The clinical speciality of radiology has a history of a little bit more than a century from the discovery of X-rays by Wilhelm Conrad Röntgen in 1895 to today’s digital imaging with enormous amounts of digital morphological and functional information presented with the help of powerful computers almost anywhere you wish. The development within radiology during the last 25 years has surpassed that of all other medical specialties. The explosion of information is applying significant demands on the radiologists to learn and apply the new knowledge in their daily work. It is now apparent for radiology, represented by the European Society of Radiology—ESR, that this body of knowledge is of such magnitude that subspecialisation has become a necessity to ensure continued research and development in radiology. The European Training Charter for Clinical Radiology published in 2006 clearly recommends that the fourth and fifth years of residency training in radiology are devoted to training in a subspecialty, such as neuroradiology. Another sign of this new insight in the importance of subspecialisation is the establishment of divisions of neuroradiology and interventional radiology within the Radiology Section of UEMS (Union Européenne des Médecins Spécialistes).

The earliest evidence of the vigour of neuroradiology as a well defined body of knowledge was the formation of a world meeting in Symposium Neuroradiologicum. This meeting has, with an exception during the second world war, taken place some every 4 years from 1939 and onwards. No other section of radiology has had a clear identity defined as early as neuroradiology. The symposium is a scientific meeting and has played, particularly in the earlier years, a significant role in encouraging neuroradiological research and to explore the important associations between neuroscience and neuroradiology. National Societies of Neuroradiology were formed all over Europe in the late 1960s and early 1970s with large societies forming particularly in Germany, France, United Kingdom, Italy and Spain. A European society (ESNR) was created in 1969 and has since held annual scientific meetings throughout Europe. ESNR has also played a significant role as a political pressure group having a dialogue with the European Society of Radiology—ESR, formerly the European Association of Radiology. This work has been intensive during the last 15 years and the new directives for residency training and the creation of a Division of Neuroradiology within UEMS are direct consequences of the persistent work by the presidents of this society during this time.

The development of radiology

To understand the role played by radiology and neuroradiology now and in the future, it is necessary to understand what is presently happening in medicine. The way we
practice medicine has changed significantly over the last decades. The time for general surgeons and general practitioners in hospitals is over and these gentlemen have been replaced by young physicians with at a minimum a “special interest in” a disease or an organ system. In larger hospitals and regional centres, all general physicians have been replaced by specialised physicians with expertise in more limited areas of medicine, e.g. endocrinology, cardiology, etc. In many countries the educational system has adapted and introduced examinations in organ specialised subjects.

This change of medical practice has also taken place in radiology, however rather as a forced consequence than as a proactive change. Until recently all radiologists were required to master all types of examinations, in all organ systems and be able to report them all, to be “general radiologists”. The use of more complicated modalities, such as CT, MRI and later interventional procedures required modality specialised radiologists. Many of today’s large radiology departments are organised, built and equipped in the times when modality knowledge and expertise was the rule of the day. As a consequence the patient had to visit several different sections within the radiology department to have his ultrasound, nuclear medicine study, CT, MR and conventional radiographs performed, interpreted and reported by at least as many radiologists. The clinician was left to put all this information together without any guidance. No radiologist took the responsibility to summarise all imaging information or to formulate one single report in which the results from all imaging procedures were integrated and interpreted in an organ focused clinical context. With increasing complexity, a change of this practice has become a necessity. To meet this challenge, the radiologist must not only reorganise the department but more importantly acquire new competence in clinical medicine as most development and research in radiology today happens in the interface between the clinical and imaging knowledge. In the past this mode of operation was pioneered by the neuroradiologists, who early mastered all available modalities as they applied to neuroradiology, particularly CT and MRI, and were early in introducing multidisciplinary conferences or rounds.

Radiology must also follow the development in medicine in general. New demands for organ based rather than modality based competence have emerged. Future radiology departments must support organ based or disease process based radiology. We will soon see more or less independent radiology departments specialised on oncology in oncology centres, and neuroradiology will be allowed to establish itself in neuroscience centres, just to give two obvious examples. This development means new and different challenges for the radiologists. It is no longer acceptable just to describe the findings in the images and to provide a list of differential diagnoses. Now the radiologist is required to interpret the images in the light of clinical, imaging and physiological evidence and to participate with the clinician in the analysis and synthesis of a diagnosis. The recent challenge for radiology has been to see or predict this development and act accordingly.

However before this insight was common, there have been casualties along this road when radiology has been unable to meet the challenge from clinical medicine. Hence we have seen how ultrasound examinations in obstetrics and neonatal neurology have been taken over by the obstetrician and neonatologist while cardiac radiology and interventions is now a lucrative business for cardiologists in most European countries. This is a consequence of the radiologists not taking new challenges seriously and missing the chance to meet the wishes and demand from the clinicians by acquiring better clinical knowledge and deeper knowledge in physiology and imaging within a more limited field of radiology, to develop a subspecialty. The ideal of the “general radiologist” has been the trap in which radiology has fallen and while the radiologist was struggling in the morass of ever increasing numbers of routine examinations, the clinicians picked the raisins out of the cake and learned just so much specialised radiology that was necessary to be more useful than a general radiologist—and the written reports of the radiologists were ignored!

There are many radiology reports buried in medical records or RIS systems that were never read because they contained no useful information for the clinician. With little or no daily intellectual contact, the general radiologist does not understand the needs of the clinician and his reports will not answer the clinician’s often unexpressed questions. With a distributed and easy access to images, clinicians will think that viewing the images will be enough and they will interpret the images, not reflecting over their clinical bias in seeing what they expect or want to see in the images. As a result, even fewer radiology reports will be read in the future, unless they on a regular basis contain useful information providing “added value” in patient care and are considered valuable by the referring physicians. This can be achieved only by a radiologist understanding the clinical context through clinical training and knowledge, earning him a valued partnership in the “clinical team”.

Properly displayed images obtained by ever improving imaging techniques have rendered the radiologist superfluous unless the radiologist can provide added value to the discussion over the images. The key to this development has been establishing multidisciplinary team meetings in which the radiologist can play an important role provided that he has knowledge about the entire clinical team and can participate as an integral part of the clinical team. This requires the radiologist to master all imaging modalities in order to advise about further investigations and to provide full diagnostic information, integrating results from all studies and modalities used in the imaging up work of the patient. To be able to fill this role, the radiologist cannot merely “have an interest in” but must have deep clinical knowledge of the specific organ system or disease process. In this he must be equal to the clinician but superior in his image interpretation skills. He must be a specialist radiologist! If not, he does not provide added value and can be disposed from the clinical team without being missed.

Neuroradiologists understood these mechanisms early and devoted their practice to just one organ system, the central nervous system (CNS). There was a large portion of trained neurologists among the early neuroradiologists in Europe; maybe this is one explanation for the early identification of neuroradiology as a speciality area within radiology. Neuroradiologists also understood early the need for using
all, old and new imaging modalities, in their study of the CNS.

Neuroradiologists have often been considered difficult to please within the structure of a Department of General Radiology. Numerous are the examples of conflicts in which the needs of an organ based specialty, i.e. neuroradiology, have been contrary to the philosophy of a general department in which a “fair” allotment of equal time on a modality rather than the usefulness for an organ based speciality, dictated how the limited recourses were shared in the department.

A neuroradiologist wishing to be part of the clinical team will also have to be present and available in the daily meetings with clinicians. There must be a build-up of trust between the clinician and the neuroradiologist to create the added value. This cannot happen if teleradiology is allowed to take a significant portion of non-routine neuroradiology. Teleradiology is cheaper in the short perspective and hence very tempting to administrators and health care providers. However, to understand the role and place of teleradiology, one must understand that there is a spectrum of imaging studies from the very simple routine study with the aim to exclude disease to the complicated mapping of a disease process prior to surgery or in follow-up after various treatments. It is only the very simple examinations that can be interpreted or read without further communication between the referring clinician and the radiologist. It is in planning and interpreting of the more complicated procedures that the expertise and skill of a neuroradiologist is required in person. Thus the neuroradiologist must be able to justify his on-site presence with superior knowledge and skill to add value and to remain in demand by the clinicians.

Neuroradiology has for several decades been at the forefront of this changing process of how medicine is practiced. European neuroradiologists understood early the importance of a practice dedicated to one organ system and to build superior expertise and skill. European neuroradiologists understood also early the importance of scientific development and realised this in their creation of the world meeting in neuroradiology—Symposium Neuroradiologicum. ESNR was first in radiology to develop postgraduate courses—European Course in Neuroradiology. Neuroradiologists also understood early the potential of new imaging techniques and were involved very early in the development of clinical use of CT and MRI. Realising the complexity of these modalities, engineers and physicists became partners and the cooperation has borne fruit in abundance.

From having been recognised as a group of professionals being difficult to please within radiology, neuroradiology has now become a role model in teaching practice for other subspecialties within radiology as is expressed in the “European School of Radiology—ESOR”.

What is the future of neuroradiology in Europe?

As a neuroradiologist, I am proud of my “heritage” as a radiologist. This was up till now clearly the best training for me to become a neuroradiologist. However the future may be very different! Whether we like it or not, imaging or radiology as an independent specialty is probably going to disappear. The need for better clinical training in ever more focused areas of clinical medicine will transform the radiologist from a generalist to an expert or specialist with superior knowledge and skills in imaging of a specific organ or disease process. A future imager is going to be a clinician with an imaging profile. This development will necessarily have implication for the future training of neuroradiologists. Future neuroradiologist fitting this new bill will need to have a solid base in basic and clinical neuroscience and will eventually focus on imaging with a tailored training in basic radiology, including technical issues and radiation protection, while the training in neuroradiology will be expanded and include diagnostic imaging and associated physiological investigations.

Awareness of this trend of development will soon raise the question about a new structure of a training program to neuroradiology. One must ask the question whether or not there is still need for, or rather if we can afford to have a long period of training in general radiology in such a system. It is likely much more effective to introduce a modular system in which teaching in basic neuroscience is followed by a system by which the student can choose from a “menu” with modules of highly invasive treatment (neurosurgery), minimally invasive (interventional neuroradiology), medical treatment (neurology) or diagnostic imaging (neuroradiology) to tailor a teaching program leading to a variety of profiles in a specialisation in the diseases of the nervous system. In such a system, when spread to other areas of medicine, radiology will be lost as a cohesive discipline and various branches of radiology, e.g. neuroradiology, will instead move to become a subspecialty of a clinical discipline.

A modular system of training is already suggested within UEMS as it is recognised that the old system of a set number of medical specialities no longer fits the developments within medicine. Hence well recognised bodies of knowledge such as oncology and intensive care medicine have no chance of forming section within UEMS and thus forming specialities. A similar situation exists for interventionell endovascular neuroradiology (INR), an activity in which several established specialties have an interest—neuroradiology, neurosurgery and neurology, just to mention the most obvious. Developing a modular training program in INR, with individually tailored training programs, is probably the only possible way to obtain an agreement concerning the content of such a training program.

Conclusion

It is my conviction that the future of neuroradiology in Europe is bright. However, this vision of our future is dependent on a few preconditions. Whether we like it or not, radiology as a single discipline is unlikely to survive. Future neuroradiologists will probably not need to have general radiology training. Thus it will be necessary to reform the training of neuroradiologist into becoming a neuroscientist with an imaging profile with or without competence in endovascular treatment. It will be necessary to reorganise future departments of radiology in order to support organ or disease process oriented work flow with distributed equipment localised close to the patient and in an intellectual environment with organ-specialised
clinicians of various profiles. The nature of neuroradiology today is not a specialty focused on producing an ever increasing number of examinations and reports but rather a clinical specialty in which the neuroradiologist can have an intellectual exchange of knowledge and skills, providing added value to patient care with his or her particular competence in imaging interpretation and minimally invasive treatment as applied in patients with diseases of the central nervous system. This is the challenge of the new decade!

Conflict of interest

The author declares no conflicts of interest.