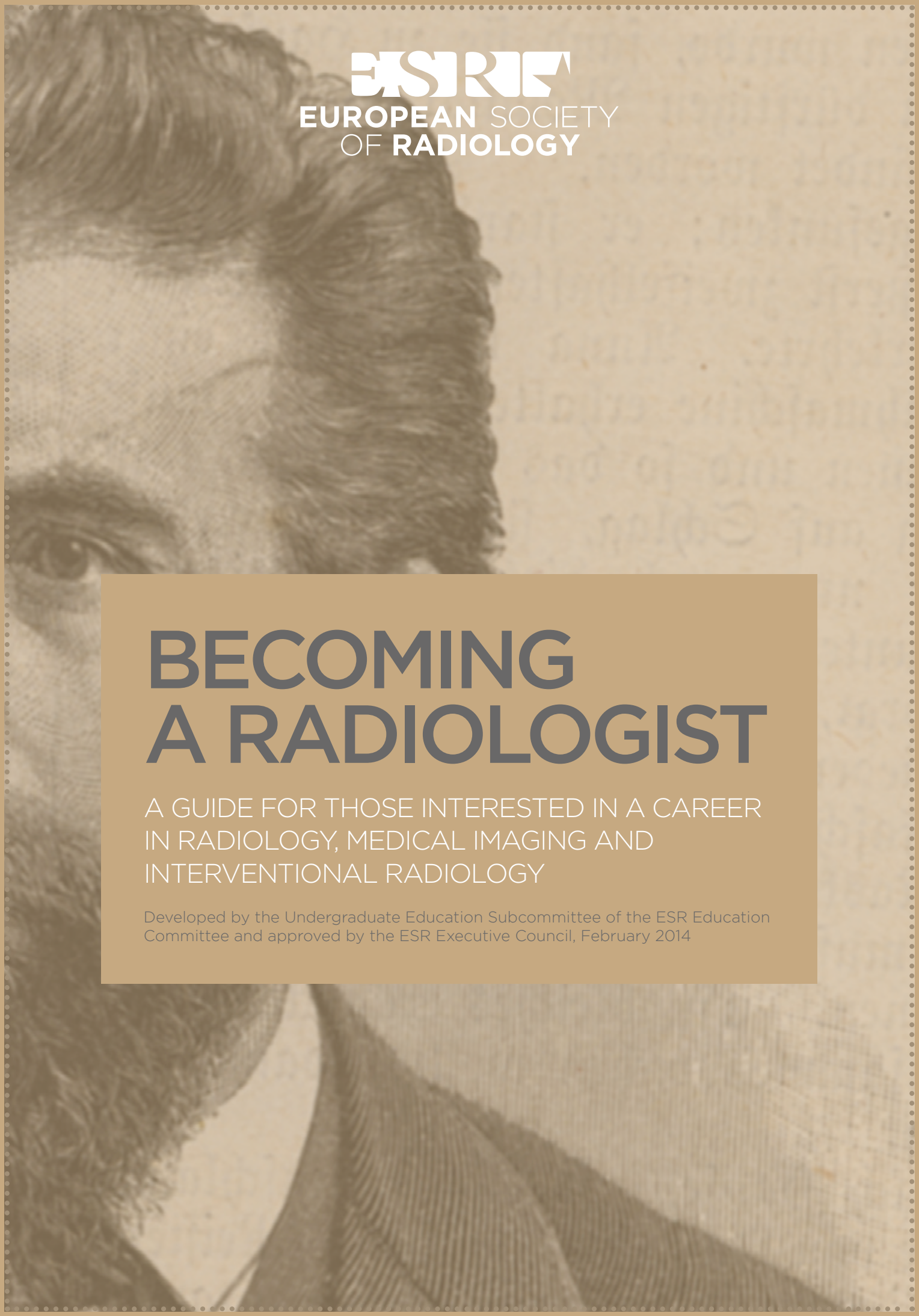

EUROPEAN SOCIETY OF RADIOLOGY

BECOMING A RADIOLOGIST

A GUIDE FOR THOSE INTERESTED IN A CAREER IN RADIOLOGY, MEDICAL IMAGING AND INTERVENTIONAL RADIOLOGY

Developed by the Undergraduate Education Subcommittee of the ESR Education Committee and approved by the ESR Executive Council, February 2014

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PREFACE

Over the last 50 years the discipline has expanded dramatically, with the development of new imaging techniques and new applications. Now almost all clinical specialties rely heavily on radiology in order to be able to function clinically. Radiology today is a cornerstone of diagnosis and treatment and radiologists are at the heart of patient care.

This expansion has been so huge that it is now possible for radiologists to choose to specialise in an individual clinical area or technique. However it is still possible to practise across the whole discipline of radiology. Academic positions are available for those who enjoy research and teaching but clinical involvement is at the centre of their work for most radiologists.

These notes are intended to inform those who are interested in the possibility of a career in radiology. They are intended only for general guidance. Conditions for training differ in different countries. Anyone contemplating a career in radiology should contact his or her national body in radiology for detailed advice.

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THE DEVELOPMENT OF RADIOLOGY

Radiology began in 1895 when Prof. Wilhelm Conrad Röntgen, a physicist at Würzburg University, discovered an unknown kind of radiation. He found that this penetrated flesh and could be used to create shadow photographs of the body (radiographs). The spread of the new discipline was dramatic; the impact on medicine was immediately obvious and within a year many hospitals had established primitive radiography departments. Over the following century the story of radiology has been one of continually advancing technology.

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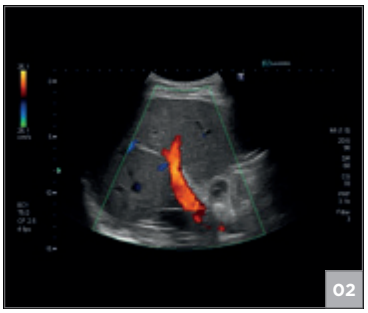
Ultrasound and imaging by radioisotope studies became clinically practical in the mid-20th century. The developments of Computed Tomography (CT) and later Magnetic Resonance Imaging (MRI) were rewarded with Nobel prizes and have revolutionised the ability to visualise, detect and characterise diseases throughout the body.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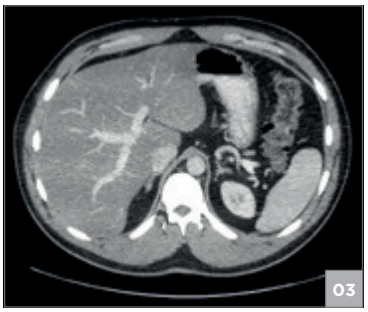
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01: © Fotolia
02: Ultrasound of the liver with Doppler blood flow highlighting © Dr. C. Nyhsen
03: CT of the upper abdomen © Dr. S. Golding
04: MRI of the cervical spine © Dr. C. Nyhsen

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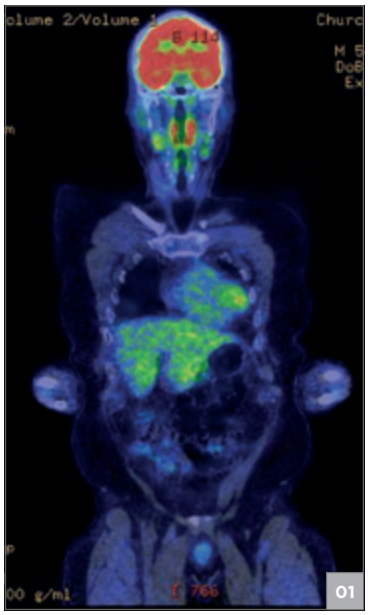
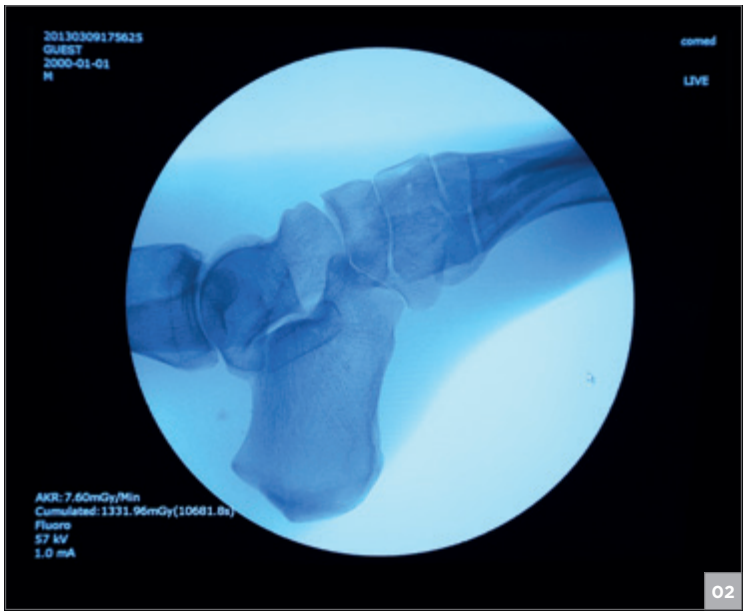
Blood vessel catheterisation became routine practice in the mid 20th century, making it possible for radiologists to carry out both diagnostic and therapeutic procedures in the vascular system. Interventional therapies were then extended into the non-vascular systems, creating the field of interventional radiology. Combining traditional imaging with nuclear medicine and other techniques that identify change in function produced functional imaging. This molecular approach, if it can be combined with targeted therapy, holds the promise of providing diagnosis and treatment in one modality.





01: Positron Emission Tomography combined with CT © Dr. S. Golding
02: Digital radiograph of the ankle © ESR – European Society of Radiology

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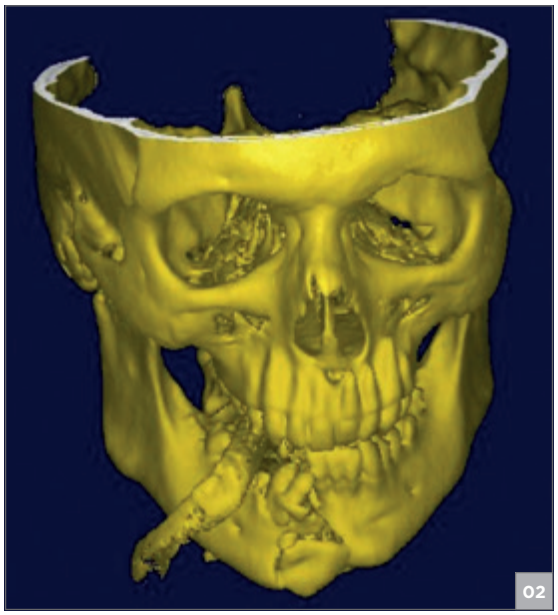
Imaging is now digitally based and open to a wide range of data processing techniques such as three-dimensional imaging or Virtual Reality. Today these techniques are used in combination to support the care of patients. New techniques and applications still emerge; radiology is a dynamic world.



01: CT of the trunk processed to display in coronal plane © Dr. S. Golding
02: Of the face processed in 3-D display © Dr. S. Golding;

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WHAT IS THE WORK LIKE?

One of the most rewarding aspects of radiology is that it relates to many points of patient care. The diagnostic role is the obvious one; when clinicians examine a patient with a specific complaint they form a view on diagnosis that is subjected to investigation. Often, imaging is one of the key investigations and frequently an essential one. The radiologist is able to advise the referring clinician what condition they should be treating, to refine the differential diagnosis or to recommend what further investigation is needed. As such, the radiologist interacts closely with the clinical disciplines.

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01: © ESR – European Society of Radiology

Radiological investigation is often demanding and may require several imaging techniques in conjunction or sequentially. Referring clinicians are dependent on the radiologist being sufficiently knowledgeable and skilled to help them deliver appropriate care for their patient.


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Radiologists are also called on to evaluate the extent of disease. This applies particularly to malignant tumours because the degree of spread usually determines the treatment, but radiology is also used in other specialties, for example to advise surgeons on appropriate access for surgical procedures, or to evaluate the response to different types of treatment and their outcome.

Cancer care now focuses around the 'Multidisciplinary Team (MDT)', where oncologic specialists, surgeons, radiologists and pathologists bring together the history, physical findings, the investigations and the histological analysis. This allows oncologists to define appropriate treatment plans.

Supporting treatment planning is an important growth area for radiologists. This includes computer-assisted treatment plans for radiotherapy, or virtual reality representations that allow surgery to be evaluated before operating. In fact the development of computer-assisted imaging has been so dramatic that some radiologists are able to specialise purely in this (radiology can absorb all types of personality, so there is even a place for the computer enthusiast!).

01: © Dr. V. Koen and Prof. M. Maas

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Medical treatment requires objective monitoring. Radiology is commonly used for this, and also to survey the patient's condition after treatment in order to ensure that disease has not recurred.

Overall, radiologists are involved and consulted at many points of patient care and find that their expertise is highly valued by clinical colleagues.

Interventional radiology

The development of vascular catheterisation made it possible to obtain detailed diagnostic angiograms. Ingeniously, the same tools were used to carry out therapeutic procedures. The first interventional procedures involved opening up narrowed blood vessels and evolved into angioplasty which is now used all over the body and includes placing stents in stenosed vessels. Very soon it was realised that vessels may also be blocked by injecting particles or coils (embolisation), to control haemorrhage or to shrink tumours or uterine fibroids. Embolisation is also used throughout the body to treat aneurysms or vascular malformations.

01: Ultrasound used in pregnancy to monitor fetal development. © Dr. S. Golding
02: © Dr. V. Koen and Prof. M. Maas

Interventional radiology techniques are also applied outside the vascular system, for example in biopsy procedures, draining abscesses, drainage or stenting of obstructed urinary or biliary tracts, relief of obstruction in oesophageal and colonic malignancies and placement of percutaneous feeding tubes. Minimally invasive treatment of spinal disc disease is now a reality, as is vertebroplasty (injection of cement into collapsed vertebral bodies for stabilisation). Interventional radiologists increasingly treat bone, joint, tendon and ligament lesions by curettage, grafting and injections.

Interventional techniques are well suited to treating malignant disease. Interventional oncology is a growing field in which tumours may be treated by arterial injection of chemotherapeutic and embolic agents (chemoembolisation). Interventional radiologists drain biliary and urinary tracts blocked by malignant tumours and place internal bypass tubes (stents). Radiologically guided treatment with High Intensity Focused Ultrasound (HIFU) or thermal-energy probes (radiofrequency, microwave or cryo-ablation) offers an adjunct or alternative to surgery.

These techniques continue to change the management of patients who would previously have been offered surgery. This ‘minimally invasive treatment’ offers lower morbidity and mortality and shorter hospital stay.

Interventional radiology is a rapidly growing clinical specialty. Its interface with other specialties, particularly surgery, cardiovascular medicine and oncology is evolving and has changed the role of the radiologist from supporting the clinician to playing a key role in treatment. Interventional radiologists may take direct patient referrals, admitting patients and taking ward rounds. This trend towards a clinical specialty continues.

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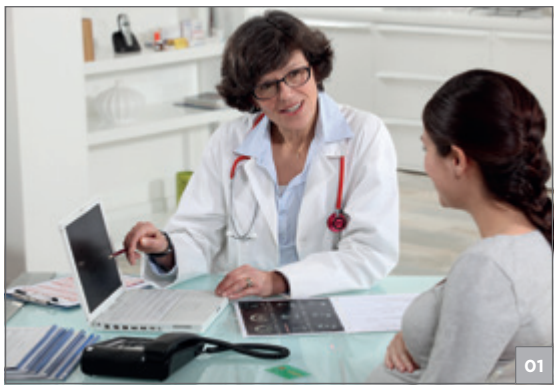
Human interactions in radiology – the patient

There is a traditional perception that radiological practice lacks clinical contact with patients. This is, in fact, misleading. While some radiologists may choose to concentrate their time on reporting diagnostic studies away from the patient, many aspects of radiology require an ability to deal with patients that is no less demanding than that of clinical colleagues. Good communication skills are in fact essential for any radiologist, and not only those who deal directly with patients.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Radiologists doing diagnostic or therapeutic procedures need to establish a professional relationship with the patient quickly. The radiologist's contact with the patient is likely to come at critical points in their care and the radiologist must be sensitive to the psychological needs at that point. Radiologists who carry out ultrasound studies or interventional techniques have a particularly close relationship with their patient. Breast imaging is another field where the radiologist may be heavily involved in the patient's primary care.


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In fact, many who decide to specialise in radiology find not only that there is sufficient patient contact to satisfy them clinically but also that to practise well they have to develop new communication skills.

01: © Fotolia
02: © ESR – European Society of Radiology

Human interactions in radiology – professionals

Radiologists deal with referrals they receive from colleagues in the hospital and may also have extensive contact with doctors working in primary care. Because interaction with clinical care is such an important feature of radiology, good communication with clinical colleagues and patients is essential. This ranges from daily advice on individual cases to formal clinicoradiological review meetings in which the radiologist demonstrates their findings and discusses the implications with the clinical team. Many radiologists find this a particularly rewarding aspect of their work. Within the hospital environment, radiologists are the team players par excellence.


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Working in radiology also requires close interaction with other staff, especially radiographic technicians, nurses, scientists and clerical staff. Departments of Radiology tend to be close working communities in which staff members with different skills combine in the interests of the patient. Many doctors find the working environment to be supportive and enjoyable. Unlike colleagues in front-line clinical specialties, radiologists rarely work alone or in an exposed position.


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01: © Fotolia
02: © ESR – European Society of Radiology

Safety and the radiologist

It is the golden rule of investigational and therapeutic medicine that the benefit must be greater than the risk. In radiology risk is provided by the use of radiation and also by drugs and contrast media used in radiological procedures and by the physical invasion of the procedures themselves. Radiologists are trained to minimise these risks in clinical practice.

Radiation risk to the patient is subject to controls under European law. In partnership with the clinician the radiologist is responsible for ensuring that investigation is fully justifiable and proceeds with the minimum radiation exposure applicable. Often this involves a clinical judgement on which may be the most appropriate or least risky approach to the individual patient. Similarly, the radiologist is called on to use their knowledge and training to minimise the other risks which arise from radiological procedures.

Because they work with radiation, radiologists are subject to statutory controls to ensure that they do not put themselves at risk. In fact, diagnostic radiologists work under well-established and safe conditions and today are at minimal personal risk. Additionally, these concerns do not apply to radiation-free techniques such as ultrasound and MRI.

WHAT TYPES OF JOBS EXIST?

Radiology today provides a wide range of different working lives. The radiologist who works in a small hospital or diagnostic centre usually provides a service across the whole of the specialty, often involving most of the available imaging techniques. In larger centres radiologists may be focused in a specific clinical area and may work exclusively with selected clinical subspecialties. A radiologist who chooses to work in one of these areas acquires a high level of expertise in the subspecialty and can expect to develop very close working relationships with clinical colleagues.

Most radiologists, whether they specialise or not, will find that their work consists of a variety of activities, ranging from providing reports on diagnostic studies to a large element of practical or 'hands-on' work with patients. Depending on the healthcare system of the country, radiologists may also work in independent diagnostic clinics. Generally a number of radiologists are involved in these and may take personal responsibility for different subspecialties. Working in these clinics offers rewards from working closely together in a small team.

The growth of digital image storage and transmission has made it possible to transfer examinations across computer networks (teleradiology) and it is no longer necessary to report images where they are created. This facility allows radiologists to offer reporting or second opinions across a wider area. Some centres have incorporated teleradiology into their emergency services to facilitate urgent reports. This facility also frees radiologists to be mobile while maintaining their work.

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01: Digital monitor display combining multiple modalities. © ESR – European Society of Radiology

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Academic radiology

Academic positions in university hospitals are particularly suited to those who like research or teaching. These activities, however, are not limited to radiologists holding academic appointments. There are many opportunities for teaching at all levels in radiology, to junior radiologists or to technical staff, students and colleagues in other specialities. Excellent research opportunity exists in radiology. Continued technical development means that radiology is a field of science providing advancing potential to engage in rewarding research. Radiologists may be engaged in exploring new techniques or their applications, or evaluating effectiveness or resource management. Because imaging provides an objective measure of disease state, radiologists, whether in academic appointments or not, are often called upon to join their clinical colleagues' research by providing accurate evaluation, or to support new drug trials.

Working in academic radiology requires a wider series of interactions. Academic radiologists frequently have contacts with scientists, research agencies and government agencies. They also maintain links with academic radiologists in other centres.

01: © Prof. K. Verstraete


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Radiologists in management

Radiologists may also take a role in managing services. In most departments one radiologist will be in overall charge and this work may take a majority of their time. In larger departments individual radiologists may be required to take managerial responsibility for their own subspecialty or imaging technique.

Because radiology interacts with so many areas of the service and provides a broad overview of medicine, radiologists become well known in their institutions and they are frequently recruited to higher management levels. It is not unusual for radiologists to be found acting as Medical Director, Chief Executive, or Dean. Some radiologists take on roles in government agencies and others may become involved in directing professional and scientific societies. These extended roles are suitable for those with leadership skills who are prepared to dedicate their time to this work.

How busy is the radiologist?

The discipline offers a variety of working environments. Life in the reporting room can be quiet but there is also place for those who like action and life-threatening situations. Imaging services must satisfy the needs of the clinical services that they serve. In a busy clinical centre there is significant demand to ensure that patients are investigated and treated in a timely and appropriate fashion. Any delay in diagnostic services may impact negatively on the patient's treatment. In short, if the hospital is busy, the radiologist is busy.

Most radiology services conform to a working day of conventional or extended office hours. This daily service is usually supplemented by radiologists being on emergency call so that urgent work can be provided. Increasingly hospitals are developing extended services where routine imaging is provided throughout daylight hours. There is also a general move throughout Europe to develop 24-hour services and this may require significant restructuring of radiologists' working lives in the future.

01: © Dr. V. Koen and Prof. M. Maas

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HOW DO DOCTORS TRAIN IN RADIOLOGY?

In order to practice effectively a radiologist needs sound knowledge of the medical background to the area in which they work. Generally speaking, a good radiologist will be characterised by an enquiring mind and a good knowledge of anatomy, pathogenesis and the behaviour of disease. Although radiology has an intensely technical basis, it is not necessary for the radiologist in training to have extensive knowledge of physics.

For this reason, those who are considering a career in the discipline are well advised to obtain 1–2 years' experience in clinical practice before undertaking their training in radiology. Some training schemes make this a formal requirement of admission.

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In general, the radiologist in training will be attached to a department in which they will work through the different subspecialties of the discipline, acquiring knowledge and expertise and building their skills. Some training schemes, but not all, require an entry examination to be taken. Some training schemes practice continuing assessment of the radiologist in training.

In addition to general training, most training schemes go on to provide subspecialty training, for example in neuroradiology or musculoskeletal or paediatric radiology. Further training in the subspecialties of radiology can also be obtained at specialised institutes.

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Professional societies in radiology

Doctors who work in radiology gain support from an extensive network of national and international societies, and of societies dedicated to maintaining inter-professional links and providing continuing education. Only the leading examples are described here.

The **European Society of Radiology (ESR)** is the largest professional organisation for radiologists in the world. It correlates scientific and political advice from the range of subspecialty societies in Europe and acts as a coordinated voice to professional bodies in European medicine and the European Union.

ESR also provides guidance on training in radiology and has established a diploma (European Diploma in Radiology – EDiR) recognising professional qualification. Its major scientific meeting is the European Congress of Radiology (ECR), which brings together all the subspecialties and related societies in a major event in Vienna each March. ESR also publishes *European Radiology,* one of the world's leading journals in radiology, and other publications.

01: © ESR – European Society of Radiology

In Europe subspecialty interests are also represented by the major **subspecialty societies.** These stimulate activity and communication between radiologists working in the same clinical area. Usually they provide at least one annual meeting, often with a number of training or continuing education courses. Some of them publish their own journals.

There are also **national societies** of radiology, which are usually responsible for representing the specialty to their national governments. Most of them provide scientific meetings or training courses and often publish their own journals. Some of them provide national qualifications in radiology.

Contact with societies is important for maintaining professional standards in the practice of radiology. Their scientific meetings and courses are a valuable source of continuing education and they provide important social links between radiologists and others in the field. Some radiologists become closely involved in the direction of their national or European societies and may achieve high profile positions in the subject as a result.

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WHERE TO FIND OUT MORE

Training requirements in radiology currently differ in detail between individual countries, and the doctor who is considering becoming a radiologist should first make contact with their national society to learn the requirements in their own country.

Advice on the requirements of training can be obtained from the ESR and also from the **Radiology Trainees Forum (RTF),** which operates under the aegis of ESR. More information on both as well as other aspects of radiology mentioned in this document can be found at **www.myESR.org.** Some national societies for radiologists in training also exist and provide useful advice.

As mentioned above, the ESR has established a **European Training Curriculum for Radiology** for a Structured Common Programme which is available at **www.myESR.org/trainingcurriculum.**

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