

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.

Dr D R M Lindsell
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.¹ 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 Focused 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*²
- *Final Examination for the Fellowship in Clinical Radiology: Examination Syllabus*³
- *Regulations for Training in Clinical Oncology and Clinical Radiology*⁴
- *Regulations for the Examinations for the Fellowship of the Royal College of Radiologists in Clinical Radiology*⁵
- *Royal College of Radiologists. Training Accreditation in Clinical Radiology, Guidance Notes for Training Schemes*⁶

1.9.1 The previous version of this curriculum, *Structured Training in Clinical Radiology, 4th Edition* (London: The Royal College of Radiologists, 2004) remains applicable to those whose training began prior to 2007.

The following documents have been withdrawn:

- The Royal College of Radiologists (1991) *Basic Training in Clinical Radiology*. London: The Royal College of Radiologists
- The Royal College of Radiologists (1994) *Subspecialty Training in Clinical Radiology*. London: The Royal College of Radiologists
- The Royal College of Radiologists (1994) *Curriculum Framework for Training in Clinical Radiology*. London: The Royal College of Radiologists
- The Royal College of Radiologists (1995, 1999 and 2001) *Structured Training in Clinical Radiology*. London: The Royal College of Radiologists

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*).^[2]

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 Examination² 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 clinicroadiological 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 (eg 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
 - vesico-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 cavography
- inferior vena cavography

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 system-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.

8 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.

Focused 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.

9 References

- 1 Department of Health (1993) *Hospital Doctors: Training for the Future (The Calman Report)*. Report of the Working Group on Specialist training for Hospital Doctors. London: Health Publications Unit
- 2 The Royal College of Radiologists (2005) *First Examination for the Fellowship in Clinical Radiology: Examination Syllabus*. London: The Royal College of Radiologists
- 3 The Royal College of Radiologists (2005) *Final Examination for the Fellowship in Clinical Radiology: Examination Syllabus*. London: The Royal College of Radiologists
- 4 The Royal College of Radiologists (2001) *Regulations for Training in Clinical Oncology and Clinical Radiology*. London: The Royal College of Radiologists
- 5 The Royal College of Radiologists (2006) *Regulations for the Examinations for the Fellowship of The Royal College of Radiologists in Clinical Radiology*. London: The Royal College of Radiologists
- 6 The Royal College of Radiologists (2003) *The Royal College of Radiologists Training Accreditation in Clinical Radiology, Guidance Notes for Training Schemes*. London: The Royal College of Radiologists
- 7 The Royal College of Radiologists (2004) *Special Interest Training Curricula*. London: The Royal College of Radiologists
- 8 The Royal College of Radiologists (2006) *Communication Skills for Radiology Trainees*

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

Other Useful Information

Postgraduate Medical Education and Training Board. *Standards for Curricula*.

[http://www.pmetb.org.uk/media/pdf/i/a/PMETB_standards_for_curricula_\(March_2005\).pdf](http://www.pmetb.org.uk/media/pdf/i/a/PMETB_standards_for_curricula_(March_2005).pdf)

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<http://www.rcr.ac.uk/index.asp?PageID=165>

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http://www.mmc.nhs.uk/download_files/Overview-of-proposed-specialty-training-framework1.doc

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**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

1.1 Introduction

- 1.1.1 This curriculum outlines the special interest training requirements for both symptomatic and screening breast imaging (this special interest training may be undertaken in a modular fashion if it is advantageous to the trainee or training scheme). The special training requirements for those involved in the National Health Service Breast Screening Programme (NHSBSP) are also outlined in the *NHSBSP Quality Assurance Guidelines for Radiologists*.
- 1.1.2 All specialist registrars will have acquired a core knowledge of breast diagnosis during core training, mainly as an observer. The special interest training outlined will extend this role into the practical situation.
- 1.1.3 Those clinical radiologists who wish to devote the majority of their sessions to breast imaging as a consultant should normally undertake the equivalent of 12 months of special interest training in breast imaging.
- 1.1.4 Those clinical radiologists who wish to practise breast imaging as one of a mixture of activities as a consultant should normally undertake around 6 months of special interest training in breast imaging.

1.2 Objectives

- 1.2.1 The aim of establishing a curriculum for special interest training in breast imaging is to ensure that trainees acquire:
- knowledge of the relevant embryological, anatomical, pathophysiological and clinical aspects of breast diseases
 - an in-depth understanding of breast disease with a particular knowledge of the nature of breast cancer in all its guises
 - a clear understanding of the role of imaging in the early diagnosis of breast cancer
 - a clear understanding of the role of imaging in the management of benign breast disease
 - the necessary clinical and management skills to enable radiologists to become an integral part of a multidisciplinary breast team in both symptomatic and population screening settings
 - a clear understanding of the organisation and quality assurance aspects of the NHSBSP
 - the skills to enable effective communication with patients and colleagues
 - detailed knowledge of current developments in the special interest
 - direct practical exposure with appropriate graded supervision in all forms of breast imaging and intervention
 - knowledge and skills to enable safe practice of analgesia
 - a clear understanding of the central role of the multidisciplinary team in planning investigations and treatment, and in outcome review
- 1.2.2 The trainee should be fully competent in intermediate life-support.
- 1.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 1.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 1.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.

- 1.2.6 Those who will be involved in the NHSBSP are required to attend one of the national training centres.
- 1.2.7 The expected outcome at the end of this special interest training in breast imaging will be for the trainee to have become competent in the full range of breast imaging, reporting and associated procedures.

1.3 **Overview of training**

- 1.3.1 The main document, to which this section should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines core knowledge, skills and experience and optional experience acquired by all trainees. The trainee undergoing special interest training in breast imaging should ideally be actively involved in the work of the breast clinic within an educational environment with graduated supervision.
- 1.3.2 The training scheme must provide or arrange access to all appropriate imaging techniques.
- 1.3.3 The trainee needs to be involved in both symptomatic diagnosis and the process of breast cancer screening, and needs to have a clear understanding of the relationship between these two activities.
- 1.3.4 As training in breast diagnosis is a mixture of image interpretation and practical procedures, it is essential that the trainee is exposed to at least a minimum number of screening and symptomatic cases, as stated in the special interest curriculum.
- 1.3.5 The trainee will gain clinical knowledge and experience by participating in breast symptomatic clinics, assessment clinics in the NHSBSP and the regular multidisciplinary meetings with the breast team.
- 1.3.6 The sensitive nature of breast imaging and its potential for the diagnosis of serious disease, requires development of strong communication skills, so that the patient can gain insight into the investigation process and outcome.
- 1.3.7 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 1.3.8 The trainee should be encouraged and funded to attend appropriate educational meetings and courses.
- 1.3.9 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.
- 1.3.10 Trainees will be expected to be familiar with current breast radiology literature.
- 1.3.11 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.
- 1.3.12 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

1.4 **Requirements of special interest training**

- 1.4.1 A comprehensive understanding of the basis of breast diagnosis, including:
- 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
- 1.4.2 Knowledge of the full range of diagnostic techniques available, in particular:
- the indications, contra-indications and complications of each imaging method
 - the factors affecting the choice of contrast media and radiopharmaceuticals
 - the effects and side effects of these agents
- Particular emphasis should be placed on 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.
- 1.4.3 Acquisition of specific skills to enable:
- the conduct, supervision and accurate interpretation of all imaging techniques used in investigation of breast diseases, to a high professional standard
 - the accurate localisation and biopsy of breast masses
 - good communication with patients and professional colleagues including:
 - attendance at a suitable course in communication skills, if this is not addressed locally
 - the development and practice of communication skills
 - accurate and informed consent to be obtained
 - continuing accreditation of life-support status
- 1.4.4 A clear understanding of the role of multidisciplinary meetings, including:
- planning of investigations including the selection of appropriate tests and imaging techniques for the diagnosis of benign and malignant disease
 - staging of malignant disease
 - planning and outcomes of treatment
 - the detection of errors in diagnosis and complications of treatment
 - an understanding of relevant breast pathology
- 1.4.5 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. During the training period it is recommended that the trainee obtains experience in the following:
- mammographic principles, grid and film screen combinations
 - equipment choice for screening and assessment
 - radiographic positions, coned and magnification views
 - specimen radiography
 - radiation dose and patient risk-benefit factors
 - ultrasound (US) imaging
 - scintimammography plus sentinel node imaging
 - magnetic resonance imaging (MRI)
 - digital imaging
- 1.4.6 Detailed and extensive experience in imaging of the breast, including an understanding of: early mammographic evidence of malignant disease
- normal variants
 - the role of US, radionuclide and MRI
- 1.4.7 A trainee will keep abreast of all other imaging techniques relevant to their practice.
- 1.4.8 Expertise in breast interventional techniques including:
- aspiration of cysts
 - fine needle aspiration cytology using stereotaxis and US
 - stereotactic core biopsy

- US-guided core biopsy
 - mammographic and US-guided localisation for biopsy and treatment
- 1.4.9 Knowledge of the organisation of breast cancer services including:
- the structure of the NHSBSP
 - the principles of triple assessment and rapid diagnosis clinics
 - cancer units and cancer centres
 - the role of the Programme Manager and the Clinical Director
 - the interface between screening and symptomatic services
 - NHSBSP Quality Assurance Guidelines for Radiologists
 - NHSBSP Clinical Guidelines for Breast Cancer Screening Assessment
- 1.4.10 Recommended minimum experience per month for training in breast screening:
- interpretation of screening mammograms—500 cases
 - experience of mammographic procedures—12 cases
 - experience of US procedures—12 cases
 - involvement in assessment clinics—4 clinics
 - attendance at multidisciplinary meetings—3 meetings
- 1.4.11 Recommended minimum experience per month for training in symptomatic breast disease:
- interpretation of symptomatic cases—60 cases
 - experience of mammographic procedures—5 cases
 - experience of US procedures—5 cases
 - involvement in triple assessment clinics—4 clinics
 - attendance at multidisciplinary meetings—2 meetings
 - attendance at surgical procedures
- 1.4.12 Trainees should acquire experience in all the practical procedures listed above, and the number of cases undertaken should be recorded in their log book.
- 1.4.13 Regardless of the imaging technique 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.
- 1.4.14 The trainee should become familiar with provision of analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.
- 1.4.15 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.

1.5 **Appraisal and assessment**

- 1.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.
- 1.5.2 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
 - a final assessment of overall professional competence before the final record of in-training assessment (RITA) review
- 1.5.3 Review of training programme
- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

1.5.4 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 breast imaging radiological practice.

2 Cardiac Radiology

2.1 Introduction

- 2.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in cardiac radiology.
- 2.1.2 All specialist registrars in clinical radiology will have core knowledge of cardiac imaging during core training and will already have acquired the core skills.
- 2.1.2 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in cardiac radiology, a period of around 12 months substantially devoted to the subject is recommended.
- 2.1.2 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. Where appropriate, trainees should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.
- 2.1.2 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) should normally undertake 6 months of special interest training in cardiac radiology.

2.2 Objectives

- 2.2.1 The aim of establishing a curriculum for special interest training in cardiac radiology is to ensure that trainees acquire:
- knowledge of the relevant embryological, anatomical, pathophysiological, biochemical and clinical aspects of cardiac disease
 - an in-depth understanding of the major imaging techniques relevant to cardiac disease
 - an in-depth understanding of the use of potentially hazardous techniques (e.g., angiography) and substances (e.g., adenosine, dobutamine, iodinated contrast media)
 - clinical knowledge relevant to cardiology so that the trainee may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician
 - detailed knowledge of current developments in the special interest
 - direct practical exposure with appropriate graded supervision in all forms of cardiac imaging and intervention
 - knowledge and skills to enable safe practice of analgesia and sedation
- 2.2.2 The trainee should be fully competent in intermediate and advanced life-support. Formal ALS certification should be considered.
- 2.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 2.2.4 The training scheme should arrange an attachment that fulfils all the requirements of the special interest curriculum.
- 2.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.
- 2.2.6 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for cardiac problems, supervise (and perform where appropriate) the appropriate examination(s) and accurately report on the examination findings. The trainee should be competent in all aspects of cardiac imaging and (where appropriate) intervention.

2.3 Overview of training

- 2.3.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines the core knowledge and skills acquired during core training, together with the optional experience, in which practical experience is not essential but a theoretical knowledge is required. The trainee undergoing special interest training should ideally be actively involved in cardiac imaging within an educational environment with graduated supervision.
- 2.3.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), echocardiography, radionuclide imaging and digital angiography. Centres should also provide access to specialised relevant radionuclide imaging [including positron emission tomography (PET)].
- 2.3.3 Clinical knowledge will be acquired by a variety of means, including close liaison with the appropriate surgical and medical teams and combined clinico-radiological conferences. The following clinical inter-relationships are desirable:
- cardiology (adult and paediatric)
 - cardiac surgery (adult and paediatric)
 - cardiac pathology
 - cardiac anaesthesia/critical care and emergency medicine
- 2.3.4 In order to further clinical knowledge relevant to the special interest it may be appropriate for the trainee to have a regular attachment to:
- cardiac out-patient clinics
 - cardiac ward rounds
 - cardiac care units
 - theatre sessions
- The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological meetings.
- 2.3.5 The trainee should be encouraged to attend appropriate educational meetings and courses.
- 2.3.6 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.
- 2.3.7 Trainees will be expected to be familiar with current cardiac radiology literature.
- 2.3.8 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.
- 2.3.9 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

2.4 Requirements of special interest training

- 2.4.1 A sound understanding of the basis of cardiac imaging including:
- the embryology, anatomy, normal variants and physiology of the cardiovascular system
 - the pathological processes of both benign and malignant processes involving the cardiovascular system
 - the epidemiology of cardiac diseases
 - local, national and where appropriate, international imaging guidelines

- 2.4.2 Knowledge of the full range of radiological diagnostic techniques available, in particular:
- the indications, contra-indications and complications of each imaging method
 - the factors affecting the choice of contrast media and radiopharmaceuticals
 - the effects and side effects of these agents

Particular emphasis should be placed on 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.

- 2.4.3 Acquisition of specific skills to enable:
- the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation of cardiac diseases to a high professional standard
 - where appropriate the safe and effective practice of interventional techniques
 - good communication with patients and professional colleagues
 - accurate informed consent to be obtained
 - continuing accreditation of life-support status

- 2.4.4 A clear understanding of the role of multidisciplinary meetings, including:
- planning of investigations including the selection of appropriate tests and imaging techniques for the diagnosis and treatment of cardiac disease
 - planning and outcomes of treatment
 - the detection of errors in diagnosis and complications of treatment
 - an understanding of relevant cardiac pathology

- 2.4.5 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; these numbers will vary from trainee to trainee. During the training period (6–12 months) the trainee should, in patients suffering from all forms of cardiac disease, gain experience in the following techniques:

- plain radiography
- cardiac ultrasound including Doppler echocardiography (150–350)
- CT (50–100)
- magnetic resonance (50–100)
- coronary angiography (100–200)
- nuclear medicine (100–200)

The range of numbers of procedures in parentheses provide guidance as to what might be expected for someone developing more than one special interest up to that which might be expected for a trainee aiming to become a dedicated cardiac radiologist.

- 2.4.6 A trainee will keep abreast of all other imaging techniques relevant to their practice.

- 2.4.7 Trainees may also wish to acquire experience in the following interventional technique:
- coronary angioplasty and stenting

- 2.4.8 Trainees should acquire experience in all the practical procedures listed above, and the number of cases undertaken should be recorded in their log book.

- 2.4.9 Regardless of the imaging technique 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.

- 2.4.10 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:

- chest x-ray film interpretation (one session)
- echocardiography (one session)
- cardiac CT and MRI (two sessions)

- coronary angiography/left and right heart catheterisations (one session)
- nuclear cardiology (one session)
- the remaining four sessions per week would be used to maintain experience in general radiology according to departmental service requirements, study and research

2.4.11 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.

2.4.12 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.

2.4.13 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.

2.5 **Appraisal and assessment**

2.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.

2.5.2 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
- a final assessment of overall professional competence prior to the final record of in-training assessment (RITA) review

2.5.3 Review of training programme

- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

2.5.4 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 cardiac radiological practice.

3 Gastrointestinal and Abdominal Radiology

3.1 Introduction

- 3.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in gastrointestinal (GI) and abdominal radiology.
- 3.1.2 Specialist registrars in clinical radiology should have undergone limited training during core training and will already have acquired the core skills.
- 3.1.3 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in GI and abdominal radiology, the equivalent of around 12 months substantially devoted to the subject is recommended.
- 3.1.4 The aim of special interest training in GI and abdominal radiology is to enable the trainee to become clinically competent and to consistently interpret the results of GI and abdominal investigations accurately and reliably. Where appropriate, trainees should also be capable of providing a safe interventional diagnostic and therapeutic service.
- 3.1.5 Those clinical radiologists who plan to practise GI and abdominal radiology as one of a mixture of activities (albeit that GI and abdominal radiology will be a particular responsibility within those activities) should normally undertake around 6 months of special interest training in GI and abdominal radiology.
- 3.1.6 GI and abdominal radiology is a broad special interest. Trained radiologists in GI and abdominal radiology have a wide and varied practice ranging from the undertaking of fluoroscopic examinations of the GI tract through complex cross-sectional imaging to interventional procedures. Some radiologists may wish to add GI endoscopy to their skills, including complex hybrid radiological/endoscopic procedures such as endoscopic retrograde cholangiopancreatography (ERCP) and endoscopic ultrasound (US).
- 3.1.7 The curriculum recognises this varied and wide range of practice. It also recognises that it is unlikely that any one radiologist will cover, in training or in practice, the whole breadth of the special interest.
- 3.1.8 The curriculum outlines a modular approach to special interest training in GI and abdominal radiology. Training modules can be selected in order to allow each individual radiologist to define his/her own training and practice needs within the special interest.
- 3.1.9 It is appropriate for the practice of a GI and abdominal radiologist to be trained in both a technique-based (e.g., cross-sectional imaging) and a system based (e.g., hepatobiliary radiology) manner.
- 3.1.10 The curriculum recognises the overlap between GI and abdominal radiology and other special interest areas with their own training curricula (interventional radiology, genitourinary, etc.).
- 3.1.11 Some training modules may be undertaken concurrently (e.g., interventional GI radiology and endoscopy).

3.2 Objectives

- 3.2.1 The aim of establishing a curriculum for special interest training in GI and abdominal radiology is to ensure that trainees acquire:
- knowledge of the relevant embryological, anatomical, pathophysiological, biochemical and clinical aspects of GI and abdominal disease
 - an in-depth understanding of the major imaging techniques relevant to GI and abdominal disease
 - an in-depth knowledge of the indications, contra-indications, complications and limitations of surgical, medical and radiological interventions and procedures

- clinical knowledge relevant to medical and surgical gastroenterology and hepatology so that the trainee may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician
 - a detailed knowledge of current developments in the special interest
 - direct practical exposure with appropriate graded supervision in all forms of GI and abdominal imaging and intervention
 - knowledge and skills to enable safe practice of analgesia and sedation
- 3.2.2 The trainee should be fully competent in intermediate life-support. Formal ALS certification should be considered.
- 3.2.3 Those practising GI and abdominal radiology must acquire and maintain an integral knowledge of diseases and their management in non-GI systems, especially genitourinary and gynaecological disease.
- 3.2.4 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 3.2.5 The training scheme should arrange an attachment(s) that fulfil the requirements of the special interest curriculum.
- 3.2.6 If the experience to fulfil the requirements of special interest training cannot be gained in one training 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 in the UK or abroad to follow particular interests in greater depth.
- 3.2.7 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for GI and abdominal problems, supervise (and perform where appropriate) the relevant examinations and accurately report on the findings. The trainee should become competent in appropriate GI and abdominal imaging and relevant intervention.

3.3 Overview of training

- 3.3.1 The main document, to which this section should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines the core knowledge, skills and experience acquired during core training, together with optional experience, in which practical experience is not essential but a theoretical knowledge is required. The trainee undergoing special interest training should ideally be actively involved in GI and abdominal imaging within an educational environment with graduated supervision.
- 3.3.2 A training scheme responsible for providing special interest training in GI and abdominal radiology should provide access to appropriate fluoroscopy, computed tomography (CT), magnetic resonance imaging (MRI), US, endoscopy, radionuclide imaging and digital angiography.

For those who wish to undertake complex procedural and interventional GI and abdominal radiology tasks, it is essential that trainees are:

- exposed to an appropriate range of such procedures
- the first or sole operator in around 50% of these

This will ensure that the necessary skills, manual dexterity and experience of the most common complications (including their management) are acquired.

- 3.3.4 Clinical knowledge will be acquired by a variety of means, including close liaison with the appropriate surgical and medical teams, together with participation in combined clinical and radiological meetings. Attendance at appropriate multidisciplinary meetings should be facilitated.

- 3.3.5 It may be appropriate for the trainee to have a regular clinical attachment to outpatient clinics, ward rounds and surgical procedures in order to further clinical knowledge relevant to the special interest.
- 3.3.6 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological meetings.
- 3.3.7 The trainee should be encouraged and funded to attend appropriate educational meetings and courses.
- 3.3.8 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.
- 3.3.9 Trainees will be expected to be familiar with current GI and abdominal radiology literature.
- 3.3.10 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.
- 3.3.11 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

3.4 **Requirements of special interest training**

- 3.4.1 A trainee should have a comprehensive knowledge of normal GI and hepatobiliary function and diseases, including:
 - the embryology, anatomy, normal variants and pathophysiology relevant to GI and hepatobiliary function
 - the pathology of benign and malignant GI and hepatobiliary and pancreatic conditions
 - the epidemiology of GI and hepatobiliary and pancreatic diseases
 - the principles of population screening for colorectal cancer
 - local, national and where appropriate, international imaging guidelines

- 3.4.2 Knowledge of the full range of radiological diagnostic techniques available, in particular:
 - the indications, contra-indications and complications of each imaging method
 - the factors affecting the choice of contrast media and radiopharmaceuticals
 - the effects and side effects of these agents

Particular emphasis should be placed on 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.

- 3.4.3 Acquisition of specific skills to enable:
 - the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation of GI and hepatobiliary diseases, to a high professional standard
 - the accurate localisation and biopsy of hepatic, abdominal, pelvic and lymph node masses
 - good communication with patients and professional colleagues
 - obtaining accurate and informed consent
 - continuing accreditation of life-support status
- 3.4.4 A clear understanding of the role of multidisciplinary meetings, including:
 - planning of investigations including the selection of appropriate tests and imaging techniques for the diagnosis of benign and malignant disease

- staging of malignant disease
- planning and outcomes of treatment
- the detection of errors in diagnosis and complications of treatment
- an understanding of relevant GI and abdominal pathology

3.4.5 All special interest trainees, irrespective of the components of their modular training, should have an understanding of the total breadth of this special interest.

3.4.6 Knowledge of the techniques involved in all imaging and interventional procedures used in evaluating and treating GI and hepatobiliary diseases, including managing the complications of these procedures.

3.4.7 Procedural competence will need to be reviewed at intervals, this regular review should also assess the number of cases required to ensure competence. During the training period it is recommended that the trainee obtains experience in the following:

Plain radiography and fluoroscopic contrast studies including:

- primary care examinations
- intubation techniques for small bowel studies
- intensive care and high dependency unit examinations
- the acute abdomen
- abdominal trauma
- ERCP
- intra-operative examinations
- proctography and related studies

US, CT and MRI of the abdomen and GI system including the relevant role of each in:

- the staging of GI and hepatobiliary cancers
- the investigation of hepatobiliary and abdominal trauma
- other hepatobiliary abnormalities
- oesophageal abnormalities
- gastric abnormalities
- small bowel abnormalities
- large bowel abnormalities
- pancreatic abnormalities
- identification and categorisation of diffuse liver disease
- staging of pelvic malignancy
- pelvic floor disorders
- renal and adrenal abnormalities

Radionuclide radiology including:

- localisation of GI bleeding
- localisation of tumours and metastases

Optional radionuclide studies:

- positron emission tomography (PET)

3.4.8 A trainee will keep abreast of all other imaging techniques relevant to their practice.

Interventional techniques.

All trainees should acquire experience in the following procedures:

- biopsy of hepatic, abdominal and pelvic lesions and lymph node masses
- drainage of hepatobiliary, intra-abdominal and intra-pelvic collections

Depending on the long-term aims of the trainee, experience should also be acquired in a range of the following optional procedures:

- percutaneous transhepatic cholangiography
- biliary stenting
- endoscopy, endoscopic biopsy and ERCP

- colonoscopy and biopsy
 - endoscopic US
 - oesophageal and colonic stenting
 - TIPSS procedures
 - angiographic techniques in relation to GI and hepatobiliary disease
 - radiofrequency ablation of tumours
- 3.4.10 Trainees should acquire experience in a selection of the practical procedures listed above, depending on their career pathway, and the number of cases undertaken should be recorded in their log book.
- 3.4.11 The duration of each training module can be variable. It will be necessary for the trainee to demonstrate that he/she has trained to a level of competence that will comply with the standards set out in the training portfolio. Some training curricula suggest a minimum number of procedures to be completed (e.g., GI endoscopy, interventional radiology). For individuals who will undertake full time GI and abdominal radiology work, a guide to the recommended numbers of interventional procedures is provided in the gastro-intestinal section of the interventional curriculum (5.4.14). This section also indicates the numbers that might be expected for someone training in more than one special interest.
- 3.4.12 Regardless of the imaging technique 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.
- 3.4.13 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.
- 3.4.14 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.
- 3.4.15 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.

3.5 **Appraisal and assessment**

- 3.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.
- 3.5.2 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 GI and abdominal diseases
 - a final assessment of overall professional competence prior to the final record of in-training assessment (RITA) review
- 3.5.3 Review of training programme
- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

3.5.4 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 GI and abdominal radiological practice.

4 Head and Neck Radiology

4.1 Introduction

- 4.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in head and neck radiology.
- 4.1.2 All specialist registrars will have acquired core knowledge of head and neck imaging during core training and will already have acquired the core skills.
- 4.1.3 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 around 12 months substantially devoted to the subject is recommended.
- 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 should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.
- 4.1.5 Those clinical radiologists who plan to practice with 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) should normally undertake around 6 months of special interest training in head and neck radiology.

4.2 Objectives

- 4.2.1 The aim of establishing a curriculum for special interest training in head and neck radiology is to ensure that trainees acquire:
- knowledge of the relevant embryological, anatomical, pathophysiological and clinical aspects of diseases of the head and neck
 - an in-depth understanding of the major imaging investigations relevant to diseases of the head and neck
 - an in-depth knowledge of the indications, contra-indications, complications and limitations of surgical, medical and radiological interventions and procedures
 - clinical knowledge relevant to medical and surgical management of head and neck diseases such that the trainee may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician
 - detailed knowledge of current developments in the special interest
 - direct practical exposure with appropriate graded supervision in all forms of head and neck imaging and intervention
 - knowledge and skills to enable safe practice of analgesia and sedation
- 4.2.2 The trainee should be fully competent in intermediate life-support.
- 4.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 4.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 4.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.
- 4.2.6 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for major head and neck problems, supervise (and perform where appropriate) the examination and accurately report on the findings. The trainee should be competent in all aspects of head and neck imaging and intervention.

4.3 Overview of training

- 4.3.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines core knowledge and skills and optional experience acquired during core training. The trainee undergoing special interest training should ideally be actively involved in head and neck imaging within an educational environment with graduated supervision.
- 4.3.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US) and fluoroscopy. Centres should also provide access to relevant radionuclide radiology [including positron emission tomography (PET)].
- 4.3.3 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 cancer meetings should be emphasised. The following inter-relationships are important:
- head and neck surgery (including ear nose and throat and maxillo-facial 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.
- 4.3.4 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 4.3.5 The trainee should be encouraged to attend appropriate educational meetings and courses.
- 4.3.6 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.
- 4.3.7 Trainees will be expected to be familiar with current head and neck radiology literature.
- 4.3.8 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.
- 4.3.9 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

4.4 Requirements of special interest training

- 4.4.1 A sound understanding of the basis of head and neck imaging including 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) and routes of lymph node spread from head and neck disease
 - anatomical routes for the spread of disease between the neck and chest, and between the neck and skull base/intracranial structures

- the pathological processes of both benign and malignant disease in the head and neck region
- local, national and where appropriate, international imaging guidelines

4.4.2 Knowledge of the full range of radiological diagnostic techniques available, in particular:

- the indications, contra-indications and complications of each imaging method
- the factors affecting the choice of contrast media and radiopharmaceuticals
- the effects and side effects of these agents

Particular emphasis should be placed on 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.

4.4.3 Acquisition of specific skills to enable:

- the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation of head and neck diseases to a high professional standard
- the accurate localisation and the biopsy of neck masses and lymph nodes
- where appropriate the safe and effective practice of interventional techniques
- good communication with patients and professional colleagues
- detailed informed consent to be obtained
- continuing accreditation of basic life-support status

4.4.4 A clear understanding of the role of multidisciplinary meetings, including:

- planning of investigations including the selection of appropriate tests and imaging techniques for the diagnosis of benign and malignant disease
- staging of malignant disease
- planning and outcomes of treatment
- the detection of errors in diagnosis and complications of treatment
- promoting an understanding of relevant head and neck pathology

4.4.5 Procedural competence will need to be reviewed at intervals, and this regular review should also assess the number of cases required to ensure competence. During the training period it is recommended that the trainee obtains experience in the following:

- plain radiography
- sialography
- dacryocystography
- ultrasonography, including Doppler
- CT of the head and neck including:
 - the use of CT for the primary diagnosis of benign and malignant head and neck lesions
 - staging of head and neck tumours
 - detection of skull base and intracranial extension of head and neck tumours
- MRI of the head and neck
 - the use of MRI for the primary diagnosis of benign and malignant head and neck lesions
 - staging of head and neck tumours
 - detection of skull base and intracranial extension of head and neck tumours
 - demonstration of cranial nerve and other intracranial disease resulting in head and neck symptoms
- upper gastrointestinal contrast studies including:
 - contrast medium swallow
 - videofluorography
- nuclear medicine

4.4.6 A trainee will keep abreast of all other imaging techniques relevant to their practice.

4.4.7 Interventional techniques.

Trainees should acquire experience in the following procedures:

- US-guided biopsy of masses and lymph nodes
 - CT-guided biopsy of masses and lymph nodes
 - where appropriate and available, MRI-guided biopsy of masses and lymph nodes
 - drainage of collections
 - cannulation and dilatation of salivary and lacrimal ducts
- 4.4.8 Regardless of the imaging technique or procedure, 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.
- 4.4.9 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:
- MRI – one to two sessions
 - CT – one to two sessions
 - US – one to two sessions
 - fluoroscopic and/or interventional procedures – one session. More than one session may be required if a particular interest is to be developed, for example sialoplasty or calculus extraction techniques
 - nuclear medicine – Some experience of nuclear medicine techniques including PET should be acquired during the course of the training. This may take the form of a dedicated session depending on the trainee’s interests. Combined CT/PET is likely to become increasingly important and the head and neck radiologist should be adequately trained to be involved with this technique
- 4.4.10 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.
- 4.4.11 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.
- 4.4.12 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.
- 4.5 **Appraisal and assessment**
- 4.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.
- 4.5.2 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 head and neck diseases
 - a final assessment of overall professional competence before the final record of in-training assessment (RITA) review
- 4.5.3 Review of training programme
- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

4.5.4 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 head and neck radiological practice.

5 Interventional Radiology

5.1 Introduction

- 5.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in interventional radiology.
- 5.1.2 This document aims to outline a curriculum for training in general interventional radiology, concentrating on vascular, gastrointestinal (GI) and urological intervention, thus covering most of the procedures carried out by interventional radiologists. Interventional procedures in other organ systems are excluded as they have special requirements, and will be addressed as appropriate in the training documents of other special interests.. Biopsy and fluid collection drainage techniques are practised by all radiologists and are not addressed in this curriculum.
- 5.1.3 Specialist registrars in clinical radiology will have undergone training in interventional procedures during core training and will already have acquired the core skills.
- 5.1.4 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise 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.
- 5.1.5 The aim of special interest training in interventional radiology is to enable the trainee to become clinically competent and to consistently interpret the results of invasive investigations accurately and reliably. The trainee should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.
- 5.1.6 Those clinical radiologists who plan to practise interventional radiology as one of a mixture of activities should normally undertake around 12 months of special interest training in interventional radiology.
- 5.1.7 The interventional radiology experience acquired during core training will count towards the total experience of special interest training in interventional radiology.

5.2 Objectives

- 5.2.1 The aim of establishing a curriculum for special interest training in interventional radiology is to ensure:
- knowledge of the relevant embryological, anatomical, pathophysiological and clinical aspects of diseases involving the cardiovascular, GI, hepatobiliary and urogenital systems
 - an in-depth understanding of the major imaging investigations relevant to diseases of the cardiovascular, GI, hepatobiliary and urogenital systems
 - in-depth understanding of indications, contraindications and complications of interventional procedures as well as their relative efficacy compared with other treatment options
 - clinical knowledge relevant to medical and surgical management of diseases such that the trainee may confidently discuss the appropriate imaging strategy and/or interventional technique for the clinical problem with the referring clinician
 - detailed knowledge of current developments in the special interest
 - extensive direct practical exposure with appropriate graded supervision in all forms of appropriate intervention
 - knowledge and skills to enable safe practice of intervention, including analgesia and sedation
- 5.2.2 The trainee should be fully competent in intermediate and advanced life-support. Formal ALS certification should be considered.

- 5.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 5.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 5.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.
- 5.2.6 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy to demonstrate the relevant abnormalities, supervise (and perform where appropriate) the examination(s) and accurately report on the findings. The trainee should also be able to select the appropriate intervention and where required, be capable of carrying out that intervention safely to a successful conclusion.

5.3 Overview of training

- 5.3.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines core knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training should ideally be actively involved in interventional radiology within an educational environment with graduated supervision.
- 5.3.2 For training purposes interventional radiology can be divided into vascular and non-vascular procedures. Whether a trainee trains in all intervention, or selects either vascular or non-vascular intervention, depends on their ultimate goal.
- 5.3.3 The training department must provide access to appropriate computed tomography (CT), MR, ultrasound (US), fluoroscopy, digital subtraction angiography and relevant radionuclide imaging.
- 5.3.4 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 should be emphasised. The following inter-relationships are important:
 - vascular surgery
 - urology
 - nephrology
 - gastroenterology
 - general surgery
 - oncology and haematology
- 5.3.5 It may be appropriate for the trainee to have a regular attachment to ward rounds, outpatient clinics and theatre sessions in order to further clinical knowledge relevant to the special interest.
- 5.3.6 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 5.3.7 The trainee should be encouraged to attend appropriate educational meetings and courses.
- 5.3.8 The trainee should participate in and initiate relevant clinical audit.
- 5.3.9 Trainees will be expected to be familiar with current interventional radiology literature.
- 5.3.10 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.

- 5.3.11 The trainee should continue to participate in the specialist registrar on-call rota, with appropriate consultant back-up.
- 5.3.12 As training in interventional radiology is predominantly hands-on, it is essential that trainees are exposed to at least a minimum number of procedures and that they are the first or sole operator in around 50% of these. This is to ensure that they develop the necessary manual dexterity and experience the most common complications and how to rectify them.
- 5.3.13 Special interest training in interventional radiology is assessed and accredited by the Training Accreditation Committee (TAC) and approved by the RCR.

5.4 Requirements of special interest training

- 5.4.1 The core requirements for a radiologist working essentially full-time in interventional radiology, and a radiologist doing a mixture of activities one of which is interventional radiology, are similar apart from the total number of procedures performed. The numbers quoted are approximate but are considered achievable in the time given and will ensure a satisfactory level of experience.
- 5.4.2 All trainees require a sound understanding of the basis of interventional radiology including:
 - the embryology, anatomy, normal variants and physiology of the appropriate body system(s)
 - the current interventional equipment used including:
 - percutaneous access needles and kits
 - catheters and guidewires
 - dilating devices
 - stents
 - embolisation materials
 - specific techniques of access to and therapeutic intervention within various organs and structures
 - local, national and where appropriate, international imaging and interventional guidelines
- 5.4.3 Knowledge of the full range of radiological diagnostic and therapeutic techniques available, in particular:
 - the indications, contra-indications and complications of each method
 - the factors affecting the choice of equipment, contrast media and route of approach
 - the effects and side-effects of these methods

Particular emphasis should be placed on the strengths and weaknesses of the different methods in various pathological conditions. The appropriate choice of imaging and interventional techniques in the investigation and treatment of specific clinical problems should be emphasised.

- 5.4.4 The trainee is expected to keep abreast of other imaging techniques relevant to their practice.
- 5.4.5 Acquisition of specific skills to enable:
 - the conduct, supervision and accurate interpretation of all imaging techniques used to a high professional standard
 - the safe and effective practice of interventional techniques in the appropriate body system(s)
 - good communication with patients and professional colleagues
 - accurate informed consent to be obtained
 - continuing accreditation of life-support status
 - appropriate decisions about terminating the procedure for technical reasons or grounds of safety/comfort to the patient

- 5.4.6 A clear understanding of the role of multidisciplinary meetings, including:
- planning of investigations including the selection of appropriate tests and imaging techniques for a clinical problem
 - planning and outcomes of treatment
 - the detection of errors in diagnosis and complications of treatment
 - promoting an understanding of relevant pathology
- 5.4.7 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.
- 5.4.8 Radiologists who devote essentially all their time to interventional radiology will be expected to undertake a wide range of complex procedures. Acquisition of the necessary expertise requires such trainees to undertake a proportionately larger number of interventional procedures.
- 5.4.9 All interventional radiologists must have a thorough knowledge of the techniques required to perform sedation and analgesia procedures, as well as patient monitoring throughout and following the procedures, and should be familiar with existing guidelines.
- 5.4.10 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.
- 5.4.11 The groupings that follow are based on the concept of modular training, and the numbers for the more routine procedures (in parentheses) range from what might be expected as a guide for someone with more than one special interest up to that which might be expected for a dedicated interventional radiologist. The lists of procedures are by no means exhaustive and certain trainees may expand their repertoire to include certain musculoskeletal (e.g., vertebroplasty) and other techniques.
- 5.4.12 Special interest training in vascular interventional radiology
- Core
- diagnostic arteriography (50–150)
 - percutaneous angioplasty (65–130)
 - percutaneous central venous access (10–20)
 - thrombolysis
 - intraventricular catheter filter insertion
 - embolisation
 - vascular stent insertion
 - alternative arterial access (e.g., axilla)
- Optional
- foreign body retrieval
 - aspiration thrombectomy
 - peripheral aneurysm exclusion
 - transjugular intrahepatic portosystemic shunt
 - chemoembolisation
 - aortic stent grafting (thoraco-abdominal)
 - coronary interventional procedures
- 5.4.13 Uroradiological intervention
- Core
- renal tract access - e.g., nephrostomy (20–40)
 - ureteric dilatation/stent insertion (5–10)
 - renal biopsy/cyst aspiration (5–10)
 - drainage of collections
- Optional
- nephrolithotomy
 - varicocele embolisation

- fallopian tube recanalisation
- miscellaneous, PUJ procedures, etc.
- transrectal prostate biopsy (20–40)

5.4.14 Gastrointestinal intervention

Core

- GI dilatations and stents (10–20)
- percutaneous gastrostomy (5–10)
- transjugular/plugged liver biopsy (5–10)

Optional

- percutaneous biliary drainage procedures and/or stent insertion
- endoscopic procedures

5.4.15 Trainees should acquire experience in the practical procedures listed above, and the number of cases undertaken should be recorded in their log book.

5.4.16 Regardless of the technique, 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 can safely perform interventional techniques.

5.5 Appraisal and assessment

5.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.

5.5.2 Methods of trainee assessment will include:

- regular direct observation of clinical techniques (including communication skills, manual dexterity, 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
- a final assessment of overall professional competence prior to the final record of in-training assessment (RITA) review

5.5.3 Review of training programme

- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR TAC will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum

5.5.4 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 interventional radiological practice.

6 Musculoskeletal Radiology

6.1 Introduction

- 6.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in musculoskeletal radiology.
- 6.1.2 The content of the special interest 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.
- 6.1.3 All specialist registrars will have acquired core knowledge of musculoskeletal imaging during core training and will already have acquired the core skills.
- 6.1.4 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 months substantially devoted to the subject is recommended.
- 6.1.5 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 should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.
- 6.1.6 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) should normally undertake around 6 months of special interest training in musculoskeletal radiology.

6.2 Objectives

- 6.2.1 The aim of establishing a curriculum for special interest training in musculoskeletal radiology is to ensure that trainees acquire:
- knowledge of the relevant embryological, anatomical, pathophysiological and clinical aspects of diseases affecting the musculoskeletal system
 - an in-depth understanding of the major imaging techniques relevant to the musculoskeletal system
 - an in-depth knowledge of the indications, contra-indications, complications and limitations of surgical, medical and radiological interventions and procedures
 - clinical knowledge relevant to medical and surgical management of musculoskeletal diseases such that the trainee may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician
 - detailed knowledge of current developments in the special interest
 - an understanding of the value of a multidisciplinary approach to diagnosis and management in musculoskeletal disorders
 - direct practical exposure with appropriate graded supervision in all forms of musculoskeletal imaging and intervention
 - knowledge and skills to enable safe practice of analgesia and sedation
- 6.2.2 The trainee should be fully competent in intermediate life-support.
- 6.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 6.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 6.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.

- 6.2.6 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 specialist registrar should be competent in all aspects of musculoskeletal imaging and intervention.

6.3 Overview of training

- 6.3.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines core knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training should ideally be actively involved in musculoskeletal imaging within an educational environment with graduated supervision.
- 6.3.2 The training department must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), radionuclide imaging and fluoroscopy. Centres should also provide access to relevant specialised radionuclide imaging [e.g., positron emission tomography (PET)].
- 6.3.3 Practical training and/or theoretical teaching and training in bone densitometry techniques should be available.
- 6.3.4 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 should 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
- 6.3.5 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 6.3.6 The trainee should be encouraged to attend appropriate educational meetings and courses.
- 6.3.7 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.
- 6.3.8 Trainees will be expected to be familiar with current musculoskeletal radiology literature.
- 6.3.9 The trainee should be encouraged to participate in research and to pursue a project 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.
- 6.3.10 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

6.4 Requirements of special interest training

- 6.4.1 A sound understanding of the basis of musculoskeletal imaging including:
- the embryology, anatomy and physiology of the musculoskeletal system including normal anatomical variants

- the pathological processes of both benign and malignant disease in the musculoskeletal system
- local, national and where appropriate, international imaging guidelines

6.4.2 Knowledge of the full range of radiological diagnostic techniques available, in particular:

- the indications, contra-indications and complications of each imaging method
- the factors affecting the choice of contrast media and radiopharmaceuticals
- the effects and side effects of these agents

Particular emphasis should be placed on 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.

6.4.3 Acquisition of specific skills to enable:

- the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation of musculoskeletal diseases to a high professional standard
- the accurate localisation and the biopsy of soft tissue, bone and lymph node masses where appropriate the safe and effective practice of interventional techniques
- good communication with patients and professional colleagues
- accurate informed consent to be obtained
- continuing accreditation of intermediate life-support status

6.4.4 A clear understanding of the role of multidisciplinary meetings, including:

- planning of investigations including the selection of appropriate tests and imaging technique for the diagnosis of benign and malignant disease
- staging of malignant disease
- planning and outcomes of treatment
- the detection of errors in diagnosis and complications of treatment
- promoting an understanding of relevant musculoskeletal pathology

6.4.5 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. During the training period it is recommended that the trainee obtains experience in the following:

- plain radiography including:
 - primary care examinations
 - trauma cases
 - rheumatological disorders
 - general and paediatric orthopaedics
- ultrasonography including:
 - joints
 - soft tissues
 - orthopaedic and sports injuries
 - where appropriate, Doppler studies
- CT:
 - the use of CT for the primary diagnosis of benign and malignant pathology
 - staging of tumours involving the musculoskeletal system
 - detection of direct extension and metastatic spread of musculoskeletal tumours
 - the investigation of rheumatological disorders
 - the investigation of trauma and sports injuries
- MRI:
 - the use of MRI for the primary diagnosis of benign and malignant pathology
 - staging of tumours involving the musculoskeletal system
 - detection of direct extension and metastatic spread of musculoskeletal tumours
 - demonstration of spinal anatomy and pathology
 - demonstration of joint anatomy and pathology
 - the investigation of rheumatological disorders

- the investigation of trauma and sports injuries
 - nuclear medicine
 - fluoroscopic procedures including arthrography
- 6.4.6 A trainee will keep abreast of all other imaging techniques relevant to their practice.
- 6.4.7 Interventional techniques.
Trainees should acquire experience in the following procedures:
- biopsy of bone and soft tissue lesions
 - arthrography
 - image-guided diagnostic and therapeutic procedures
 - facet joint injections
 - discography
- Optional experience:
- CT myelography
 - vertebroplasty
- 6.4.8 Trainees should acquire experience in all the practical procedures listed above, and the number of cases undertaken should be recorded in their log book.
- 6.4.9 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.
- 6.4.10 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:
- MRI (one to three sessions)
 - CT (one session)
 - US (one to two sessions)
 - radionuclide imaging (one session)
 - plain film reporting (two to three sessions)
 - fluoroscopy with or without intervention (one session)
- 6.4.11 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.
- 6.4.12 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.
- 6.4.13 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.
- 6.5 Appraisal and assessment
- 6.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.
- 6.5.2 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
 - a final assessment of overall professional competence before the final record of in-training assessment (RITA) review

6.5.3 Review of training programme

- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum

6.5.4 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 musculoskeletal radiological practice

7 Neuroradiology

7.1 Introduction

- 7.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in neuroradiology, including interventional neuroradiology.
- 7.1.2 In the UK trainees will usually enter into neuroradiology training towards the end of the third year of clinical training, following success in the final FRCR examination. This training is either in diagnostic neuroradiology or diagnostic and interventional neuroradiology. However earlier, more focussed, individualised training in neuroradiology is being encouraged for those trainees with previous neuroscience experience.
- 7.1.3 Most trainees will complete their training within the indicative 5 years although occasionally it may be necessary to extend their CCT date.
- 7.1.4 All specialist registrars will have acquired core knowledge of neuroradiology diagnosis as a specialist registrar during core training and will already have acquired core skills.
- 7.1.5 This document outlines the training curriculum for a consultant neuroradiologist. A minimum of 18 months of full-time training in neuroradiology is essential, but two years are recommended. A trainee undertaking training in neurointerventional procedures requires two years of neuroradiological training. This recommendation conforms to the advice of the British Society of Neuroradiologists.
- 7.1.6 Dedicated neuroradiology training received at a neuroscience centre within an accredited radiology training scheme may be taken into consideration.
- 7.1.7 All neuroradiology training programmes should be approved and accredited for training by the TAC (TAC) of the Royal College of Radiologists (RCR). The TAC visiting team should include a neuroradiologist.
- 7.1.8 The aim of special interest training in neuroradiology is to enable the trainee to become clinically competent and to consistently interpret the results of neuroradiological investigations accurately and reliably. Where appropriate, trainees should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.
- 7.1.9 The content of training needs to be flexible and appropriate to the ultimate goal of the trainee. Neuroradiology is an expanding special interest with development of interventional services, paediatric neuroradiology and functional brain imaging, including magnetic resonance spectroscopy. Some trainees may wish to obtain extra training in these areas.

7.2 Objectives

- 7.2.1 The aim of establishing a curriculum for special interest training in neuroradiology is to ensure that the trainee acquires:
- knowledge of the relevant embryology and anatomy of the nervous system
 - an in-depth understanding of the relevant pathophysiological, and clinical aspects of neurological diseases
 - an in-depth understanding of the indications, contraindications and complications of imaging studies of neurological diseases
 - an in-depth understanding of the major imaging techniques relevant to neuroradiology, so that they can, with confidence, discuss with their colleagues the choice of best imaging method for a particular clinical problem
 - clinical knowledge relevant to neuroradiology so that the trainee may confidently discuss patients with colleagues
 - direct practical exposure to interventional procedures to provide them with a full knowledge of the technical problems and risks of the procedures. Some hands-on experience with graded supervision will be required by all trainees in neuroradiology,

but will vary from straightforward procedures to more complex procedures depending on the trainee's future job goals

- knowledge of the current developments in neuroradiology

- 7.2.2 The trainee should be fully competent in intermediate and advanced life-support. Formal ALS certification should be considered.
- 7.2.3 Experience will be documented in the RCR Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 7.2.4 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.
- 7.2.5 The expected outcome at the end of this special interest training in neuroradiology will be for the specialist registrar to be competent in all aspects of diagnostic neuroradiology imaging, and where applicable interventional neuroradiology.

7.3 Overview of training

- 7.3.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines the core knowledge, skills and experience acquired during core training, together with the optional experience, in which practical experience is not essential but theoretical knowledge is required. Core skills in neuroradiology will have been acquired before special interest training.
- 7.3.2 A training scheme responsible for training in neuroradiology must provide access to appropriate computed tomography (CT), magnetic resonance imaging (MRI), digital subtraction angiography, ultrasound (US) and radionuclide imaging facilities. Trainees should also have access to neonatal cranial US.
- 7.3.3 Clinical knowledge will be acquired by a variety of means. This will include close liaison with the appropriate surgical and medical teams and participation in combined clinical and radiological meetings. Clinical inter-relationships are necessary with:
- neurosurgery (paediatric and adult)
 - neurology (paediatric and adult)
 - neuropathology
 - neurophysiology
 - neuroanaesthesia/critical care and emergency medicine
 - trauma
- Other specialties will also provide important training opportunities, in particular ophthalmology, otology, genetics, endocrinology, psychiatry, neuro-oncology, maxillo-facial surgery, spinal surgery and rehabilitation services.
- 7.3.4 It may be appropriate for the trainee to have a regular attachment to ward rounds, outpatient clinics and theatre sessions in order to further clinical knowledge relevant to the special interest.
- 7.3.5 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological meetings.
- 7.3.6 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.
- 7.3.7 The trainee should be involved in research and have the opportunity to attend and present at national and international meetings. The progression of research projects to formal peer-reviewed publication should be supported and encouraged by the supervising consultant(s).

- 7.3.8 Attendance at the British, European and American Neuroradiology Societies should be encouraged.
- 7.3.9 The trainee should be encouraged to become an associate member of the British Society of Neuroradiologists.
- 7.3.10 The trainee is expected to participate in undergraduate and postgraduate teaching including training for FRCR, FRCS and MRCP.
- 7.3.11 The trainee should continue to participate in the specialist registrar neuroradiology on-call rota, after adequate training with appropriate consultant cover.
- 7.3.12 Special interest training in neuroradiology is assessed and accredited by the TAC and approved by the RCR.

7.4 **Requirements of special interest training**

- 7.4.1 A comprehensive knowledge of normal brain function and neurological diseases, including:
 - the embryology, anatomy, normal variants and physiology of the central and peripheral nervous system, organs of special senses, head and neck, and spine and spinal cord in adults and children
 - the pathological correlation of diseases and variations of the central nervous system, including the spine and cranium and disorders of the ophthalmological and otorhinolaryngological systems, including appropriate applications and interpretation of the various imaging modalities
 - local, national and where appropriate, international imaging guidelines
- 7.4.2 Knowledge and understanding of the physical principles and technical background for the performance of CT, MRI, angiography, US, conventional imaging and myelography for the diagnostic imaging of the head, spine and spinal cord, neck and organs of special senses in adults and children. Exposure to magnetic resonance spectroscopy (MRS)/functional imaging and nuclear medicine studies [single photon emission computed tomography (SPECT), positron emission tomography (PET)] related to neuroradiology should be available.
- 7.4.3 To develop the interpretative skills of CT, MRI, angiography, US, conventional imaging and myelography for the diagnostic imaging of the head, spine and spinal cord, neck and organs of special senses in adults and children.
- 7.4.4 The specialist registrar should know the inherent strengths and limitations of these modalities, as well as appropriate imaging protocols for neuroradiological consultation.
- 7.4.5 Knowledge of the techniques involved in the imaging used to evaluate and treat neurological diseases, including interventional procedures and the management of the complications of these procedures.
- 7.4.6 Knowledge of pharmacology, particularly with respect to contrast media and invasive procedures.
- 7.4.7 Knowledge of patient protection and safety in neuroradiology.
- 7.4.8 Understanding of fundamentals of quality assurance (management) in neuroradiology.
- 7.4.9 Acquisition of specific skills to enable competence in clinical neuroradiological skills in children and adults including:
 - diagnostic and interpretative skills
 - manual and procedural skills
 - basic endovascular and therapy skills
 - computer skills in imaging acquisition and post-processing

- the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation of neurological diseases, to a high professional standard
- good communication with patients and professional colleagues
- competence in style of reporting
- continuing accreditation of ALS status
- ability to manage post procedure care for invasive diagnostic, therapeutic techniques and neuroradiological emergencies
- ability to manage patients and to obtain valid informed consent for all procedures
- competence in effective consultation, presentation of scholarship material and ability to teach neuroradiology to peers and residents in other disciplines
- ability to evaluate medical literature critically and to conduct neuroradiological research
- ability to conduct or supervise quality assurance

7.4.10 The core requirements for a neuroradiologist or a specialist interventional neuroradiologist are similar, apart from the total number of interventional procedures performed (Section 7.5.11).

7.4.11 Regardless of the imaging technique 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 such investigations accurately and reliably.

7.4.12 During the training period it is recommended that the trainee receives the following:

- CT—the equivalent of two sessions per week
- MRI—the equivalent of two sessions per week
- angiography—the equivalent of two sessions per week
- interventional neuroradiology—see Section 5.11
- study/meetings—the equivalent of one session per week
- research—the equivalent of one session per week
- myelography/radiculography—the opportunity to observe, and whenever possible, obtain hands-on experience of the limited number of these procedures now carried out

7.4.12 During the training period the trainee should also gain experience in the following:

Plain radiography including:

- primary care examinations
- skull, facial and spinal trauma
- paediatric examinations including NAI

Optional experience:

- radionuclide radiology including SPECT imaging and PET
- US including neonatal cranial US and Doppler

7.4.13 The techniques listed and the time devoted to each will be reviewed at intervals along with the number of cases required, as it is recognised that some procedures may become obsolete and new techniques will be developed (e.g., functional brain imaging and magnetic resonance spectroscopy).

7.4.14 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.

7.4.15 The trainee should become fully aware of the local and national guidelines in obtaining informed patient consent.

7.5 **Interventional neuroradiology requirements**

7.5.1 All specialist registrars training in neuroradiology should have a basic understanding of interventional techniques so that they have full knowledge of indications, technical problems,

contraindications and risk of procedures. Trainees with a special interest in interventional neuroradiology will need more extensive experience.

- 7.5.2 All trainees in interventional radiology should complete at least 1 year of diagnostic neuroradiology training.
- 7.5.3 Trainees who wish to spend a significant part of their work as a consultant in interventional neuroradiology should spend around 1 year in a training post in which substantially the whole time is devoted to interventional neuroradiology.
- 7.5.4 Earlier, more focussed, individualised training in neuroradiology is being encouraged for those trainees with previous neuroscience/neurovascular experience
- 7.5.5 Trainees need to develop clinical judgement. The risks and benefits of each therapeutic procedure need to be appreciated. Training might include a clinical attachment.
- 7.5.6 Trainees should have adequate exposure to neurosurgical operations and ward/high dependency unit management of acutely ill patients.
- 7.5.7 Regular involvement in neurosciences audit and mortality/morbidity meetings is necessary to understand risk management for different clinical conditions.
- 7.5.8 It is the responsibility of the trainee to be aware of the current local and national guidelines in obtaining informed patient consent.
- 7.5.9 All interventional trainees must have thorough knowledge of techniques of sedation and analgesia required to perform these procedures, as well as patient monitoring throughout and following the procedures.
- 7.5.10 Trainees should be aware of the full range of intra- and post-operative complications and their management.
- 7.5.11 The interventional trainee should participate in around 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.
- 7.5.12 It is desirable that the trainee also attends other centres, especially if the range and quantity of interventional procedures is limited.

7.6 **Appraisal and assessment**

- 7.6.1 Regular appraisal of the trainee will occur as described in the RCR TPP.
- 7.6.2 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 diseases
 - a final assessment of overall professional competence prior to the final record of in-training assessment (RITA) review
- 7.6.3 Review of training programme
 - It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR TAC will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

7.6.4 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 neuroradiological practice.

8 Obstetric and Gynaecological Radiology

8.1 Introduction

- 8.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in obstetric and gynaecological radiology.
- 8.1.2 All specialist registrars will have acquired core knowledge of obstetric and gynaecological radiology during core training and will already have acquired the core skills.
- 8.1.3 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in obstetric and gynaecological radiology, a period of around 12 months substantially devoted to the subject is recommended.
- 8.1.4 It is envisaged that the prospective general radiologist with an interest in gynaecology would undergo around 6 months special interest training in gynaecological radiology during special interest training, whilst those wishing to have a near full-time commitment in this particular area would need around 1 year in special interest training. Those radiologists who will have a commitment to obstetric ultrasound (US) should undertake the joint Royal College of Radiologists (RCR)/Royal College of Obstetricians and Gynaecologists diploma in higher obstetric US.
- 8.1.5 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 all gynaecological investigations accurately and reliably.

8.2 Objectives

The aim of establishing a curriculum for special interest training in obstetric and/or gynaecological radiology is to ensure that trainees acquire:

- knowledge of the relevant embryological, anatomical, pathophysiological and clinical aspects of obstetrics and/or gynaecology
 - an in-depth understanding of the major imaging techniques relevant to obstetric and gynaecological diseases and problems
 - understand the role of radiology in the management of these specialist areas
 - an in-depth knowledge of the indications, contra-indications, complications and limitations of procedures
 - clinical knowledge relevant to the management of obstetric and/or gynaecological diseases such that the trainee may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician
 - become sufficiently well trained in order to become an integral member of the multidisciplinary team
 - consolidate and develop their practical skills
 - detailed knowledge of current developments in the special interest
 - knowledge and skills to enable safe practice of analgesia and sedation
- 8.2.2 The trainee should be fully competent in intermediate life-support.
- 8.2.3 Experience will be documented in the RCR Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 8.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 8.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.

- 8.2.6 The expected outcome at the end of special interest training in obstetric imaging will be for the specialist registrar to be competent in all aspects of obstetric imaging.
- 8.27 The expected outcome at the end of special interest training in gynaecological imaging will be for the specialist registrar to be competent in all aspects of gynaecological imaging.

8.3 Overview of training

- 8.3.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines core knowledge, skills and experience and optional experience acquired during core training. The trainee undergoing special interest training will need to build on this background by becoming actively involved in the work of a Radiology Department with a considerable commitment to gynaecology and/or obstetrics in an educational environment of one-to-one graduated supervision.
- 8.3.2 The gynaecological and/or obstetric radiology experience acquired in the first 4 years of training will count towards the total experience of special interest training in obstetric and gynaecological radiology.
- 8.3.3 The training department must provide access to appropriate US, computed tomography (CT), magnetic resonance imaging (MRI), and fluoroscopy. The scheme should also provide access to relevant radionuclide imaging.
- 8.3.4 Clinical knowledge will be acquired by a variety of means such as participation in clinico-radiological conferences, hospital grand rounds and close liaison with appropriate surgical and medical teams. Clinical knowledge and acumen in obstetric and gynaecology will form part of the assessment made by the trainer.
- 8.3.5 Trainees will be expected to provide advice and guidance to clinical colleagues as to the best method of radiological investigation of clinical problems.
- 8.3.6 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 8.3.7 The trainee should be encouraged to attend appropriate educational meetings and courses.
- 8.3.8 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.
- 8.3.9 Trainees will be expected to be familiar with current obstetrics and gynaecology literature.
- 8.3.10 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.
- 8.3.11 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

8.4 Requirements of special interest training

- 8.4.1 A sound understanding of the basis of obstetric and/or gynaecological imaging including:
- the embryology, anatomy and physiology of the female genitourinary system
 - normal anatomical variants
 - the pathology and pathophysiology of benign and malignant conditions involving the female genitourinary system
 - the epidemiology of gynaecological disease
 - local, national and where appropriate, international imaging guidelines

- 8.4.2 Knowledge of the full range of radiological diagnostic techniques available, in particular:
- a clear understanding of the role and importance of imaging in obstetrics and/or gynaecology, together with the relative merits of differing imaging modalities in various pathological conditions
 - the indications, contra-indications and complications of each imaging method

Particular emphasis should be placed on 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.

- 8.4.3 Knowledge of dose reduction techniques in obstetrics/gynaecological radiology.

- 8.4.4 Acquisition of specific skills to enable:
- the conduct, supervision and accurate interpretation of all imaging techniques used to a high professional standard
 - the accurate localisation and (where appropriate) the biopsy of masses and lymph nodes
 - where appropriate the safe and effective practice of interventional techniques
 - good communication with patients and professional colleagues
 - accurate informed consent to be obtained
 - continuing accreditation of life-support status

- 8.4.5 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. During the training period it is recommended that the trainee obtains experience in the following:

- plain radiography
- competence in undertaking and reporting US examinations
 - of the abdomen and pelvis including transvaginal techniques
 - Doppler studies; including spectral, basic colour, power Doppler and the relevant basic calculations
- competence in undertaking and reporting routine fluoroscopic examinations of the genitourinary tract
- competence in undertaking and reporting gynaecological CT examinations
- competence in undertaking and reporting gynaecological MRI examinations. This may require secondment to a specialist centre in order to obtain the relevant MRI experience
- competence in communication skills (i.e., in communicating investigation results and management options to patients)

- 8.4.6 A trainee will keep abreast of all other imaging investigations and other clinical and radiological advances relevant to the special interest(s).

- 8.4.7 Interventional techniques.
Trainees should acquire experience in the following procedures:

- biopsy procedures
- abscess drainage
- insertion of percutaneous nephrostomies

Optional

- selective catheterisation of the Fallopian tube

- 8.4.8 Trainees should acquire experience in all of the practical procedures listed above and the number of cases should be recorded in their log book.

- 8.4.9 Regardless of the imaging technique 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.

- 8.4.10 Obstetric and gynaecological radiology is a mixture of image interpretation and practical procedures and it is essential that the trainee is exposed to:
- an appropriate number of each
 - a broad case mix

However, because of variations in case mix between different institutions, it would be inappropriate to dictate specific numbers in relation to the various diseases/problems or the number of investigations.

- 8.4.11 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.
- 8.4.12 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.
- 8.4.13 The trainee should be aware of local and national guidelines in, and be capable of obtaining informed patient consent for practical procedures.
- 8.4.14 The trainee should understand the medico-legal aspects of obstetric and gynaecological practice.

8.5 **Appraisal and assessment**

- 8.5.2 Regular appraisal of the trainee will occur as described in the RCR TPP.

- 8.5.3 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 in obstetric and gynaecological radiology
- a final assessment of overall professional competence before the final record of in-training assessment (RITA) review

- 8.5.4 Review of training programme

- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR TAC will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum

- 8.5.5 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 obstetric and gynaecological radiology practice.

9 Oncological Imaging

9.1 Introduction

- 9.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in oncological imaging.
- 9.1.2 All specialist registrars will have acquired core knowledge of oncological imaging during core training and will already have acquired the core skills.
- 9.1.3 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in oncological imaging, a period of around 12 months substantially devoted to the subject is recommended.
- 9.1.4 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 should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.
- 9.1.5 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) should normally undertake around 6 months of special interest training in oncological imaging.
- 9.1.6 The curriculum for training in oncological imaging relates to the role of imaging in staging and the management of malignant disease.
- 9.1.7 Tumour diagnosis is not addressed in this curriculum as it forms a major part of all general radiological practice.
- 9.1.8 Interventional procedures such as biopsy and drainage are also part of general radiological practice and are not separately covered in this document. The more specialised therapeutic interventional procedures are covered within the special interest training curriculum for interventional radiology.
- 9.1.9 Symptomatic breast cancer diagnosis forms an integral part of the special interest training curriculum for breast imaging and is not addressed within this curriculum.
- 9.1.10 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.

9.2 Objectives

- 9.2.1 The aim of establishing a curriculum for special interest training in oncological imaging is to ensure that the trainee acquires:
- an appreciation of the integral role of imaging in the multidisciplinary management of cancer
 - knowledge of the principles of tumour staging, monitoring the response to treatment and the detection of relapse
 - detailed knowledge of the common cancers including their pathology and their pattern of spread at the time of diagnosis and at relapse; some knowledge of less common and rare tumours, based on the referral pattern within the cancer centre
 - an in-depth understanding of image interpretation and the role of plain film radiography, cross-sectional imaging and nuclear medicine in cancer management
 - knowledge of the common complications of chemotherapy, radiotherapy and surgery and their relevant imaging findings
 - an appreciation of the altered patterns of metastatic disease that may occur following primary therapy; a recognition of second primary cancers

- an appreciation of the role of imaging in radiotherapy planning and treatment
- 9.2.2 The trainee should be fully competent in intermediate life-support.
- 9.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 9.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 9.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.
- 9.2.6 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 examination(s) and accurately report on the findings. The trainee should be competent in all aspects of oncological imaging and appropriate intervention.

9.3 Overview of training

- 9.3.1 The main document, to which this appendix should be viewed as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines core knowledge and skills and optional experience acquired during core training. The trainee undergoing special interest training should ideally be actively involved in oncological imaging within an educational environment with graduated supervision.
- 9.3.2 The trainee should gain expertise in interpretation of computed tomography (CT), 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).
- 9.3.3 The trainee should gain experience in rare tumours as relevant to the referral pattern within the training centre.
- 9.3.4 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 multi disciplinary clinico-radiological conferences for the different cancers.
- 9.3.5 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.
- 9.3.6 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 9.3.7 The trainee should be encouraged and funded to attend appropriate educational meetings and courses.
- 9.3.8 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.
- 9.3.9 Trainees will be expected to be familiar with current oncological radiology literature.
- 9.3.10 The trainee should be encouraged to participate in research, and to pursue one or more project(s) 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.

- 9.3.11 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

9.4 Requirements of special interest training

- 9.4.1 A sound understanding of the basis of oncological imaging including:
- the embryology, anatomy and pathophysiology of the major tumour-bearing organs
 - the various tumour staging methods used for each major organ
 - lymph node notation and routes of lymph node spread from primary tumours
 - anatomical routes for the spread of common tumours
 - the pathological processes of malignant disease
 - local, national and where appropriate, international imaging guidelines
 - methods of analysing tumour response

- 9.4.2 Knowledge of the full range of radiological diagnostic techniques available, in particular:
- the indications, contra-indications and complications of each imaging method
 - the factors affecting the choice of contrast media and radiopharmaceuticals
 - the effects and side effects of these agents

Particular emphasis should be placed on 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.

- 9.4.3 Acquisition of specific skills to enable:
- the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation and staging of tumours to a high professional standard
 - the accurate localisation and (where appropriate) the biopsy of masses and lymph nodes
 - where appropriate the safe and effective practice of interventional techniques
 - good communication with patients and professional colleagues
 - accurate informed consent to be obtained
 - continuing accreditation of intermediate life-support status

- 9.4.4 A clear understanding of the role of multidisciplinary meetings, including:
- planning of investigations including the selection of appropriate investigations and imaging techniques for the diagnosis of benign and malignant disease
 - staging of malignant disease
 - planning and outcomes of treatment
 - the detection of errors in diagnosis and complications of treatment
 - promoting an understanding of relevant tumour pathology

- 9.4.5 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. During the training period it is recommended that the trainee obtains experience in the following:
- general oncological radiology
 - expertise in plain radiographic assessment for staging and follow-up of tumours
 - knowledge of the indications for referral for cross-sectional imaging based on the plain film findings
 - expertise in recommending the most appropriate investigation
 - CT
 - detailed knowledge of tumour types appropriate for CT staging and follow-up

- detailed knowledge of the appropriate techniques for the examination and the assessment of different common cancers
- knowledge of patterns of disease spread for common tumour types on CT which will lead to greater diagnostic accuracy and more appropriately tailored examinations
- knowledge of the advantages of new developments in CT such as multi-helical techniques in cancer management (e.g., three-dimensional imaging, multi-planar reformatting)
- expertise in biopsy techniques with a particular relevance to cancer, such as retroperitoneal biopsy and pelvic side wall biopsy
- knowledge of requirements for CT planning in radiotherapy and the importance of diagnostic input
- magnetic resonance imaging (MRI)
 - knowledge of the indications for MRI for staging, follow-up and reassessment of patients at the time of suspected relapse
 - knowledge of basic MRI techniques, findings and pitfalls in diagnosis in those cancers frequently referred for imaging (e.g., pelvic cancers, head and neck cancer)
 - knowledge of the advances in MRI which are relevant to the diagnosis and treatment of cancer patients
- US
 - knowledge of 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)
 - knowledge of 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
 - knowledge of advances in US imaging and techniques that have an application to cancer
- nuclear medicine
 - knowledge of the indications for nuclear medicine techniques as required for staging and expertise in image interpretation (e.g., technetium skeletal scintigraphy)
 - understanding of the complementary role of plain radiography, MRI and CT to nuclear medicine in the evaluation of an equivocal diagnosis of metastases
 - detailed knowledge of indications for functional imaging techniques and expertise in image interpretation (e.g., thyroid cancer imaging)
 - knowledge of tumour-specific agents and their application to cancer management (e.g., MIBG scanning)
 - knowledge of advances in nuclear medicine including positron emission tomography (PET/ CT PET). A basic knowledge of the technique is required. Knowledge of the current and evolving indications for referral for PET

- 9.4.6 A trainee will keep abreast of all other imaging techniques relevant to their practice.
- 9.4.7 Interventional techniques. Trainees should acquire experience in the following procedures:
- US-guided biopsy of masses and lymph nodes
 - CT-guided biopsy of masses and lymph nodes
 - where appropriate and available, MRI-guided biopsy of masses and lymph nodes
 - drainage of collections
- 9.4.8 Trainees should acquire experience in all the practical procedures listed above, and the number of cases undertaken should be recorded in their log book.
- 9.4.9 Regardless of the imaging technique or procedure, 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.

- 9.4.10 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
- 9.4.11 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.
- 9.4.12 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.
- 9.4.13 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.

9.5 **Appraisal and assessment**

- 9.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.
- 9.5.2 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
 - a final assessment of overall professional competence before the final record of in-training assessment (RITA) review
- 9.5.3 Review of training programme
- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.
- 9.5.4 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.

10 Paediatric Radiology

10.1 Introduction

- 10.1.1 This curriculum outlines the training requirements for specialist registrar training in paediatric radiology.
- 10.1.2 All specialist registrars in clinical radiology will have undergone training in paediatric radiological procedures and interpretation during core training and will already have acquired core skills.
- 10.1.3 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in paediatric radiology, a period of around 12 months substantially devoted to the subject is recommended.
- 10.1.4 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 should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.
- 10.1.5 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) should normally undertake around 6 months of special interest training in paediatric radiology.
- 10.1.6 Earlier, more focussed, individualised training in paediatric radiology may be possible for those trainees with extensive paediatric experience.

10.2 Objectives

- 10.2.1 The aim of establishing a curriculum for special interest training in paediatric radiology is to ensure that trainees:
- consolidate and develop their practical skills
 - develop an in-depth understanding of paediatric diseases
 - increase their familiarity with children's disease and the practice of children's radiology, emphasising the differences from adult practice
 - understand the role of radiology in the management of sick children
 - become sufficiently trained to become an integral member of the multidisciplinary teams now required in hospitals providing full services to children
 - acquire clinical knowledge relevant to medical and surgical management of paediatric diseases such that the trainee may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician
 - detailed knowledge of current developments in the special interest
 - direct practical exposure with appropriate graded supervision in all forms of paediatric imaging and intervention
 - knowledge and skills to enable safe practice of analgesia and sedation
- 10.2.2 The trainee should be fully competent in paediatric life-support.
- 10.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 10.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 10.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.

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

10.3 Overview of training

- 10.3.1 The main document, to which this appendix should be viewed as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines core knowledge, skills and experience and the optional experience acquired during core training. The trainee undergoing special interest training should ideally be actively involved in paediatric radiology within an educational environment with graduated supervision.
- 10.3.2 The training department must provide access to appropriate computed tomography (CT), MR, ultrasound (US), radionuclide imaging and fluoroscopy.
- 10.3.3 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 should be emphasised. The following inter-relationships are important:
- paediatric surgery
 - paediatric medicine
 - paediatric oncology
 - neonatal unit
 - obstetric unit
 - community paediatrics
- Additional clinical knowledge may be acquired through participation in appropriate ward rounds, attending outpatient clinics and theatre sessions. Training may require secondment to an appropriate specialist hospital to gain experience in neonatal radiology and/or paediatric neuroradiology.
- 10.3.4 The paediatric radiology experience acquired during core training will count towards the total experience of special interest training in paediatric radiology.
- 10.3.5 Paediatric radiology is a mixture of image interpretation and practical procedures and it is essential that the trainee is exposed to appropriate numbers of each of these and to a broad case mix. However, because of variations in case mix between different institutions, it would be inappropriate to dictate specific minimum numbers of diseases or investigations.
- 10.3.6 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 10.3.7 The trainee should be encouraged and funded to attend appropriate educational meetings and courses.
- 10.3.8 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.
- 10.3.9 Trainees will be expected to be familiar with current paediatric radiological literature.
- 10.3.10 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.
- 10.3.11 The trainee should continue to participate in the specialist registrar on-call rota, with appropriate consultant back-up.

10.3.12 Towards the completion of training, a trainee will be expected to provide expert advice and guidance to clinical colleagues as to the most appropriate imaging methods for investigation of paediatric clinical problems.

10.4 Requirements of special interest training

10.4.1 A sound understanding of the basis of paediatric imaging including:

- the embryology, anatomy, normal variants, developmental abnormalities and relevant physiology of children
- the pathological processes of both benign and malignant disease in the paediatric age group
- local, national and where appropriate, international imaging guidelines

10.4.2 Knowledge of the full range of radiological diagnostic techniques available, in particular:

- the indications, contra-indications and complications of each imaging method
- the factors affecting the choice of contrast media and radiopharmaceuticals
- the effects and side effects of these agents

Particular emphasis should be placed on 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.

10.4.3 Acquisition of specific skills to enable:

- the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation of paediatric diseases to a high professional standard
- where appropriate the safe and effective practice of interventional techniques
- good communication with patients, their parents and professional colleagues
- accurate informed consent to be obtained
- continuing accreditation of paediatric life-support status

10.4.4 A clear understanding of the role of multidisciplinary meetings, including:

- planning of investigations including the selection of appropriate tests and imaging techniques for the diagnosis of benign and malignant disease
- staging of malignant disease
- planning and outcomes of treatment
- the detection of errors in diagnosis and complications of treatment
- promoting an understanding of relevant paediatric pathology

10.4.5 Detailed knowledge of dose reduction techniques in paediatric radiology.

10.4.6 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. During the training period it is recommended that the trainee obtains experience in the following:

- plain radiography, to include the full range of clinical subspecialties, e.g., trauma, accident and emergency, orthopaedics, rheumatology, chest and abdomen
- undertaking and reporting US examinations:
 - of the abdomen, gastrointestinal (GI) tract (including bowel), genitourinary tract, chest, head and musculoskeletal system
 - Doppler studies, including spectral, basic colour and power Doppler, as well as basic calculations
- undertaking and reporting routine fluoroscopic examinations of the GI and urinary tract, together with more complex investigations such as:
 - small bowel enema
 - reduction of intussusception
 - management of neonatal distal intestinal obstruction
 - velopalatal competence and studies of phonation
 - disorders of swallowing

- undertaking and reporting paediatric CT and magnetic resonance examinations
- undertaking and reporting basic paediatric radionuclide imaging examinations:
 - static and dynamic renal studies, including cystography
 - musculoskeletal imaging
 - ventilation and perfusion lung scintigraphy
 - GI studies, including pertechnetate studies for Meckel's diverticulum,
 - identification of a GI bleeding site
 - thyroid imaging
 - MIBG studies
 - dynamic biliary examinations

10.4.7 A trainee will keep abreast of all other imaging techniques relevant to their practice.

Interventional techniques. Trainees should acquire experience in the following procedures:

- biopsy procedures
- abscess drainage
- insertion of percutaneous nephrostomies
- joint aspiration (e.g., hip)

Optional experience

- arthrography
- angiography
- balloon dilatation of oesophageal strictures
- embolisation techniques
- musculoskeletal intervention

10.4.9 Trainees should acquire experience in all the practical procedures listed above, and the number of cases undertaken should be recorded in their log book.

10.4.10 Understanding of the medico-legal aspects of paediatric practice.

10.4.11 Regardless of the imaging technique or procedure, 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.

10.4.12 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.

10.4.13 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.

10.4.14 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed consent for practical procedures.

10.5 Appraisal and assessment

10.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.

10.5.2 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 paediatric diseases
- a final assessment of overall professional competence prior to the final record of in-training assessment (RITA) review

10.5.3 Review of training programme

- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

10.5.4 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 paediatric radiological practice.

11 Radionuclide Radiology

11.1 Introduction

- 11.1.1 This curriculum outlines the special interest training requirements for specialist training in radionuclide radiology.
- 11.1.2 All specialist registrars will have acquired core knowledge of radionuclide radiology as a specialist registrar during core training and will already have acquired the core skills and experience.
- 11.1.3 Those clinical radiologists who wish to specialise in radionuclide radiology as a consultant, should undertake the equivalent of a 12-month period of special interest training in radionuclide radiology in a recognised training centre. This training would normally be sufficient to support a successful application for an Administration of Radioactive Substances Advisory Committee (UK) (ARSAC) certificate to cover imaging procedures. At present, given the scarcity of positron emission tomography (PET) resources, training in PET imaging may require a further 3-month modular attachment; in time, when PET is widely practised within nuclear medicine and radionuclide radiology, the need for such an additional attachment should diminish.
- 11.1.4 This 12-month training may take place during the final year of training or may be acquired in modular form over a longer period, or may be acquired as a continuous period of part-time training concurrent with other aspects of radiology training.
- 11.1.5 Those clinical radiologists wishing to make a fuller commitment to nuclear medicine, including therapy, non-imaging studies and PET, should undertake a further 12 months of training in these areas. This additional year in nuclear medicine should be spent in a centre approved for training by the Joint Committee on Higher Medical Training (JCHMT). This additional year of training would lead to accreditation in nuclear medicine (in addition to that in clinical radiology) and would normally be sufficient to support a successful application for a full diagnostic and therapeutic ARSAC certificate. Such radiologists seeking such 'dual accreditation' in clinical radiology and nuclear medicine should inform the JCHMT prospectively (as early as possible and well before the additional year of nuclear medicine begins) and be conversant with other current JCHMT requirements.

11.2 Objectives

The aim of establishing a curriculum for special interest training in radionuclide radiology is to ensure that trainees acquire:

- detailed knowledge of:
 - computing and image processing including the principles and their applications to nuclear medicine data acquisition, processing and display
 - tracer principles and techniques which will provide the trainee with a working knowledge of the tracer principles and techniques and in vitro studies using radioactive techniques
 - radiation biology and protection which will provide the trainee with a working knowledge of the science of radiation biology and radiation protection including the diagnosis and treatment of radiation exposure and the management of radiation accidents
 - radiopharmacy and radiochemistry which will provide the trainee with a working knowledge of radiopharmacy and radiochemistry
- more detailed knowledge of:
 - properties of commonly used diagnostic radionuclides
 - production of radionuclides by reactors, cyclotron and radionuclide generators
 - principles of localisation of radiopharmaceuticals
 - quality control

For each topic area listed below an in-depth understanding of protocols and procedures including:

- protocols for study performance and analysis including use of SPECT

- preparation of patients, precautions (including drug effects), complications
- special protocols for paediatric studies
- quality assurance
- significance of normal/abnormal findings
- test evaluation
- sensitivity/specificity/predictive value
- Bayes' theorem
- concepts of risks benefit and cost–benefit analysis

Topic areas:

- breast
- thorax
- gastrointestinal (GI)
- head and neck
- musculoskeletal
- neuroradiology
- oncology
- paediatric
- genitourinary
- vascular

An in-depth understanding of the legal and regulatory requirements which will provide the trainee with a working knowledge of the regulatory framework of nuclear medicine including:

- national and international regulatory requirements for the practice of nuclear medicine
- product licences
- radiopharmacy aspects
- waste disposal
- radiopharmaceutical transport

Sufficient knowledge of all aspects of radionuclide imaging to allow him/her to manage an imaging service and obtain ARSAC certification for routine imaging procedures.

- 11.2.2 The trainee should be fully competent in intermediate life-support.
- 11.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 11.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 11.2.5 If experience to fulfil the requirements of special interest training cannot be gained in one training 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.
- 11.2.6 The expected outcome at the end of this special interest training will be for the specialist registrar to be competent in all aspects of radionuclide imaging, to allow him/her to manage an imaging service and be sufficiently trained to obtain ARSAC certification for routine imaging procedures.

11.3 Overview of training

- 11.3.1 The main document to which this appendix is attached, *Structured Training Curriculum for Clinical Radiology*, outlines the core knowledge and experience and optional experience acquired during core training. The trainee undergoing special interest training should ideally be actively involved in radionuclide imaging within an educational environment with graduated supervision.

- 11.3.2 A training scheme responsible for training in radionuclide radiology must provide access to appropriate nuclear medicine facilities, including support from radiopharmacy and medical physics. Appropriate radiation protection officers should be in place (RPS, RPA).
- 11.3.3 Clinical knowledge will be acquired by a variety of means. This will include close liaison with the appropriate surgical and medical teams and participation in combined clinical and radiological meetings.
- 11.3.4 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 11.3.5 The trainee should be encouraged to attend appropriate educational meetings and courses.
- 11.3.6 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.
- 11.3.7 Trainees will be expected to be familiar with current radionuclide radiology literature.
- 11.3.8 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.
- 11.3.9 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

11.4 **Requirements of special interest training**

- 11.4.1 An in-depth understanding of computing and image processing including:
- principles
 - applications to nuclear medicine data acquisition, processing and display
 - appropriate mathematics and physics applied to radionuclide tracer theory, modelling of tracer kinetics and quantitative imaging
- 11.4.2 An in-depth understanding of tracer principles and techniques that will provide the trainee with a working knowledge of the following:
- the kinetics of radioactive tracers used in nuclear medicine
 - the use of principles of kinetics and modelling techniques to calculate parameters such as glomerular filtration rate etc.
 - the physiological principles of tracer techniques
 - errors associated with the quantitative measurement
- 11.4.3 Knowledge of radiation biology and protection, to provide the trainee with a working knowledge of the following:
- the theory of biological effects of high and low-level radiation from unsealed sources
 - the calculation of radiation dose from radiopharmaceuticals (effective dose)
 - the necessary precautions for the safe handling of radiopharmaceuticals
 - the diagnosis and treatment of radiation exposure
 - the management of radiation accidents
- 11.4.4 An in-depth knowledge of radiopharmacy and radiochemistry, to provide the trainee with a working knowledge of the following:
- the production of radionuclides by reactors, cyclotron and radionuclide generators
 - the properties of commonly used diagnostic radionuclides
 - the physiochemical and biological properties of different radiopharmaceuticals in routine clinical practice, clinical trials, and under development
 - the principles of localisation of radiopharmaceuticals

- different formulations used in nuclear medicine
- cell labelling techniques
- quality control

11.4.5 Knowledge of the full range of radionuclide diagnostic techniques available, in particular:

- the indications, contra-indications and complications
- the factors affecting the choice of radiopharmaceuticals
- the effects and side effects of these agents

Particular emphasis should be placed on the strengths and weaknesses of radionuclide imaging compared to other imaging methods in various pathological conditions.

11.4.6 Acquisition of specific skills to enable:

- the conduct, supervision and accurate interpretation of radionuclide imaging to a high professional standard
- good communication with patients and professional colleagues
- accurate informed consent to be obtained
- continuing accreditation of intermediate life-support status

11.4.7 A clear understanding of the role of multidisciplinary meetings, including:

- planning of investigations including the selection of appropriate tests and imaging techniques for the diagnosis of benign and malignant disease
- staging of malignant disease
- planning and outcomes of treatment
- the detection of errors in diagnosis and complications of treatment
- an understanding of relevant pathology

11.4.8 Procedural competence will need to be reviewed at intervals, and this regular review should also assess the number of cases acquired in order to ensure competence. During the training period it is recommended that the trainee obtains clinical experience to provide more detailed understanding of radionuclide diagnostic imaging and common non-imaging procedures in the following topic areas:

- breast
- chest
- GI
- head and neck
- musculoskeletal
- neuroradiology
- oncology
- paediatric, including:
 - understanding of growth and maturation in children with special reference to the handling of radiotracers by immature organs.
 - specific indications for radionuclide investigations in children especially of the renal tract, biliary tract and skeleton.
 - comparative diagnostic investigations in children (ultrasound, computed tomography, MR etc.)
 - knowledge of statutory issues relating to children (e.g., Children's Act)
 - principles of consent in children
 - radiation protection issues appropriate to children
- urology
- vascular
- endocrine diseases
- inflammatory conditions

Relevant clinical knowledge for each of the above topic areas includes the following:

- embryology, anatomy, normal variants, physiology and molecular biology for each system
- radiopharmaceuticals

- protocols for study performance and analysis including the use of SPECT
- preparation of patients, precautions (including drug effects), complications
- special protocols for paediatric studies
- quality assurance
- significance of normal/abnormal findings
- test evaluation
- sensitivity/specificity/predictive value
- Bayes' theorem
- concepts of risks benefit and cost-benefit analysis
- radiation protection issues

11.4.9 An in-depth knowledge of the legal and regulatory requirements which will provide the trainee with a working knowledge of the regulatory framework of nuclear medicine:

- national and international regulatory requirement on the practice of nuclear medicine including: IRR99; MARS legislation; ARSAC; RSA 93; IR(ME)R 2000; medical guidance notes; product licences and other appropriate legislation
- 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

11.4.10 In accordance with the curriculum of the European Nuclear Medicine Society and the JCHMT of the Royal Colleges of Physicians, the clinical radiologist completing this programme is expected to have supervised and contributed to the report of around 2500 procedures. These should include a wide range of pathology and include paediatric studies. The number of procedures in each diagnostic group may vary; different trainees achieve competence at different rates; illustrative numbers, which are widely adopted throughout Europe, are:

- central nervous system, 30
- skeletal system, 1000
- cardiovascular system, 300
- pulmonary system, 300
- gastrointestinal system, 150
- urogenital system, 400
- endocrine system, 400
- tumours and inflammation, 100

It would be anticipated that around 20% of this total will have been undertaken in the first 4 years of training and the majority (80%) in the dedicated 12 months of radionuclide radiology training. It is recognised that such numbers may not be achieved in each area but the knowledge base must be demonstrated and the experience can be drawn from other areas (e.g., image libraries) and secondments to other departments.

Additional time would be required to gain appropriate modular experience in PET imaging. A 3-month attachment would be appropriate and the trainee would be expected to have supervised and contributed to the report of the following illustrative number of procedures:

- PET, 300

11.4.11 A trainee will keep abreast of all other imaging techniques relevant to their practice.

11.4.12 Trainees should acquire experience in all the practical procedures listed above, and the number of cases undertaken should be recorded in their log book

11.4.13 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.

11.4.14 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.

11.5 Appraisal and assessment

11.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.

11.5.2 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 radionuclide investigations
- a final assessment of overall professional competence before the final record of in-training assessment (RITA) review

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

11.5.3 Review of training programme

- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

11.5.4 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 radionuclide radiological practice.

12 Thoracic Radiology

12.1 Introduction

- 12.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in thoracic radiology.
- 12.1.2 All specialist registrars will have acquired a core knowledge of thoracic radiology as a specialist registrar during core training and will already have acquired the core skills.
- 12.1.3 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in thoracic radiology, a period of around 12 months substantially devoted to the subject is recommended.
- 12.1.4 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 should also be capable of providing a comprehensive and safe interventional diagnostic and therapeutic service.
- 12.1.5 Those clinical radiologists who plan to practise thoracic imaging as one of a mixture of activities (albeit that thoracic imaging will be a particular responsibility within those activities) should normally undertake around 6 months of special interest training in thoracic imaging.

12.2 Objectives

- 12.2.1 The aim of establishing a curriculum for special interest training in thoracic radiology is to ensure that the trainee acquires:
- knowledge of the relevant embryological, anatomical, pathophysiological and clinical aspects of thoracic disease
 - an in-depth understanding of the major imaging techniques relevant to thoracic disease
 - an in-depth understanding of the use of potentially hazardous techniques (e.g., angiography and other contrast studies, bronchoscopy and interventional techniques)
 - an in-depth understanding of the indications, contraindications and complications of surgical, medical and radiological interventions and procedures
 - clinical knowledge relevant to thoracic medicine and surgery such that the trainee may confidently discuss the appropriate imaging strategy for the clinical problem with the referring clinician
 - detailed knowledge of current developments in the special interest
 - direct practical exposure with appropriate graded supervision in all forms of thoracic imaging and intervention
 - knowledge and skills to enable safe practice of analgesia and sedation
- 12.2.2 The trainee should be fully competent in basic and advanced life-support. Formal ALS certification should be considered
- 12.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 12.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- If experience to fulfil the requirements of special interest training cannot be gained in one training 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.
- 12.2.5 The expected outcome at the end of this special interest training in thoracic radiology will be that the trainee can select the appropriate imaging modality for thoracic problems, supervise

(and perform where appropriate) the examination and accurately report on the examination findings. The trainee should be competent in all aspects of thoracic imaging and intervention.

12.3 Overview of training

- 12.3.1 The main document to which this appendix is attached, *Structured Training Curriculum for Clinical Radiology*, outlines the core knowledge, skills and experience acquired during core training, together with the optional experience, in which practical experience is not essential but theoretical knowledge is required. The trainee undergoing special interest training should ideally be actively involved in thoracic imaging within an educational environment with graduated supervision.
- 12.3.2 A training scheme responsible for training in thoracic radiology must provide access to appropriate computed tomography (CT), MR, ultrasound (US), echocardiography, fluoroscopy and radionuclide imaging facilities.
- 12.3.3 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 cancer meetings should be emphasised. The following inter-relationships are important:
- thoracic medicine
 - thoracic surgery
 - respiratory pathology
 - pulmonary physiology (i.e., in relation to measurements)
- Other specialties will also provide important training opportunities, in particular cardiology and cardiac surgery.
- 12.3.4 It may be appropriate for the trainee to have a regular attachment to thoracic out-patient clinics, ward rounds and bronchoscopy/theatre sessions in order to further clinical knowledge relevant to the special interest.
- 12.3.5 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 12.3.6 The trainee should be encouraged to attend appropriate educational meetings and courses.
- 12.3.7 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.
- 12.3.8 Trainees will be expected to be familiar with current thoracic radiology literature. The trainee should be encouraged to participate in research, and to pursue one or more project(s) 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.
- 12.3.9 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back-up.

12.4 Requirements of special interest training

- 12.4.1 A comprehensive knowledge of normal respiratory function and thoracic diseases, including:
- the embryology, anatomy, normal variants and pathophysiology relevant to cardiorespiratory function
 - the pathology of benign and malignant conditions involving the thorax
 - the epidemiology of lung diseases
 - the principles of population screening for lung cancer
 - the surgical techniques used in the staging and treatment of lung cancer.

- the techniques involved in all imaging and interventional procedures used in evaluating and treating thoracic diseases, including managing the complications of these procedures
- local, national and where appropriate, international imaging guidelines

12.4.2 Knowledge of the full range of radiological diagnostic techniques available, in particular:

- the indications, contra-indications and complications of each imaging method
- the factors affecting the choice of contrast media and radiopharmaceuticals
- the effects and side effects of these agents

Particular emphasis should be placed on 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.

12.4.3 Acquisition of specific skills to enable:

- the conduct, supervision and accurate interpretation of all imaging techniques used in the investigation of thoracic diseases to a high professional standard
- the accurate localisation and (where appropriate) the biopsy of pulmonary, mediastinal, pleural and chest wall masses and lymph nodes
- where appropriate the safe and effective practice of interventional techniques
- good communication with patients and professional colleagues
- accurate informed consent to be obtained
- continuing accreditation of life-support status

12.4.4 A clear understanding of the role of multidisciplinary meetings, including:

- planning of investigations including the selection of appropriate tests and imaging techniques for the diagnosis of benign and malignant disease
- staging of malignant disease
- planning and outcomes of treatment
- the detection of errors in diagnosis and complications of treatment
- an understanding of relevant thoracic pathology

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. During the training period it is recommended that the trainee obtains experience in the following:

- plain radiography including:
 - primary care examinations
 - intensive care and high dependency unit examinations
 - thoracic trauma
 - paediatric examinations
 - acute medical and surgical emergencies
- CT of the thorax including:
 - the staging of bronchial carcinoma
 - the investigation of pleural lesions
 - thoracic wall lesions
 - pulmonary lesions
 - mediastinal lesions
- identification and categorisation of diffuse lung disease
- CT pulmonary angiography
- magnetic resonance imaging (MRI) where applicable in thoracic imaging
- Radionuclide radiology including:
 - ventilation/perfusion lung scintigraphy
 - optional radionuclide studies:
- positron emission tomography (PET)

12.4.5 A trainee will keep abreast of all other imaging techniques relevant to their practice.

- 12.4.6 **Interventional techniques.**
Trainees should acquire experience in the following procedures:
- biopsy of thoracic wall, pleural, pulmonary and mediastinal lesions including:
 - CT-guided
 - fluoroscopically-guided
 - US-guided
 - other interventional procedures including:
 - US-guided thoracocentesis
 - chest drain insertion

Optional interventional procedures

- bronchoscopy
 - airway stenting
 - vascular stenting
 - thoracoscopy
- 12.4.7 Regardless of the imaging technique 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.
- 12.4.8 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.
- 12.4.9 The trainee should become familiar with providing analgesia and/or sedation where required, as well as the necessary continuous monitoring required to perform this safely.
- 12.4.10 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.

12.5 **Appraisal and assessment**

12.5.1 Regular appraisal of the trainee will occur as described in the RCR TPP.

12.5.2 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 thoracic diseases
- a final assessment of overall professional competence before the final record of in-training assessment (RITA) review

12.5.3 Review of training programme

- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) 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 thoracic radiological practice.

13 Urogenital Radiology

13.1 Introduction

- 13.1.1 This curriculum outlines the special interest training requirements for specialist registrar training in urogenital radiology.
- 13.1.2 All specialist registrars will have acquired core knowledge of urogenital imaging during core training and will already have acquired the core skills.
- 13.1.3 The period spent in training will vary according to the needs of the trainee. For a person wishing to specialise primarily in urogenital radiology, a period of around 12 months substantially devoted to the subject is recommended.
- 13.1.4 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. Trainees should also be capable of providing a comprehensive and safe interventional urological service.
- 13.1.5 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) should normally undertake around 6 months of special interest training in urogenital radiology.

13.2 Objectives

- 13.2.1 The aim of establishing a curriculum for special interest training in urogenital radiology is to ensure that the trainee acquires:
- knowledge of the relevant embryological, anatomical, pathophysiological and clinical aspects of urogenital disease
 - an in-depth understanding of the major imaging investigations relevant to urogenital disease
 - an in-depth knowledge of the indications, contra-indications, complications and limitations of procedures
 - an in-depth understanding of the use of interventional radiology in the urogenital tract
 - clinical knowledge relevant to urology, nephrology and gynaecology such that the trainee may confidently discuss the appropriate imaging with the referring clinician
 - detailed knowledge of developments in the special interest
 - direct practical exposure with appropriate supervision in all forms of imaging and interventional techniques in the urogenital tract
 - knowledge and skills to enable safe practice of analgesia and sedation
- 13.2.2 The trainee should be fully competent in intermediate life-support. Formal advanced life-support (ALS) certification should be considered.
- 13.2.3 Experience will be documented in the Royal College of Radiologists (RCR) Trainee Personal Portfolio (TPP) and procedural numbers recorded in a log book.
- 13.2.4 The training scheme should arrange an attachment that fulfils the requirements of the special interest curriculum.
- 13.2.5 If adequate experience cannot be offered in one training scheme, it will be necessary for the trainee to have a period of attachment(s) to other training schemes. There are, in any case, advantages for trainees in visiting other departments in the UK or abroad to follow particular interests in greater depth.

- 13.2.6 The expected outcome at the end of this special interest training will be that the trainee can select the appropriate imaging strategy for urogenital problems, supervise (and perform where appropriate) the examination(s) and accurately report on the findings. The specialist registrar should be competent in all aspects of urogenital imaging and intervention.

13.3 Overview of training

- 13.3.1 The main document, to which this appendix should be regarded as an attachment, *Structured Training Curriculum for Clinical Radiology*, outlines the core knowledge, skills and experience acquired during core training, together with optional experience in which practical experience is not essential but theoretical knowledge is required. The trainee undergoing special interest training should ideally be actively involved in urogenital imaging and intervention within an educational environment with graduated supervision.
- 13.3.2 A training scheme responsible for training in urogenital radiology must provide appropriate access to all relevant imaging techniques i.e., plain films, fluoroscopy, ultrasound (US), computed tomography (CT), magnetic resonance imaging (MRI), radionuclide imaging and digital subtraction angiography.
- 13.3.3 Clinical knowledge will be acquired by a variety of means including:
- close liaison with the appropriate surgical and medical teams including 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
- 13.3.4 The trainee should be encouraged and given the opportunity to attend and lead appropriate clinico-radiological and multidisciplinary meetings.
- 13.3.5 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.
- 13.3.6 Trainees will be expected to be familiar with current urogenital radiological literature.
- 13.3.7 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.
- 13.3.8 The trainee should continue to participate in the specialist registrar general on-call rota, with appropriate consultant back up.

13.4 Requirements of special interest training

- 13.4.1 A comprehensive knowledge of:
- 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
- 13.4.2 Knowledge of the full range of uro-radiological diagnostic techniques available, in particular:
- the indications, contra-indications and complications of each imaging method
 - the factors affecting the choice of contrast media and radiopharmaceuticals
 - the effects and side effects of these agents.

Particular emphasis should be placed on 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.

- 13.4.3 Acquisition of specific skills to enable:
- the conduct, supervision and accurate interpretation of all imaging techniques used in investigation of urogenital diseases, to a high professional standard
 - the accurate localisation and biopsy of renal masses
 - the safe and effective practice of interventional techniques
 - good communication with patients and professional colleagues
 - accurate and informed consent to be obtained
 - continuing accreditation of life-support status
- 13.4.4 A clear understanding of the role of multidisciplinary meetings, including:
- planning of investigations including the selection of appropriate tests and imaging techniques for the diagnosis of benign and malignant disease
 - staging of malignant disease
 - planning and outcomes of treatment
 - the detection of errors in diagnosis and complications of treatment
 - an understanding of relevant urogenital pathology
- 13.4.5 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. During the training period it is recommended that the trainee obtains experience in the following:
- plain radiography (kidney, ureter and bladder)
 - intravenous urography
 - retrograde and antegrade pyelography
 - ileal loopography
 - cystourethrography
 - hysterosalpinogography
 - ultrasonography, including abdominal, scrotal, transrectal, transvaginal and Doppler
 - CT of the urinary tract and pelvic organs including:
 - unenhanced CT for renal colic
 - staging of renal and urothelial tumours
 - staging of pelvic malignancy
 - CT-urography
 - CT-angiography
 - MRI of the urinary tract and pelvic organs
 - angiography for trainees with a special interest in interventional radiology
 - video urodynamics
 - nuclear medicine including renal transplant studies
- 13.4.6 A trainee will keep abreast of all other imaging techniques relevant to their practice.
- 13.4.7 Interventional techniques.
Trainees should acquire experience in the following procedures:
- renal tract access (percutaneous nephrostomy) (20–40)
 - antegrade pyelography
 - biopsy (renal, retroperitoneal masses, prostate) (25–50)
 - renal cyst aspiration and ablation
 - drainage of collections (5–10)
 - nephrolithotomy
 - ureteric dilatation / stent insertion (5–10)
 - transrectal prostate biopsy
 - suprapubic access to the bladder
 - other procedures e.g., PUJ procedures

The numbers for the more routine procedures (in parentheses) range from what might be expected as a guide for someone developing more than one special interest up to that which might be expected for a dedicated urogenital radiologist.

- 13.4.8 Trainees should acquire experience in the practical procedures listed above, and the number of cases undertaken should be recorded in their log book.
- 13.4.9 Regardless of the imaging technique, 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.
- 13.4.10 The exact structure of the training needs to be flexibly interpreted to allow for local facilities and expertise. It is suggested that centres who 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 one to two sessions

- 13.4.11 The trainee will become familiar with providing analgesia and/or sedation where required as well as the necessary continuous monitoring required to perform procedures safely.
- 13.4.12 The trainee should be aware of local and national guidelines on consent, and be capable of obtaining informed patient consent for practical procedures.

13.5 **Appraisal and assessment**

13.5.1 Regular appraisal of trainee will occur as described in the RCR TPP.

13.5.2 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
- a final assessment of overall professional competence before the final record of in-training assessment (RITA) review

13.5.3 Review of training programme

- It is expected that trainees will complete a feedback form (RCR TPP) 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 RCR Training Accreditation Committee (TAC) will regularly review these records to ensure that special interest training complies with the appropriate special interest curriculum.

13.5.4 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 urogenital radiological practice.