Structured Training Curriculum
for
Clinical Radiology

Education Board of the Faculty of Clinical Radiology
The Royal College of Radiologists
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Foreword

This new document has been prepared for those starting training in clinical radiology as from 2007. There have been several changes in training since the previous edition issued in 2004. First is the change in training requirements advocated by European bodies (Education Committee of the ESR and the UEMS) to move towards three years of core training followed by a two year period of advanced training (special interest training/consolidation). This change from the old four plus one model has meant a slightly reduced core curriculum (three years) with more topics in this phase becoming optional. One example is the reduction in diagnostic angiography requirements. A clear advantage of the new structure is that it will allow some trainees to obtain much more experience in a single special interest within their final two years of advanced training (e.g. those wishing to become a neuroradiologist at a specialised centre). It also provides opportunities for those who wish to consolidate their interests in, say, two or three special interests for future work in a more general setting.

There have also been considerable recent changes in postgraduate medical training in the UK. The changes outlined under Modernising Medical Careers (MMC) make it almost inevitable that more doctors will enter run-through training in clinical radiology as specialist registrars directly from Foundation Year 2. Even though entry was possible at this stage in the past, most candidates coming into radiology had more clinical experience; the curriculum has needed slight adjustment to reflect this aspect.

Profound changes to the way in which medicine is practised have occurred and amongst these the need for team working and good communication skills is of paramount importance. Many of these changes are alluded to in the GMC publication ‘Good Medical Practice’. Several of the necessary skills will be taught during Medical School and Foundation Years 1 and 2. However, some are more germane to radiology and these are included in this new curriculum.

Finally, the formation of the Postgraduate Medical Education and Training Board (PMETB) brought with it clear educational goals and standards with an emphasis on competence based training, formalised educational goals and formalised methods of assessment. Furthermore, there was a need to create uniformity amongst specialties so that the curriculum in clinical radiology is in an approximately similar format to those for other specialties.

Since the previous edition, the successful development of the Radiology Integrated Training Initiative (R-ITI), an innovative approach to radiological training developed by the Royal College of Radiologists and the Department of Health has taken place. This programme has been developed along the three plus two year model of training. Thus, the curriculum for that programme had already anticipated many of the necessary changes. The RCR is very grateful to all those who have contributed to and are continuing to update that programme.

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Warden of the Faculty of Clinical Radiology
1 Introduction

1.1 The first version of this document (published in December 1995) was produced in response to the need to formalise the curriculum for specialist training in clinical radiology, consequent upon the Calman Report. The second, third and fourth editions (published in 1999, 2001 and 2004) expanded this document in a more detailed and structured form. This new fifth edition may be regarded as a natural evolution and replaces all former editions. It has been developed by various members of the RCR Education Board and its Working Parties in consultation with trainees, trainers and the various Special Interest Groups within and without the RCR – obviously it has to broadly conform to European Curricula for Training in Radiology. It has been approved by the Patient Liaison Group, the Faculty of Clinical Radiology and the Council of the RCR.

1.2 The purpose of this document is to define the present curriculum for each phase of training for the benefit of the trainee, the trainers and those responsible for training. Training is delivered in a modular fashion and training objectives are identified for all the constituent special interests of clinical radiology. The successful completion of training leads to the award of the Certificate of Completion of Training (CCT) by the Postgraduate Medical Education and Training Board (PMETB).

1.3 The training objectives identified in this document are listed on the modular training objectives forms, which are included in the Trainee Personal Portfolio.

1.4 These training objectives are used to assist trainee appraisal and assessment during specialist training and when achieved can verify that training has taken place to the required standard for a Certificate of Completion of Training (CCT) to be awarded.

1.5 Training for the CCT must take place in accredited departments. Training schemes are centred on teaching and specialist hospitals and include rotations to general hospitals. All training schemes are approved by the PMETB in conjunction with local Deaneries and the RCR for the purpose of specialist training, on a regular cycle.

1.6 Clinical radiology

1.6.1 The specialty of clinical radiology involves all aspects of medical imaging that provide information about anatomy, function and disease states, interventional radiology and those aspects of minimally invasive therapy that fall under the remit of departments of clinical radiology.

1.6.2 A clinical radiologist requires a good clinical background in order to work in close collaboration with colleagues in other medical disciplines, and should be demonstrably conversant with, the basic sciences relevant to diagnostic and functional imaging, the pathological and functional aspects of disease, current clinical practice as related to clinical radiology, the full range of clinical radiology as indicated in this document, the administration, management and medico-legal aspects of radiological practice and the basic elements of research in clinical radiology.

1.6.3 Clinical radiology involves much more than the mere reporting of a radiograph. The radiologist provides the continuum between the patient, the referring clinician and the sequence of radiological investigations. A high proportion of diagnoses are established within a department of clinical radiology. Thus, communication skills are crucially important. This includes breaking bad news (eg requesting further views at mammography), obtaining consent for biopsies, dealing with emergencies and helping to prioritise procedures about access to medical care within a busy department. Communication skills generic to radiology must be acquired and assessed as training progresses.

1.6.4 Selection into the specialty is organised by Deaneries against strict agreed selection criteria on the basis of the application form, structured interviews and accompanying supporting documentation, taking into account training and proof of training in clinical medicine and communication skills.
1.7 **Outline of training programmes in clinical radiology**

1.7.1 Each trainee in clinical radiology undertakes a programme of structured training over an indicative period of five years (wholetime equivalent) in order to achieve a level of competence in all aspects of clinical radiology that will enable him/her to practise as a specialist. The training will also instil those values, behaviours and relationships that underpin the trust the public has in doctors (medical professionalism).

1.7.2 **Core Training years 1-3** Fundamental science and radiation safety relevant to clinical radiology will be taught over a period of about three months during the first year. Structured training to cover core interpretative and procedural skills in all the required special interests (see Section 3.2) will be delivered during the first three years.

1.7.3 **Advanced training** lasting for a period of about 24 months is required to allow for consolidation of those skills learnt during core training alongside training in one special interest for those who wish to declare a single special interest, or training in a mixture of two or more special interests in order to provide a more generalised service.

1.7.4 This advanced training in a special interest(s) will usually be undertaken in the fourth and fifth years, but may be scheduled in a modular fashion at other stages of training (eg Focussed Individualised Training – see Glossary). Assuming that trainees have selected their chosen special interest(s) during their third year, there should be little need for additional special interest training after Year 5, except perhaps for those pursuing complex interventional radiology (eg neurointervention) and nuclear medicine. Curricula for special interest training are published at Appendix 1.

1.7.5 The current examination structure is as follows.

- The First FRCR Examination comprises radiation physics and radiation safety
- The Final FRCR Examination, which is an intermediate examination covering all the special interests within clinical radiology, is in two parts: Part A (modules of multiple choice questions) and Part B (oral examinations and reporting session). The Final FRCR Part A Examination tests the candidate’s knowledge base; the Final FRCR Part B Examination is a realistic test of clinical practice.
- The regulations and syllabi for these examinations are published separately and are available on the RCR website. Trainees are advised to check this website regularly as the examination will change in time as more electronic testing becomes possible.

The usual timing for these examinations is currently as follows:

- First FRCR Examination during Year 1
- Final FRCR Part A Examination during Years 2/3
- Final FRCR Part B Examination at the end of Year 3

1.7.6 Trainees entering a radiology training programme are required to have a minimum of two years of appropriate clinical experience. Current entry criteria define this clinical experience as being equivalent to that obtained in Foundation Years 1 and 2. This will have included basic life support training, and training in infection control, child protection and other generic issues.

1.7.7 **Academic Radiology and Research.** A period of academic radiology and research during the indicative five years of training is encouraged. Six months of full-time research in any aspect of diagnostic imaging is allowed as part of the five years of specialist training. At the discretion of the Warden, up to 12 months of the five years of accredited training may be spent in clinically-based research.
A few Specialist Registrars express an interest in and have a background that justifies considering a research career at the outset. This they could do under the terms of the Focussed Individualised Training scheme (see Glossary). Such applications need to be considered by the Head of Training, the Regional Adviser and the projected Academic supervisor. Under this scheme the trainee would pursue some research as a short block during ST1 and then maintain some sessional commitment to research during the rest of their training. These trainees must fulfil all the other aspects of training to complete the same steps for the award of a CCT in Clinical Radiology as conventional trainees. However, as they will spend the equivalent of one year in full time research, it is likely that they may reach CCT with slightly less comprehensive training in Special Interests than conventional trainees. It is more likely that they will have very deep Special Interest expertise in those areas relevant to their research. In common with all trainees, they will, during Years 4 and 5, consolidate those skills acquired during Core Training so that they can safely manage general radiological work as an independent practitioner. Deaneries run teaching courses for trainees, and radiology trainees are encouraged to attend these. In addition, radiology trainees are taught how to present material at multidisciplinary meetings which are in themselves teaching experience for radiology trainees and others. Increasingly, radiology trainees are teaching anatomy in medical schools and receive training to enable them to do so.

Much the same arrangements are in place for those entering the newly emerging Integrated Academic Training Initiative as Clinical Fellows or Lecturers. In 2006 only two such posts in the country had been so earmarked and funded, but it is anticipated that there will be further successful bids in order to stimulate much needed research in this rapidly changing field. The main difference is that such trainees are expected to gain a higher degree concurrent with their training. Ideally a PhD should be obtained but existing PhD holders might pursue an MD. While some of the work for these higher degrees could be performed on a part time basis, it is almost inevitable that a period of Out of Programme Experience (OOPE) will be required and agreed in advance with the Royal College of Radiologists. These Academic Trainees would be expected to have attained the core and some of the optional competencies as laid out in 3.2.2.22. Again, these trainees must fulfil all the other aspects of training to complete the same steps for the award of a CCT in Clinical Radiology as conventional trainees. Those embarking on Integrated Academic Training with Clinical Fellowships and Lectureships must ensure, in collaboration with their Head of Training, that they will have covered the entire structured training curriculum by the conclusion of their training.

Apart from pursuing research, trainees pursuing academic training are also expected to acquire more specialised teaching skills than conventional trainees. Indeed it is possible that some Academic trainees may choose to concentrate rather more on teaching than research. They would be encouraged to pursue a degree course in teaching along the lines expressed for PhD training above.

1.7.8 Trainees who have demonstrated their knowledge and competence by passing the Final FRCR Part B Examination may apply for a CCT no earlier than 3 months before their expected CCT date.

1.7.9 Trainers are expected to:
- have substantial expertise in their special interest(s)
- be up-to-date with the requirements of the RCR continuing professional development scheme and be in possession of appropriate supporting certificates
- have demonstrated an interest in training
- have appropriate equipment available
- have a sufficiently large throughput of cases
- have appropriate teaching resources
1.8  This document should be read in conjunction with the published curricula for each of the special interests in clinical radiology and the most up-to-date version of the following documents issued by the RCR. The dates of the current versions are provided in the reference list.

- *First Examination for the Fellowship in Clinical Radiology: Examination Syllabus*
- *Final Examination for the Fellowship in Clinical Radiology: Examination Syllabus*
- *Regulations for Training in Clinical Oncology and Clinical Radiology*
- *Regulations for the Examinations for the Fellowship of the Royal College of Radiologists in Clinical Radiology*
- *Royal College of Radiologists. Training Accreditation in Clinical Radiology, Guidance Notes for Training Schemes*


The following documents have been withdrawn:

1.10  **Summary of key points on training and curriculum implementation**

1.10.1  Summary of Standard Training for a CCT in Clinical Radiology:

- Primary Medical Qualification
- 2 Years of Foundation Years Training (FY 1 and 2) or equivalent and, for some, additional experience in other programmes (medicine, surgery, etc)
- Core Radiology Training as a specialist registrar (ST 1-3) over an indicative period of 3 years followed by:
  - Advanced Radiology Training (ST 4-5) over an indicative period of 2 years

These indicative training periods are assumed to be related to full-time training. The intensity of part time training should, at a minimum, amount to not less than five sessions per week (i.e. not less than half that of the full-time equivalent). Less than full-time trainees should be involved in an on-call rota on a pro-rata basis.

1.10.2  Summary of Methods of Learning:

- Clinical attachments with gradual reduction in supervision according to increasing competence as judged by trainers (apprenticeship model)
- Knowledge assimilation: lectures, seminars, tutorials, books/journals, electronic material, meetings etc

1.10.3  Summary of the management of curriculum implementation:

- New curriculum has already been discussed with all Regional Postgraduate Education Advisers and Heads of training schemes – the former meet twice yearly on a national basis; the latter meet yearly
- Local training schemes develop rotations that deliver the curriculum, which is checked by:
  - Regional Postgraduate Education Advisers at the workplace and through the Deanery led RITA process; further checked during:
  - The training accreditation process supervised by local Deaneries and the PMETB with input from the RCR
  - A final check that the curriculum has been delivered for each trainee is carried out by the RCR before recommendation to the PMETB for the award of a CCT

1.10.4  Summary of Methods of Appraisal and Assessment:

- Knowledge tests (First FRCR Examination and Final FRCR Part A Examination)
- Trainee Personal Portfolio including
  - Attachment sign-up form of achieved competence (see Trainee Portfolio Form 4 in Guidance for Appraisal and Assessment on the RCR website)
- Testing of reporting, clinical and communication skills (Final FRCR Part B Examination)
- Informal and formal meetings with attachment supervisors, mentors, tutors and head of training scheme
- Multi-source feedback in line with:
- NHS and RCR Appraisal and Assessment
- Formal Deanery led RITA process
2 Aims and Principles

2.1 The aim of the curriculum is to produce well trained, competent clinical radiologists capable of being appointed as, and to undertake the duties of, a National Health Service (NHS) consultant radiologist. The training should ensure that newly appointed consultants understand the values, behaviours and relationships that underpin the trust the public has in doctors (medical professionalism).

2.2 These standards have to be achieved before the award of a CCT in Clinical Radiology and entry onto the Specialist Register.

2.3 A major component of training in clinical radiology is achieved by the apprenticeship system with the trainee undertaking an increasing number of radiological tasks. Each component of the training programme should have a clearly defined structure with supervision of the trainee by senior colleagues (trainers). A named consultant/s will assume overall responsibility for each special interest module of training. Training in more than one special interest may take place during a rotational attachment.

2.4 Each module of training will define all of the core training objectives. The core training objectives will detail the knowledge and skills to be achieved and the experience to be acquired by the trainee during training.

2.4.1 Core knowledge is the knowledge required by a radiologist at the start of their training (in one or more special interests). In this document, core knowledge has been defined in terms of clinical systems, incorporating elements of anatomy and radiographic/radiological techniques. Knowledge relating to imaging techniques [computed tomography (CT), ultrasound (US), magnetic resonance imaging (MRI) and radionuclide radiology] is incorporated into the relevant clinical system and is no longer defined separately. Core knowledge includes:

- clinical knowledge, that is medical, surgical and pathological, relating to the specific body systems
- knowledge of current clinical practice
- knowledge of the indications, contraindications and potential complications of radiological procedures
- knowledge of the management of procedural complications.

2.4.2 Core skills are the practical procedures that are necessary for the trainee to be capable of performing independently but will be supervised during the training period until the necessary level of competence is achieved. Core skills must be assessed at a local level.

2.4.3 Core experience is acquired by the trainee during the initial three years of training. The RCR recognises that during this period it is not possible for trainees to become competent in all aspects of radiology and, therefore, distinguishes between core skills (which indicates an essential skill) and core experience. Core experience consists of observation, participation, knowledge and understanding of various procedures and investigations, which will not necessarily be performed by every trainee radiologist, but which should be available in most training schemes.

2.4.4 Optional experience. This refers to investigations, procedures and other aspects of clinical radiology, which may be available in some training schemes. Such experience is desirable, not mandatory, and, if available, would lead to a more rounded training. Whilst it is hoped that trainees will take advantage of opportunities to acquire such optional experience as may be available, those unable to do so will not be disadvantaged in their assessments and progression through training.

2.4.5 The skills that must be acquired and assessed for each module of structured training as well as the knowledge and experience appropriate to that module are listed in this document at sections 3 and 4, in the relevant special interest training curriculum and on the modular training objective forms included in the Trainee Personal Portfolio.

The competency levels that the trainee is expected to achieve in the relevant skills, knowledge and experience requirements are as follows:
**Level 1** – the trainee has a comprehensive understanding of the principles of the procedure including, where applicable, complications and interpretation of results and has witnessed the procedure being performed

**Level 2** – the trainee is able to carry out the procedure under direct supervision

**Level 3** – the trainee is able to carry out the procedure under indirect supervision

**Level 4** – the trainee is able to carry out the procedure competently and independently (has achieved independent competence).

It is expected that the trainee will achieve competency level 4 in all core skills before the award of the CCT. Once level 4 is achieved, the trainer should sign off and date the achievement on the relevant portfolio form. Where on the portfolio forms the level is shaded the trainee is not expected to reach this level, but may do so.

2.4.6 Log books should be used for documenting the skills and experience attained and to facilitate reflective learning. Log books are mandatory for all interventional procedures irrespective of special interest.

2.4.7 Trainee appraisal is mandatory within each module of training. The purpose of appraisal is to assess the progress of the trainee through each module and to anticipate and correct any deficiencies in training at an early stage.

2.4.8 The First FRCR and Final FRCR Part A Examinations currently test knowledge through multiple choice questions. The Final FRCR Part B Examination assesses competence (interpretative, analytical and communication skills).

2.5 Training schemes will be expected to offer training in a significant proportion of the optional objectives. It is recognised that the amount of training in the optional objectives will vary from training centre to training centre according to the facilities available. Both core and optional objectives will be reviewed by the RCR from time to time as practice changes and newer techniques are introduced.

2.6 Years of training activity are not synonymous with levels of competence.

2.7 All trainees will be required to develop skills in research and audit methodology that are necessary to structure and perform research and audit under appropriate guidance. These skills will include the ability to review published articles critically and to perform effective literature searches on a given topic. An appreciation of the effective application of research findings in everyday practice will also be required.

2.8 The Trainee Personal Portfolio will be used to document that training is progressing satisfactorily through to the award of the CCT. The portfolio, in addition to the log book, will be reviewed at each annual RITA assessment.

2.9 The portfolio is also used throughout training to assess that the trainee can practise in accordance with the relevant aspects of the GMC’s *Good Medical Practice* which are:

- Good Clinical Care
- Maintaining Good Medical Practice
- Teaching and Training, Appraising and Assessing
- Relationships with Patients
- Working with colleagues
- Probity
- Health
2.10 Individual progress will be recorded by an annual review (RITA: Record of In-Training Assessment). The RCR recommends that the Regional Postgraduate Dean should collaborate with the Head of the training scheme and the Regional Postgraduate Education Adviser when overseeing these reviews. College Tutors should also be involved in the process. The RCR also encourages the inclusion of an external assessor (such as a consultant clinical radiologist from another training scheme) in the annual review of trainees.
3 Core Training

3.1 First year of core training

For most trainees the first year of training represents their first opportunity to learn and acquire radiological skills.

3.1.1 Overview

At the end of the first year trainees should:

- feel confident in their choice of clinical radiology as a career
- have mastered the basic radiation physics and radiation safety required in clinical radiology to the level of the First FRCR Examination (see Section 3.1.2)
- be familiar with the concepts and terminology of diagnostic and interventional radiology
- understand the role and usefulness of the common diagnostic and interventional techniques in all age groups
- understand the responsibilities of a radiologist to the patient including the legal framework and the necessity for informed consent
- be familiar with the various contrast media, drugs (including intravenous sedation) and monitoring used in day to day radiological practice, and be aware of indications, contraindications, doses (adult and paediatric) and the management of reactions and complications
- be competent in cardiopulmonary resuscitation
- understand the principles of radiation protection and be familiar with the legal framework for protection against ionising radiation. Trainees should also be able to demonstrate that they are capable of safe radiological practice
- be familiar with safety requirements for radionuclide radiology and imaging with non-ionising radiation (ie US and MRI)
- have a sound understanding of basic radiological and radiographic procedures (see Section 3.1.3.1)
- have developed, under supervision, some basic reporting skills (see Section 3.1.3.2)
- understand and practise clinical audit and risk management
- have mastered and been assessed in basic communication skills and relationships with patients, especially issues around respecting confidentiality and obtaining consent
- have reviewed their knowledge of the relevant points in the GMC guide to ‘Good Medical Practice’ - in particular those relating to good clinical care, maintaining good medical practice, working with colleagues, probity and health (see section 2.9).

3.1.2 Basic sciences

An introductory course on basic radiation physics and radiation safety relevant to clinical radiology is provided during the first three months of training. The knowledge required for the First FRCR Examination has been defined by the RCR (First Examination for the Fellowship in Clinical Radiology: Examination Syllabus).

3.1.2.1 Physics

The RCR recommends that approximately 30 hours of formal tuition in basic radiation physics and radiation safety, including the current ionising radiation regulations and statutory obligations related to ionising radiation, are delivered before attempting the First FRCR Examination. This teaching is given primarily by medical physicists supplemented by clinical radiologists. Candidates for the First FRCR Examination will be expected to supplement this tuition by a substantial amount of self-directed learning.
Core knowledge
The syllabus for the First FRCR Examination includes the following:
• the fundamental physics of matter and radiation
• practical radiation protection
• statutory regulations and non-statutory recommendations
• the physics of diagnostic radiology and radionuclide radiology techniques

Further knowledge about clinically applied physics is tested in the Final FRCR Part A examination.

3.1.3 Clinical skills

3.1.3.1 Radiological and radiographic techniques and procedures

In the first year of training the trainee must be introduced to, obtain a sound understanding of, and begin to acquire some of the practical skills that will eventually be required of a consultant clinical radiologist.

In the case of conventional radiography, trainees should become familiar with the various radiographic techniques even if they do not take the radiographs personally.

3.1.3.2 Communication, interpretation and report writing

In the first year of training the trainee must begin to acquire some of the core interpretation, reporting and communication skills that will eventually be required of a consultant radiologist. This will include discussing the management of patients with clinicians before and after a procedure has been performed. It will also include the discussion of procedures and their possible complications with patients. These skills are identified in the document “Communication Skills for Radiology Trainees”, which addresses training in communication with both patients and colleagues.

The RCR recommends a minimum requirement of two sessions per week to be devoted to reporting. By the end of the first year trainees will have interpreted and formally reported the following under the supervision of a recognised trainer:

Core
• All core procedures and techniques performed by the trainee
• A selection of radiographs taken for trauma
• A selection of in-patient and out-patient radiographs

Optional
• US, radionuclide, CT and magnetic resonance investigations
• Special procedures not performed by the trainee
• Paediatric investigations

3.1.4 Supervision and Feedback

The first year in clinical radiology can be a difficult year of transition for trainees. Heads of training schemes and College Tutors are encouraged to offer advice, a mentor system and a counselling service during the year. The following milestones should be acknowledged:

3.1.4.1 The trainee must meet with the College Tutor and/or the Head of the training scheme at the beginning of and after three months in post, to identify any difficulties and suggest solutions.

3.1.4.2 The trainee’s practice must be closely supervised and the safety of the patient is of paramount importance. Such aspects are checked in the formal portfolio sign-ups from the consultant responsible for each rotation. However, the Head of Training within each training scheme should establish clear methods for more immediate feedback to the tutor and individual trainee if problems are perceived.
3.1.4.3 Candidates failing the First FRCR Examination should be counselled by the Head of the training scheme and/or the College Tutor on each occasion.

3.1.4.4 All trainees should be assessed at the end of the first year by the local training scheme before the annual RITA process (defined in Section 2.9). The possible outcomes of this assessment and the RITA process are listed below:

- **Progress** into the second year of training (RITA Form C completed)
- **Conditional progress** into the second year of training (RITA Form D completed). A specific action plan will be formulated with the trainee to redress deficiencies in performance. Progress will be re-assessed as appropriate within the second year of training.
- **Directed training without progression** (RITA Form E completed). If the trainee is so far short of the objectives from their first year of training such as to prevent them continuing into the second year of training, directed training is recommended to achieve those objectives. The RCR recommends that repetition of the entire first year should only be recommended for exceptional reasons.

3.2 **Second and third years of core training**

After the initial three month period of training when the First FRCR Examination syllabus is covered, there will be approximately 33 months of core training during which trainees should receive structured training in all the constituent special interests of clinical radiology.

By the end of the third year a trainee will usually have had the opportunity to pass the Final FRCR Examination. The core knowledge required to pass the final FRCR examination has been defined by the RCR (*Final Examination for the Fellowship in Clinical Radiology: Examination Syllabus*).³

During the first 3 years of training, individual trainees will have had the opportunity to assess their aptitude for, and interest in, the various special interests, so that they are in a position to decide the most appropriate areas on which to focus during Years 4 and 5 (advanced training).

By the end of the third year the trainee will have achieved the level of competence of core knowledge, skills and experience defined for each special interest on Portfolio Form 3 in the Trainee Personal Portfolio.

A small number of trainees may be able to demonstrate experience which might allow an even earlier decision about starting training in a special interest (see Glossary- Focussed Individualised Training).

3.2.1 **Overview**

3.2.1.1 The framework for core training will consist of rotations which should give appropriate experience in the areas identified below.

**System-based special interests:**
- breast imaging
- cardiac imaging
- gastrointestinal (GI) and abdominal imaging
- head and neck imaging including ear, nose and throat/dental
- musculoskeletal and trauma imaging
- neuroradiology
- obstetric imaging and gynaecological imaging
- thoracic imaging
- uroradiology
- vascular imaging including intervention

**Technique-based special interests:**
- radionuclide radiology
Disease-based special interests:
• oncological imaging

Age-based special interest:
• paediatric imaging

Academic radiology
• Academic radiology will be learnt either in conjunction with the system based rotations, or in a dedicated period of training.

3.2.1.2 The core knowledge for each system-based module includes physics, detailed radiological anatomy and techniques. The trainee will also be expected to have knowledge of how multisystem disease manifests itself.

3.2.1.3 Technique-based special interests (CT, MRI, US, interventional and radionuclide radiology) are incorporated (for the purposes of defining structured training) within each system-based module and are no longer defined separately in the Trainee Personal Portfolio, but are defined in this document for reference. Because some training schemes deliver training centred on technique-based rotations, the core competencies necessary to be acquired are listed (3.2.2.17–3.2.2.21). There is no requirement for training schemes to also re-organise training to align with system-based modules, provided that core knowledge, skills and experience are acquired during the five years of structured training.

3.2.1.4 In many training schemes it will be possible for trainees to receive training in more than one special interest at the same time, and there may also be opportunities to link certain special interests (e.g. CT and oncological imaging). Because of the complexities of such rotations and the inherent differences between training schemes, the RCR leaves it to individual training schemes to determine the order of rotations and their duration to ensure that the curriculum is covered.

3.2.1.5 Training schemes must ensure that their trainees are able to achieve all the core training objectives for each special interest.

3.2.1.6 On-call: When competence for such work has been established, each trainee will participate in an appropriate on-call rota, or other schemes of exposure to acute and emergency radiology, in which he/she will be responsible to a named consultant(s). This should commence during the third year of training, although on-call experience at an earlier stage also provides valuable training opportunities.

3.2.2 Clinical skills
3.2.2.1 The following sections delineate the training objectives (knowledge, skills and experience) that will be acquired during Years 1-3. Where an optional objective is given, practical experience is not essential but a theoretical knowledge is still required.

3.2.2.2 Each component of the training programme will have a clearly defined structure for the supervision of the trainee by senior colleagues (trainers). There will be a named consultant(s) who will assume overall responsibility for the training given during that period, including the techniques performed and reports issued by the trainee.

3.2.2.3 The trainer will also be responsible for undertaking appraisal of the trainee at the beginning, during and at the end of the rotation and may be involved in the end of rotation assessment.
3.2.2.4 Generic competencies

Core knowledge
- secure knowledge of the current legislation regarding radiation protection
- able to offer advice as to the appropriate examination to perform in different clinical situations
- knowledge of infection control, child protection, nutrition and other generic issues that could apply to radiological interpretation and procedures
- Knowledge about maintaining Good Medical Practice

Core skills
- participation in reporting plain radiographs which are taken during the general throughput of the normal working day of a department of clinical radiology
- performing any routine radiological procedure that might be booked during a normal working day
- performing and reporting on-call investigations appropriate to the level of training with the appropriate level of supervision
- attendance at and conducting clinicoradiological conferences and multidisciplinary meetings
- competence at reviewing studies on a workstation and familiarity with digital image manipulation and post-processing
- Teaching and Training, Appraising and Assessing
- Provision of a good standard of practice and care, treatment in emergencies
- writing reports, giving evidence and signing documents
- Working with colleagues:
  - treating colleagues fairly
  - working in teams
  - leading teams
  - arranging cover
  - taking up appointments
  - sharing information with colleagues
  - delegation and referral
  - assessing conduct or performance of colleagues
- Relationships with Patients
  - obtaining consent
  - respecting confidentiality
  - maintaining trust
  - good communication
- Probity
  - dealing with problems in professional practice
  - handling complaints and formal inquiries

3.2.2.5 Breast

Core knowledge
- knowledge of breast pathology and clinical practice relevant to clinical radiology
- understanding of the radiographic techniques employed in diagnostic mammography
- understanding of the principles of current practice in breast imaging and breast cancer screening
- awareness of the proper application of other imaging techniques to this specialty (e.g., US, MRI and radionuclide radiology)

Core skills
- mammographic reporting of common breast disease
Core experience

- participation in mammographic reporting sessions (screening and symptomatic)
- participation in breast screening and symptomatic assessment clinics and multidisciplinary meetings
- performing ultrasound of the breast
- observation of breast biopsy and localisation

Optional experience

- performing breast biopsy and localisation

3.2.2.6 Cardiac

Core knowledge

- knowledge of cardiac anatomy and clinical practice relevant to clinical radiology
- knowledge of the manifestations of cardiac disease demonstrated by conventional radiography
- familiarity with the application of the following techniques:
  - echocardiography (including transoesophageal)
  - radionuclide investigations
  - CT
  - MRI
  - angiography, including coronary angiography

Core skills

- reporting plain radiographs performed to show cardiac disease and post-operative appearances
- reporting of common and relevant cardiac conditions shown by US, CT and MRI

Optional experience

- observation of relevant angiographic, echocardiographic and radionuclide studies
- supervising and reporting radionuclide investigations, CT and MRI performed to show cardiac disease
- experience in echocardiography (including transoesophageal)
- observing/performing coronary angiography and other cardiac angiographic and interventional procedures

3.2.2.7 Gastrointestinal and abdominal (including liver, pancreas and spleen)

Core knowledge

- knowledge of GI and biliary anatomy and clinical practice relevant to clinical radiology
- knowledge of the radiological manifestations of disease within the abdomen on conventional radiography, contrast studies (including ERCP), US, CT, MRI, radionuclide investigations and angiography
- knowledge of the applications, contraindications and complications of relevant interventional procedures

Core skills

- reporting plain radiographs performed to show GI disease
- performing and reporting the following contrast examinations:
  - swallow and meal examinations
  - small bowel studies
  - enema examinations
• performing and reporting transabdominal US of the GI system and abdominal viscera
• supervising and reporting CT of the abdomen including CT colonography
• supervising and reporting certain MRI examinations of the abdomen (eg MRCP)
• performing:
  – US-guided biopsy and drainage
  – CT-guided biopsy and drainage

Core experience
• participation in clinicoradiological/multidisciplinary meetings
• experience of the following contrast medium studies:
  – sinogram
  – stomagram
  – GI video studies
• experience of the current application of radionuclide investigations in the following areas:
  – liver
  – biliary system
  – GI bleeding (including Meckel’s diverticulum)
  – abscess localisation
  – assessment of inflammatory bowel disease
• experience of the application of angiography and vascular interventional techniques to this area
• experience of the relevant application of the following interventional procedures:
  – percutaneous biliary procedures

Optional experience
• observation of ERCP and other diagnostic and therapeutic endoscopic techniques
• endoluminal US
• performing T-tube cholangiography
• performing percutaneous cholangiography
• observation and performance of percutaneous gastrostomy
• familiarity with performance and interpretation of the following contrast studies: proctogram, pouchogram, herniogram
• experience of the relevant application of the following interventional procedures:
  – balloon dilatation of the oesophagus/stent insertion
  – porto-systemic decompression procedures

3.2.2.8 Head and neck imaging including ENT/dental

Core knowledge
• knowledge of head and neck anatomy and clinical practice relevant to clinical radiology
• knowledge of the manifestations of ENT/dental disease as demonstrated by conventional radiography, relevant contrast examinations, US, CT and MRI
• awareness of the application of US with particular reference to the thyroid and salivary glands and other neck structures
• awareness of the application of radionuclide investigations with particular reference to the thyroid and parathyroid glands

Core skills
• reporting plain radiographs performed to show ENT/dental disease
• performing and reporting relevant contrast examinations (eg barium studies including video swallows)
• performing and reporting US of the neck (including the thyroid, parathyroid and salivary glands)
• supervising and reporting CT of the head and neck for ENT problems
• supervising and reporting CT for orbital problems
• supervising and reporting MRI of the head and neck for ENT problems
• reporting radionuclide thyroid investigations

Core experience
• participation in clinicoradiological/multidisciplinary meetings

Optional experience
• performing biopsies of neck masses (thyroid, lymph nodes etc.)
• observation or experience in performing US of the eye
• supervising and reporting CT and MRI of congenital anomalies of the ear
• reporting radionuclide parathyroid investigations
• performing and reporting of sialography
• performing and reporting of dacrocystography

3.2.2.9 Musculoskeletal including trauma

Core knowledge
• knowledge of musculoskeletal anatomy and clinical practice relevant to clinical radiology
• knowledge of normal variants of normal anatomy, which may mimic trauma
• knowledge of the manifestations of musculoskeletal disease and trauma as demonstrated by conventional radiography, CT, MRI, contrast examinations, radionuclide investigations and US

Core skills
• reporting plain radiographs relevant to the diagnosis of disorders of the musculoskeletal system including trauma
• reporting radionuclide investigations of the musculoskeletal system, particularly skeletal scintigrams
• supervising and reporting CT of the musculoskeletal system
• supervising and reporting MRI of the musculoskeletal system
• performing and reporting US of the musculoskeletal system
• supervising CT and MRI of trauma patients

Core experience
• experience of the relevant contrast examinations (e.g., arthrography)
• participation in clinicoradiological meetings

Optional experience
• familiarity with the application of angiography
• awareness of the role and where practicable, the observation of discography and facet injections
• observing and performing image-guided bone and soft-tissue biopsy

3.2.2.10 Neuroradiology

Core knowledge
• knowledge of neuroanatomy and clinical practice relevant to neuroradiology
• knowledge of the manifestations of central nervous system disease as demonstrated on conventional radiography, CT, MRI and angiography
• awareness of the applications, contraindications and complications of invasive neuroradiological procedures
• familiarity with the application of radionuclide investigations in neuroradiology
• familiarity with the application of CT and magnetic resonance angiography in neuroradiology

Core skills
• reporting plain radiographs in the investigation of neurological disorders
• supervising and reporting cranial and spinal CT, including trauma
• supervising and reporting cranial and spinal MRI

Core experience
• observation of cerebral angiograms and their reporting
• observation of carotid US including Doppler
• experience in MR and CT angiography and venography to image the cerebral vascular system
• participation in clinicoradiological/multidisciplinary meetings

Optional experience
• performing and reporting cerebral angiograms
• experience of CT perfusion techniques
• performing and reporting myelograms
• performing and reporting carotid US including Doppler
• performing and reporting transcranial paediatric US
• observation of interventional neuroradiological procedures
• observation of advanced MR techniques, including magnetic resonance spectroscopy
• experience of functional brain imaging techniques (radionuclide and MRI)

3.2.2.11 Obstetrics and gynaecology

Core knowledge
• knowledge of obstetric and gynaecological anatomy and clinical practice relevant to clinical radiology
• knowledge of the physiological changes affecting imaging of the female reproductive organs
• knowledge of the changes in maternal and foetal anatomy during gestation
• awareness of the applications of angiography and vascular interventional techniques
• awareness of the applications of MRI in gynaecological disorders and obstetrics

Core skills
• reporting plain radiographs performed to show gynaecological disorders
• performing and reporting transabdominal and endovaginal US in gynaecological disorders, including possible complications of early pregnancy (eg ectopic)
• supervising and reporting CT in gynaecological disorders
• supervising and reporting MRI in gynaecological disorders

Core experience
• participation in clinicoradiological meetings
• participation in multidisciplinary meetings
• observation of foetal MRI
• observation of angiography and vascular interventional techniques in gynaecological disease
Optional experience

- performing and reporting hysterosalpingography
- supervising and reporting MRI in obstetric applications (eg assessing pelvic dimensions)
- performing and reporting transabdominal and endovaginal US in obstetrics

3.2.2.12 Oncology

Core knowledge

- knowledge of oncological pathology and clinical practice relevant to clinical radiology
- familiarity with tumour staging nomenclature
- familiarity with the application of US, radionuclide investigations, CT and MRI, angiography and interventional techniques in oncological staging, and monitoring the response of tumours to therapy
- familiarity with the radiological manifestations of complications which may occur in tumour management

Core skills

- reporting plain radiographs performed to assess tumours
- performing and reporting US, CT, MRI and radionuclide investigations (including PET/CT) in oncological staging and monitoring the response of tumours to therapy
- performing image-guided biopsy of masses under US and CT guidance

Core experience

- Participation in multidisciplinary meetings

3.2.2.13 Paediatric

Core knowledge

- knowledge of paediatric anatomy and clinical practice relevant to clinical radiology
- knowledge of disease entities specific to the paediatric age group and their clinical manifestations relevant to clinical radiology
- knowledge of disease entities specific to the paediatric age group and their manifestations as demonstrated on conventional radiography, US, contrast studies, CT, MRI and radionuclide investigations
- the management of suspected non-accidental injury and the recognition of features of child abuse.

Core skills

- reporting plain radiographs performed in the investigation of paediatric disorders including trauma
- performing and reporting US in the paediatric age group
- supervise and report cranial CT studies, particularly in the setting of acute trauma
- performing and reporting routine fluoroscopic procedures in the paediatric age group, particularly:
  - contrast studies of the urinary tract
  - contrast studies of the GI system

Core experience

- experience of supervising and reporting CT, MRI and radionuclide investigations in the paediatric age group
- participation in clinicoradiological and multidisciplinary meetings
Optional experience
• the practical management of the following paediatric emergencies:
  – neonatal GI obstruction
  – intussusception

3.2.2.14 Thoracic

Core knowledge
• knowledge of thoracic anatomy and clinical practice relevant to clinical radiology
• knowledge of the manifestations of thoracic disease as demonstrated by conventional radiography and CT
• knowledge of the application of radionuclide investigations to thoracic pathology with particular reference to radionuclide lung scintigrams
• knowledge of the application, risks and contraindications of the technique of image-guided biopsy of thoracic lesions

Core skills
• reporting of plain radiographs performed to show thoracic disease
• supervising and reporting radionuclide lung scintigrams
• supervising and reporting CT of the thorax, including high-resolution examinations and CT pulmonary angiography
• drainage of pleural space collections under image guidance

Core experience
• observation of image-guided biopsies of lesions within the thorax
• participation in clinicoradiological/multidisciplinary meetings

• familiarity with the applications of the following techniques:
  – MRI
  – angiography

Optional experience
• supervising and reporting MRI
• angiography
• bronchial stenting

3.2.2.15 Uroradiology

Core knowledge
• knowledge of urinary tract anatomy and clinical practice relevant to clinical radiology
• knowledge of the manifestations of urological disease as demonstrated on conventional radiography, US, CT and MRI
• familiarity with the current application of radionuclide investigations for imaging the following:
  – renal structure
  – renal function
  – vescio-ureteric reflux
• awareness of the application of angiography and vascular interventional techniques

Core skills
• reporting plain radiographs performed to show urinary tract disease
• performing and reporting the following contrast studies:
– intravenous urogram (even if not performed at certain training centres)
– retrograde pyelo-ureterography
– loopogram
– nephrostogram
– ascending urethrogram
– micturating cysto-urethrogram

• performing and reporting transabdominal US to image the urinary tract
• supervising and reporting CT of the urinary tract
• reporting radionuclide investigations of the urinary tract in the following areas:
  – kidney
  – renal function
  – vesico-ureteric reflux

Core experience
• observing nephrostomies
• drainage of renal abscesses and peri-renal collections
• observation of percutaneous ureteric stent placement
• observation of endorectal US
• performing image-guided renal biopsy under US and/or CT guidance
• MRI applied to the urinary tract
• experience of angiography and vascular interventional techniques
• participation in clinicoradiological/multidisciplinary meetings
• experience of antegrade pyelo-ureterography

Optional experience
• urodynamics
• performing nephrostomies
• percutaneous nephrolithotomy
• lithotripsy

3.2.2.16 Vascular and vascular intervention

Core knowledge
• knowledge of vascular anatomy and clinical practice relevant to clinical radiology
• familiarity with the indications, contraindications, pre-procedure preparation (including informed consent), sedation and anaesthetic regimens, patient monitoring during procedures, procedural techniques and post-procedure patient care
• familiarity with procedure and post-procedure complications and their management
• familiarity with the appropriate applications of the following techniques:
  – US (including Doppler)
  – digital subtraction techniques
  – CT and CT angiography
  – MRI and MR angiography
  – intra-arterial angiography

Core skills – imaging
• reporting plain radiographs relevant to cardiovascular disease
• performing and reporting lower limb venography (contrast medium and/or US)
• supervising and reporting CT examinations of the vascular system including image manipulation
• supervising and reporting MRI examinations of the vascular system including image manipulation
• performing and reporting: US (including Doppler), venous and arterial
• participation in clinicoradiological meetings

**Optional experience – imaging**
• femoral artery puncture techniques and the introduction of guide wires and catheters into the arterial system
• venous puncture techniques both central and peripheral and the introduction of guide wires and catheters into the venous system (eg central venous access)
• performing and reporting the following procedures:
  – lower limb angiography
  – arch aortography
  – abdominal aortography
  – digital subtraction angiography
• selective angiography (eg hepatic, renal, visceral)
• pulmonary angiography
• alternative arterial access (brachial/radial punctures etc)
• upper limb venography
• portal venography
• pelvic venography via femoral approach
• superior vena cavaography
• inferior vena cavaography

**Optional experience – interventional**
• angioplasty and stenting techniques, including endografting
• embolisation
• thrombolysis
• caval filter insertion

**Technique-based special interests**

The core training objectives for the following technique based special interests - CT (3.2.2.17), MRI (3.2.2.18), radionuclide radiology (3.2.2.19) and US (3.2.2.20) are listed below for reference, although they have also been incorporated into the system-based modules for the purpose of this document and the Trainee Personal Portfolio. Core training objectives for interventional radiology (3.2.2.21) are listed below but are also incorporated into the system-based modules.

**3.2.2.17 Computed tomography**

**Core**
• knowledge of the technical aspects of performing CT, including the use of contrast media
• knowledge of cross-sectional anatomy as demonstrated by CT
• practical experience in supervision including vetting requests, determining protocols, the examination, and post processing and reporting of the examination in the following anatomical sites:
  – brain
  – head and neck
  – chest
  – abdomen and pelvis
  – musculoskeletal
  – vascular
• experience in performing CT-guided procedures, eg biopsy and drainage
• familiarity with the application of CT venography and angiography
• familiarity with post-image acquisition processing

NB these examinations may be performed during a system-based attachment (eg neuroradiology) or during a CT attachment.
3.2.2.18 Magnetic resonance imaging

Core

- understanding of current advice regarding the safety aspects of MRI
- knowledge of the basic physical principles of MRI, including the use of contrast media
- knowledge of the cross-sectional anatomy in orthogonal planes, and the appearance of normal structures on different pulse sequences
- experience in supervision including vetting requests, determining protocols, the examination, and post-processing and reporting of the examination in the following anatomical sites:
  - brain
  - head and neck
  - chest
  - abdomen and pelvis
  - musculoskeletal (eg hips, knees, shoulders, and extremities)
- experience of the application of magnetic resonance angiography and venography
- familiarity with post image acquisition processing

NB this experience may have been gained during a system-based attachment (eg musculoskeletal) or during a MRI attachment.

3.2.2.19 Radionuclide radiology

Core

- secure knowledge of the relevant aspects of current legislation regarding the administration of radiopharmaceuticals
- knowledge of the technical aspects of radionuclide radiology relevant to optimising image quality
- knowledge of the radiopharmaceuticals currently available for the purposes of imaging organs and locating inflammatory collections, tumours and sites of haemorrhage
- knowledge of the relevant patient preparation, precautions (including drug effects), and complications of the more commonly performed radionuclide investigations
- knowledge and understanding of the principles and indications of the more commonly performed radionuclide investigations and how these relate to other imaging techniques, in particular knowledge of the radionuclide investigations in the following topic areas:
  - cardiology
  - endocrinology
  - gastroenterology and hepato-biliary disease
  - haematology
  - infection
  - lung disease
  - nephro-urology
  - nervous system
  - oncology
  - paediatrics
  - skeletal disorders
- understanding the significance of normal and abnormal results
- knowledge of the strengths and weaknesses of radionuclide investigations compared to other imaging modalities
- experience in supervision and reporting of radionuclide investigations
- an appreciation of functional/anatomical imaging including hybrid technologies such as PET-CT and SPECT-CT
  - a knowledge of the role of PET-CT in the staging of the common malignancies (lung, colon, etc)
  - an understanding of the role of PET-CT in other tumour groups and its potential use in cardiology and neurology
NB ideally the training in radionuclide radiology should take place during a radionuclide imaging attachment, but it may occur in part or wholly during one or more system-based attachments.

3.2.2.20 Ultrasound

Core
- knowledge of the technical aspects of US relevant to optimising image quality
- knowledge of the cross-sectional anatomy as visualised on US
- experience in performing and reporting transabdominal US examination of structures in the following anatomical areas:
  - general abdomen (including vessels)
  - pelvis (non-obstetric)
  - small parts (scrotum, thyroid, neck structures)
  - upper abdomen (including lower chest)
- experience of performing Doppler US imaging (eg leg veins, portal vein, carotid artery)
- performing US of the breast
- experience in US of the musculoskeletal system
- performing US-guided interventional procedures (eg biopsy and drainage)
- knowledge of infection control and probe cleaning

Optional
- obstetric US
- performing transcranial paediatric US

3.2.2.21 Interventional radiology

Core
- familiarity with the equipment and techniques used in vascular, biliary, and renal interventional techniques
- familiarity with the indications, contraindications, pre-procedure preparation including informed consent, patient monitoring during the procedure and post-procedure patient care
- familiarity with procedure and post-procedure complications and their management
- US-guided interventional procedures (eg biopsy and drainage)
- CT-guided interventional procedures (eg biopsy and drainage)

Optional
- performing nephrostomies
- angioplasty and stenting techniques
- observation of the spectrum of interventional procedures currently performed in the following systems:
  - vascular system (including neurovascular)
  - urinary system
  - biliary system
  - GI and abdominal system
  - musculoskeletal system
- experience of MRI-guided interventional procedures

Academic radiology

3.2.2.22 Academic radiology

Core
- Literature reviews
- Experimental design
- Statistics and power calculations
• Research ethics and submissions
• Research governance
• Writing skills
• Presentation skills
• Teaching skills

Optional
• Attachments to external mentors/units
• Out of programme (research) experience
• Grant writing

NB academic trainees are expected to have attained the core and some of the optional competencies as laid out above (see section 1.7.7).

3.2.3 The trainee will also attain an appropriate level of knowledge in:
• clinical conditions in which radiology has a role in diagnosis and/or treatment
• applied pathology and physiology where it contributes to a better understanding of radiological signs and methods of investigation
• those aspects of clinical medicine and pathology which are essential to the safe and effective conduct of interventional procedures
• current trends and recent advances in clinical radiology
• medical ethics
• statistics and research methods
• communication (breaking bad news, consent, communication with colleagues etc)
• the legal and ethical framework within which radiology and general healthcare provision operate

3.2.4 The trainee will develop skills, as part of his/her general professional development, in:
• teaching
• clinical audit
  – clinical effectiveness
  – clinical risk management including discrepancy review
  – quality standards
• research
• management (see Section 3.2.4.1)
• health informatics (See Section 3.2.4.2)

Some of these aspects of training will require attendance at in-house and/or external meetings and courses at appropriate periods during training.

3.2.4.1 The following management skills should be acquired:
• contextual awareness understanding the bigger picture and developing an ability to operate effectively at all appropriate levels in the NHS
• strategic thinking
• functional and operational skills, and knowledge of the day-to-day operation of radiology departments and other health care units
• clinical governance including clinical effectiveness, quality assurance and clinical risk management
• human resources/people management, team building, complaints procedures, professional development

3.2.4.2 Health informatics
The trainee should:
• develop core skills in information technology, especially the ability to perform basic word-processing, and to access computerised medical databases, electronic mail systems and the internet
• keep abreast of developments in information management relevant to radiology departments
• strive for best practice in patient record keeping and the transfer of clinical data and images
• comply with the Acts and Directives concerning data protection in clinical practice, and when using patient data for research, audit or teaching
• understand the principles and practice of evidence-based medicine
• understand how clinical information is used in clinical governance

3.2.5 The trainee should develop the following personal attributes as part of his/her general professional development, along with the principles outlined in the GMC’s Good Medical Practice (see section 2.9). These include:
• self-awareness
• time management
• teamwork
• handling uncertainty
• skill in communicating with patients
• skill in communicating with colleagues

3.2.6 At the end of the third year the trainee should:
• have substantial experience of interpreting and reporting plain radiographs in all special interests as set out in 3.2.1.1
• have acquired experience of performing and reporting all core procedures as defined in Sections 3.2.2.5–3.2.2.21 to the level of competence indicated on the Trainee Personal Portfolio Form 3 for the relevant special interest
• be able to advise clinicians on appropriate imaging strategies for the investigation of routinely encountered clinical situations (eg jaundice)
• be able to perform and give a provisional interpretation of standard emergency imaging procedures
• be preparing to attempt the Final FRCR Part B Examination
• have arranged their advanced training programme for fourth and fifth year special interest training (see Section 4.1)

3.2.7 There will be annual RITA reviews of all trainees as outlined in Section 2.10. These will aim to:
• verify experience and competence gained during the preceding year by reviewing the in-training assessments
• ensure that set targets have been met
• review clinical, technical and general professional development (listed in Sections 3.2.2–3.2.5)

The use of the Trainee Personal Portfolio (Section 2.8) and standardised log books (Section 2.4.6) will facilitate this review and help the review panel to:
• identify any deficiencies in expected knowledge, practical skills or experience so that these may be remedied in the ensuing year
• set targets for the forthcoming year
• offer career guidance and counselling as appropriate.

The review of in-training assessments should be formalised and completed jointly by the trainee and reviewers with a copy of the review result being sent to the Regional Dean and the RCR Regional Postgraduate Education Adviser.

3.2.8 The possible outcome of the annual RITA review process will be:
• Progress into the next year of training (RITA Form C completed).
• Conditional progress into the next year of training (RITA Form D completed). A specific action plan will be formulated with the trainee to redress deficiencies in performance. Progress will be re-assessed as appropriate within the next year of training.
• Directed training without progression (RITA Form E completed). If the trainee is so far short of the objectives of their previous year of training such as to prevent them continuing into the next year of training, directed training is recommended to achieve...
those objectives. The precise course of action will be formulated by the group undertaking the RITAs and will depend on the individual situation, but will range from the trainee having to repeat their training in the areas judged to be severely deficient, to the recommendation that the trainee’s contract is not renewed. This will only happen in exceptional circumstances, and only after consultation between the Head of the Training scheme, College Tutor, RCR Regional Postgraduate Education Adviser and Regional Dean.
4 Advanced Training, Years 4-5

4.1 Overview

The fourth and fifth years of advanced training allow for consolidation of those skills learnt during core training, alongside training in one special interest for those who wish to declare a single special interest, or training in a mixture of two or more special interests in order to provide a more generalised service. Advanced training in one or more special interests will normally be undertaken in Years 4 and 5 but may be undertaken in a modular or continuous fashion throughout training (see Focussed Individualised Training – FIT – Glossary).

Special interest training contains elements of choice to reflect the requirements and aptitude of the trainee. These include:

- continued training in the core competencies to an advanced professional level;
- development of one or more special interests;
- further training in a single special interest which, only rarely and with the agreement of both the RCR and the Regional Postgraduate Dean, may need to continue into a sixth year of training.

It is envisaged that for special interest rotations there will be a minimum commitment of six sessions per week to the special interest, coupled with up to three sessions per week in general radiology in order that trainees can consolidate their core training. It will sometimes be appropriate to link systems-based expertise with technique-based expertise. Whether or not it is possible or advisable for this special interest training to be undertaken in the base training centre, elsewhere in the UK, or abroad, should be decided on the basis of:

- previous assessment of progress;
- trainee aspirations;
- local availability and suitability of specialist rotations;
- the necessary agreements (see Sections 4.6.1 and 4.6.2).

A few well qualified trainees may identify their chosen special interest at an early stage in their training. In such circumstances, focussed individualised training programmes may be created to allow flexibility in training opportunities while providing the total experience outlined in this document and the relevant special interest curriculum.

4.2 The elements of general professional development, as outlined in Sections 3.2.3 to 3.2.5, will also be pursued during special interest training to a level sufficient to demonstrate professional competence.

4.3 Annual reviews, as defined in Sections 2.10, 3.2.7 and 3.2.8, will continue during advanced training with an emphasis on guidance as to future career choices. Accurate log books will continue to be essential in documenting the progress of the trainee towards the completion of his/her training, and the award of a CCT. At this stage it is essential that the trainee has demonstrated knowledge and competence in the relevant aspects of the GMC’s Good Medical Practice (see section 2.9).

4.4 The curricula for selected special interests are at Appendix 1. In general terms, the trainees are expected to acquire the elements identified below (see specific special interest curricula for more details).

- Detailed knowledge of current theoretical and practical developments in their chosen special interest(s)
- Development of clinical knowledge relevant to their chosen special interest(s). This could take the form of attending clinics/ward rounds
- Extensive directly observed, or unobserved but supervised, practical experience in their chosen special interest(s)
- Full utilisation of study allowance (currently equivalent to one session per week with a maximum of 30 days in a year) to pursue research projects within their chosen special interest(s) and to strive to see this work through to publication. Trainees should be assiduous in attending and presenting such work at appropriate meetings
- Understanding of clinical audit and risk management, and its application to their chosen special interest(s)
• Documentation of the extent of all relevant training in their Trainee Personal Portfolio and in their log book of all relevant experience.

4.5 Where the desired advanced training in a particular special interest cannot be provided on-site, the RCR recommends that training schemes should make every effort to assist the trainee to obtain an attachment or fellowship at another institution if this is appropriate to his/her career needs. It is recognised that this will require consultation and agreement between the Head of the training scheme, the RCR Regional Postgraduate Education Adviser, the Regional Dean, the Clinical Director of the department to which the trainee is attached and where relevant, the Head of the special interest training or fellowship. Other forms of attachment, such as a day- or week-release, may provide a suitable alternative for some trainees.

4.6 Training schemes must identify a named trainer responsible for each special interest in which training is offered.

4.6.1 Trainers should assess the trainee’s aptitude for his/her chosen special interest at the earliest opportunity. The trainer, together with the College Tutor and Head of Training should advise those trainees unlikely to succeed within that particular special interest as soon as this becomes apparent. Trainees are advised to discuss their chosen special interest(s) with suitable mentors before embarking on such training.

4.6.2 Apart from the annual review (see Sections 2.10, 3.2.7 and 3.2.8), continuing competence assessment of the trainee by the trainer will be required in order to focus the development of radiological skills.

5 Special circumstances

5.1 Absences from training: Absence on sick leave or maternity leave reduces the time spent in training. In appropriate circumstances, an absence for sick or maternity leave of up to three months may occur without necessarily affecting the expected date for completion of specialist training. Such absences must be notified to the Royal College of Radiologists in advance, or as soon as training is recommenced if advance notice is not feasible.

5.2 Acting-up: A trainee who has obtained the Fellowship of the Royal College of Radiologists may spend up to three months, during the final year of specialist training, "acting-up" as a consultant without affecting his/her expected CCT date, provided that a consultant supervisor is identified for the post, prospective approval has been obtained from the RCR, and satisfactory progress is made. It is advisable to confirm with the relevant Deanery as to whether such experience counts as Out of Programme Experience (see section 5.4).

5.3 Alternative Entry Points: Those trainees who move into a specialist training programme from a Locum Appointment – Training (LAT) post or a Fixed Term Training Post will be eligible to have the post accepted towards the CCT provided that the post has been approved by PMETB, that their training is relevant to the CCT programme in clinical radiology and that progress and performance have been satisfactory. It is a legal requirement that a CCT can only be awarded only to a person who has completed an entire course of training approved by PMETB. Those with training and/or qualifications from outside the UK will be required to complete the full duration of the CCT training programme including success in all parts of the FRCR Examination if they wish to acquire a CCT in clinical radiology, or to apply under Article 14 of current PMETB legislation for assessment of equivalence to the CCT.

5.4 Out of Programme Experience: Permission to take up Out of Programme Experience during training, such as a Fellowship post, should be obtained in advance from the relevant Deanery and the RCR. It should be noted that any experience undertaken outside the trainee’s own training scheme is counted as Out of Programme Experience and therefore appropriate prospective approval must be sought.
6. Appeals

There are formal mechanisms for appealing against decisions taken at all stages of training. Appeals against decisions of the Deanery Specialist Training Committee are conducted locally under the supervision of the Postgraduate Dean. Appeals against examination results are conducted by the RCR; information can be obtained from the Examinations Office. Appeals against a failure to award a CCT may be made to PMETB. It is important to be aware that the relevant regulations specify strict time limits within which appeals must be lodged.

7. Curriculum Review and Updating

The way in which this curriculum has evolved is set out in the Foreword and in Section 1.1. The Education Board of the Royal College of Radiologists is responsible for review of the curriculum. Formal review will take place every two years. Clinical radiology is a rapidly evolving specialty and it is important that a swift response to continuing developments in specialist training can be facilitated. Revisions to other curricula outside the UK may also prompt a review. The regular meetings of Special Interest Groups, Faculty Board and Education Board allow opportunities for the curriculum to be discussed and amendments to be proposed and approved in advance of formal review.

Curriculum evaluation should establish how trainees have responded to the curriculum and that the curriculum facilitates practical delivery of the required training. The curriculum will be evaluated by means of trainee questionnaires and formal meetings of Regional Postgraduate Educational Advisers and Heads of Training.

Trainees and lay representatives have been involved in the preparation of this curriculum and will continue to be involved in reviews, through representation from the College’s Junior Radiologists’ Forum and the Patients’ Liaison Group. Trainers, tutors, Regional Advisers and Programme Directors will also continue to be involved in reviews through their membership of relevant working parties and committees.
Glossary of Terms

A training programme/training scheme
A training programme/scheme provides a comprehensive indicative five-year training programme matching the requirements of the RCR structured training curriculum. The training may be delivered by a single or a number of departments of clinical radiology. Training programmes/schemes are accredited for training on a regular cycle by the PMETB through the local Deaneries.

A training department
A department of clinical radiology which is part of an accredited training programme/scheme. The training department may contribute to one or more parts of the curriculum.

Certificate of Completion of Training (CCT)
This certificate is issued by the Postgraduate Medical Education and Training Board (PMETB) on the recommendation of the RCR after:
(i) satisfactory completion of each of the five years of the curriculum within an accredited training scheme; and
(ii) admission to the Fellowship of the RCR following success in the Final FRCR Examination.

Record of in-training assessment (RITA)
The RITA form provides a record of the annual review at which a specialist registrar’s progress through training is evaluated. The review is undertaken by a small specialty-based panel accountable to the deanery-based committee but taking advice from the RCR.

Fellowship appointment
An attachment, usually of 6–12 months, spent in a specialist unit, which may be away from the main training centre, designed to provide particular experience in one (or more) radiological special interest.

Head of training scheme
In each training scheme there will be one clearly identifiable person who has overall responsibility for the organisation and delivery of the training. This should be a separate post from that of the clinical director to avoid potential conflict of interest, but may on occasion be the same individual where this arrangement can be shown to be advantageous to the scheme as a whole. In all circumstances the line of accountability must be clearly understood by all.

Regional Postgraduate Education Adviser
This post is jointly appointed and approved by the RCR and the Regional Post-Graduate Dean. For the RCR aspects of the post, the holder is accountable to the Warden. He/she is primarily responsible for ensuring that the RCR’s aims in regard to postgraduate education are adopted throughout the region. He/she is normally chairman of the regional radiology training committee.

College Tutor
This is a locally appointed consultant who is responsible for supervising the needs of individual trainees. There will be at least one College Tutor in each training department.

Focussed individualised training (FIT)
Some specialist registrars training in clinical radiology would benefit from identifying their individual special interest area at an early stage in their training. They have to be able to provide evidence to their local training scheme of their aptitude for their chosen special interest (e.g. a paediatrician wishing to become a paediatric radiologist). Training could then be delivered with that aim in mind. The principal difference is that one rotation through their chosen special interest would be covered early on in their training and studied in a part-time fashion for the rest of their training. They would return to their chosen special interest once core competencies had been achieved. The same total curriculum would be covered. The total length of training and the proposed date of their CCT would remain unchanged. Such flexibility is very much in line with the concept of ‘Individualised Training Profiles’ encouraged by Regional Post-Graduate Deans.

Trainee Personal Portfolio
This is the tool that trainers and trainees use to monitor the rotations undertaken and the competencies achieved throughout the whole training period. The portfolio is available on the RCR website.
References


Readers are advised to regularly check the RCR website for the latest versions of relevant documents

Other Useful Information


Special Interest Curricula
for
Clinical Radiology

Education Board of Faculty of Clinical Radiology
The Royal College of Radiologists
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1. **BREAST RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM**

1.1 **Introduction**

1.1.1 This curriculum outlines the special interest training requirements for specialty training in breast radiology.

1.1.2 The content of the special interest curriculum in breast radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of symptomatic breast disease in both females and males and asymptomatic breast disease including breast screening.

1.1.3 All trainees will have acquired knowledge of breast imaging during core training and will already have acquired core skills.

1.1.4 The aim of special interest training in breast radiology is to enable the trainee to become clinically competent and to consistently interpret the results of breast investigations accurately and reliably. Trainees will also be capable of performing image guided interventional procedures.

1.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in breast radiology, the equivalent of 12 months substantially devoted to the subject is recommended (with a minimum of 6 sessions per week dedicated to the special interest).

1.1.6 Those clinical radiologists who plan to practise breast radiology as one of a mixture of activities (albeit that breast radiology will be a particular responsibility within those activities) will normally undertake around 6 months of special interest training in breast radiology (with a minimum of 6 sessions per week dedicated to the special interest).

1.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

1.1.8 Those who will be involved in the National Health Service Breast Screening Programme (NHSBSP) are required to attend for training at one of the National Breast Screening Training Centres.

1.1.9 Supervision during training must be conducted by those who are appropriately skilled in breast radiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

1.1.10 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

1.1.11 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for particular breast disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of breast imaging and breast intervention as appropriate.

1.1.12 There will be continuing development of generic professional competencies.
1.2 **Overview of Training**

1.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training will be actively involved in breast imaging within an educational environment with graduated supervision.

1.2.2 The training department must provide access to appropriate mammographic equipment to include film-screen combination and digital imaging, specimen radiography equipment, ultrasound (US) imaging, magnetic resonance imaging (MRI), and sentinel node imaging.

1.2.3 Practical training and theoretical teaching and training in the following techniques should be available:
- Standard mammographic projections
- Additional mammographic projections
- Breast ultrasound
- Breast interventional techniques, biopsy and localisation
- Breast MRI

1.2.4 Clinical knowledge will be acquired by a variety of means, including close liaison with the appropriate pathological, surgical, oncological and other members of the multidisciplinary team. Attendance at multidisciplinary team meetings is a mandatory part of breast training.

1.2.5 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

1.2.6 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

1.2.7 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to breast radiological practice.

1.2.8 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

1.2.9 Trainees will be expected to be familiar with current breast radiology literature.

1.2.10 The trainee will be encouraged to participate in research and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

1.2.11 As audit is an integral part of the process of breast cancer screening, trainees will acquire a ready-made analysis of the proficiency of their activities. The trainee will also be expected to complete a specifically focused audit involving screening or symptomatic work. The process of interval cancer analysis should be participated in and understood.

1.2.12 The trainee will continue to participate in the specialty registrar general on-call rota, with appropriate consultant back-up.
## General principles of breast imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
</table>
| Understand the basis of breast imaging | Is familiar with:  
The embryology, anatomy and physiology of the breast  
The pathology of the breast in benign and malignant conditions  
The epidemiology of breast cancer  
The principles of population screening for breast cancer  
Local, national and where appropriate, international imaging guidelines | |
| Can describe the full range of diagnostic techniques available | Knows the indications, contraindications and complications of each imaging method.  
Understands the factors affecting the choice of contrast media and pharmaceuticals.  
Can describe the effects and side effects of these agents.  
Able to select the optimum imaging method and pathway for different breast conditions.  
Knows radiation dose and patient risk-benefit factors for breast imaging. | To conduct, supervise and accurately interpret all imaging techniques used in investigation of breast diseases, to a high professional standard.  
The accurate localisation and biopsy of breast abnormalities. |
| Is aware of current developments in breast radiology | Able to describe recent advances in breast imaging.  
Able to describe current NICE, NHSBSP and European breast management guidance. | Obtains appropriate training for new interventional procedures. |
| Understands the role of multidisciplinary meetings | Able to plan investigations including the selection of appropriate tests and imaging techniques for the diagnosis of benign and malignant disease of the breast  
Planning and outcomes of treatment  
Can describe the staging for malignant diseases of the breast  
Detects errors in diagnosis and complications in treatment  
Promotes an understanding of relevant breast pathology. | Able to communicate effectively and work in a multidisciplinary team. |
| The organisation of breast cancer services | The structure of the NHSBSP.  
The principles of triple assessment and rapid diagnosis clinics cancer units and cancer centres.  
The roles of the Breast Screening Programme Manager and Clinical Director  
The interface between screening and symptomatic services. | Able to practice all three elements of triple assessment: clinical examination, imaging and diagnostic biopsy to a high professional standard in breast clinics |
| Understands the clinical aspects of breast diseases | Is familiar with the clinical management pathways for breast disorders. | Able to confidently discuss the appropriate imaging strategy with other members of the multidisciplinary team.  
An understanding of: early mammographic evidence of |

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malignant disease, normal variants and the role of US, radionuclide imaging and MRI.

### Imaging Procedures (non-interventional)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret mammograms</td>
<td>Understands the basic principles of image acquisition and technique.</td>
<td>Able to interpret mammogram images produced using analogue, CR or DR acquisition.</td>
</tr>
<tr>
<td>Able to perform and interpret breast ultrasound</td>
<td>Able to describe the range of pathological appearances seen in breast tissues on ultrasound.</td>
<td>Competent in the use of ultrasonography for imaging the breast and associated structures and where appropriate Doppler studies.</td>
</tr>
<tr>
<td>To be familiar with the use of magnetic resonance imaging in breast disorders</td>
<td>Give detailed descriptions of imaging protocols used for breast investigation</td>
<td>Accurately stage breast tumours.</td>
</tr>
<tr>
<td>Define the role of nuclear medicine in breast investigation</td>
<td>Understand the process of sentinel node biopsy.</td>
<td></td>
</tr>
</tbody>
</table>

### Breast Interventional Techniques

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Understand and describe the principles of stereotaxis. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination. Able to visualise a 2-dimensional image in 3 dimensions. Able to work effectively with ultrasound and X-ray guided intervention.</td>
</tr>
<tr>
<td>Be familiar with a wide range of interventional techniques used in breast radiology</td>
<td>Be able to describe the advantages and disadvantages of the different devices available for image guided sampling of breast lesions.</td>
<td>Able to perform biopsy of breast lesions visible on ultrasound only. Able to perform biopsy of breast lesions visible on X-ray only. Able to perform localisation procedures under X-ray or U.S guidance. Able to orientate and correlate information from breast specimens.</td>
</tr>
<tr>
<td>Be proficient in the safe practice of analgesia and sedation in interventional practice</td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation.</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient.</td>
</tr>
<tr>
<td>Be competent in intermediate life support and anaphylaxis treatment</td>
<td>Describe the processes and actions required in intermediate life support and management of anaphylaxis.</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation. Be able to manage the immediate response to acute anaphylaxis.</td>
</tr>
</tbody>
</table>
### Good Medical Practice

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
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</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure.</td>
<td>Obtain informed consent in a clear and effective manner.</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge.</td>
<td>Know when to seek further information or help.</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date.</td>
<td>Be able to discuss current medical practice with colleagues and patients.</td>
</tr>
<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types.</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exhibit a flexible approach taking into account different learning styles and expectations of patients.</td>
</tr>
<tr>
<td>Demonstrate good team working skills</td>
<td>Understand the value of team working.</td>
<td>Demonstrate good communication with patients and professional colleagues including attendance at a suitable course in communication skills, if this is not addressed locally.</td>
</tr>
<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach.</td>
<td>Participate in clinical governance processes, e.g. clinical audit, guideline development.</td>
</tr>
<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning.</td>
<td>Conduct teaching sessions in a quality-assured training programme and develop competence as a clinical supervisor.</td>
</tr>
<tr>
<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity.</td>
<td>Demonstrate clarity and honesty in record and document keeping.</td>
</tr>
<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health.</td>
<td>Demonstrate a commitment to managing personal health.</td>
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Note “Good Medical Practice” 2006. GMC

1.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

1.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

1.3.3 The following is the recommended minimum experience per month for special interest trainees training in both breast screening and symptomatic practice. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long-term aims:

- Interpretation of screening mammograms: 400 cases
- Experience of stereotactic procedures: 6 cases
- Experience of breast MRI studies: 6 cases
- Experience of US breast procedures: 12 cases
- Involvement in assessment clinics: 4 clinics
- Attendance at multidisciplinary meetings: 3 meetings
- Observation of surgical procedures
1.3.4 The following is the recommended minimum experience per month for special interest trainees training in symptomatic breast disease only. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long-term aims:

- Interpretation of symptomatic mammograms: 60 cases
- Experience of stereotactic procedures: 6 cases
- Experience of breast MRI studies: 6 cases
- Experience of US breast procedures: 6 cases
- Involvement in triple assessment clinics: 4 clinics
- Attendance at multidisciplinary meetings: 2 meetings
- Observation of surgical procedures.

1.4 Appraisal

1.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

1.5 Assessment

1.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for breast diseases
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

1.6 Overall Review

1.6.1 Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken.
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum

1.6.2 Review of special interest curriculum

- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current breast radiological practice.

June 2008
2. CARDIAC RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM

2.1 Introduction

2.1.1 This curriculum outlines the special interest training requirements for specialty training in cardiac radiology.

2.1.2 Cardiac radiology is unusual in that clinicians will perform a significant number of imaging procedures. Competencies across the range of cardiac modalities are not usually possible with specialisation in several, but not all, areas being the norm. Competencies are well established in several areas of cardiac imaging and should be applicable to radiologists and cardiologists alike.

2.1.3 The content of the special interest of cardiac radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of cardiac conditions in adults and children.

2.1.4 All trainees will have acquired a broad general knowledge of cardiac imaging during core training. Cardiac specific modules in the electronic learning database will have supplemented this.

2.1.5 The aim of special interest training in cardiac radiology is to enable the trainee to become clinically competent and to consistently interpret the results of cardiac investigations accurately and reliably.

2.1.6 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in cardiac radiology, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

2.1.7 Those clinical radiologists who plan to practise cardiac radiology as one of a mixture of activities (albeit that cardiac radiology will be a particular responsibility within those activities) will normally undertake around 6 to 12 months of special interest training in cardiac radiology (with a minimum of 6 sessions per week dedicated to the special interest).

2.1.8 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

2.1.9 Supervision during training must be conducted by those who are appropriately skilled in cardiac radiology and in teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

2.1.10 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

2.1.11 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for cardiac disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in areas of cardiac imaging and cardiac intervention as appropriate.

2.1.12 There will be continuing development of generic professional competencies.
2.2 **Overview of training**

2.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training will be actively involved in cardiac imaging within an educational environment with graduated supervision.

2.2.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US) and radionuclide imaging and fluoroscopy. Centres will also provide access to relevant specialised radionuclide imaging, e.g. positron emission tomography (PET).

2.2.3 Practical training in echocardiography (both trans thoracic and trans oesophageal) techniques should be available either within radiology or cardiology.

2.2.4 Clinical knowledge will be acquired by a variety of means, including close liaison with cardio thoracic surgeons and cardiologists and combined clinical and radiological meetings. In order to further clinical knowledge it may be appropriate for the trainee to have regular attachments to relevant out patient clinics, ward rounds and theatre sessions. Multidisciplinary meetings will be emphasised. The following inter-relationships are important:

- Cardiology
- Cardiac surgery
- Vascular surgery

2.2.5 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

2.2.6 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

2.2.7 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

2.2.8 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

2.2.9 Trainees will be expected to be familiar with current cardiac radiology literature.

2.2.10 The trainee will be encouraged to participate in research and to pursue a project, or projects up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

2.2.11 The trainee will continue to participate in the trainee general on-call rota, with appropriate consultant backup.
### 2.3 General Principles of Cardiac Imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
</table>
| Understand the basis of cardiac imaging | Is familiar with the embryology, anatomy, physiology, pathology and mechanisms of disease of the heart.  
Has a good working knowledge of normal anatomical variants | | |
| Can describe the full range of diagnostic techniques available | Knows the indications, contraindications and complications of each imaging method.  
Understands the factors affecting the choice of contrast media and pharmaceuticals. Can describe the effects, side effects and hazards of commonly used substances in cardiac imaging including adenosine and dobutamine.  
Able to select the optimum imaging method and pathway for different pathological conditions | Conducts and supervises cardiac imaging techniques to high standard.  
Safely and effectively performs interventional techniques |
| Is aware of current developments in cardiac radiology | Able to describe recent advances in imaging  
Able to describe current NICE guidance. | Obtains appropriate training for new interventional procedures |
| Understands the role of multidisciplinary meetings | Able to plan effective imaging pathways.  
Detects errors in diagnosis and complications in treatment.  
Promotes an understanding of relevant cardiac pathology | Able to communicate effectively and work in a multidisciplinary team |
| Understands the clinical aspects of cardiac diseases | Is familiar with the clinical management pathways for cardiac disorders | Able to confidently discuss the appropriate imaging strategy with the referring clinicians |

### Imaging Procedures (non-interventional)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret plain film x-rays used in cardiac radiology</td>
<td>Understands the basic principles of plain film radiography.</td>
<td>Able to interpret images using plain film radiography</td>
</tr>
<tr>
<td>Able to perform and interpret echocardiography</td>
<td>Able to describe the range of pathological appearances seen on echocardiography</td>
<td>Full competence would require fulfilling current British Society of Echocardiography criteria – currently 250 cases logged.</td>
</tr>
<tr>
<td>Able to perform and interpret ECG gated computerised tomography and calcium scoring</td>
<td>Able to describe the protocols and image processing techniques used in cardiac CT</td>
<td>Able to interpret CT images used in the diagnosis of cardiac and particularly coronary disease. A minimum number of 100 CT angiograms and 50 calcium scores to be performed with a minimum duration of cumulative training of 3 months.</td>
</tr>
<tr>
<td>To be familiar with the use of magnetic resonance imaging in cardiac disorders</td>
<td>Give detailed descriptions of imaging protocols used for cardiac investigation</td>
<td>Able to interpret MRI images used in the diagnosis of cardiac disease. A minimum number of 100 procedures being performed under</td>
</tr>
</tbody>
</table>
Define the role of nuclear medicine in cardiac investigation

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define the role of nuclear medicine in cardiac investigation</td>
<td>Describe the range of normal and abnormal appearances in isotope cardiac imaging</td>
<td>Able to accurately interpret cardiac scans. A minimum number of 100 procedures performed under supervision with a minimum duration of cumulative training of 3 months</td>
</tr>
</tbody>
</table>

Imaging Procedures – (interventional)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination Able to work effectively with fluoroscopic imaging, ultrasound and CT guided intervention</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret diagnostic coronary angiography</td>
<td>Understands the indications/contraindications and complications of catheter angiography</td>
<td>Able to interpret images produced at coronary angiography. A minimum number of 100 procedures performed under supervision with a minimum duration of cumulative training of 3 months</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be proficient in the safe practice of analgesia and sedation in interventional practice</td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be competent in intermediate life support and anaphylaxis treatment</td>
<td>Describe the processes and actions required in intermediate life support and management of anaphylaxis</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation. Be able to manage the immediate response to acute anaphylaxis</td>
</tr>
</tbody>
</table>

Good Medical Practice

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate good team working skills</td>
<td>Understand the value of team working</td>
<td>Demonstrate good communication with patients and professional colleagues</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assure and improve the</td>
<td>Be able to describe an effective clinical</td>
<td>Participate in clinical governance</td>
</tr>
<tr>
<td>Quality of Care</td>
<td>Governance Approach</td>
<td>Processes e.g. Clinical Audit, Guidelines Development</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>Develop Teaching Competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
</tr>
<tr>
<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
</tr>
<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health</td>
</tr>
</tbody>
</table>

Note “Good Medical Practice” 2006. GMC

2.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

2.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

2.3.3 During the training period, the weekly sessional commitments will need to be determined according to the agreed range of competencies across the range of cardiac modalities to be acquired by the trainee. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long-term aims. It is to be expected that their sessional commitments will comprise a combination of the following:

- MRI
- CT
- US
- Radionuclide imaging
- Plain film reporting
- Fluoroscopy with or without intervention

2.4 Appraisal

2.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

2.5 Assessment

2.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for cardiac diseases
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).
2.6  **Overall Review**

2.6.1  Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken.
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

2.6.2  Review of special interest curriculum

- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current radiological practice in cardiac imaging.

June 2008
3. **GASTROINTESTINAL AND HEPATOBILIARY RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM**

3.1 **Introduction**

3.1.1 This curriculum outlines the special interest training requirements for specialty training in gastrointestinal and hepatobiliary (GI) radiology.

3.1.2 The content of the special interest of gastrointestinal radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of diseases of the gastrointestinal and hepatobiliary tract.

3.1.3 All trainees will have acquired a broad knowledge of gastrointestinal and hepatobiliary imaging during core training and will already have acquired the core skills.

3.1.4 The aim of special interest training in GI radiology is to enable the trainee to become clinically competent and to consistently interpret the results of gastrointestinal and hepatobiliary investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

3.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in GI radiology, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

3.1.6 Those clinical radiologists who plan to practise GI radiology as one of a mixture of activities (albeit that gastrointestinal and hepatobiliary radiology will be a particular responsibility within those activities) will normally undertake around 6 to 12 months of special interest training in gastrointestinal and hepatobiliary radiology (with a minimum of 6 sessions per week dedicated to the special interest).

3.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

3.1.8 Supervision during training must be conducted by those who are appropriately skilled in gastrointestinal and hepatobiliary radiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

3.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

3.1.10 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for gastrointestinal and hepatobiliary disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of GI imaging and GI intervention as appropriate.

3.1.11 There will be continuing development of generic professional competencies.
3.2 **Overview of training**

3.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training will be actively involved in gastrointestinal and hepatobiliary imaging within an educational environment with graduated supervision.

3.2.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging and fluoroscopy. Centres will also provide access to relevant specialised radionuclide imaging, e.g. positron emission tomography (PET).

3.2.3 Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical, surgical and oncological teams and combined clinical and radiological meetings. Multidisciplinary meetings will be emphasised. The following inter-relationships are important:

- Hepatology
- Luminal gastrointestinal gastroenterology
- Upper gastrointestinal surgery
- Hepatobiliary surgery
- Colorectal surgery

3.2.4 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

3.2.5 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

3.2.6 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

3.2.7 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

3.2.8 Trainees will be expected to be familiar with current gastrointestinal and hepatobiliary radiology literature.

3.2.9 The trainee will be encouraged to participate in research and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

3.2.10 The trainee will continue to participate in the trainee general on-call rota, with appropriate consultant back-up.
3.3 **General Principles of Gastrointestinal and Hepatobiliary Imaging**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the basis of gastrointestinal and hepatobiliary imaging</td>
<td>Is familiar with the embryology, anatomy, physiology, pathology and mechanisms of disease of both the gastrointestinal tract and hepatobiliary conditions Has a good working knowledge of normal anatomical variants</td>
<td>Conducts and supervises gastrointestinal and hepatobiliary techniques to high standard. Accurately performs biopsy of liver and abdominal masses. Accurately perfumes abdominal drainage procedures Safely and effectively performs interventional techniques, including stenting of both the lumen and hepatobiliary tracts</td>
</tr>
<tr>
<td>Can describe the full range of diagnostic techniques available</td>
<td>Knows the indications, contraindications and complications of each imaging method. Understands the factors affecting the choice of contrast media and pharmaceuticals. Can describe the effects and side effects of these agents. Able to select the optimum imaging method and pathway for different pathological conditions</td>
<td></td>
</tr>
<tr>
<td>Is aware of current developments in gastrointestinal and hepatobiliary radiology</td>
<td>Able to describe recent advances in imaging Able to describe current NICE guidance.</td>
<td>Obtains appropriate training for new interventional procedures</td>
</tr>
<tr>
<td>Understands the role of multidisciplinary meetings</td>
<td>Able to plan effective imaging pathways. Can describe the staging for malignant diseases. Detects errors in diagnosis and complications in treatment. Promotes an understanding of relevant gastrointestinal and hepatobiliary pathology</td>
<td>Able to communicate effectively and work in a multidisciplinary team</td>
</tr>
<tr>
<td>Understands the clinical aspects of gastrointestinal and hepatobiliary diseases</td>
<td>Is familiar with the clinical management pathways for gastrointestinal and hepatobiliary disorders</td>
<td>Able to confidently discuss the appropriate imaging strategy with the referring clinicians</td>
</tr>
</tbody>
</table>

**Imaging Procedures (non-interventional)**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret plain film x-rays used in gastrointestinal and hepatobiliary radiology</td>
<td>Understands the basic principles of plain film radiography.</td>
<td>Able to interpret images using plain film radiography.</td>
</tr>
<tr>
<td>Able to perform and interpret ultrasound used in gastrointestinal and hepatobiliary radiology</td>
<td>Able to describe the range of pathological appearances seen in gastrointestinal and hepatobiliary on ultrasound</td>
<td>Competent in the use of ultrasonography for the abdominal organs and where appropriate the small and large bowel. An understanding of the role of Doppler ultrasound. <strong>Optimal Skills.</strong> The role and use of contrast enhanced ultrasound Endorectal ultrasound</td>
</tr>
<tr>
<td>Objective</td>
<td>Knowledge</td>
<td>Skills</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>--------</td>
</tr>
<tr>
<td>Able to perform and interpret computerised tomography relevant to gastrointestinal and hepatobiliary radiology</td>
<td>Able to describe the protocols and image processing techniques used in CT of gastrointestinal and hepatobiliary radiology</td>
<td>Able to interpret CT studies performed for the investigation of both acute abdominal conditions and the role of CT in the management of chronic conditions of the abdomen. Able to interpret CT images used in the diagnosis of benign and malignant pathology and staging of tumours involving the gastrointestinal and hepatobiliary system. Able to understand the developing role of abdominal CT in specialist areas within the abdomen i.e. CT colonography.</td>
</tr>
<tr>
<td>To be familiar with the use of magnetic resonance imaging in GI disorders</td>
<td>Give detailed descriptions of imaging protocols used for gastrointestinal and hepatobiliary investigation.</td>
<td>Be able to identify the role of MR in liver disease including MRCP, diffuse disease and in the diagnosis of benign and malignant focal liver lesions. Understand the role of MR in staging rectal cancers. Understand the role of MR in identifying complications of inflammatory bowel disease.</td>
</tr>
<tr>
<td>Define the role of nuclear medicine in the investigation of GI disorders</td>
<td>Describe the range of normal and abnormal appearance in isotope imaging of the liver and GI tract.</td>
<td>Able to accurately interpret isotopic imaging of the hepatobiliary and GI tract. Have an appreciation of the role of PET scanning in the staging of GI malignancy.</td>
</tr>
<tr>
<td>Fluoroscopy</td>
<td>Understand the role of fluoroscopic investigation in the management pathways for gastrointestinal and hepatobiliary radiology.</td>
<td>Able to perform a wide range of fluoroscopically guided examinations/interventions (see below).</td>
</tr>
</tbody>
</table>

**Gastrointestinal and Hepatobiliary Interventional Techniques**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination Able to work effectively with fluoroscopic imaging, ultrasound and CT guided intervention.</td>
</tr>
<tr>
<td>Be familiar with a wide range of interventional techniques used in gastrointestinal and hepatobiliary radiology</td>
<td></td>
<td>Able to perform biopsy of abdominal masses. Able to perform drainage procedures within the abdominal cavity.</td>
</tr>
<tr>
<td>Objective</td>
<td>Knowledge</td>
<td>Skills</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>--------</td>
</tr>
<tr>
<td>Be proficient in the safe practice of analgesia and sedation in interventional practice</td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient</td>
</tr>
<tr>
<td>Be competent in intermediate life support and anaphylaxis treatment</td>
<td>Describe the processes and actions required in intermediate life support and management of anaphylaxis</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation. Be able to manage the immediate response to acute anaphylaxis</td>
</tr>
</tbody>
</table>

**Good Medical Practice**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
</tr>
<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
</tr>
<tr>
<td>Demonstrate good team working skills</td>
<td>Understand the value of team working</td>
<td>Demonstrate good communication with patients and professional colleagues</td>
</tr>
<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
</tr>
<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
</tr>
<tr>
<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
</tr>
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</table>
Maintain Health | Understand the importance of personal health | Demonstrate a commitment to managing personal health.

Note “Good Medical Practice” 2006. GMC

3.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

3.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

3.3.3 During the training period the following weekly sessional commitments are suggested as a work profile for special interest trainees. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long-term aims:
- MRI (one to two sessions)
- CT (one to three sessions)
- US (one to three sessions)
- Radionuclide imaging (half to one session)
- Plain film reporting (one to three sessions)
- Fluoroscopy with or without intervention (half to one session)

This training period should be tailored to the trainee’s individual requirement with emphasis on either gastrointestinal or hepatobiliary experience. Ample opportunity to develop interventional experience should be provided.

3.4 Appraisal

3.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid-point and end of rotation.

3.5 Assessment

3.5.1 Methods of trainee assessment will include:
- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for gastrointestinal and hepatobiliary diseases
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

3.6 Overall Review

3.6.1 Review of training programme
- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

3.6.2 Review of special interest curriculum
• The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current gastrointestinal and hepatobiliary radiological practice.

June 2008
4. **HEAD AND NECK RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM**

4.1 **Introduction**

4.1.1 This curriculum outlines the special interest training requirements for specialty training in head and neck radiology.

4.1.2 The content of the special interest of head and neck radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of head and neck disorders in adults and children.

4.1.3 All trainees will have acquired a basic knowledge of head and neck imaging during core training and will already have acquired the core skills.

4.1.4 The aim of special interest training in head and neck radiology is to enable the trainee to become clinically competent and to consistently interpret the results of head and neck investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

4.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in head and neck radiology, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

4.1.6 Those clinical radiologists who plan to practice head and neck radiology as one of a mixture of activities (albeit that head and neck radiology will be a particular responsibility within those activities) will normally undertake around 6 to 12 months of special interest training in head and neck radiology (with a minimum of 6 sessions per week dedicated to the special interest).

4.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

4.1.8 Supervision during training must be conducted by those who are appropriately skilled in head and neck radiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

4.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

4.1.10 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for head and neck disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of head and neck imaging and intervention as appropriate.

4.1.11 There will be continuing development of generic professional competencies

4.2 **Overview of training**

4.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing
special interest training will be actively involved in head and neck imaging within an educational environment with graduated supervision.

4.2.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US) and fluoroscopy. Centres will also provide access to relevant specialised radionuclide imaging, e.g. positron emission tomography (PET).

4.2.3 Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical, surgical and oncological teams and combined clinical and radiological meetings. Multidisciplinary meetings will be emphasised. The following inter-relationships are important:

- head and neck surgery (including ear nose and throat and maxillofacial surgery)
- medical endocrinology
- faciomaxillary trauma
- oral medicine and surgery
- ophthalmology
- oncology and haematology
- paediatrics

Other specialties will also provide important training opportunities, particularly thoracic (chest and oesophageal) surgery.

4.2.4 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

4.2.5 The trainee will be encouraged and trained to attend appropriate educational meetings and courses and to access relevant e-learning material.

4.2.6 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

4.2.7 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

4.2.8 Trainees will be expected to be familiar with current head and neck radiology literature.

4.2.9 The trainee will be encouraged to participate in research and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

4.2.10 The trainee will continue to participate in the trainee general on-call rota, with appropriate consultant back-up.
### General Principles of Head and Neck Imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the basis of head and neck imaging</td>
<td>Is familiar with: the embryology, anatomy and physiology of the head and neck, including normal anatomical variants, fascial spaces and their notation, the skull base, lymph node notation (levels and groups), routes of lymph node spread from head and neck disease and anatomical routes for the spread of disease between the neck and chest and between the skull base and intracranial structures. the pathological processes of benign and malignant disease in the head and neck region. local, national and, where appropriate, international imaging guidelines.</td>
<td>Conducts and supervises head and neck imaging procedures to a high standard. Safely and effectively performs basic interventional techniques (notably guided fine needle biopsy). Appropriately develops skills for more complex intervention according to opportunities and inclination.</td>
</tr>
<tr>
<td>Can describe the full range of diagnostic techniques available</td>
<td>Has an in-depth understanding of the major imaging investigations relevant to diseases of the head and neck and their appropriate use. Has an in-depth knowledge of the range of head and neck interventions and procedures (medical, surgical and radiological), the indications, contraindications, limitations, potential benefits and the appropriate use of analgesia and sedation such that the trainee may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician.</td>
<td></td>
</tr>
<tr>
<td>Is aware of current developments in head and neck radiology</td>
<td>Has a detailed knowledge of current developments in the specialty. Able to describe current NICE guidance.</td>
<td></td>
</tr>
<tr>
<td>Understands the role of multidisciplinary meetings</td>
<td>Able to plan effective imaging pathways. Can describe the staging for malignant diseases. Detects errors in diagnosis and complications in treatment. Promotes an understanding of relevant head and neck pathology.</td>
<td>Able to communicate effectively and work in a multidisciplinary team</td>
</tr>
<tr>
<td>Understands the clinical aspects of head and neck diseases</td>
<td>Has a clinical knowledge relevant to medical and surgical management of head and neck diseases.</td>
<td>Able to confidently discuss the appropriate imaging strategy with the referring clinicians</td>
</tr>
<tr>
<td>Competence in appropriate life support</td>
<td></td>
<td>Able to be fully competent in basic life support as a minimum; intermediate life support if substantial intervention is undertaken in the head and neck (for example arterial embolisation)</td>
</tr>
</tbody>
</table>

### Imaging Procedures (non-interventional)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret plain film x-rays used in head and neck</td>
<td>Understands the basic principles of plain film radiography.</td>
<td>Able to interpret images using plain film radiography from all sources.</td>
</tr>
</tbody>
</table>
### Neck Radiology

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret ultrasound used in head and neck radiology.</td>
<td>Able to describe the range of pathological appearances seen in head and neck tissues on ultrasound.</td>
<td>Competent in the use of ultrasonography for head and neck diseases including, where appropriate, doppler studies.</td>
</tr>
<tr>
<td>Able to perform and interpret computerised tomography relevant to head and neck radiology.</td>
<td>Able to describe the protocols and image processing techniques used in head and neck CT.</td>
<td>Able to interpret CT images in the diagnosis and staging of diseases of the head and neck including benign and malignant tumours, developmental, inflammatory and traumatic lesions.</td>
</tr>
<tr>
<td>To be familiar with the use of magnetic resonance imaging in head and neck disorders.</td>
<td>Give detailed descriptions of imaging protocols used for head and neck investigations.</td>
<td>Able to interpret MRI images in the diagnosis and staging of diseases of the head and neck including benign and malignant tumours, developmental, inflammatory and traumatic lesions.</td>
</tr>
<tr>
<td>Define the role of nuclear medicine in head and neck investigation.</td>
<td>Describe the range of normal and abnormal appearance in isotope bone imaging.</td>
<td>Able to accurately interpret radionuclide investigations for head and neck diseases, particularly combined CT/PET.</td>
</tr>
</tbody>
</table>

### Head and Neck Interventional Techniques

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice.</td>
<td>Be able to describe the basic principles of safe interventional technique.</td>
<td>Good hand-eye co-ordination</td>
</tr>
<tr>
<td></td>
<td>Describe the anatomy relevant to the procedure.</td>
<td>Able to work effectively with fluoroscopic imaging, ultrasound and CT guided intervention.</td>
</tr>
<tr>
<td></td>
<td>Describe the recognised complications of the procedures.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Understand the therapeutic actions and complications of injected agents.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Describe techniques for radiation dose reduction to operator and patient.</td>
<td></td>
</tr>
<tr>
<td>Be familiar with a wide range of interventional techniques used in head and neck radiology.</td>
<td></td>
<td>Able to perform ultrasound guided fine needle aspiration biopsies.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optional skills: CT/MRI guided biopsies. Image guided abscess drainage. Complex and advanced interventional procedures (arterial embolisation, petrosal sinus sampling etc).</td>
</tr>
<tr>
<td>Be proficient in the safe practice of analgesia and sedation in interventional practice.</td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation.</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient.</td>
</tr>
<tr>
<td>Be competent in</td>
<td>Describe the processes and actions required in</td>
<td>Demonstrate the ability to perform</td>
</tr>
</tbody>
</table>
### Intermediate Life Support and Anaphylaxis Treatment

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intermediate life support and management of anaphylaxis</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Be able to manage the immediate response to acute anaphylaxis</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
</tr>
</tbody>
</table>

### Good Medical Practice

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
</tr>
<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
</tr>
<tr>
<td>Demonstrate good team working skills</td>
<td>Understand the value of team working</td>
<td>Demonstrate good communication with patients and professional colleagues</td>
</tr>
<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
</tr>
<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
</tr>
<tr>
<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
</tr>
<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health.</td>
</tr>
</tbody>
</table>

Note “Good Medical Practice” 2006. GMC

4.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

4.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

4.3.3 During the training period the following weekly sessional commitments are suggested as a work profile for special interest trainees. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long term aims:

- MRI (one to two sessions)
- CT (one to two sessions)
- US (one to two sessions)
- Radionuclide imaging, particularly CT/PET (half to one session)
- Fluoroscopy with or without intervention (some experience is recommended but a sessional commitment of half to one session is optional. More than will be appropriate if development of skills in interventional head and neck radiology is desired).
4.4 Appraisal

4.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

4.5 Assessment

4.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for diseases of the head and neck.
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competency progression (ARCP).

4.6 Overall Review

4.6.1 Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

4.6.2 Review of special interest curriculum

- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current radiological practice relating to head and neck imaging.

June 2008
5. **MUSCULOSKELETAL RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM**

5.1 **Introduction**

5.1.1 This curriculum outlines the special interest training requirements for specialty training in musculoskeletal radiology.

5.1.2 The content of the special interest curriculum of musculoskeletal radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of bone, joint, soft tissue and spinal disorders in adults and children.

5.1.3 All trainees will have acquired a broad knowledge of musculoskeletal imaging during core training and will already have acquired the core skills.

5.1.4 The aim of special interest training in musculoskeletal radiology is to enable the trainee to become clinically competent and to consistently interpret the results of musculoskeletal investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

5.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in musculoskeletal radiology, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

5.1.6 Those clinical radiologists who plan to practise musculoskeletal radiology as one of a mixture of activities (albeit that musculoskeletal radiology will be a particular responsibility within those activities) will normally undertake around 6 to 12 months of special interest training in musculoskeletal radiology (with a minimum of 6 sessions per week dedicated to the special interest).

5.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

5.1.8 Supervision during training must be conducted by those who are appropriately skilled in musculoskeletal radiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

5.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

5.1.10 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for musculoskeletal disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of musculoskeletal imaging and musculoskeletal intervention as appropriate.

5.1.11 There will be continuing development of generic professional competencies.

5.2 **Overview of training**

5.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing
special interest training will be actively involved in musculoskeletal imaging within an educational environment with graduated supervision.

5.2.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging and fluoroscopy. Centres will also provide access to relevant specialised radionuclide imaging, e.g. positron emission tomography (PET).

5.2.3 Practical training and/or theoretical teaching and training in bone densitometry techniques should be available.

5.2.4 Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical, surgical and oncological teams and combined clinical and radiological meetings. Multidisciplinary meetings will be emphasised. The following inter-relationships are important:
- orthopaedics (general and paediatric)
- rheumatology
- metabolic and endocrine medicine
- bone and soft tissue oncology
- trauma including accident and emergency
- spinal surgery

5.2.5 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiological and multidisciplinary meetings.

5.2.6 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

5.2.7 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

5.2.8 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

5.2.9 Trainees will be expected to be familiar with current musculoskeletal radiology literature.

5.2.10 The trainee will be encouraged to participate in research and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

5.2.11 The trainee will continue to participate in the trainee general on-call rota, with appropriate consultant back-up.
## 5.3 General Principles of Musculoskeletal Imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the basis of musculoskeletal imaging</td>
<td>Is familiar with the embryology, anatomy, physiology, pathology and mechanisms of disease of the musculoskeletal system. Has a good working knowledge of normal anatomical variants</td>
<td>Conducts and supervises musculoskeletal imaging techniques to high standard. Accurately performs biopsy of soft tissue, bone and lymph nodes. Safely and effectively performs interventional techniques</td>
</tr>
<tr>
<td>Can describe the full range of diagnostic techniques available</td>
<td>Knows the indications, contraindications and complications of each imaging method. Understands the factors affecting the choice of contrast media and pharmaceuticals. Can describe the effects and side effects of these agents. Able to select the optimum imaging method and pathway for different pathological conditions</td>
<td></td>
</tr>
<tr>
<td>Is aware of current developments in musculoskeletal radiology</td>
<td>Able to describe recent advances in imaging Able to describe current NICE guidance.</td>
<td>Obtains appropriate training for new interventional procedures</td>
</tr>
<tr>
<td>Understands the role of multidisciplinary meetings</td>
<td>Able to plan effective imaging pathways. Can describe the staging for malignant diseases. Detects errors in diagnosis and complications in treatment. Promotes an understanding of relevant musculoskeletal pathology</td>
<td>Able to communicate effectively and work in a multidisciplinary team</td>
</tr>
<tr>
<td>Understands the clinical aspects of musculoskeletal diseases</td>
<td>Is familiar with the clinical management pathways for musculoskeletal disorders</td>
<td>Able to confidently discuss the appropriate imaging strategy with the referring clinicians</td>
</tr>
</tbody>
</table>

### Imaging Procedures (non-interventional)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret plain film x-rays used in musculoskeletal radiology</td>
<td>Understands the basic principles of plain film radiography.</td>
<td>Able to interpret images using plain film radiography from primary care examinations, trauma cases, rheumatological disorders, general and paediatric orthopaedics.</td>
</tr>
<tr>
<td>Able to perform and interpret ultrasound used in musculoskeletal radiology</td>
<td>Able to describe the range of pathological appearances seen in musculoskeletal tissues on ultrasound</td>
<td>Competent in the use of ultrasonography for joints, soft tissues, orthopaedic and sports injuries and where appropriate doppler studies.</td>
</tr>
<tr>
<td>Able to perform and interpret computerised tomography relevant to musculoskeletal radiology</td>
<td>Able to describe the protocols and image processing techniques used in musculoskeletal CT</td>
<td>Able to interpret CT images used in the diagnosis of benign and malignant pathology and staging of tumours involving the musculoskeletal system. Able to interpret CT studies performed for the investigation of rheumatological disorders, trauma</td>
</tr>
<tr>
<td><strong>To be familiar with the use of magnetic resonance imaging in musculoskeletal disorders</strong></td>
<td>Give detailed descriptions of imaging protocols used for musculoskeletal investigation and sports injuries</td>
<td>Accurately stage musculoskeletal tumours. Be able to interpret both spinal and joint normal anatomy and pathology. Diagnose pathology in rheumatological disorders, trauma and sports injuries</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Define the role of nuclear medicine in musculoskeletal investigation</strong></td>
<td>Describe the range of normal and abnormal appearance in isotope bone imaging</td>
<td>Able to accurately interpret bone scanning for staging tumours, investigation of joint prostheses and metabolic bone disease</td>
</tr>
<tr>
<td><strong>Fluoroscopy</strong></td>
<td>Understand the role of fluoroscopic investigation in the management pathways for joint and spinal disorders</td>
<td>Able to perform a wide range of fluoroscopically guided examinations/interventions (see below).</td>
</tr>
</tbody>
</table>

### Musculoskeletal Interventional Techniques

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Be familiar with the principles of interventional radiological practice</strong></td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination Able to work effectively with fluoroscopic imaging, ultrasound and CT guided intervention</td>
</tr>
<tr>
<td><strong>Be familiar with a wide range of interventional techniques used in musculoskeletal radiology</strong></td>
<td></td>
<td>Able to perform biopsy of bone and soft tissue lesions and a wide range of arthrographic examinations (shoulder, knee, ankle, hip, elbow and wrist). Able to perform spinal image guided procedures e.g. facet joint injections, nerve root blocks and discography. Optional skills: Able to undertake CT myelography and vertebroplasty</td>
</tr>
<tr>
<td><strong>Be proficient in the safe practice of analgesia and sedation in interventional practice</strong></td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient</td>
</tr>
<tr>
<td><strong>Be competent in intermediate life support and anaphylaxis treatment</strong></td>
<td>Describe the processes and actions required in intermediate life support and management of anaphylaxis</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation. Be able to manage the immediate response to acute anaphylaxis</td>
</tr>
</tbody>
</table>
### Good Medical Practice

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
</tr>
<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
</tr>
<tr>
<td>Demonstrate good team working skills</td>
<td>Understand the value of team working</td>
<td>Demonstrate good communication with patients and professional colleagues</td>
</tr>
<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
</tr>
<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
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<tr>
<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
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<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health.</td>
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</tbody>
</table>

Note “Good Medical Practice” 2006. GMC

5.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

5.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

5.3.3 During the training period the following weekly sessional commitments are suggested as a work profile for special interest trainees. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long-term aims:
- MRI (one to three sessions)
- CT (half to one session)
- US (one to two sessions)
- Radionuclide imaging (half to one session)
- Plain film reporting (one to three sessions)
- Fluoroscopy with or without intervention (half to one session)

5.4 **Appraisal**

5.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.
5.5 **Assessment**

5.5.1 Methods of trainee assessment will include:
- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for musculoskeletal diseases
- TAB
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

5.6 **Overall Review**

5.6.1 Review of training programme
- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

5.6.2 Review of special interest curriculum
- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current musculoskeletal radiological practice.

June 2008
6. **NEURORADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM**

6.1 **Introduction**

6.1.1 This curriculum outlines the special interest training requirements for specialty training in diagnostic and interventional neuroradiology.

6.1.2 The content of the special interest of neuroradiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of brain and spinal disorders in adults and children.

6.1.3 All trainees will have acquired a broad knowledge of neuroimaging during core training and will already have acquired the core skills.

6.1.4 The aim of special interest training in neuroradiology is to enable the trainee to become clinically competent and to consistently interpret the results of neuroimaging investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

6.1.5 The period spent in training will vary according to the needs of the trainee. For a diagnostic neuroradiologist a minimum of 18 months of full time training (i.e. a minimum of 6 sessions per week) in neuroradiology is essential. For interventional neuroradiology a period of 2 years is required including a year spent in diagnostic neuroradiology. This recommendation conforms to the advice of the British Society of Neuroradiologists.

6.1.6 Those clinical radiologists who plan to practise neuroradiology as one of a mixture of activities (albeit that neuroradiology will be a particular responsibility within those activities) will normally undertake around 6 to 12 months of special interest training in neuroradiology (with a minimum of 6 sessions per week dedicated to the special interest).

6.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

6.1.8 Supervision during training must be conducted by those who are appropriately skilled in neuroradiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

6.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

6.1.10 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for neurological and neurosurgical disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of neuroimaging and neurointervention as appropriate.

6.1.11 There will be continuing development of generic professional competencies

6.2 **Overview of training**

6.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing
special interest training will be actively involved in neuroimaging within an educational environment with graduated supervision.

6.2.2 The training departments must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging and fluoroscopy. Centres will also provide access to relevant specialised radionuclide imaging, e.g. positron emission tomography (PET). Trainees should also have access to neonatal cranial ultrasound and transcranial Doppler.

6.2.3 Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical, surgical and oncological teams and combined clinical and radiological meetings. Multidisciplinary meetings will be emphasised. The following inter-relationships are important:

- Neurology (adult and paediatric)
- Neurosurgery (adult and paediatric)
- Neuropathology
- Neurophysiology
- Neuroanaesthesia and critical care
- Neurooncology
- Trauma.

Other specialities will also provide important training opportunities, in particular orthopaedic spinal surgery, ophthalmology, otology, genetics, endocrinology, psychiatry, maxillofacial surgery and rehabilitation services. Head and neck imaging has its own special interest curriculum.

6.2.4 It may be appropriate for the trainee to have regular attachments to ward rounds, outpatient clinics and theatre sessions in order to further clinical knowledge relevant to the subspecialty.

6.2.5 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

6.2.6 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

6.2.7 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

6.2.8 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

6.2.9 The trainee will be expected to be familiar with current neuroradiology literature and should be encouraged to attend scientific meetings of the British, European and American Neuroradiology Societies.

6.2.10 The trainee will be encouraged to participate in research and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

6.2.11 In order to maximise exposure to, and become competent in, a wide range of emergent interventional (neuroradiological) procedures, it may be appropriate for the trainee to spend at least some time in Years 4 and 5 of training as part of a dedicated interventional (neuroradiological) on call rota. It is important that this is balanced against the requirement for all radiology trainees to acquire core general emergency radiology skills whilst on call.
### General Principles of Neuroimaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand basic anatomy and physiology of the brain, spine and spinal cord</td>
<td>Familiarity with detailed brain and spine structure (including normal variants) and function including embryology, tractography and nuclear anatomy. Knowledge of physiology and pharmacophysiology.</td>
<td></td>
</tr>
<tr>
<td>Understand principles of imaging modalities for neuroradiology</td>
<td>Familiarity with physics and technical aspects of CT, MRI, US and DSA, SPECT and PET, including use of contrast agents</td>
<td></td>
</tr>
<tr>
<td>Understand advanced applications of MRI and other techniques</td>
<td>Familiarity with physics and technical aspects of perfusion MRI, MR spectroscopy, diffusion tensor imaging, fMRI and CT-PET</td>
<td></td>
</tr>
<tr>
<td>Understand the spectrum of pathology affecting the brain and spine</td>
<td>Familiarity with the full spectrum of neurological and neurosurgical disease including those conditions only likely to be encountered in a specialist neuroscience centre</td>
<td></td>
</tr>
<tr>
<td>Understand appropriate use of imaging techniques</td>
<td>Familiarity with imaging protocols for the full spectrum of clinical presentation of neurological diseases. Knowledge of all contraindications and limitations of techniques</td>
<td>Ability to select and protocol the most appropriate imaging technique for all clinical situation including advanced techniques such as pMRI, fMRI and MRS.</td>
</tr>
<tr>
<td>Understand the role of cerebral and spinal DSA</td>
<td>Familiarity with the indications for neuro DSA and the technique including contraindications and complications</td>
<td>Ability to perform cerebral arterial DSA. Optional: Ability to perform spinal arterial DSA</td>
</tr>
<tr>
<td>Ability to perform cerebral and spinal DSA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understand the role of myelography</td>
<td>Familiarity with the indications for contrast myelography and the technique including contraindications and complications</td>
<td>Optional: Ability to perform lumbar puncture and contrast myelography</td>
</tr>
<tr>
<td>Ability to perform myelography</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop interpretive skills for all imaging modalities in neuroradiology</td>
<td>Familiarity with the abnormal appearances associated with the full spectrum of neurological diseases likely to be encountered in routine and specialist practice for CT, MRI, DSA and US</td>
<td>Able to recognise and characterise all neurological diseases</td>
</tr>
<tr>
<td>Able to perform image manipulation and post processing on purpose designed workstations</td>
<td>Familiarity with available image processing functions – MPRs, MIPs 3D surface shaded and volume rendered techniques.</td>
<td>Able to perform 2D and 3D reconstructions, MIPS and volume rendered images, perfusion analysis</td>
</tr>
<tr>
<td>Understand the spectrum of disease and its imaging manifestations in the paediatric population</td>
<td>As for adults applied to the paediatric age group</td>
<td>As for adults applied to the paediatric age group</td>
</tr>
<tr>
<td>Understand the spectrum of disease and its imaging manifestations in the foetus</td>
<td>As for adults applied to the foetus</td>
<td>As for adults applied to the foetus</td>
</tr>
<tr>
<td>Objective</td>
<td>Knowledge</td>
<td>Skills</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
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<td>-----------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Understand the craniospinal circulation</td>
<td>Embryology, anatomy and physiology of the cranial and spinal circulation including variations and potential anastomotic connections</td>
<td></td>
</tr>
<tr>
<td>Understand the full spectrum of craniospinal vascular disease</td>
<td>Pathophysiology of craniospinal vascular diseases including natural history.</td>
<td></td>
</tr>
<tr>
<td>Understand the use of drugs affecting the cranial circulation</td>
<td>Pharmacology of the craniospinal circulation</td>
<td></td>
</tr>
<tr>
<td>Understand issues around anaesthetising patients for endovascular</td>
<td>Principles of neuroanaesthesia related to craniospinal endovascular procedures</td>
<td></td>
</tr>
<tr>
<td>Understand the full spectrum of craniospinal vascular disease</td>
<td>Clinical features of acute and chronic craniospinal vascular disease and differential diagnoses</td>
<td>Ability to perform a competent clinical neurological examination</td>
</tr>
<tr>
<td>Understand principles of imaging modalities for neuroradiology</td>
<td>Imaging of the craniospinal circulation (anatomical and physiological)</td>
<td>Conduct/supervision and interpretation of all diagnostic imaging techniques associated with craniospinal vascular disease. Post processing of acquired data sets from neurovascular imaging</td>
</tr>
<tr>
<td>Understand the full range of techniques available to treat endovascular</td>
<td>Techniques for endovascular treatment of:</td>
<td>Ability to assess most appropriate treatment for a given situation (ideally in a multidisciplinary setting)</td>
</tr>
<tr>
<td></td>
<td>• Intracranial aneurysms</td>
<td>Ability to select and deploy the most appropriate delivery systems and therapeutic material to deal with a given case, achieving an optimal balance of efficacy and safety</td>
</tr>
<tr>
<td></td>
<td>• Cerebral, spinal and dural AVMs and AVFs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Tumours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vasospasm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Thromboembolism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Epistaxis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Arterial and venous stenoses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indications, contraindications, complications</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assessment of suitability of patients for neurointerventional procedures in conjunction with other appropriate clinicians and specialists</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Local, national and international guidelines for neurointerventional therapies</td>
<td></td>
</tr>
<tr>
<td>Understand alternative and complementary therapies</td>
<td>Understanding of alternative and supplementary non-endovascular therapies for treatment of these disorders</td>
<td></td>
</tr>
<tr>
<td>Consent of patients</td>
<td>Principles of informed consent and executive consent</td>
<td>Communication with patients and relatives especially in respect of consent</td>
</tr>
<tr>
<td>Knowledge of the</td>
<td>Familiarity with the range of catheters, wires, Handling and preparation of delivery</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Use of above devices in vivo</td>
<td>Introduction and navigation of delivery systems into the craniospinal circulation Introduction, delivery and deployment of therapeutic devices and agents to the pathological lesion</td>
<td></td>
</tr>
<tr>
<td>Understanding of procedural complications</td>
<td>Strategies and techniques for dealing with procedural complications especially thromboembolism, device retrieval, perforation and haemorrhage, vasospasm</td>
<td>Ability to recognise and deal appropriately with procedural complications</td>
</tr>
<tr>
<td>Post procedural care</td>
<td>Aftercare of patients undergoing these procedures</td>
<td></td>
</tr>
</tbody>
</table>

**Spinal Interventional Techniques**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination Able to work effectively with fluoroscopic imaging, ultrasound and CT guided intervention</td>
</tr>
<tr>
<td>Be familiar with a wide range of interventional techniques used in spinal radiology</td>
<td></td>
<td>Able to perform biopsy of bone and soft tissue lesions. Able to perform spinal image guided procedures e.g. facet joint injections, nerve root blocks and discography. Optional skills: Able to undertake CT myelography and vertebroplasty or kyphoplasty.</td>
</tr>
<tr>
<td>Be proficient in the safe practice of analgesia and sedation in interventional practice</td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient</td>
</tr>
<tr>
<td>Be competent in intermediate life</td>
<td>Describe the processes and actions required in intermediate life support and management of</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation.</td>
</tr>
</tbody>
</table>
support and anaphylaxis treatment | anaphylaxis | Be able to manage the immediate response to acute anaphylaxis

**Good Medical Practice**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
</tr>
<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
</tr>
<tr>
<td>Demonstrate good team working skills</td>
<td>Understand the value of team working</td>
<td>Demonstrate good communication with patients and professional colleagues</td>
</tr>
<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
</tr>
<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
</tr>
<tr>
<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
</tr>
<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health</td>
</tr>
</tbody>
</table>

Note “Good Medical Practice” 2006. GMC

6.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

6.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

6.3.3 During the training period the following weekly sessional commitments are suggested as a work profile for diagnostic neuroradiology special interest trainees. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long-term aims:

- MRI (two to three sessions)
- CT (one to two sessions)
- MDT meetings, including preparation (half to one session)
- Ward round, theatre time (up to 1 session)
- Radionuclide imaging, US (half to one session)
- Plain film reporting (one session)
- DSA and fluoroscopy (half to two sessions)
- Research and audit (one session)
The above may be customised to include subspecialty interests such as paediatric neuroradiology, ENT, maxillofacial and ophthalmic radiology within neuroradiology training. Neuroradiology trainees with a special interest in head and neck radiology should refer to the special interest curriculum for this area.

For interventional trainees the above should be modified to include

- DSA - endovascular neurointervention (two to four sessions)
- Ward work and outpatient consultation (up to 1 session)
- Neurovascular MDT and mortality/morbidity meetings (up to 1 session)

The interventional trainee should participate in approximately 80 neuroradiological interventional procedures of which a substantial proportion will be for intracranial vascular lesions. The trainee should be the first operator in around a third of cases.

Neurointervention generally refers to endovascular procedures. Spinal intervention including biopsies, nerve root blocks, facet injections and vertebroplasty may be accommodated as part of training as a diagnostic neuroradiologist. This also applies to invasive angiography i.e. diagnostic DSA.

6.4 **Appraisal**

6.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

6.5 **Assessment**

6.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for neurological and neurosurgical diseases
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

6.6 **Overall Review**

6.6.1 Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum

6.6.2 Review of special interest curriculum

- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current neuroradiological practice.

June 2008
7. GYNAECOLOGICAL RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM

7.1 Introduction

7.1.1 This curriculum outlines the special interest training requirements for specialty training in gynaecological radiology.

7.1.2 The content of the special interest of gynaecological radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of gynaecological disorders in adults and children.

7.1.3 All trainees will have acquired a broad knowledge of gynaecological imaging during core training and will already have acquired the core skills.

7.1.4 The aim of special interest training in gynaecological radiology is to enable the trainee to become clinically competent and to consistently interpret the results of gynaecological investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

7.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in gynaecological radiology, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

7.1.6 Those clinical radiologists who plan to practise gynaecological radiology as one of a mixture of activities (albeit that gynaecological radiology will be a particular responsibility within those activities) will normally undertake around 6 to 12 months of special interest training in gynaecological radiology (with a minimum of 6 sessions per week dedicated to the special interest).

7.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

7.1.8 Supervision during training must be conducted by those who are appropriately skilled in gynaecological radiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

7.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

7.1.10 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for gynaecological disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of gynaecological imaging and gynaecological intervention as appropriate.

7.1.11 Those radiologists wishing to specialise in perinatal imaging in addition to the above would be expected to undergo further training in obstetric ultrasound, perinatal imaging, and foetal MRI. The curriculum for specialist obstetric and perinatal imaging is covered in the joint RCR/RCOG training document.

7.1.12 There will be continuing development of generic professional competencies.
7.2 Overview of training

7.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training will be actively involved in gynaecological imaging within an educational environment with graduated supervision.

7.2.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging and fluoroscopy. Centres will also provide access to relevant specialised radionuclide imaging, e.g. positron emission tomography (PET).

7.2.3 Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical, surgical and oncological teams and combined clinical and radiological meetings. Multidisciplinary meetings will be emphasised. The following inter-relationships are important:

- Gynaecology
- Infertility
- Obstetrics
- Gynaecological oncology

7.2.4 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

7.2.5 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

7.2.6 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

7.2.7 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

7.2.8 Trainees will be expected to be familiar with current gynaecological radiology literature.

7.2.9 The trainee will be encouraged to participate in research and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, should be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

7.2.10 The trainee will continue to participate in the trainee general on-call rota, with appropriate consultant back up.
General Principles of Gynaecological Imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the basis of gynaecological imaging</td>
<td>Is familiar with the embryology, anatomy, physiology, pathology and mechanisms of disease of the reproductive system in women. Has a good working knowledge of normal anatomical variants</td>
<td>Conducts and supervises gynaecological imaging techniques to high standard. Accurately performs biopsy of soft tissue, and lymph nodes. Safely and effectively performs interventional techniques such as fallopian tube catheterisation.</td>
</tr>
<tr>
<td>Can describe the full range of diagnostic techniques available</td>
<td>Knows the indications, contraindications and complications of each imaging method. Understands the factors affecting the choice of contrast media and pharmaceuticals. Can describe the effects and side effects of these agents. Able to select the optimum imaging method and pathway for different pathological conditions</td>
<td></td>
</tr>
<tr>
<td>Is aware of current developments in gynaecological radiology</td>
<td>Able to describe recent advances in imaging Able to describe current NICE guidance.</td>
<td>Obtains appropriate training for new procedures.</td>
</tr>
<tr>
<td>Understand the role of multidisciplinary meetings</td>
<td>Able to plan effective imaging pathways. Can describe the staging for malignant diseases. Detects errors in diagnosis and complications in treatment. Promotes an understanding of relevant gynaecological pathology</td>
<td>Able to communicate effectively and work in a multidisciplinary team</td>
</tr>
<tr>
<td>Understand the clinical aspects of gynaecological diseases</td>
<td>Is familiar with the clinical management pathways for gynaecological disorders</td>
<td>Able to confidently discuss the appropriate imaging strategy with the referring clinicians</td>
</tr>
</tbody>
</table>

Imaging Procedures (non-interventional)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret ultrasound used in gynaecological radiology</td>
<td>Able to describe the range of normal and pathological appearances seen in gynaecological ultrasound</td>
<td>Competent in the use of ultrasonography for gynaecology and where appropriate doppler studies.</td>
</tr>
<tr>
<td>Able to perform and interpret computerised tomography relevant to gynaecological radiology</td>
<td>Able to describe the protocols and image processing techniques used in gynaecological CT</td>
<td>Able to interpret CT images used in the diagnosis of benign and malignant pathology and staging of tumours involving the reproductive system.</td>
</tr>
<tr>
<td>To be familiar with the use of magnetic resonance imaging in gynaecological disorders</td>
<td>Give detailed descriptions of imaging protocols used for gynaecological investigation</td>
<td>Accurately stage gynaecological tumours. Be able to interpret both normal gynaecological anatomy and pathology.</td>
</tr>
<tr>
<td>To be familiar with the use of PET scanning in the investigation of gynaecological malignancy</td>
<td>Understand the role of PET in staging of gynaecological malignancy</td>
<td>Be familiar with interpretation of positive and negative PET images</td>
</tr>
<tr>
<td>Fluoroscopy</td>
<td>Understand the role of fluoroscopic investigation in the management pathways for</td>
<td>Able to perform a fluoroscopically guided examinations/interventions (see</td>
</tr>
</tbody>
</table>
infertility below), such as hysterosalpingography, and fallopian tube catheterisation.

**Gynaecological Interventional Techniques**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination Able to work effectively with fluoroscopic imaging, ultrasound and CT and MRI guided intervention.</td>
</tr>
<tr>
<td>Be familiar with the indications for interventional techniques used in gynaecological radiology</td>
<td></td>
<td>Optional skills Able to undertake fallopian tube catheterisation. Fibroid embolisation will usually be carried out by an interventional radiologist</td>
</tr>
<tr>
<td>Be proficient in the safe practice of analgesia and sedation in interventional practice</td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation.</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient.</td>
</tr>
<tr>
<td>Be competent in intermediate life support and anaphylaxis treatment</td>
<td>Describe the processes and actions required in intermediate life support and management of anaphylaxis</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation. Be able to manage the immediate response to acute anaphylaxis</td>
</tr>
</tbody>
</table>

**Good Medical Practice**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
</tr>
<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
</tr>
<tr>
<td>Demonstrate good team working skills</td>
<td>Understand the value of team working</td>
<td>Demonstrate good communication with patients and professional colleagues</td>
</tr>
<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
</tr>
<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and</td>
</tr>
</tbody>
</table>
Demonstrate Probity
Describe the areas embraced by probity
Demonstrate clarity and honesty in record and document keeping

Maintain Health
Understand the importance of personal health
Demonstrate a commitment to managing personal health.

Note “Good Medical Practice” 2006. GMC

7.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

7.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

7.3.3 During the training period the following weekly sessional commitments are suggested as a work profile for special interest trainees. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long term aims:

- MRI (one to three sessions)
- CT (one to two sessions)
- US (two to three sessions)
- Fluoroscopy with or without intervention (half to one session).

7.4 Appraisal

7.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

7.5 Assessment

7.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for gynaecological diseases
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

Overall Review

7.6.1 Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
• The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum

7.6.2 Review of special interest curriculum

• The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current gynaecological radiological practice.

June 2008
8. **THORACIC IMAGING – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM**

8.1 **Introduction**

8.1.1 This curriculum outlines the special interest training requirements for specialty training in thoracic radiology.

8.1.2 The content of the special interest of thoracic radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of diseases occurring within the chest and primarily concerning the lungs, mediastinum and pleura.

8.1.3 All trainees will have acquired a broad knowledge of thoracic imaging during core training and will already have acquired the core skills.

8.1.4 The aim of special interest training in thoracic radiology is to enable the trainee to become clinically competent and to consistently interpret the results of thoracic investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

8.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in thoracic radiology, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

8.1.6 Those clinical radiologists who plan to practise thoracic radiology as one of a mixture of activities (albeit that thoracic radiology will be a particular responsibility within those activities) will normally undertake around 6 to 12 months of special interest training in thoracic radiology (with a minimum of 6 sessions per week dedicated to the special interest).

8.1.7 The training scheme will arrange an attachment that fulfils the requirement of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

8.1.8 Supervision during training must be conducted by those who are appropriately skilled in thoracic radiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

8.1.9 If experience to fulfil the requirements of the specialist interest training cannot be gained in one training centre, it will be necessary for the trainee to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other centres at home or abroad to follow particular interests in greater depth.

8.1.10 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for thoracic disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of thoracic imaging and thoracic intervention as appropriate.

8.1.11 There will be continuing development of generic professional competencies.

8.2 **Overview of Training**

8.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training will be actively involved in thoracic imaging within an educational environment with graduated supervision.
8.2.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging and fluoroscopy. Centres will also provide access to relevant specialised radionuclide imaging, e.g. positron emission tomography (PET).

8.2.3 Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical, surgical and oncological teams and combined clinical and radiological meetings. Multidisciplinary meetings will be emphasised. The following inter-relationships are important:
- Respiratory medicine
- Thoracic surgery
- Thoracic oncology
- Thoracic pathology
- Pulmonary physiology
- Other members of the thoracic multidisciplinary team such as clinical nurse specialists and the MDT coordinator.

8.2.4 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

8.2.6 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

8.2.7 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

8.2.8 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

8.2.9 Trainees will be expected to be familiar with current thoracic radiology literature.

8.2.10 The trainee will be encouraged to participate in research and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

8.2.11 The trainee will continue to participate in the trainee general on-call rota, with appropriate consultant back-up.
8.3 General Principles of Thoracic Imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the basis of thoracic imaging</td>
<td>Is familiar with the embryology, anatomy, physiology, pathology and mechanisms of disease found within the thorax. Has a good working knowledge of normal anatomical variants</td>
<td>Conducts, supervises and reports on thoracic imaging techniques to a high standard.</td>
</tr>
<tr>
<td>Can describe the full range of diagnostic techniques available</td>
<td>Knows the indications, contraindications and complications of each imaging method. Understands the factors affecting the choice of contrast media and pharmaceuticals. Can describe the effects and side effects of these agents. Able to select the optimum imaging method and pathway for different clinical conditions</td>
<td></td>
</tr>
<tr>
<td>Is aware of current developments in thoracic radiology</td>
<td>Able to describe recent advances in imaging. Able to describe current NICE guidance and key international guidelines relating to thoracic practice.</td>
<td>Is aware of and can implement technical developments relating to imaging techniques. Obtains appropriate training for new interventional procedures.</td>
</tr>
<tr>
<td>Understands the role of multidisciplinary meetings</td>
<td>Able to plan effective imaging pathways. Can describe the staging for malignant diseases. Detects errors in diagnosis and complications in treatment. Promotes an understanding of relevant thoracic pathology.</td>
<td>Able to communicate effectively and work in a multidisciplinary team</td>
</tr>
<tr>
<td>Understands the clinical aspects of thoracic diseases</td>
<td>Is familiar with the clinical management pathways for thoracic disorders. Fully conversant with the surgical techniques used in the diagnosis, treatment and staging of lung cancer and mesothelioma. Understands the investigative pathway and team approach used in cases of suspected interstitial lung disease.</td>
<td>Able to confidently discuss the appropriate imaging strategy with the referring clinicians – either individually or in the multidisciplinary team meeting setting.</td>
</tr>
<tr>
<td>The pathology of thoracic diseases</td>
<td>Familiarity with pathological processes commonly encountered in thoracic imaging practice</td>
<td>Able to outline the pathological processes underlying the tumours commonly found in thoracic practice, in particular lung cancer and mesothelioma. Able to outline the pathological processes involved in large and small airway diseases and in the commoner diffuse parenchymal lung diseases.</td>
</tr>
<tr>
<td>The physiological consequences of parenchymal and airway diseases.</td>
<td>Is familiar with the physiological changes that occur in large and small airway diseases and in diffuse parenchymal disease. Understanding of the basic parameters recorded by lung function testing laboratories.</td>
<td>Able to explain the significance of key measures of lung function.</td>
</tr>
</tbody>
</table>
### Imaging Procedures (non-interventional)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret plain film X-rays used in thoracic radiology</td>
<td>Understands the basic principles of plain film radiography.</td>
<td>Able to interpret images using plain film radiography from primary care examinations, trauma cases, respiratory medicine and thoracic surgical cases, occupational lung diseases, and other disciplines such as rheumatology where lung disease is a significant component of practice.</td>
</tr>
<tr>
<td>Able to perform and interpret computerised tomography relevant to the thorax</td>
<td>Able to describe the protocols and image processing techniques used in thoracic CT</td>
<td>Able to interpret CT images used in the diagnosis of focal and diffuse lung diseases, pleural disease and chest trauma. Able to diagnose and stage chest wall, pleural, lung and mediastinal tumours.</td>
</tr>
<tr>
<td>Able to perform and interpret ultrasound relating to the thorax and upper abdomen</td>
<td>Able to describe the range of pathological appearances seen in the thorax on ultrasound and evaluate liver and adrenal abnormalities in thoracic malignant disease.</td>
<td>Able to evaluate the liver and adrenal glands to complement the CT scan staging of lung cancer.</td>
</tr>
<tr>
<td>To be familiar with the use of magnetic resonance imaging in the thorax.</td>
<td>Give detailed descriptions of imaging protocols used in the thorax.</td>
<td>Able to interpret MRI in thoracic cases including the evaluation of lung and pleural tumours and neurogenic tumours within the thorax and thoracic spine.</td>
</tr>
<tr>
<td>Define the role of nuclear medicine in the thorax.</td>
<td>Describe the range of normal and abnormal appearance in thoracic imaging.</td>
<td>Able to accurately interpret PET and PET/CT in staging lung cancer and other intrathoracic tumours. Able to accurately interpret isotope lung (V/Q) scans in suspected pulmonary embolism.</td>
</tr>
<tr>
<td>Fluoroscopy</td>
<td>Understand the role of fluoroscopic investigation in the thorax.</td>
<td>Able to perform fluoroscopic examinations such as diaphragmatic screening and contrast swallow examinations.</td>
</tr>
</tbody>
</table>

### Thoracic Interventional Techniques

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional thoracic practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination Able to work effectively with fluoroscopic imaging, ultrasound and CT guided intervention. Able to perform biopsy of lung, pleural, mediastinal and chest wall lesions. Able to aspirate pleural fluid or air collections. Optional procedures: Able to perform radiofrequency ablation of lung masses. Bronchoscopy, Airway stenting Vascular stenting,</td>
</tr>
<tr>
<td>Objective</td>
<td>Knowledge</td>
<td>Skills</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------</td>
<td>--------</td>
</tr>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
</tr>
<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
</tr>
<tr>
<td>Demonstrate good team working skills</td>
<td>Understand the value of team working</td>
<td>Demonstrate good communication with patients and professional colleagues</td>
</tr>
<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
</tr>
<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
</tr>
<tr>
<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
</tr>
<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health.</td>
</tr>
</tbody>
</table>

Note “Good Medical Practice” 2006. GMC

8.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

8.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

8.3.4 During the training period the following weekly sessional commitments are suggested as a work profile for special interest trainees. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long-term aims:
MRI (one session)
CT (two or three sessions)
US (one session)
Radionuclide imaging (half to one session)
Plain film reporting (one to three sessions)
Fluoroscopy with or without intervention (half to one session)

8.4 **Appraisal**

8.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

8.5 **Assessment**

8.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee's skills in the accurate interpretation of investigations for musculoskeletal diseases
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

8.6 **Overall Review**

8.6.1 Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

8.6.2 Review of special interest curriculum

- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current thoracic radiological practice.

June 2008
9. **UROGENITAL RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM**

9.1 **Introduction**

9.1.1 This curriculum outlines the subspecialty training requirements for specialty training in urogenital radiology.

9.1.2 The content of the special interest curriculum of urogenital radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of urogenital disorders in adults and children.

9.1.3 All trainees will have acquired a broad knowledge of urogenital imaging during core training and will already have acquired the core skills.

9.1.4 The aim of special interest training in urogenital radiology is to enable the trainee to become clinically competent and to consistently interpret the results of urogenital investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic urogenital radiology service.

9.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in urogenital radiology, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

9.1.6 Those clinical radiologists who plan to practise urogenital radiology as one of a mixture of activities (albeit that urogenital radiology will be a particular responsibility within those activities) will normally undertake around 6 to 12 months of special interest training in urogenital radiology (with a minimum of 6 sessions per week dedicated to the special interest).

9.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

9.1.8 Supervision during training must be conducted by those who are appropriately skilled in urogenital radiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

9.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

9.1.10 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for urogenital disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of urogenital imaging and urogenital intervention as appropriate.

9.1.11 There will be continuing development of generic professional competencies.

9.2 **Overview of training**

9.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee
undergoing special interest training will be actively involved in urogenital imaging and intervention within an educational environment with graduated supervision.

9.2.2 The training department must provide access to appropriate imaging techniques, i.e. plain films, fluoroscopy, intravenous urography, ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI), radionuclide imaging and digital subtraction angiography.

9.2.3 Clinical knowledge will be acquired by a variety of means including:
- close liaison with appropriate medical, surgical and oncological teams as well as urology, nephrology and gynaecology
- participation in combined clinical and radiological conferences and multi-disciplinary team meetings
- attendance at appropriate out-patient clinics and theatre sessions

9.2.4 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

9.2.5 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

9.2.6 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

9.2.7 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

9.2.8 Trainees will be expected to be familiar with current urogenital radiological literature.

9.2.9 The trainee will be encouraged to participate in research, and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings should be encouraged.

9.2.10 The trainee will continue to participate in the specialist registrar general on-call rota, with appropriate consultant back up.
## 9.3 General Principles of Urogenital Imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
</table>
| Understand the basis of imaging | Is familiar with:  
- The embryology, anatomy, normal variants and physiology relevant to the urogenital system.  
- The pathology and pathophysiology of benign and malignant conditions involving the urogenital system  
- The epidemiology of urogenital diseases.  
Local, national and where appropriate, international imaging guidelines. | Conducts and supervises imaging techniques to high standard.  
Accurately performs biopsy within the tract.  
Safely and effectively performs interventional techniques |
| Can describe the full range of diagnostic techniques available | Knows the indications, contraindications and complications of each imaging method.  
Understands the factors affecting the choice of contrast media and pharmaceuticals.  
Can describe the effects and side effects of these agents.  
Able to select the optimum imaging method and pathway for different pathological conditions | |
| Is aware of current developments in radiology | Able to describe recent advances in imaging  
Able to describe current NICE guidance. | Obtains appropriate training for new interventional procedures |
| Understands the role of multidisciplinary meetings | Able to plan effective imaging pathways.  
Can describe the staging for malignant diseases.  
Detects errors in diagnosis and complications in treatment.  
Promotes an understanding of relevant pathology | Able to communicate effectively and work in a multidisciplinary team |
| Understands the clinical aspects of diseases | Is familiar with the clinical management pathways for disorders | Able to confidently discuss the appropriate imaging strategy with the referring clinicians |

### Imaging Procedures (non-interventional)

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Able to perform and interpret plain film x-rays used in urogenital radiology</td>
<td>Understands the basic principles of plain film radiography.</td>
<td>Able to interpret images using plain film radiography (kidney, ureter and bladder) and perform and interpret intravenous urography.</td>
</tr>
</tbody>
</table>
| Able to perform and interpret ultrasound used in urogenital radiology | Able to describe the range of pathological appearances seen in system on ultrasound | Competent in the use of ultrasonography for examination of the urogenital system and where appropriate doppler studies.  
Competence should include: abdominal, scrotal, transrectal, and transvaginal ultrasound. |
| Able to perform and interpret computerised | Able to describe the protocols and image processing techniques used in urogenital CT | Able to interpret CT images used in the diagnosis of benign and malignant |

91
<table>
<thead>
<tr>
<th>Tomography relevant to urogenital radiology</th>
<th>Pathology and staging of tumours involving the urogenital system. Competence should include: enhanced CT for renal colic, CT-urography, CT – angiography, staging of renal and urothelial tumours and staging of pelvic malignancy.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To be familiar with the use of magnetic resonance imaging in urogenital disorders</strong></td>
<td>Give detailed descriptions of imaging protocols used for urogenital investigation</td>
</tr>
<tr>
<td>Accurately stage urogenital tumours. Be able to interpret urogenital normal anatomy and pathology.</td>
<td></td>
</tr>
<tr>
<td><strong>Define the role of nuclear medicine in urogenital investigation</strong></td>
<td>Describe the range of normal and abnormal appearance in isotope imaging of the urogenital system.</td>
</tr>
<tr>
<td>Able to accurately interpret radionuclide examinations used for investigation of the urogenital system.</td>
<td></td>
</tr>
<tr>
<td><strong>Fluoroscopy</strong></td>
<td>Understand the role of fluoroscopic investigation in the management pathways for urogenital disorders</td>
</tr>
<tr>
<td>Able to perform a wide range of fluoroscopically guided examinations/interventions(see below).</td>
<td></td>
</tr>
</tbody>
</table>

**Urogenital Interventional Techniques**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination. Able to work effectively with fluoroscopic imaging, ultrasound and CT &amp; MR guided intervention</td>
</tr>
<tr>
<td>Be familiar with a wide range of interventional techniques used in urogenital radiology</td>
<td>Be familiar with the role of the full range of interventional techniques, including biopsy.</td>
<td>Able to perform the range of interventional urogenital procedures. These should include Percutaneous nephrostomy, Antegrade pyelography, Biopsy (renal, retroperitoneal masses, transplant renal, prostate, peritoneal / omental mass, pelvic sidewall mass, vaginal vault mass). Renal cyst aspiration and ablation. Drainage of collections via percutaneous and endoluminal approach. Percutaneous nephrolithotomy. Ureteric dilatation and stent insertion. Transrectal prostate biopsy. Suprapubic access to the bladder. Other procedures e.g. PUJ procedures. Embolization in the genitourinary tract. Percutaneous renal artery interventions. Percutaneous renal mass ablation. Ileal loopography.</td>
</tr>
</tbody>
</table>
Cystourethrography.  
Hysterosalpingography.

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<th>Objective</th>
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<tbody>
<tr>
<td>Be proficient in the safe practice of analgesia and sedation in interventional practice</td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient</td>
</tr>
<tr>
<td>Be competent in intermediate life support and anaphylaxis treatment</td>
<td>Describe the processes and actions required in intermediate life support and management of anaphylaxis</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation. Be able to manage the immediate response to acute anaphylaxis</td>
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**Good Medical Practice**

<table>
<thead>
<tr>
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<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
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<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
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<td>Demonstrate good team working skills</td>
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<td>Demonstrate good communication with patients and professional colleagues</td>
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<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
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<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
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<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
</tr>
<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health.</td>
</tr>
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</table>

Note “Good Medical Practice” 2006. GMC

9.3.1 Trainees will acquire experience in the practical procedures listed above, and the number of cases undertaken will be recorded in their log book. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

9.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

9.3.3 The exact structure of the training needs to be flexibly interpreted to allow for local facilities and expertise. It is suggested that centres which offer training in urogenital radiology should make available a fixed number of weekly sessions.
An appropriate number per week would be:

- US list one to two sessions
- intravenous urogram (or equivalent): one session
- urological fluoroscopy procedures including urodynamics: one session
- CT: one session
- MRI: one session
- intervention: two sessions
- MDT meeting attendance and participation

9.4 **Appraisal**

9.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

9.5 **Assessment**

9.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for urogenital diseases
- Team Assessment of Behaviour
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

9.5.2 Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken.
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

13.5.4 Review of subspecialty curriculum

- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current urogenital radiological practice.

June 2008
10. INTERVENTIONAL RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM

10.1 Introduction

10.1.1 The aim of special interest training in interventional radiology is to enable the trainee to become clinically competent to provide a comprehensive safe elective and acute interventional diagnostic and therapeutic service, both in and out-of-hours.

10.1.2 This curriculum outlines the training requirements for trainees who wish to develop a special interest in interventional radiology.

10.1.3 This document provides the curricular framework for special interest training in interventional radiology. Interested parties will find additional material in the form of the Standards in Vascular Radiology¹ [The Royal College of Radiologists, the British Society of Interventional Radiology. Achieving Standards for Vascular Radiology. London: The Royal College of Radiologists, 2007. Ref No. BFCR(07)13 © The Royal College of Radiologists, October 2007].

10.1.4 During the course of their training in interventional radiology, trainees will acquire experience and competence in a staged manner reflecting the individual trainees’ requirements.

10.1.5 Competence and performance will be assessed as the trainee progresses through the program and be based on knowledge, understanding and practical skills.

10.1.6 Regular appraisal and assessment will identify individual trainees’ needs and provide timely feedback.

10.1.7 Appropriate tools will be used for each element of the assessment in a similar fashion to that described in the CanMEDS 2000 project² and by the Postgraduate Medical Education Training Board (PMETB).³ This will be based on formal examination (FRCR or equivalent) and work based assessment.

10.1.8 Interventional radiology is no longer a required component of core radiology training. However, trainees wishing to develop a special interest in interventional radiology will have acquired general interpretive and technical skills relevant to the practice of interventional radiology during the core training years 1-3. More advanced interventional skills training may be commenced in the third core year for trainees showing particular aptitude for interventional radiology.

10.1.9 These general competencies will be consolidated and built upon during the advanced training years 4-5 enabling trainees to become clinically and technically competent independent practitioners, able to deliver a comprehensive high quality elective and emergency service to their patients.

10.1.10 The period spent in training will vary according to the needs of the trainee. For a person wishing to develop a specialty interest primarily in interventional radiology, the equivalent of 24 months substantially devoted to the subject is recommended. However, earlier, more focussed, individualised training in interventional radiology is being encouraged for those trainees with appropriate previous clinical experience.

10.1.11 Those clinical radiologists who plan to practice interventional radiology as one of a mixture of activities should normally undertake a minimum of 12 months special interest training in interventional radiology. This may lessen their range of clinical competences; this must be reflected in their logbook and personal portfolio and be recorded in the annual review of competency progression (ARCP). Where a doctor wishes to develop further skills this should involve a period of further training and assessment.
10.1.12 In order to maximise exposure to, and become competent in, a wide range of emergent interventional (neuroradiological) procedures, it may be appropriate for the trainee to spend at least some time in Years 4 and 5 of training as part of a dedicated interventional (neuroradiological) on call rota. It is important that this is balanced against the requirement for all radiology trainees to acquire core general emergency radiology skills whilst on call.

10.2 Objectives

10.2.1 The expected outcome at the end of special interest training in interventional radiology will be that the trainee is able to:

- Select the appropriate imaging strategy to demonstrate the relevant abnormalities, supervise (and perform where appropriate) the examination(s) and accurately report on the findings.
- Perform an appropriate clinical assessment of the patient, discuss the treatment options (conservative, medical interventional or surgical) and discuss the outcomes of the proposed options.
- Select the appropriate intervention and, where required, be capable of carrying out that intervention safely to a successful conclusion.
- Provide appropriate aftercare and follow-up, both clinical and imaging, of patients having interventions.

10.2.2 The curriculum defines the specific knowledge, skills, and attitudes required for trainees to achieve the objectives of special interest training in interventional radiology. Emphasis will be placed on ensuring that the trainee becomes competent to manage common interventional emergencies (appendix 1).

10.2.3 Following the programme will optimise the abilities of the trainee to practice as an interventional radiologist at completion of training.

10.2.4 The trainee should be fully competent in intermediate and advanced life-support. Formal Advanced Life Support (ALS) certification should be considered.

10.2.5 The curriculum is intended to combine with modular training in radiology and to allow crossover from other specialties into interventional radiology as proposed by Modernising Medical Careers (MMC).4

10.2.6 The interventional radiology programme will provide the educational experiences necessary to fulfil the Essential Roles and Key Competencies of Specialist Physicians as defined in CanMEDS 2000.2

10.2.7 The program will develop the trainee’s academic skills through active participation in clinical audit and research, leading to presentations at scientific meetings and publications in peer-reviewed journals relevant to interventional radiology.

10.2.8 If experience to fulfil the requirements of special interest curriculum training cannot be gained in one centre, it will be necessary for the trainee to have a period of attachment(s) to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

10.3 Overview of training

The Structured Training Curriculum for Clinical Radiology document outlines the expected knowledge, skills and experience and additional optional experience to be acquired during core radiology training and leading to acquisition of the Fellowship of the Royal College of Radiologists (FRCR). Interventional radiology is no longer a core item in radiology training. Hence, doctors wishing to undergo special interest training in interventional radiology will be expected to have demonstrated a commitment and aptitude for the specialty by selecting attachments with interventional components during their core training. Following core training any trainee undergoing
special interest training will be actively involved in interventional radiology within an appropriately supervised educational environment.

The content of the training programme will emphasise the need for trainees to acquire knowledge, awareness and skills in a number of key areas:

10.3.1 **Patient care** - The trainee will develop the ability to provide care that is patient centred, compassionate, appropriate, and effective for the treatment of health problems and the promotion of health. The trainee will acquire the clinical skills to:

- Select appropriate patients for invasive procedures.
- Properly evaluate a patient before an interventional procedure.
- Identify factors that increase procedural risk and risk for conscious sedation and assign an American Society of Anesthesiologists (ASA) score.
- Develop communication with the patient and relevant clinicians regarding potential risks and their implications for management (see 10.3.3 below)
- Obtain informed consent after a review of the procedure with the patient.
- Assign the proper medication regimens / precautions before, during or after a procedure.
- Recognise and treat any complications or problems occurring before, during and after the procedure.
- Ensure appropriate peri-procedural care for the patient.
- Ensure appropriate aftercare for the patient.
- Provide appropriate patient follow-up in the inpatient and outpatient settings.

10.3.2 **Pharmacology of interventional radiology** - The trainee will understand the indications, contraindications, interactions and side effects of the principal pharmacological agents in common usage in interventional radiology, including but not restricted to:

- Aetiology, prevention and treatment of contrast reactions.
- Local anaesthetics.
- Analgesics.
- Sedatives.
- Vasoactive drugs.
- Drugs affecting coagulation.
- Drugs used in diabetes.
- Antibiotics.
- Antiemetics.
- Management of circulatory collapse.
- Management / pharmacology of cardiorespiratory arrest.

10.3.3 **Communication skills** - The trainee will develop effective communication with:

- Patients and their relatives, including obtaining appropriate consent
- Relevant clinicians and other members of a multi-disciplinary team

10.3.4 **Clinical knowledge and skills** - The trainee will gain an understanding of the various disease processes they will encounter in terms of:

- Anatomy and embryology relevant to practice of interventional radiology
- Epidemiology relevant to practice of interventional radiology
- Pathophysiology relevant to practice of interventional radiology
- Presentation and clinical manifestations of conditions relevant to practice of interventional radiology.
- Diagnosis and investigation of conditions relevant to practice of interventional radiology.
- Therapeutic options, including non-interventional treatment alternatives and expected outcomes / prognosis.
Knowledge will be acquired through a variety of means, including close liaison with clinical teams relevant to the practice of interventional radiology, attendance at and actively part-taking in regular out-patient clinics and ward rounds, attending and leading clinicoradiological meetings, attendance at appropriate educational meetings and courses. Appropriate clinical attachments to develop specific skills will be encouraged.

10.3.5 **Diagnostic imaging skills** - The trainee will understand the mechanisms, complementary roles and limitations of ultrasound, magnetic resonance angiography, computed tomography angiography, catheter angiography and other diagnostic techniques relevant to the practice of interventional radiology (see appendix 1).

10.3.6 **Interventional skills** - At the conclusion of training, the trainee will be able to demonstrate technical competence in the performance of core (index and emergency safe*) interventional procedures (see appendix 1). Additional skills will be acquired to a variable degree. The focus will be on index procedures, which will be subject to external review through national audits and registries, and procedures necessary for emergency safety.

*Emergency safe – group of key procedures considered necessary for the provision of an acute and out-of-hours emergency service.

10.3.7 **Academic skills** - The trainee will be expected to acquire an understanding of the principles and techniques used in research, including the value of clinical trials and knowledge of basic biostatistics. In order to achieve this, the trainee will be encouraged to:

- Participate in research and pursue one or more projects up to and including publication.
- Present research and audit results at local, national and international meetings.

10.3.8 **Clinical governance** - The trainee will:

- Adhere to the principles of ‘Good Medical Practice’.
- Incorporate practice-based learning and improvement, involving investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care.
- Show professionalism, as manifested through a commitment to carrying out clinical governance appraisal and revalidation, professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population.
- Keep abreast of current literature relevant to interventional radiology.
- Develop their practice in line with legislation and national/international guidance relevant to interventional radiology.

10.3.9 **Interventional radiology clinical practice** - The trainee will be able to:

- Understand the importance of the relationship with all sources of referral to the interventional radiology service.
- Understand the necessity of developing and maintaining an interventional radiology clinic.
- Understand healthcare coding systems relevant to the practice of interventional radiology.
- Provide care for patients as necessary utilising the interventional radiology clinic.
- Recognise the need to ensure that there are formal arrangements for provision of interventional radiology services for patients within and outside normal working hours. Recognize the value of becoming a hub for patient referrals.
- Communicate effectively with referring clinicians.
- Integrate patient care coordinators to staff a functional interventional radiology clinic.
- Keep adequate medical records for interventional radiology patients and integrate with the hospital information systems.
- Adhere to institutional and national information privacy and ethical standards.
• Understand the mechanisms and requirement for continually monitoring quality assurance. [The Royal College of Radiologists, the British Society of Interventional Radiology. Achieving Standards for Vascular Radiology. London: The Royal College of Radiologists, 2007. Ref No. BFCR(07)13 © The Royal College of Radiologists, October 2007]

10.3.10 The interventional radiology team - The trainee will be able to:

• Recognize and promote a team environment in the practice of interventional radiology.
• Help to provide a safe, stimulating working environment in which all interventional radiology team members are encouraged to participate.
• Encourage skills development of members of the interventional radiology team.

10.3.11 Recognising and reducing occupational hazards - The trainee will be able to minimise:

• Complications of interventional radiology.
• The risks of ionizing radiation for the patient and interventional radiology staff.
• The risks from pathogens, hazardous drugs and materials.
• Risks of injury during patient transfers.

10.3.12 Systems-based practice - The trainee should demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to work in multidisciplinary teams and to effectively utilise system resources to provide care that is of optimal value to individual patients.

This includes interpersonal and communication skills that result in appropriate clinical linkages, effective information exchange within the interventional radiology team and with patients, their families, and other health professionals.

10.4 Requirements of special interest training

10.4.1 Trainees are expected to obtain competencies in the core (index and emergency safe) interventional radiology procedures to the level expected of a consultant interventional radiologist.

10.4.2 Throughout the programme trainees will be required to record their procedural activity in a logbook which will serve as a record of their “experience”. The logbook will incorporate trainers’ comments regarding the trainee’s “competence”.

10.4.3 The logbook will allow scope for reflection regarding each case i.e. what the trainee has learnt relating to any aspect of that particular procedure. This could include patient selection, consent, techniques, and complications. The trainee cannot receive accreditation if they fail either to complete the logbook or to achieve appropriate levels of experience / competence.

10.4.4 The curriculum, including the training and assessment / evaluation of competence and knowledge, should be geared towards producing well rounded clinicians whose practice will reflect:

• An understanding of the disease processes relevant to their specialty interest.
• An understanding of the respective disease prognoses, with and without treatment.
• An understanding of the respective treatment alternatives.
• An understanding of the limitations and expected outcomes of interventional radiology procedures.
• The ability to responsibly perform interventional radiological procedures.
• The ability to recognize and manage complications of interventional procedures.
• The ability to communicate with and consent patients by explaining the above in a clear manner.
The ability to select the appropriate patients for treatment.
The ability to appropriately manage patients under their care.
The ability to work within multidisciplinary teams.
The ability to recognize their limitations and refer cases accordingly.

10.4.5 The consultant trainer must be satisfied that the trainee is clinically and technically competent to interpret the results of investigations and can safely perform interventional procedures. Competence will be assessed on the basis of section 5 below. It is noted that there is no indicative number of cases to achieve competence as this will vary between individuals.

10.5 Appraisal and assessment

The training programme must demonstrate an effective plan for assessing performance and monitoring progress during and after completion of training and for utilising assessment results to improve performance of both the trainee and the training scheme. This plan should include appraisal, assessment and examination.

10.5.1 Trainee evaluation

10.5.1.1 Use of measures to assess:

- Procedural experience via:
  - detailed log book records.
- Procedural competence via:
  - log book commentary by supervisors
  - direct observation of procedures (DOPs).
- Knowledge via:
  - reflective log books and examination including objective structured clinical examination (OSCE).
- Practice-based learning and improvement via:
  - appraisal and assessment.
- Interpersonal and communication skills, professionalism via:
  - 360° appraisal and assessment.
- Evidence based practice via:
  - appraisal and assessment.
- Objective assessment measures - these require development and validation for interventional radiology.

10.5.1.2 Mechanism for providing regular and timely performance assessment and feedback:

- Mentoring / tutoring – regular assessment and appraisal.

10.5.1.3 Monitoring of progression through expected career milestones:

- Use of results of assessment and appraisal to achieve progressive improvements in experience, competence and performance.

10.5.2 Program Evaluation

10.5.2.1 The program should monitor its effectiveness by reviewing performance and outcome assessment results.

10.5.2.2 The training scheme should have a process for using performance assessment together with evaluation results to improve the program (via the program training committee). The analysis and subsequent actions should be formally recorded.
### General Principles of Interventional Radiology

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<tbody>
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<td>Understand the basis of interventional radiology imaging</td>
<td>Is familiar with the embryology, anatomy (including anatomical variants), physiology and mechanisms of disease for the body systems relevant to interventional radiology.</td>
<td></td>
</tr>
<tr>
<td>Describe and perform the range of diagnostic and interventional techniques available</td>
<td>Knows the indications, contraindications and complications of each imaging method. Understands the factors affecting the choice of contrast media and pharmaceuticals. Can describe the effects and side effects of these agents. Able to select the optimum imaging method and pathway for different pathological conditions.</td>
<td>Conducts and supervises diagnostic techniques to high standard. Performs interventional techniques safely, effectively and to a high standard</td>
</tr>
<tr>
<td>Awareness of current developments in interventional radiology</td>
<td>Able to describe recent advances in relevant imaging and intervention Able to describe current National Institute for Health and Clinical Excellence (NICE) guidance.</td>
<td>Obtains appropriate training for new interventional procedures</td>
</tr>
<tr>
<td>Understand the role of multidisciplinary meetings</td>
<td>Able to plan effective imaging and treatment pathways. Detects errors in diagnosis and complications in treatment. Promotes an understanding of relevant pathology</td>
<td>Able to communicate effectively and work in a multidisciplinary team</td>
</tr>
<tr>
<td>Understand the clinical aspects of interventional radiology</td>
<td>Is familiar with the clinical management pathways for disorders pertinent to the practice of interventional radiology</td>
<td>Able to confidently discuss the appropriate imaging and treatment strategy with the referring clinicians</td>
</tr>
</tbody>
</table>

### Diagnostic Procedures in Interventional Radiology

<table>
<thead>
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<tbody>
<tr>
<td>Describe and, where appropriate, perform plain film, ultrasound, computerised tomography, magnetic resonance, nuclear medicine and fluoroscopic imaging techniques relevant to interventional radiology; discuss the complimentary roles of these techniques and their indications, limitations and contraindications</td>
<td>Understand and describe the range of abnormalities seen the various diagnostic imaging modalities in the assessment of diseases relevant to the practice of interventional radiology.</td>
<td>Accurately interpret images from the range of modalities used in the diagnosis and management of pathology relevant interventional radiology and, where appropriate, perform these safely and competently, to a high standard.</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Be familiar with the principles of interventional radiology practice</strong></td>
<td>Describe the basic principles of safe interventional technique.</td>
<td>Good hand-eye co-ordination.</td>
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<td>Describe the anatomy relevant to the procedure.</td>
<td>Able to work effectively with fluoroscopic imaging, ultrasound and CT guided intervention.</td>
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<td>Describe the recognised complications of the procedures.</td>
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<td>Understand the therapeutic actions and complications of injected agents.</td>
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<td>Describe techniques for radiation dose reduction to operator and patient.</td>
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<tr>
<td><strong>Be familiar with the range of consumables available for interventional procedures</strong></td>
<td>Describe the range and appropriate use of consumables for a varied range of interventions</td>
<td>Select and safely manipulate appropriate equipment for a range of core interventions, including alternatives</td>
</tr>
<tr>
<td><strong>Be familiar with the core range of techniques employed in interventional radiology</strong></td>
<td>Describe the indications, contraindications and techniques used in the core range of interventional procedures</td>
<td>Perform the range of core interventional procedures safely, competently and to a high standard.</td>
</tr>
<tr>
<td><strong>Be familiar with the range of techniques used to manage complications of interventions</strong></td>
<td>Describe the techniques available to manage complications of interventions</td>
<td>Show the ability to think clearly and appropriately manage complications, including timely surgical referral.</td>
</tr>
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<td><strong>Be proficient in the safe practice of analgesia and sedation in interventional radiology</strong></td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation</td>
<td>Administer the appropriate agents in the correct dose for a given clinical situation and monitor the patient safely.</td>
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<td><strong>Be competent in intermediate life support and anaphylaxis treatment</strong></td>
<td>Describe the processes and actions required in intermediate life support and management of anaphylaxis</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation. Manage the immediate response to acute anaphylaxis</td>
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<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
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<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date. Maintain skills and monitor performance. Ensure the interest of the patient is paramount.</td>
<td>Be able to discuss current medical practice with colleagues and patients. Ensure practice conforms to nationally prescribed standards. Draw to the attention of the appropriate body issues that might compromise patient safety.</td>
</tr>
<tr>
<td>Provision of continuity of care</td>
<td>Be aware of the need for appropriate arrangements for the provision of patient care during periods of absence and out-of-hours</td>
<td>Have formal arrangements for the provision or transfer of care during periods of absence and out-of-hours</td>
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<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
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<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health.</td>
</tr>
</tbody>
</table>
## Appendix i

### Core Techniques and Procedures

<table>
<thead>
<tr>
<th>Diagnostic skills</th>
<th>Emergency Safe*†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vascular</strong></td>
<td></td>
</tr>
<tr>
<td>i. Interpretation of plain films, ultrasound, computerised tomography and magnetic resonance scanning for the detection and assessment of vascular pathology</td>
<td>✔</td>
</tr>
<tr>
<td>ii. Interpretation of non-invasive imaging studies of acute/ emergent conditions relevant to vascular intervention, e.g. trauma, GI bleeding, pulmonary embolism, acute arterial or venous thromboembolism, etc</td>
<td>✔</td>
</tr>
<tr>
<td>iii. Diagnostic peripheral angiography</td>
<td>✔</td>
</tr>
<tr>
<td>iv. Diagnostic mesenteric angiography</td>
<td>✔</td>
</tr>
<tr>
<td>v. Diagnostic renal angiography</td>
<td></td>
</tr>
<tr>
<td>vi. Angiography in the trauma setting</td>
<td>✔</td>
</tr>
<tr>
<td>vii. Performance and interpretation of arterial duplex</td>
<td>✔</td>
</tr>
<tr>
<td>viii. Performance and interpretation of venous duplex</td>
<td>✔</td>
</tr>
</tbody>
</table>

| **Non-vascular** |                  |
| i. Interpretation of plain films, ultrasound, computerised tomography and magnetic resonance scanning for the detection and assessment of pathology relevant to non-vascular intervention | ✔ |

### Interventional skills

| **Vascular** |                  |
| i. Obtaining vascular access at common sites including use of ultrasound guidance | ✔ |
| ii. Elective and acute recanalisation and stenting of iliac artery occlusion | ✔ |
| iii. Elective and acute femoro-popliteal arterial angioplasty | ✔ |
| iv. Elective and acute embolisation therapy with coils and particulate agents | ✔ |
| v. Elective and acute mechanical and pharmacological thrombolysis and thrombectomy in the arterial and venous systems | ✔ |
| vi. Stent grafting for arterial rupture | ✔ |
| vii. Insertion of vena cava filter | ✔ |
| viii. Acute interventional management of massive pulmonary embolus | ✔ |
| ix. Management of failing/failed dialysis access |                  |
| x. Insertion of central venous tunnelled catheters |                  |

| **Non-vascular** |                  |
| i. Image-guided access into the urinary or biliary systems | ✔ |
| ii. Image-guided biopsy |                  |
| iii. Image-guided aspiration and drainage of collections/abscesses | ✔ |
| iv. Elective and acute percutaneous drainage procedures in the urinary system | ✔ |
| v. Urteric stenting |                  |
| vi. Elective and acute percutaneous drainage procedures in the biliary tree | ✔ |
| vii. Stenting of the biliary tree – for distal obstruction |                  |
| viii. Radiologically inserted percutaneous gastrostomy |                  |
| ix. Colonic stenting – to relieve acute obstruction from distal colonic tumours | ✔ |
| x. Oesophageal stenting – for mid and low obstruction |                  |

### Advanced Techniques and Procedures

<p>| <strong>Vascular</strong> |                  |
| i. Elective and acute transjugular intrahepatic portosystemic shunt† |                  |
| ii. Tibial artery angioplasty in critical limb ischaemia |                  |
| iii. Visceral artery stenting |                  |
| iv. Aortic stent grafting |                  |</p>
<table>
<thead>
<tr>
<th>v.</th>
<th>Foreign body retrieval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Non-vascular</strong></td>
</tr>
<tr>
<td>i.</td>
<td>Gastro-duodenal stenting</td>
</tr>
<tr>
<td>ii.</td>
<td>Oesophageal stenting – for high obstruction and fistulae</td>
</tr>
<tr>
<td>iii.</td>
<td>Stenting of the biliary tree – for central obstruction</td>
</tr>
</tbody>
</table>

*Emergency safe – group of key procedures considered necessary for the provision of an acute and out-of-hours emergency service. Every interventional radiologist will be expected to be able to perform the core procedures at completion of training.*

**Advanced techniques and procedures – the trainee should have exposure to and have performed these techniques/procedures, but not necessarily be proficient in them as an independent operator.**

†It is recognised that not every centre will be appropriately staffed to provide cover for every acute/emergent procedure but it is assumed that responsible interventional radiologists will alert their Trusts to areas where the service is deficient so that formal alternative arrangements for cover can be organised (see paragraph 3.9.5).

**REFERENCES**


June 2008
11. RADIONUCLIDE RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM

11.1 Introduction

11.1.1 This curriculum outlines the special interest training requirements for specialty training in radionuclide radiology. Radionuclide radiology can be defined as the performance and interpretation of radionuclide imaging techniques relevant to the investigation and management of disease. The aim of special interest training in radionuclide radiology is to enable the trainee to become clinically competent and to consistently perform and interpret the results of radionuclide investigations accurately and reliably.

11.1.2 All trainees will have acquired a basic knowledge of radionuclide imaging during core training and will already have acquired the core skills and experience.

11.1.3 Those clinical radiologists who wish to sub-specialise in radionuclide radiology as a consultant should undertake special interest training in radionuclide radiology in a recognised training centre.

11.1.4 The duration of this additional training in radionuclide radiology would normally be the equivalent of 8 sessions a week for 12 months, which would include one optional module of training in either PET and PET-CT or cardiac imaging. This could be spread out over 2 years, doing 4 sessions per week. Trainees wishing to take up both cardiac and PET and PET-CT options would need to undertake a further 3 months (8 sessions per week) of training. This programme would normally be sufficient to support a successful application for an Administration of Radioactive Substances Advisory Committee (UK) (ARSAC) certificate to cover imaging procedures.

11.1.5 The specialty training may take place during the final years of training or may be acquired in a continuous part-time modular form over a longer period concurrent with other aspects of radiology training.

11.1.6 Those clinical radiologists wishing to obtain specialist registration in nuclear medicine including therapy and non-imaging studies should undertake further training in these areas, commensurate with the relevant sections of the higher training curriculum specified by the SAC (Nuc Med). Trainees will need to have completed the cardiac option specified in 1.4. This additional training would normally be sufficient to support a successful application for a full diagnostic and therapeutic ARSAC certificate. Radiologists seeking such dual accreditation in clinical radiology and nuclear medicine should inform the JRCPBT prospectively (as early as possible and well before the additional year of radionuclide imaging begins) and be conversant with other current JRCPBT requirements.

11.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

11.1.8 Supervision of the trainees must be conducted by trainers who are appropriately skilled in radionuclide radiology or nuclear medicine teaching and who have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

11.1.9 If experience to fulfil the all the requirements of the curriculum cannot be gained in a single training centre, the trainee will need to have one or more attachments to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.
11.1.10 The expected outcome at the end of this special interest training is that the trainee can select the appropriate radionuclide procedures, supervise (and perform where appropriate) the examination(s) and accurately report on the findings.

11.1.11 There will be continuing development of generic professional competencies.

11.2 Overview of training

11.2.1 The main document - Structured Training Curriculum for Clinical Radiology - to which this appendix is attached, outlines the objectives, core knowledge, core skills and experience and the optional experience acquired during core training.

11.2.2 The trainee undergoing special interest training will be actively involved in radionuclide imaging in an educational environment with graduated supervision.

11.2.3 The training programme must provide access to appropriate radionuclide imaging facilities, including support from radiopharmacy and medical physics staff. Appropriate radiation protection officers (RPS - Radiation Protection Supervisor, and RPA - Radiation Protection Advisor) should be in place.

11.2.4 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging and fluoroscopy.

11.2.5 Clinical knowledge will be acquired by a variety of means. This will include close liaison with surgical, medical and oncological teams and participation in relevant multidisciplinary meetings. The trainee should attend, and be encouraged to lead, appropriate clinico-radiological meetings.

11.2.6 The trainee should be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

11.2.7 The trainee should participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

11.2.8 The trainee should become familiar with current radionuclide radiology literature.

11.2.9 The trainee should be encouraged to participate in research, and to pursue one or more projects up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, should be acquired. Presentation of research and audit results at national and international meetings should be encouraged.

11.2.10 The trainee should continue to participate in the trainee on-call rota for radiology with appropriate consultant back-up.

11.2.11 The trainee should contribute to the teaching programme of the training centre and should provide appropriate clinical supervision of other healthcare professionals, developing competence as a clinical supervisor.
11.3 **Radionuclide imaging: Objectives, knowledge, skills and attitudes**

### BASIC SCIENCE
Objective: to provide the trainee with a working knowledge of the basic science appropriate to radionuclide radiology

#### 1. Physics and mathematics

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure and modes of decay of radioactive atoms</td>
<td>Practices these effectively</td>
<td>Recognises the need to understand the basic science appropriate to radionuclide radiology</td>
</tr>
<tr>
<td>Interaction of emissions from radioactive atoms with matter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biological implications of and radiation hazards from ionising radiation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molecular biology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probability theory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parametric and non-parametric statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appropriate mathematics and physics applied to radionuclide tracer theory, modelling of tracer kinetics and quantitative imaging</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 2. Instrumentation and computers

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory of systems used to detect and analyse emissions from radioactive atoms</td>
<td>Practical experience with the use of monitoring devices, probes, dose calibrators, gamma cameras, and positron emission tomography systems</td>
<td>Willing to learn new skills and keep up to date with developments in technology</td>
</tr>
<tr>
<td>Principles of collimation and practical experience with the use of collimators</td>
<td>Use of computers to display and process images</td>
<td></td>
</tr>
<tr>
<td>Principles of single-photon emission tomography and co-incidence counting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principles of image reconstruction</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 3. Radiation biology and radiation protection

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory of biological effects of high and low-level radiation from unsealed sources</td>
<td>The safe handling of radiopharmaceuticals</td>
<td>Appreciate the importance of safe handling of radiopharmaceuticals for self and for others</td>
</tr>
<tr>
<td>Calculation of radiation dose from radiopharmaceuticals (effective dose [ED])</td>
<td>Deploy appropriate signs in radionuclide radiology departments</td>
<td></td>
</tr>
<tr>
<td>Management of radiation accidents relating to radionuclide radiology</td>
<td>Write local rules for the use of unsealed source radiation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demonstrate ability to handle incidents of radioactive spillage or contamination</td>
<td></td>
</tr>
</tbody>
</table>

#### 4. Radiochemistry and radiopharmacy

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of radionuclides using reactors, cyclotrons and generators</td>
<td>Perform elution of a technetium generator</td>
<td>Show attention to detail in handling radiopharmaceuticals and in ensuring radiochemical and radionuclide purity and also aseptic technique</td>
</tr>
<tr>
<td>Physical properties of radionuclides, clinical applications</td>
<td>Prepare a cold kit</td>
<td></td>
</tr>
<tr>
<td>Physicochemical and biological properties of different radiopharmaceuticals in routine clinical practice, clinical trials and under development</td>
<td>Perform cell labelling</td>
<td></td>
</tr>
<tr>
<td>Cell labelling techniques</td>
<td>Perform simple tests of radionuclide and radiochemical purity</td>
<td></td>
</tr>
<tr>
<td>Principles of Quality Assurance (QA) in the radiopharmacy</td>
<td>Demonstrate techniques of aseptic preparation</td>
<td></td>
</tr>
<tr>
<td>Quality control parameters which determine the quality of radiopharmaceuticals including radionuclide &amp; radiochemical purity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principles of aseptic preparation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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5. The regulatory framework of radionuclide radiology

Knowledge
- National and international regulatory requirement on the practice of radionuclide radiology including: IRR99; MARS legislation; ARSAC; RSA 93; IR(ME)R 2000; Medical guidance notes; Product licenses and other appropriate legislation.
- Regulatory requirements which apply to the design and operation of radiopharmacies GMP 1997 (Orange Guide)
- Regulations controlling transport of radioactive materials in the UK RM(Road Transport) (GB) R 1996
- Mechanism by which the regulations are applied and policed within the UK
- 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)
- Any subsequent revisions of or additions to the above legislation

Skills
- Demonstrate ability to translate the regulations into local practice

Attitudes
- Show willingness to keep up with developments in the regulations governing radionuclide radiology
- Appreciates the need to work with others in ensuring that the regulations are strictly adhered to

CENTRAL NERVOUS SYSTEM

Objective: To provide the trainee with the knowledge, skills and attitudes to evaluate the central nervous system (CNS) using radionuclide techniques

Central nervous system imaging

Knowledge
- Basic neuroanatomy, neurophysiology and neurochemistry.
- Radiopharmaceuticals currently in use for CNS imaging and those in development
- Indications for cerebral blood flow (rCBF) imaging using tracers such as HMPAO
- Indications for blood-brain barrier imaging
- Indications for neuroreceptor imaging
- Role of comparative imaging tests such as ultrasound, CT and MR scanning
- Radiation protection issues

Skills
- Preparation of the patient prior to the test
- Choice of radiopharmaceutical and imaging protocol
- Radiotracer preparation and its quality assurance
- Radiopharmaceutical injection
- Setting up of instrumentation for SPECT acquisition and performance of scan
- Data processing, image reconstruction and quantification
- Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts
- Audit outcome of studies

Attitudes
- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
- Consider the importance of audit in the outcome of results
- Show openness to critical feedback of reports
- Appreciate the importance of keeping up-to-date with developments and with relevant medical literature
- Show awareness of health and safety issues

ENDOCRINE SYSTEM

Objective: To provide the trainee with the knowledge, skills and attitudes to evaluate endocrine disorders using radionuclide techniques

1. Adrenal Imaging

Knowledge
- Basic science including the biochemistry of adrenal disorders
- Clinical syndromes associated with adrenal disease
- Basic science of adrenal imaging with ¹²³I MIBG and cholesterol imaging agents
- Indications for radionuclide adrenal imaging
- Sensitivity and specificity of the tests
- Role of comparative tests in the diagnosis of adrenal disorders
- Radiation protection associated with ¹²³I MIBG and cholesterol imaging agents

Skills
- Preparation of the patient prior to the test
- Measurement and drawing up of the tracer
- Injection of the radiopharmaceuticals

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<p>| Knowledge | Science of parathyroid imaging using ²⁰¹Tl/⁹⁹mTc and ⁹⁹mTc/¹²³I subtraction and washout ⁹⁹mTcMIBI imaging as well as those tracers/protocols in development |
| Skills | Preparation of the patient prior to the test(s) |
| Attitudes | Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test |
| | Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease |
| | Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician |
| | Consider the importance of audit in the outcome of results |
| | Show openness to critical feedback of reports |
| | Appreciate the importance of keeping up-to-date with developments and with relevant medical literature |
| | Show awareness of health and safety issues |</p>
<table>
<thead>
<tr>
<th>Administration of the radiopharmaceuticals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performing the scans developing good technique allied to knowledge of the pitfalls associated with the study</td>
</tr>
<tr>
<td>Image processing and display</td>
</tr>
<tr>
<td>Image interpretation and reporting of sufficient number of patient studies to assess utility, pitfalls, normal variants and artefacts</td>
</tr>
<tr>
<td>Audit of outcomes</td>
</tr>
</tbody>
</table>

**Attitudes**

- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
- Consider the importance of audit in the outcome of results
- Show openness to critical feedback of reports
- Appreciate the importance of keeping up-to-date with developments and with relevant medical literature
- Show awareness of health and safety issues

### GASTROINTESTINAL SYSTEM

**Objective:** To provide the trainee with the knowledge, skills and attitudes to evaluate gastrointestinal disorders using radionuclide techniques

#### 1. Salivary Gland Imaging

**Knowledge**

- Physiology and pathophysiology of salivary gland disorders.
- Basic science of salivary gland function using $^{99m}$TcO$_4$
- Indications for radionuclide salivary gland studies
- Comparative investigations
- Radiation protection issues

**Skills**

- Preparation of the patient prior to the test
- Measurement and drawing up of the radiopharmaceutical
- Radiopharmaceutical and salivary gland excretory stimulation administration
- Performing the scans developing good technique and a knowledge of the pitfalls associated with the study
- Data processing, image display and quantification
- Image interpretation and reporting of sufficient number of patient studies to assess utility, pitfalls, normal variants and artefacts
- Audit of outcome

**Attitudes**

- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
- Consider the importance of audit in the outcome of results
- Show openness to critical feedback of reports
- Appreciate the importance of keeping up-to-date with developments and with relevant medical literature
- Show awareness of health and safety issues

#### 2. Oesophageal transit and gastro-oesophageal reflux

**Knowledge**

- Physiology and pathophysiology of oesophageal transit and the lower oesophageal sphincter
- Basic science of oesophageal motility and gastro-oesophageal reflux using tracers e.g. $^{99m}$Tc colloid or DTPA
- Indications for radionuclide oesophageal transit and reflux measurements
- Comparative investigations including oesophageal imaging and manometry
- Radiation protection issues

**Skills**

- Preparation of the patient prior to the test
- Measurement and drawing up of the radiopharmaceutical
- Radiopharmaceutical administration including patient instruction and positioning
- Performing the scans using appropriate acquisition techniques and knowledge of the pitfalls associated with the study
- Image processing including quantification and display
- Image and data interpretation and reporting of sufficient number of patient studies to assess utility, pitfalls, normal variants and artefacts
- Audit of outcome
### 3. Gastrointestinal Transit Measurements

**Knowledge**
- Physiology and pathophysiology of gastric emptying and small bowel and colonic transit.
- Clinical conditions known to lead to gastroparesis and to slow transit constipation.
- Radiopharmaceuticals used to assess solid and liquid phase gastric emptying and to define the limits of the stomach.
- Radiopharmaceuticals used to assess small and large bowel transit including the use of large bowel stimulants.
- Indications for the above studies.
- Comparative tests of gastric emptying, small bowel and colonic transit assessment.

**Skills**
- Preparation of the patient prior to the test(s).
- Preparation and administration of radiopharmaceuticals.
- Performing the scans using appropriate acquisition techniques and a knowledge of the pitfalls.
- Data processing with ROI positioning and calculation of T½ emptying.
- Recognition of patterns of emptying (e.g. gastric dumping).
- Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts.
- Audit of outcome.

**Attitudes**
- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test.
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease.
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician.
- Consider the importance of audit in the outcome of results.
- Show openness to critical feedback of reports.
- Appreciate the importance of keeping up-to-date with developments and with relevant medical literature.
- Show awareness of health and safety issues.

### 4. Gastrointestinal blood loss and Meckel’s diverticulum imaging

**Knowledge**
- Anatomy and pathophysiology of gastrointestinal (GI) blood loss and Meckel’s diverticulum.
- Basic science of measuring GI bleeding using radionuclides including ⁹⁹ᵐTc colloid or labelled autologous red cells (in vivo or in vitro).
- Principles of detection of Meckel’s diverticulum using ⁹⁹ᵐTcO₄⁻.
- Indications for GI blood loss studies and Meckel’s test.
- Comparative tests for sources of GI blood loss and diagnosis of Meckel’s diverticulum.

**Skills**
- Preparation of the patient prior to the test.
- Measurement and drawing up of the radiopharmaceutical.
- Preparation and administration of radiopharmaceutical.
- Performing the scans developing good technique and a knowledge of the pitfalls associated with the study.
- Data processing and image display.
- Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts.
- Audit of outcome.

**Attitudes**
- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test.
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease.
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician.
- Consider the importance of audit in the outcome of results.
5. Hepatic and Splenic function assessment

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Anatomy and physiology of the liver blood flow, Kupffer cell and the spleen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Radiopharmaceuticals used to evaluate hepatic reticuloendothelial (RES) function and suspected liver haemangioma</td>
</tr>
<tr>
<td></td>
<td>Hepatic blood flow measurements, first pass techniques, calculation of hepatic perfusion index (HPI) and choice of tracer ((^{99m} \text{Tc}) colloid or (^{99m} \text{TcO}_4 ))</td>
</tr>
<tr>
<td></td>
<td>Assessment of hypersplenism using colloid or denatured red cells</td>
</tr>
<tr>
<td></td>
<td>Comparative tests of hepatic blood flow, RES and splenic function</td>
</tr>
<tr>
<td></td>
<td>Radiation protection issues</td>
</tr>
</tbody>
</table>

| Skills | Preparation of the patient prior to the test. |
|        | Choice of appropriate radiopharmaceutical and imaging protocol |
|        | Administration of the radiopharmaceutical |
|        | Performing the scans ensuring good technique and developing knowledge of the pitfalls |
|        | Data processing, calculation of the HPI and image display |
|        | Data and image interpretation and reporting of sufficient number of patient studies to assess utility, pitfalls, normal variants and artefacts |
|        | Audit of outcome |

| Attitudes | Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test. |
|           | Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease |
|           | Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician |
|           | Consider the importance of audit in the outcome of results |
|           | Show openness to critical feedback of reports |
|           | Appreciate the importance of keeping up-to-date with developments and with relevant medical literature |

6. Hepatobiliary function

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Clinical spectrum of biliary disorders including knowledge of operative procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physiology and pathophysiology of bile formation, gallbladder and sphincter of Oddi function</td>
</tr>
<tr>
<td></td>
<td>Basic science of (^{99m} \text{Tc} ) HIDA derivatives and pharmacology of cholecystokinin analogues</td>
</tr>
<tr>
<td></td>
<td>Use of (^{99m} \text{Tc} ) HIDA or derivatives to evaluate</td>
</tr>
<tr>
<td></td>
<td>Biliary obstruction</td>
</tr>
<tr>
<td></td>
<td>Acute cholecystitis Biliary leaks</td>
</tr>
<tr>
<td></td>
<td>Gallbladder dyskinesia</td>
</tr>
<tr>
<td></td>
<td>Sphincter of Oddi dysfunction</td>
</tr>
<tr>
<td></td>
<td>Duodenogastric bile reflux</td>
</tr>
<tr>
<td></td>
<td>Alternative methods of assessing the biliary tract</td>
</tr>
<tr>
<td></td>
<td>Radiation protection issues</td>
</tr>
</tbody>
</table>

| Skills | Preparation of the patient prior to the test |
|        | Measurement and drawing up of the radiopharmaceutical |
|        | Choice of imaging protocol and administration of the radiopharmaceutical |
|        | Performing the scan ensuring good technique and awareness of the pitfalls of the study |
|        | Timing the administration of the gall bladder provocation agent |
|        | Data processing and quantification of gallbladder function |
|        | Image interpretation and reporting sufficient numbers of patient studies to assess utility, sources of error, normal variants and artefacts |
|        | Audit |

| Attitudes | Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test. |
|           | Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease |
|           | Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician |
|           | Consider the importance of audit in the outcome of results |
|           | Show openness to critical feedback of reports |
|           | Appreciate the importance of keeping up-to-date with developments and with relevant medical literature |
**INFECTION/INFLAMMATION**

**Objective:** To provide the trainee with the knowledge, skills and attitudes to evaluate sites of infection/inflammation using radionuclide techniques

### Imaging sites of infection or inflammation

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic science of infection/inflammation including cellular mechanisms</td>
<td>Patient preparation.</td>
<td>Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test.</td>
</tr>
<tr>
<td>Clinical spectrum of occult sepsis</td>
<td>Choice of appropriate radiopharmaceutical and imaging protocol</td>
<td>Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease.</td>
</tr>
<tr>
<td>Radiopharmaceuticals used for infection/inflammation imaging including (^{67}\text{Ga}) Gallium citrate, (^{99m}\text{Tc}\text{HMPAO} ) or (^{111}\text{In}) autologous white cells, (^{99m}\text{Tc}\text{HIG}) and other infection/inflammation imaging agents in current use or in development</td>
<td>Preparation (including cell labelling skills) and administration of the radiopharmaceutical</td>
<td>Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician.</td>
</tr>
<tr>
<td>Indications for use of radioactive tracers to image occult infection or inflammation</td>
<td>Performing the scans ensuring good technique and developing knowledge of the pitfalls</td>
<td>Consider the importance of audit in the outcome of results.</td>
</tr>
<tr>
<td>Role of complementary and comparative investigations for the diagnosis of occult infection or inflammation</td>
<td>Image processing and display</td>
<td>Show openness to critical feedback of reports.</td>
</tr>
<tr>
<td>Radiation protection issues</td>
<td>Image interpretation and reporting of sufficient number of patient studies to assess utility sources of error, normal variants and artefacts.</td>
<td>Appreciate the importance of keeping up-to-date with developments and with relevant medical literature.</td>
</tr>
</tbody>
</table>

**LYMPHOISCINTIGRAPHY**

**Objective:** To provide the trainee with the knowledge, skills and attitudes to evaluate regional lymphatic drainage using radionuclide techniques (see common objectives)

### Lymphoedema evaluation and Sentinel Node Localisation

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Skills</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional lymphatic anatomy and physiology</td>
<td>Preparation of the patient prior to the test</td>
<td>Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test.</td>
</tr>
<tr>
<td>Mechanisms of tumour spread and concept of the sentinel node</td>
<td>Choice of radiopharmaceutical</td>
<td>Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease.</td>
</tr>
<tr>
<td>Basic science of radiopharmaceuticals used to identify regional lymphatic drainage</td>
<td>Injection techniques</td>
<td>Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician.</td>
</tr>
<tr>
<td>Indications for lymphoscintigraphy</td>
<td>Performing the scans ensuring good technique and knowledge of the pitfalls</td>
<td>Consider the importance of audit in the outcome of results.</td>
</tr>
<tr>
<td>Comparative regional lymphatic localisation techniques</td>
<td>Surface localisation of the sentinel node</td>
<td>Show openness to critical feedback of reports.</td>
</tr>
<tr>
<td>Radiation protection issues</td>
<td>Calibration and use of the hand-held probe</td>
<td>Appreciate the importance of keeping up-to-date with developments and with relevant medical literature.</td>
</tr>
<tr>
<td></td>
<td>Performance and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts.</td>
<td>Show awareness of health and safety issues.</td>
</tr>
</tbody>
</table>

**Audit**

- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test.
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease.
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician.
- Consider the importance of audit in the outcome of results.
- Show openness to critical feedback of reports.
- Appreciate the importance of keeping up-to-date with developments and with relevant medical literature.
### ONCOLOGY

**Objective.** To provide the trainee with the knowledge, skills and attitudes to evaluate cancer using radionuclide techniques (see also PET and PET-CT section)

#### Imaging tumour sites using radionuclide techniques

<table>
<thead>
<tr>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic science of tumour biology, metabolism, and spread</td>
</tr>
<tr>
<td>Characteristics of solid organ tumours and haematological malignancies</td>
</tr>
<tr>
<td>Principles of tumour localisation</td>
</tr>
<tr>
<td>Radiopharmaceuticals currently used to detect tumours (e.g. $^{67}$Ga, $^{201}$Tl, pentavalent DMSA, $^{18}$FDG radiolabelled antibodies, and peptides) and those in development</td>
</tr>
<tr>
<td>Knowledge of imaging protocols including whole body or planar static imaging, SPECT and SPECT/CT</td>
</tr>
<tr>
<td>Indications for radionuclide tumour imaging including sensitivity and specificity of the investigations</td>
</tr>
<tr>
<td>Role of comparative tumour imaging techniques including CT and MR imaging.</td>
</tr>
<tr>
<td>Radiation protection issues</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation of the patient prior to the test</td>
</tr>
<tr>
<td>Measurement and drawing up of tracer</td>
</tr>
<tr>
<td>Injection of the tracer</td>
</tr>
<tr>
<td>Performing the scan aiming for good technique and awareness of the pitfalls of the study</td>
</tr>
<tr>
<td>Image reconstruction and display</td>
</tr>
<tr>
<td>Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts</td>
</tr>
<tr>
<td>Review of sequential data on patients and comparison with other methods of assessment</td>
</tr>
<tr>
<td>Audit of outcome</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Attitudes</th>
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</thead>
<tbody>
<tr>
<td>Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test</td>
</tr>
<tr>
<td>Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease</td>
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<tr>
<td>Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician</td>
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<tr>
<td>Consider the importance of audit in the outcome of results</td>
</tr>
<tr>
<td>Show openness to critical feedback of reports</td>
</tr>
<tr>
<td>Appreciate the importance of keeping up-to-date with developments and with relevant medical literature</td>
</tr>
<tr>
<td>Show awareness of health and safety issues</td>
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</tbody>
</table>

### OPHTHALMIC SYSTEM

**Objective:** To provide the trainee with the knowledge, skills and attitudes to evaluate nasolacrimal drainage using radionuclide techniques

#### NASOLACRIMAL DRAINAGE

<table>
<thead>
<tr>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physiology and pathophysiology of nasolacrimal ducts</td>
</tr>
<tr>
<td>Basic science of nasolacrimal drainage using $^{99}$mTcO$_4$</td>
</tr>
<tr>
<td>Indications for measurement of nasolacrimal drainage</td>
</tr>
<tr>
<td>Comparative tests</td>
</tr>
<tr>
<td>Radiation protection issues</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Skills</th>
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</thead>
<tbody>
<tr>
<td>Preparation of the patient prior to the test</td>
</tr>
<tr>
<td>Ocular radiopharmaceutical instillation techniques</td>
</tr>
<tr>
<td>Performing the scans developing good technique and a knowledge of the pitfalls associated with the study</td>
</tr>
<tr>
<td>ROI placement and quantification</td>
</tr>
<tr>
<td>Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts</td>
</tr>
<tr>
<td>Audit</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Attitudes</th>
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<tbody>
<tr>
<td>Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test</td>
</tr>
<tr>
<td>Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease</td>
</tr>
<tr>
<td>Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician</td>
</tr>
<tr>
<td>Consider the importance of audit in the outcome of results</td>
</tr>
<tr>
<td>Show openness to critical feedback of reports</td>
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<tr>
<td>Appreciate the importance of keeping up-to-date with developments and with relevant medical literature</td>
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<tr>
<td>Show awareness of health and safety issues</td>
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<tr>
<td>PAEDIATRICS</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Objective.</strong> To provide the trainee with the knowledge, skills and attitudes to assess disorders in children using radionuclide techniques</td>
</tr>
<tr>
<td><strong>Imaging children using radionuclides</strong></td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
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<tr>
<th>PULMONARY SYSTEM</th>
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<tbody>
<tr>
<td><strong>Objective:</strong> To provide the trainee with the knowledge, skills and attitudes to evaluate pulmonary disorders using radionuclide techniques (see common objectives)</td>
</tr>
<tr>
<td><strong>1. Pulmonary Embolism (PE)</strong></td>
</tr>
<tr>
<td><strong>Knowledge</strong></td>
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<td><strong>Attitudes</strong></td>
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</tbody>
</table>
2. Regional Ventilation, Mucociliary and Small Solute Clearance

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Clinical features and management of obstructive pulmonary disease, bronchiectasis and alveolitis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basic science of regional ventilation, the mucociliary escalator and alveolar-capillary membrane integrity</td>
</tr>
<tr>
<td></td>
<td>Characteristics of aerosol physics</td>
</tr>
<tr>
<td></td>
<td>Indications for measurement of regional ventilation and small solute clearance including evidence base</td>
</tr>
<tr>
<td></td>
<td>Radiation protection issues</td>
</tr>
<tr>
<td>Skills</td>
<td>Preparation of the patient prior to the test</td>
</tr>
<tr>
<td></td>
<td>Choice of radiopharmaceutical and imaging protocol</td>
</tr>
<tr>
<td></td>
<td>Techniques of radiopharmaceutical delivery</td>
</tr>
<tr>
<td></td>
<td>Performing the test ensuring good technique and developing knowledge of the pitfalls</td>
</tr>
<tr>
<td></td>
<td>Data processing, image display and quantification</td>
</tr>
<tr>
<td></td>
<td>Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts</td>
</tr>
<tr>
<td>Attitudes</td>
<td>Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test</td>
</tr>
<tr>
<td></td>
<td>Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease</td>
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<tr>
<td></td>
<td>Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician</td>
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<tr>
<td></td>
<td>Consider the importance of audit in the outcome of results</td>
</tr>
<tr>
<td></td>
<td>Show openness to critical feedback of reports</td>
</tr>
<tr>
<td></td>
<td>Appreciate the importance of keeping up-to-date with developments and with relevant medical literature</td>
</tr>
<tr>
<td></td>
<td>Show awareness of health and safety issues</td>
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</tbody>
</table>

SKELETAL SYSTEM

Objective: To provide the trainee with the knowledge, skills and attitudes to evaluate the skeletal disorders using radionuclide techniques

<table>
<thead>
<tr>
<th>Bone scans</th>
<th>Anatomy and physiology of the skeleton</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clinical presentation and management of disorders affecting the skeleton</td>
</tr>
<tr>
<td></td>
<td>Basic science of $^{99m}$Tc diphosphonate bone scans</td>
</tr>
<tr>
<td></td>
<td>Basic science of $^{99m}$Tc colloid bone marrow scans</td>
</tr>
<tr>
<td></td>
<td>Indications for bone and marrow scans including understanding of the evidence base</td>
</tr>
<tr>
<td></td>
<td>Use of bone scans in conjunction with other radionuclide imaging to assess bone or peri-prosthetic infections (see section on infection/inflammation)</td>
</tr>
<tr>
<td></td>
<td>Knowledge of imaging protocols including three-phase imaging, whole body or spot planar static imaging SPECT and SPECT/CT</td>
</tr>
<tr>
<td></td>
<td>Role of comparative imaging (plain XR, CT and MR scans) for the assessment of skeletal disorders</td>
</tr>
<tr>
<td></td>
<td>Radiation protection issues</td>
</tr>
<tr>
<td>Skills</td>
<td>Preparation of the patient for and during the test</td>
</tr>
<tr>
<td></td>
<td>Choice of appropriate imaging protocol</td>
</tr>
<tr>
<td></td>
<td>Radiopharmaceutical injection</td>
</tr>
<tr>
<td></td>
<td>Performing the test ensuring good technique and developing knowledge of the pitfalls</td>
</tr>
<tr>
<td></td>
<td>Image reconstruction, display, interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts</td>
</tr>
<tr>
<td>Attitudes</td>
<td>Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test</td>
</tr>
<tr>
<td></td>
<td>Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease</td>
</tr>
<tr>
<td></td>
<td>Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician</td>
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<td>Consider the importance of audit in the outcome of results</td>
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<td>Show openness to critical feedback of reports</td>
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<tr>
<td></td>
<td>Appreciate the importance of keeping up-to-date with developments and with relevant medical literature</td>
</tr>
</tbody>
</table>
### UROGENITAL SYSTEM

**Objective:** To provide the trainee with the knowledge, skills and attitudes to evaluate urogenital disorders using radionuclide techniques

<table>
<thead>
<tr>
<th>Renal and bladder function</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td></td>
</tr>
<tr>
<td>Basic science associated with the urogenital tract.</td>
<td></td>
</tr>
<tr>
<td>Radiopharmaceuticals used for renal imaging (e.g. DMSA, DTPA and MAG3)</td>
<td></td>
</tr>
<tr>
<td>Principles of dynamic renography</td>
<td></td>
</tr>
<tr>
<td>Computation of differential renal function</td>
<td></td>
</tr>
<tr>
<td>Computation of renal transit/drainage</td>
<td></td>
</tr>
<tr>
<td>The use of interventions such as Frusemide and Captopril</td>
<td></td>
</tr>
<tr>
<td>Urodynamic studies (reflux, cystography)</td>
<td></td>
</tr>
<tr>
<td>Assessment of renal transplants</td>
<td></td>
</tr>
<tr>
<td>Assessment of testicular torsion and varicoceles</td>
<td></td>
</tr>
<tr>
<td>Role of comparative renal imaging such as ultrasound, CT etc</td>
<td></td>
</tr>
<tr>
<td>Radiation protection issues</td>
<td></td>
</tr>
<tr>
<td>Skills</td>
<td></td>
</tr>
<tr>
<td>Preparation of the patient prior to the test</td>
<td></td>
</tr>
<tr>
<td>Choice of radiopharmaceutical and imaging protocol</td>
<td></td>
</tr>
<tr>
<td>Techniques of radiopharmaceutical injection for renal studies</td>
<td></td>
</tr>
<tr>
<td>Performing the scans ensuring good technique and developing knowledge of the pitfalls</td>
<td></td>
</tr>
<tr>
<td>Data processing, display and quantification</td>
<td></td>
</tr>
<tr>
<td>Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts.</td>
<td></td>
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<tr>
<td>Audit</td>
<td></td>
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<tr>
<td>Attitudes</td>
<td></td>
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<tr>
<td>Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test</td>
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<td>Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician</td>
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<td>Show openness to critical feedback of reports</td>
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<td>Appreciate the importance of keeping up-to-date with developments and with relevant medical literature</td>
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</tr>
<tr>
<td>Show awareness of health and safety issues</td>
<td></td>
</tr>
<tr>
<td>Review of sequential data on patients and comparison with other methods of assessment</td>
<td></td>
</tr>
</tbody>
</table>

### OPTIONAL MODULE - CARDIOVASCULAR SYSTEM

**Objective:** To provide the trainee with the knowledge, skills and attitudes to evaluate coronary artery disease using radionuclide techniques

| 1. Myocardial perfusion and infarct imaging (see also PET and PET-CT imaging) |  |
|------------------------|  |
| Knowledge              |  |
| Cardiac & coronary anatomy, cardiac physiology and pathophysiology. |  |
| Principles of myocardial perfusion and SPECT imaging including ECG-gated SPECT |  |
| Radiopharmaceuticals currently used for myocardial perfusion imaging (e.g. $^{201}$TI and the $^{99m}$Tc-labelled tracers) and infarction imaging (e.g. $^{99m}$Tc-pyrophosphate and antimyosin antibodies) and those in development |  |
| Principles of physiological and pharmacological stress tests |  |
| Imaging protocols used to evaluate myocardial viability, ischaemia and function |  |
| Indications for myocardial perfusion and infarction imaging |  |
| Role of comparative assessment methods including the exercise ECG, stress echocardiography and coronary angiography |  |
| Radiation protection issues |  |
| Skills                 |  |
| Preparation of the patient prior to the test. |  |
| Measurement and drawing up of tracer |  |
| Performance of cardiac stress test using physiological or pharmacological techniques |  |
| Injection of the tracer |  |
| Setting up of instrumentation for ECG-gating and SPECT acquisition |  |
| Performance of the scans developing good technique allied to a knowledge of the pitfalls |  |
Techniques of tomographic reconstruction, qualitative and quantitative analysis, and display, including knowledge of image artefacts

Image interpretation and reporting including sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts

Audit outcome of scan results

Attitudes
Recognise the importance of proper vetting of request forms and for patient evaluation prior to the test.
Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
Consider the importance of audit in the outcome of results
Show openness to critical feedback of reports
Appreciate the importance of keeping up-to-date with developments and with relevant medical literature
Show awareness of health and safety issues

2. Radionuclide ventriculography

Knowledge
Cardiac physiology and pathophysiology
Principles of radionuclide ventriculography (first pass and equilibrium techniques, rest and exercise studies)
Radiopharmaceuticals used for assessment of radionuclide ventriculography (99mTc-labelled red cells)
Indications for radionuclide ventriculography
Role of comparative techniques such as echocardiography and contrast ventriculography
Radiation protection issues

Skills
Preparation of the patient prior to the test
Measurement and drawing up of tracer
Injection of the tracer
Setting up of instrumentation for gated acquisition
Performance of rest and stress scans developing good technique allied to a knowledge of the pitfalls
Data processing and quantification
Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts
Audit outcome of results

Attitudes
Recognise the need for proper vetting of request forms and for patient evaluation prior to the test
Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
Consider the importance of audit in the outcome of results
Show openness to critical feedback of reports
Appreciate the importance of keeping up-to-date with developments and with relevant medical literature
Show awareness of health and safety issues

OPTIONAL MODULE – PET and PET-CT
Objective: To provide the trainee with the knowledge, skills and attitudes to have a working knowledge of PET and PET-CT imaging

1. Basic science appropriate to PET and PET-CT imaging

Knowledge
Theory of the production and decay of positron radionuclides used in clinical PET and PET-CT
Compartmental analysis methods
Appropriate mathematics and physics applied to PET tracer theory, modelling of tracer kinetics and quantitative imaging
Radiopharmacy of the tracer used in PET
Physiological principles of the techniques
Dosimetry of the various tracers used
Legal aspects associated with tracers
Methods of measurement of tracer activity and imaging equipment
Errors associated with the quantitative measurements
Knowledge of gamma camera and dedicated PET and PET-CT systems
Method of acquiring PET and PET-CT images
SUV quantification and variables
### 2. PET and PET-CT in Oncology

#### Knowledge
- Basic science of tumour metabolism
- Normal anatomical and physiological variation in tracer distribution
- PET tracers used for tumour detection including FDG
- Benign conditions producing FDG uptake eg sarcoid, TB
- Effect of chemotherapy or prior radiotherapy / surgery
- Evidence base for clinical indications for PET
- PET and PET-CT in tumour diagnosis e.g. pulmonary nodules
- PET and PET-CT in tumour staging e.g. lung cancer, lymphoma, germ cell tumours etc
- PET and PET-CT in the detection of recurrent disease e.g. colorectal cancer
- Role of PET tracer imaging compared to other imaging methods including CT and MR scans
- Current tumour staging (usually TNM) in common tumours

#### Economics – cost/benefit
- Radiation protection issues

#### Skills
- Preparation of the patient prior to the test
- Measurement and drawing up of tracer
- Injection of the tracer
- Methods of scanning and data manipulation
- Image reconstruction and display
- Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts
- Review of sequential data on patients and comparison with other methods of assessment
- Audit of results

#### Attitudes
- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
- Consider the importance of audit in the outcome of results
- Show openness to critical feedback of reports
- Appreciate the importance of keeping up-to-date with developments and with relevant medical literature
- Show awareness of health and safety issues

### 3. PET and PET-CT in Neuropsychiatry

#### Knowledge
- Basic neurophysiology, neurochemistry and cross-sectional neuroanatomy
- PET tracers used for brain imaging
- Normal variation in PET tracer distribution within the brain
- Role of PET and PET-CT in the diagnosis of common brain disorders such as epilepsy and dementia
- PET and PET-CT in the evaluation of brain tumours
- Role of PET tracer imaging compared to other imaging methods including CT and MR scans
- Radiation protection issues

#### Skills
- Preparation of the patient prior to the test
- Measurement and drawing up of tracer
- Injection of the tracer
- Methods of scanning and data manipulation
- Image reconstruction and display
- Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts
- Review of sequential data on patients and comparison with other methods of assessment
- Audit of results

#### Attitudes
- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
- Consider the importance of audit in the outcome of results
- Show openness to critical feedback of reports
| Appreciate the importance of keeping up-to-date with developments and with relevant medical literature |
| Show awareness of health and safety issues |

### 4. PET and PET-CT in Cardiology

**Knowledge**
- Coronary and cardiac anatomy, cardiac physiology and pathophysiology
- Assessment of myocardial ischaemia using $^{82}$Rb, $^{13}$N-ammonia, $^{15}$O-water
- FDG PET for assessment of myocardial viability
- Control and monitoring of glucose metabolism for FDG injection
- Principles of pharmacological cardiac stress tests
- Normal variation in FDG tracer distribution within the heart
- Role of PET tracer imaging compared to other imaging methods including cardiac stress echo and coronary angiography
- Radiation protection issues

**Skills**
- Preparation of the patient prior to the test
- Measurement and drawing up of tracer
- Performance of cardiac stress testing using pharmacological techniques
- Injection of the FDG, NH$_3$, and any new tracers
- Production of parametric perfusion images and calculation of numeric results
- Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts
- Review of sequential data on patients and comparison with other methods of assessment
- Audit of results

**Attitudes**
- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
- Consider the importance of audit in the outcome of results
- Show openness to critical feedback of reports
- Appreciate the importance of keeping up-to-date with developments and with relevant medical literature
- Show awareness of health and safety issues

### MULTI-MODALITY IMAGING: RADIONUCLIDE RADIOLOGY AND COMPUTED TOMOGRAPHY

**Objective:** To provide the trainee with the knowledge, skills and attitudes to have a working knowledge of Cross-sectional imaging using CT scanning in the context of PET, PET-CT and SPECT-CT

**Knowledge**
- PET-CT and SPECT-CT hardware
- CT protocols for PET-CT and SPECT-CT and how they differ from diagnostic CT
- Principles of co-registering CT images with PET and SPECT and other CT post-image acquisition processing techniques

**Skills**
- Preparation of the patient prior to the test
- Assessment of the need and/or contra-indications for CT contrast media and treatment of complications
- Image interpretation of a sufficient number of PET-CT and/or SPECT-CT studies to assess utility, sources of error, normal variants and artefacts, including an ability to (i) assign PET/SPECT abnormalities to specific anatomical structures, (ii) assimilate CT appearances into the assessment of the significance of PET and SPECT findings, and (iii) recognise CT abnormalities that are not associated with radiotracer uptake
- Review of sequential data on patients and comparison with other methods of assessment
- Audit of results

**Attitudes**
- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
- Recognise the limitations of CT imaging used for PET-CT and SPECT-CT and the need for an additional radiological opinion or examination where necessary
- Appreciate the importance of keeping up-to-date with hardware and software developments and with the relevant medical literature
- Show awareness of health and safety issues
### Good Medical Practice

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain radionuclide imaging procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure</td>
<td>Obtain informed consent in a clear and effective manner</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
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<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
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<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients</td>
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<td>Demonstrate good team working skills</td>
<td>Understand the value of team working</td>
<td>Demonstrate good communication with patients and professional colleagues</td>
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<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development</td>
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<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
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<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
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<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health.</td>
</tr>
</tbody>
</table>

Note “Good Medical Practice” 2006. GMC

### Generic Skills

- Preparation of the patient prior to the test
- Choice of radiopharmaceutical and imaging protocol
- Techniques of radiopharmaceutical injection
- Performing the scans ensuring good technique and developing knowledge of the pitfalls
- Data processing, display and quantification
- Image interpretation and reporting of sufficient number of patient studies to assess utility, sources of error, normal variants and artefacts.

### Generic Attributes

- Recognise the importance of proper vetting of request forms and of patient evaluation prior to the test
- Show willingness to provide explanation to patient as to nature of the investigation and to put them at ease
- Appreciate the importance of timely reporting and of prompt and accurate communication of the result to the referring clinician
- Recognise the limitations of radionuclide investigations and the need for an additional radiological opinion or examination where necessary
- Appreciate the importance of keeping up-to-date with hardware and software developments and with the relevant medical literature
- Show awareness of health and safety issues
- Consider the importance of audit in the outcome of results
- Show openness to critical feedback of reports

11.3.1 Trainees should acquire experience in all the procedures listed above, and the number of cases undertaken should be recorded in a logbook.
11.4 **Appraisal**

11.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal should be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

11.5 **Assessment**

11.5.1 Methods of trainee assessment will include:
- direct observation of clinical techniques (including communication skills and ability to obtain informed consent) by the trainer and/or external observer
- formal review of the trainee’s skills in the accurate interpretation of radionuclide investigations
- team assessment of behaviour (TAB)
- a final assessment of overall professional competence before the final annual review of competence progression (ARCP)
- the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

These assessments will ensure that the trainee:
- is fully competent in the performance and interpretation of radionuclide investigations in all topic areas;
- has a comprehensive knowledge of scientific principles, benefits and dangers of radionuclide radiology;
- is able to provide a radionuclide radiology service in conjunction with all other imaging modalities;
- can demonstrate sufficient training and experience to be successful in an application for an ARSAC certificate for radionuclide radiology.

11.6 **Overall Review**

11.6.1 Review of training programme:
- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

11.6.2 Review of special interest curriculum
- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current radionuclide imaging practice.

June 2008
ONCOLOGICAL IMAGING – ADVANCED/SPECIAL INTEREST
TRAINING CURRICULUM

12.1 Introduction

12.1.1 This curriculum outlines the special interest training requirements for specialty training in oncological imaging.

12.1.2 The content of the special interest curriculum of oncological imaging can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the investigation and management of oncological disease in adults and children.

12.1.3 All trainees will have acquired basic knowledge of oncological imaging during core training and will already have acquired the core skills.

12.1.4 The aim of special interest training in oncological imaging is to enable the trainee to become clinically competent and to consistently interpret the results of oncological imaging investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

12.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in oncological imaging, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

12.1.6 Those clinical radiologists who plan to practise oncological imaging as one of a mixture of activities (albeit that oncological imaging will be a particular responsibility within those activities) will normally undertake around 6 months of special interest training in oncological imaging (with a minimum of 6 sessions per week dedicated to the special interest).

12.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

12.1.8 Supervision during training must be conducted by those who are appropriately skilled in oncological imaging and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

12.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

12.1.10 Some specialised areas of oncological practice, including neuro-oncology and paediatric oncology will be available in some but not all cancer centres. Where such experience is available, the trainee will have the opportunity to gain experience in these areas. However, such experience is not regarded as essential for special interest training.

12.1.11 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for demonstrating tumours and their complications, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all aspects of oncological imaging and appropriate intervention.

12.1.12 There will be continuing development of generic professional competencies.
12.2 **Overview of training**

12.2.1 The main document, to which this appendix should be viewed as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training will be actively involved in oncological imaging within an educational environment with graduated supervision.

12.2.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US) and nuclear medicine techniques as applied to staging all of the common cancers (breast, lung, prostate, colon) as well as many of the intermediate, i.e., less common, cancers (urological, gynaecological, head and neck) and special cancers, e.g., lymphoma.

12.2.3 The trainee should gain experience in rare tumours as relevant to the referral pattern within the training centre.

12.2.4 Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical, surgical and oncological teams. The trainee should gain knowledge of the relationship of imaging results to clinical management through participation in multidisciplinary clinicoradiological conferences for the different cancers.

12.2.5 The trainee should understand the impact of positive and negative imaging results on patient management, particularly in relation to determining a radical or palliative approach to treatment.

12.2.6 The trainee will be encouraged and given the opportunity to attend and lead appropriate clinicoradiological and multidisciplinary meetings.

12.2.7 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

12.2.8 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

12.2.9 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

12.2.10 Trainees will be expected to be familiar with current oncological radiology literature.

12.2.11 The trainee will be encouraged to participate in research, and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, should be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

12.2.12 The trainee will continue to participate in the trainee general on-call rota, with appropriate consultant back-up.
### General Principles of Oncological Imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the basis of oncological imaging</td>
<td>Is familiar with the embryology, anatomy, physiology, and pathology of the major tumour-bearing organs and the pathological processes of malignant disease. Has a good working knowledge of normal variants that could mimic disease.</td>
<td>May accurately stage the common tumour types and have the resources to be able to stage unusual tumour types.</td>
</tr>
<tr>
<td></td>
<td>Is familiar with the staging classifications used for each major organ, e.g., TNM.</td>
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<tr>
<td></td>
<td>Knows the anatomical routes and patterns of spread of common tumours.</td>
<td>May advise on the extent of imaging required to identify the possible sites of metastatic disease.</td>
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<tr>
<td></td>
<td>Knows the criteria for lymph node diagnosis and the typical routes of spread from primary tumours; understand the limitations of imaging in diagnosis of lymph node metastases.</td>
<td>May accurately identify draining lymph nodes and predict the possibility of lymph node metastases.</td>
</tr>
<tr>
<td></td>
<td>Knows the local, national and where appropriate, international imaging guidelines.</td>
<td>May advise on the appropriate diagnostic imaging and follow-up protocols for different tumour types.</td>
</tr>
<tr>
<td></td>
<td>Is familiar with methods of analysing and measuring tumour response, e.g., RECIST criteria.</td>
<td>May accurately assess response to treatment according to recognised criteria.</td>
</tr>
<tr>
<td>Can describe the full range of diagnostic techniques available</td>
<td>Knows the indications, contraindications and complications of each imaging method. Understands the factors affecting the choice of contrast media and pharmaceuticals. Can describe the effects and side effects of these agents.</td>
<td>Able to protocol, conduct and supervise oncological imaging techniques to high standard.</td>
</tr>
<tr>
<td></td>
<td>Acquires a sound understanding of the strengths and weaknesses of the different imaging methods in various pathological conditions. The appropriate choice of imaging techniques and/or the appropriate sequence of imaging techniques in the investigation of specific clinical problems should be emphasised.</td>
<td>Able to plan effective imaging pathways.</td>
</tr>
<tr>
<td></td>
<td>Can describe the staging for malignant diseases. Is familiar with the techniques for obtaining diagnostic samples from tissue. Detects errors in diagnosis and complications in treatment.</td>
<td>May conduct and supervise accurate interpretation of all imaging techniques used in the investigation and staging of tumours to a high professional standard. May accurately localise and biopsy masses and lymph nodes and where appropriate safely undertake interventional procedures.</td>
</tr>
<tr>
<td>Understands the clinical aspects of oncological diseases</td>
<td>Is familiar with the clinical management pathways for oncological disorders.</td>
<td>Able to confidently discuss the appropriate imaging strategy with the referring clinicians.</td>
</tr>
<tr>
<td></td>
<td>Develops good communications skills.</td>
<td>Able to communicate effectively with patients and professional colleagues.</td>
</tr>
<tr>
<td></td>
<td>Is familiar with the current local and national guidance on consenting patients.</td>
<td>Able to obtain accurate informed consent from patients.</td>
</tr>
<tr>
<td>Understands the role of multidisciplinary meetings</td>
<td>Able to plan effective investigations pathways including the selection of appropriate investigations and imaging techniques for the diagnosis of benign and malignant disease.</td>
<td>Able to communicate effectively and work in a multidisciplinary team. Promotes an understanding of relevant tumour pathology.</td>
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<tr>
<td></td>
<td>Understands the use of imaging in treatment planning and assessing outcomes of treatment.</td>
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<td></td>
<td>Able to detect errors in diagnosis and complications of treatment</td>
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</tbody>
</table>
Procedural Competence (Non-Interventional)
<table>
<thead>
<tr>
<th>Objectives</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Procedural competence</strong></td>
<td>Procedural competence will need to be reviewed at intervals, and this regular review should also assess the number of cases required in order to ensure competence.</td>
<td></td>
</tr>
<tr>
<td><strong>Able to perform and interpret plain film x-rays used in oncological radiology</strong></td>
<td>Understands the basic principles of plain film radiography. Understands the indications for referral for cross-sectional imaging based on the plain film findings.</td>
<td>Expertise in plain radiographic assessment for staging and follow-up of tumours. Expertise in recommending the most appropriate further investigation.</td>
</tr>
<tr>
<td><strong>Able to perform and interpret computerised tomography relevant to oncological radiology</strong></td>
<td>Able to describe the protocols and image processing techniques used in oncological CT.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demonstrates a detailed knowledge of tumour types appropriate for CT staging and follow-up.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Demonstrates a detailed knowledge of the appropriate CT techniques for the assessment of different common cancers.</td>
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</tr>
<tr>
<td></td>
<td>Able to describe the patterns of disease spread for common tumour types on CT.</td>
<td>Able to tailor examinations appropriately. Able to accurately interpret CT studies used in the diagnosis, staging, assessment of response and detection of recurrent disease of the common cancers.</td>
</tr>
<tr>
<td></td>
<td>Is familiar with the advantages of new developments in CT such as multi-helical techniques in cancer management, e.g., three-dimensional imaging, multi-planar reformatting.</td>
<td>Able to provide clinicians with optimised images which may aid surgical management or treatment planning including the role of imaging in radiotherapy planning and treatment</td>
</tr>
<tr>
<td></td>
<td>Is familiar with the requirements for CT planning in radiotherapy and the importance of diagnostic input.</td>
<td></td>
</tr>
<tr>
<td><strong>To be familiar with the use of magnetic resonance imaging in oncological disorders</strong></td>
<td>Give detailed descriptions of the indications for MRI in staging, follow-up and assessment of patients at the time of suspected relapse.</td>
<td>Able to ensure that MRI is used appropriately for the investigation of oncological disease.</td>
</tr>
<tr>
<td></td>
<td>Understands the imaging protocols and techniques used for MRI of the common tumours.</td>
<td>Able to appropriately protocol MRI examinations in oncology patients.</td>
</tr>
<tr>
<td></td>
<td>Has a detailed knowledge of basic MRI techniques, findings and pitfalls in diagnosis in those cancers frequently referred for imaging, e.g., pelvic cancers, head and neck cancers.</td>
<td>Able to accurately diagnose, stage, assess response and detect recurrent disease in tumours that are frequently imaged on MRI.</td>
</tr>
<tr>
<td></td>
<td>Has knowledge of the advances in MRI which are relevant to the diagnosis and treatment of cancer patients.</td>
<td>Able to introduce improvements to MR imaging used in oncological diagnoses.</td>
</tr>
<tr>
<td><strong>Able to perform and interpret ultrasound used in oncological radiology</strong></td>
<td>Understands the indications for US examinations in cancer patients and the relationship of US to CT/ MRI/nuclear medicine for lesion detection, e.g., liver metastases.</td>
<td>Competent in the use of ultrasonography for the detection of primary and secondary disease and complications of disease and where appropriate doppler studies.</td>
</tr>
<tr>
<td></td>
<td>Understands the role of endocavitary US techniques for tumour staging, e.g., endoscopic US for oesophageal staging, endorectal US for prostate cancer staging. Expertise in these areas is not essential.</td>
<td>Able to advise/recommend appropriate endocavitary investigations and where fully trained, able to undertake these investigations with expertise.</td>
</tr>
<tr>
<td></td>
<td>Has knowledge of advances in US imaging and techniques.</td>
<td>Able to introduce improvements to ultrasound imaging which may have</td>
</tr>
<tr>
<td>Define the role of nuclear medicine in oncological investigation</td>
<td>Is familiar with the indications for nuclear medicine techniques as required for staging and expertise in image interpretation, e.g., technetium skeletal scintigraphy</td>
<td>Able to accurately interpret bone scanning for staging tumours.</td>
</tr>
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<tr>
<td></td>
<td>Understands the complementary role of plain radiography, MRI and CT to nuclear medicine in the evaluation of an equivocal diagnosis of metastases.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Understands the indications for functional imaging techniques and expertise in imaging interpretation, e.g., thyroid cancer imaging.</td>
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</tr>
<tr>
<td></td>
<td>Has knowledge of tumour-specific agents and their application to cancer management, e.g., MIBG scanning.</td>
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</tr>
<tr>
<td></td>
<td>Has knowledge of advances in nuclear medicine including positron emission tomography (PET/CT and PET). A basic knowledge of the technique is required. Knowledge of the current and evolving indications for referral for PET.</td>
<td>Able to advise on the appropriate use of PET and PET/CT.</td>
</tr>
<tr>
<td></td>
<td>A trainee will keep abreast of all other imaging techniques relevant to their practice.</td>
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</tr>
</tbody>
</table>
### Procedural Competence (Interventional)

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination. Able to work effectively with US and CT-guided interventions and where appropriate, fluoroscopic imaging.</td>
</tr>
</tbody>
</table>
| Be familiar with a wide range of interventional techniques used in oncological radiology | Describe the procedures for percutaneous fine needle aspiration, biopsy or drainage using image-guidance. | Trainees should be able to undertake the following procedures:  
- US-guided biopsy of masses and lymph nodes  
- CT-guided biopsy of masses (retroperitoneal, pelvic side-wall, thoracic and lymph nodes)  
- MRI-guided biopsy of masses and lymph nodes, where appropriate and available  
- Drainage of collections |
| Be proficient in the safe practice of analgesia and sedation in interventional practice | Describe the pharmacological actions of the agents used in analgesia and sedation and the necessary monitoring required to perform this safely. | Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient. |
| Be competent in intermediate life support and anaphylaxis treatment       | Describe the processes and actions required in intermediate life support and management of anaphylaxis. | Demonstrate the ability to perform cardiopulmonary resuscitation. Be able to manage the immediate response to acute anaphylaxis. |

### Good Medical Practice

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<tr>
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<tbody>
<tr>
<td>Be able to explain interventional procedures</td>
<td>Be able to describe the technique, risks and benefits of a procedure.</td>
<td>Obtain informed consent in a clear and effective manner.</td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge.</td>
<td>Know when to seek further information or help.</td>
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<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date.</td>
<td>Be able to discuss current medical practice with colleagues and patients.</td>
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<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types.</td>
<td>To explain diagnostic and therapeutic radiology procedures effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients.</td>
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<td>Demonstrate good team working skills</td>
<td>Understand the value of team working.</td>
<td>Demonstrate good communication with patients and professional colleagues.</td>
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<tr>
<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach.</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development.</td>
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<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning.</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor.</td>
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<td>Describe the areas embraced by probity.</td>
<td>Demonstrate clarity and honesty in record and document keeping.</td>
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<td>Maintain health</td>
<td>Understand the importance of personal health.</td>
<td>Demonstrate a commitment to managing personal health.</td>
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</table>
12.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their log book. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

12.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

12.3.3 During the training period the following weekly sessional commitments are suggested as a work profile for special interest trainees. Trainees may follow a suitable work plan for a period of 6 or 12 months depending on their long term aims:
- CT: three sessions per week
- MRI: one or two sessions per week
- US/nuclear medicine: one or two sessions per week
- flexible session for simple imaging-guided interventional procedures
- general oncological radiology (reporting/procedures): one session per week
- study/meetings: one session per week
- research/audit: one session per week

12.4 Appraisal

12.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

12.5 Assessment

12.5.1 Methods of trainee assessment will include:
- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for oncological diseases
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

12.6 Overall Review

12.6.1 Review of training programme
- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken.
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

12.5.4 Review of special interest curriculum
- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current oncological radiological practice.

June 2008
13. **PAEDIATRIC RADIOLOGY- ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM**

13.1 **Introduction**

13.1.1 This curriculum outlines the training requirements for specialty training in paediatric radiology.

13.1.2 The content of the special interest of paediatric radiology can be broadly defined as the study of the application, performance and interpretation of all imaging techniques/procedures relevant to the paediatric age group.

13.1.3 All trainees will have acquired a broad knowledge of paediatric imaging during core training and will already have acquired the core skills.

13.1.4 The aim of special interest training in paediatric radiology is to enable the trainee to become clinically competent and to consistently interpret the results of paediatric investigations accurately and reliably. Where appropriate, trainees will also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.

13.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in paediatric radiology, the equivalent of 12 to 24 months substantially devoted to the subject is recommended (i.e. a minimum of 6 sessions per week dedicated to the special interest).

13.1.6 Those clinical radiologists who plan to practise paediatric radiology as one of a mixture of activities (albeit that paediatric radiology will be a particular responsibility within those activities) will normally undertake around 6 months of subspecialty training in paediatric radiology (with a minimum of 6 sessions per week dedicated to the special interest).

13.1.7 The training scheme will arrange an attachment that fulfils the requirements of the special interest curriculum as described in this document. The caseload of the attachment(s) must be sufficient to gain adequate training and experience to undertake safe independent practice as a consultant.

13.1.8 Supervision during training must be conducted by those who are appropriately skilled in paediatric radiology and teaching. They should have successfully completed training in the principles of equality and diversity. Such skills will require refreshment from time to time.

13.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment to other training centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad to follow particular interests in greater depth.

13.1.10 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for paediatric disorders, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the findings. The trainee will be competent in all areas of paediatric imaging and paediatric intervention as appropriate.

13.1.11 There will be continuing development of generic professional competencies.

13.1.12 Earlier, more focussed, individualised training in paediatric radiology may be possible for those trainees with extensive paediatric experience.

13.2 **Overview of training**

13.2.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing
special interest training will ideally be actively involved in paediatric imaging within an educational environment with graduated supervision.

13.2.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging and fluoroscopy. Centres will also provide access to relevant specialised radionuclide imaging, e.g. positron emission tomography (PET).

13.2.3 Clinical knowledge will be acquired by a variety of means, including close liaison with appropriate medical, surgical and oncological teams and combined clinical and radiological meetings. Multidisciplinary meetings will be emphasised. The following inter-relationships are important:

- Paediatric surgery
- Paediatric medicine
- Paediatric sub specialities
- Paediatric oncology
- Neonatal unit
- Obstetric unit
- Community paediatrics
- Medicolegal agencies

Additional clinical knowledge may be acquired through participation in appropriate ward rounds, attending outpatient clinics and theatre sessions.

13.2.4 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiology and multidisciplinary meetings.

13.2.5 The trainee will be encouraged to attend appropriate educational meetings and courses and to access relevant e-learning material.

13.2.6 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

13.2.7 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

13.2.8 Trainees will be expected to be familiar with current paediatric radiological literature.

13.2.9 The trainee will be encouraged to participate in research, and to pursue a project (or projects) up to and including publication. An understanding of the principles and techniques used in research, including the value of clinical trials and basic biostatistics, will be acquired. Presentation of research and audit results at national and international meetings will be encouraged.

13.2.10 The trainee will continue to participate in the trainee on-call rota, with appropriate consultant back-up.

13.2.11 Experience in the supervised reporting and management of skeletal surveys for child protection work should be available.
# General Principles of Paediatric Imaging

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the basis of paediatric imaging.</td>
<td>Is familiar with the embryology, anatomy, physiology, pathology and mechanisms of disease within the paediatric age group. Has a good working knowledge of normal anatomical variants. Be aware of the differences between paediatric and adult practice.</td>
<td>Be aware of the knowledge and skills to enable safe practice of analgesia and sedation.</td>
</tr>
<tr>
<td>Can describe the full range of diagnostic techniques available.</td>
<td>Knows the indications, contraindications and complications of each imaging method. Understands the factors affecting the choice of contrast media and pharmaceuticals. Can describe the effects and side effects of these agents. Able to select the optimum imaging method and pathway for different pathological conditions.</td>
<td>Conducts and supervises paediatric imaging techniques to high standard. Be able to perform standard fluoroscopic procedures and have experience of pneumatic reduction of intussusceptions. Safely and effectively performs interventional techniques.</td>
</tr>
<tr>
<td>Is aware of current developments in paediatric radiology.</td>
<td>Able to describe recent advances in imaging. Able to describe current NICE guidance.</td>
<td>Obtains appropriate training for new interventional procedures.</td>
</tr>
<tr>
<td>Understands the role of multidisciplinary meetings.</td>
<td>Able to plan effective imaging pathways. Understands the relevance of dose reduction and avoidance of ionising radiation. Detects errors in diagnosis and complications in treatment. Promotes an understanding of relevant paediatric pathology.</td>
<td>Able to communicate effectively and work in a multidisciplinary team.</td>
</tr>
<tr>
<td>Understands the clinical aspects of paediatric diseases.</td>
<td>Is familiar with the clinical management pathways for paediatric disorders.</td>
<td>Able to confidently discuss the appropriate imaging strategy with the referring clinicians.</td>
</tr>
<tr>
<td>Understands the difference in basic physiology between a child and adult.</td>
<td></td>
<td>Competent in paediatric life support.</td>
</tr>
<tr>
<td>Objective</td>
<td>Knowledge</td>
<td>Skills</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
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<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Able to interpret radiographs used in paediatric radiology.</td>
<td>Understands the basic principles of radiography.</td>
<td>Able to interpret images using radiography from primary care examinations, general paediatrics, paediatric sub-specialties and paediatric surgery.</td>
</tr>
<tr>
<td>Able to perform and interpret ultrasound used in paediatric radiology.</td>
<td>Able to describe the range of pathological appearances seen in paediatric disorders on ultrasound.</td>
<td>Competent in the use of ultrasonography for paediatric abdominal, pelvic, joint, chest and where appropriate vascular and Doppler imaging.</td>
</tr>
<tr>
<td>Able to perform and interpret computerised tomography relevant to paediatric radiology.</td>
<td>Able to describe the protocols and image processing techniques used in paediatric CT.</td>
<td>Able to interpret CT images used in the diagnosis of benign and malignant pathology throughout the paediatric age groups.</td>
</tr>
<tr>
<td>Able to perform computerised tomography relevant to paediatric radiology.</td>
<td>Give detailed descriptions of imaging protocols used for paediatric investigation.</td>
<td>Able to interpret the MR images of benign and malignant disease processes. Be aware of the formal protocols in paediatric tumours.</td>
</tr>
<tr>
<td>To be familiar with the use of magnetic resonance imaging in paediatric disorders.</td>
<td>Describe the range of normal and abnormal appearance in isotope paediatric imaging.</td>
<td>Able to accurately interpret bone, renal and tumour nuclear medicine imaging including static and dynamic renal studies, musculoskeletal imaging, ventilation and perfusion lung scintigraphy, GI studies (identification of GI bleeding), thyroid imaging, MIBG studies and dynamic biliary examinations.</td>
</tr>
<tr>
<td>Define the role of nuclear medicine in paediatric investigation.</td>
<td></td>
<td>Able to perform an upper gastrointestinal contrast study on children.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Be able to perform a micturating cystogram on a child. Able to perform small bowel and large bowel enemas.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Studies on swallowing and phonation.</td>
</tr>
<tr>
<td>Fluoroscopy.</td>
<td>Understand the role of fluoroscopic investigation in the management pathways for paediatric disorders.</td>
<td></td>
</tr>
<tr>
<td>Medicolegal aspects</td>
<td>Gain awareness of the medicolegal aspects in paediatric radiology, with particular reference to child protection.</td>
<td>Acquire experience in reporting skeletal surveys in cases of suspected child abuse.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gain awareness of local and national policies with respect to child protection.</td>
</tr>
</tbody>
</table>
### Paediatric Interventional Techniques

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be familiar with the principles of interventional radiological practice</td>
<td>Be able to describe the basic principles of safe interventional technique. Describe the anatomy relevant to the procedure. Describe the recognised complications of the procedures. Understand the therapeutic actions and complications of injected agents. Describe techniques for radiation dose reduction to operator and patient.</td>
<td>Good hand-eye co-ordination. Able to work effectively with fluoroscopic imaging, ultrasound and CT guided intervention</td>
</tr>
<tr>
<td>Be familiar with a wide range of interventional techniques used in paediatric radiology</td>
<td>Able to perform biopsies and image guided procedures. They should be able to perform drainage procedures. They should be able to perform an air reduction of an intussception.</td>
<td></td>
</tr>
<tr>
<td>Be proficient in the safe practice of analgesia and sedation in interventional practice</td>
<td>Describe the pharmacological actions of the agents used in analgesia and sedation</td>
<td>Able to administer the appropriate agents in the correct dose in the clinical situation and monitor the patient</td>
</tr>
<tr>
<td>Be competent in intermediate life support and anaphylaxis treatment</td>
<td>Describe the processes and actions required in intermediate paediatric life support and management of anaphylaxis</td>
<td>Demonstrate the ability to perform cardiopulmonary resuscitation. Be able to manage the immediate response to acute anaphylaxis</td>
</tr>
</tbody>
</table>

### Good Medical Practice

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Be able to explain interventional procedures,</td>
<td>Be able to describe the technique, risks and benefits of a procedure. Be aware of the risks of radiation in the paediatric age group.</td>
<td>Obtain informed consent in a clear and effective manner.</td>
</tr>
<tr>
<td>Conduct good clinical care.</td>
<td>Be aware of the limits of personal knowledge.</td>
<td>Know when to seek further information or help.</td>
</tr>
<tr>
<td>Maintain good medical practice.</td>
<td>Keep knowledge base up to date.</td>
<td>Be able to discuss current medical practice with colleagues and patients.</td>
</tr>
<tr>
<td>Work in partnership with patients.</td>
<td>Be aware of different levels of patient understanding and personality types. To explain diagnostic and therapeutic radiology effectively. Exhibit a flexible approach taking into account different learning styles and expectations of patients.</td>
<td></td>
</tr>
<tr>
<td>Demonstrate good team working skills.</td>
<td>Understand the value of team working.</td>
<td>Demonstrate good communication with patients and professional colleagues.</td>
</tr>
<tr>
<td>Assure and improve the quality of care.</td>
<td>Be able to describe an effective clinical governance approach.</td>
<td>Participate in clinical governance processes e.g. clinical audit, guidelines development.</td>
</tr>
<tr>
<td>Develop teaching competencies.</td>
<td>Understand the principles of teaching and learning.</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor.</td>
</tr>
<tr>
<td>Demonstrate Probity.</td>
<td>Describe the areas embraced by probity.</td>
<td>Demonstrate clarity and honesty in record and document keeping.</td>
</tr>
</tbody>
</table>
Maintain Health. Understand the importance of personal health. Demonstrate a commitment to managing personal health.

Note “Good Medical Practice” 2006, GMC

13.3.1 Trainees will acquire experience in all the practical procedures listed above, and the number of cases undertaken will be recorded in their logbook. The techniques listed and the time devoted to each will be reviewed at intervals. It is recognised that some studies will become obsolete and new imaging techniques will be developed.

13.3.2 Regardless of the imaging technique or procedure concerned, the consultant trainer must be satisfied that the trainee is clinically competent, as determined by an in-training performance assessment, and can consistently interpret the results of investigations accurately and reliably and formulate correct management plans.

13.3.3 During the training period the following weekly sessional commitments are suggested as a work profile for special interest trainees. Trainees may follow a suitable work plan for a period of 6 to 24 months depending on their long term aims:

- MRI (one to three sessions)
- CT (half to one session)
- US (two to three sessions)
- Radionuclide imaging (half to one session)
- Plain film reporting (one to three sessions)
- Fluoroscopy with or without intervention (one to two sessions)

13.4 Appraisal

13.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

13.5 Assessment

13.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and sedation skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in the accurate interpretation of investigations for musculoskeletal diseases
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

13.6 Overall Review

13.6.1 Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
- It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
- The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum

13.6.2 Review of special interest curriculum

- The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current paediatric radiological practice.

June 2008
14 ACADEMIC RADIOLOGY – ADVANCED/SPECIAL INTEREST TRAINING CURRICULUM

14.1 Introduction

14.1.1 This curriculum outlines the special interest training requirements for specialty (Clinical Lectureship) training in academic radiology.

14.1.2 The special interest of academic radiology involves the further development of knowledge and skills related to the educational and research aspects of imaging, based on a solid background of clinical radiology.

14.1.3 Trainees who pursue academic radiology as an advanced special interest will have acquired a broad knowledge of academic radiology during core training. They will already have exhibited their interest in this area, usually by means of a higher degree and publications, and they will have acquired the relevant core skills.

14.1.4 The aim of special interest training in academic radiology is to enable the trainee to become competent in teaching and research, although it is accepted that some may concentrate more on one than the other. At the end of training in advanced academic radiology, the trainees should be eligible for a Senior Lectureship.

14.1.5 The period spent in training will vary according to the needs of the trainee. For a person wishing to pursue a career in academic radiology, the equivalent of around 24 months substantially devoted to the subject is recommended (at least 50% of their time dedicated to academic endeavours).

14.1.6 Trainees who plan to become academic radiologists should also continue training in a mixture of other activities within other special interests, probably related to their academic work. They should also maintain core radiological skills during this phase of their career.

14.1.7 The training scheme will arrange an attachment(s) that fulfils the requirements of the special interest curriculum as described in this document. The time devoted to academic matters and relevant mentoring and supervision must be sufficient for the trainees to gain the necessary experience for future independent practice as an academic radiologist.

14.1.8 Supervision and mentoring during training must be conducted by those who are appropriately skilled in academic matters and who have successfully completed training in the principles of equality and diversity, research governance, etc. Such skills will require refreshment from time to time.

14.1.9 If experience to fulfil the requirements of special interest training cannot be gained in one training centre, it will be necessary for the trainees to have one or more periods of attachment and research collaboration with other academic centres. There are, in any case, advantages for trainees in visiting other departments at home or abroad.

14.1.10 The expected outcome at the end of this special interest training will be that the trainee can pursue independent teaching and research as well as being competent in all areas covered in core training. It is also likely that such trainees will become competent in several areas within one or more system based special interests and in one or more radiological techniques (Ultrasound, CT, MRI, Radionuclide Radiology, Molecular Imaging, etc).

14.1.11 There will be continuing development of generic professional competencies

14.2 Overview of training

14.2.1 The main document, to which this appendix should be regarded as an attachment, Structured Training Curriculum for Clinical Radiology, outlines objectives, knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing
special interest training in academic radiology will be actively involved in teaching and research as well as in relevant system based and technique based radiology. All this needs to be provided within an educational environment with graduated supervision.

14.2.2 The training department must provide access to:

- appropriate imaging infrastructure – modern computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging (including PET/CT) and fluoroscopy.
- a wide range of clinical material
- adequate space and IT infrastructure for research and teaching

14.2.3 Detailed training in epidemiology, statistics, teaching methodology, grant writing, ethical submissions, research methodology and governance must be provided along with ready access to basic science departments (physics, engineering, molecular biology, etc). Indeed reciprocal teaching and training with young research workers in allied departments is much to be encouraged.

14.2.4 Clinical knowledge will continue to be acquired by a variety of means, including close liaison with appropriate clinical teams and attendance at clinicoradiological and multidisciplinary meetings. Such clinical interactions are extremely valuable for discussion and subsequent execution of research studies.

14.2.5 The trainee will be expected to attend appropriate educational meetings and courses and to access and develop relevant e-learning material.

14.2.6 The trainee will participate in relevant clinical audit, management, and clinical governance, and have a good working knowledge of local and national guidelines in relation to radiological practice.

14.2.7 The trainee will be encouraged and trained to participate fully in appropriate clinicoradiological and multidisciplinary meetings.

14.2.8 The trainee will contribute to the teaching programme of the training centre. They will provide appropriate clinical supervision of other healthcare professionals and develop competence as a clinical supervisor.

14.2.9 Trainees will be expected to be familiar with current radiological literature, especially in their areas of interest.

14.2.10 Presentation of research and audit results at national and international meetings will be expected, along with publication in appropriate journals.

14.2.11 The trainee will continue to participate in the trainee general on-call rota, with appropriate consultant back up.
14.3 **Principles of Academic Radiology**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Knowledge</th>
<th>Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the basis of preparing and executing a research proposal</td>
<td>Is familiar with the literature and searching techniques, ethical considerations, relevant methodology, including epidemiology and statistics.</td>
<td>Attention to detail, especially concerning: Data handling and calculations. Ethical committee submission. Interpretation of data.</td>
</tr>
<tr>
<td>Understands research governance</td>
<td>Knowledge of NHS and University Research Governance. Is familiar with principles enshrined by COPE on dual publication, gift authorship, etc. Registration and Sponsorship of projects. Data protection rules</td>
<td>Accurate and logical recording of data, interpretable to others. Awareness of probity issues. Awareness of patient rights.</td>
</tr>
<tr>
<td>To become experienced in presenting and publishing research work</td>
<td>Understanding of relevant research meetings and their proceedings. Knowledge of relevant journals, instructions to authors and impact factors. Understanding of peer review process</td>
<td>Presentation and communication skills. Critique and review of papers. Analytical and writing skills. Systematic reviews. Peer review.</td>
</tr>
<tr>
<td>Understands the importance of multidisciplinary research</td>
<td>Able to identify the key collaborators and gather together the necessary expertise.</td>
<td>Able to communicate effectively and work in a multidisciplinary team. Organise collaborative work.</td>
</tr>
<tr>
<td>Understands the different methods of teaching</td>
<td>Is familiar with problem based learning, small group teaching, seminars, teaching in the clinical environment</td>
<td>Prepare handouts. Ability to engage audience Seek views from quiet students Organise feedback Audio-Visual aids</td>
</tr>
<tr>
<td>Able to design a curriculum</td>
<td>Curriculum content Learning objectives Learning outcomes</td>
<td>Design of course Personal portfolio</td>
</tr>
<tr>
<td>Able to assess students</td>
<td>Summative and Formative Assessment Assessment reflecting learning outcomes</td>
<td>Cultural and diversity awareness Assessment of student performance</td>
</tr>
<tr>
<td>To understand assessment methodologies</td>
<td>MCQ design – single best answer OSCE design Case based discussion Mini CEX Electronic tests (web)</td>
<td>MCQ design – single best answer OSCE design Case based discussion Mini CEX Electronic tests (web)</td>
</tr>
<tr>
<td>To understand techniques of feedback and monitoring</td>
<td>How to handle feedback and complaints. Maintenance of confidentiality while discussion with other supervisors</td>
<td>Identify struggling students Provide feedback with tact</td>
</tr>
<tr>
<td>Objective</td>
<td>Knowledge</td>
<td>Skills</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Be able to explain a research project to a</td>
<td>Be able to discuss the relative risks and benefits of procedures</td>
<td>Obtain informed consent for a research project in a clear and effective manner</td>
</tr>
<tr>
<td>patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct good clinical care</td>
<td>Be aware of the limits of personal knowledge</td>
<td>Know when to seek further information or help</td>
</tr>
<tr>
<td>Maintain good medical practice</td>
<td>Keep knowledge base up to date</td>
<td>Be able to discuss current medical practice with colleagues and patients</td>
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<tr>
<td>Work in partnership with patients</td>
<td>Be aware of different levels of patient understanding and personality types</td>
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<td>Demonstrate good team working skills</td>
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<td>Assure and improve the quality of care</td>
<td>Be able to describe an effective clinical governance approach</td>
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<tr>
<td>Develop teaching competencies</td>
<td>Understand the principles of teaching and learning</td>
<td>Conduct teaching sessions in a quality assured training programme and develop competence as a clinical supervisor</td>
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<tr>
<td>Demonstrate Probity</td>
<td>Describe the areas embraced by probity</td>
<td>Demonstrate clarity and honesty in record and document keeping</td>
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<tr>
<td>Maintain Health</td>
<td>Understand the importance of personal health</td>
<td>Demonstrate a commitment to managing personal health.</td>
</tr>
</tbody>
</table>

Note “Good Medical Practice” 2006. GMC

14.4 Appraisal

14.4.1 Regular appraisal of the trainee will occur as described in the RCR Trainee Personal Portfolio. Appraisal will be conducted at the commencement of each attachment. An educational plan is required. Further appraisals are required at the mid point and end of rotation.

14.5 Assessment

14.5.1 Methods of trainee assessment will include:

- Regular direct observation of clinical techniques (including communication skills, ability to obtain informed consent and teaching skills) by the trainer and/or external observer
- Regular formal review of the trainee’s skills in teaching and research
- Team assessment of behaviour (TAB)
- A final assessment of overall professional competence before the final annual review of competence progression (ARCP).

14.6 Overall Review

14.6.1 Review of training programme

- It is expected that trainees will complete a feedback form (RCR Trainee Personal Portfolio) for each special interest training period undertaken
• It is expected that the training committee responsible for organising special interest training will review and analyse these feedback forms and act appropriately to ensure that training complies with the relevant special interest curriculum. The analysis and subsequent actions should be formally recorded.
• The relevant authorities will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum

14.6.2 Review of special interest curriculum

• The Education Board of the RCR will regularly review this special interest curriculum to ensure that it complies with current academic radiological practice.