communication, dishonesty etc)	CbD	3,4
Dealing with dissatisfied patients or relatives	MSF	3,4
Outline the principles of an effective apology	MSF	3,4
Identify sources of help and support when a complaint is made about yourself or a colleague	MSF	3,4
Skills		
Contribute to processes whereby complaints are reviewed and learned from	MSF	1,2,3
Explain comprehensibly to the patient the events leading up to a medical error	MSF	1,2,3
Recognise when something has gone wrong and identify appropriate staff to communicate this with	MSF	3,4
Act with honesty and sensitivity in a non-confrontational manner	MSF	3,4
Deliver an appropriate apology	MSF	1,2,3
Distinguish between system and individual errors	MSF	1,2,3
Show an ability to learn from previous errors	MSF	1,2,3
Behaviours		
Take leadership over complaint issues (If appropriate or legal)	MSF	2,3,4
Recognise the impact of complaints and medical error on staff, patients, and the National Health Service	MSF	2,3,4
Adopt behaviour likely to prevent complaints	MSF	3,4
Contribute to a fair and transparent culture around complaints and errors	MSF	2,3,4
Recognise the rights of patients, family members and carers to make a complaint	MSF	2,3,4

The trainee shall recognise the desirability of monitoring performance, learning from mistakes and adopting no blame culture in order to ensure high standards of care and optimise patient safety		
Knowledge	**Assessment Methods**	**GMP**
Understand the elements of clinical governance	CbD, mini-CEX, MSF	1,2
Recognise that governance safeguards high standards of care and facilitates the development of improved clinical services	CbD, mini-CEX, MSF	1,2
Define local and national significant event reporting systems relevant to specialty	CbD, mini-CEX,, MSF	1,2
Recognise importance of evidence-based practice in relation to	CbD, mini-CEX, MSF	1,2

clinical effectiveness		
Outline local health and safety protocols (fire, manual handling etc)	CbD, mini-CEX, MSF	1,2
Understand risk associated with the trainee's specialty work including biohazards and mechanisms to reduce risk	CbD, mini-CEX, MSF	1,2
Outline the use of patient early warning systems to detect clinical deterioration where relevant to the trainees clinical specialty	CbD, mini-CEX, MSF	1,2
Keep abreast of national patient safety initiatives including National Patient Safety Agency, NCEPOD reports, NICE guidelines etc	CbD, mini-CEX, MSF	1,2
Skills		
Contribute to quality improvement processes e.g.: • Audit of personal and departmental performance • Errors / discrepancy meetings • Critical incident reporting • Unit morbidity and mortality meetings • Local and national databases	CbD, mini-CEX, MSF	1,2,3
Maintain a folder of information and evidence, drawn from your medical practice	CbD, mini-CEX, MSF	1,2,3
Reflect regularly on your standards of medical practice in accordance with GMC guidance on licensing and revalidation	CbD, mini-CEX, MSF	1,2,3
Behaviours		
Show willingness to participate in safety improvement strategies such as critical incident reporting	CbD, mini-CEX, mini-IPX, MSF	2,3,4
Engage with an open no blame culture	CbD, mini-CEX, mini-IPX, MSF	
Respond positively to outcomes of audit and quality improvement	CbD, mini-CEX, mini-IPX, MSF	
Co-operate with changes necessary to improve service quality and safety	CbD, mini-CEX, mini-IPX, MSF	

The trainee shall know, understand and apply appropriately the principles, guidance and laws regarding medical ethics and confidentiality

Knowledge	Assessment Methods	GMP
Outline and follow the guidance given by the GMC on confidentiality	CbD, mini-CEX, mini-IPX, MSF	1,2
Define the provisions of the Data Protection Act and Freedom of Information Act	CbD, mini-CEX, mini-IPX, MSF	1,2
Define the role of the Caldicott Guardian within an institution, and outline the process of attaining Caldicott approval for audit or research	CbD, mini-CEX, MSF	1,2
Outline the procedures for seeking a patient's consent for disclosure of identifiable information	CbD, mini-CEX, mini-IPX, MSF	1,2
Outline situations where patient consent, while desirable, is not required for disclosure e.g. communicable diseases, public interest	CbD, mini-CEX, mini-IPX, MSF	1,2
Recall the obligations for confidentiality following a patient's death	CbD, mini-CEX, mini-IPX, MSF	1,2

Recognise the problems posed by disclosure in the public interest, without patient's consent	CbD, mini-CEX, mini-IPX, MSF	1,2
Recognise the factors influencing ethical decision making: religion, moral beliefs, cultural practices	CbD, mini-CEX, mini-IPX, MSF	1,2
Do not resuscitate: Define the standards of practice defined by the GMC when deciding to withhold or withdraw life-prolonging treatment	CbD, mini-CEX, MSF	1,2
Outline the principles of the Mental Capacity Act	CbD, mini-CEX, mini-IPX, MSF	1,2
Be aware of the need to control access to data from various IT systems	CbD, mini-CEX, mini-IPX, MSF	1,2
Be aware of the use of pseudonym based data	CbD, mini-CEX, mini-IPX, MSF	1,2
Skills		
Use and share information with the highest regard for confidentiality, and encourage such behaviour in other members of the team	MSF	1,2,3
Use and promote strategies to ensure confidentiality is maintained e.g. anonymisation	MSF	1,2,3
Counsel patients on the need for information distribution within members of the immediate healthcare team	MSF	1,2,3
Counsel patients, family, carers and advocates tactfully and effectively when making decisions about resuscitation status, and withholding or withdrawing treatment	MSF	1,2,3
Behaviours		
Encourage ethical reflection in others	MSF	2,3,4
Show willingness to seek advice of peers, legal bodies, and the GMC in the event of ethical dilemmas over disclosure and confidentiality	MSF	2,3,4
Respect patient's requests for information not to be shared, unless this puts the patient, or others, at risk of harm	MSF	2,3,4

Level 2 Competencies

The trainee will understand what is required to authorize a nuclear medicine request		
Knowledge	**Assessment Methods**	**GMP**
Demonstrate a wide knowledge of relevant medical knowledge	CbD, PGD, mini-IPX	1,2
Know the legal framework of IR(ME)R 2000	CbD, PGD, mini-IPX	1,2
Understand the relevancy and importance of the request in that patients clinical pathway	CbD, PGD, mini-IPX	1,2
Skills		
Know how to discuss requests with referrer	CbD, MSF	2,3
Combine knowledge base of nuclear medicine and clinical medicine	CbD, MSF	2,3
Have confidence in that knowledge	CbD, MSF	2,3
Behaviours		
Ability to discuss and where necessary to contravene the requests of senior colleagues	MSF	3

The trainee will understand how to produce a nuclear medicine report		
Knowledge	**Assessment Methods**	**GMP**
Know the role of the physician within the nuclear medicine department	mini-IPX	2,3
Recognise those artefacts which could influence a nuclear medicine report and where possible ensure a patient is re-imaged or if not possible know how this could influence the report	mini-IPX	2,3
Know how to structure a report into the following 4 phases: • Indication • Description • Interpretation • Recommendation	mini-IPX	2,3
Know which results must be communicated rapidly to the referring clinician and how to ensure this happens	mini-IPX	2,3
Skills		
Clear use of English	mini-IPX	2,3
Logical progression of report		
Behaviours		
Be open to comments and criticism of others	mini-IPX, MSF	3
Be confident that final report is correct	mini-IPX, MSF	3

The trainee will understand how to undertake a research project in diagnostic or therapeutic nuclear medicine		
Knowledge	**Assessment Methods**	**GMP**
Know how to write a research protocol	CbD	1,2
Know how to obtain any required funding	CbD	1,2
Work within the current ethical guidelines as stated within the European Clinical Trials Directive, national and local research ethics committees	CDB, PGD	1,2
Know how to determine the required sample size and how this can be obtained	PGD	1,2
Know the requirements for undertaking research within the trainee's hospital	CbD, MSF	1
Know the special requirements for research with radioisotopes including the role of ARSAC	PGD	1
Skills		
Have access to required statistical knowledge	PGD	1
Be able to write clearly any grant application forms, EUDRACT and ethics forms	PGD	1
Write a patient information sheet	MSF	1,2
Be able to recruit subjects	MSF	1,2
Be able to obtain consent correctly	MSF	1,2
Behaviours		
Be able to take on suggestions from co-researchers	MSF	3,4
Be positive in the face of adversity and setbacks	MSF	3,4

The trainee will undertake appropriate quality improvement projects (which may include audit) to measure their practice and their departments recognising and committing to the culture of continuous improvement in clinical practice		
Knowledge	**Assessment Methods**	**GMP**
Know how to organize a quality improvement project	AA	2,4
Understand the idea of an audit standard	AA	2,4
Know how to identify the relevant guidelines available from the National Institute of Clinical Research, the British Society of Nuclear Medicine and the European Association of Nuclear Medicine	AA	2,4
Skills		
Be able to design and undertake quality improvement projects based on clinical practice of nuclear medicine	AA, MSF	2,4
Ability to communicate the results of such an project	AA, MSF	2,4
Be able to implement changes in practice secondary to projects	AA, MSF	2,4
Behaviours		
Have a positive view of quality improvement and be able to deal with fears induced in fellow workers positively	MSF	3

Level 3 Competencies

The trainee will be able to present results of nuclear medicine and radiology in MDM/Ts		
Knowledge	**Assessment Methods**	**GMP**
Understand the role of the MDM/T and in the case of cancer the legal framework in which it works	DOPS, MSF	2,3,4
Understand the role of a member of an MDM/T and its role in cooperate decision making	DOPS, MSF	2,3,4
A good level of knowledge of both the nuclear medicine and clinical medicine in the topic covered within an MDM/T	DOPS, MSF	2,3,4
Skills		
Know how to work within a team	MSF	2,3,4
Have confidence in own skills and experience	MSF	2,3,4
Know your limitations within MDT/M	MSF	2,3,4
Behaviours		
Work with colleagues from different specialties to enhance patient care	MSF	3,4

The trainee will show that they can work with children undergoing nuclear medicine studies or therapy		
Knowledge	**Assessment Methods**	**GMP**
Have a working knowledge of how children develop and understand how they see the world at various stages in their development	CbD, PGD, MSF	1,2
Know the current law concerning consent in children and the rights and roles of the parent/guardian	CbD, PGD, MSF	1,2
Know the meaning of Ghillick competency and its application to nuclear medicine	CbD, PGD, MSF	1,2
Be aware of the need to ensure compliance to the principle of ALARA in children whilst ensuring a diagnostic study is performed	CbD, PGD, MSF	1,2
Whether or not any given radiopharmaceutical is licensed in children and if not the legal position	CbD, PGD, MSF	1,2
Be aware of the advantages and disadvantages of sedation in children	CbD, PGD, MSF	1,2
Know when children may need to be anaesthetised for a scan and how this is safely achieved	CbD, PGD, MSF	1,2
Skills		
Be able to communicate what needs to be done with the child	CbD, PGD, MSF	1,2,3
Gain the child's trust and co-operation	CbD, PGD, MSF	1,2,3
Be able to perform intravenous injection or if required bladder catheterisation in a way that discomforts the child the least	CbD, PGD, MSF	1,2,3
Be able to engage the child and maintain co-operation throughout the	CbD, PGD, MSF	1,2,3

study		
Be aware of the special requirements for resuscitation in children	CbD, PGD, MSF	1,2,3
Know the present guideline from ARSAC vis-à-vis recommended adjustments to activity for children for any given radiopharmaceutical	CbD, PGD, MSF	1,2,3
Know similar dose reductions for Frusemide and sodium pyophosphate	CbD, PGD, MSF	1,2,3
Be able recruit other team members including play therapists and parents/guardians into the process of scanning the child	CbD, PGD, MSF	1,2,3
Behaviours		
Be open and honest	MSF	3,4
Be aware of the fears and hopes of the child and their parent guardian	MSF	3,4
Involve the parent/guardian in the procedure and be willing to answer their questions	MSF	3,4
Be open to the fears of the child and their parents/guardians to illness especially when terminal or potentially fatal	MSF	3,4

The trainee will be able to apply for a license from the Administration of Radioactive Substances Advisory Committee (ARSAC) N.B. Though this knowledge must be obtained whilst the candidate is a trainee the law states that an application cannot be made until the candidate has a CCT and has been appointed to a specific Consultant post

Knowledge	Assessment Methods	GMP
Understand the role of ARSAC	PGD	1,2
Understand the different licences available	PGD	1,2
Know how to fill in an ARSAC application form	PGD	1,2
Provide required evidence of competence	PGD	1,2
Skills		
Able to provide the correct data on forms	PGD	3
Ability to both learn from and teach non-medically qualified staff	PGD	3
Behaviours		
Open to help from colleagues	MSF	3,4

The trainee shall understand the structure of the NHS and the management of local healthcare systems in order to be able to participate fully in managing healthcare provision

Knowledge	Assessment Methods	GMP
Understand the guidance given on management and doctors by the GMC	CbD, PGD	1,2,3,4
Understand the local structure of NHS systems in your locality recognising the potential differences between the four countries of the UK	CbD, PGD	1,2,3,4
Understand the structure and function of healthcare systems as they	CbD, PGD	1,2,3,4

apply to your specialty		
Understand the principles of: • Clinical coding • European Working Time Regulations • National Service Frameworks • Health regulatory agencies (e.g. CHI, NICE, Scottish Government) • NHS Structure and relationships • NHS finance and budgeting • Consultant contract and the contracting process • Resource allocation • The role of the Independent sector as providers of healthcare	CbD, PGD	1,2,3,4
Understand the principles of recruitment and appointment procedures	CbD, PGD	1,2,3,4
Understand the need to be non-discriminatory in the recruitment process	CbD, PGD	1,2,3,4
Skills		
Participate in managerial meetings	CbD, MSF	1,2,3
Take an active role in promoting the best use of healthcare resources	CbD, MSF	1,2,3
Work with stakeholders to create and sustain a patient-centred service	CbD, MSF	1,2,3
Employ new technologies appropriately, including information technology	CbD, MSF	1,2,3
Be involved in business case development for new equipment	CbD, MSF	1,2,3
Behaviours		
Recognise the importance of just allocation of healthcare resources	CbD, MSF	2,3,4
Recognise the role of doctors as active participants in healthcare systems	CbD, MSF	2,3,4
Respond appropriately to health service targets and take part in the development of services	CbD, MSF	2,3,4
Recognise the role of patients and carers as active participants in healthcare systems and service planning	CbD, MSF	2,3,4
Show willingness to improve managerial skills (e.g. management courses) and engage in management of the service	CbD, MSF	2,3,4

Basic Science and Regulations

Level 1 Competencies

The trainee will learn the basic physics and mathematics as related to the delivery of safe nuclear medicine where not covered in Clinical Radiology

Knowledge	Assessment Methods	GMP
Structure and modes of decay of radioactive atoms	PGD	1,2
Interaction of emissions from radioactive atoms with matter	PGD	1,2
Biological implications of and radiation hazards from ionising radiation	PGD	1,2
Molecular biology	PGD	1,2
Probability theory	PGD	1,2
Parametric and non-parametric statistics	PGD	1,2
Understand how radioisotopes are manufactured and problems of supply and transportation	PGD	1,2
Appropriate mathematics and physics applied to radionuclide tracer theory, modelling of tracer kinetics and quantitative imaging	PGD	1,2
Skills		
Understand how these are to be applied on a daily basis	PGD	1,2
Behaviours		
Be willing to learn	PGD, MSF	1,2,3,4
Understand their limitations and ask for assistance from non-medical colleagues	PGD, MSF	1,2,3,4

The trainee will learn the methods by which radiation is detected in nuclear medicine and the principles of the computer based image analysis and display including artefacts where not covered in Clinical Radiology

Knowledge	Assessment Methods	GMP
Theory of systems used to detect and analyse emissions from radioactive atoms	CbD, PGD	1,2
Knowledge of how detection systems are used, calibrated and tested in Nuclear Medicine	CbD, PGD	1,2
Principles of collimation and practical experience with the use of collimators	CbD, PGD	1,2
Understanding of the tracer principle in particular the use of time activity analysis	CbD, PGD	1,2
Principles of single-photon emission tomography and co-incidence counting	CbD, PGD	1,2
Principles of image reconstruction	CbD, PGD	1,2
Understand how artefacts occur and how their effect can be reduced if possible and if not their effect on image quality and clinical report	CbD, PGD	1,2

Understand the principles of positron imaging	CbD, PGD	1,2
Understand how cross sectional images are registered and the issues with image mis-registration	CbD, PGD	1,2
Kinetics of radioactive tracers used in Nuclear Medicine	CbD, PGD	1,2
Use of principles of kinetics and modelling techniques to calculate parameters such as glomerular filtration rate etc	CbD, PGD	1,2
Physiological principles of tracer techniques	CbD, PGD	1,2
Errors associated with quantitative measurements	CbD, PGD	1,2
Skills		
Understand how these are to be applied on a daily basis	PGD, mini-IPX	1,2
Able to apply these techniques	PGD, mini-IPX	1,2
Able to understand how problems with these techniques can lead to deterioration of image quality and how this may be affect clinical reporting	PGD, mini-IPX	1,2
Recognise and if possible correct mis-registration in hybrid imaging and if such correction is not possible know the possible effect on image interpretation	PGD, mini-IPX	1,2
Be able to check the validity of non imaging tests such as a GFR estimation	PGD, mini-IPX	1,2
Behaviours		
Be willing to learn	PGD, MSF	1,2,3,4
Understand their limitations and ask for assistance from non-medical colleagues	PGD, MSF	1,2,3,4

The trainee will learn the principles of radiation biology and radiation protection and know the legal framework in which nuclear medicine is practised where not covered in Clinical Radiology

Knowledge	Assessment Methods	GMP
Theory of biological effects of high and low-level radiation from unsealed sources	PGD	1,2
Calculation of radiation dose from radiopharmaceuticals (Effective dose [ED])	PGD	1,2
Know the importance of the upper limits of activities of radioactivity as defined by ARSAC for each investigations	PGD	1,2
Know the circumstances in which these upper limits may be breached	PGD	1,2
Know the recommended adjustments made in the administered activity for children	PGD	1,2
Know advice must be given to lactating women receiving radioisotopes	PGD	1,2
Know when radioisotopes can be given to women who are pregnant	PGD	1,2
Basic principles of radionuclide therapy	PGD	1,2
Nature of the cancerous process and the radiobiological basis of cancer radionuclide therapy	PGD	1,2
Management of radiation accidents such as spills relating to Nuclear Medicine	PGD	1,2

Know those laws affecting the practice of nuclear medicine	PGD	1,2
Understand the role of the regulatory authorities such as ARSAC, The Environment Agency, The Health and Safety Executive, The Health Commission and their effect on practice and understand that infringements of these regulations represent a criminal offence National and international regulatory requirement on the practice of nuclear medicine including: IRR99; MARS legislation; ARSAC; RSA 93; IR(ME)R 2000; Medical guidance notes; Product licenses and other appropriate legislation	PGD	1,2
Regulatory requirements which apply to the design and operation of radiopharmacies GMP 1997 (Orange Guide)	PGD	1,2
Regulations controlling transport of radioactive materials in the UK RM(Road Transport) (GB) R 1996	PGD	1,2
Mechanism by which the regulations are applied and policed within the UK	PGD	1,2
Health and safety regulations governing safe practice e.g. COSHH Regulations 1999 ALARA (as low as reasonably achievable) and ALARP (as low as reasonably practical)	PGD	1,2
Know the role of the RPS in Nuclear Medicine	PGD	1,2
Skills		
Understand how these are to be applied on a daily basis	PGD, MSF	1,2,3,4
Learn to work in a way which is safe for self and colleagues	PGD, MSF	1,2,3,4
Understand the importance of complying with the legal framework of nuclear medicine	PGD, MSF	1,2,3,4
Behaviours		
Be willing to learn	PGD, MSF	1,2,3,4
Understand their limitations and ask for assistance from non-medical colleagues	PGD, MSF	1,2,3,4
Be willing to self report incidents such as spills and mal administration to the RPS	PGD, MSF	1,2,3,4
Be willing to report any witnessed infringements of the regulations to the proper authorities	PGD, MSF	1,2,3,4

Level 2 Competencies

The trainee will learn the methods by which radiopharmaceuticals are prepared		
Knowledge	**Assessment Methods**	**GMP**
Production of radionuclides using reactors, cyclotrons and generators	PGD	1,2
Physical properties of radionuclides, clinical applications	PGD	1,2
Physicochemical and biological properties of different radiopharmaceuticals in routine clinical practice, clinical trials and under development	PGD	1,2
Different formulations used in Nuclear Medicine	PGD	1,2
Cell labelling techniques	PGD	1,2
Principles of Quality Assurance (QA) in the radiopharmacy	PGD	1,2
Quality control parameters which determine the quality of radiopharmaceuticals including radionuclide & radiochemical purity	PGD	1,2
Principles of aseptic preparation	PGD	1,2
Skills		
Be able to measure the activity of radiopharmaceutical given correctly	PGD, DOPS	1,2
Be able to draw up a patient dose using aseptic technique	PGD, DOPS	1,2
Be able to perform and understand a simple quality assurance test	PGD, DOPS	1,2
Behaviours		
Be willing to learn	PGD, MSF	1,2,3,4
Be willing to use techniques that reduce the risk of cross infection between patients and ensure those around also comply	PGD, MSF	1,2,3,4
Understand their limitations and ask for assistance from non-medical colleagues	PGD, MSF	1,2,3,4

Diagnostic Nuclear Medicine

Level 1 Competencies

The trainee will learn how to report correctly a ventilation/perfusion lung scan		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of thrombo-embolic disease	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand the methodology of ventilation perfusion imaging including the different methods of ventilation and their advantages and disadvantages	CbD, PGD, mini-IPX	1,2
Understand the special circumstances of imaging women during pregnancy and lactation	CbD, PGD, mini-IPX	1,2
Understand how the images are displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for positivity and negativity in the diagnosis of pulmonary embolism	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Skills		
Give an effective and safe injection of Tc-99 MAA	CbD, PGD, mini-IPX	1,2
Recognise the patterns of positivity and negativity for pulmonary embolism	CbD, PGD, mini-IPX	1,2
Recognise the patterns of abnormality that suggest an alternate diagnosis such as COPD or lung cancer	CbD, PGD, mini-IPX	1,2
Behaviours		
Be willing to transmit important urgent results to the patient and their referring clinician	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly a bone scan in a patient with metastases		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of malignant disease and how it affects the bones	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand those conditions that can affect the result of the bone scintigraphy	CbD, PGD, mini-IPX	1,2
Understand the methodology of bone imaging	CbD, PGD, mini-IPX	1,2
Understand how the images are displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for positivity and negativity in the diagnosis of bone metastases	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2

Know when SPECT may be helpful	CbD, PGD, mini-IPX	1,2
If applicable have sufficient knowledge of non-contrast CT to interpret SPECT-CT image of the spine and pelvis	CbD, PGD, mini-IPX	1,2
Know when to suggest treatment with bone palliation radionuclide methods	CbD, PGD, mini-IPX	1,2
Skills		
Recognise the patterns of positivity and negativity for bone metastases	CbD, PGD, mini-IPX	1,2
Recognise the patterns of abnormality that suggest an alternate diagnosis such as degenerative disease. Know how to use alternative imaging such as CT or SPECT-CT to determine this	CbD, PGD, mini-IPX	1,2
Behaviours		
Be willing to transmit important urgent results to the patient and their referring clinician especially if the patient was not known to have a history of cancer	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly a bone densitometry (optional)		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of osteoporosis and the factors which influence bone density	CbD, PGD, mini-IPX	1,2
Know the methodology of dual photon densitometry	CbD, PGD, mini-IPX	1,2
Understand the criteria for osteoporosis and low bone density	CbD, PGD, mini-IPX	1,2
Know current guidelines for use of bone densitomerty	CbD, PGD, mini-IPX	1,2
Skills		
Ensure current regions of interest have been drawn	CbD, PGD, mini-IPX	1,2
Know the relevance of T and Z scores	CbD, PGD, mini-IPX	1,2
Know what recommendations for treatment should be given	CbD, PGD, mini-IPX	1,2
Behaviours		
Understand the concerns of the patients undergoing bone densitometry	CbD, MSF	1,2,3,4
Be able to discuss with patients those life style factors which may reduce the risk of osteoporosis	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly a static renal DMSA scan		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of reflux nephropathy	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Know the latest guidelines on if and when Tc-99m DMSA should be performed in children	CbD, PGD, mini-IPX	1,2
Know the time interval required between last urinary tract infection	CbD, PGD, mini-IPX	1,2

and scanning		
Understand the methodology of DMSA imaging including the different views taken, the meaning of quantification and in adults the possible use of SPECT	CbD, PGD, mini-IPX	1,2
Understand how the images are displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for positivity and negativity in the diagnosis of renal scars and other space occupying lesions	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Skills		
Recognise the patterns of abnormality suggestive of renal scarring or acute renal infection	CbD, PGD, mini-IPX	1,2
Recognise the patterns of abnormality that suggest an alternate diagnosis such as cyst or tumour	CbD, PGD, mini-IPX	1,2
Behaviours		
Understand the concerns of the parents for children undergoing the test including why there may a considerable delay until imaging can be performed	CbD, MSF	1,2,3,4
Understanding the Ghillick rules on consent in children	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly dynamic renography		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of renal clearance	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Know the latest guidelines on if and when dynamic renography should be performed in children	CbD, PGD, mini-IPX	1,2
Understand the methodology of dynamic renography imaging including whether or not Frusemide should be given and the timing of that injection	CbD, PGD, mini-IPX	1,2
Understand how the images are displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for interpreting dynamic renography, for example the criteria for diagnosing/excluding obstruction	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Skills		
Give an effective and safe injection of Tc-99m DTPA/MAG3 via a central line if required	CbD, PGD, mini-IPX	1,2
Recognise patterns of abnormality - abnormal relative renal function or obstruction	CbD, PGD, mini-IPX	1,2
Behaviours		
Understand the concerns of the patient and parents of children undergoing the test	CbD, MSF	1,2,3,4
Understanding the Ghillick rules on consent in children	CbD, MSF	1,2,3,4

Be willing to transmit important urgent results about the patient to their referring clinician	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly a GI transit study		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of the problems that can occur in the GI tract concerning transit including sclerodermas, diabetes and severe constipation	CbD, PGD, mini-IPX	1,2
Understand the preparation requirement for each study	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient and examine the patient as required	CbD, PGD, mini-IPX	1,2
Determine the correct study for the indication and correct type of meal to be administered	CbD, PGD, mini-IPX	1,2
Understand the methodology of imaging different types of GI transit including that of the oesophagus, stomach and colon	CbD, PGD, mini-IPX	1,2
Understand how the images and any computer analysis are displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for positivity and negativity in the diagnosis of GI dysmotility	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Skills		
Recognise the patterns of abnormality suggestive of GI dysmotility in the oesophagus, stomach and colon	CbD, PGD, mini-IPX	1,2

The trainee will learn how to report correctly a thyroid scan		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of thyroid disease	CbD, PGD, mini-CEX, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-CEX, mini-IPX	1,2
Understand those factors than can effect thyroid scinigtigraphy and be able to decide if the study can proceed	CbD, PGD, mini-CEX, mini-IPX	1,2
Understand the methodology of thyroid imaging including any additional views taken, including the possible use of SPECT and SPECT-CT	CbD, PGD, mini-CEX, mini-IPX	1,2
Understand how the images are displayed for reading	CbD, PGD, mini-CEX, mini-IPX	1,2
Understand what may influence the result of a thyroid scan and how abnormality can be diagnosed	CbD, PGD, mini-CEX, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-CEX, mini-IPX	1,2
Skills		

Recognise the patterns of abnormality suggestive of Grave's disease, multi-nodular goitre, toxic nodule, "cold" nodule and thyroiditis	CbD, PGD, mini-IPX	1,2
Behaviours		
Understand the concerns of the patients	CbD, mini-IPX, MSF	1,2,3,4
Be able to recommend I-131 therapy if relevant	CbD, mini-IPX, MSF	1,2,3,4

The trainee will be able to perform myocardial stressing as required for myocardial perfusion scintigraphy

Knowledge	Assessment Methods	GMP
Understand the pathophysiology of coronary artery disease	CbD, PGD, DOPS	1,2
Be able to take an appropriate history from the patient and examine the patient as required	CbD, PGD, DOPS	1,2
Understand the methodology of adenosine/dobutamine and physical stress.	CbD, PGD, DOPS	1,2
Understand correct patient preparation for each type of test and relevant drug interactions	CbD, PGD, DOPS	1,2
Understand the contra-indications for each type of stress and alternates that can be offered in such circumstances	CbD, PGD, DOPS	1,2
Understand the time parameters such as how long should stress be administered, when during that stress should the radiopharmaceutical be given, when should the stress be terminated, what time should the patient be scanned and any instructions to the patient between stressing and imaging	CbD, PGD, DOPS	1,2
Know how to deal with complex co-morbidities and other complications including patients within 6 weeks of myocardial infarction patients with left bundle branch block patients with untreated arrhythmias patients with 1st and 2nd degree heart block	CbD, PGD, DOPS	1,2
Skills		
Have their ALS certificate	CbD, PGD, DOPS	1,2
Recognise abnormalities on a resting ecg that mean the stress can proceed safely or should not be done	CbD, PGD, DOPS	1,2
Understand what constitutes an appropriate and sufficient stress for a diagnostic test	CbD, PGD, DOPS	1,2
Recognise those symptoms and signs that should result in termination of the stress test including changes in vital signs and arrhythmias	CbD, PGD, DOPS	1,2
Be able to communicate to the patient what is happening and what to expect to happen and the duration of any side effects	CbD, PGD, DOPS	1,2
Behaviours		
Understand the concerns of the patients undergoing	DOPS, MSF	1,2,3,4

radionuclide tests and stress tests		
Be willing to explain why the stress test is required for the management of their condition and obtain oral/written consent as required	DOPS, MSF	1,2,3,4
Be open in discussion with the patient of measures that can be taken to reduce the risk of ischaemic heart disease including dietary advice and smoking cessation	DOPS, MSF	1,2,3,4

Level 2 Competencies

The trainee will learn how to report correctly a myocardial perfusion SPECT		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of coronary artery disease	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand when attenuation correction should be applied and the consequences of that action	CbD, PGD, mini-IPX	1,2
Understand when gating should be performed and the usefulness of a gated study including normal ranges for parameters such as LVEF, EDV and ESV	CbD, PGD, mini-IPX	1,2
Understand how the images analysed and are displayed for reading	CbD, PGD, mini-IPX	1,2
Understand those factors which may influence image quality, including attenuation and left bundle branch block	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Understand the role of SPECT-CT and the relevance of calcium scoring	CbD, PGD, mini-IPX	1,2
Skills		
Understand the strengths and weaknesses and the biodistribution of the main agents used in MPS –Tl-201 chloride, Tc-99m MIBI and Tc-99m tetrofosmin	CbD, PGD, mini-IPX	1,2
Recognise the patterns of abnormality that define a positive and negative test	CbD, PGD, mini-IPX	1,2
Be able to determine if there are artefacts such as attenuation affecting the scan and interpret how these may change the result	CbD, PGD, mini-IPX	1,2
Be able to use a gated study to improve accurate reading of the MPS	CbD, PGD, mini-IPX	1,2
In a gated study be able to identify dyskinesia and the presence of apical aneurysm	CbD, PGD, mini-IPX	1,2
Be able to identify abnormal activity outside of the heart on the MPS or abnormality on the CT (if performed) that could represent other significant thoracic abnormality	CbD, PGD, mini-IPX	1,2
Behaviours		
Be willing to repeat imaging if this will improve diagnostic accuracy and be able to communicate why this must be done to patient	CbD, MSF	1,2,3,4

Be willing to transmit urgent results about the patient to their referring clinician	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly bone scintigraphy in a range of benign diseases		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of bone disease including congenital disease, trauma, infection, inflammatory disease, hamartomas, degenerative and metabolic diseases and benign bone tumours	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand the methodology of 3 phase bone scanning, SPECT and SPECT-CT	CbD, PGD, mini-IPX	1,2
Have sufficient knowledge of cross-sectional imaging to be able to read a SPECT-CT study	CbD, PGD, mini-IPX	1,2
Understand how the images are analysed and displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for normal and abnormal and the clinical relevance of these results	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Understand the legal consequences of diagnosing a non-accidental injury in both a child and a vulnerable adult	CbD, PGD, mini-IPX	1,2
Skills		
Recognise the patterns of abnormality which can be seen within bones	CbD, PGD, mini-IPX	1,2
Understand the non-specific nature of bone scintigraphy and the importance of pattern recognition in reading a scan	CbD, PGD, mini-IPX	1,2
Recognise potentially life threatening conditions such as discitis, septic arthritis	CbD, PGD, mini-IPX	1,2
Recognise the appearances of non-accidental injury in both children and adults	CbD, PGD, mini-IPX	1,2
Be able to use CT (and other available imaging) to improve accuracy of reporting	CbD, PGD, mini-IPX	1,2
Behaviours		
Be willing to transmit important urgent results about the patient to their referring clinician	CbD, MSF	1,2,3,4
If non accidental injury is suspected be willing and able to contact the proper authorities	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly and understand dynamic renography with interventions

Knowledge	Assessment Methods	GMP
Understand the pathophysiology of vesico-ureteric reflux	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand the methodology of indirect and direct (optional) radionuclide micturating cystography	CbD, PGD, mini-IPX	1,2
Understand how images are analysed and are displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for reflux and the clinical relevance for grade III/IV reflux	CbD, PGD, mini-IPX	1,2
Understand the pathophysiology of renovascular hypertension	CbD, PGD, mini-IPX	1,2
Know the drugs that will interfere with the test and the times they need to be stopped	CbD, PGD, mini-IPX	1,2
Understand the physiological differences that occur when giving ACE inhibitors	CbD, PGD, mini-IPX	1,2
Understand the criteria for renovascular hypertension as seen on a pre and post ACE inhibitor dynamic renography	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Skills		
Recognise how the images may need to be manipulated to see reflux	CbD, PGD, mini-IPX	1,2
Be able to apply any additional mathematic analysis such as de-convolution which will aid in the diagnosis of renovascular hypertension	CbD, PGD, mini-IPX	1,2
Behaviours		
To be able to communicate with patients the importance of complying with anti-hypertensive medication if this has been prescribed	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly and understand non-imaging tests done in nuclear medicine

Knowledge	Assessment Methods	GMP
Understand the present role of the following non-imaging studies: Glomerular filtration rate, red cell mass, plasma volume and bile salt absorption	CbD, PGD	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD	1,2
Understand the methodology of Glomerular filtration rate, red cell mass, plasma volume and bile salt absorption	CbD, PGD	1,2
Understand how data is analysed and possible causes of error, and how if possible these can be minimised and corrected	CbD, PGD	1,2

Skills		
Recognise the significance of Glomerular filtration rate, red cell mass, plasma volume and bile salt absorption tests	CbD, PGD	1,2

The trainee will learn how to report correctly and understand hepatobiliary scintigraphy		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of biliary disease in particular the causes of neonatal jaundice and cholecystitis. Also in post liver transplant(optional)	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand the methodology of HIDA and the preparation for imaging in biliary atresia and in suspected gall bladder disease	CbD, PGD, mini-IPX	1,2
Understand how images are analysed and displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for a positive study in biliary atresia and for a positive study in gall bladder disease	CbD, PGD, mini-IPX	1,2
Know when it is correct to give a fatty meal or CCK stimulus	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Skills		
Be able to make a definitive diagnosis of biliary atresia or other causes of neonatal jaundice	CbD, PGD, mini-IPX	1,2
Be able to give a fatty meal or CCK safely	CbD, PGD, mini-IPX	1,2
Understand the results of hepatobiliary scintigraphy	CbD, PGD, mini-IPX	1,2
Behaviours		
Be able to deal with the concerns of parents of very sick infants	CbD, MSF	1,2,3,4

The trainee will learn understand how single photon emission tomography (SPET or SPECT/CT) can be used in the management of CNS disease		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of a wide range of disease affecting the brain including tumour, cerebrovascular disease, degenerative disease and Parkinson's syndromes	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Have a basic understanding of neuroanatomy with knowledge of the sites of major intra-cerebral features as seen on cross sectional imaging and how this correlates with SPET	CbD, PGD, mini-IPX	1,2
Understand which nuclear medicine test should be applied for a particular situation	CbD, PGD, mini-IPX	1,2
Know which medications may need to be stopped or reduced for I-123 iopflupane imaging	CbD, PGD, mini-IPX	1,2

Know the normal distribution of Tc-99m MIBI/Tl-201, Tc-99m HMPAO and I-123 iopflupane	CbD, PGD, mini-IPX	1,2
Recognise and understand the changes in distribution of brain seeking agents in disease	CbD, PGD, mini-IPX	1,2
Identify when and what quantification may help diagnosis	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2
Skills		
As appropriate be able to make a diagnosis of intracerebral tumour with Tl-201/Tc-99m MIBI	CbD, PGD, mini-IPX	1,2
Be able to identify the difference between Alzheimer's and multi-infarct dementia on Tc-99m HMPAO imaging. Understand when other methods such as F-18 florbetapir may be useful	CbD, PGD, mini-IPX	1,2
Be able to identify Parkinson's syndromes with I-123 iopflupane and determine the severity of disease	CbD, PGD, mini-IPX	1,2
Understand those factors that can result in artefacts that can reduce the accuracy of the test and how these can be corrected or their effect reduced	CbD, PGD, mini-IPX	1,2
Be able to work with vulnerable adults and understand the legal requirements of consent in the mentally frail	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly and understand radionuclide imaging of infection and inflammation including use of PET/CT and SPECT/CT

Knowledge	Assessment Methods	GMP
Understand the pathophysiology of infection and inflammation; in particular, be aware of the patterns of infection that can occur in osteomyelitis, infected joint prosthesis and in patients who are immunocompromised. Know the criteria for diagnosis of fever of unknown origin	CbD, PGD, mini-IPX	1,2
In addition be aware of the causes and clinical presentation of inflammatory bowel disease	CbD, PGD, mini-IPX	1,2
Know when to apply a specific infection/inflammation study or when a simpler less specific study may be sufficient	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand the strengths and weaknesses of Ga-67 citrate, In-111 or Tc-99m HMPAO labelled leucocytes, Tc-99m Selusomab and F-18 FDG. Know when each should be used	CbD, PGD, mini-IPX	1,2
Be aware of the imaging times for each radiopharmaceuticals and their normal distribution	CbD, PGD, mini-IPX	1,2
Be aware of any medications which may interfere with radionuclide infection/inflammation imaging and decide if their use should be stopped or modified	CbD, PGD, mini-IPX	1,2
Understand how images are analysed and displayed for reading	CbD, PGD, mini-IPX	1,2
Understand the criteria for a positive study with each radiopharmaceutical in each clinical scenario	CbD, PGD, mini-IPX	1,2
Be able to decide whether alternate or additional imaging is required	CbD, PGD, mini-IPX	1,2

Skills		
Be able to identify the difference between normal distribution and pathology in Ga-67 imaging	CbD, PGD, mini-IPX	1,2
Be able to identify the variable results of Ga-67 in sarcoid and their significance	CbD, PGD, mini-IPX	1,2
Be able to determine the presence of inflammatory bowel disease with labelled leucocytes	CbD, PGD, mini-IPX	1,2
Know when SPET or SPET/CT may be helpful and be able to interpret those results	CbD, PGD, mini-IPX	1,2
Know when it is appropriate to use F-18 FDG in infection and inflammation images	CbD, PGD, mini-IPX	
Behaviours		
Be willing to transmit important urgent results about the patient to their referring clinician	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly and understand parathyroid localisation including the use of SPECT-CT

Knowledge	Assessment Methods	GMP
Understand the pathophysiology of parathyroid disease and its clinical importance. Take note of the possibility of ectopic sites of adenomas	CBD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CBD, PGD, mini-IPX	1,2
Understand the different methodologies for imaging parathyroid adenomas and know one of these in detail	CBD, PGD, mini-IPX	1,2
Know when SPET or SPET/CT may be of use	CBD, PGD, mini-IPX	1,2
Understand how images are analysed and displayed for reading	CBD, PGD, mini-IPX	1,2
Be able to decide the relationship between radionuclide imaging and ultrasound in localisation of a parathyroid adenoma	CBD, PGD, mini-IPX	1,2
Skills		
Be able to decide if a study is positive for a parathyroid adenoma and be able to identify its site (possibly with the aid of SPET-SPET/CT	CBD, PGD, mini-IPX	1,2
Behaviours		
Understand the concerns of the patients undergoing radionuclide tests and be able to explain the complementary nature of ultrasound	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly and understand radionuclide imaging of adrenal adenoma

Knowledge	Assessment Methods	GMP
Understand the pathophysiology of medullary and cortical adrenal tumours. Know the probability of bilateral disease or malignant spread	CbD, PGD, mini-IPX	1,2

Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand the methodologies for imaging the adrenal gland with I-123/I-131 nor cholesterol and I-123/I-131 mIBG	CbD, PGD, mini-IPX	1,2
Know which medications may interfere with imaging and be able to determine if they can be stopped or modified before imaging	CbD, PGD, mini-IPX	1,2
Know when the use of renal imaging and/or SPET or SPET/CT may be of use for localisation	CbD, PGD, mini-IPX	1,2
Understand how the images analysed and are displayed for reading	CbD, PGD, mini-IPX	1,2
Be able to decide the relationship between radionuclide imaging in adrenal tumours and other imaging modalities including CT and MRI	CbD, PGD, mini-IPX	1,2
Skills		
Be able to decide if a study is positive identify its site (possibly with the aid of SPET-SPET/CT	CbD, PGD, mini-IPX	1,2
Be able to differentiate between physiological and pathological activity of tracer	CbD, PGD, mini-IPX	1,2
Be able to use any available quantification to determine positivity	CbD, PGD, mini-IPX	1,2
Behaviours		
Be willing to transmit important urgent results about the patient to their referring clinician and to advise the patient concerning further care	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly and understand sentinel node localisation		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of malignant disease know how it spreads and in which cancers sentinel node localisation is both possible and useful	CbD, PGD, DOPS, mini-IPX	1,2
Be aware of national and international guidelines concerning sentinel node localisation	CbD, PGD, DOPS, mini-IPX	1,2
Be able to take an appropriate history from the patient and examine the patient as required	CbD, PGD, DOPS, mini-IPX	1,2
Understand the different methodologies for injection and imaging sentinel nodes depending on the primary cancer and learn at least one of these in detail. Know when and if SPET/CT may be of use	CbD, PGD, DOPS, mini-IPX	1,2
Understand how the images analysed and are displayed for reading, including the use of a “shadowgram”	CbD, PGD, DOPS, mini-IPX	1,2
Skills		
Be able to explain to the patient that the test is a form of staging and not diagnostic	CbD, PGD, DOPS, mini-IPX	1,2
Be able to give a sentinel node injection correctly to ensure good lymph flow in a timely manner	CbD, PGD, DOPS, mini-IPX	1,2
Be able to identify the site of a sentinel node and mark it for surgery and communicate the results of marking effectively with the referring surgeon	CbD, PGD, DOPS, mini-IPX	1,2

Behaviours		
Understand the concerns of the patients undergoing radionuclide tests pre surgery for cancer	CbD, MSF	1,2,3,4
Understand the fears of a patient with a potentially fatal cancer	CbD, MSF	1,2,3,4
Be willing to transmit important urgent results about the patient to their referring clinician	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly and understand tumour specific imaging with single photon agents

Knowledge	Assessment Methods	GMP
Understand the pathophysiology of cancers that can be imaged with radionuclide techniques and understand the specific nature of those techniques in tumour sites and how nuclear medicine techniques are used to compliment CT and MRI	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand the different methodologies for imaging Cancers with single photon including the following; • I-123/I-131 mIBG in neuroblastoma • I-123/I-131 mIBG in maliganant pheochromocytoma • I-123/I-131 mIBG in neuroencodrine tumours • In-111 pentatreotide in neuroendcrine tumours • I-123/I-131 in thyroid cancer • Tc-99m DMSA (V) in medullary cell thyroid cancer (optional) • Tc-99m MIBI in breast cancer (optional) • Tc-99m depreotide in lung cancer (optional) • Tl-201 in Kaposi's sarcoma (optional) • Tc-99m MIBI in sarcomas (optional)	CbD, PGD, mini-IPX	1,2
Know those that are not optional in detail	CbD, PGD, mini-IPX	1,2
Know when SPET or SPET/CT may be of use	CbD, PGD, mini-IPX	1,2
Know the clinical situation in which test may be applied and understand the clinical imaging schedule for each referring to national and EANM guidelines as required	CbD, PGD, mini-IPX	1,2
Know what medication must be stopped/modified before administration of the radiopharmaceuticals This includes the drugs that interfere with uptake of I-123/I-131 Mibg, injected somatostatins in In-111 pentetreotide imaging and thyroid preparations when imaging with I-123/I-131. Know how to give rTSH and when it should be used for imaging with I-123/I-131	CbD, PGD, mini-IPX	1,2
Know when specialist imaging techniques such as scitnimammography should be used (optional)	CbD, PGD, mini-IPX	1,2
Understand how the images analysed and are displayed for reading	CbD, PGD, mini-IPX	1,2
Skills		
Be able to decide if a study is positive and be able to identify its site (possibly with the aid of SPET-SPET/CT)	CbD, PGD, mini-IPX	1,2

Know what can produce false positive results and how to communicate that possibility to the referring clinician	CbD, PGD, mini-IPX	1,2
Understand the consequences of a test being negative in a patient with known disease and how this is determined by tumour biology. Know if this affects prognosis	CbD, PGD, mini-IPX	1,2
Be able to present results at MDT	CbD, PGD, mini-IPX	1,2
Behaviours		
Understand the concerns of the patients (and for neuroblastoma the parents/guardians of children) undergoing radionuclide tests	CbD, MSF	1,2,3,4
Deal sensitively with patients with cancer (or their parents in children with neuroblastoma)	CbD, MSF	1,2,3,4
Be willing to transmit important urgent results about the patient to their referring clinician	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly F-18 FDG PET-CT in diagnosis and staging of primary cancer

Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of cancer	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand how F-18 FDG may be used to diagnose lung cancer in a patient with a single pulmonary nodule or stage a patient which CT suggests is operable	CbD, PGD, mini-IPX	1,2
Understand the role of FDG imaging in a range of cancers	CBD, PGD, mini-IPX	1,2
Know the health economic arguments concerning the use of PET-CT in diagnosing and staging cancer	CbD, PGD, mini-IPX	1,2
Know the causes of a false negative or false positive result	CbD, PGD, mini-IPX	1,2
Be able to identify other unsuspected pathology on the PET or CT study	CbD, PGD, mini-IPX	1,2
Skills		
Be able to run a glucose clamp in a diabetic patient if required	CbD, PGD, mini-IPX	1,2
Be able to decide if a study is positive for lung cancer and also be able to determine if a patient with known lung cancer is operable	CbD, PGD, mini-IPX	1,2
Recognise issues related to mis-registration of fusion images and be able to determine how the effect of this may be reduced	CbD, PGD, mini-IPX	1,2
Be able to recognise the causes of false positive uptake of F-18 FDG and if possible how to differentiate this uptake from cancer	CbD, PGD, mini-IPX	1,2
Know when additional images/tests may be required	CbD, PGD, mini-IPX	1,2
Keep up to date with the latest research findings and recommendations on the use of F-18 FDG PET in cancer	CbD, MSF	1,2,3,4
Be able to confidently present the results in an MDT		1,2

Behaviours		
Understand the concerns of the patients with suspected or known cancer undergoing radionuclide tests	CbD, MSF	1,2,3,4
Be willing to transmit important urgent results about the patient to their referring clinician	CbD, MSF	1,2,3,4

Level 3 Competencies

The trainee will learn how to report correctly F-18 FDG PET-CT in diagnosis and staging of lymphoma

Knowledge	Assessment Methods	GMP
Understand the pathophysiology of different forms of lymphoma including how lymphoma is staged using F-18 FDG PET	CbD, PGD, mini-IPX	1,2
Understand the mechanism of uptake of F-18 FDG and what may lead to a false negative or false positive study	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand how F-18 FDG may be used to stage and re-stage a patient with lymphoma	CbD, PGD, mini-IPX	1,2
Know the health economic arguments concerning the use of PET-CT in staging and re-staging lymphoma	CbD, PGD, mini-IPX	1,2
Be aware of the timing issues concerning when scanning should occur both during chemotherapy treatment and after completion of chemotherapy/radiotherapy	CbD, PGD, mini-IPX	1,2
Know the Deauville or similar criteria for response measurement using PET	CbD, PGD, mini-IPX	1,2
Skills		
Be able to run a glucose clamp in a diabetic patient if required.	CbD, PGD, mini-IPX	1,2
Be able to decide if a study is positive for lymphoma and be able to describe the site of abnormality using cross sectional imaging	CbD, PGD, mini-IPX	1,2
Be able to recognise common causes of physiological activity of F-18 FDG including brown fat, thymic and bone marrow uptake. Know how it is possible to reduce the effect of these on the scan	CbD, PGD, mini-IPX	1,2
Recognise issues related to mis-registration of fusion images and be able to determine how the effect of this may be reduced	CbD, PGD, mini-IPX	1,2
Be aware of other pathologies that can have uptake of F-18 FDG especially in the immunocompromised	CbD, PGD, mini-IPX	1,2
Be able to identify other important unsuspected pathologies on the PET study or the CT study provided	CbD, PGD, mini-IPX	1,2
Be able to confidently present the results in an MDT	CbD, PGD, mini-IPX	1,2
Know when any additional test may be required	CbD, PGD, mini-IPX	1,2

Behaviours		
Understand the concerns of the patients with suspected or known lymphoma undergoing radionuclide tests	CbD, MSF	1,2,3,4
Keep up to date with the latest research findings and recommendations on the use of F-18 FDG PET in lymphoma	CbD, MSF	1,2,3,4
Be willing to transmit important urgent results about the patient to their referring clinician	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly cardiac PET		
Knowledge	**Assessment Methods**	**GMP**
Understand the pathophysiology of coronary artery disease	CbD, PGD, mini-IPX	1,2
Understand the mechanism of uptake of F-18 FDG and Rb-82 and what may lead to a false negative or false positive study	CbD, PGD, mini-IPX	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD, mini-IPX	1,2
Understand what is being measured in the heart by uptake of these two agents and how they can be used to establish a diagnosis in heart disease	CbD, PGD, mini-IPX	1,2
Know when additional imaging such calcium scoring and CT angiography is available during cardiac PET-CT	CbD, PGD, mini-IPX	1,2
Know the health economic arguments concerning the use of PET-CT in diagnosing staging heart disease	CbD, PGD, mini-IPX	1,2
Be aware of the protocols for stress and rest imaging	CbD, PGD, mini-IPX	1,2
Skills		
Be able to run a glucose clamp in a diabetic patient if required	CbD, PGD, mini-IPX	1,2
Be able to read the studies and use any quantification to improve the accuracy of reporting cardiac PET-CT	CbD, PGD, mini-IPX	1,2
Recognise issues related to mis-registration of fusion images and be able to determine how the effect of this may be reduced	CbD, PGD, mini-IPX	1,2
Be able to identify other important unsuspected pathologies on the PET study or the CT study provided	CbD, PGD, mini-IPX	1,2
Know when any additional test may be required	CbD, PGD, mini-IPX	1,2
Behaviours		
Keep up to date with the latest research finding and recommendations on the use of PET-CT in cardiology	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly examples of non-oncological F-18 FDG PET-CT		
Knowledge	**Assessment Methods**	**GMP**
Understand how F-18 FDG PET-CT can be used in a variety of diseases including:	CbD, PGD	1,2

• Brain metabolism studies • Dementia studies • Vasculitis • Infection or inflammation		
Understand the mechanism of uptake of F-18 FDG and what may lead to a false negative or false positive study	CbD, PGD	1,2
Be able to take an appropriate history from the patient (or their parents) and examine the patient as required	CbD, PGD	1,2
Skills		
Be able to run a glucose clamp in a diabetic patient if required	CbD, PGD	1,2
Be able to read the studies	CbD, PGD	1,2
Recognise issues related to mis-registration of fusion images and be able to determine how the effect of this may be reduced	CbD, PGD	1,2
Be able to identify other important unsuspected pathologies on the PET study or the CT study provided	CbD, PGD	1,2
Know when any additional test may be required	CbD, PGD	1,2
Behaviours		
Keep up to date with the latest research finding and recommendations on the use of PET-CT in non-oncological disease	CbD, MSF	1,2,3,4

The trainee will learn how to report correctly at least ONE example of non- F-18 FDG PET-CT (this is a fast moving field and examples will be given but other examples can be used).

Knowledge	Assessment Methods	GMP
Understand PET can be used in a variety of different diseases using a variety of PET pharmaceuticals to look at a different types of disease including: • F-18 skeletal disease • F-18 FLT cancer cell turnover • F-18 choline Renal cell cancer Prostate cancer • F-18 DOPA pancreatic neuroendocrine tumours Parkinson's syndrome • F-18 FMISO Hypoxia • C-11 or F-18 beta amyloid for Alzheimer's disease • C-11 methionine Brain primary tumours • Ga-68 somatostatins Neuroendocrine tumours	CbD, PGD	1,2
Understand the mechanism of uptake of each agent and what may lead to a false negative or false positive study	CbD, PGD	1,2
Understand the imaging protocol for each agent and for each indication	CbD, PGD	1,2
Be aware of the legal framework in place when using novel tracers	CbD, PGD	1,2
Know when such an agent must be used as part of an approved research project	CbD, PGD	1,2
Be able to take an appropriate history from the patient (or their	CbD, PGD	1,2

parents) and examine the patient as required		
Skills		
Be able to read the studies and how this information may be used	CbD, PGD	1,2
Recognise issues related to mis-registration of fusion images and be determine how the effect of this may be reduced	CbD, PGD	1,2
Be able to identify other important unsuspected pathologies on the PET study or the CT study provided	CbD, PGD	1,2
Know when any additional test may be required	CbD, PGD	1,2
Behaviours		
Keep up to date with the latest research finding and recommendations on the use of PET-CT with different tracers	CbD, MSF	1,2,3,4

Therapy with Radio-Isotopes

To provide the trainee with the knowledge, skills and attitudes to prescribe, administer and monitor the use of radiopharmaceuticals for therapy.

Level 2 Competencies

The trainee will be able to deliver I-131 therapy for hyperthyroidism		
Knowledge	**Assessment Methods**	**GMP**
Pathophysiology of different causes of hyperthyroidism	PGD, mini-CEX, mini-IPX, MSF	1
Different treatment option for patients with hyperthyroidism	PGD, mini-CEX, mini-IPX, MSF	1
Appropriate selection of patients with hyperthyroidism for I-131	PGD, mini-CEX, mini-IPX, MSF	1
Understand appropriate follow-up required for patients having been treated with I-131	PGD, mini-CEX, mini-IPX, MSF	1
Reading pre-therapy radioisotope studies to determine if treatment is appropriate with I-131	PGD, mini-CEX, mini-IPX, MSF	1
Understand both the dosimetric and empirial methods method used in treating hyperthyroidism with I-131	PGD, mini-CEX, mini-IPX, MSF	1
Understand the legislation concerning the safe delivery of I-131 including radiation protection for self, other staff and the patient's carers	PGD, mini-CEX, mini-IPX, MSF	1
Understand special requirements for treatment of patients under the age of 18	PGD, mini-CEX, mini-IPX, MSF	1
Skills		
Be able to take relevant history and perform relevant clinical examination within thyroid clinic	CbD, PGD, mini-CEX	2,3
Recognise those complications that would be a contra-indication to treatment with I-131	CbD, PGD, mini-CEX	2,3
Be able to explain the treatment and obtain consent for treatment with special reference to female patient's concerns about fertility and contraception	CbD, PGD, mini-CEX	2,3
Be able to advise on management of thyroid eye disease	CbD, PGD, mini-CEX	2,3
Give advice on termination and re-commencement of anti-thyroid medication	CbD, PGD, mini-CEX	2,3
Arrange appropriate follow-up and further management of the patient	CbD, PGD, mini-CEX	2,3
Behaviours		
Be responsive to the concerns of the patient and their carers concerning treatment	CbD, DOPS, mini-CEX, MSF	1,3,4
Show a professional attitude in interactions with patient and colleagues	CbD, DOPS, mini-CEX, MSF	1,3
Communicate essential information in an appropriate and timely way	CbD, DOPS, mini-CEX, MSF	1,3
Be aware of issues concerning fertility and contraception in different	CbD, DOPS, mini-	1,3

ethnic cultures and how that impacts on patient care	CEX, MSF	
Work well with other team members, be willing to take advice from the RPS and RPA	CbD, DOPS, mini-CEX, MSF	1,3,4

Level 3 Competencies

The trainee will be able to deliver I-131 therapy for treatment of patients with thyroid cancer		
Knowledge	**Assessment Methods**	**GMP**
Pathophysiology of thyroid cancer	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Different treatment option for patients with thyroid cancer	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Appropriate selection of patients with hyperthyroidism for I-131. Understand the need for ablation of thyroid remnant	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Understand the long term prognosis of the disease in patients treated or not with I-131	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Understand appropriate follow-up required for patients having been treated with I-131 for thyroid cancer	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Reading pre-therapy radioisotope studies to determine if treatment is appropriate with I-131 including I-123 and F-18 FDG PET imaging	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Understand both the dosimetric and empirial methods method used in treating thyroid cancer with I-131	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Understand the advantages and disadvantages and methodology of use of withdrawal of thyroid hormone supplementation and/or TSH stimulation in preparation for therapy	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Understand the role of thyroglobulin in the long term follow-up of patients with thyroid cancer	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Understand the legislation concerning the safe delivery of I-131 including radiation protection for self, other staff and the patient's carers	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Understand special requirements for treatment of patients under the age of 18	CbD, PGD, mini-CEX, mini-IPX, MSF	1
Skills		
Be able to take relevant history and perform relevant clinical	CbD, PGD, mini-CEX	1,3

examination within thyroid cancer clinic		
Work with the thyroid cancer MDT to determine best management of the patient	CbD, PGD, mini-CEX	1,3,4
Recognise those complications that would be a contra-indication to treatment with I-131	CbD, PGD, mini-CEX	1
Be able to prepare the patient for therapy with I-131 including use of low-iodine diets and side effects of thyroid hormone supplement withdrawal	CbD, PGD, mini-CEX	1,3,4
Be able to explain the treatment and obtain consent for treatment with special reference to female patient's concerns about fertility and contraception	CbD, PGD, mini-CEX	1,3
Give advice on termination and re-commencement of thyroxine replacement therapy	CbD, PGD, mini-CEX	1
Arrange appropriate follow-up and further management of the patient	CbD, PGD, mini-CEX	1,3
Behaviours		
Be responsive to the concerns of the patient and their carers concerning treatment in particular reference to concerns the patient may have about cancer	CbD, DOPS, mini-CEX, MSF	1,3
Show a professional attitude in interactions with patient and colleagues	CbD, DOPS, mini-CEX, MSF	1,3
Communicate essential information in an appropriate and timely way	CbD, DOPS, mini-CEX, MSF	1,3
Be aware of issues concerning fertility and contraception in different ethnic cultures and how that impacts on patient care	CbD, DOPS, mini-CEX, MSF	1,3
Work well with other team members, be willing to take advice from the RPS and RPA	CbD, DOPS, mini-CEX, MSF	1,3

The trainee will be able to deliver radionuclide synovectomy (optional)

Knowledge	Assessment Methods	GMP
Pathophysiology of different causes of inflammatory joint disease	PGD, mini-CEX, mini-IPX, MSF	1
Different treatment options with inflammatory joint disease	PGD, mini-CEX, mini-IPX, MSF	1
Appropriate selection of patients for treatment with radionuclides	PGD, mini-CEX, mini-IPX, MSF	1
Understand appropriate follow-up required for patients having been treated with radiation synovectomy including awareness of complications including infection and radionecrosis	PGD, mini-CEX, mini-IPX, MSF	1
Know the European Association of Nuclear Medicine guidelines on appropriate radio-isotope and activity to be given depending on joint and the number of joints that can be treated at any given time	PGD, mini-CEX, mini-IPX, MSF	1
Understand the need for immobilisation of the joint for 24 hours after treatment	PGD, mini-CEX, mini-IPX, MSF	1
Understand the legislation concerning the safe delivery of Y-90, Re-186 and Eu-169 including radiation protection for self, other staff and the patient's carers	PGD, mini-CEX, mini-IPX, MSF	1

Understand special requirements for treatment of patients under the age of 18	PGD, mini-CEX, mini-IPX, MSF	1
Skills		
Be able to take relevant history and perform relevant clinical examination of patient with joint disease	CbD, PGD, DOPS, mini-CEX	2,3
Be able to explain procedure to patient and obtain consent	CbD, PGD, DOPS, mini-CEX	2,3
Be able to ensure correct activity of radiopharmaceutical has been drawn up	CbD, PGD, DOPS, mini-CEX	2,3
Be able to have skills to inject joints using a sterile technique or use other clinicians such as radiologists and rheumatologist to obtain access to the joint	CbD, PGD, DOPS, mini-CEX	2,3
Be able to withdraw an appropriate amount of fluid from the joint and give corticosteroids if indicated	CbD, PGD, DOPS, mini-CEX	2,3
Able to give radioisotopes without contamination of patient, self or colleagues	CbD, PGD, DOPS, mini-CEX	2,3
Give advice post therapy complication and suggest appropriate actions	CbD, PGD, DOPS, mini-CEX	2,3
Ensure patient's joint is appropriately immobilised for at least 24 hours	CbD, PGD, DOPS, mini-CEX	2,3
Arrange appropriate follow-up and further management of the patient	CbD, PGD, DOPS, mini-CEX	2,3
Behaviours		
Be able to explain to patient criteria for treatment success and failure including expected time scale for response	CbD, DOPS, mini-CEX, MSF	1,3

The trainee will be able to deliver P-32 in haematological malignancy

Knowledge	Assessment Methods	GMP
Pathophysiology of polycythaemia and essential thrombocythaemia	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of probable success of treatment compared to alternative therapies. In addition possible side effects compared to alternate treatments and long term prognosis including risk of myleofibrosis and acute leukaemia	CbD, PGD, DOPS, mini-CEX, MSF	1
Appropriate selection of patients for P-32 treatment	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand appropriate follow-up required for patients having been treated with P-32 working closely with haematologist	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of guidelines of the European Association Nuclear Medicine guidelines for treatment with P-32	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the legislation concerning the safe delivery of P-32 including radiation protection for self, other staff and the patient's carers	CbD, PGD, DOPS, mini-CEX, MSF	1

Skills		
Be able to discuss appropriate use of P-32 with haematological colleagues including within an MDT	CbD, PGD, DOPS, mini-CEX	1,3
Recognise those complications that would be a contra-indication to treatment with P-32	CbD, PGD, DOPS, mini-CEX	1
Be able to explain the treatment and obtain consent for treatment with special reference to female patient's concerns about fertility and contraception	CbD, PGD, DOPS, mini-CEX	1,3
Communicate to the patient a realistic view of outcomes in this palliative treatment	CbD, PGD, DOPS, mini-CEX	1,3
Arrange appropriate follow-up and further management of the patient	CbD, PGD, DOPS, mini-CEX	1,3,4
Behaviours		
Be responsive to the concerns of the patient and their carers concerning treatment	CbD, DOPS, mini-CEX, MSF	1,3
Be aware of issues concerning fertility and contraception in different ethnic cultures and how that impacts on patient care	CbD, DOPS, mini-CEX, MSF	1,3

The trainee will be able to deliver radiolabelled antibodies in haematological malignancy		
Knowledge	**Assessment Methods**	**GMP**
Pathophysiology of lymphoma, leukaemia and myeloma and when to use of radiolabelled antibodies in treatment of these diseases	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of probable success of treatment compared to alternative therapies. In addition possible side effects compared to alternate treatments and long term prognosis including risk of myleofibrosis and acute leukaemia	CbD, PGD, DOPS, mini-CEX, MSF	1
Appropriate selection of patients for patients with hyperthyroidism with these agents	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of the use of immunohistochemistry in identifying patients appropriate for treatment	CbD, PGD, DOPS, mini-CEX, MSF	1
Know in which clinical situations pre-scanning with a tracer dose is needed for dosimetric assessment or to determine suitability for treatment	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of the indications for use of Y-90 tiuxetan ibritumomab and other available agents	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of the dosing regimes for use of Y-90 tiuxetan ibritumomab (or other agents)	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of the need for conditioning with un-radiolabelled antibodies such as Rituximab and the required timings for these treatments	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware if the treatment will be performed in isolation or in	CbD, PGD, DOPS,	1

combination with other anti-cancer drugs or bone marrow transplant	mini-CEX, MSF	
Understand the legislation concerning the safe delivery of Y-90 and I-131 products including radiation protection for self, other staff and the patient's carers	CbD, PGD, DOPS, mini-CEX, MSF	1
Skills		
Be able to discuss appropriate use of Y-90 tiuxetan ibritumumab or alternate agents with haematological colleagues including within an MDT	CbD, PGD, DOPS, mini-CEX	1,3
Recognise those complications that would be a contra-indication to treatment with these agents	CbD, PGD, DOPS, mini-CEX	1,3
Be happy to administer these drugs via a central line catheter using an aseptic technique	CbD, PGD, DOPS, mini-CEX	1,2
Be able to explain the treatment and obtain consent for treatment with special reference to female patient's concerns about fertility and contraception	CbD, PGD, DOPS, mini-CEX	1,3
Communicate to the patient a realistic view of outcomes in these treatments	CbD, PGD, DOPS, mini-CEX	1,3
Understand the experimental nature of some of these treatments	CbD, PGD, DOPS, mini-CEX	1,3
Be prepared to treat acute anaphylaxis or other less acute immune reactions	CbD, PGD, DOPS, mini-CEX	1,3
Arrange appropriate follow-up and further management of the patient	CbD, PGD, DOPS, mini-CEX	1,3
Behaviours		
Be aware of issues concerning fertility and contraception in different ethnic cultures and how that impacts on patient care being sensitive to those patients who may have lost fertility as part of their treatment	CbD, DOPS, mini-CEX, MSF	1,3

The trainee will be able to deliver radionuclide treatment for bone metastases		
Knowledge	**Assessment Methods**	**GMP**
Pathophysiology of bone metastases and the methods used to treat bone pain	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the relevance and useful of diagnostic imaging with Tc-99m MDP/HDP in selecting patients for therapy	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of probable success of treatment compared to alternative therapies. In addition possible side effects compared to alternate treatments and long term prognosis including risk of bone marrow suppression	CbD, PGD, DOPS, mini-CEX, MSF	1
Appropriate selection of patients for treatment via site specific MDT	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand appropriate preparation of patient for treatment of painful bone metastases including whether or not it will be given in combination with chemotherapy drugs and/or bisphosphonates	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of recommendations for activities to be given for both the beta emitters Sr-89, Sm-153 EDTMP, Re-186/Re-188 HEDP and the alpha emitter Ra-233	CbD, PGD, DOPS, mini-CEX, MSF	1

Understand the appropriate dosing regimes including standard dose and weight related dosing including minimum time intervals for repeat treatments	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the legislation concerning the safe delivery of these products and the different requirements for radiation protection for self, other staff and the patient's carers with each agent	CbD, PGD, DOPS, mini-CEX, MSF	1
Skills		
Be able to discuss appropriate use of agents used to treat painful bone metastases with colleagues including within an MDT	CbD, PGD, DOPS, mini-CEX	1,3
Recognise those complications that would be a contra-indication to treatment with each agent with particular reference to possible haematological toxicity	CbD, PGD, DOPS, mini-CEX	1
Understand that some contra-indications such as risk of long bone and vertebral fracture may be treated and then the patient presented for therapy	CbD, PGD, DOPS, mini-CEX	1
Be able to explain the treatment and obtain consent for treatment with special reference to female patient's concerns about fertility and contraception (where relevant)	CbD, PGD, DOPS, mini-CEX	1,3
Communicate to the patient a realist view of outcomes in this palliative treatment	CbD, PGD, DOPS, mini-CEX	1,3
Be able to explain the possibility of a flare reaction, the best methods to treat and expected duration	CbD, PGD, DOPS, mini-CEX	1,3
Explain how success in treatment is determined including the use of pain diaries the expected duration of treatment and the time when a repeat treatment may be given	CbD, PGD, DOPS, mini-CEX	1,3
Arrange appropriate follow-up and further management of the patient	CbD, PGD, DOPS, mini-CEX	1,3,4
Behaviours		
Be responsive to the concerns of the patient and their carers concerning treatment and post treatment expectations and precautions	CbD, DOPS, mini-CEX, MSF	1,3

The trainee will be able to deliver I-131 mIBG therapy		
Knowledge	**Assessment Methods**	**GMP**
Pathophysiology of those tumours including neuroblastoma, phaeochromocytoma, paraganglioma and neuroendocrine tumours in which I-131 mIBG may be useful	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the relevance and useful of diagnostic imaging with I-123/I-131 mIBG in selecting patients for therapy	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of probable success of treatment compared to alternative therapies. In addition possible side effects compared to alternate treatments and long term prognosis including risk of bone marrow suppression and effects on the thyroid	CbD, PGD, DOPS, mini-CEX, MSF	1
Appropriate selection of patients for treatment with I-131 mIBG	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand appropriate follow-up required for patients having been treated with I-131 mIBG with appropriate referring clinician	CbD, PGD, DOPS, mini-CEX, MSF	1

Be aware of guidelines of the European Association Nuclear Medicine guidelines for treatment with I-131mIBG	CbD, PGD, DOPS, mini-CEX, MSF	1
In particular be aware of the dosimetric and empirical approach to treatment	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the legislation concerning the safe delivery of I-131 mIBG including radiation protection for self, other staff and the patient's carers	CbD, PGD, DOPS, mini-CEX, MSF	1
Skills		
Be able to discuss appropriate use of I-131 mIBG with oncological colleagues including within an MDT	CbD, PGD, DOPS, mini-CEX	1
Know how patients should be prepared for therapy for example the stopping or reduction of drugs which interfere with uptake and the need to give appropriate cover with potassium iodide	CbD, PGD, DOPS, mini-CEX	1
Recognise those complications that would be a contra-indication to treatment with I-131 mIBG for example when and where cardiovascular monitoring is required	CbD, PGD, DOPS, mini-CEX	1
Be able to deal with any resultant cardiovascular side effect	CbD, PGD, DOPS, mini-CEX	1
Be able to explain the treatment and obtain consent for treatment with special reference to female patient's concerns about fertility and contraception	CbD, PGD, DOPS, mini-CEX	1,3
Communicate to the patient a realist view of outcomes in this palliative treatment	CbD, PGD, DOPS, mini-CEX	1,3
Arrange appropriate follow-up and further management of the patient	CbD, PGD, DOPS, mini-CEX	1,3,4
Be able to deal with the special concerns in treating children including the fears and hopes of the patient's family/guardians	CbD, PGD, DOPS, mini-CEX	1,3
Behaviours		
Be responsive to the concerns of the patient (and parent/guardian) and their carers concerning treatment and an understanding of expectations and long term effects of treatment	CbD, DOPS, mini-CEX, MSF	1,3
When treating children be able to communicate in a manner appropriate for the child's age and development	CbD, DOPS, mini-CEX, MSF	1,3

The trainee will be able to deliver radiolabelled somatostatin therapy		
Knowledge	**Assessment Methods**	**GMP**
Pathophysiology of those tumours including phaeochromocytoma, paraganglioma and neuroendocrine tumours in which radiolabelled somatostatins may be useful	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the relevance and useful of diagnostic imaging with In-111 pentatreotide/Ga-68 DOTATATE/NOC/TOC PET in selecting patients for therapy and how this helps patient selection	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the relationship between the diagnostic and therapeutic peptides used	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of the legislation required to perform radiolabelled somatostatin therapy	CbD, PGD, DOPS, mini-CEX, MSF	1

Be aware of the different peptides available and the characteristics of Y-90 and Lu-177 and how selections are made on the combination used for therapy	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of probable success of treatment compared to alternative therapies. In addition possible side effects compared to alternate treatments and long term prognosis including risk of bone marrow suppression and renal failure and the need for co-administration of anionic amino acids	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand appropriate follow-up required for patients having been treated with radiolabelled somatostatins with the appropriate referring clinician	CbD, PGD, DOPS, mini-CEX, MSF	1
In particular be aware of published dosing regimes	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the legislation concerning the safe delivery of both Y-90 and Lu-177 labelled somatostatins including radiation protection for self, other staff and the patient's carers	CbD, PGD, DOPS, mini-CEX, MSF	1
Skills		
Be able to discuss appropriate use of radiolabelled somatostatins with oncological colleagues including within an MDT	CbD, PGD, DOPS, mini-CEX	1,3
Know how patients should be prepared for therapy for example the stopping or reduction of short acting or long acting somatostatins and starting amino acid infusions at least 1 hour prior to therapy and providing anti-emetics	CbD, PGD, DOPS, mini-CEX	1
Be able to explain the treatment and obtain consent for treatment with special reference to female patient's concerns about fertility and contraception. Also explain the dosing regime (normally 3-4 cycles every 6-12 weeks)	CbD, PGD, DOPS, mini-CEX	1,3
Communicate to the patient a realist view of outcomes in this palliative treatment	CbD, PGD, DOPS, mini-CEX	1,3
Arrange appropriate follow-up and further management of the patient	CbD, PGD, DOPS, mini-CEX	1
Be able to deal with the special concerns in treating children including the fears and hopes of the patient's family/guardians	CbD, PGD, DOPS, mini-CEX	1
Behaviours		
When treating children be able to communicate in a manner appropriate for the child's age and development	CbD, DOPS, mini-CEX, MSF	1,3

The trainee will be able to deliver intra-arterial therapy of liver primary cancer/metastatic disease		
Knowledge	**Assessment Methods**	**GMP**
Pathophysiology of primary and secondary cancers within the liver	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the relevance and use of diagnostic imaging with CT/MRI and PET in selecting patients for therapy	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of probable success of treatment compared to alternative therapies. In addition possible side effects compared to alternate treatments and long term prognosis including risk of bone marrow suppression and effects on the thyroid	CbD, PGD, DOPS, mini-CEX, MSF	1

Appropriate selection of patients for treatment including size and site of tumour(s) and the presence or absence of portal vein thrombosis	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand appropriate follow-up required for patients having been treated with these agents with appropriate referring clinician	CbD, PGD, DOPS, mini-CEX, MSF	1
Be aware of guidelines of the European Association Nuclear Medicine guidelines for treatment with Y-90 particulates	CbD, PGD, DOPS, mini-CEX, MSF	1
In particular be aware of the dosimetric and empirical approach to treatment	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand that with Y-90 labelled particulates a pre-dosing intra-arterial Tc-99m MAA scan should be performed to determine both the possibility of shunting to the lungs (must be less than 20%) and effect on the administered activity	CbD, PGD, DOPS, mini-CEX, MSF	1
Understand the legislation concerning the safe delivery of Y-90 labelled products including radiation protection for self, other staff and the patient's carers	CbD, PGD, DOPS, mini-CEX, MSF	1
Skills		
Be able to discuss appropriate use of Y-90 particulates with colleagues including within an MDT	CbD, PGD, DOPS, mini-CEX	1,3
Know how patients should be prepared for therapy for example the requirements for intra-arterial cannulation including clotting screen and platelet count	CbD, PGD, DOPS, mini-CEX	1,3
Be able to give product safely within the sterile facilities of X-ray special suite	CbD, PGD, DOPS, mini-CEX	1,2
Be able to explain the treatment and obtain consent for treatment with special reference to female patient's concerns about fertility and contraception	CbD, PGD, DOPS, mini-CEX	1,3
Communicate to the patient a realistic view of outcomes in this palliative treatment	CbD, PGD, DOPS, mini-CEX	1,3
Be able to deal with the special concerns in treating children including the fears and hopes of the patient's family/guardians	CbD, PGD, DOPS, mini-CEX	1,3
Behaviours		
Be responsive to the concerns of the patient (and parent/guardian) and their carers concerning treatment	CbD, DOPS, mini-CEX, MSF	1,3
When treating children be able to communicate in a manner appropriate for the child's age and development	CbD, DOPS, mini-CEX, MSF	1,3
Be aware of issues concerning fertility and contraception in different ethnic cultures and how that impacts on patient care	CbD, DOPS, mini-CEX, MSF	1,3