Machine learning is promising

Machine learning is playing an increasing role in computer-aided diagnosis, and Big Data is beginning to penetrate oncological imaging. However, some time may pass before it truly impacts on clinical practice, according to leading UK-based German researcher Professor Julia Schnabel, who spoke during the last ESMRMB annual meeting, Mélisande Rouger reports.

Machine learning techniques are starting to reach levels of human performance in challenging visual tasks. Tools such as the convolutional neural network (CNN or ConvNet), a class of deep neural networks that has been applied to analysing visual imagery, have become instrumental in segmentation tasks.

Analysing such huge data is still a challenge

However, a number of obstacles remain before adequate image analysis arrives, starting with the huge amount of data analysts must work with, according to Professor Schnabel, computational imaging expert at King’s College London. ‘In imaging, the challenges are that we work in 3-D or 4-D, and we have a lot of features to deal with. If we are lucky, we deal with hundreds or thousands, but not millions of images, so we don’t have a high number of image data to work with. We have this whole sample size problem.’

The professor also identified the high associated cost and imperfection of training data. Training data may be wrongly labelled, depending on the expertise of the observer. Furthermore, machine learning is resource-intensive: only specialists and consultants can perform specific tasks. ‘I personally couldn’t distinguish a glass nodule from a semi-solid nodule. Only specialist consultants and expert radiologists can do that,’ she pointed out. For a disease such as cancer, the image analysis team needs confirmation from pathology, which is often difficult to obtain.

For brain imaging, where different protocols exist, one sees different appearance of the same disease on different image protocols for the same patient and between patients. ‘Disease location and size of these pathologies may vary quite significantly, and the appearance of disease may be very localised: it may be a very sharp “blob”, or it may be very diffused or infiltrated,’ she explained.

Deep neural networks

The professor shared practical advice on how to work with CNNs appropriately. She stressed the size of the receptive field of a CNN will determine the amount of information that will be obtained. ‘The size of patches used is important, since a large receptive field increases computation and memory requirements, and (max) pooling leads to loss of spatial information. In contrast, if you use very small patches, they are more susceptible to noise.’

As a solution, Schnabel points to using a multi-scale approach, i.e. having smaller patches operating on small filters and larger ones on larger filters, and putting them together in the end.

‘Oncological image analysis brings challenges of its own. Machine learning-based segmentation often degrades when deployed in clinical scenarios. This is caused by differences between training and test data due to variations in scanner hardware and scanner protocols and sequences. Schnabel explained. ‘There is often an imbalance in the training or test data because of a different ratio of healthy vs. pathological cases, individual patient variability and individual disease variability – also within the same patient. For example, lesions in the liver usually are a secondary cancer, caused by a primary cancer elsewhere, such as in the colorectum.’

Therefore, it is crucial to choose the appropriate network architecture. Currently three models in literature are interesting: DeepMedic, FCN (in Deep Learning Toolkit) and U-Net, which owes its name to its ‘U’ shape. These networks use different approaches and for all these, there is the good, the bad and the ugly,’ she pointed out.

An ensemble of multiple models and architectures

All three networks use CNN based approaches with good performance, but there are a lot of meta-parameters – more than input cases –, and the architecture and configuration influence performance and behaviour. The ugly part is that chosen models and parameters may be suboptimal for other data and applications. ‘Results and conclusions may therefore be strongly biased,’ she said.

One solution could be to use an ensemble of networks; one such example is EMMA (ensemble of multiple models & architectures), for which performance is insensitive to suboptimal configuration and behaviour is unbiased by architecture and configuration.
Artificial Intelligence (AI) has enormous potential to revolutionise the delivery of healthcare, being able to remove the drudgery of routine tasks, join data sets and infer knowledge from large amounts of data, which can then be used to make more robust and secure predictions. Bakhai from CPI’s Strategic Programme Manager in the technology firms and that they look ahead more cohesively and for clinicians, while still active in clinical practice—working alongside digital technologies to conduct research and create an evidence base on the value of AI interventions. The way we measure AI value in healthcare is also going to be crucial, he emphasised. ‘Often, for digital technologies, we commission or introduce something with anecdotal evidence, and AI will have some benefit, but we haven’t really put them through the rigour that we would use with any other intervention in healthcare.’ He concludes that if healthcare can work cohesively with technology firms and together with industry, AI will be the future—enabling AI to enable the future, and AI to change the way we do things. ‘The new centre will provide expertise and facilities to help companies bring these products to market more quickly.’ The centre’s intended scope of activity, he explained, covers an innovation space from the point where the key features of a new product or process have been shown to work in principle, to a point where the product has been tested and proved and is ready for the end-user so that the technology is ready to become a commercial proposition. ‘As such companies will be able to manufacture quantities required for clinical investigation and clinical validation trials but not to produce at commercial scale,’ he added.

With an initial focus on imaging, diagnostics and therapy, the Centre for Healthcare Photonics will provide a collaborative and flexible workspace for photonic technologies specialists. Key facilities: a manufacturing area with controlled access, temperature and humidity control, flexible optics laboratories, a suite of life science laboratories for the pre-piloting and analysis of samples; an electronics development laboratory; a workshop with facilities for rapid prototyping; an X-ray test and development lab; and a modelling and design laboratory with access to 3-D CAD design software, optics-design related software, image analysis software.

Alongside the infrastructure, equipment and accommodation, CPI will provide clients with services such as health economic modelling, clinical trial planning, understanding of the regulatory approval process, advice on CE-Marking, intellectual property protection, supply chain analysis and access to finance.

From a healthcare perspective, photonics-enabled diagnostic methods in working more cohesively for and clinicians, while still active in clinical practice—working alongside digital technologies to conduct research and create an evidence base on the value of AI interventions.

The Centre for Process Innovation (CPI), a UK technology innovation provider for process manufacturing, is setting up a National Centre for Healthcare Photonics (NCHP) in a bid to extend the use of healthcare photonics technologies and make them more widely available for a range of applications, including the early diagnosis and monitoring of conditions such as skin, eye problems, cancer or brain injury.

Scheduled to open in December 2018, the NCHP will be based in northeast England and provide open access facilities and expertise to help companies develop the technologies and reduce barriers that commonly prevent early research and inventions reaching the market. ‘Photonics is a key that enables technology for a range of healthcare products related to imaging, diagnostics and therapy,’ Dr Tom Harvey, CPI’s Strategic Programme Manager for Healthcare Photonics, pointed out. ‘The new centre will provide expertise and facilities to help companies bring these products to market more quickly.’

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From a healthcare perspective, photonics-enabled diagnostic methods

**Machine learning is promising**

Continued from page 1

**High dimensional multi-modality datasets are not big data**

Machine learning is a promising tool in oncological imaging and image analysis, and the challenge is to find the right model parameters for good estimation and generalisation. ‘We have high dimensional and multi-modality datasets, but it’s not really big data, it’s rather dense data. Cohort studies which collect large amounts of data,’ he added, ‘will help a lot in that sense’.

**Most efforts concentrate on lung nodules or lymph node detection in lung CT. Deep learning is now largely replacing conventional CADe and CADx methods, which were based on texture analysis, hand-crafted features and simple classification techniques.**

According to Schnabel, using deep learning, detection rate is generally very high and the main focus is now on false positives reduction.

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Taipei hits highs in Medica 2017

Konica Minolta constantly pursues new ideas and technologies for healthcare – which was clearly visible at Medica 2017, where the firm’s novel products and systems were on show. Portable ultrasound, digital wound care or secure patient monitoring – the portfolio is highly diverse. However, the successful effort to balance customisation and intuitive usage was evident in all the solutions, Lena Petzold reports.

After acquiring Panasonic’s Ultra-sound Imaging Division, Konica Minolta entered the ultrasound market with Sonimage HS1, a portable system focused on point-of-care use. Randolph ten Cate, the firm’s Marketing Manager for Europe, the Middle East & Africa (EMEA), explained: ‘We developed the system for users who appreciate the added value of ultrasound imaging yet are not themselves radiologists, as is often the case, for example, in rehabilitation, anaesthesiology or rheumatology.

‘We also aim at users in intensive or trauma care who value portable, speedy solutions. The new ultrasound system is easy accessible and can be handled intuitively. It has only eight buttons, everything else can be entered via the touchscreen.’

Despite the ease of use, the system covers a great range of functions, including Colour, Pulse and Continuous wave Doppler, as well as linear, colour and phased array technology, for example.

‘To keep the intuitiveness, we created a customisable interface where any user can add shortcuts to their favourite functions,’ Marco Lagustena, EMEA Product Manager for ultrasound explains. Konica also focused on integrating powerful technology. ‘Our goal was to obtain the quality of a cart-based system in a portable format for, so for example, we included an 18 MHz transducer and Triad Tissue Harmonic Imaging,’ ten Cate adds.

The system takes up almost no time to start, being ready to use in under 15 seconds. Battery-run, and operating for about one hour, when connected to a power-supply, or cart, it recharg-es yet remains operable. The sys-tem features two specific advantages, Product Manager Lagustena explains. ‘We include simple needle visualisa-tion that works without any add-ons.

The WoundeAide system automatically detects a wound’s boundaries as well as the circumference and depth or additional hardware, and also we incorporated a special rheumatology feature. The Rheumatoid Arthritis Work-flow, based on the DAS28 pro-tocol, was programmed as a feature into the system, so users can follow it consecutively, experiencing a smooth workflow.’

Following their key focus on easy usage, Konica Minolta branched into a different area to develop an inno-vative system that improves wound care management. ‘With diabetes on the rise, there are more wounds to take care of and they are taking longer to heal. This obviously increases the cost of healthcare and the time patients spend in a hospital,’ explains Zhang Qiu Ying, Head of Healthcare Innovation at the Konica Minolta Business Innovation Centre in Singapore.

Capturing 3-D wound data
To minimise the time doctors need for the tedious business of docu-men-tation, Konica Minolta developed a device called ‘WoundeAide’, which allows clinicians to capture non-contact 3-D wound data. ‘As of now, wound documentation is still mostly done manually and is not only rather inaccurate and time-con-suming but often invasive and there-fore painful for patients. Precious time is wasted by measuring the wound, estimating its depth, may be photographing it and transferring the data to the hospital’s record system afterwards,’ Ying points out.

‘Our intelligent system helps with the rise, there are more wounds to take care of and they are taking longer to heal. This obviously increases the cost of healthcare and the time patients spend in a hospital,’ explains Zhang Qiu Ying, Head of Healthcare Innovation at the Konica Minolta Business Innovation Centre in Singapore.

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Central alarm management of the Xenios console via the Philips IntelliVue MX800 patient monitoring system is easy and efficiently achieves its goal through a combination of safety and innovation," the manufacturer reports. ‘The Barmherzige Brüder hospital in Regensburg and Xenios combine both in clinical practice.’

In clinical use since 2014, the Xenios console combines three therapies on one platform for the benefit of the patient and support of the user. After three years in clinical use, the Xenios console has established itself. However, those, who move around in daily clinical practice will quickly realise that only everyday life defines the requirements and poses new challenges which can best be met by working hand in hand with users. "Stephan Schöffl MD, PhD, senior physician at the Barmherzige Brüder hospital in Regensburg, Germany, and Christian Hoff, clinical support Xenios AG, are long-standing partners, who know and trust each other. This is the starting point for expertise and safety as shown with our example.

The Barmherzige Brüder hospital in Regensburg has a modern intensive care unit with 28 beds, which include 20 ventilation beds. Due to the historically grown situation construction-wise, as well as the size of the intensive care unit, a central alarm registration is of great importance. This also includes central monitoring of the most important parameters when performing an extra-corporeal membrane oxygenation (ECMO) procedure," Stephan Schöffl stresses. For this reason, a connection was installed between the Xenios console and the Philips IntelliVue MX800 central monitoring system. The connection can easily be established via the interface of the central patient monitoring system (Philips Intellivue: EC10 Module) to the data interface of the console (Xenios console, lLA active system). This ensures central monitoring of the most important parameters, such as blood flow and speed of the pump in the extracorporeal circuit at all times.

Additionally, the most important pressure measurements are also centrally monitored in the ECMO system. By transferring the alarm settings of the Xenios console, no additional settings for central monitoring are necessary. All settings are made automatically after connecting the interconnection cable. This clear advantage, says Dr Stephan Schöffl. "For us, the possibility of centrally monitoring important parameters of the ECMO systems means additional safety for the patients and, at the same time, a reduced workload in everyday life of the intensive care unit.

That is exactly one of the goals of Xenios AG, the company explains: ‘Safety in use and for the patient, bringing together innovation and support from experts for experts. From this, a continuous enhancement and progress results. In this concrete example, the alarm message is no longer optionally sent individually at the console in a room, but the messages are also accessible to the entire staff at a central point, for a whole team of therapists at the monitoring centre. ‘We, in clinical support, listen to the uses and bring the therapists’ experiences to our developers and the entire Xenios team,’ Christian Hoff explains. ‘Hand in hand, together into a secure future, for the benefit of patients and for their safety.’

"The technology is being tested in a care facility in the Netherlands, a camera-controlled system warns the night watch staff in case of unexpected movements in patient rooms. This technology makes repeated night watch rounds obsolete," says Lessmann, adding that this ‘increases flexibility and reduces pressure on the staff’. To ensure such a system respects patient privacy, Mobotix designed a particular configuration. All images recorded by the camera are pixelated. Only when the camera detects a potential emergency is the image recognisable and a signal is sent to the staff, who then check and decide whether an intervention is necessary.

"This initial feedback from a Dutch care facility is positive, all those who use the devices are satisfied with the system and a frequent routine is underlined. Thus the facility intends to expand the system. This seems to be another example where the approach ‘easy to use but customisable’ has borne fruit.

"Germany. ‘Thermal technology is used, for example, in early warning systems that are triggered when a critical temperature threshold is exceeded. Such a system, which uses cameras with an integrated heat sensor, can detect infections in high-risk ICUs by identifying patients with fever. ‘Another potential field of application is monitoring hospital equipment; increased heat emission is often a sign of imminent failure, for example if there is mechanical friction. ‘To be able to detect such electronic components that have a higher power consumption shortly before they break down. The system will detect and signal this unusual temperature increase early enough for maintenance work. ‘Currently, thermal technology is being tested in a care facility in the Netherlands, a camera-controlled system warns the night watch staff of unexpected movement in patient rooms. This technology makes repeated night watch rounds obsolete’, says Lessmann, adding that this ‘increases flexibility and reduces pressure on the staff’. To ensure such a system respects patient privacy, Mobotix designed a particular configuration. All images recorded by the camera are pixelated. Only when the camera detects a potential emergency is the image recognisable and a signal is sent to the staff, who then check and decide whether an intervention is necessary. ‘This initial feedback from a Dutch care facility is positive, all those who use the devices are satisfied with the system and a frequent routine is underlined. Thus the facility intends to expand the system. This seems to be another example where the approach ‘easy to use but customisable’ has borne fruit.

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TAINAN EXCELLENCE

Extra-dimension out of the box

Technical innovations? Fair enough. However, they are of little value if hospitals do not have the necessary personnel to use these tools. That is where ‘MonoStereo’ by the ‘Taiwan Excellence’ winner MedicalTek comes in. This is a ‘4K’ image system for endoscopes, as explained by Chairman Kai-Che (Jack) Liu. ‘The software we developed converts the monoscopic images from any current 2-D system and processes them in real-time to stereoscopic 3-D images.’

A strong point in favour of the product is the high degree of compatibility. ‘This is convenient for hospitals, because they already have all the necessary equipment,’ he points out. ‘Their endoscopy systems are simply connected to our conversion box. The depth is then perceived by the surgeon through the system’s 3-D endoscopic images not only improving visualisation of depth, the surgeon can now also see the images. Surgeons need to convert the 2-D endoscopic images to 5-Movements in a room. ‘For some, the ‘MonoStereo’ system will detect and signal this unusual temperature increase early enough for maintenance work.

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Sonimage H55 has only eight buttons; everything else can be entered via the touchscreen.
New navigation imaging and neurophysiological stimulation techniques enable an approach to brain tumours long considered unresectable before and during surgery, but not one does it quite as well as ultrasound, according to a leading Spanish neurosurgeon.

Report: Méisande Rouger

Resecting an entire tumour and determining brain shift remain challenging for surgeons in brain cancer surgery. However, they are likelier to overcome these difficulties if they use intraoperative ultrasound, according to Dr Cristian de Quintana Schmidt, neuro oncologist at Santa Creu i Sant Pau Hospital in Barcelona. Neuro navigated ultrasound provides the surgeon with confidence in the assessment of resection accuracy and in the determination of brain shift, he said. Last August, during the World Congress of Neurosurgery in Istanbul, Turkey, de Quintana presented the results of a prospective two-year study on ultrasound use in intra-axial tumours. For surgeons, brain shift is a major problem. Even if they use pre surgical imaging to help plan surgery, the brain will change during the intervention; it will lose liquid and volume, shift shape and move, and ultimately make it harder for surgeons to perform.

Intraoperative ultrasound takes just over two minutes

Unlike intraoperative magnetic resonance imaging (MRI), which requires 20-30 minutes time to adjust to pre-surgical images, it takes a little over two minutes (2 minutes 19 seconds) for intraoperative ultrasound to overlap with previous images. Because ultrasound is so fast, it can be repeated many times during surgery, enabling the surgeon to detect brain shift and evaluate how much tumour is left, almost instantly.

Ultrasound scanning tells the surgeon if the tumour is left, almost instantly. Brain shift and evaluate how much is resected, I check if the tumour has been fully removed, or whether there is any residual tissue. In 14% of the cases, ultrasound helps to resect further, which significantly improves our results. Extensive resection tremendously increases patient survival and prognosis, de Quintana pointed out.

Intraoperative imaging enables to safely excite tumours long thought to be unresectable. At Santa Creu & Sant Pau Hospital, ultrasound has helped de Quintana to successfully carry out surgery in 10-20 patients of the 40-50 patients he operates on annually. Another benefit of ultrasound compared to other intraoperative techniques is that it is cheap and easily moveable across the hospital, without losing too much in image quality.

After studying hundreds of cases over two years, de Quintana observed that ultrasound had achieved 78% of correlation with pre-surgery MRI. ‘That’s a totally acceptable performance for intraoperative imaging,’ he confirmed. Ultrasound is particularly helpful in visualising metastases, which are less infiltrative than glioma and usually easier to resect.

But last but not least, the learning curve is much faster than with MRI. ‘All you need is a bit of experience. Ultrasound is not a complicated technique, but you need good equipment and good probes,’ de Quintana pointed out.

All these benefits have convinced the researcher that ultrasound is the best imaging tool in his arsenal. ‘Based on image quality, time, ease of use and cost, ultrasound is the most efficient intraoperative imaging technique at our disposal.’

Nevertheless de Quintana stressed the role of functional MR and tractography in the pre surgical setting. ‘We are increasingly using these techniques to help prepare for surgery,’ he said. ‘They remain crucial to be able to localise tumour and determine our approach, in order to resect as much tumour as possible without damaging neurofunctional role.’

‘Tractography, in particular, is instrumental in visualising subcortical neural tracts and understanding how the tumour relates to surrounding structures. The technique relies on 3-D modelling based on data collected by diffusion-weighted images, and uses colour to image functions such as language, vision and motion. This information is then sent to the neuro navigator to facilitate surgery.’

Neurophysiological stimulation during surgery

De Quintana also highlighted the role of neurophysiological stimulation during surgery to help distinguish functional areas of the brain and evaluate patient response.

‘Brain mapping in tumours located in or close to key areas generating motion, vision and speech or linked to memory or emotion will guide response while the patient is awake or asleep. A surgeon, neurophysiologist and neuroanatomist usually perform this stage of treatment together. Once the patient is asleep, the medical team will gently wake him or her up to perform brain mapping and ask him or her to move. Doctors then perform tumoural resection, and close up the patient when he/she is asleep or sedated.

The best intraoperative imaging technique

Navigated ultrasound

The centre is equipped with four stereotactic accelerators and treats 2,200 patients annually. CyberKnife has also opened ‘a field of possibilities’, especially in patients with colon cancer and resilient liver or lung metastases, according to Le Prisé. ‘We can now give them a break from their chemo treatment and increase survival in a way that is comfortable for patients. That’s something we had not been able to offer before.

‘Acquiring the system, and building the site to host it, was nothing easy and the medical team shed blood and tears to convince the administrators of the tool’s value. T’ve started discussions to acquire the system since 2008. Since we bought the CyberKnife we’ve increased our activity by 500 patients per year,’ Le Prisé noted. 80 million was poured in by Brittany’s Regional Health Agency (Agence régionale de santé de Bretagne) to build and fit in the platform. Equipment maintenance costs €350,000 annually.

Cristian de Quintana Schmidt MD

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Cristian de Quintana Schmidt MD, neuro oncologist at the department of surgery at Santa Cruz i Sant Pau Hospital in Barcelona, Spain. He is a specialist in highly excise brain tumour resection and an expert in technological advances in this field. His publications, conference presentations number more than a hundred.

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A new therapy: virtual reality experiences

Report: Madeleine van de Wouw

A patient walks slowly into the Intensive Care Unit (ICU). He sits on a hospital bed, hears unfamiliar beeps and other sounds. Doctors and nurses arrive to talk about all the surrounding machines and how things work in an ICU. Everything is calm and without stress for the patient as he listens to them. Then the virtual reality (VR) glasses he is wearing are removed, and he returns to reality. The walkabout was a scenario. Its purpose was to deal with the traumaticising effects of a sudden ICU admittance by having prior experience of being there.

Dr Michel van Genderen, an intern at Erasmus MC, works at the Franciscus Gasthuis & Vlietland in Rotterdam, The Netherlands, where, in November 2017, he initiated research into a method to help patients through Post Intensive Care Syndrome (PICS) by using VR. The project also includes Jolanda van der Wal, GZ-Psychologist at the same hospital, ICU specialists Evert-Jan Wils and Arjan Brouwers (Franciscus Gasthuis) and Jasper van Rompaey (Erasmus MC).

Why VR-Goggles?

‘Many patients are unexpectedly hospitalised and put into a coma in the ICU; van Genderen points out. ‘When they regain consciousness, patients speak of a “hole” in their memories. They awaken in an unfamiliar surrounding with noises they don’t recognise; they see people they don’t know and are surrounded by equipment on which their basic existence depends. Besides that, the patient is unable to communicate, due to the use of a ventilator.’

‘I’ve been working in this field for 30 years and, in the meantime, radiotherapy has taken a gigantic step ahead thanks to advances made in imaging and IT. The future will be MRI accelerators, and we would like to purchase one within the next three to four years,’ the radiologist adds.

For the time being, efforts should focus on improving software used for Cyberknife, she believes. ‘Definitions of regions of interest used for CyberKnife, she believes. Focus on improving software added.’ Dr Elisabeth Le Prêtre has been head of the radiation department at Eugène Marquis Cancer Centre in Rennes, France, since 2000. She has also presided over the Eugène Marquis management team since 2011. A former hospital resident, she is an oncologist and radiation therapist specialising in cancer centre medicine.

Research shows that many of them suffer from post intensive care syndrome. They endure psychological problems, like anxieties, depression and returning nightmares. Physical complaints, such as fatigue and cognitive problems, like amnesia and concentration-problems also occur. ‘These problems lead to a lower quality-of-life. ‘We think that, when a patient experiences the ICU through Virtual Reality he will be able to deal with all things that occurred in a better way, because he learns how he got into the ICU and what all the beeps mean. Virtual Reality is already being used to prepare patients for upcoming treatment, but for this project we use this technique as treatment after an unexpected event. Naturally one can’t prepare for such events.’

Post-intensive care syndrome

‘This is still relatively unknown and not much research has been done. The figures regarding the prevention of the Post Intensive Care Syndrome are not very reliable. International research shows that approximately 30 to 60 percent of ex-ICU patients have complaints. Research at the four hospitals in Rotterdam shows that 50 to 60 percent have serious issues.

‘We put two-and-a-half years in preliminary research before starting with VR. Initially we needed financial resources. Luckily we received 445,000 from Stichting Coolsingel, which was used to develop the software.’

Other trauma processing methods

‘Sure, there are several forms like keeping a journal, reading brochures or watching information videos. This is not all very helpful to process the ICU treatment experience. A later visit to the ICU has shown to be more effective; however, that’s almost impossible to organise. With Cognitive Processing Therapy (CPT) and Eye-Movement Desensitisation and Reprocessing (EMDR) you are completely reliant on your own memory and associations, which are not there for these patients.’

‘Using Virtual Reality is less dependent on memories and this may have a positive impact on patients. Many ex-patients have remarked that they feel out of control and would like to be able to experience the ICU again, with the explanation and context VR might give them back control.’

The research project

This involves 50 patients at the Franciscus Gasthuis who were admitted to the intensive care unit (ICU) with sepsis (blood infection). On the fourth day after they are moved out of the ICU into a 16-bed ward, which provides five VR glasses, the patients can request the use of VR-glasses for one week. They are randomly divided into two groups: 25 patients see images of the ICU. 25 are the ‘control’ group and the images they see are of relaxing surrounding, such as a forest, concert or other soothing scene or event. All patients receive the same personal guidance.

Research results

‘We expect to have results by mid-2018. If the results are positive, we can start to implement the method in other hospitals. We want to do this regionally, in cooperation with and from the Erasmus MC. Most important is that we can help patients. ‘The fact that it is very effective has shown with our first test patient, José Smit, aged 63. She developed psychological problems after being admitted to the ICU. After the treatment with the VR-exposure therapy she responded to have had a lot of help from it. She now sleeps and functions better. In the end, potentially it will reduce costs because patients will suffer less trauma. And there is the issue of the costs: aftercare will be less expensive.

‘Initially the hospitals must invest in this technology but, down the line, it’s also cost reductive for them. This research project might be a difficult path for patients – but not as difficult as experiencing the trauma – and the potential outcome is big. If the research results show that VR can be used as a preventive means, the gain will be even larger. In a couple of years, this may become mainstream.’
Endoscopy education increases

Hygiene is still a leading topic in endoscopy, and education remains crucial in Europe, according to Ulrike Beilenhoff, scientific secretary of the European Society of Gastroendoscopy and Endoscopy Nurses and Associates (ESGENA). The two subjects took centre stage during the 21st ESGENA Conference, held during UEG Week in Barcelona this October, Mélissande Rouger reports.

With around 600 participants, lectures, posters, hands-on training workshops and industry symposia, all stressressing the importance of multidisciplinary cooperation and all with good feedback, Ulrike Beilenhoff, scientific secretary of the European Society of Gastroendoscopy and Endoscopy Nurses and Associates (ESGENA) was pleased with the three-day event. ‘The Spanish Society of Endoscopy Nurses and Associates (AEEED) and Spanish Society of Digestive Disease Nurses (AEEPD) hosted the event – we have an excellent relationship with these two organisations,’ she said.

Highlights

Hygiene, advanced roles and education in different countries were among the most discussed aspects. ‘The session on liver transplantation was also very important, because the endoscopy team handles complications if something goes wrong following surgery. In endoscopy, nurses have a very close relationship with the endoscopist.’

Leading topics

‘Hygiene has been a big issue since the early 2000s,’ Beilenhoff points out, referring to the increased rate of multidrug-resistant infections internationally. ‘In the last three or four years a number of these infections have been reported in endoscopy. Examinations are more invasive, and there’s a potential higher risk of infection. Infections highlight the important impact of staff training, appropriate reprocessing and quality assurance.

‘Nurses’ advanced role is also a major topic. Nurses already fulfil advanced roles in nutrition, functional tests and caring for special patient groups e.g. IBDD patients. Only five European countries allow nurses to perform colonoscopy screening: the UK, Ireland, Denmark, Sweden and the Netherlands. Due to different national health systems and national laws, other European countries forbid this at the moment.’

‘However, studies have shown that, to carry out these examinations, nurses are at least as good as doctors. In the UK, nursing and medical endoscopists have the same education. In Denmark, the Netherlands and Sweden, nurses receive a formal, officially recognised training to perform endoscopy examinations.’

Endoscopy training for nurses

‘From 1989, nurse Ulrike Beilenhoff has specialised in endoscopy since 1989 and was head nurse in an endoscopy department for more than 15 years. She now trains endoscopy during nurse training in Germany. A founding member of ESGENA, Beilenhoff has served on its governing board for several years, and currently she is the organisation’s scientific president. President of the German Society of Endoscopy Nurses and editor-in-chief of the German journal Endo-Praxis.

Endoscopy training is crucial in Europe, according to Ulrike Beilenhoff, scientific secretary of the European Society of Gastroendoscopy and Endoscopy Nurses and Associates (ESGENA).’

Trends in Europe

‘There is a clear trend towards university training, although nurses still train at school for basic and specialised education in many countries. But the trend is for countries to switch to university training.

‘Additional training, for instance in hygiene or sedation, is delivered on the job.’

New endoscopy techniques with clinical impact

‘We now carry out a lot of procedures that replace surgery. Minimally invasive treatments have multiplied over the years. The endoscopist now does a lot of advanced endoscopic procedures, for instance tumour resection in the gastrointestinal tract, if the tumour is inside the lumen.

‘Since nurses play an active role during a procedure,’ Beilenhoff continued, ‘new developments also influence their daily work, because deeper knowledge and new training skills are necessary.’

Challenges

‘We have two main tasks in endoscopy nursing: assisting the endoscopist during the procedure and specialised patient care before, during and after the procedure. In Germany and some other European countries, nurses are specially trained to administrate sedation of the patient. For sedation, you need to have a certain amount of experience to handle the medications, and you need to be aware of all resuscitation techniques, so you need special training.

‘When assisting the endoscopist, you need a lot of medical knowledge because you look at the screen or an X-ray study. You need to manipulate endoscopic accessories and play an active part during the procedure. So you have to understand what you are doing together.

‘These are two totally different but fascinating tasks.’

Infections associated with osteosynthesis and prostheses are not to be underestimated: the infection rate is reported to be one to three percent after joint prosthetic surgery and five to 10 percent after osteosynthesis. ‘When you include later infections, the rate is twice as high,’ says Professor Andrej Trampuz, infectious diseases specialist and Head of the Centre for Septic Surgery at the Centre of Musculoskeletal Surgery (CMSC) in Charité, Berlin, Germany. Since the avascular tissue of the implants impairs phagocytes, he points out, ‘A mere 200 bacteria are sufficient to form a resistant biofilm.’

Biofilms that are a maximum of four to six weeks old are usually caused by highly virulent microbes, such as Staphylococcus aureus, Streptococcus or Gram-negative rods that can be easily eradicated without replacement of the implant. By contrast, mature biofilms form low-virulent microbes, such as Staphylococcus epidermidis and Cutibacterium acnes. ‘The older the biofilm, the more difficult the eradication becomes and the more urgent is an implant replacement,’ Trampuz explains.

Sequestrectomy and removal of infected bone material require aggressive debridement, local soft tissue and bone conditioning, one and two-stage exchange as well as post-surgery antibiotics. Efficiency of the antibiotic therapy is closely related to effective debridement and the reduction of pathogen load during surgery. The antibiotics should be bactericidal and biofilm-active and offer good bone penetration and oral bioavailability, such as rifampicin, ciprofloxacin, penicillin, amoxicillin, fosfomycin and gentamicin.

‘We are currently witnessing a renaissance of local antibiotics therapy,’ Trampuz says. ‘Gentamicin and vancomycin can be applied locally in bone cement in a much higher concentration.’ Prophylaxis requires 0.5 to 1.0 g antibiotic per 40 g cement. In the spacer, a dose of 2.0 to 4.0 g per 40 g cement is used. Professor Ingo Marzi of the Clinic for Trauma Surgery, Hand Surgery and Restorative Surgery at the University of Frankfurt, Germany, adds: ‘Soft tissue coverage is of crucial importance in the therapy of osteosynthesis infections. Secondary reconstruction is most successful in a clean and properly vascularised bone and soft tissue bed.

‘Reconstruction entails thorough removal of infected bone material and insufficiently perfused soft tissue, stabilisation of the limb with spaces, surgical closure of the defect with grafts or flap surgery and bone build-up of the impaired bone.’

Marzi recommends the Masquelet technique for bone defect management.
Joint infections are not to be underestimated. In this, following thorough bone debridement and soft tissue coverage an antibiotic-loaded bone cement spacer is inserted into the bone defect. In a second intervention, the cement spacer is removed, without damaging the membrane, and the bone defect is filled with a mixture of BMP-7, tricalcium phosphate and endogenous bone. Bone tissue is harvested either from the iliac crest or via RIA technique (Reamer-Irrigator-Aspirator).

Compared with other bone reconstruction methods the Masquelet technique is rather quick, even with large diaphyseal and metaphyseal femur or tibia defects," Marzi says.

Unlike Masquelet himself, who did not apply antibiotics in order to avoid infection masking, Professor Gerhard Schmidmaier of the German University of Heidelberg uses the procedure to deliver bone cement and high doses of gentamicin and vancomycin.

One advantage is improved perfusion: ‘It’s amazing that today we can improve bone perfusion with the help of the Masquelet technique,’ says the interim director of Heidelberg’s Clinic of Orthopaedics and Trauma Surgery. Today, due to organism induction bone defects of 6-25 cm heal well. ‘In addition, locally applied high doses of antibiotics ensure that all bacteria are eradicated,’ Schmidmaier points out. ‘Masquelet used his technique solely for membrane induction and enhancement of perfusion, not to treat infections.’

Prior to the intervention cement is prepared in a bowl. This makes the cement a bit more porous and the antibiotic is released better, Schmidmaier explains. Nonetheless, he also routinely works with ready-to-use products such as Copa GxV, for example in infected pseudarthroses. Bone cement loaded with a mixture of gentamicin and vancomycin, he explains, catches up to 80 percent of all microbes.

He recommends that, when placing the bone cement, it makes sense to create irregularly shaped edges on the bone, for the subsequent integration of the new bone, the bone cement should overlap onto the healthy bone material. When the bone cement is removed after six to eight weeks, the objective is to spare the membrane.

For harvesting graft material Schmidmaier favours RIA, a procedure that allows acquisition of large volumes (20-75 ml) of high-quality autologous bone tissue. Research indicates, he points out that morbidity decreases with harvesting using the RIA technique."

In conclusion, he says: ‘The Masquelet technique is suited for interventions with plates and nails but also in recent trauma. It makes sense from a biological point of view and the combination of gentamicin and vancomycin offers benefits. If a tissue sample is loaded with bacteria that do not respond to the antibiotics, the spacer can be replaced or a suitable antibiotic can be applied locally.’
Optoacoustics: the sound of cells

For centuries, hands, eyes and ears were the physicians’ most important instruments when it came to detecting and diagnosing diseases. Today, one of the traditional techniques, percussion, is being revived, supported by state-of-the-art technology and dressed in a new name: optoacoustics.

In one of the most exciting visionary ideas in modern healthcare, laser pulses (optics) are transmitted to tissue where they generate ultrasound signals (acoustics) that allow the identification of cells and diseases in the body. The advantages of this technology? No ionising radiation, no invasive procedure.

Pioneer of clinical optoacoustics is Professor Vasilis Ntziachristos, Chair for Biological Imaging at the Technical University Munich (TUM), Germany, and Director of the Institute of Biological and Medical Imaging (IBMI) at Helmholtz Zentrum, Munich. His groundbreaking research not only sparks hope for cancer patients but also opens new diagnostic perspectives for Alzheimer’s, diabetes and dermatological diseases.

Multi-spectral optoacoustic tomography (MSOT)
The laser pulses penetrate the body where they are absorbed differently, depending on their wavelength and on the type of target tissue. These laser pulses create a minimum rise in temperature which expands the tissue. Those equally minute movements generate acoustic signals – with each type of tissue producing unique signals. A blood cell, for example, sounds very different from a skin cell.

Ultrasound detectors on the skin surface register these different signals and a computer generates the corresponding 3-D image. Thus, single cells, for example cancer cells, can be detected. This is a major advantage compared to ultrasound, which cannot differentiate on this level. Ntziachristos explains.

Currently, multi-spectral optoacoustic tomography shows its potential, particularly in the treatment of melanoma cells. But their unique sound also gives away other cell types, which might allow surgeons to check accurately during a tumour resection whether indeed all cancer cells were removed.

Following successful animal studies, the procedure is now being tested in human volunteers. Different clinical studies are currently being conducted for breast and thyroid cancer, and peripheral atherosclerosis.

To display the images, another expert in medical imaging, Professor Dr Daniel Razansky of Helmholtz Zentrum Munich, is developing an affordable diagnostic device for clinical use in the operating room (OR). While the device today costs around €200,000, Ntziachristos considers a future price tag of €50 to be realistic. Thus, in 2011 he and two partners founded a spin-off, iThera Medical in Munich.

In 2013, he received the Leibniz Prize of the German Research Foundation (DFG) and last year he was awarded – for the second time – the ERC Advanced Grant of the European Research Council.

That grant of €2.9 million will be disbursed over a period of five years. The funds will be used to develop a portable device for human patients. As to market maturity the Helmholtz Zentrum did not provide any information since the product is still under development.

While working on the marketability of the device, Ntziachristos research is also addressing the major limitations of optoacoustics: the laser cannot penetrate deeper in a cost-effective way. The project group for automation in medicine and biotechnology PAMB at the Institute has therefore set itself the task of simplifying these processes with digital technology.

Finding the largest common denominator
The difficult part of the project was the compilation of the user profile. Finding a common language for doctors and engineers, and jointly exploring the opportunities and limits of such a system, was a complicated undertaking – which we mastered step by step,’ Rothfuss says.

Medics and engineers continued to keep in close contact after the development of the profile. ‘Obtaining regular input and resolving any issues arising without complications was extraordinarily helpful,’ he adds, describing the Mannheium University Hospital cooperation.

Software generates a positioning plan
The result is a system that combines the advantages of digital support with medical craftsmanship. A software programme reads the patient’s CT or MRI scans to present a positioning plan.

When the robot holds the needle, X-rays can be obtained without the doctor’s hand in the images.

As the robot holds the needle in position it is possible to take X-ray images without the doctor’s hand obstructing the image, which reduces radiation exposure for the doctor.

The robot-guided positioning also ensures that the needle cannot slip, which means not as many X-ray images are required for control, and radiation exposure for the patient is also lower.

Software reads/calibrates CT or MRI scans to present a positioning plan

Correct placement of needles is time consuming. So much so that researchers at the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) along with experts at Roka AG developed a robotic assistance system that enables needle placement in only six minutes. The doctor can fully concentrate on needle insertion, with calibration and positioning carried out by a computerised system with a robotic arm.

Needle placement takes six minutes

At the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA) in Stuttgart, Germany, Andreas Rothfuss worked as an assistant while studying for his degree, specialising in manufacturing engineering at Stuttgart University. After joining the Project Group for Automation in Medicine and Biotechnology PAMB in Mannheim, Germany, in 2012, he began writing his diploma thesis, The evaluation of shape-memory actuators with respect to possible applications in minimally invasive surgery. He is now a doctoral researcher for the PAMB.

As the robot holds the needle in position it is possible to take X-ray images without the doctor’s hand obstructing the image, which reduces radiation exposure for the doctor.

The intuitive software and positioning groundwork not only save time but also offer valuable support to less experienced doctors.

Rothfuss is convinced that progress will be fast: ‘First clinical tests are due to be carried out from spring 2018, and we hope to have ready to launch the system in three years’ time.

The system has great potential – it may in time even facilitate fully automated placement.’
ETIM 2018

After this year’s successful first congress about Emerging Technologies in Medicine (ETIM) in Essen, Germany, the organizing committee sets the stage for the second edition on February 16 and 17, 2018.

The congress will again take place at the Lefrund Lernzentrum of the medical faculty of University Hospital of Essen, Germany. The first day is dedicated to Artificial Intelligence and the second to Robotics. Key topics will include the role of artificial intelligence in diagnostics and the future of robot-assisted surgery.

Advances in healthcare and medical research are already strongly driven by information technology and engineering, the ETIM committee points out. Technologies like individual genome sequencing or high-performance multiparametric imaging generate exponentially growing datasets while contemporary data-mining techniques allow to extract valuable data from existing archives. These offer the opportunity for highly specific clinical decision making and personalized precision medicine. Further acceleration of medical innovation can be safely predicted. However, as complex challenges often require complex solutions, these technologies demand an interdisciplinary approach between clinicians, computer scientists, engineers, researchers, healthcare providers, legislators and many other disciplines. The 2018 ETIM will therefore provide an opportunity for experts to get together.

Detailed information is available at https://etim.uk-essen.de.
Preempting disease before it strikes

Report: Cynthia E. Keen

Many challenges and opportunities exist for innovation in diagnostic imaging in the 21st century. One lies in biomedical science, especially in terms of personalised medicine. Just as radiology today is essential for the diagnosis and treatment of disease, imaging’s contribution to biomedical science has the potential to dramatically alter medical treatment by focusing on proactive intervention prior to disease progression, Elisa A. Zerhouni MD, told attendees at the opening session of the 2017 RSNA annual meeting.

Historically, innovations in diagnostic imaging have been interdisciplinary, achieved through collaborations of physical, medical, biological, and engineering disciplines. Zerhouni rhetorically asked: ‘How do we get biomedical imaging information at the molecular level and do we get biomedical imaging information at the molecular level and do we get biomedical imaging information at the molecular level and do we get biomedical imaging information at the molecular level and do we get biomedical imaging information at the molecular level and do we get biomedical imaging information at the molecular level?’

Science is shifting from the ‘hardware’ to the software’ of life. Zerhouni believes that imaging sciences will play a major role in precise reclassification of what medicine is all about: a network of molecules interacting. These are affected by organic and autonomic diseases and, because of their interaction complexity, diseases are not homogeneous. No one disease can be controlled by just one target, which is why the response by patients to treatments differs.

Radiologists can contribute to personalised medicine by identifying the ‘tools’ to address targets. ‘If imaging can show the interaction of every therapeutic agent and every one of their targets, and the consequences of their interaction, the gold mine of information would make progress very fast. Diagnostics and therapeutics are two sides of the same coin,’ he pointed out.

‘Understanding molecular network, metabolism, and their regulation in health and disease will lead to a functional and more specific reclassification of most diseases based on their specific molecular pathways, enable predictive biomarkers, and suggest a greater understanding of environmental drivers,’ Zerhouni said. Identification of reliable biomarkers needs to be strategic goal of imaging innovation. A goal today of research and therapeutic is to develop ‘dream molecules’ that will do multiple things at once. The challenge to radiology is to focus on imaging data and generating data.

‘Imaging biomarkers (PET/CT, PET/MRI) need to be identified and correlated with biological markers. Zerhouni predicted that diagnostic imaging departments in academic research organisations would have their staff dedicated to this.

‘With respect to machine-augmented intelligence (AI), Zerhouni predicts that in 5-10 years its use will become standards in radiology. He sees the technology as being able to improve radiologists’ performance and to help standardise levels of performance.

He predicts that huge global reference databases queried by AI will enable radiologists within seconds to compare an exam they are interpreting with a wealth of stored and relevant medical information. ‘I see a future where a radiologist will say in a radiology report that the patient corresponds to RSNA Reference Database Number xxxxx. Radiologists will be able to track the evolution of disease and extract novel information.’

Zerhouni concluded by offering this advice to the RSNA meeting attendees:

- Ask not what radiology can do but what this discipline should do.

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Radiographers gain a European diploma by 2019

Report: Mélissande Rouger

Radiographers are increasingly central to patient care, but the heterogeneity of educational qualifications across Europe remain challenging. Dr. Håkon Hjeltnes (Haukeland and Håkon Hjeltnes, of the European Federation of Radiographers Societies (EFRS), explained how they plan to improve radiographers’ visibility and work towards homogenising training across Europe, notably by launching a European Diploma in Radiography by early 2019.

‘We very strongly feel that radiographers across Europe should be trained to the highest possible level. That allows them to make a greater contribution to healthcare and to enhance radiology and radiation therapy services. The profession must be duly regulated,’ McNulty said. A bachelor’s level qualification is seen as the minimum standard for us, it should be the entry level to the profession, but it’s still not the case in some countries.’

‘To make up for the gap between some regions of Europe, who have had radiographers’ role development. Earlier, McNulty summed up. ‘The official title we use is radiographers, but there are 20 or more other titles for the profession. Radiographers can also be nurses, technicians, radio therapists,…’

The EFRS plans to change this by promoting a bachelor’s level as the entry level to the profession, versus shorter, vocational qualifications meaning it will require a minimum three-year program at level 6 in its European qualification framework (EQF) benchmarking document. The organisation has also introduced an EQF level 7 (masters level) benchmarking document, in a move to raise the bar for future generations.

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Taking the diploma could be useful for those who only received a two-year education. ‘I see a future where a radiographer who qualifies struggle to find work and many will have to work for free to get a foot through the door. Consequently, many have come to Ireland and the United Kingdom for a job but, for others, their qualification may not be recognised because it may not be equivalent to bachelor level,’ McNulty explained.

The lack of homogeneity in European radiographers’ education has become a pressing issue, as the unequal distribution of professionals leads to migration, which can prove expensive to the public sector, as clinical radiographers, who qualify struggle to find work and many will have to work for free to get a foot through the door. Consequently, many have come to Ireland and the United Kingdom for a job but, for others, their qualification may not be recognised because it may not be equivalent to bachelor level,’ McNulty explained.

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Radiographers are key team players in medicine, within medical, surgical, and radiation therapy, and their role is growing, boosted by the rising demand for imaging studies and procedures and the continuous shortage of radiologists in many countries. But radiographers have many faces and names, and this compromises the recognition of their skills across healthcare, according to Jonathan McNulty, EFRS newly elected president.

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Artificial Intelligence helps to detect breast cancer

Scientists are using Artificial Intelligence to support more effective breast cancer detection. The researchers at Massachusetts Institute of Technology (MIT) Computer Science and Artificial Intelligence Laboratory (CSAIL), Massachusetts General Hospital (MGH), and Harvard Medical School are using the machine learning system to predict whether breast lesions identified from a biopsy will turn out to be cancerous, Mark Nicholls reports.

The hope now is that this research could help reduce the number of unnecessary breast cancer surgeries because it could pinpoint which lesions are cancerous more accurately and more efficiently.

In the study, the system was trained on information about such lesions and looked for patterns among a range of data points, including demographics, family history, biopsies and pathology reports.

When tested on 335 high-risk lesions, it correctly diagnosed 97% as malignant. The researchers suggest that such levels of accuracy could lead to a reduction in the number of unnecessary surgeries by more than 50%.

While mammograms can detect cancers, there is also a risk of false positive results that can lead to unnecessary biopsies and surgeries -- often from 'high-risk' lesions that appear suspicious on mammograms and have abnormal cells when tested by needle biopsy. The researchers say patients have the lesion surgically removed but often it is benign and the operations were unnecessary.

To address this, the team developed the machine learning system to predict if a high-risk lesion identified on needle biopsy after a mammogram will upgrade to cancer at surgery.

"Because diagnostic tools are so inexact, there is an understandable tendency for doctors to overscreen for breast cancer," Dr Regina Barzilay, MIT's Delta Electronics Professor of Electrical Engineering and Computer Science, pointed out. "When there's this much uncertainty in data, machine learning is exactly the tool that we need to improve detection and prevent over-treatment."

'A model like this will work anytime you have lots of different factors that correlate with a specific outcome. It hopefully will enable us to start to go beyond a one-size-fits-all approach to medical diagnosis.'

Using a method known as a 'random-forest classifier', the model resulted in fewer unnecessary surgeries compared to the strategy of always doing surgery, while also being able to diagnose more cancerous lesions than the strategy of only doing surgery on traditional 'high-risk lesions'.

"Dr Constance Lehman, Professor of Electrical Engineering and Computer Science and Regina Barzilay MD is a Delta Electronics Professor in the Department of Electrical Engineering and Computer Science and a member of the Computer Science and Artificial Intelligence Laboratory at the Massachusetts Institute of Technology, USA. Her research focuses on natural language processing, applications of deep learning to chemistry and oncology.

Constance Lehman MD is a Professor at Harvard Medical School in Boston, USA, and Chief of the Breast Imaging Division at MGH's Department of Radiology. After graduating from Duke University and receiving medical and doctoral degrees at Yale University, she became Professor and Vice Chair of Radiology and Division Chief of Breast Imaging at the Seattle Cancer Care Alliance before her recent move to Massachusetts General Hospital.

In 335 high-risk lesions the system correctly diagnosed 97% as malignant.

From left: Manisha Bahl MD is a breast imaging radiologist and director of the Breast Imaging Fellowship Program at Massachusetts General Hospital/Harvard Medical School in Boston, USA. After graduating from the Harvard School of Public Health with an MPH in Health Policy and Management, she completed a radiology residency and breast imaging fellowship at Duke University Medical Centre and joined the faculty at Massachusetts General Hospital/Harvard Medical School in July 2016.

Regina Barzilay MD is a Delta Electronics Professor in the Department of Electrical Engineering and Computer Science and a member of the Computer Science and Artificial Intelligence Laboratory at the Massachusetts Institute of Technology, USA.

Recognising radiographers’ skills could be pertinent in countries with an acute shortage of radiologists, based on the experience of cooperation between radiographers and radiologists in the UK or Ireland, for example. In the end, a collaborative approach can only benefit healthcare, Mcnulty concludes.
The DNA mismatch repair mechanism

Report: Mark Nicholls

A new genetic study by UK-based scientists suggests that immunotherapy drugs could prove to be an effective treatment for some breast cancer patients.

Scientists from the Wellcome Trust Sanger Institute, near Cambridge – one of the world’s leading genome centres – and their collaborators, have identified particular genetic changes in a DNA repair mechanism in breast cancer.

Led by Dr Serena Nik-Zainal, the researchers suggest it could open up the possibility of another therapy option for around 1,000 UK breast cancer patients who could benefit from existing drugs.

The study found that a particular group of breast cancer patients have genetic changes, or mutations, that occur due to an abnormality of a DNA repair mechanism known as mismatch repair, which is a mechanism to recognise and remedy mistakes in the genetic code that arise during DNA replication and recombination. The mechanism also repairs some forms of DNA damage.

When cells lack the mismatch repair pathway, mutations build up, which results in cancerous tumours formation. These mutations are found in other cancers, such as colorectal cancer, but are rarely looked for in breast cancer.

In recent work in the USA, colorectal cancers with deficient mismatch repair have been treated with immunotherapies, which exploit the fact that, under the influence of these so-called check point inhibitors, highly mutated tumour cells can be recognised as foreign by the patient’s immune system. The results of this new Sanger Institute study suggest that these immunotherapies could also be effective for some breast cancer patients, based on the same mutation patterns seen in their tumours.

‘We unequivocally found mismatch repair deficient breast cancers;’ Serena Nik-Zainal said. ‘As these tumours have the same mutational signatures as those of other cancers, like colorectal cancer, in theory they should respond to the same immunotherapy drugs.’

‘Our results suggest expanding the cohort of cancer patients that could possibly be treated with checkpoint inhibitors to include these mismatch repair deficient breast cancer patients.’

The study researchers analysed the whole genome sequences of 640 breast cancer tumours and looked for patterns in the mutations, known as mutational signatures, which indicated abnormalities in the mismatch repair mechanism.

From the mutational signatures, the team identified 11 tumours that had the mismatch repair defects causing the breast cancer.
 Asked about the latest advances in PCA diagnosis, Professor Lars Schimmoller spoke of ‘a remarkable change’ – the increasing role of magnetic resonance imaging (MRI) in routine clinical diagnosis. In its updated guidelines, which will be published later this year, the German Society of Radiology notably insists on the importance of multiparametric MRI (mp-MRI) and MRI-guided biopsy for PCA diagnosis.

The new recommended technical approach is that mp-MRI can not only be used but also should be used in secondary PCA detection after negative transrectal ultrasound (TRUS)- guided biopsy and before inclusion of patients for active surveillance, similar to international guidelines. Moreover, the updated German preliminary recommendations for 2017 state that mp-MRI can be used for primary PCA detection as long as quality standards are fulfilled. Based on these requirements, urologists can and should perform targeted biopsies of MRI-suspected lesions, by using either the cognitive approach (fusion of MRI and TRUS) or a software-based MRI-US fusion-guided biopsy approach.

Five to ten years ago, the standard was to just measure prostate-specific antigen (PSA) value, carry out digital rectal examination, and then an ultrasound and US-guided systematic biopsy. The problem with systematic biopsy is that especially the anterior and apical parts of the prostate are not covered, and cancers missed or only partially captured with up to 50% false negative lower grade histology, so that you never know if higher grade proportions of the tumour exist.

‘One of the big challenges in PCA is its biology. When you have multifocal tumour cells, which are quite common, it’s hard to get the real imaging of where the index lesion is located. Performing an MRI-guided biopsy and an mp-MRI examination before biopsy to help prepare it enables it to hit a tumour with more precision. If you have quality mp-MRI, you can say with over 95% accuracy if there is clinical relevant cancer or not.

‘Also, if you carry out an MRI examination before you do a biopsy, you may discover the reason for high PSA value. Sometimes it may just be prostate enlargement or an infection. So carrying out an MRI scan may also avoid performing unnecessary biopsies.’

Another significant advance in PCA diagnoses has been the use of prostate specific membrane antigen (PSMA) as a relatively new tracer to check PCa recurrence.

Lars Schimmoller MD, associate professor of radiology at Düsseldorf University Hospital, tackled current diagnosis of prostate cancer (PCa) and addressed surveillance and recurrence during the Medica Academy session on Imaging Update. He also highlighted how MRI helps improve biopsies and avoid unnecessary surgery in PCa.

Interview: Mélisande Rouger

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Which diagnostic and imaging modalities do you use in PCa?

The PSA determination is the basic diagnostic tool for PCa check-up, but PSA is specific to the prostate gland and not prostate cancer. An elevation of PSA does not have to be associated with PCa, but when you use it wisely, it is an easy and excellent test for a preexclusion.

The role of PSA screening has been extensively discussed, especially in over diagnosis and over treatment, but trial results from large European studies have shown the relevance of this test. We are currently trying to figure out when it makes sense and in whom – in patients aged 40, 45, 50 or 55 years.

Ultrasound is the standard urologic imaging modality, but US has limitations in PCA detection. It is not so good for sensitivity or specificity, even combined with contrast agents. Currently none of these additional US-tools are recommended for primary PCa detection. US is primarily used to guide biopsy.

Computed tomography (CT) only makes sense in combination with PSMA-PET, e.g. for PCa recurrence, or it may be chosen for pre-operative staging. CT is easily available and gives you an idea of metastases of bone lesion or lymph node metastasis in patients with extensive disease. But lymph nodes imaging is challenging, because they are often very small. CT is mostly not good at differentiating whether they are tumours or not in the prostate setting.

‘Magnetic Resonance Imaging (MRI) is extremely promising for active surveillance and furthermore it is good for local staging. It can also help in unclear cases or PCa recurrence.

‘PSMA-PET is the most promising imaging tool for PCa-recurrence and may be used for detection in unclear cases with high PSA suspicion. Combination of PSMA-PET with MRI might be very nice, but PET/ MRI is rarely available and its clinical benefit remains to be demonstrated.

Screening programs in Germany

The updated recommendation is that men of at least 45 years of age and a life expectancy of more than 10 years should be informed on the possible benefits and drawbacks of early detection measures of prostate cancer like PSA determination.

‘We are performing a huge national prospective multicentre randomised trial on early PSA screening in young men. Currently we have over 30,000 patients enrolled. The study is called PROBANE and we try to assess if it makes sense to measure baseline PSA for risk-adapting PSA screening. Screening must help lower mortality. It only makes sense if you help people not to die or die later from that cancer. PCa is most often a slow growing tumour, so that’s why screening studies results need so long to show their value. You need at least 10 to 15 years approximately to show if a patient benefits from screening.’

What are PCA imaging risks?

‘Nationwide coverage of qualitative mp-MRI examinations and quantitative standardised reporting are two of the most important challenges in PCa imaging. Furthermore, the subsequent correct targeted biopsy is also a challenge for urologists and radiologists.

A further issue is that the biology of prostate tumours is often multifocal and/or heterogeneous in histology, and sometimes hard to differentiate from inflammation or atypical stromal hyperplasia. It is also complex to determine the possible metastatic clone with current technology. It’s crucial to differentiate tumours that are life limiting from those who are not. Mortality in PCa is often due to late cancer detection or inaccurate diagnosis. But most tumours are not life limiting or can be treated.’

‘Radiation risk, as a general limitation or challenge in radiology, is not a problem, because these patients are usually not young and MRI, as the best imaging tool, does not use radiation.’

A: Detection: Multiparametric MRI with T2-weighted image, ADC-map, high b-value image, and perfusion-map showing a large anterior prostate cancer in a patient with negative systematic biopsy
B: Staging: Extensive seminal vesicle invasion and lymph node metastasis on a coronal T2-weighted turbo spin echo (TSE) MRI-image
C: Active Surveillance: Tumour increase in size and aggressiveness (ADC-value decrease) in follow-up MRI in a patient with biopctic verified low-grade prostate cancer
D: Recurrence: PSMA-PET/CT with parallel lymph node metastasis on the left side

The MedTech Forum is the biggest medical technology industry event in Europe. This three-day event brings together CEOs, healthcare disruptors and key opinion leaders to discuss future trends in the medical technology sector.

‘At MedTech Europe, the association representing the in vitro diagnostic (IVD) and medical devices (MD) industries in Europe, we are reshaping our annual Forum with the ambition of making it “the” European medical technology event for health technology stakeholders.”

Join us in Brussels!

Serge Bernasconi
Chief Executive Officer, MedTech Europe

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The emerging field of psycho-
radiotherapy is taking a major step ahead. A new study highlights MRI's role in identifying people with attention deficit and hyper-
activity disorder (ADHD) and classifies subtypes of the condi-
tion, a leading Chinese research-
er explained at the ESMRMB annual meeting, Melissa
Rouger reports

Advances in MRI technology enable the
detection, evaluation and follow-
up of mental illnesses and psychi-
atric conditions. Recently, Chinese
researchers have been able to iden-
tify and distinguish among subtypes of ADHD, thanks to data extracted
from MRI scans.

Qiyong Gong, a radiologist at the
West China Hospital, Sichuan
University, revealed the details of a
study he co-authored with colleagues
Huaqing Sun and Ying Chen, ahead of
its online publication in Radiology.

The researchers used radiomics, i.e.
the extraction of a large amount of
quantitative information from digital
imaging features that can be mined for
disease characteristics. Gong and
colleagues believe cerebral radion-
ics could improve diagnosis accu-
rate by highlighting subtle treat-
ment earlier in patients with ADHD.

Earlier detection means earlier pre-
diction. Using radiomics extracted
from MRI scans, we can build and
evaluate classification models based
on pathological subsampling. These
models can then assist the psycho-
logist in diagnosing and subtyping
ADHD, Gong explained.

The researchers examined 83 chil-
dren aged 7-14 with newly diag-
nosed ADHD, with 42 suffering from
the inattentive subtype (ADHD-1) and
41 from the combined subtype (ADHD-C).

These premiers compared these MRI
results with those of a control group
of 87 healthy children of the same
age, and screened relevant radion-
ics signatures from more than 3,100
quantitative features extracted from
the grey and white matter.

While they found no overall differ-
ence between ADHD and controls in
total brain volume or total grey and
white matter volumes, Gong, Sun and
Chen observed alterations in the
shape of the left temporal lobe,
bilateral cuneus and areas around
left central sulcus. These differences
carried significantly to distin-
guishing ADHD from typically deve-
oping controls.

Within the ADHD population, fea-
tures involved in the default mode
network and the insular cortex sig-
ificantly contributed to discrimi-
ating the ADHD inattentive sub-
type from the combined subtype.

Results highlight the accuracy of
the method researchers could dis-
criminate patients with ADHD with
control subjects with 75.7 percent
accuracy and to discriminate ADHD-
1 from ADHD-C patients with over
81.0 percent accuracy. ‘These results are
quite significant for future man-
agement and treatment of ADHD, and
also provide a major tool in assisting
clinicians to objectively diagnose as
well as monitor the condition,’ he said.

During his ESMRMB talk Gong
reviewed advances in this new field of
radiology, which relies on imag-
ing data analysis rather than visual
inspection of images, particularly
for imaging schizophrenia.

Schizophrenia

Ever since CT identified bilateral
ventricular enlargement in patients
with schizophrenia, imaging tech-
tiques have improved and the
number of descriptions of structural
or neuroanatomical abnormalities in
mental illness has increased tremen-
dously.

Advances in MRI, particularly func-
tional MRI (fMRI), MRI spectroscopy,
perfusion mapping, diffusion-tensor
imaging (DTI) and tractography,
have enabled to identify functional
abnormalities particularly in patients
with schizophrenia.

Studies have shown a neuromarker-
tical signature of schizophrenia across
different ethnic groups. DTI has
recently shown micro-structur-
al differences between the brains of
healthy patients and those with
schizophrenia, including superior
longitudinal fissure, inferior frontal
and inferior parietal lobule. However,
there is dissociation between altered
regions and functional changes and
functional studies in default mode
fronto-parietal networks, and we
must be aware of that,’ he said.

MRI techniques have also ena-
bled identification of cerebral abnor-
malities after antipsychotic treat-
ment, notably after two-year treat-
ment, according to Gong. ‘We have
observed greater loss of grey matter
volume and increase in cerebrospinal
fluid in the frontal lobe.

In the brain of patients with long-
term schizophrenia who have never
been treated with antipsychotics,
we also observed accelerated age-
delayed decline in prefrontal and
temporal cortical grey matter, sug-
gestings a neu-
ropressive process.’

Findings highlighting functional
differences between schizophrenia
and control subjects with 73.7 percent
accuracy and to discriminate ADHD-
1 from the combined subtype.

Research has also shown that
structural changes remained rela-
tively stable in the early years after
a first episode of schizophrenia and
became more dynamic in later phases
of illness. Functional changes, which
may reflect physiological alterations
related to clinical status, are more
sensitive to the effects of treat-
ment on the brain, Gong pointed out.

In the future, imaging-based dis-
case classification will gain import-
ance vs. diagnostic and statis-
tical manual of mental disorders.

‘The main challenge will be to clini-
cally validate these techniques,
but they will prove useful as they
are in molecular and data acqui-
sition and analysis. Interventional
psychoradiology will also develop,
Gong concluded.

‘Image-guided interventions will
be the next big thing. Psychoradiology
will help to deeply understand the
mechanisms of schizophrenia, pro-
vide objective detection and early
diagnosis and enable prognosis and
early treatment.

‘Psychoradiology will also bring
new pharmacological perspectives,
such as depression, bipolar,
and borderline personality disorder,
but they will prove useful as they
are in molecular and data acqui-
sition and analysis. Interventional
psychoradiology will also develop,
Gong concluded.

Mobile C-arms rise in values

More than a decade ago, Ziehm
Imaging paved the way for flat-panel
detectors in mobile imaging. The
company's flat-panel detector on a
mobile C-arm was a world first. As
innovation leader, Ziehm Imaging
remains committed to their mission
of continually setting new technology
benchmarks. Which is why, for exam-
ple, Ziehm Imaging was also the first
company to offer CMOs technology
in a full-size mobile C-arm. Today,
the company still pio-
ners the CMOs C-arm
segment with a complete portfolio
extending from compact mini-Carms
to potentiometric to C-arms that
are based on a Ziehm Imaging CMOS flat-
panel detector.

CMOSline systems

In addition, the leading-edge
Ziehm presents a comprehensive
line-up of choices

CMOSline3 is aimed at professionals
who are not content with the ordi-
nary and who strive for the optimal.
These premium systems offer an
enhanced CMOS imaging chain from
generator to detector. All CMOSline
systems come with a Ziehm Imaging
CMOS detector that is tailored exactly
to the needs of surgeons. Based on
our tried-and-trusted flat-panel
technology, the new CMOSline enables
superior image quality by showing sig-
ificantly more detail. Highlights include
greater sensitivity, enabling surgeons
to achieve better resolution – espe-
cially in magnification modes – while
minimizing dose levels.

Exceptional dose reduction with
Beam Filtration

The feature-rich SmartDose concept
now comes in a further developed
version with the groundbreaking
Beam Filtration® technology. The new
dose reduction technique for an opti-
mized X-ray spectrum supports the
enhanced CMOS imaging chain. This
combination enables an exceptional
reduction in the skin entrance dose
for all CMOSline systems in com-
parison to systems with conventional
filtration technology. In a nutshell, the
premium line of Ziehm Imaging
C-arms provides excellent image
quality with a lower dose.

3D imaging with CT-like
image quality

Equipped with a 31 x 31 cm CMOS
flat-panel detector, our flagship sys-
tem Ziehm Vision RFD 3D delivers
high-end multidisciplinary capabili-
ties for hybrid room applications and
specialized procedures such as coch-
lear and maxillofacial. Furthermore,
the Ziehm Vision RFD 3D offers the
freedom to choose from a range of
3D volume sizes to meet diverse
needs in clinical routine. In addition
to the standard volume of 16 x 16 x
16 cm, the system now also provides
further volume sizes for special-
ized applications. A dedicated larger
field of view with 19.8 x 19.8 x 18.0
cm (axial x sagittal x coronal) covers
larger anatomical regions and deliv-
ers more structure for procedures
such as pelvis surgery with 512°
vertex. The higher number of voxels
in all volume sizes guarantees a
better resolution without increasing
dose levels from those used with the
conventional 200° voxel. Further,
with an edge length of 10 x 10 x
10 cm, the mobile 3D C-arm provides
a suitable option for actions in
intrathecal imaging in cochlear
implantation.

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demanding interventions

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Edition is the first fully motorized
mobile C-arm for trauma, spine and
inconspicuous. Time to get AHEAD with CMION.

*CMOSline represents a system configuration with Ziehm Imaging's dedicated flat-
panel detector.

* The technology Beam Filtration reduces the local dose exposure for all CMOSsystems in comparison to conventional filtration
techniques (Status Before September 2017).

Data on file. Results may vary.

Qiyong Gong MD, PhD is Professor
of radiology at the West China Hospital
at Sichuan University (China). His
research has focused on imaging of
neuropyschiatric disorders with the
 Innovative utilization of MRI for mental
health, neuropsychiatric diseases to
epilepsy. He has published over 300 peer-reviewed
articles, which, in the last five years,
have made him a member of the
mainstream professional
organisation, the International Society
of Magnetic Resonance in Medicine (ISMRM). Professor Gong was awarded the ISMRM
New Horizons Lectureship in 2015, and
the Fellowship of ISMRM in 2016. He is
now Secretary and Future Chair of the
ISMRM Governing Committee of the
Psychiatric MRI Study Group.

Advertorial
The EFSUMB’s nineteen GIUS recommendations

Ultrasound of the gastrointestinal (GI) tract is advancing with the development of elastography and contrast agents. Odd Helge Gilja, director and senior consultant at the National Centre for Ultrasound in Gastroenterology at Haukeland University Hospital, Bergen, Norway, has worked with the technique for trast agents. Odd Helge Gilja, director and senior consultant at the National Centre for Ultrasound in Gastroenterology at Haukeland University Hospital, Bergen, Norway, is also a Professor at the University of Bergen. His interests are ultrasound, gastrointestinal (GI) motility, biomechanics of the GI tract, contrast-enhanced ultrasound, perfusion, registration of dynamic image sequences, advanced visualisation, medical imaging, functional dyspepsia, ultrasound microbubbles, targeted diagnosis and treatment. From 2001-07, he presided over the Norwegian Society for Diagnostic Ultrasound in Medicine. He has edited seven books and authored more than 230 scientific papers, as well as 60 popular science publications.

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The first ever guidelines on gastrointestinal ultrasound

The EFSUMB world's first guide lines on gastrointestinal ultrasound (GIUS) contain 19 recommendations on basic technical and clinical methods to perform ultrasound of the GI tract including, for example, how to follow the small intestine, or how to use Doppler.

Elastography is well established in the breast, prostate, and most importantly the liver, for the diagnosis of hepatitis B and C, and degree of fibrosis and cirrhosis, explains senior consultant and Professor Odd Helge Gilja, from Haukeland University Hospital, in Bergen, Norway.

Elastography is fairly new in GI tract, however. We use it to evaluate stiffness of tissue, and indicate if is more fibrotic or inflammatory, for instance in Crohn's disease. Elastography will help us characterise and decide what treatment to choose: anti-inflammatory drugs when the tissue is soft, or to recommend surgery when there is predominant fibrosis.

Contrast agents are also a rather new addition to GIUS. SonVue has been used for almost twenty years in Europe, for the liver, pancreas and now GI tract. It gives a better understanding of blood perfusion of the GI tract in various diseases and enables depiction of vasculature or indicates inflammation in the tissue. Furthermore, it’s very helpful for abscess detection in and around the intestines.

Contrast agents and elastography are showing good results, so much that we can now give recommendations, and an increasing number of papers support the use of these techniques, especially contrast agents.

New GIUS guidelines will be on Crohn’s disease and inflammatory bowel disease, and we have four more in the pipeline on GI tract, especially contrast agents. There are many indications for ultrasound use here, but the main one would be inflammatory bowel disease, Crohn’s disease being the most important.

US and the intestine: sparing invasive colonoscopies

Call it a prep or a prep-free colonoscopy, the CT-scan has become a dominant modality, whereas ultrasound is often used sequentially for staging, or to spare patients further invasive procedures.

Furthermore, EFSUMB is now updating both the CUES and general elastography guidelines. There are many indications for ultrasound use here, but the main one would be inflammatory bowel disease, Crohn’s disease being the most important.

US and the intestine: sparing invasive colonoscopies

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US and the intestine: sparing invasive colonoscopies

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The Past-President of EFSUMB and acting chair in the WFUMB Education Committee, Odd Helge Gilja MD, PhD, Director and Senior Consultant at National Centre for Ultrasound in Gastroenterology at Haukeland University Hospital, Bergen, Norway, is also a Professor at the University of Bergen. His interests are ultrasound, gastrointestinal (GI) motility, biomechanics of the GI tract, contrast-enhanced ultrasound, perfusion, registration of dynamic image sequences, advanced visualisation, medical imaging, functional dyspepsia, ultrasound microbubbles, targeted diagnosis and treatment. From 2001-07, he presided over the Norwegian Society for Diagnostic Ultrasound in Medicine. He has edited seven books and authored more than 230 scientific papers, as well as 60 popular science publications.

GIUS training candidates

Anyone needs training who will use the modality, and that means radiologists, radiographers, surgeons who can specialise in GI and internists – in some countries, internists also treat patients with GI disorders.”
Experts present CEUS insights

In April 2016 CEUS received the USA's FDA approval. This year's RSNASamsung Symposium 'Contrast-Enhanced Ultrasound (CEUS): Innovations and a Problem-Solving Tool in Clinical Practice' provided an opportunity to discuss. For European Hospital, Professor Andreas Clevert, head of the Interdisciplinary Centre for Ultrasound at University Hospital Munich, Germany, describes the current state of affairs and ventures a guess regarding the future of this technology.

'Today, it's safe to say, the advantages of CEUS, particularly in paediatrics, are obvious, as Paul Salbu, Professor of Imaging Sciences at King's College London and President of the British Medical Ultrasound Society, clearly showed at the recent RSNA conference in April 2016, when microbubbles were approved for liver diagnostics in children. The range of diagnostic options has broadened,' Professor Clevert points out. CEUS is important in trauma diagnostics to detect liver injuries or liver haemorrhage; moreover it facilitates the precise description of liver lesions.

The second presentation, by Professor Stephanie Wilson, Clinical Professor of Radiology, at the University of Calgary and member of the Diagnostic Imaging Department at Foote Medical Center, Calgary, and member of Professor Stephanie Wilson, Clinical Professor of Radiology, at the University of Calgary and member of the Diagnostic Imaging Department at Foote Medical Center, Calgary, highlighted the advantages of CEUS in the setting of liver lesions and their changes over time.

'She was able to show in case studies that contrast-enhanced imaging as an additional diagnostic tool offers renewed hope to those patients who add,' With CEUS waiting times can be reduced and patients can undergo further diagnostic procedures right after abdominal sonography.

Deep insights

The final presentation on CEUS examined the different forms of hepatocellular carcinoma (HCC), from rather rare lesions in the non-cirrhotic liver to mixed HCCs, such as cholangiocarcinoma (CCC), plus HCC. Whilst a CCC, as such, cannot yet be differentiated in ultrasound, a biopsy will tell whether a bile duct carcinoma is present, or a CCC plus HCC,' Professor Clevert explains.

However, CEUS does not only play an important role in HCC diagnostics; it is also extremely helpful in evaluating treatment response, as Professor Clevert points out. 'There are several intervention options for HCC – from transcatherter embolisation (TAE) and transarterial chemoembolisation (TACE) to radiofrequency ablation and microwave ablation. All these therapies need adequate follow-up and assessment whether a vital residual tumour is present post-surgery. This is easy to ascertain with CEUS.'

A very rare variant of HCC, the fibrolamellar hepatocellular carcinoma, can occur in young women without coexistent liver disease. This is, as Professor Clevert explains, 'a tumour originating in the liver in younger patients without liver cirrhosis. The tumour usually remains a singular mass in the liver but metastasises to the lymph nodes. The origins of these tumours have not yet been fully researched; genetic disposition cannot be excluded.'

Above and beyond the liver

At the RSNA symposium, Professor Vito Cantisano from Polliclinico Umberto I, Sapienza University in Rome, Italy, looked at CEUS fields of application beyond the liver, such as the evaluation of plaques. 'Today,' Clevert explains, 'plaque evaluation is done by CT, which, however, cannot confirm vascularisation of plaque. This is where CEUS might come in.' Other presenters at the symposium shared their CEUS experience in terms of vessels, kidneys, and other organs. A crucial advantage of CEUS is the fact that, in many cases, changes can only be made visible by administering contrast agent. For example, when an aortic stent has been placed, conventional techniques can only show a 50 percent risk that endoleaks are not detected. As far as kidneys are concerned, the diagnosis of kidney cysts is so complex that only contrast media allow precise and fast confirmation of carcinoma or cyst. Clevert points out.

Deep insights

The final presentation on CEUS examined the different forms of hepatocellular carcinoma (HCC), from rather rare lesions in the non-cirrhotic liver to mixed HCCs, such as cholangiocarcinoma (CCC), plus HCC. Whilst a CCC, as such, cannot yet be differentiated in ultrasound, a biopsy will tell whether a bile duct carcinoma is present, or a CCC plus HCC,' Professor Clevert explains.

However, CEUS does not only play an important role in HCC diagnosis; it is also extremely helpful in evaluating treatment response, as Professor Clevert points out. 'There are several intervention options for HCC – from transcatherter embolisation (TAE) and transarterial chemoembolisation (TACE) to radiofrequency ablation and microwave ablation. All these therapies need adequate follow-up and assessment whether a vital residual tumour is present post-surgery. This is easy to ascertain with CEUS.'

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Increased vascularisation of the lesion (yellow arrows) is not visible in coloured duplex sonography.

CEUS – the future

'No doubt, we'll see an expansion of ultrasound diagnostics and a clear focus on multiparametric imaging,' Clevert predicts. 'A major aim on our wish list is the display of numeric values in multiparametric imaging for us to be able to detect temporary changes early on and initiate targeted treatment.'

Artificial Intelligence and Machine Learning, major issues at this year's RSNA, present particular challenges for ultrasound, as Clevert knows.

Interview: Miélsande Rouger

What is Savana?

'As doctors, we have been gathering information from our patients' clinical records for many years. This information has great value, but until now it hasn't really been exploited, because we write our reports in natural language, or free speech. We write in complex semantics and narratives, rather than in a structured way. For some years we have been using natural language and linguistics computational processing, so that computers can decode human language. That's the technology used by Google, for instance. Savana is the first company that has been able to subspecialise this AI technology to convert free speech contained in clinical records in a database, and to mine this data.'

What inspired this business idea initially?

'In our society, we have access to large databases all the time, whether for music, banking, etc. In healthcare, very large quantities of data are being generated, most of which are digital, however, we did not reuse it – which is possible with technology and a bit of organisation. So that's what we did.'

Is Savana unique?

'There are many innovative companies in Spain; social entrepreneur- ship is growing steadily. Technology is a great way to improve people's lives. Savana handles very big amounts of medical information, which very few private or public projects do. We manage tens of millions of clinical episodes and this makes us very unique.'

How is big data developing in Spain?

'Outlook Germany, the UK and the US. Spain did not pave the way for big data use. We need to get on board now and use big data in healthcare. Just as e-banking is becoming bank- ing, e-health is becoming health. The Spanish healthcare system is very strong, but things may change within 10 years if we don't realise that health is becoming digital.'

Are doctors or healthcare people sceptical about this?

'Innovation means realising that you need to get it wrong three or four times before it works. This is very hard to accept in healthcare. Mistakes are badly tolerated, so it's harder for innovation to go further in this sector. That's why big data and digitisation have advanced in other areas, such as banking.'

Nevertheless, no human produc- tion generates as much data as a hospital. So big data has an impor- tant role to play in healthcare too; and it already does, at the level of drugs and diagnostic or therapeutic algorithms, which improve human capacities.

'It's true that doctors tend to have a conservative attitude, especially regarding their role in society. But, when one realises that powerful algorithms that can improve diagno- sis and treatment can be obtained through managing large amounts of data, then everything will fall into place, because patient care improves. If a machine gives what's best to the patient, doctors will follow. And that's not the future: that's right now.'

Currently, how many hospitals use Savana?

'We provide services to around 40 hospitals, so that would be a six million population. We definitely should have more by the end of the year. The more clinical information we have, the better it will be for everyone.'

Outside Spain, we have informa- tion from Chile, and contacts with the United Kingdom, the United States and Argentina, and we hope we will expand soon.'

Are you working on other projects?

'Yes, I'm working with Mendelian, a company in the United Kingdom, which has developed an online rare disease search engine, built with the aim of increasing diagnostic hit rates. I met the other people behind Mendelian while studying at the Singularity University.'

'Rare diseases are complex and take a long time to be diagnosed. There's very little knowledge around these diseases, and our tool offers to speed up the process. Rare diseases associated genes and their exist- ing gene panels are algorithmically matched to phenotypes. Recently we've helped a kid with a rare dis- ease to be diagnosed.'

What did you learn at the Singularity University?

'Private companies founded the university eight years ago to promote the impact of positive technology. The school has an annual number of 80 people who all want to improve
Contrast enhanced ultrasound delivers diverse benefits

Ultrasound device can now be smartphone size

Sonography generates huge data volumes since we are dealing with moving images rather than stills. Consequently, in a first step, an image documentation standard has to be defined for the system to be able to learn anything at all. Furthermore the tumour classifications “benign” and “malignant” will not be sufficient to obtain valid results. A lot of work remains to be done!

Emergency ultrasound training

Training is at the heart of the biggest annual fair globally, thanks to the newly introduced Medica Academy sessions, i.e. full-day seminars that deal with practical questions, current techniques and advances in medicine. One of the hot topics tackled by the new format will be emergency ultrasound, with renowned experts such as Dr Wolfgang Heinz from Stuttgart giving hands-on training to use this modality.

Mortality and morbidity reduction through AF ablation?

CASTLE-AF has the answer!

Learn more: www.castle-af.org

Ultrasound brings patients to the hospital – and sometimes even home

Focusing on the origin of the fluid in the Douglas space after trauma, and the general rule is to see as much as possible. ‘It’s become our motto as emergency physicians: the more you see, the more you know.’

Learn more: www.castle-af.org
E-health developments in Spain

Esaúl, the Spanish annual event, took place in Madrid at the end of November with 200 on-site partici-
pants, a live stream and 60,000 viewers on Twitter. The Leading celebrations were observed at the conference under the leadership of Mélisande Rouger spoke with Carlos Mateos, Vice president of the Spanish E-health Researchers Association, who organised the conference, to assess the latest advances in e-health projects across the peninsula.

Highlights - ‘The meeting featured the second consensus on issues related to the future development of Healthcare professionals, journalists, and patients worked together on ways to improve the availability and accessibility of information available online, and confront issues such as rumours or even hacking. Carlos Mateos, Vice president of the Spanish E-health Researchers Association, said: ‘We were happy to welcome once again a great variety of health-related institutions – scientific societies, patient organisations, professional colleges, management associations and healthcare authorities.

‘Our session tackled advances in artificial intelligence; Big Data, wearable devices, applications, robotics and virtual reality. We also offered a space for entre-
preneurs to show their projects and start networking with potential investors and companies. A lot of interesting solutions are now being developed that can really improve healthcare (HC). The main problem remains that the adoption curve for every technology is stagnant.’

Healthcare gamification
Gamification – using aspects of game playing, i.e. point scoring, competition with rules, in marketing and in this case – to educate and rehabilitate, has definitely consolidated. When we organised our first conference on video games use in healthcare in 2014, most HC professionals and a significant amount of companies had no idea what gamification was. Now it is part of healthcare training and education programs.

‘Many applications aiming at improving treatment adhesion and raising awareness of healthy habits also use gamification, and so do most wearable and rehabilitation devices.

‘A number of projects also use gamification to rehabilitate patients who suffer from neurological pathologies. I’m thinking of CicerOn, an initiative led by the research chair in accessible technologies at the University Centre for Technology and Digital Art (C-Tad), Universia Foundation and IT company Indra. CicerOn helps patients with Asperger’s syndrome to train for public presentations and social interactions.’

Big Data and Spanish healthcare
Healthcare very much lags behind other technologies at the University Centre for Technology and Digital Art (C-Tad), Universia Foundation and IT company Indra. CicerOn helps patients with Asperger’s syndrome to train for public presentations and social interactions.

The main challenge for profession-
als is to find value in training and collaboration with other special-
ists, and to improve communication with the patient. Many say they lack the time and the opportunity to find the right professionals. ’Big Data and Spanish healthcare’ is Vice President of the Spanish E-health Researchers Association, Carlos Mateos in the global cyber attack last May, 2017. ‘That attack on the NHS occurred,’ said Knight, ‘we survived because we took cyber security seri-
ously. We have our barriers and the latest technology, our patch management strategy is as auto-
mated as possible and we respond as soon as we are alerted; and we are good at communicating to our staff about not opening emails which look ‘dodgy’, but we can never be complacent.

With the development of the University Hospitals NHS Trust aiming to become paperless within two years, it is already moving towards more referrals into hospital from clini-
cians, patients and primary care, being done electronically. However, that goal is also dependent on the rate at which partner organisations work towards being fully digital.

As hospitals and health systems across the UK and Europe work to deliver first assistance and to use real data to manage your patients and healthcare more effectively, it will enable you to deliver better services and you can use real data to manage your business rather than rely on anecdote.’

With over 20 years of journalism experience working in specialising in healthcare management, Carlos Mateos is Vice President of the Spanish E-health Researchers Association, a communication agency focused on healthcare. The agency also organises the National Congresses of Health Games, Wearables and Big Data in Healthcare.
Knowledge dissemination is key to defeating cancer, says renowned expert

Half of cancers can be avoided if institutions would exchange knowledge, according to Josep Garcia, executive director of the University of Texas MD Anderson Cancer Center in Houston, who opened the Centre’s meeting in Madrid in October 2016.

‘We can prevent 50% of cancers approximately, and if we can’t do that, we can at least detect them in stage 1 or 2 instead of 3 or 4,’ Garcia stated in his inaugural lecture. But, he added, medicine is heterogeneous and its focus not well adjusted. ‘The current clinical care model is episodic, reactionary and very expensive; it varies from country to country. We concentrate on why we look for new cancer and what is going to be the next silver bullet. In 20-30 years from now I think you are going to turn back and say: you guys did it wrong.’ For instance, health professionals know the cost model is expensive but do not have a value for a person’s health. ‘In population healthcare we can only talk of pathologies; it’s a pathogenic-centric process. We have to combine the knowledge of scientists to be able to identify the real diagnosis and have people like me and others find a way to prevent that cancer from happening.’

One day to go so is for healthcare providers to use models based on quality and evidence-based decision support, he argued.

MD Anderson’s Moon Shots program is an initiative that uses a multi-disciplinary approach to speed up the development of new treatments, diagnostic methods and prevention programs from scientific discoveries. The centre, which collaborates with community hospitals and health systems in the USA and has a local branch in Madrid, has 15 moon shots, each dedicated to a particular cancer area. ‘If the knowledge we have today was applied effectively, it would reduce cancer mortality within the next five to 10 years of initiation of a moon shot project,’ Garcia said quoting Ronald DePinho, president of MD Anderson Cancer Center. ‘What he meant is that our goal is to do what currently takes eight to 10 years in three to five years.’

The centre’s Moon Shots program notably inspired former US President Barack Obama, who announced a national cancer moon shot to cure cancer by 2020.

On the US level the centre has managed to influence change in some public policies as legislation regarding minors’ protection, for instance by forbidding youngsters’ access to tanning beds, a known risk factor for melanoma in younger populations. ‘This remains a significant challenge in the US, according to Garcia. ‘We have a trillion US dollar system which is very ineffective; there’s a huge disparity of knowledge, one of which is among physicians.’

One of the organisation’s aims is to help spread knowledge to non-specialised centres through their network. ‘The centre also cooperates with the WHO on prevention and control, and provides community based services and teleconsulting in nutrition, exercise, smoking, prevention, UV protection and vaccination at various sites across the world.’

One of the main issues in cancer research is knowledge dissemination. ‘There’s a lot of knowledge in a lot of pockets, but they do not exchange intelligence between them. Why don’t we share data and information?’ he suggested.

A step in that direction, and a currently highly discussed idea in population health, is to open clinical trials not only to people who can meet the criteria, but also to people who might have other diseases. Typically a medication approved by the FDA to go to a clinical trial comes out successfully in only two to three percent of patients who actually qualified for that trial, Garcia pointed out. ‘As soon as the drug goes into the market it has actually never been tested in people with asthma, diabetes or other chronic diseases. And then the drug fails and comes out of the market, and you’ve lost a billion dollars in research and 20 years of work!’

MD Anderson also plans to narrow the gap between providers to increase the number of available phenotypes. ‘The centre’s US network tries to identify locations that have other genomic pools to identify more mutations and see how those are affected in terms of phenotypes per se.’

Additionally, the institution is working to create a digital platform for second opinion pathologists, because specialists are crucially lacking in many areas, including Africa, Asia, parts of Latin America and Eastern Europe, and the USA. ‘Several years ago we had areas in Connecticut where the diagnosis would come from a general surgeon. Endometriosis was diagnosed as ovarian carcinoma and the patient would have had three to four different chemotherapies, she was cured after six months... but she never had cancer. This should not happen in a community.’

Having predictive models comprising people’s genotypes and identifying which factors can amplify cancer risk, such as living area, are the future of medicine, not only in cancer but also chronic diseases, Garcia believes.

Screening services will have to adapt to the needs of a particular population, unlike the ’utopic idea that people should have mammograms at this age, or a PSA test at this time. A lot of biomarkers will help and change the way we practice medicine,’ he believes.

However policy makers must back up institutions so that communities can have more access to up-to-date healthcare.

Report: Mêlisande Rouger

Technology has progressed enormously and there has never been such a knowledge of cancer to prevent it and find treatment tools.

‘We can prevent 50% of cancers approximately, and if we can’t do that, we can at least detect them in stage 1 or 2 instead of 3 or 4,’ Garcia stated in his inaugural lecture. But, he added, medicine is heterogeneous and its focus not well adjusted. ‘The current clinical care model is episodic, reactionary and very expensive; it varies from country to country. We concentrate on why we look for new cancer and what is going to be the next silver bullet. In 20-30 years from now I think you are going to turn back and say: you guys did it wrong.’

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However policy makers must back up institutions so that communities can have more access to up-to-date healthcare.

From left: Dr Joseph Heery with Dr Juan Fernando Garcia MD, from the Anderson Cancer Center Madrid and Josef Garcia, MD Anderson Cancer Center Houston.

A former four-star admiral in the US’s Public Health Service Commissioned Corps and US assistant secretary for health in that service, since 2013 Dr Josep Garcia has been Executive Director of the MD Anderson Cancer Control and Prevention Platform in Houston, Texas, USA. He is also a member of the leadership team of the MD Anderson Moon Shots program. Prior to these endeavours, he served as president and dean at the Ponce School of Medicine and Health Sciences in Puerto Rico.
Analytics meets diagnostics

Up to the early 18th century, essentially medical diagnostics was limited to urachroscopy – the observation of a urine sample in a urachroscopic flask with a candle providing light.

In a visual examination the doctor would determine the colour of the urine as well as cloudiness and precipitates, followed by a smell and taste test.

The information he gathered provided the basis of his diagnosis.

One hundred years later, the first microscopes were developed to examine insects in 60x magnification.

Around 1650, the devices had become powerful enough for scientists in the Netherlands to discover red blood cells. From then on the development of technical devices and instruments boomed. While we can assume this evolution has not yet reached its pinnacle, in the 18th and 19th centuries it did take very different routes in the life sciences (medicine, chemistry, biology).

In chemistry and medicine, a series of distinct analyses were invented. Only in the 1960s, some clever people thought it high time to bind again what had been strictly divided by convention.

Combining chromatography instruments and mass spectrometers, for instance, began with the sole purpose of chemical analysis.

Only later it was recognised that this fused technology yields excellent results in medical diagnostics.

Pioneer Herbert Keller

A major European trailblazer of laboratory analytics, clinical chemistry and related disciplines was Professor Herbert Keller MD PhD, at Kantonsspital St. Gallen, Switzerland.

In a presentation ‘Artificial Intelligence’ given in 1990 at a symposium in honour of his 65th birthday, Keller underlined a ‘very desirable cooperation’ between chemistry and medicine, ‘wherever such a cooperation makes sense.’

In the 1950s, Keller had completed his medical studies with a double doctorate. In the 1970s and 1980s, he served as President of the German Society for Laboratory Medicine and subsequently of the German Society for Clinical Chemistry.

More than fifty years ago, he (and a few others) realised the cross-fertilisation potential of interdisciplinary work, and the fusion of clinical chemistry and medical diagnostics was to become one of his lifelong projects.

Unfortunately, he did not live to see his endeavours come to fruition in 2003. While he did witness the

‘We will master this problem’

Report: Lena Petzold

Norms and directives are the backbone of medical devices manufacturer. Frequent updates keep them current, but also often create unforeseen problems, especially for smaller and medium-size companies, because the bureaucracy is rarely considered.

‘No exception to this, the EU IVD directive, issued in May 2017, contains new definitions of requirements for in-vitro diagnostics. The new version stipulates more extensive documentation requirements than before.’

‘This creates significant, additional expenditure for manufacturers,’ says Christian Hötzl, founder of Teco Medical Instruments, Production + Trading in Neufahrn, Germany.

He knows this from his own experience with DO 13485, a standard that governs requirements for medical products manufacture – its latest version came into force in 2016.

‘We are a company with 20 employees, which offers products and solutions for blood tests,’ Hötzl explains. ‘We have customers worldwide. Prior to the introduction of the standard, it was possible for an employee appointed as a quality management representative to take on the documentation requirements, i.e. the drawing up and writing of product descriptions and defining of workflows. The extension of the obligations has made it nigh impossible for all the necessary steps to be managed by one person alone, especially as the risk assessment now includes the manufacture.’

This means that a comprehensive risk analysis must be carried out during the production process. ‘As a manufacturer we obviously always try to optimise processes and make them safe; but now we must document in writing that we have analysed and, if necessary, remove the possible risks involved in each and every step of the procedure.’

Critical market surveillance obligations

One particularly critical point is the expansion of the market surveillance obligations. Manufacturers must document that they scrutinise the market extensively and that they react to any potential risks,’ Hötzl explains. Companies are asked to publish any notifiable errors without delay. These are published in central databases such as the BFARM (Federal Institute for Drugs and Medical Devices) portal.

‘We have to check these notifications and, if problems are reported for products that are similar or even identical as competitors’ products in the field of coagulation diagnostics, we need to investigate without delay if these problems can potentially also occur with our products. If this is the case we need to take the necessary countermeasures at once, otherwise we are obliged to provide precautions to ensure that the problem cannot even arise.’

The manufacturers’ responsibility not only extends to accurate operation. According to the standards, all manufacturers must take precautions to ensure that their products cannot be misused. ‘Exactly what this means is not clearly defined in the standard, forcing manufacturers to comprehensively safeguard themselves in all directions,’ Hötzl emphasises.

This includes the design of devices with long-term stability in mind. ‘We carry out extensive life-time measurements and test and record the stability of the measurements,’ he warns. ‘This ensures that the products are being used on a day to day basis. Workflow differs from laboratory to laboratory, so it is therefore essential to maintain communication and find out about any potential sources of error at an early stage.’

Preventing anomalous use

‘However, even this is not enough to guard against misuse. We are also required to prevent so-called anomalous use. This includes, for instance, the use of cuvettes that are not licensed. Our quality cuvettes, devices and other consumer and wear parts are subject to the strictest quality standards. Products from manufacturers that are not licensed can be of lower quality and can block the devices or even falsely measure results. Although, we are not responsible for the potential use of any third-party cuvettes we can ultimately be made liable.’

‘From a legal perspective, as soon as we become aware of the existence of any such problematic cuvettes predictably be misused. Exactly what this means is not clearly defined in the standard, forcing manufacturers to comprehensively safeguard themselves in all directions,’ Hötzl emphasises. This includes the design of devices with long-term stability in mind. ‘We carry out extensive life-time measurements and record stability of the measurements,’ he warns. ‘This ensures that the products are being used on a day to day basis. Workflow differs from laboratory to laboratory, so it’s therefore essential to maintain communication and find out about any potential sources of error at an early stage.’
early days of tandem mass spectrometry (LC-MS/MS), the combination of liquid chromatography (LC) and two mass analysers in mass spectrometry (MS/MS), he passed away before this technology conquered clinical routine.

High-performance tandem mass spectrometry
The technique entails combining chromatographic separation with subsequent highly specific and sensitive detection. One crucial advantage of this method is that, depending on the method, several values can be determined in one run. Other widely used methods, such as immunoassays (ELISA, RIA), photometry or conventional liquid chromatography (HPLC), are all highly specific and do not possess the same high degree of substrate specificity as LC/MS/MS. When used properly, the capital expense is quickly amortised, since high-performance analytical methods can be established quickly with low operating costs for supplies and chemicals. Efficiency can be further increased by using fast UHPLC separation and commercially available open automation platforms.

Newborn screening and drug monitoring
What are the current and future fields of application of tandem mass spectrometry? According to Dr Matthias Weber, LaborDiagnostik, Karlsruhe, Germany, there are all highly specific and do not possess the same high degree of substrate specificity as LC/MS/MS. When used properly, the capital expense is quickly amortised, since high-performance analytical methods can be established quickly with low operating costs for supplies and chemicals. Efficiency can be further increased by using fast UHPLC separation and commercially available open automation platforms.

Newborn screening for metabolic disorders is important and indeed has been mandatory since 2005 because its long-term benefit EBM is well established. Similarly, LC-MS/MS has long been considered gold standard and indispensable in therapeutic drug monitoring and drug analytics. A more recent field of application is steroid analytics (e.g. cortisol, testosterone, 17-hydroxy-progesterone). Since cross-reactions, a well-known problem with the routinely used immunoassays, do not occur in tandem mass spectrometry, this procedure yields much better results and unambiguous clinically relevant information. LC-MS/MS is also useful for proteomic, metabolomic and steroid profiling in clinical routine and will surely enable the clinician to arrive not only at a faster but a more precise diagnosis.

Increased precision
On possible future applications in analytics, Weber said, ‘We already use conventional LC-MS/MS systems routinely for qualitative questions such as haemoglobin differentiation, thus closing an underreported diagnostic gap. Moreover, a number of tumour markers and panels were described that can be detected with high sensitivity and specificity in plasma or urine with LC-MS/MS. Synthetic peptides and metabolites, even in stable isotope-labelled forms, are easily available today, which is a precondition for widespread use of these methods in the short term. In my opinion, the increased use of mass spectrometry methods will significantly increase diagnostic precision.’
UK uptake increases in digital pathology

Professor Jo Martin, the newly-appointed President of the Royal College of Pathologists in the United Kingdom, believes the National Health Service (NHS) is on the brink of embracing digital pathology more widely. A number of UK laboratories, he explained, are adopting digital pathology in histopathology – in line with some labs in Sweden and Holland, where it has become routine – and the benefits to clinicians and patients in increased efficiency, quicker results, and flexibility are ever more apparent.

However, there remain investment challenges, particularly at a time when the NHS is facing severe financial pressures. ‘I think the barriers to wide-scale adoption are largely around capital investment and IT capacity,’ Martin pointed out. However, I think there is an increasing recognition that digital pathology – with the workforce issues we have in pathology and histopathology in particular – will help us work in a more effective way.

Challenges also lay in integration with the electronic health record and laboratory information management systems and having the capacity to implement such major change. Yet, she also said digital pathology offers huge advantages in the way it will improve workflow, meaning pathologists can work remotely and share slides and information digitally – as opposed to current glass slides – as they make a diagnosis or seek a second opinion for patients and deliver quicker results for patients.

Additionally, it offers flexibility and more efficient working, routine quality assessment, quality assurance and training opportunities.

A keynote speaker at the Digital Pathology Congress in London with the presentation ‘Digital pathology – making a difference’, Jo Martin added: ‘There is also the integration of digital pathology with molecular pathology and genetics, in the way that we are already doing for integrated reporting, for example in haematological oncology where histopathologists are already using genetic data, and flow cytometry data, haematological data and morphological data and integrating those into one report. Combining the image based potential with the other elements of the genetic data is very important.’ Martin also pointed to the potential for the integration of machine learning and artificial intelligence, and how validated algorithms can cut down on routine workloads and save time, such as with the ability to count mitoses per high power field.

Digital pathology is already making a difference, she pointed out, in areas of training, education and revalidation, where pathologists can share digital slides and make diagnoses and comparisons as part of a learning and education process, such as through the EQA (External Quality Assessment) process.

As for future trends and opportunities she continued: ‘The potential is huge for sharing, learning for more adaptable training programmes, and for more flexible working. It will help in retaining people in the workforce longer, enabling more flexible working, and those returning to work and in creating the potential for resilience between sites.’

The Royal College of Pathologists (RCPath) is working actively to encourage and support the expansion of digital pathology and expertise in the field, along with a range of other measures to help make working pathologists lives easier at a time of great workload pressure.

‘We have issued guidelines about the use of digital pathology and will continue to look at professional standards in relation to the use of digital pathology. Martin added. ‘The current requirements are constantly being reviewed, not just for digital pathology but also for information technology, and we are looking at training modules that will support that.’ During her coming three-year tenure as RCPath President, she is keen to raise the profile of the profession, increase its influence with other national bodies, and further highlight the levels of expertise within the discipline of digital pathology.

The other element is to ensure that the organisation continues to be active in research and development, she said. ‘Digital pathology has come about in huge part through the activities of pathologists, we have very skilled practitioners working with industry to create these ground-breaking products and this is happening across pathology.’

‘I want to raise awareness of the R&D and innovation that is going on throughout the profession and show that, as pathologists, we are not just stuck in labs, we are out there preventing, monitoring and in many cases helping to treat disease through new drug development and new technology development.’

Accurate colour augments pathology diagnostics

Digital pathology places particularly high demands on image quality and thus on monitors. Especially the exact colour rendering is a challenge – no other discipline needs such precision for a reliable diagnosis. To that end, following ‘intensive research and development’, JVC Kenwood has launched the JD-C240, a 24.1-inch colour monitor. We are drawing on many years of experience in the professional video sector, especially regarding colour calibration and adjustment,’ Marcel Herrmann, Marketing Manager for Totoku at JVC Kenwood, pointed out.

The JD-C240 has some new, innovative technologies, including contrast enhancement, which was developed specifically for imaging in pathology. Usually, such technologies only improve the contrast and the dynamics, but this leads to a less realistic image reproduction, the company points out. ‘To avoid this, we have taken a completely new approach,’ Herrmann says. ‘The contrast enhancement recognises transitions like structures and improves them. The rest of the picture remains untouched.’

The colour enhancement gives the user full control over colour reproduction on the monitor, such as through the EQA (External Quality Assessment) process.

The CAL016 also supports the 3-D look up Table of the JVC JD-C240. "The Caldwell16 also supports the 5-D look up Table of the JVC JD-C240."