When it comes to lung biopsies, the key factors are patient consent and collaboration, the indications and contraindications, imaging review, guidance selection, patient positioning and the use of local anaesthesia, and recovery and potential complications, said Italian interventional radiologist Dr. Mario Bezzi, from the department of radiological sciences at the Sapienza University of Rome. “Remember to team up with the patient,” he said.

Bezzi had some practical advice on how to perform a lung biopsy. “I start the procedure without contrast medium at that point,” he said. “If I need more than 30 mL of contrast medium, I split the dose. I inject contrast medium near the vessel, I inject contrast medium on the non-contrast images, but when it comes to going near the vessel, I inject contrast medium at that point.” He lighted the dose of the contrast medium if needed more than 30 mL.

“Four is the maximum number,” he said. “For a skinny lady, I would say that 40 mL is enough. At that point, you can be sure that you have three to four biopsies.”

A point of controversy, however, was needle size. “A member of the audience said he uses a 20G Tru-Cut side-cutting needle for most lung biopsies and gets good results, but Bezzi expressed surprise. He prefers 20G modified Menghini end-cutting needles because compared to side-cutting needles, modified Menghini devices allow for a bigger tissue core.”

When discussing the pre-procedural evaluation for lung biopsies, Bezzi expressed surprise. “What are the main risk factors?” asked a delegate. “The main risk factors are chronic obstructive pulmonary disease, patient age, needle size, lesion size <10 mm, lesion depth, lack of previous surgery procedure time, an operator’s experience, and conditions that increase chest pressure, such as a cough or tracheal cannula.”

Pre-procedural evaluation for lung cancer comprises peripheral emphysematous bullae, bronchiectasis, and the presence of comorbidities and conditions that can suddenly increase pressure in the chest. Other potential complications are haemoptysis, haemorrhage, failure and the consequent need to repeat the procedure, infection, sepsis, and air embolism, he said. A haemorrhage “is very often asymptomatic, self-limiting and intraparenchymal. In the case of haemoptysis, it’s necessary to reassure the patient and inform a referring physician of the need for closer monitoring during the recovery period.”

An air embolism can occur if the vessel is punctured inadvertently, and air is aspirated by negative pressure or embolised by positive pressure. The symptoms resemble those of stroke, transient ischaemic attack, seizures or cardiopulmonary collapse, and a CT scan of the chest and brain is recommended. To manage air embolism, make the diagnosis and place the patient in the left lateral decubitus position or with the head down, and 100% O2 or hyperbaric O2 should be administered in the intensive care unit, he noted.

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MRI ensures no more stabbing in the dark over wound length

A ground-breaking study examining the reliability of MRI to image experimentally produced stab wounds in amputated human limbs was presented for the first time during the opening day of ECR 2014.

The Italian study involves collaboration between the University of Padua’s radiology and forensic departments. It’s exciting news for the growing number of radiologists imaging non-life-threatening wounds that don’t require immediate resuscitation or CT, but that do need careful clinical management and from which images may end up as forensic evidence in criminal cases or being used in post-mortem reports.

The study is the first using MRI on the path to more MR studies on stab wound patients in the routine clinical setting, whether for defining the length and direction of the wound or for diagnosis of vessel or organ injury.

The researchers used both 5-mm CT and 1.5-T MRI to ascertain the incision length of 10 wounds, each of which was between 4 cm and 6 cm deep. CT and MRI examinations were performed before stabbing, and with the knife inside the wound track, the latter with CT only. Both MR and CT were also carried out before and after filling each wound with contrast medium. The length of the ceramic blade used to penetrate the limb was then compared with the length of wound filled with contrast medium.

Both modalities underestimated the length of the wounds inflicted, possibly due to tissue retraction once the knife was pulled out of the limb; CT underestimated wound length by an average of 11.9%, and MRI by an average of 12.5%. Although this is not a great statistical difference, one cannot yet extrapolate from this that MR is superior; the results generally reflect good signal with MRI and may lead to even more positive results in future, according to Dr Chiara Giraudo, a resident radiologist at Padua who specialises in forensic and musculoskeletal imaging, and who presented the study at yesterday’s scientific session on emergency radiology.

She said the limits of the study consist of the small number of stab wounds studied, their orientation and site (stab wounds may be multi-directional and have different features in different organs) and the fact that these wounds were made on amputated limbs and the results therefore don’t factor in bleeding and tissue elasticity. Nevertheless, the preliminary results are promising.

“So far both CT and MRI can provide consistent and reproducible data on the injury depth,” Giraudo told ECR delegates.

She noted that further trials on live subjects are scheduled for next year, and will help overcome the current limitations of this study in tandem with the creation of a new forensic unit at the hospital. Such studies are needed to confirm and explore the reliability of MRI and are due to include different MR sequences used to explore a range of wounds in various anatomical areas, not just the limbs, inflected by different weapons. Furthermore the studies should also include a protocol for MRI without contrast medium.

Another Italian study took centre stage during Thursday’s session, this one also pertaining to patient management but focusing on the clinical impact of chest and abdominal CT on emergency patients. The presenter was Dr. Matteo Brambati, a radiologist at San Donato Milanese Hospital, Milan.

While the number of CT scans has increased by 20% in the past 20 years, CT only yields expected findings in 40% of cases. The study aimed to determine how CT changed clinical management of patients and also measure therapeutic variation related to CT results in each subject, he said.

What do James Bond’s boss and French singer Matthieu Chedid have in common? Their name: a single letter that carries with it the elegant mystery of Ian Fleming’s most famous character and sounds like aime, love in French. It was only a matter of time before this iconic letter entered the ECR’s history as well.

The M building usually hosts scientific sessions being held at the M building to discover the EuroSafe Imaging campaign’s exhibition. The campaign in the ESR’s latest initiative to promote medical radiation protection in the EU.

The M building is a remarkable piece of architecture that swallows natural light through large windows and open space. This new addition to the Austrian Center Vienna is particularly welcomed by the congress participants. There’s no such light pouring in it’s very enjoyable. It’s also easy to find thanks to good signage and the purple colour, that reminds us of the congress bag,” said Daniel, a young French radiographer.

ECR’s new building puts the M back in meeting

The M building was opened in 2009. It was built in the early 2000s to provide extra space during renovation work in the Vienna International Centre (VIC), and was previously designated C1. It hosted all conferences during the renovation of the C building, the main conference facility until 2013.
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It is CIRSE Members, Fellows and Committee Members that make up our Society. To celebrate 30 years of this extraordinary community, we’re offering our Members a specially reduced registration fee of €300 for CIRSE 2014. But this is only available until June 5, so don’t miss out!
The overwhelming thirst for basic knowledge was evident at yesterday’s Mini Course on skeletal radiology, as delegates crammed into Room E2 to hear insights from Prof. Iain McCall, former ESR President and a gold medallist at ECR 2012.

McCall was keen to highlight how radiologists must approach the analysis and interpretation of plain film radiographs in a structured format. Vital to building up an understanding of plain film was recognizing the features of differing responses of the bone, joints and soft tissue to various disease processes, and to trauma, he explained.

The availability and relative cheapness of plain film make it the first line investigations in the majority of situations pertaining to musculoskeletal (MIS) disorders. Weight-bearing and dynamic views, as well as capacity to quantify, add value to this established modality, particularly in skeletal imaging.

“As you all know, orthopaedic surgery uses low quantification. They’ll draw a line or an angle on almost every radiograph they have,” said McCall, formerly professor of radiological sciences at the University of Keele and consultant MSK radiologist at Oswestry’s Orthopaedic Hospital, UK.

He pointed to several standard views of the lumbar spine in which quantification of the anteroposterior index had been conducted for congenital diaphragmatic hernia. While in these images dislocation was clearly visible, in some circumstances dislocation is less well-defined, and in those cases quantification is of key assistance to the diagnostic process.

Continuing his talk in the structured manner he favours for the interpretation of plain film, McCall’s first key point was to always have two views.

“Never settle for one view. Fundamental fact. If you take nothing else from this lecture, make absolutely sure that you have two views at least,” he insisted.

He demonstrated this by showing delegates images of a limb in which there was a scientific focus on the bone shaft in the anteroposterior (AP) view. Radiologists might be torn between a diagnosis of a caught disc or a superimposed lymph node. The lateral view, however, showed cortical thickening, and further investigation with CT revealed benign cortical thickening in the anterior aspect of theibia.

His second take-home message was to know normal anatomy and its appearances – as well as its variants.

“If you do not know what the plain film looks like normally, then it is very difficult to make a diagnosis of an abnormality,” said McCall, pointing to images of a normal wrist in AP-oblique and lateral views all giving different amounts of information about the relationships of the carpal bone’s. “Any examination of junior trainee radiologists should include a test of their knowledge of normal anatomy.”

Radiologists should also remember the numerous normal variants, as demonstrated by a view of the normal lumbar spine and one of a lumbar vertebra – a variant of the normal growth process, according to McCall.

Good radiographic technique should result in a low patient dose and high-quality images, but that’s not always the case, as there is generally a trend towards increased dose through a greater frequency of examinations and high dose examinations.

Decision-making and variation exposure factor selection also vary significantly from radiographer to radiographer, according to a study by the University College Dublin (UCD) School of Medicine and Medical Science in Dublin, and the College of Radiographers, according to a study by Sarah Darcy, who presented the results of the study in front of a packed audience.

She and her colleagues at UCD used the Tobii TX300 system, an eye-tracker using pupil-centre correlation technology (PCC) eye-tracking using an infrared light to print the reflection, which is then captured by a camera. The images obtained are then turned into data: “What we were interested in was fixation, fixation duration and the time it takes to first fixation. We wanted to determine whether variations do exist between radiographers in the area of exposure factor selection and, if so, how does this relate to the way they visually assess patients before examination,” she said.

They asked radiographers of different ages and experience from an Irish teaching hospital to sit down at the eye tracker, look at the images and explain which examination factors they were going to use for this or that examination. Darcy and her colleagues used 40 virtual patient models and four commonly performed radiographic examinations (AP shoulder, portable chest, AP lumbar and lateral lumbar). They also recorded exposure factors for patient models while eye tracked.

“What Darcy and her colleagues found out was unexpected,” he said. “There is a significant correlation between lower radiant milliampere-seconds (mA) values and age and experience, and an even stronger correlation with the number of years of digital only practice.”

“Older and more experienced radiographers gave lower mA doses for the lumbar examinations. The higher mA doses were used for AP shoulder. The longer the time to first fixation on relevant anatomical areas for the AP portable chest examination, the higher the patient’s kilovoltage dose was,” she said.

In this environment, standardisation and equalisation of dose is even more important and must be achieved, she argued. “To achieve this we believe that we need to understand the decision-making of the radiographer. Further investigation is necessary and should be expanded to other centres, and we should pursue optimal patient care.”

In another talk, Nejc Mekiš from Ljubljana, Slovenia, discussed the impact of additional copper filtration upon radiation dose received and image quality during adult chest examinations. Copper filtration is used, especially in paediatric applications, to reduce radiation dose to patient.

Mekiš took part in a study by the University of Ljubljana, the UCD School of Medicine and Medical Science in Dublin, and the College of Health and Technology Polytechnic Institute of Coimbra in Portugal.

They looked at the impact of additional copper filtration within the primary’s dry beam, and used anthropomorphic phantom imaging to do so. They used routine chest examination protocols across Slovenian clinical sites and experimental protocols in two representative clinical centres. They then analysed the resultant radiation dose and image quality findings.

“We found out there is a wide range of protocols in use clinically for the most common diagnostic examination (chest x-ray). Even in the PA position, radiographers organs recorded significant dose reductions, between 20 and 37%,” he said. “There is also potential for greater superficial organ dose savings in this position,” he said. “The sharing of experiences between the three academic centres created the potential to investigate practice and optimise protocols to achieve dose reductions.”

Radiographers explore dose reduction strategies

Exposure indices, image quality and patient dose were at the heart of the scientific session for radiographers on Thursday at the ECR.
The ECR celebrated World Book Day on Thursday as the ECR’s very own bookshop, the Buchkontor, opened its doors. The shop stocks a selection of Austrian literature so delegates on their way to the EPOS area can pick up books by classic Austrian authors like Arthur Schnitzler and Stefan Zweig and contemporary writers, including Nobel Prize winner Elfriede Jelinek and thriller novelist Wolf Haas.

The bookshop also sells books about architecture and cooking, as well as travel guides, maps of Vienna, souvenirs, snow globes and postcards. It also stocks chocolate and organic children’s clothes by local designers.

Radiologists who don’t have time to visit the city but want to experience Austria should visit the stand and take something with them, according to the bookshop’s owner, Ulla Harms. “I think they will just want to take a piece of Austria with them if they don’t have time to go to the centre. Vienna is a very attractive city to visit,” she said.

Radiologists tired of looking at images on their computers all day should also pay a visit to the stand. “People should read less on their tablets. We work the whole day on computers so it should be nice to flip through a book’s pages and enjoy the images,” she said.

Buchkontor owner Ulla Harms offers a huge variety of books in the bookshop on the first level.
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Russian radiology enters critical period of rapid change and modernisation

Today’s ESR meets Russia session will provide ECR delegates with a rare opportunity to get acquainted with the current practices and challenges facing the country’s radiologists. Over the past couple of years, radiology has benefited greatly from its share of the government’s 10 billion Euros investment in medical equipment, made between 2011 and 2012, and the profession is now entering a phase of modernisation and restructuration.

Every year around 100 million x-ray diagnoses take place across more than 6,000 hospitals in Russia. Besides x-ray investigations, the nation’s imaging tests in 2012 covered 142 million. This is a stark contrast to the financial and infrastructure meltdown after the break-up of the former Soviet Union and the creation of independent states. This had a major impact on healthcare in particular.

However, even after the government’s investment, some difficulties still remain in radiology and across the wider healthcare system that doctors must address in daily practice, according to experts introducing today’s session. Among them will be Prof. Nadezhda Rozhkova, head of mammology at the Russian Scientific Center of Roentgenoradiology in Moscow and president of the Russian Association of Radiology (RAR) and Prof. Igor Tyurin, chief radiologist of the Russian Ministry of Healthcare and vice-president of the RAR. The challenges include the significant differences in provision between urban and rural areas, a vast chain existing between the villages of Cherkaz in Yakutia, for example, where 2,000 people have access to one x-ray room, and Moscow, where patients have access to a multitude of clinics and modalities.

Furthermore, radiology’s new influx of equipment brings with it the necessity for new areas of knowledge and more specialists, as well as a reorganisation of education programs. This reorganisation may help resolve the division between the country’s 15,000 ultrasound specialists and its 2,000 roentgenologists specialised in x-ray CT and MRI, which has stemmed in part from a system in which Russian doctors undergo only two years of subspecialisation after their five years of general medicine.

“We are very glad that Russia has been selected to be a one ESR’s hosts countries, as it won in 2006. Today’s ESR meets Russia session testifies to the recognition of Russian radiology by the European and international radiological community and reflects the ever increasing activities of radiologists and radiographers from our country. Thanks to the ESR, an ERA member society, over 800 Russian radiologists will obtain their individual ESR memberships every year. We hope that this trend will continue across the congresses to come,” said ESR 2014 President Prof. Valentin Sinitsyn, chief of radiology at the Federal Centre of Medicine and Rehabilitation, Moscow.

In terms of equality in access to radiological services, the Russian healthsystem promises much needed modernisation, but proponents need to be careful in the way they implement it. Starting first with the problem, not the solution, is imperative or the result could be disastrous, according to speaker Dr. Oleg Pianykh, assistant professor at Harvard Medical School, U.S.

“Despite the recent Russian government decree reducing it time zone to 9, the country’s territory has not become any smaller travelling from Vladivostok to Moscow is often more challenging than going to a different continent. This is exacerbated by uneven and diverse population, patchy infrastructure, and very irregular distribution of clinical expertise. Russian radiology may approach Western standards in major cities, but it looks extremely antiquated elsewhere,” he explained.

This situation is even more complicated by the lack of unifying standardisation, training, planning and financing, essential for improving services. As a result, what can be predictably achieved in an average EU country turns into a lengthy process in Russia, according to Pianykh.

“In many regards, Russia still remains a terra incognita for the international radiological community, as well as for its own patients. I know that many European radiologists and teleradiology companies are interested in exploring the Russian healthcare market, and I would like to address some of their questions,” said Pianykh, whose lecture will cover the development and use of web-based teleradiology in Russia. He cites teleradiology development as imperative for solving many of the country’s healthcare problems. He believes, however, that the main approach in any solution should be bottom-up. Russian hospitals need to understand the benefits of teleradiology and start adapting it themselves. "Forcing top-down solutions, ‘prescribed’ by the government or major teleradiology players, often leads to deadlocked projects, unused installations, and resistant physicians. The sheer efficiency of teleradiological implementation should be its major driving force. Teleradiology in Russia should provide services in the most severe conditions, where minimal expertise meets minimal infrastructure, often seasoned with a lack of interest,” Pianykh said. “We can only prove the benefits of teleradiology to Russian hospitals and their patients if we start by solving their most important problems first.”

Pianykh is working with several hospitals in Moscow, St. Petersburg, Yakutsk, and Sakhalin, willing to explore teleradiology and medical image sharing in general. However, these projects depend entirely on the individuals involved. When they relocate to other hospitals, the projects often follow. “True successfull teleradiology should become contagious. So far it is not the case, and there is no general success trend, or country-wide success recipe,” he noted.

Making teleradiology practically useful in the only way to make it widely accepted in Russia. The top-down approach, when governmental legislators and teleradiology monopolies gather enough resources to force ‘typical’ teleradiology solutions into the majority of Russian clinics is far less desirable than developing a demand-driven ecosystem of diverse solutions and educated users, with growing demand driving the natural spread of teleradiology services. An average Russian radiologist, faced with any shortage of local resources or expertise, should be able to say: I know this problem, and I know how it can be optimally solved with my teleradiology setup. And if I do not have this set-up yet, I know how I can get the one I need.”

Pianykh concluded. Also at today’s session, a subspecialist in pancreatic imaging, Prof. Grigory Karmanovsky, chief of radiology at Moscow’s Vavilovsk Institute of Surgery will discuss how increased incidence of pancreatic malignancies is leading to a demand for new imaging techniques. He will present his group’s experience with the ever increasing activities of radiologists and teleradiology companies, and reflect on the financial and infrastructure monopolies that are interested in exploring the Russian healthcare market, and I would like to address some of their questions,” said Pianykh, whose lecture will cover the development and use of web-based teleradiology in Russia. He cites teleradiology development as imperative for solving many of the country’s healthcare problems. He believes, however, that the main approach in any solution should be bottom-up. Russian hospitals need to understand the benefits of teleradiology and start adopting it themselves. “Forcing top-down solutions, ‘prescribed’ by the government or major teleradiology players, often leads to deadlocked projects, unused installations, and resistant physicians. The sheer efficiency of teleradiological implementation should be its major driving force. Teleradiology in Russia should provide services in the most severe conditions, where minimal expertise meets minimal infrastructure, often seasoned with a lack of interest,” Pianykh said. “We can only prove the benefits of teleradiology to Russian hospitals and their patients if we start by solving their most important problems first.”

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Pianykh concluded. Also at today’s session, a subspecialist in pancreatic imaging, Prof. Grigory Karmanovsky, chief of radiology at Moscow’s Vavilovsk Institute of Surgery will discuss how increased incidence of pancreatic malignancies is leading to a demand for new imaging techniques. He will present his group’s experience with the radiation protection campaign to address challenges of radiation protection.

Welcome by the ESR President G. Fijař, Paris/FR

Panel of speakers:

N. Rozhkova; Moscow/RU
VE. Sinitsyn; Moscow/RU
L.E. Tyurin, Moscow/RU

Introduction: Russian radiology today

N. Rozhkova; Moscow/RU
L.E. Tyurin, Moscow/RU

CT perfusion in the differential diagnosis of CNS pathology

I.N. Proenč, Moscow/RU

Interlude: Development and use of web-based teleradiology in Russia

O.S. Pianykh; Newton Highlands, MA/US

Tuberculosis in Russia: a challenge for a national radiological service

L.E. Tyurin, Moscow/RU

Interlude: Mystery of Denizov’s cave and palaeoradiology

M. Mednikova, Moscow/RU

Advances in imaging of pancreatic masses

G.G. Karmazanovsky; Moscow/RU

Interlude: An artistic view of CT

A.L. Fudin, Moscow/RU

Panel discussion: Future developments in Russian radiology: which path to take?
removal of pancreatic tissue, o/ft en could be operated on with minimal excluding ductal adenocarcinoma, diagnosis. However, all tumours, level of correlation between MDCT typical cases, staff achieved a high the department’s own formula. In modern statistical methods and types of pancreatic tumours using fusion for estimation of tumour and data have increased from tech- niques such as PET/CT and PET/MRI, per- fusion MDCT, as well as low-dose iterative image reconstruction and endoscopic ultrasound.

Karmazanovskiy’s radiology department recently attempted to assess the likely success of contrast-enhanced MDCT in the differential diagnosis of various types of pancreatic tumours using modern statistical methods and the department’s own formula. In typical cases, staff achieved a high level of correlation between MDCT data and morphology. However, some cases complicated the differential diagnosis. Various, excluding ductal adenocarcinoma, could be operated on with minimal removal of pancreatic tissue, often through robot-assisted or laparo- scopic surgery discussed with the surgeons in advance. All post-processing techniques were an extension of radiological diagnosis and the beginning of sur- gical planning. The most ‘optimal’ tumour location was the distal por- tion of the gland. In some cases, a median pancreatectomy could be performed, he noted.

Endoscopic ultrasound and MR pancreatic cholangiography are effective methods for the evaluation of cystic lesions because with these techniques it is possible, for example, to differentiate the different types of intraductal papillary mucinous neoplasms (IPMN), according to Karmazanovskiy: “If dynamic monitoring shows rapid increase in the diameter of a cystic lesion, growth of internal pap- illary mass, or infiltration of pancre- atic tissue – these are signs of malignancy,” he said. “Conventional cysts have clear, smooth contours and are not associated with the ductal system.”

Looking forward, Karmazanovskiy foresees a growing role for PET and the discovery of new tumour ‘mark- ers’. Fast MR pulse sequences will also gain ground in pancreatic tumour diagnosis, he predicts, with PET/MR and PET/CT used in specialised cen- tres after initial diagnosis. In elderly patients, MDCT remains the leading method, with new technologies such as iterative reconstruction making this method less deleterious to the patient.

The European Society of Head and Neck Radiology (ESHNR) was founded in 1987 and is one of the smaller subspeciality societies affi- liated with the European Society of Radiology (ESR). Membership is open to any qualified professional who has made a significant contribution to head and neck radiology or who devotes a significant portion of their time to the study of diseases of the head and neck. Our society benefi ts from a healthy mixture of radiolo- gists, crossing the boundaries of body imaging and neuroradiology. Next to neuroradiologists, there are body imagers or those who only practice head and neck radiology which allows a high level of understanding in head and neck radiology

Training in head and neck radiology training is often neglected, and should form part of core training, allowing the acquisition of knowledge nec- essary for acute care and general radiology. ESHNR Education Board members therefore submit ques- tions to the ESR to be used in the European Diploma in Radiology (EDiR) examination. The ESHNR has a particular interest in education, and holds a popular annual meeting which consists of a mixture of cutting-edge topics, scientifi c research presentations and a refresher course. The last meeting took place in 19th in Moscow, 2013. The next meeting the 21st Congress and refresher course is to be held in Marseille on September 26–27, 2014. The ESHNR will present prizes for the best oral presentation and poster.

We recognize that high level specialist training in head and neck radiology may be difficult to attain. Therefore, we have established head and neck imaging fellowships for radiologists within three years of certifi cation. These programmes off er trainees the opportunity to supplement their exist- ing knowledge with further intensive modular training in head and neck radiology supervised by a specialised tutor in highly regarded academic training centres around Europe. These programmes were off ered and will be continued in cooperation with the European School of Radiology (ESOR) in 2013. Successful applicants receive a grant provided by the ESR, ESHNR and the ESR. A certificate from the ESR and ESOR is awarded upon successful completion of the programme, and a written report of the work undertaken is provided.

Members of the Society assist the ESR in the preparation and organisa- tion of the annual European Congress of Radiology providing a broad spectrum of education to those who want to learn basic head and neck radiology and those who wish to learn from lecturers from the best centres in the world.

Radiologists who wish to demon- strate that they have attained a higher level of understanding of head and neck radiology can take the exami- nations for the European Diploma in Head and Neck Radiology by con- tributing to the ESR self-assessment tools, we encourage continuous, life- long learning. As a friendly and active multi- national society we aim to make a difference to the level of knowledge and understanding in head and neck radiology across Europe. The size of our membership allows all members to participate actively if they wish to, and have their voice heard. The annual meeting is a perfect opportunity to meet other radiologists and exchange new ideas. New members are always welcome to our society. You are warmly invited to come to Marseille to learn, have fun and make new friends.

More information about the ESHNR can be found at www.eshnr.eu
MRI and MRI-based techniques accordingly, “he said.

“Areas in the brain are like airports of different sizes. You have small airports like Geneva, intermediate or small areas, and the nervous system to a description of the functional and structural connectivity between all cortical areas and subcortical structures,” he said.

“A typical example of a disease primarily affecting the hubs would be Alzheimer’s disease. Schizophrenia is different, with a more distributed network of alterations affecting global efficiency. ‘In this case, it is as if traffic were reduced by 10%; global traffic is still going, but not as well as it normally would,’ said Hagmann, who has been working on the topic extensively at CHUV.

“The development of diffusion MRI and MRI-based techniques such as white matter tractography – the computed reconstruction of images acquired during an MRI scan – and segmentation of white and grey matter in the past decade have played a crucial role in the emergence of connectomics, by providing tools to map, in vivo, the entire human structural connectivity at a macroscopic scale,” he said.

“The brain represented as a network: image obtained from MR (Provided by Patric Hagmann, CHUV-UNIL, Lausanne, Switzerland)
ESR launches EuroSafe Imaging campaign to address challenges of radiation protection

Patients undergoing x-ray and CT examinations will probably never know it, but 2014 looks set to be a critically important year for making the whole process safer because the ESR has chosen ECR 2014 to start the EuroSafe Imaging campaign.

Just as the launch of Image Gently in January 2008 has educated both imaging and healthcare professionals worldwide about the need to minimise radiation dose exposure to children, the ESR's new initiative is also expected to have a significant impact, given the society's global reach and membership base.

This new initiative – as well as the accompanying activities of Image Gently of the American College of Radiology (ACR)/RSNA Image Wisely, and national safety campaigns in the U.K. – will be discussed at the 2014 ESR Radiation Protection Session. Dr. Madan M. Rehani, the ESR's director of radiation protection, will be joined by three leading advocates of radiation protection for a highly informative session on how radiologists, radiographers, and medical physicists are making imaging safer for their patients.

"Europe has a great tradition of placing much importance upon medical radiation protection," Rehani said. "However, for each new generation, each new introduction of the CT increases the risk of harmful exposure. While some of my peers may only have seen a handful of imaging exams in their lifetime, a child may be scanned perhaps five or six times by 2020, when I joined the International Atomic Energy Agency (IAEA) as a Radiation Safety Specialist. There has not much discussion about this subject with respect to protecting staff (e.g., radiologists and radiology department staff) from exposure to radiation. Now the focus is predominately on the patient."

The objectives of the EuroSafe Imaging campaigns are to promote appropriateness in radiological imaging to maintain radiation doses within diagnostic reference levels (DRLs) and to use the ALARA (as low as reasonably achievable) principle to further reduce doses without compromising clinical image quality. "The campaign will also join forces with relevant national radiological societies, subspecialties societies, related medical professions, international organisations and utilise social media effectively," he explained.

To be supported by a major media campaign, a variety of outreach programs, and a dedicated website, EuroSafe Imaging includes an ambitious number of activities planned. Educational material prepared in multiple European languages will include development of lists of criteria for safe radiological exams for CT, mammography, radiography and other less used but high radiation dose procedures. Radiation protection sessions for department chairs and senior radiologists will be held. Training material and electronic self-assessment modules on radiation protection topics for residents will be developed and every ESR electronic newsletter will include an article on this topic. On the healthcare IT front, the ESR will continue to work on its current large scale project to develop European imaging referral guidelines and integrate them into a web-based clinical decision support (CDS) system at the point-of-care to increase their use. CDS deployment has already proven to reduce the number of exams ordered for patients that are either clinically inapposite or unnecessary.

Development of a certification scheme for hospitals that comply with the campaign’s recommendations is planned, and the Friends of EuroSafe Imaging Group is being established. Both this group and the ESR will be lobbying for funding of medical radiation protection activities.

"This campaign is building upon excellent projects supported by the European Commission which have produced valuable results: The ESR itself has been coordinator of a number of projects on medical radiation protection. The goal is to consolidate these efforts and produce coherent picture, and increase visibility throughout Europe. One of the most important aspects of the campaign is to show how much we have achieved in terms of patient protection – it’s what we have done and achieved in Europe and what we can do for the future," Rehani noted.

One of its projects is to implement a European Commission Tender project to provide European DRLs for children and to promote their use. The project will be undertaken by a consortium that includes the European Society of Paediatric Radiology, one of more than 75 members of the Alliance for Radiation Safety in Pediatric Imaging (STUK).

"With this perspective, it's no surprise that the ESR also plans to link the campaign with Image Gently. Prof. Marilyn J. Goake, professor of radiology at the Cincinnati Children’s Hospital Medical Center in Ohio, was one of the original team of concerned paediatric radiologists to launch the ImageGently campaign. She remains one of its most active leaders.

Since its inception, the Alliance has conducted six major international campaigns, starting with an initiative to childish CT scans and to encourage physicians to order alternative exams if possible. Alliance members have worked diligently with medical device vendors to encourage them to adopt a standardised exposure index, to provide better and more comprehensive training to radiographers on imaging children, both with respect to educational materials and on-site training by application specialists. CT vendor accomplishments in particular have included new scan protocols to reduce radiation exposure and reconstruction software that improves the quality of a low dose CT Image. But the routine display of DRL-specific dose estimates on CT scanners will be great step forward for quality improvement within radiology departments and in dose registries, she commented.

"The Image Gently website is filled with educational information, one of which is available in several languages, for parents, ordering physicians, radiographers, radiologists and medical physicists. Recent campaigns, such as the ones developed for fluoroscopy and nuclear medicine, have had a lot of input from European societies," said Goake. "Until Image Gently began, Europe was at the forefront in protecting its paediatric patients from receiving radiation. Look at it now. It's 2014 and we are at the cutting edge of ultrasound. We think that Image Gently has this desire to protect children globally."

In her talk, she intends to provide an update on the Image Gently campaign. In particular, she will discuss the need for diagnostic reference levels in paediatric radiology, and the importance of educating parents about what they need to do and ask in this digital age. Unlike several generations ago today, children now have the unique opportunity of having all of the imaging exams and reports of their lifetime consolidated electronically. "Young parents especially have become social media astute. Our social media efforts can make them knowledgeable about how they can keep track of the radiation exposure of their children and also to ask if a non-radiating exam can be used," she added.

Social media is also at the heart of the Image Wisely campaign, which will be discussed by Dr. James A. Brink, radiologist-in-chief of Massachusetts General Hospital and professor of radiology at Harvard Medical School. Image Wisely launched at the RSNA 2010 annual meeting by the ACR and the RSNA is a predominantly North American focused campaign but with a global message. Its goal is to encourage radiology professionals to take personal responsibility for keeping patients safe from inappropriate and excessive exposure to radiation dose.

One recent development that Brink plans to discuss is the series of radiation safety cases being developed. Each year, Image Wisely develops six radiation safety cases. These allow radiologists, radiographers, and medical physicists to assess their own understanding of important radiation safety concepts such as radiation dose monitoring and interventions. He’ll also update session attendees on other developments, including how Image Wisely plans to work with and support the ECR and its EuroSafe Imaging campaign.

ESR Radiation Protection Session

Friday, March 7, 10:30–12:00, Room P 12/13, ECR 2014

Panel Discussion: Moderators: C. Owens, London/UK; P. Wick, Liège/BE

Panelists:

- Dr. Madan Rehani is the ESR’s director of radiation protection.
- Prof. Marilyn J. Goake from Cincinnati, Ohio, is one of the leaders of the Image Gently campaign.
- Dr. James A. Brink from Boston, one of the Image Wisely campaign task force members.

• ESR EuroSafe Imaging Campaign
  • M.M. Rehani, Vienna/AT
  • Image Gently Campaign
  • M.J. Goake, Cincinnati, OH/US
  • Image Wisely Campaign
  • J.A. Brink, Boston, MA/US
  • Lessons from a national approach to patient safety in radiation protection
  • P. Cavagni, Taunton/UK
  • Current challenges for radiation protection research in Europe
  • J. Jeppsson, Paris/FR

Speakers (as listed above)

European Commission, C. Simonov; Luxembourg/LU
IAEA, R. Chibnall, Vienna/AT
WHO, M. del Rosario Perez, Geneva/CH
IHECA and Federal Office for Radiation Protection (BfS), J. Greibel, Munich/DE
Art. 13 Group of Experts/ICRP, E. Vain, Madrid/ES
COCER, L. Dünzip, Brüssel/BE
EBRA, G. Paulo Coimbra/PT
EFOMP, J. Damakulski, Irkutsk/RU
CIRBE; W. Jachais, Innsbruck/AT
EPF, N. Bedlington, Brüssel/BE

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American and European emergency radiologists compare experiences

For the fourth year in a row, the European Society of Radiology (ESR) and the Radiological Society of North America (RSNA) will hold a joint course on a hot topic in radiology. After oncologic imaging for the past three years, emergency radiology will be under the scope of North American and European radiologists, who will share and compare their experiences in the dedicated Mini Course today at the ECR.¹

**Joint Course of the ESR and RSNA: Emergency Radiology**

**Friday, March 7, 16:00–17:30, Room F1**

**#ECR2014F1 #MC722**

**Moderators:** S.E. Mirvis; Baltimore, MD/US

**A. General principles**

U. Linsenmaier; Munich/DE

**B. Challenges of imaging paediatric abdominal emergencies**

S.D. John, Houston, TX/US

**C. Imaging in ENT emergencies**

D. Nunzi, New Haven, CT/US

**MC 622: Chest emergencies**

**Friday, March 7, 14:00–15:30, Room F1**

**#ECR2014F1 #MC622**

**Moderators:** S.E. Mirvis; Baltimore, MD/US

**A. Non-traumatic thoracic emergencies**

C.M. Schaefer-Prokop; Amersfoort/NL

**C. Interactive case discussion**

R.A. Rowley, Madison, WI/US

M. Smits, Rotterdam/NL

**MC 722: Abdominal emergencies**

**Friday, March 7, 08:30–10:00, Room F1**

**#ECR2014F1 #MC422**

**Moderators:** S.E. Mirvis; Baltimore, MD/US

**A. Thoracic injuries**

S.E. Mirvis; Baltimore, MD/US

C.M. Schaefer-Prokop; Amersfoort/NL

**A. Interactive case discussion**

R.J. Zagoria; San Francisco, CA/US

R.J. Zagoria; San Francisco, CA/US

**Saturday, March 8, 16:00–17:30, Room F1**

**#ECR2014F1 #MC22**

**Moderators:** S.E. Mirvis; Baltimore, MD/US

**A. Abdominal injuries**

A. Palkó; Szeged/HU

R.J. Zagoria; San Francisco, CA/US

**A. Interactive case discussion**

A. Palkó; Szeged/HU

R.J. Zagoria; San Francisco, CA/US

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**myESR.org**

¹ www.eser-society.org

² www.rsna.org

³ www.snm.org

⁴ www.esr-society.org
The cost of developing new drugs to treat cancer is extraordinarily expensive, and the time to bring a promising drug to market takes many years. Functional imaging biomarkers offer the potential to help make product evaluation more accurate and to expedite the process of bringing a drug to market.

In pre-clinical studies, imaging biomarkers can help identify treatments that are achieving stated objectives and those that are not. In clinical trials, they are used to characterise a tumour phenotype by quantifying biological characteristics such as necrosis, hypoxia, cellularity, and metabolism. The standardisation of imaging will address what is needed and what is being done to qualify imaging biomarkers and functional imaging in cancer drug development. ECR today interviewed two of the presenters to find out more about the main issues.

The use of functional imaging in large-scale multi-centre clinical trials is complicated by limited technical reproducibility between imaging modalities and the protocols used at research centres, inadequate standardisation of protocols and imaging techniques, and lack of necessary skills outside large centres, according to Professor Nandita M. deSouza, professor of oncology and imaging at the University of Manchester and NHS Foundation Trust in Salford, U.K. It is important for radiologists to be involved with the design and planning of clinical trials at the outset. Clinical trials can only be managed properly if radiologists know what questions can be answered by Functional imaging. Radiologists first need to establish a close relationship with oncologists and with collaborators, they said. “If radiologists are engaged in the process from inception, then they will be able to standardise the protocols, identify all factors needed for comparable data and prove that the protocol is compatible with the clinical pathway. DeSouza explained. Because of this, specialist radiologist input is essential at the stage of trial design and set up to make sure that the trial protocol is designed accordingly and it is important that functional imaging is incorporated appropriately for the agent under investigation.

Recent advances in imaging and quality control represent the foundation in determining compatibility of data. Measurements need to be made on a test object of known value on scans in order to establish standardised test objects, to represent the foundation of this, specialist radiologist input is imperative that functional imaging is performed using CT, MR, US, and PET, often with a contrast agent or radiotracer. DeSouza recommends defining a standard protocol and using this protocol to establish the variability of the measurement across sites. However, use of scanning protocols to deliver data that can be compared may not be obvious, and differences in scanner hardware and software may mean that identical protocols are not achievable on different scanners. It is important to investigate this and to do what is needed to compensate, and it is also important to select contrast agents to scanner hardware or software being used at all the trial sites. DeSouza also recommended defining a standard test object and all variations are reported.

To help avoid significant variations between scanners and software, DeSouza recommends defining a standard protocol and using this protocol to establish the variability of the measurement across sites. Unfortunately, use of scanning protocols to deliver data that can be compared may not be obvious, and differences in scanner hardware and software may mean that identical protocols are not achievable on different scanners. It is important to investigate this and to do what is needed to compensate, and it is also important to select contrast agents to scanner hardware or software being used at all the trial sites. DeSouza also recommended defining a standard test object and all variations are reported.

Another problem is that compatibility may be compromised by radiographers who may not appreciate the necessity of strictly adhering to the imaging protocol. By making adjustments to suit a patient during scanning, data output may be affected. Additionally contrast agent injection time and rate during an exam must be consistent.

Analysis needs to be centralised using the same software. Data should never be processed by individual scanners. Reader variability needs to be addressed with agreed protocols for observer-annotated data. Unless observed for quality assurance and quality control measures.

Functional imaging should be performed at least in the expansion phase of a Phase I trial so that it can inform and assist in the evaluation of targeted agents under investigation. If this is incorporated appropriately for the agent under investigation.

In order to achieve accurate and reproducible quantitative results from imaging, it becomes meaningless,” she stressed. Validation of an imaging biomarker can be measured reliably anywhere in the world. Validating an imaging biomarker is a massive undertaking and may be best achieved by consensus and in public-private partnership. The Innovative Medicines Initiative (IMI) is Europe’s largest public-private initiative. It is a joint undertaking between the European Union and the European Federation of Pharmaceutical Industries and Associations (EFPIA). IMI has a substantial budget to boost pharmaceutical innovation in Europe. One of its flagship projects is QuaIC-ConCePT, established to qualify imaging biomarkers of tumour cell proliferation, apoptosis, and necrosis. The consortium includes academic and EFPIA partners. Similarly, the RSNA-sponsored Quantitative Imaging Biomarkers Alliance (QIBA) is an initiative to advance qualitative imaging and the use of imaging biomarkers in clinical trials.

To date in 2013, it has brought together a consortium of vendors, researchers, and other healthcare professionals who have been working to accelerate the development and adoption of hardware and software standards needed to achieve accurate and reproducible quantitative results from imaging methods.

Special Focus Session

Friday, March 7 16:00-17:30, Room 1M

ECR TODAY | FRIDAY, MARCH 7, 2014

SD 16: Imaging biomarkers in cancer drug development

- Chairman’s introduction R.E. Vercauteren- Clijsenaers
- Qualification of imaging biomarkers in drug development J.C. Waterton; Manchester/UK
- Functional imaging in cancer drug development N.M. deSouza; Salford/UK
- Nuclear medicine in cancer drug development A. Bilodeau; Vancouver/CA
- What new imaging biomarkers are on the horizon in drug development?
Radiographers and radiologists tackle educational challenges and child protection issues

Two topics of relevance to the whole spectrum of medical imaging professions will be addressed on Friday, in the first two of this year’s promising selection of sessions aimed primarily at radiographers.

A Refresher Course with a broad perspective on child protection issues kicks off the programme, moving beyond the usual key area of radiation protection to look closely at risk communication, as well as images and reports as legal evidence. Then, later in the afternoon, the Special Focus session on Educational challenges for radiographers will bring radiologists very much into the conversation. Both sessions are sure to appeal to a wide audience, not least due to the panel discussions rounding them off, both of which address radiologists and radiographers together.

Over the last decade or so, there have been many changes in the educational environment for radiographers, and all healthcare professionals. Although hugely positive, the paradigm shift resulting from the Bologna process, although hugely positive, the paradigm shift resulting from the Bologna process, which tips the balance of responsibility to both of these professions could be key, as today’s session will highlight.

“This is a ninety-minute session, so we don’t expect to solve the problems of the world but we will have the opportunity to make an analysis of the strengths and weaknesses of radiographers’ education, as well as the opportunities and threats, taking into consideration the economic crisis and its impact on the health sector,” said McNulty. “We are stepping aside a bit from the floor.”

The session will provide advice on how to approach such situations, as well as insights into the value of keeping good notes in paediatric imaging scenarios. “Any radiographer or radiologist could potentially find themselves answering questions in court about the images or reports they have produced, in that they could be used as evidence. There are ways of avoiding this, by having good contemporaneous notes or producing a good, detailed witness statement at the time of the examination. A lot of professionals are not aware of the importance of this and will be summoned to the court to give evidence months or years later,” said McNulty. “This should be a very exciting session for all attendees; not only radiographers,” said McNulty. “We are stepping aside a bit from the floor.”

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Along with radiation protection, risk communication is extremely topical in healthcare and the radiology community is generally aware that more focus needs to be put on communication and consent procedures. The issue of communicating risk to both the child and their family or carers in a major fashion, for instance when obtaining consent for a child to undergo an invasive interventional procedure, and an awareness of how to do so effectively to assuage parents or guardians can have benefits for all involved. The session will provide advice on how to approach such situations, as well as insights into the value of keeping good notes in paediatric imaging scenarios. “Any radiographer or radiologist could potentially find themselves answering questions in court about the images or reports they have produced, in that they could be used as evidence. There are ways of avoiding this, by having good contemporaneous notes or producing a good, detailed witness statement at the time of the examination. A lot of professionals are not aware of the importance of this and will be summoned to the court to give evidence months or years later,” said McNulty. “This should be a very exciting session for all attendees; not only radiographers,” said McNulty. “We are stepping aside a bit from the floor.”

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Advanced MR techniques can help cope with peculiarities of tumour progression

MRI performed by radiologists as part of a multi-disciplinary team is crucial for both the diagnosis and follow-up of brain tumours, as is the careful evaluation of the peculiarities of progression of all tumours.

Speakers in today’s session on Imaging after systemic therapies: the standards also will draw attention to adherence to international guidelines in ensuring uniformity of treatment response evaluation.

Dr. Carlos Majós, a radiologist who works for the public health system in Spain, specializing in brain tumours, and is based at the Institut de Diagnóstic per la Imatge (IDI) in the Bellvitge Hospital of Barcelona, said that the best way to evaluate brain tumours after systemic therapy is by follow-up imaging. "Assessment of response, diagnosis in Neuro-Oncology (RANO) criteria, with strictly standardised protocols of sequences and timing.

"RANO is critical in the diagnosis and follow-up of brain tumour," he said. "Nowadays, it is widely accepted that the evaluation of brain tumours has to be a part of a multidisciplinary approach, and that the radiologist should play a prominent role in this task.

Malignant gliomas (World Health Organization grade II and IV) are the most common primary tumours of the brain. According to consensus guidelines, the standard of care for these tumours includes maximal safe surgical resection followed by combined treatment with chemotherapeutic agents and radiotherapy. Small brain tumours have peculiarities that distinguish them from tumours found in other sites. These tumours require different strategies to influence their evolution. Malignant gliomas of grade II, IIIa, and the low- and high-grade tumours of the brain, and the T3M3 classification of malignant gliomas is very helpful.

"These tumours are highly infiltrative, and local recurrence is the rule. An isolated recurrence is not possible, since the tumours are multifocal and cannot correspond to anything but the brain," commented Majós. "As a consequence, it is the radiology specialist who evaluates the extent of resection (EDR) as opposed to the pathologist. There are also concerns that treatment-related inflammatory phenomena can largely influence imaging and the evaluation of the response. "As such, it is important that the general radiologist becomes aware of the peculiarities of these tumours and is familiarized with their management and the evaluation."

In today’s talk, he will discuss points of critical importance relating to radiological assessment of brain tumours.

1. Within 72 hours of surgery, an early post-operative MRI is required to evaluate the extent of resection (EDR) as opposed to the pathologist. The extent of resection is more common and distant follow-up is often challenging due to the subjective nature of the assessment and variation in the interpretation of terms and definitions.

2. Two to six weeks after completing chemoradiotherapy, a new MRI examination is recommended to evaluate treatment response according to the RANO criteria.

Majós noted that at this point the pseudoprogression (PsPD) phenomenon, which was instrumental in treatment decision-making, requires a decision on whether to switch treatments or not.

Majós continued that tumour response might still be found in follow-up in cases with PsPD (see figure), so stopping treatment in PsPD could sometimes prevent patient benefit. "Currently it is not possible to distinguish between PsPD and true progression by MRI within 3 months of radical surgery, and the only radiological method for distinguishing between progressive disease and PsPD is to perform follow-up examinations.

He also noted that advanced MRI techniques, such as diffusion-weighting imaging (DWI) in particular, as well as localisation of the tumour, can provide advantages for the assessment of PsPD, but evaluation of these alternative techniques was needed. Until such data is available, Majós advices caution in using these techniques.

"Currently it is not possible to distinguish between PsPD and true progression by MRI within 3 months of radical surgery, and the only radiological method for distinguishing between progressive disease and PsPD is to perform follow-up examinations.

Also speaking in the same session, Dr. Yoav Meno, professor and head of radiology at Saint Antoine Hospital in Paris and president of ECR 2011, will discuss the importance of imaging to evaluate systemic therapy response now that various cancer medications have improved prognosis significantly.

He will also focus on the value of following international guidelines to ensure uniformity of treatment-related decision-making and in interpreting the peculiarity of progression versus new lesions.

"Thirty years ago the survival of patients with metastatic colon cancer was seven months on average," he remarked. "Today the same patient would be expected to survive for around 7-8 years. More than 50% of patients with metastatic disease are expected to survive more than 5 years after the course of treatment, a patient needs imaging in order to evaluate treatment results.

With this respect to evaluation of response Meno emphasized the importance of international guidelines in ensuring an international language and uniform evaluation across institutions. "For patients with the same disease and the same treatment results should be evaluated similarly whatever the country, the machine, the oncologist or the radiologist. The oncology community including the radiologist should all agree on the definition of a progressive disease, a partial and a complete response, or a stable or a stable disease," he said. "International morphological criteria are also very complementary to each other in functional evaluation rather than concurrence."

He also noted that such uniformity was instrumental in treatment decision-making because virtually all decision criteria are met, or stable disease is not an option.

Reflecting aspects of Majós talk, Meno will also discuss the peculiarities of tumour progression. He noted that progression of non-target lesions was often challenging due to the subjective nature of the assessment and variation between institutions.

New lesions present difficulties, according to Meno. "In most cases the new lesions are unequivocal, either big, and cannot correspond to anything else but tumour progression. However in some cases new lesions are small, or difficult to differentiate from tumour progression or sometimes small and may correspond to fibrosis or scar tissue.

In such cases, the oncologist would probably continue treatment until progression was unequivocal.

"It is not advisable to decide that a patient is progressive only because a small lesion appears. For this reason, criteria like ibrc (immune-related response criteria) include the potential for new lesions within the bulk of the tumour, and these new lesions do not necessarily mean that there is progression. However this applies to specific treatments, specific tumours, and specific clinical cases."

Commenting on the future, Meno suggested that criteria might need greater adaptation to specific situations. "For instance, patients treated with targeted therapy can sometimes experience an increasing size of the tumour at the first evaluation, even if the patient will further positively respond to the therapy."

The Categorical Course, Oncologic Imaging: Follow-up of Systemic and Local Therapies, will continue until Monday.

Follow-up images obtained in the early post-operative period of a glioblastoma and 1, 3, and 6 months after concomitant chemoradiotherapy. There is a slight growth in the post-operative exam that could be attributed to true progression or pseudoprogression. A reduction of the enhancement in the exam a month after radiotherapy confirms pseudoprogression. Complete response was obtained to months after radiotherapy by maintaining adjuvant chemotherapy. To stop this treatment (3 months) because of the patient's health prevented the patient receiving effective treatment. It is important for the radiologists to be aware of the pseudoprogression phenomenon. (Provided by Dr. Carlos Majós)
MRI manufacturers demonstrate the latest innovations, upgrades and enhancements

MRI has opened up the human body for radiologists to explore with remarkable precision and to gather clinical information of enduring value for physicians, colleagues, but the liver has so far proved a real diagnostic challenge. A combination of the organ's complex vasculature and motion effects in free-breathing patients have meant that other modalities have often been chosen instead of MRI, particularly when looking for metastases in oncology cases.

This situation is changing due to the efforts of imaging vendors who have been working on expanding the role of this technology in body imaging. Visitors to the commercial exhibition can inspect a new software application which improves temporal resolution in images along with other developments that make scans both safer and more comfortable for patients.

**SIEMENS** is unveiling a technology that it says will make contrast-enhanced liver imaging fast and robust and allow free-breathing dynamic liver imaging, giving more patients access to high-quality MR-based abdominal imaging.

Dr Bernd Ohnesorge, chief executive of Siemens' MRI business unit, explained that the key software technologies underlying the company's new Twist-Vibe and StarVibe features will be available together as a package called FREEZEit. The former is a sequence that offers high-temporal and spatial resolution with full 4D coverage for multi-arterial imaging with 100% contrast-timing. Mean-while, StarVibe is an application software suite and additional scan can sometimes exceed three seconds with about 1 mm spatial resolution, it not only removes the problem of motion artefacts but also produces high-quality images, enabling the accurate detection and characterisation of small lesions.

In time, the software produced for liver imaging could be adapted for investigations into other organs such as the breast and lungs, Ohnesorge suggests.

At ECR 2014, TOSHIBA is introducing a reportedly compact and cost-effective new scanner that delivers robust, free-breathing, contrast-enhanced exams for non-compliant patients by resisting motion artefacts.

Toshiba’s Twist-Vibe MR sequence is designed to enable correct contrast imaging in dynamic liver MRI, allowing fast, robust liver imaging with full 4D coverage. This series of images shows how the new technology can boost lesion enhancement within the arterial phase with Twist-Vibe: it is now possible to generate multiple stacks of images from the arterial phase to follow the lesion enhancement over time. (Provided by University Hospital IKS, Mannheim, Germany)

**GE HEALTHCARE** is another vendor that has been concerned about the potential distress caused by excessive noise in some older MR machines, and last year introduced its own proprietary technology, called Silent Scan. This year it is unveiling a software upgrade that includes tools for carrying out quieter procedures in more clinical areas.

The company points out that machine noise during a conventional scan can sometimes exceed 110 decibels, equivalent to the sound level near the stage at a rock concert. This is caused by vibration in the coils resulting from rapid changes in field strength. Silent Scan is based on a novel data acquisition method where gradients are used continuously, but are not rapidly switched on or off. Thereby, mechanical vibration is eliminated in order to make the patient feel a little more comfortable. Moreover, the new light design of the board helps reduce the claustrophobic feeling that many patients experience,” said Hans Baartman, senior product manager for Toshiba’s European MRI business.

Full arials and premium suites are available, and the body package can be extended to include the SpineLine so that allows vascular imaging without the use of contrast, will reduce potential health risks for the patient and make the procedure more cost-effective, the company suggests.

MRI manufacturers continue on page 18

**FREEZEit** will be commercially available from summer 2014 onwards in Siemens Magnetom Aera CT and Magnetom Skyra 3T scanners, and this technology offers the first step in the process of making MRI a more appropriate modality for use in staging early cancers. By providing full high-resolution liver exams in two to three seconds with about 1 mm spatial resolution, it not only removes the problem of motion artefacts but also produces high-quality images, enabling the accurate detection and characterisation of small lesions.

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and virtually no noise is generated during the process, according to the company.

The new applications are continuing a wave of interest, spurred on by high-profile legislation legally mandating a wave of interest, spurred on by high-profile legislation legally mandating breast density. Use should be limited to patients that have already had mammography or 3D tomosynthesis scans, or automated breast ultrasound scans, or automated breast ultrasound scans. Only if both are inconclusive should MRI be used, according to the high cost and significant demand for MRI resources. The same should also apply for procedural and diagnostic use; it should be used as a last resort if ultrasound or initial scans need additional clarification. This has also been highlighted by recent research on the over-use of MRI for pre-operative breast surgery in low-risk cases, where MRI is used to offer further clinical benefit to care. This may change moving forward as reimbursement for MRI continues to decline. However, in order for MRI to be used most effectively, the ongoing debate into breast screening needs to lead to a formal, universal, adaptive care pathway. Only then will MRI be most effectively used to offer a patient-focused solution.

RESEARCH: AT THE CUTTING EDGE
Neurology is currently experiencing a wave of interest, spurred on by high-profile government policies and vendor focus on neurology-specific MRI tools. The recent realization that 7 Tesla MRI could also be viable in the future for more widespread research has also spurred on development in this field. Admittedly, the majority of advancements have been at the premium end of the market, especially highlighted by intriguing partnership of MRI and the emergence of fully integrated PET/MRI. With rising awareness of neurological conditions such as Alzheimer’s and schizophrenia, development of neurology-specific MRI technology will surely continue. This could also mean neurology-specific technology will become more widely available in less expensive systems, prompting the possibility of widespread MRI screening for neurological disorders in the not too distant future.

BY STEPHEN HOLLOWAY

Despite severe reimbursement cuts, limited healthcare spending and the threat of EU legislation, MRI remains one of the leading diagnostic imaging modalities. It has also become the new champion of radiology for general imaging, picking up the slack following the dose concerns and misuse of CT.

In recent years, development of application-focused MRI technology has appeared to slow. Improvements on scan-speed, workflow and operating costs have begun to unravel developments, broadening the availability of MRI imaging during acute times. Few of these developments however have offered new insight for clinical diagnosis – but that might be about to change. Could MRI finally be on a path towards greater clinical specificity?

EXTREMIT Y MRI: OVERLOOKED AND UNDEVALUED
In recent years, extremity MRI has long been seen as a secondary market for high-end specialist orthopaedic clinics. Yet as healthcare providers search for more efficient cost-saving solutions, the interest in extremity MRI has increased. Improvements in extremity MRI technology have also helped raise interest, offering an intriguing alternative MRI workflow. It is common knowledge that central hospital MRI systems are often overbooked, with patient waiting time for MRI scans often months long. What is less well known is the proportion of extremity MRI scans performed on whole-body scanners. Recent estimates suggest it could be as high as one quarter. Yet extremity systems accounted for approximately 7% of the global revenue total last year. Surely utilisation of the newest generation of extremity MRI systems exceeds ‘over/’out’ for busy hospital MRI systems makes clinical and financial sense for many users.

NON STANDARD MRI: EXPANDING DIAGNOSTIC HORIZONS
Some of the most effective advances in imaging recently have not necessarily been purely due to MRI technology advances. Instead, collaboration with other modalities has led to innovative new diagnostic techniques. Fusion imaging, using MRI and ultrasound or interventional x-ray has been particularly prominent, mostly due to the efficiency and improvement in guidance offered with dual-modality imaging. PET/CT imaging has also become far more regularly used, especially in oncology and radiology planning. PET/MRI is also close to commercial availability despite the eye-watering costs, it is trusted as the gold standard in diagnostic imaging. However, it is offering a far cheaper solution in the meantime. Overlaying and fusing PET/CT images with high resolution MRI imaging could provide a far less-expensive virtual PET/MRI solution, or until real PET/MRI becomes more affordable and available. Watch this space.

BREAST MRI: MISGUIDED BUT STILL A ROLE TO PLAY
Breast MRI is currently one of the most heated debate topics among healthcare providers. Realisation that breast-screening and diagnostic pathways should be more patient-specific has also raised the profile of MRI as an alternative to conventional mammography. Breast density remains at the core of the issue, with support for adaptive diagnostic pathways based on patient breast density growing day by day. High-profile legislation implies requiring physicians to tell patients their breast density has also fuelled the debate.

Expanding the scope and regularity of MRI use is a positive development for the MRI market, with vendors keen to capitalise on the high profile and contentious topic of breast screening. However, to date, the application of breast MRI has been relatively misguided and patchy. Clearly the future for breast MRI should form part of a diagnostic pathway based on breast density. Use should be limited to patients that have already had mammography or 3D tomosynthesis scans, or automated breast ultrasound scans. Only if both are inconclusive should MRI be used, according to the high cost and significant demand for MRI resources. The same should also apply for procedural and diagnostic use; it should be used as a last resort if ultrasound or initial scans need additional clarification. This has also been highlighted by recent research on the over-use of MRI for pre-operative breast surgery in low-risk cases, where MRI is used to offer further clinical benefit to care. This may change moving forward as reimbursement for MRI continues to decline. However, in order for MRI to be used most effectively, the ongoing debate into breast screening needs to lead to a formal, universal, adaptive care pathway. Only then will MRI be most effectively used to offer a patient-focused solution.

NEUROLOGY: AT THE CUTTING EDGE
Neurology is currently experiencing a wave of interest, spurred on by high-profile government policies and vendor focus on neurology specific MRI tools. The recent realization that 7 Tesla MRI could also be viable in the future for more widespread research has also spurred on development in this field. Admittedly, the majority of advancements have been at the premium end of the market, especially highlighted by intriguing partnership of MRI and the emergence of fully integrated PET/MRI. With rising awareness of neurological conditions such as Alzheimer’s and schizophrenia, development of neurology-specific MRI technology will surely continue. This could also mean neurology-specific technology will become more widely available in less expensive systems, prompting the possibility of widespread MRI screening for neurological disorders in the not too distant future.

STEPHEN HOLLOWAY is Associate Director at Medical Devices & ICT, ECR.
During the last year of the preparatory phase, Euro-BioImaging successfully carried out the first call for Nodes and finalised plans for its infrastructure model and user access policies. In spring 2013, Euro-BioImaging published the first Open call for Nodes, taking concrete steps towards the construction of a coordinated, open-access imaging infrastructure. Euro-BioImaging invited imaging facilities to submit their expressions of interest in becoming Euro-BioImaging Nodes. In total, 77 proposals for Euro-BioImaging Nodes were submitted by 211 institutions from 32 European countries. Fourteen proposals came from the medical imaging field and presented sound concepts for Nodes on Ultra-highfield MRI, MR/PET, population imaging and phase-contrast imaging. Ten proposals for molecular imaging were submitted.

The results of the first open call generated much interest among potential users, with over 2,200 submitted project proposals, a positive indication that the European imaging community would make use of the service provided by Euro-BioImaging.

All expressions of interest were reviewed by an independent international evaluation board, comprising some of the world’s best imaging scientists. Euro-BioImaging’s first open call was a great success, and it is promising to see that so many European imaging facilities are ready to provide open access to external users.

In November 2013, Euro-BioImaging brought together more than 200 of its 1,500 stakeholders in Heidelberg, Germany. The meeting provided the platform for a productive discussion about the Euro-BioImaging structure model, the establishment of Nodes and future operation. Stakeholders also expressed their unanimous support for the project.

The preparatory phase coming to an end, Euro-BioImaging will enter into a transition phase to achieve implementation. This phase will be guided by the Euro-BioImaging Interim Board, which represents the future Euro-BioImaging Nodes. This group of ministry and funding agency delegates will steer and further develop the Euro-BioImaging concept, and decide on all necessary steps to construct and operate Euro-BioImaging such as, for example, the legal model and its implementation, a governance structure, financial issues, the hub and node selection process, user access, the business plan and any other issues relevant to the construction and operation of Euro-BioImaging.

Interested member states will sign a memorandum of understanding (MoU), stating their intent to take action in the realisation of the legal model for Euro-BioImaging and facilitating continued discussions during the transition phase. Members of this group also expressed their interest in relying on the experience of the Euro-BioImaging Preparatory Phase Project Management Team for bringing Euro-BioImaging into operation.

Looking ahead in 2014, MoU signatories will work together towards the realisation of the legal model for Euro-BioImaging and the determination and integration of future Nodes, and the revision and adoption of the financial plan. One of the most exciting upcoming tasks will be the identification of the country that will host the Hub of Euro-BioImaging. Criteria and procedures are currently being formulated by member state representatives.

The large number of countries that have put Euro-BioImaging high on their political agendas and roadmap was shown in signing the MoU as an encouraging sign for Euro-BioImaging. Furthermore, the investment in medical and biological imaging research infrastructure already made within the EU member states guarantees their commitment to the field of imaging.

National coordinators in almost every country serve as liaisons to the Euro-BioImaging Nodes. This full list of coordinators is uploaded on the Euro-BioImaging website or by contacting Dr. Pamela Zolda (pzolda@eibir.org).
Paediatric CT is a well-established diagnostic imaging modality, especially since the advent of multi-detector technology, comprising large volume coverage with enhanced speed and improved isotropic resolution.

Often, it is the availability and speed of CT over MRI that prompts clinicians to refer patients for CT investigation, without consideration of the associated radiation burden, or the organ and tissue radiosensitivity in growing children. Therefore it is our duty both radiologist and technician to ensure safe working practices by minimizing radiation exposure and thus reducing the cumulative radiation dose in children by adopting intelligent referral criteria through the setting and clinical justification of all requests. Scans should be tailored by tailoring the imaging protocol to the specific clinical condition and the individual patient.

In our practice, those patients referred for monitoring in the post-infectious phase following pneumococcal meningitis, e.g. hydrocephalus, receive a lower radiation dose compared to those who undergo routine neuroradiological imaging. Children with cystic fibrosis receive a limited investigation, and those referred for plexus excavation assessment have lower scanning parameters than the routine chest protocols.

Further consideration must be taken in the parameter settings when imaging the chest and abdomen in a single acquisition. Should the parameters be optimised for the abdomen, then the thoracic will be overexposed. Likewise, the abdomen will be underestimated if the chest parameters are utilised. Two separate acquisitions with differing parameters is the preferred technique, but is more problematic as care must be taken to avoid overlap and acquiring data in a different phase of respiration, which may lead to lost information.

In addition, the imaging parameters are further optimised by patient age, weight or size-based protocols, since using the same settings across the wide age range for a specific body part would lead to younger or smaller children receiving a higher radiation dose than older and larger children. Unlike plain radiography, there is no visual penalty for overexposure in CT. Indeed, a higher dose may be seen as an improvement in the resultant image quality but only up to a certain threshold level, above which it will only contribute towards excessive radiation dose to the patient. However, very high-resolution image quality is often an unnecessary requirement provided the image data is of diagnostic quality and the examination is fit for diagnostic purpose.

The most familiar and simple method of monitoring radiation dose delivered per examination is by the volume-weighted CT dose index (CTDIvol) and dose-length product (DLP) as displayed on the scanner console. These factors are not applicable to radiation risk assessment, but useful as a measure for monitoring and auditing radiation dose, and to aid modification and design of the imaging parameters. In this way, refined empirical imaging protocols have been developed with age- and weight-based exposure factors in our practice.

The development of imaging protocols and parameters, with the aim of minimizing radiation dose in paediatrics, is challenging but essential to ensuring the welfare of children and their safety.
A group of Irish medical physicists are involved with a national PACS project entitled NIMIS (National Integrated Medical Imaging System). This involves the installation of a radiology PACS network in the majority of Irish publicly funded hospitals. As part of the informatics solution, dose-tracking software (eXposure, Radimetrics Inc.) has been installed in all of these hospitals. The system has been used to gather and analyse CT dose data (from 19 Irish hospitals to date) for comparison with national diagnostic reference levels (NDRLs) in Europe.

In terms of radiation protection practice, the data from Ireland is from a large number of CT facilities, and practice will vary among institutions. However, in relation to initiatives in paediatric CT imaging, the responses are a reflection of practice from one dedicated paediatric hospital that took part in the study; they confirmed that radiation protection is promoted by the radiology team, and this includes the director of radiology, the radiography services manager, and the medical physicist/radiation protection adviser. All paediatric CT requests are justified by a consultant radiologist. The Irish dose data shows that in general, paediatric DRLLs are child-sized (significant reduction in head and chest exams compared to the adult doses), and this is a quantitative reflection of dose reduction on a national basis. In this dedicated paediatric hospital, all brain scans are adjusted by age, and all other scans are adjusted by weight. The authors would like to investigate further to establish if this is the practice across the board in Irish hospitals, most of which predominantly scan adult patients with only a small number of paediatric CT cases.

The results of CT doses in terms of DLPs for a range of common examinations (adults and paediatric patients) are shown in the poster from ‘Murphy et al. Doses’ have been compared with published data, and calculated DRLLs were found to be broadly similar to data published elsewhere in Europe. Some of the benefits identified with this national system are that the number of samples (n), in most cases, far exceeds the typical number of ten average-sized patients used for establishing DRLLs. The adult data is based on all adults examined over a period of six months, not just standard size patients. Paediatric data is based on age groups; however, the system can easily be used to generate data based on body width. The 75th percentile was calculated for the country as a whole.

The automated dose-tracking software, used on a national basis, was found to be a very powerful and efficient tool for the determination of DRLLs on large numbers of patients. Some problems in the dosimetry software were noted during data collection and were reported to the Radiometrics project team. The authors are keen to make further advances in knowledge in this key area of imaging, and they are currently involved in a more comprehensive data integrity exercise.

Una O’Connor works at the Medical Physics and Bioengineering Department at St. James’ Hospital, Dublin, Ireland.
Paediatric CT optimisation in Portuguese hospitals

According to the literature the radiological exposure of paediatric patients in CT examinations has increased dramatically in the last decade. Concern is particularly justified for children due to their higher sensitivity to radiation and longer expected lifespan.

Due to the large variation in size between newborns and adolescents, patient demographics such as weight, height and AP diameter vary tremendously. This is an important factor and requires full consideration in the formulation of imaging protocols relevant to paediatric cohorts, as the European guidelines on quality criteria for diagnostic radiographic images in paediatrics recommend, and international DRL papers evidence. Limited literature is available for comparison with paediatric CT imaging protocols across European countries, and there is a lack of standardisation with respect to age and size categories of paediatric patients across European countries. In order to facilitate dose level comparisons, all centres should adhere to common European policy.

CT optimisation research has demonstrated that manipulation of exposure parameters such as tube voltage and current, pitch, slice thickness, tube current-time product, tube voltage, pitch, slice thickness and acquisition mode facilitates mean dose reductions of 35% and 38% for head and chest CT examinations respectively across the clinical sites. The majority of the optimised head and chest CT examinations resulted in image noise readings similar to currently employed values. The findings were discussed locally with the participating centres.

In a second phase of experimental work, barium vinyl shielding was applied during head and chest CT examinations, using three paediatric anthropomorphic phantoms (0.5 and ten years old). Dose reports and MOSFET dosimeters (cGy) recorded CT dose and specific organ doses. OsiriX software quantified image noise levels as defined by the mean pixel value and standard deviation within six regions of interest (ROIs – 1cm). An image noise increase was identified on paediatric head and chest CT examinations but deemed superficial and clinically non-significant once the shields were foam-backed. In-plane barium vinyl shielding applied during head CT examinations decreased the eye lens dose by 39%, 38% and 38%, and decreased breast dose by 40%, 27% and 37% during chest examinations for newborn, five-year-old and ten-year-old phantoms respectively.

Based on the optimisation results, a CT system upgrade (Sensation 64-slice –Siemens Somatom Definition AS, 64-multidetector row) with tube current and voltage modulation was carried out in one centre. Patient data, pre-upgrade and post-upgrade, was collated to review dose and image quality metrics. Patient images were presented in ViewDEX software with visual grading characterisation (VGC) image quality evaluation by paediatric neuroradiologists (n=4) using anatomical criteria scoring. The local DRLs in CTDIvol for head CT examinations decreased 19%, 18% and 24%, and breast dose by 45%, 27% and 15% during chest examinations for newborn, five-year-old and ten-year-old, and 15-year-old patients respectively. VGC image analyses demonstrated quality criteria were, at minimum, maintained for the majority of age categorisations, with newborn data demonstrating improved image quality post upgrade. Image noise measurements remained comparable pre and post upgrade.

Considering the radiation risk documented in research for paediatric patients undergoing justified CT examinations, the manipulation of exposure parameters according to paediatric categorisation, the use of barium vinyl shielding and the software upgrade demonstrated a high impact on children’s radiation dose and image quality.

Joana Santos works at the Instituto Politécnico de Coimbra, ESTESC, DRad, Coimbra, Portugal.
The Radiological Society of Cyprus, with 82 members, was founded in 1986, 26 years after the independence of the island. Despite the current political division in Cyprus, there is generally a good working relationship between radiologists.

The lack of a Medical School in Cyprus, until recently, made it necessary for Cypriots to study abroad. The island was thus provided with very well-educated Cypriot radiologists from famous medical schools from all over the world, who continue to have very close links with their universities. The Cypriot radiologists graduated mainly from universities in Greece, the UK, the rest of Europe, and the USA.

The first radiologist in Cyprus studied in Germany, and he was very proud to have shaken hands with Wilhelm Conrad Roentgen himself. Although the University of Cyprus was established in 1989, the first state medical school in Cyprus started operating this academic year. However, three years ago the St. George's University of London started offering a medical programme in Cyprus, in collaboration with the University of Nicosia, while this year the European University of Cyprus also started offering a medical programme. The first group of radiologists are currently in their second year of training in Cyprus hospitals.

The Radiological Society of Cyprus has an obligation to uphold a standard of training for the new radiologists and, in this respect, small countries like Cyprus could benefit greatly from the experience of the ESR and its European Training Curriculum. In Cyprus, with a population of 870,000 people, there are six state hospitals and 12 private hospitals. Few of these hospitals, however, are dedicated to oncologic, paediatric or cardiac patients.

The Radiological Society of Cyprus has held several scientific meetings and congresses over the last five years, including joint meetings with other societies like the Greek Radiological Society, the Scottish Radiological Society, and the Magnetic Resonance Radiologists Association of the UK.

The research activities of various radiological departments in the island are based on scientific collaboration with public organisations and research institutions, such as the University of Cyprus, the Technological University of Cyprus, the Institute of Neurology and Genetics, the University of London, and the University of California, San Francisco. Projects have mainly focused on applied MRI research and relevant topics include:

- a) The use of advanced neuroimaging techniques for studying chronic traumatic brain injury patients and neurodegenerative diseases.
- b) The use of high resolution imaging techniques for computational fluid dynamics modeling of blood flow in the carotids and in arterial-venous grafts.
- c) The combinational use of quantititative methods for accurate staging of colon and breast cancer.
- d) The development of robotic manipulators for real-time, MR-guidance of minimally invasive procedures.
- e) Treatment evaluation of metastatic disease using quantifying perfusion parameters with contrast enhanced ultrasound.
- f) Development of a Breast Cancer Density Specific Computer Aided Detection System for the evaluation of breast density as it appears on mammograms and the effects it has on computer-aided detection.

The Cyprus Breast Screening Programme commenced on an experimental basis in 2003. Since its establishment, the programme has performed in excess of 140,000 mammographies and has identified around 1,500 breast cancers that are being treated at specialized breast centres. The programme aims to comply fully with EU Directives on mammography and obtain accreditation from EUREF as soon as possible.

A non-academic but pressing issue, which is of current relevance to our society in the protection of the radiologists’ professional interests. To do so, we need to have the legal and profesional power to present non-professionals from entering our field. This is deteriorating with the economic crisis and radiologists are in dire need of strong laws to protect the scientific and professional aspects of radiology. The assistance of ESR in this field would be more than welcome.

More about the Radiological Society of Cyprus can be found at www.cyrad.org.cy.

Dr Chrysa Tzakouri-Shiakalli is the President of the Cyprus Radiological Society.

**Radiology education gets major boost in Cyprus**

The Radiological Society of Finland (RSF) represents the interests of academic radiology in Finland. The Society was founded in 1924, after Finnish radiologists contributed to the creation of the Nordic Radiological Society and its journal Acta Radiologica in 1921.

Hence, the coming year will see the 90th anniversary of the society. To celebrate this, the society will arrange a symposium centered on the applications of Nuclear Medicine in emergency radiology. The Society functions through an executive board that has representatives from each of the five universities and several other interest groups. The general assembly elects the board and selects one of the academic professors as president. The Society has a keen interest in developing scientific research in the field of radiology and has an active grant programme to support this, with annual research grants mainly awarded to young investigators.

Diagnostic skills are also supported in the form of annual grants to all radiology residents to attend teaching courses, as well as an annual scholarship for Finnish residents to participate in the AFIP courses at the NIH. The Society organises an annual two-day general radiological conference and takes part in organising the Nordic Radiological Conference and also collaborates with ESR. There is also an annual lecturehip and prize honouring Carl Wepplius, the first Finnish professor of diagnostic radiology.

The Society collaborates closely with the Finnish Associations of Medical Physicists and the Radiation and Nuclear Safety Authority (STUK). Physicists are full members of the RSF, with one executive board representative.

Finland has five academic medical centres providing a platform for radiology specialization. The regional academic centres provide an umbrella of tertiary healthcare with state-of-the-art radiology services. The radiology specialization programme is five years long, of which four years are devoted exclusively to radiology. The two-year specialization programmes are in various stages of development. There is a two-part national board examination run jointly by the five medical faculties. The RSF endorses the ESR European Training Curriculum.

The Radiological Society of Finland is open to physicians and physicists and all other academic personnel working in the field of radiology and radiography. There are currently over 900 members. The Finnish radiology community supports many active research groups engaged in many fields of radiological investigation, MRI and PET in particular.

More information about the Radiological Society of Finland can be found at www.arsf.fi.
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Highly-respected Dutch researcher delivers honorary lecture on cardiac imaging

In recognition of his significant research and work in the areas of MRI, CT and cardiovascular imaging, Professor Albert de Roos from Leiden, the Netherlands, will deliver the Josef Lissner Honorary Lecture entitled, ‘Research in cardiac imaging: how I do it’.

In 1986, Prof. de Roos received his medical degree (Cum Laude) from the University of Amsterdam and went on to carry out a residency in internal medicine at Ziekenhuis Universiteit Leiden. He then went on to pursue a residency in radiology at St. Elisabeth Goudsmit Haarlem and University Hospital, Haarlem. In 1989, he was awarded a PhD for his thesis on ‘Biphasic Calcium Examination’.

By Michael Crean

ESR awards Gold Medal to expert of international renown

In recognition of his dedication to promoting the role of radiology on an international level Professor Peter Aspelin from Malmö, Sweden, will be awarded the Gold Medal of the European Society of Radiology at ECR 2014.

Peter Aspelin is professor of radiology and chairman of the department of radiology at the Karolinska Institutet and Huddinge University Hospital. He was subsequently appointed dean of education at the Karolinska Institutet and later served as vice president for six years.

‘There are three reasons behind my choice in becoming a radiologist. Firstly, I found it fascinating and challenging to find the true content of an imaging of the correct diagnosis. The second was that radiology has a central role in patient care. The third was that the pioneers in Swedish radiology were devoted to the combination of clinical work and science. I found, early on, that I could develop my curiosity and was privileged to be in the front of the technical development,’ explained Aspelin.

Apart from his work as a clinician and academic, Prof. Aspelin is also dedicated to promoting the role of radiology at a political level. In the past he served as chairman of the Swedish Society of Radiology and the Swedish Society of Medicine. However, his work has not been limited to Sweden; he took part in creating the European Society of Radiology’s European Training Curriculum for Radiology and the European Society of Urogenital Radiology’s Contrast Media Guidelines. He was also a member of the programme planning committee for the European Congress of Radiology. He has hosted courses for the European School of Radiology and has delivered online lectures on behalf of the International Society of Radiology.

A well-published researcher, Prof. de Roos has authored or co-authored more than 40 scientific journal articles. In addition to writing articles, he currently serves as deputy editor of the scientific journal Radiology.

Given his broad interest in medicine, Prof. Aspelin has served in a number of multidisciplinary roles. He was vice-president of the Swedish Society of Medicine and Hungarian Societies of Radiology. For his work and has received honorary membership from the German and Hungarian Societies of Radiology. He has also been awarded a large number of grants throughout his career.

‘I appreciate very much the honour to deliver this lecture about radiological research. The topic is challenging due to the many changing facets of radiological research, but is a crucial task for the longevity of the field,’ said de Roos in response to his invitation to deliver the lecture.

An active member of many national and international scientific societies, Prof. de Roos served as president of the European Society for Magnetic Resonance in Medicine and Biology, in 1997; and the Society of Cardiovascular Magnetic Resonance in 2013. On a national level, he served as scientific secretary of the Dutch Society of Radiology from 1996 to 1999.

By Michael Crean
Former European Radiology editor-in-chief honoured at ECR 2014

BY MICHAEL CREAN

In recognition of his great service to scientific publishing in Europe and his distinguished clinical career, Professor Adrian K. Dixon from Cambridge, UK, will be awarded the Gold Medal of the European Society of Radiology at ECR 2014.

Adrian K. Dixon is Mater of Peterhouse, the oldest College at Cambridge University and Emeritus Professor of Radiology, having been head of the department of Radiology for 27 years. He is also an honorary consultant radiologist at Addenbrooke’s Hospital, Cambridge.

From an Irish background, he was born in Cambridge where he earned a bachelor’s degree at King’s College. He qualified in medicine after clinical studies at St. Bartholomew’s Hospital London. He then specialised in general medicine, gaining his MRCP in 1974 before deciding to pursue a career in radiology (an appropriate career in view of his profound deafness). He qualified as a radiologist in 1978 and worked in paediatric radiology at Great Ormond Street Hospital, and in computed tomography at St. Bartholomew’s Hospital. In 1979, he became a lecturer at the University of Cambridge department of radiology. He earned his doctor of medicine degree for his thesis on computed tomography of the lumbar spine. In 1985, he was elected a Fellow of Peterhouse, where he became director of medical studies.

“The team spirit within radiology whether in a hospital department, an editorial team or an organisation such as the ESR, is a most stimulating feature of one’s professional life. We are truly lucky and privileged to be in such an exciting specialty where it is, quite simply, impossible to be bored!” said Prof Dixon as he reflected on his long career. Throughout his career, Prof. Dixon has been actively engaged in the field of scientific publishing, as both author and editor. He has published extensively in the areas of computed tomography, magnetic resonance imaging and various aspects of effectiveness within radiology. Thus in addition to having written and co-edited various books on CT, anatomy and diagnostic radiology. He also served as editor of the journal Clinical Radiology from 1998 to 2002 and Warden of the Faculty of Clinical Radiology of the ESR from 2002 to 2006. He was awarded Fellowship of the Academy of Medical Sciences in 1998.

In 2007 Prof. Dixon was appointed editor-in-chief of European Radiology, where he served until December 2012. His tenure as editor saw a steady increase in submissions and consolidation of the journal’s impact factor. He has received a number of awards throughout his career and he is a honorary member of the national radiological societies of France, Hungary, Spain, Sweden, Switzerland and the USA, as well as being an honorary fellow of the Royal Australian and New Zealand College of Radiologists and the Faculty of Radiologists at the Royal College of Surgeons in England.

In recent years, the universities of Cork and Munich have awarded him honorary doctorates in medicine.

Presentation of the ESR Gold Medal Award
Friday March 7 12:15-12:33 Room A
Peter Aspelin; Stockholm/SE
Adrian K. Dixon; Cambridge/UK
Gerard D. Hurley; Dublin/IE

Irish radiologist takes gold at ECR 2014

BY MICHAEL CREAN

In recognition of his numerous and most valuable contributions to the international radiological community, especially in the early development of the ESR, Dr. Gerard D. Hurley will be awarded the Gold Medal of the European Society of Radiology at ECR 2014.

Gerard D. Hurley is a former consultant radiologist at Tullamore Hospital and the Charlemont Clinic in Dublin, Ireland. A native of County Cork, Dr. Hurley received his undergraduate medical training from the Royal College of Surgeons in Ireland (RCSI), Dublin. He trained in radiology in the UK, initially at the Western Infirmary and Stobhill Hospitals in Glasgow and subsequently as Senior Registrar at St. Thomas’ and Brompton Hospitals in London. He proceeded to FRCR in 1977 and later to the Fellowship of the Faculty of Radiologists (FFRCSI) in 1978. He was appointed consultant radiologist at Nottingham City Hospital in 1971.

In 1978, Dr. Hurley became consultant radiologist at the Federated Dublin Voluntary Hospitals and the Meath and Adelaide Hospitals. These were replaced by the Tullamore Hospital, a new teaching hospital of Trinity College Dublin which opened in 1984. He was involved in the planning of the new hospital and worked there until 2012.

Apart from his long clinical career, Dr. Hurley has been an active member of the international radiological community. He was president of the radiology section of the European Union of Medical Specialists (UEMS) from 1997 to 2000 and was chairman of the Professional Organisation Committee (POC) of the European Association of Radiology (EAR) and a member of the EAB Executive Bureau at that time, linking the academic and professional strands of European radiology.

“The technical, organisational and academic metamorphosis of radiology over the past four decades has been remarkable and we are all fortunate to have been involved in these developments which have improved radiological services to patients throughout Europe. It was a privilege to be involved in the professional and academic strands of European radiology during the stepwise transition from the federal structure of the European Association of Radiology (EAR) to the new, all embracing, European Society of Radiology (ESR) based on individual membership and legally centralised in Vienna,” said Hurley.

He subsequently served as president of EAR from 2003 to 2004 and saw through changes leading to its merge with the European Congress of Radiology to form today’s European Society of Radiology (ESR) in 2005.

At a national level he served on a number of healthcare statutory advisory boards concerned with radiological education and staffing. Dr. Hurley served as dean of the Faculty of Radiologists RCSI from 1992 to 1994. He taught throughout his career, as a clinical teacher at Trinity College Dublin and at the RCSI Faculty of Radiologists and anatomy department.

After nearly 40 years of practice, Dr. Hurley retired in 2012. In his spare time he enjoys watercolour painting, studying the history of art and playing golf (three holes-in-one so far). He has received many awards for his work including honorary membership of the Radiological Society of North America and the French Society of Radiology. He was also awarded the Boris Rajewsky from the ESR and the RCSI’s Gold Medal.

“I am delighted and pleasantly surprised to receive this prestigious award as I feel there are many more deserving candidates.”

Dr Gerard D. Hurley from Dublin, Ireland.
In its eighth year, the European School of Radiology continues to promote the European Society of Radiology’s strong and unflinching commitment to invest in radiological education while pursuing its two main goals: to assist in harmonising radiological education throughout Europe, by supporting the implementation of the European Training Curriculum, and to raise the scientific profile of radiological education.

The past seven years of ESOR have been marked by an outstanding growth, in a wide range of modalities, activities, including visiting schools, seminars, tutorials, teaching/training programmes, visiting professorships, and exchange programmes for fellowships. So far, ESOR has delivered structured continuing education to almost 12,000 residents and board-certified radiologists worldwide.

Furthermore, ESOR has gradually evolved into a major, not the major, international, provider of complementary education in radiology, as it is now active beyond Europe in the Middle East, Asia and South America. With its expanded outreach programmes, the ASLEFOD孔子 courses, the AIMS School and Seminars, the ESOR in action community for years to come and will continue to deliver successfully, connecting the world of radiology.

“...I belong to a third-world country, where there are almost no specialised musculoskeletal radiologists to my knowledge. Due to this fact, the patients and the physicians often have to rely on suboptimal reporting in this field. I am very thankful that the ESR has developed such a programme, that provides a chance for the residents of the developing nations to enhance their skills in their respective fields of interest,” said another resident in radiology from a South-East Asian country, with tens of millions of inhabitants.

In addition to impressive numbers, ESOR is proud of being instrumental in mobilising the resources available for radiological evidence in Europe and the world, and for creating a long-term educational commitment and structured network, the ESOR community through partnerships. All of this hugely appreciated utilisation of teaching resources has been implemented with the unlimited support of highly esteemed and renowned lecturers, tutors, mentors, volunteer reference-training centres, local organisations, subspecialty and national societies, academic institutions, and valued industrial partners. ESOR sincerely indebted to them all.

Nicholas Gourtsoyiannis serves as Educational & Scientific Director of the European School of Radiology (ESOR) and chairman of the ESR’s ESOR Committee.
Following its overwhelming support in a European Parliament vote in early October last year, the Council adopted the revised professional qualifications directive on November 15, 2013. Member states will now have to transpose the directive into national law within the next two years.

Published in 2011, the proposed modernisation of the existing professional qualifications directive (2005/36/EC) aims at facilitating the free movement of professionals and helping allise staff shortages throughout the European Union.

While the objective of the 2005 Directive was to simplify the legislation, this modernisation aims at adapting it to an evolving labour market. It covers the harmonisation of training requirements, which are mainly in the health sector, and mutual recognition of all professions for which member states require a qualification.

The main elements of the directive include the following:

**Alert Mechanism**
In future, competent authorities of member states will have to proactively alert the authorities of other member states about professionals who are no longer entitled to practice their profession due to a disciplinary action or criminal conviction, through a specific alert mechanism.

**Language Assessment**
Competent authorities will be allowed to assess the language competence of professionals before granting access to the profession but only after recognising their qualification.

**Continuous Medical Development and Education for Health Professionals**
Member states are to promote the continuous professional development of professionals who benefit from the automatic recognition of their professional qualification.

This means in particular: doctors of medicine, medical specialists, general practitioners, nurses responsible for general care, dental practitioners, specialised dental practitioners, veterinary surgeons, midwives, pharmacists and architects.

**Harmonisation of Minimum Training Requirements**
The Directive also includes revised minimum training requirements for some healthcare professions, updated minimum training requirements for these sectors, as well as a requirement for member states to encourage continuous professional education and training.

The ESR welcomes the European Commission’s (EC) efforts to harmonise the European labour market, but emphasises the need for a harmonised training curriculum within radiology. The revised consolidated version of Annex V of the Directive is subject to amendments by the EC.

Following a petition the ESR launched in early summer 2012, which was distributed among all European radiology societies and showed that the vast majority of the national societies are in line with the ESR’s position, the ESR submitted a proposal to the EC outlining its position and key issues in this regard.

**ELIGIBILITY CRITERIA**
- Full ESR membership
- Board certification as radiologist
- Five years professional experience after board exam
- Demonstrated experience in at least one of the following:
  - Officer of a national society (minimum at committee level)
  - Officer of a national subspecialty society (minimum at committee level)
  - Officer of an international society (minimum at subcommittee level)
  - Regular official cooperation with UEMS, WHO or EU in an area related to radiology or one of its subspecialties
  - Regular participation at the ESR or European level subspecialty congresses
- Good command of English
- Speaker at ESR or European level subspecialty congresses
- Author of papers in international radiology or subspecialty journals
- Faculty member of ESR or subspecialty schools, courses, workshops

**ENROLMENT**
Enrolment is free. Those interested are encouraged to send their application, including a detailed CV, to the ESR Office, Committee and Board Affairs Department (ina.berger@myESR.org) for evaluation.

**METHOD OF SELECTION**
Applicants are pre-evaluated by the ESR Committee and Board Affairs Department and formal nominations are made by the ESR Scientific Programme Department (congress contributions) and the ESR-STAF (school contribution). The eligible candidates are then evaluated by the ESR Nominations and Awards Committee, chaired by the ESR Past-President. The final selection is made by the ESR Executive Council.

ESR Leadership Institute – enhance your CV

In 2011, the ESR founded the Leadership Institute (then-called ‘Resonant Body’) as a group of professionals whose abilities and experience contribute to the activities of the ESR. Those who express their willingness to participate in this endeavour are regularly informed about the activities of the society and will be contacted by the different committees and subcommittees for their opinion and feedback regarding these matters and any other issue they feel appropriate. The Leadership Institute, along with its members as individuals, functions as an interface between the members and the executive level of the society. This body also serves as pool for future recruitment of active, committed members into offices within the ESR.

Boost your CV and get active in the world’s largest radiological community.
Top tips for trainees and teachers Part 2: Case publication

Completing the ‘publications’ section of a job application gives many young doctors a headache, and teachers who want to support their trainees also struggle, in particular when working in a smaller hospital. But case publications are an excellent way to learn and publish at the same time. Read on to get some expert advice from Prof. Johan Bloem, editor-in-chief of EURORAD.

BY MÉLISANDE ROUGER

New features draw participants to Rising Stars programme

The highly successful programme will offer more basic topics and case-based diagnosis training, allowing it to better fit the needs of the audience, explained Alexander Sachs, the Rising Stars representative on the ESR’s Undergraduate Education Subcommittee, in an interview with ECR Today.

ECR Today: Will there be any new features in the Rising Stars programme at ECR 2014?

Alexander Sachs: Besides the standard three basic sessions and four student sessions with presentations, there will be a new category: case-based diagnosis training. This special programme for residents and young graduates will focus on interesting cases or pathologies of a certain organ or organ system. In general, students, residents and radiologists adore interesting cases, and case-based learning is a key to the competition, comparable to a quiz show. There are also four student hands-on workshops on ultrasound, with improved content and focused more on educational benefit.

ECRT: Last year you mentioned that more sessions would be welcome. Have your suggestions been taken into account?

AS: Faith Seker and I proposed to extend the programme from three to five basic sessions. Unfortunately only three slots are available this year, but they focus more on the main radiological topics: cardiac radiology, neuroradiology and oncologic imaging. Instead of extending the basic lectures, the new session with case-based diagnostic training has been established, which I appreciate very much.

ECRT: What is your opinion on this?

AS: Compared to 2013, the sessions focus more on practical aspects. The session on interventional radiology has been replaced by a basic session on oncologic imaging with three main subtopics: lung cancer, kidney cancer and rectal cancer. Furthermore, the basic session on neuroradiology focuses on topics such as brain trauma or brain tumours, which are definitely less specific than the cases we had last year – for example the session entitled, 'Is the Circle of Willis a circle?'

ECRT: Do you have any other suggestions for further improvements?

AS: Cardiac imaging is important and has been in the basic session for the last three years. I would appreciate if there could be a session on chest radiology. Every student and every resident has to deal with chest radiology in the beginning or during their daily routine. Students who do not choose radiology as their future specialisation are also very interested in that standard topic. How to report a chest x-ray or ‘Common pathologies in chest x-ray’ could be two general and important lectures.

A session on undergraduate education of education programmes in universities around Europe would also be very interesting to help people connect with each other, exchange information and work on a standard European education programme.

ECRT: The ultrasound workshops proved to be very successful last year, with even more tutors than the year before. Do you think participation will be as high this year?

AS: I can promise you that there will be fewer participants than in 2013 because we reduced the number of machines from 12 to 8. But there will be surprises about new developments on ultrasound devices. Moreover, the highlight of the workshop this year will be the special sessions with case-based diagnosis training. Each workshop will have a maximum of five participants on each machine. In contrast to previous years, each workshop will have a different main topic. Furthermore, for the first time, an international team of tutors from three different countries will guide students through the workshops, reflecting our original idea of promoting international ultrasound education.

ECRT: You are now doing your residency at Vienna General Hospital. How is it going?

AS: I really love my job. So far, I have started to work with modalities other than ultrasound, like chest x-ray, CT and PET/CT. I have to say, it gives me a much better insight of the whole range of pathologies, and I also like the young team of residents in the department.

The working atmosphere is really comfortable, which helps in stressful situations that you often have in such a big department, like Biomedical Imaging and Image-guided Therapy at the Medical University of Vienna.

I’m very happy about a paper I wrote with Prof. Peter Piskeiser, ‘Radiological media and modern supporting tools in radiology’, that was published in the German journal ‘Der Radiologe’ last January. Moreover, a very nice update and overview of the different modern tools in radiology.

Furthermore, I became involved in the medical curriculum of the university to improve ultrasound and education for 600 students in their fourth year of study. The experience was quite tough and time consuming, as I helped prepare and assist the coordination of a four-hour-long ultrasound course over three weeks. For the first time, eight expert student tutors supported radiologists in teaching basic ultrasound of the abdomen and thorax to medical students. It was all worth it – the response to the course was fantastic and we want to improve ultrasound education in the whole curriculum. Let’s see what is possible – this was just a first step.
THE WORLD OF FABERGÉ

FROM THE COLLECTIONS OF THE MOSCOW KREMLIN AND THE FERSMAN MINERALOGICAL MUSEUM
AN EXHIBITION AT THE KUNSTHISTORISCHES MUSEUM

Fabergé: The Trans-Siberian Express Easter Egg with key
Saint Petersburg, 1900
© The Moscow Kremlin State Historical and Cultural Museum and Heritage Site
As part of the Austro-Russian Cultural Seasons the Kunsthistorisches Museum is hosting a major exhibition that showcases both the work of Carl Fabergé and the period's leading and most influential Russian jeweller, and the decorative arts in Imperial Russia at the turn of the 20th century.

Over 30 selected loans from the Kremlin and the Ferrman Mineralogical Museum in Moscow document Fabergé's virtuosity, and place his work in the context of contemporary Russian jewellery design. Another focus of the exhibition is the role of the imperial family as patrons and connoisseurs.

Two of Moscow's largest museums – the museums of the Moscow Kremlin and the Ferrman Mineralogical Museum – are showing works at the Kunsthistorisches Museum for the first time. In many ways their history and organisation are similar to those of the Kunsthistorisches Museum: the latter evolved from collections assembled by the Habsburgs, the former from those amassed by the Imperial Russian family. In the Imperial Treasury the collection of Russian goldsmith work and jewellery from the second half of the 19th and the early 20th century forms a seminal section.

‘The house of Fabergé' conjures up exceptional jewellery creations – a combination of brilliant imagination and virtuosic craftsmanship using only the choicest materials. This is particularly true for objects created for members of the Imperial Russian family after 1893, the year Fabergé received a Royal Warrant.

In 1893 Peter Carl Fabergé took over the company from his father. At the same time he began to restore historical gold and silver artefacts in the Hermitage, and to assist in the new installation of the Imperial Treasury. This careful study of historical jewellery and goldsmith work may be the reason why the master craftsmen executed a jeweller to a company, celebrated for their objects de fantaisie – objects that do not have any practical use – that are in many ways similar to Kunstkammer objects. In 1900, these objects cut from precious or semi-precious stones – from baroque bouquets of flowers to animal figurines inspired by Japanese netsuke – induced the jury of the Paris World Fair to proclaim that these works touch the frontier of perfection – where jewellery turns into art.

Over thirty of these small hardstone sculptures depicting animals, plants or people will be on show in the exhibition; they were produced either in the Imperial stone carving workshops or by the house of Fabergé. Another section of the show focuses on Fabergé's enamel work, celebrated for its virtuosity, and the firm's sumptuous presentations. Only a handful of the latter has survived in Russia, most was broken or reworked, and many of the precious stones have been replaced. A rare exception is the hoard of magnificent pieces of jewellery discovered by chance in the 1990s during refurbishing work in a Moscow house. We now know that they were hidden by one of the directors of the holding company C. Fabergé; this egg features the tsarevich's star sign; this was the last egg ever begun by Fabergé but events in the course of the Great War and the outbreak of the Russian Revolution in February 1917 prevented its completion. This egg, featuring the star sign of the doomed Crown Prince, is a poignant symbol of the fall of the House of Romanov.

In addition to the four Easter eggs by Fabergé, the exhibition showcases personal objects that belonged to members of the Russian Imperial family. Among these are precious objects for every-day use such as cigarette cases, objects to be placed on a writing desk, seals and fans. However, a particular focus of this exhibition is on a section of the decorative arts produced that featured at this exalted level only in Russian hardstone carving.

The collections range from Ancient Egyptian, Greek and Roman antiquities to the Collections of Medieval Art to the splendid Renaissance and Baroque Collections. The world famous Picture Gallery contains main works by P. Bruegel the Elder, Dürer, Rubens, Vermeer, Rembrandt, Titian, Raphael, Tin-toretto, Veronese, Caravaggio, Velasquez et al.

Kunsthistorisches Museum

Museum of Art History
Maria Theresien-Platz
1010 Vienna

Opening hours:
Tuesday–Sunday 10 am–6 pm
Thursday 10 am–9 pm

www.khm.at
### Theatre & Dance

Please note that all performances, except at Vienna’s English Theatre, are in German.

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<td><em>Die Marquise</em> von O. by Ferdinand Bruckner</td>
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<td>Burgtheater</td>
<td><em>Maria Magdalena</em> by Friedrich Hebbel</td>
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<td>Museumsquartier – Halle E+G</td>
<td><em>Red Bull – Flying Bach</em> Unique performance combining Johann Sebastian Bach and Breakdance, interpreted by the Breakdance world champions Flying Steps and opera director Christoph Hagel</td>
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<tr>
<td>Schauspielhaus</td>
<td><em>Die Ereignisse</em> by David Greig</td>
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<td>stadtTheater walfischgasse</td>
<td><em>Drei Mal Leben</em> by Yasmina Reza</td>
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<td>Tanzquartier Wien</td>
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<td>Theater in der Josefstadt</td>
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<tr>
<td>Vienna’s English Theatre</td>
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### Concerts & Sounds

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<td>Konzerthaus (Classical Music)</td>
<td><em>Belcea Quartet</em>, string quartet by H. Purcell, J. Haydn, B. Britten</td>
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<tr>
<td>Musikverein (Classical Music)</td>
<td><em>Berliner Philharmoniker</em>, conductor Simon Rattle</td>
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<tr>
<td>Porgy &amp; Bess (Jazz)</td>
<td><em>Wiener Filmmusik Preis 2014</em> Film Composers’ Lounge #5</td>
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### Opera & Musical Theatre

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<tr>
<td>Volkspark</td>
<td><em>Carmen</em> by Georges Bizet</td>
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<tr>
<td>Wiener Staatsoper – Vienna State Opera</td>
<td><em>Eugen Onegin</em> by Pyotr Ilyich Tchaikovsky, conducted by Patrick Lange With Dinara Alieva, Nadia Krasteva, Marian Kwietniewski, Rolando Villazín, Aín Angér</td>
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<tr>
<td>Ronacher</td>
<td><em>Der Besuch der alten Dame</em> by Michael Reed, Mortiz Schneider</td>
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