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 ESFMIR 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," 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 special 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 ‘blobs’, 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," she explained.

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, as such 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 of other data and applications. "Results and conclusions may therefore be strongly biased," she said.

One solution could be to use an ensemble of networks, such as an example is EMMMA (ensemble of multiple models & architectures), for which performance is insensitive to suboptimal configuration and behaviour is unbiased by architecture and configuration.
All could enhance or disrupt healthcare

The National Centre for Healthcare Photonics (NCHP) is launching a new UK centre that will develop light technologies to disrupt healthcare.

"[This] is the first centre of its kind to be established in the UK and will bring together academia, industry, and the NHS to develop new technologies that use light for healthcare applications," Mark Nichols reports.

Construction has now begun of the 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 chronic diseases such as skin, eye problems, cancer or brain injury.

Scheduled to open by December 2018, the NCHP will be based in northeast England and provide open access facilities and expertise to help companies develop photonics technologies and reduce barriers that currently prevent early research and inventions reaching the market.

"Photonics is a key enabling technology for a range of healthcare products relating 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."

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 its end-use performance, so that the technology is ready to become a commercial proposition.

"As such, an innovation space is 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 NCHP will provide a collaborative and flexible workspace for photonics 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-patient 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, most efforts concentrate on lung nodules or lymph node detection in lung CT. Deep learning is now largely replacing conventional CADF and CAX methods, which were based on texture analysis, handcrafted 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."

High dimensional multi-modality datasets are not big data

Machine learning is promising

Machine learning is promising Continued from page 1

Mark Schnabel reports.

"We used a off-the-shelf confocal microscopy, an imaging technique that has very anisotropic voxels of a few micrometres in axially and tumour cells were both fluorocently labelled, and approximately 60 slices where acquired in the z-direction. Vasculature was visible up to 30 slices from the surface."

In lung cancer imaging analysis, most efforts concentrate on lung nodules or lymph node detection in lung CT. Deep learning is now largely replacing conventional CADF and CAX methods, which were based on texture analysis, handcrafted 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

Inspired concepts increasingly impress global markets

Taiwan presented its most exciting products at this year’s Medica trade fair in Germany – all bearing the prestigious national stamp ‘Taiwan Excellence’. Organised by the semi-public Taiwan Excellence (TATRA), Taiwan’s presence at this prestigious show presented the cutting edge of Taiwan’s medical technology.

An algorithm for how good and bad differ

Nowadays, artificial intelligence (AI) and deep learning are among the buzziest buzzwords in healthcare. Not surprisingly then that Taiwanese developers also explore the potential of these new technologies. For example, AmCad BioMed uses the power of algorithms to automatically classify thyroid tumours. ‘Our software can analyse the characteristics of textures, such as microcalcification and echotexture, and calculate whether a tumour is benign or malignant,’ explains Peter Wu, President of AmCad. ‘Using this method, we achieve an accuracy of 90 percent – on average, 15 to 25 percent higher than the capability of the best professionals.’

Machine learning enables software to improve its precision with each and every new case it analyses. ‘Of course the doctor must make the final decision,’ Wu emphasises, ‘but, our software provides all the necessary information.’ Increased precision is envisaged to reduce the number of unnecessary fine needle aspiration (FNA) biopsies by 50 percent and thyroidectomies by 30 percent.

The technology applied in another of the company’s products works in a similar way: software automatically analyses airflow in the upper respiratory tract to determine the risk of Obstructive Sleep Apnoea (OSA) syndrome. ‘This procedure normally takes several hours and requires the patient to stay in a sleep monitoring facility overnight,’ Wu explains. ‘Our system can do it in just 10 minutes, while the patient is awake.’ Saving time and money by reducing length of hospital stay and the number of interventions is the professional aim of the product. Contact: http://www.amcad.com.tw/en/

Smart Surgical Glasses can speed up surgical procedures because the need to switch between patient and monitor is eliminated

Smart Surgical Glasses. The product is designed to enable the surgeon to look into the patient during surgery via Mixed Reality: X-ray images or tissue images of the regions of interest can be viewed in real-time and in full HD resolution (1080p). ‘The relaying of the processed image to the patient is determined via four infra-red sensors,’ Communications Manager Dr Min-Liang Wang explains. This provides the high degree of precision required in, for example, dorsal spinal surgery.

‘The developers are convinced that Smart surgical glasses will become a key tool for significant advances in surgery.’ The fact that the surgeon does not have to switch between patient and monitor is said to reduce the duration of the procedure by 30 percent – a fact that also means less radiation exposure for clinical staff and patient alike. At this point, there is only a prototype of the smart-operat

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 appreciated the added value of ultrasound imaging yet are not themselves radiologists; as is often the case, for example, in rehabilitation, anaesthesiology or radiology.

‘We also aim at users in intensive or trauma care who value portable, speedy solutions. The new ultrasound system is easily 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, convex and phased-array technology, for example.

‘To keep the intuitiveness, we created a customisable interface where any user can add short-cuts 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 for-mat so, for example, we included an 18 MHz transducer and Triaxial Harmonic Imaging,’ ten Cate adds. The system takes a total of eight minutes 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 portable: ‘The sys-tem features two specific advantages,’ Product Manager Lagustena explains. ‘We include simple needle visualisation that works without any add-ons for free-supplying, or cart, it recharg-es yet remains portable: ‘The sys-tem features two specific advantages,’ Product Manager Lagustena explains. ‘We include simple needle visualisation that works without any add-ons for 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 Zhuang 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 documentation, Konica Minolta developed a device called ‘WoundAide’, 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 therefore 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 documenting the wound more con-sistently and precisely within mere seconds.’

‘The system uses machine algo-rithms to automatically detect wound

The thermographic camera M16 Thermal detects temperatures ranging from -40 to 550°C boundaries and it reduces the varia-bility following manual assessments. Data is then automatically trans-ferred to the hospital’s record system where it can be accessed and easily shared. Since no wound con-tact is needed, the risk of infection is lowered. Furthermore, trends may be identified from the gathered data. ‘We want to enhance the system, so that in the future it will be able to make suggestions on how to treat a wound, based on the previously gathered input,’ Ying says.

‘The system is on trial in several hospitals and nursing homes and the feedback is promising. ‘We are work-ing to bring the solution to Europe,’ Ying reveals.

Thermal technology

Being a shareholder of Mobotix, Konica Minolta is also involved in security technology development, which could be relevant in healthcare, for example, as thermal technology systems, according to Steen Løsemann, Mobotix Business Development Manager for north
Extra-dimension out of the box

Technical innovation? Fair enough. However, they are of little value if hospitals do not have the necessary infrastructure to use them. This is where "Monterosso" by the "Taiwan Excellence" winner MedicalTek comes in. It is a 3-D conversion box for endoscopes, as explained by Chairman Kai-Che (Jack) Liu. "The software makes it possible to view 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 using the 3-D endoscopic images."

In clinical use since 2014, the Xeos 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 Xeos 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.

"Safety in use and for the patient, means easily 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.'"

The Barmherzige Brüder hospital in Regensburg and Xenios AG, the company explains: "We, in clinical support, listen to the experiences to our development, bring the therapists' voices 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.'"
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 as many times as necessary, enabling the surgeon to detect brain shift and evaluate how much tumour is left, almost instantly.

Ultrasound has changed the way we operate on patients. When I've finished a resection, I check if the tumour has been fully removed, or whether there is any residual there. 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 excise tumours long thought to be unexcisable. At Santa Creu i 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 portable, as it is easy and the medical team shed blood and tears to convince the administrators of the site to host it, was nothing less than miraculous, he said. ‘They remained crucial to be acquired the system we've bought the CyberKnife we've used is hypofractioning, which consists in squeezing high radiation doses in the 8-24 Grayscale in as short as possible irradiation times. After each session, patients can go home and rest, therefore reducing the hospital stay.

This comfort and precision have enabled radiotherapy physicians to access tumours that were untreatable in any other way than with chemotherapy or many radiotherapy sessions, because the tumour was too large to be operated. Stereotactic radiotherapy can help a lot of patients, especially those who need to be treated in a particular way. We've had very good results; it's a real technological advance. For us, it means another way of thinking and working in very small lesions.

**The best intraoperative imaging technique**

In Rennes, France, more than 850 patients have already been treated with a top accelerator equipped with a multileaf collimator, the first of its kind in the country, Mélisande Rouger reports.

Brittany's capital Rennes is leading stereotactic radiotherapy practice as Eugène Marquis Cancer Centre gears up to welcome worldwide technicians to train on the latest CyberKnife system. Accurate’s powerful robotic radiosurgery system targets small lesions.

The centre, based in the city’s University Hospital (Centre Hospitalier Universitaire), is one of the few places in France to host the new CyberKnife M6 system, which features an adapted multileaf collimator in addition to IBIS or fixed collimator, an advance that decreases treatment time dramatically while allowing a very high level of precision. The system has helped treat patients with benign brain tumours but also colon, breast and lung metastases as well as primary tumours of the lung and liver ever since its introduction in Rennes in 2014.

Perhaps one of the most striking features of the volumetric machine, which has a 50m2 footprint, is its millimetric precision in tumours smaller than 1cm up to 6 cm. Sessions with the CyberKnife last longer than conventional accelerators, but only one to five slots are necessary per patient. The technique used is hypofractionning, which consists in squeezing high radiation doses in the 8-24 Grayscale in as short as possible irradiation times. After each session, patients can go home and rest, therefore reducing the hospital stay.

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Stereotactic radiotherapy spreads

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The best intraoperative imaging technique

The system reacts automatically to a patient moving

2,200 patients annually. CyberKnife has also opened ‘a field of possibilities’, especially in patients with colon cancer and rectal liver and 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. I’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 €365,000 annually.

Eugène Marquis is now a referent centre for Brittany and beyond. It will soon be a training centre in stereotactic radiotherapy as well as a partnership with Accuray is signed. Radiotherapy physicians, medical physicists and technicians from India, Eastern Europe and Africa to learn how to use the platform. Stereotactic radiotherapy is one of the latest developments in radiotherapy, a field that has advanced hand in hand with radiology and IT.
A new therapy: virtual reality experiences

VR glasses could ease trauma of waking up in an ICU

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 traumatising effects of a sudden ICU admittance by having prior experience of being there.

Dr Michel van Gendelen, an intern at Erasmus MC, works at the Francisca 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 Wilks and Arjan Brouwers (Francisca Gasthuis) and Jasper van Romoof (Erasmus MC).

Why VR-Goggles?
Many patients are unexpectedly hospitalised and put into a coma in the ICU, van Gendelen 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 ventilation.’

Dr Elisabeth Le Prîlé 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.

‘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 and treatment planning are time consuming compared with other conventional accelerators.’

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 a grant of €45,000 from Stichting Coelsingel, 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 been 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 explanations and context VR might give them back control.’

The research project
This involves 50 patients at the Francisca 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 was 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.’

Michel Egide van Genderen MD joined the ICU at Erasmus MC, Rotterdam, The Netherlands, in 2015, the same year in which he concluded his PhD. In 2016 he gave an internship in 2019 he will advance his training to become an intensivist. For his research, he aims to limit the impact of ICU re-admission, and later to expand this understanding for other patient groups. He also wants to improve quality of care by training doctors and medical specialists to work with the technology he is using.
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 Gastroenterology 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, Mélissa Rouger reports.

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

Highlights
Hygiene, advanced roles and education in different countries were amongst 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," she said.

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
"After basic nurse training, which lasts three years, nurses should do specialist endoscopy training. In many European countries such as the UK, Ireland, Sweden, Italy and France, specialist nurses’ education in endoscopy or gastroenterology is established at university level, as part of a bachelor or masters’ program."

"In other countries, higher education institutions offer specialist training in endoscopy. A pretty current model across Europe is for nurses to receive gastroenterology and endoscopy education for one year, while they are working in parallel. This is not the case in Germany, where specialist endoscopy education for nurses stretches over two years."

Trends in Europe
"There is a clear trend towards university training, although nurses still train at school for basic and specialist 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 at an X-ray study; you 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 osteosynthesises. "When you include later infections, the rate is twice as high," says Professor Andrej Trampuz, infectionist 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, Streptococcoci or Gram-negative rods that can be easily eradicated with or 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 pathogen eradication becomes and the more urgent 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." Prephylaxis 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 spacers, 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.

Report: Beate Wagner
Joint infections are not to be underestimated

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 osteotomy induction bone defects of 20-25 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 G4V, for example in infected pseudarthrosis. 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.’

Infection – defect – regeneration

Source: Suttha Burawonk / Shutterstock

www.healthcare-in-europe.com
Optoacoustics: the sound of cells

Report: Anja Behringer

For centuries, hands, eyes and ears were the physicians’ most important instruments when it came to detecting and diagnosing disease. 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 ionised 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 minute 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 well in aggressive 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, Razansky considers a future price tag of €50 to be realistic. Thus, in 2011 he and two partners founded the spin-off iThera Medical in Munich to fine-tune the product for a market launch. This requires capital.

Awards for visionary research

When it comes to raising capital, the many awards Ntziachristos, a qualitative clinical researcher, has collected over the past few years obviously help to give investors peace of mind. 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 market-ability 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 denominator of automating the placement.

The difficult part of the project was finding a common language for doctors and engineers, and jointly exploring the opportunities and limits of such a system, was a complex undertaking – which we mastered step by step,’ Rothfuss says. Medicos and engineers continued to keep in close contact after the development of the profile.

‘Omitting regular input and resolving any issues arising without complications was extraordinarily helpful,’ he adds, describing the Mannheim 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 images, calibrates them and generates a positioning plan. The doctor checks the plan and emits it if there are no objections. The intuitive software and positioning carried out by a computerised system with a robotic arm.

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.

Report: Lena Petzold

‘Correct needle positioning for surgical interventions or biopsies is time-consuming,’ explains Engineer Andreas Rothfuss, a member of the working group for Information Systems for Medical and Biosciences at Fraunhofer IPA. The angle and position must be accurate as mistakes can lead to the removal of the wrong tissue or even organ damage. The procedure can easily take half an hour. This represents a considerable chunk of time for doctors under constant time pressure, particularly as it is rarely possible to carry out these types of biopsies without the doctor’s hand in the image.

When the robot holds the needle, X-rays can be obtained without the doctor’s hand in the image. The doctor checks the plan and stops manually at any time during the process. The arm reacts to the patient’s body at a precise angle. The intuitive software and position planning ensure that the radiation exposure for the doctor is very low.

‘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,’ Rothfuss says.

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.

Progress with this technique will be fast

The intuitive software and positioning guidance 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 be ready to launch the system in three years’ time.

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

Needle placement takes six minutes

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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 actors with respect to possible applications in minimally invasive surgery’. He is now a doctoral researcher for the PAMB.

Old technique + new technology diagnose disease

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SonoVue® approved for detection of vesicoureteral reflux in paediatric patients

**Summary of Project Characteristics I. NAME OF THE MEDICAL PRODUCT**
SonoVue® is a microbubble contrast agent, indicated for the ultrasound visualization of the excretory urinary tract in adults or by intravesical administration for the visualization of the excretory urinary tract in children from 2 days to 18 years of age. It is indicated for use in ultrasonography of the excretory tract in children from 2 days to 18 years of age. The recommended dose of SonoVue is 1 mL.

**II. DESCRIPTION OF THE MEDICAL PRODUCT**
SonoVue® is a suspension in water for injection containing sulphur hexafluoride. The main component is sulphur hexafluoride (95%), which is enclosed in a monolayer of perfluoropropane (5%). The suspension is white and slightly viscous, with a pH of 7.0 to 7.4. The suspension is 90% stable for at least 18 months when stored at 2-8°C.

**III. QUALITATIVE AND QUANTITATIVE COMPOSITION**
The suspension contains sulphur hexafluoride, perfluoropropane, sodium chloride 0.9% (0.9% solution for injection) and sodium hydroxide or hydrochloric acid for pH adjustment.

**IV. PHARMACEUTICAL FORM**
SonoVue® is supplied as a sterile, white, powder in a vial. The vial contains 5 mL of sodium chloride 0.9% (0.9% solution for injection) solution for injection. The suspension is prepared by reconstituting the powder with the sterile, preservative-free sodium chloride 0.9% (0.9% solution for injection) solution for injection.

**V. CLINICAL PHARMACOLOGY**
SonoVue® improves the visualization of the excretory urinary tract. The intensity of the reflected signal is dependent on concentration of the microbubbles and frequency of the ultrasound. The intensity of the reflected signal is also affected by the type and concentration of the microbubbles. The intensity of the reflected signal is also affected by the type and concentration of the microbubbles.

**VI. indications for use**
SonoVue® is indicated for use in ultrasonography of the excretory tract in paediatric patients from 2 days to 18 years of age. The recommended dose of SonoVue is 1 mL.

**VII. CONTRAINDICATIONS**
SonoVue® is contraindicated in patients with: acute endocarditis, prosthetic valves, acute systemic inflammation and/or sepsis, hyperactive coagulation states and/or thrombocytopenia.

**VIII. PRECAUTIONS FOR USE**
SonoVue® should only be administered in a hospital or other medical facility by medical personnel with the necessary experience. SonoVue® should only be used in cases where the risks and benefits of the procedure outweigh the risk of adverse events. SonoVue® should be used with caution in patients with a history of hypersensitivity to any of the components of the product. SonoVue® should be used with caution in patients with a history of hypersensitivity to any of the components of the product.

**IX. WAY OF ADMINISTRATION**
SonoVue® should be administered immediately after reconstitution of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via the national reporting system listed in the summary of product characteristics.

**X. OVERDOSAGE**
In the event of an anaphylactic reaction, beta blockers (including eye drop preparations) may aggravate the reaction. Patients may be unresponsive to adrenaline. In the event of an anaphylactic reaction, beta blockers (including eye drop preparations) may aggravate the reaction. Patients may be unresponsive to adrenaline.

**XI. METHOD OF DISPOSAL**
SonoVue® is a sulphur hexafluoride-containing contrast agent. The suspension is not recyclable. The suspension is not recyclable.

**XII. WAY OF DISPOSAL**
SonoVue® is a sulphur hexafluoride-containing contrast agent. The suspension is not recyclable. The suspension is not recyclable.

**XIII. STABILITY**
SonoVue® is stable for at least 18 months when stored at 2-8°C.

**XIV. INCOMPATIBILITIES**
SonoVue® is compatible with saline until patient has the urge to micturate or there is the first slight sign of back pressure to the infusion. Ultrasound imaging of the bladder should be performed prior to the infusion.

**XV. INCOMPATIBILITIES**
SonoVue® is compatible with saline until patient has the urge to micturate or there is the first slight sign of back pressure to the infusion. Ultrasound imaging of the bladder should be performed prior to the infusion.

**XVI. EFFECTS ON LABORATORY TESTS**
SonoVue® does not affect the results of laboratory tests.

**XVII. PROFESSIONAL INFORMATION**
SonoVue® should only be administered in a hospital or other medical facility by medical personnel with the necessary experience. SonoVue® should only be used in cases where the risks and benefits of the procedure outweigh the risk of adverse events. SonoVue® should be used with caution in patients with a history of hypersensitivity to any of the components of the product. SonoVue® should be used with caution in patients with a history of hypersensitivity to any of the components of the product.

**XVIII. PATIENT INFORMATION**
SonoVue® is a sulphur hexafluoride-containing contrast agent. The suspension is not recyclable. The suspension is not recyclable.

**XIX. REPORTING OF SUSPECTED ADVERSE REACTIONS**
Healthcare professionals are asked to report any suspected adverse reactions via the national reporting system listed in the summary of product characteristics.

**XX. CLINICAL STUDIES**
SonoVue® has been shown to provide marked increase in signal intensity of more than 2 minutes for B-mode ultrasound imaging of the macrovascular. The intensity of the reflected signal is dependent on concentration of the microbubbles and frequency of the ultrasound. The intensity of the reflected signal is dependent on concentration of the microbubbles and frequency of the ultrasound.
Pre-empting 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 biomedicine, especially in terms of personalised medicine. Just as radiology today is essential for the diagnosis and treatment of disease, imaging’s contribution to biomedicine has the potential to dramatically alter medical treatment by focusing on proactive intervention prior to disease progression, Elias 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 related physical, biological, and medical sciences. The biomedical information clinicians need to understand the body is multidimensional. Defining bio-imaging science as the extraction of spatially and temporally resolved, functional, and structural multidimensional biological information from molecules to humans, Zerhouni, rhetorically asked: ‘How do we get biomedical imaging information at the molecular level and transfer this into an organ?’

He explained that the multidimensional complexity of medicine can be perceived as layers of interactivity that incorporate the DNA/RNA and proteins interacting with each other within a cell, and the cells interacting with tissues, organs, and the environment. There are seven to eight layers in total that need to be understood with respect to interacting with each other in varying environments. This complexity is multiplied by the number of permutations in genes and RNA. More than 50 years of research have been spent trying to understand these interactions.

‘The challenge facing medicine is how to combine the need to understand the complexity while achieving precision at an individual level. This is the centre point of biomedicine in the 21st century. Medicine should no longer wait for disease to strike a patient, but rather pre-empt disease before it strikes.’

Zerhouni explained that it is necessary to understand individual variations in disease risks and pathways. Radiology researchers have begun to identify correlations between imaging data and genotype data.

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 genetic, infectious or autoimmune 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, this ‘gold mine’ of information would make progress very fast. Diagnostics and therapeutics are two sides of the same coin,’ he pointed out.

‘Understanding molecular networks, regulation and their interaction in health and disease will lead to a functional and more precise reclassification of most diseases based on their specific molecular pathways, enable predictive biomarkers and stratification, and a greater understanding of environmental drivers,’ Zerhouni said. Identification of reliable biomarkers needs to be a strategic goal of imaging innovation. A goal today of research in therapeutics is to develop ‘dream molecules’ that will do multiple things at once. The challenge to radiology is to focus on ‘tools that can affect the therapeutic molecules and their targets in vivo.’

‘A multidimensional 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-augment predictive intelligence (AI), Zerhouni predicts that in 5-10 years its use will become standard in radiology. He sees the technology as being able to improve radiologists’ performance and help to 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 reference data. ‘I see a future where a radiologist will say in a radiology report that the patient corresponds to RSNA Reference Database Number XXXX. Radiologists will be able to track the evolution of disease and extract novel information.’

Zerhouni concluded by offering thanks to the RSNA meeting attendees:

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

Leveling EU qualifications

Radiographers are increasingly central to patient care, but the heterogeneity of education and skills across Europe remain challenging. During the 2017 RSNA, Håkon Hjemly, of the European Federation of Radiographers Societies (EFRS), explained how they plan to improve radiographers’ visibility and work towards homogenising education and skill standards across Europe.

Report: Mélisande Rouger

Radiographers are key team players in multiple health care programmes, from medical 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 health-care, according to Jonathan McNulty, EFRS newly elected president.

‘The official title we use is radiographer, but there are 20 or more other titles for the profession! Radiographers can also be nurses, technicians, radio manipulators (…) and may provide very different services depending on the country. Not only does the profession have multiple identities, but also education varies considerably across Europe. While some countries offer masters or postgraduate education in digital radiography by early 2019.

The EFRS plans to change this by promoting a bachelor’s level as the entry level to the profession, versus shorter, vocational qualifications. Meaning 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 what radiographers, who had their qualification decades ago, and what they want the profession to look like from now on, the EFRS is also working on the practicalities of launching a European Diploma in Radiography very soon, which was among topics discussed by the federation during its last annual business meeting, in November in Alcalá de Henares near Madrid. This remains one of our major objectives. We hope to progress this through 2018, with a view to launching in 2019. Radiology has such a diploma, medical physics has it too, so it’s something we want to certify as a minimum standard of professional radiography knowledge in Europe,’ McNulty explained.

Taking the diploma could be useful for those who only received a two-year education in their country but have 20-year experience. ‘The diploma could help show that they have what the EFRS is calling the minimum level of knowledge for the practice of radiography,’ he added.

Continuing professional development (CPD) is also instrumental in securing high professional standards across Europe. ‘It should be homogenised too, according to Håkon Hjemly, immediate past president of the EFRS. ‘It’s necessary to maintain and renew your skills and CPD is an excellent system for that. This is something that many countries have mandatory, but many still don’t,’ he said.

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 tough when countries have different curricula.

‘About 50% of our member societies have a shortage of radiographers and the other half is producing too many. In Italy, for instance, many 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.

Having the same education could also help improve the profession’s profile among medical specialties. Radiographers are simply under-utilised, yet research shows they would have the skills to take on more responsibilities, according to McNulty. ‘I feel quite strongly how under-utilised and under-valued radiographers are. There is not enough recognition of our knowledge and skills in some countries, whereas in others radiographers are involved in reporting
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 Nichols 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 positives which 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.

To address this, the team developed and trained the machine learning system to predict if a high-risk lesion identified on needle biopsy after a mammogram would 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 overtreatment."

"A model like this will work any time 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.

"A model like this will work any time 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."

Dr Constance Lehman, Professor at Harvard Medical School and chief of the Breast Imaging Division at MGH’s Department of Radiology added: "To our knowledge, this is the first study to apply machine learning to the task of distinguishing high-risk lesions that need surgery from those that don’t. We believe this could support women to make more informed decisions about their treatment, and that we could provide more targeted approaches to healthcare in general."

It is hoped that MGH radiologists will begin incorporating the model into their clinical practice over the next year. "In the past, we might have recommended that all high-risk lesions be surgically excised, Lehman said. "But now, if the model determines that the lesion has a very low chance of being cancerous in a specific patient, we can have a more informed discussion with our patient about her options. It may be reasonable for some patients to have their lesions followed with imaging rather than surgically excised."

The team – which also included Manisha Bahl, director of the Massachusetts General Hospital Breast Imaging Fellowship Program 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.

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**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 Center 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. 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.

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The DNA mismatch repair mechanism

Report: Mark Nicholls

A new genetic study by UK-based scientist 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 deficiencies, 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’ve unequivocally found mismatch repair deficient breast cancers,’ Serena Nik-Zainal said. ‘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.’

The researchers analysed the whole genome sequences of 640 breast cancer tumours and looked for patterns in the mutations, known as mutational signatures, which indicate 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.

‘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.

‘Using whole genome sequencing we can start to stratify breast cancer patients into different categories based on their mutational signatures,’ said one of the researchers Dr Helen Davies, from the Wellcome Trust Sanger Institute. Current clinical criteria means these tumours would not have been detected as being deficient in the mismatch repair pathway.

We have shown that there is, in fact, another category of breast cancers – those with defective mismatch repair.’

Professor Karen Vousden, chief scientist at Cancer Research UK (CRUK), added: ‘Immunotherapies have shown promise for some cancer patients, but the challenge for doctors has been predicting which patients they are likely to help. This study reveals more about the genetic patterns that could show which women with breast cancer are more likely to respond to immunotherapy treatments.

The next step is to stage clinical trials to determine if immunotherapies could help selected breast cancer patients.

The Wellcome, CRUK, Dana-Farber/Harvard Cancer Center UK SPORE in Breast Cancer and National Research Foundation of Korea will be funded by the Korean government, supporting this research project.

Mastectomies due to ‘family history’ could drop by a third

Report: Mark Nicholls

A new genetic test to assess breast cancer risk in women who have a family history of the disease could be introduced into clinical practice in the UK within the next few months.

Devised at Manchester University NHS Foundation Trust (MFT) and the University of Manchester, researchers believe the test for high-risk groups could also help reduce the number of women needing to have surgery to remove their breasts. By narrowing down their risk, women will be better informed about whether to have a mastectomy, or not, explained Professor Gareth Evans, who led the work that resulted in the new test.

Scientists say the test will accurately predict breast cancer risk in women who do not test positive for BRCA1/2 gene mutations and, in some cases, may also help to refine breast cancer risk in those with the BRCA1/2 mutations.

The most common cancer that affects women having a parent or sibling with breast cancer makes women twice as likely to develop breast cancer themselves. Mutations in the BRCA1/2 genes have been identified as a cause of hereditary cancer, but only account for 15-20% of the underlying inherited genetic trigger for the condition.

The test is supposed to help women at risk of familial breast cancer to make more informed decisions about their care.

The new genetic test assesses breast cancer risk based on genetic variations – single nucleotide polymorphisms (SNPs) – in an individual’s DNA.

Researchers found that mutations of 18 SNPs were indicative of breast cancer risk for women who did not carry BRCA1/2 mutations. These were found to have minimal effect in isolation, but when combined could increase or decrease breast cancer risk considerably.

The study recruited 451 women (112 with BRCA1/2 mutations) with a family history of breast cancer who had developed breast cancer. The researchers compared the diagnosis of invasive breast cancer and genetic profile in the case group against that of a control group of 1,605 women (691 with BRCA1/2 mutations).

The analysis of DNA using participants’ blood samples was used to determine their individual genetic makeup and predict an overall risk estimate alongside other risk factors such as age at first assessment, family history of first and second-degree relatives, age at first child, first and menopause, height and weight, and history of prior non-cancerous breast disease.

From the findings, women originally viewed as high risk (lifetime risk of 50% or greater) were reclassified to a lower risk, where mastectomy is not recommended to reduce the risk.

The study suggested that the number of women with BRCA1/2 mutations who currently choose to have a mastectomy could now fall by a third from 50% to 30%.

Professor Evans, a Consultant in Medical Genetics and Cancer Epidemiology at The University of Manchester and the city’s Saint Mary’s Hospital – where the test will first be made available – said: ‘This new test will help women at risk of familial breast cancer to make more informed decisions about their care.

‘BRCA1 and BRCA2 are just part of what we should be looking for when assessing risk and in Manchester we plan to incorporate screening for these new genetic markers in clinical practice within the next six months.

‘We are committed to improving cancer prevention through research and, with funding from the NHRI Manchester Biomedical Research Centre, we plan to develop new screening strategies and biomarkers for other common cancers, including womb, bowel, ovarian and prostate.

‘Professor Evans is hoping the test will become more widely available, and describes it as a ‘massive game changer for breast cancer’, which can be accurately assess risk in the whole population from those with a family history and those with BRCA mutations.'
MRT’s role in prostate cancer diagnosis

Lars Schimmöller 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: Milisandre Rouger

Asked about the latest advances in PCA diagnosis, Professor Lars Schimmöller 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 role of MRI as a screening tool was defined for the first time.

The role of PCA screening has been extensively discussed, especially in over diagnosis and over treatment, but trials result 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.’

‘mp-MRI is currently the best imaging tool for prostate cancer detection, especially clinical relevant PCa. Qualitative mp-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 PCA 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 PROBAVE and we try to assess if it makes sense to measure baseline PSA for risk-adapting PCA 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 qualitative 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.’

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 preselection.

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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 metastases on a coronal T2-weighted turbo spin echo (TSE) MR-image
C: Active Surveillance: Tumour increase in size and aggressiveness (ADC-value decrease) in follow-up MRI in a patient with biopsic verified low-grade prostate cancer
D: Recurrence: PSMA-PET/CT with parallel lymph node metastasis on the left side

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The emerging field of psycho-radiology is taking a major step ahead. A new study highlights MRI’s role in identifying people with attention deficit and hyperactivity disorder (ADHD) and classifies subtypes of the condition, leading a Chinese researcher explained at the ESMRMB annual meeting, Melissa Roeper.

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

Qiying Gong, a radiologist at the West China Hospital, Sichuan University, revealed the details of a study he co-authored with colleagues Huaqiang 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 radiomics could improve diagnosis accuracy and help them to individually target treatment earlier in patients with ADHD. Earlier detection means earlier prediction. Using radiomics extracted from MRI scans, we can build and evaluate classification models based on pathological subtyping. These models can then assist the psychologist in diagnosing and subtyping ADHD, Gong explained.

The researchers examined 83 children aged 7-14 with newly diagnosed and never-treated ADHD, including children with the inattentive ADHD subtype (ADHD-I) and the combined subtype (ADHD-C). The scientists compared these MRI results with those of a control group of 87 healthy children of the same age, and screened relevant radiomics signatures from more than 3,100 quantitative features extracted from the grey and white matter.

While they found no overall difference between ADHD and controls in total brain volume or total grey and white matter volumes, Sun, Gong and Chen observed alterations in the shape of the left temporal lobe, bilateral cuneus and areas around left central sulci. These differences contributed significantly to distinguishing ADHD from typically developing controls.

Within the ADHD population, features involved in the default mode network and the insular cortex significantly contributed to discriminating the ADHD inattentive subtype from the combined subtype. Results highlight the accuracy of the method researchers could discriminate patients with ADHD with control subjects with 75.7 percent accuracy and to discriminate ADHD-I from ADHD-C patients with 80.1 percent accuracy. These results are quite significant for future management and treatment of ADHD, according to Gong. They could also become 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 nascent field of radiology, which relies on imaging data analysis rather than visual inspection of images, particularly in imaging schizophrenia.

Schizophrenia

Ever since CT identified bilateral ventricular enlargement in patients with schizophrenia in 1977, imaging techniques have improved and the number of descriptions of structural or neuropsychiological abnormalities in mental illness has increased tremendously. Advances in MRI, particularly functional 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 neuropeuropathological signature of schizophrenia across different ethnic groups. DTI has recently shown micro-structural differences between the brains of healthy patients and those with schizophrenia, including superior longitudinal fasciculus changes and inferior fronto-opercular fasciculus. However, there is dissociation between altered regions based on structural and functional studies in default mode or fronto-parietal network, and we must be aware of that, he said.

MRI techniques have also enabled identification of cerebral abnormalities after antipsychotic treatment, notably after two-year treatment, according to Gong. We have observed greater loss of grey matter volume and increase in cerebrospinal fluid in the frontal lobes.

In the brain of patients with long-term schizophrenia who have never been treated with antipsychotics we have also observed accelerated age-related decline in prefrontal and temporal cortical grey matter, suggesting a neuro-regressive process.

Findings highlighting functional changes of the left inferior parietal lobule in treatment significantly correlated with improvement of symptoms, Gong added. Therefore, looking at regional functional changes after one-year treatment, studies have shown that abnormalities in low frequency fluctuations (ALFF) in the three brain areas at baseline were significantly related to the magnitude of the changes in ALFF, according to Gong. MRI also picked functional connectivity changes after one-year treatment.

Research has also shown that structural changes remained relatively stable in the early years after a first episode of schizophrenia and became more evident during the second phase of illness. Functional changes, which may reflect physiological alterations related to clinical status, are more sensitive to reflect the effects of treatment on the brain, Gong pointed out.

In the future, imaging-based disease classification will gain importance through iMRI and the application of machine learning techniques to clinically validate these techniques, but they will prove useful as they help them to develop new diagnostic criteria in data acquisition and analysis. Interventional psychoradiology will also develop in the future.

Imagined interventions will be the next big thing. Psychoradiology will help to deeply understand the mechanisms of schizophrenia, provide objective detection and early diagnosis and enable prognosis and early treatment.

‘Psychoradiology will also bring new treatment strategies in some conditions, such as depression, bipolar and borderline personality disorders, and may therefore provide new avenues for instance individual cognition, behaviour and fluid intelligence,’ 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 example, Ziehm Imaging was also the first company to offer CMOS technology in a full-size mobile C-arm. Today, the Ziehm Imaging portfolio has grown to include the leading-edge CMOSline1 is aimed at professionals looking for regional functional changes after one-year treatment. Studies have shown that structural changes remained relatively stable in the early years after a first episode of schizophrenia and became more evident during the second phase of illness. Functional changes, which may reflect physiological alterations related to clinical status, are more sensitive to reflect the effects of treatment on the brain, Gong pointed out.

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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 over the past fifteen years. At UEG Week in Barcelona, Gilja presented new guidelines on GI ultrasound, now published by the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB).

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, Bergøen, Norway.

‘Elastography is fairly new in GI tract, however. We use it to evaluate stiffness of tissue, and indicate if there is more fibrotic or inflammatory tissue, 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. SonoVue 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 conditions. It’s a really big project. Furthermore, EFSUMB is now updating both the CURES and general elastography guidelines.

A GI ultrasound examination usually starts in the right lower abdomen and often the appendix can be identified. In this image the appendix is shown behind the distal ileum and marked between the two green crosses with a diameter of 0.26 cm. If appendicitis is present, the diameter will increase above 0.6 cm.

The EFSUMB world’s first guideline on gastrointestinal ultrasound (GIUS) contains 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.

‘EFSUMB has ultrasound learning centres (ULCs) all across Europe, which are happy to take beginners, who can come to stay for two to four weeks and have training on ultrasound and specific topics, including GI tract ultrasound. The courses are designed for different levels – doctors need to update their skills constantly, even the most experienced professionals.

‘At UEG Week we provided postgraduate ultrasound courses, hands-on training sessions, and offer GI ultrasound specific training under supervision of an expert every day.’

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.’

The first ever guidelines on gastrointestinal ultrasound

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In April 2016 CEUS received the USA’s FDA approval. This year’s RSNA Samsung Symposium ‘Contrast-Enhanced Ultrasound (CEUS): Innovations and a Problem-Solving Tool in Clinical Practice’ provided an opportunity to speak. For European Hospital, Professor André Clevert, Director 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 Sidhu, Professor of Imaging Sciences at King’s College London and President of the British Medical Ultrasound Society, clearly shared this belief 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 and Radiologist at the University of Calgary and member of the Diagnostic Imaging Department at Foothills Medical Centre in Calgary, Canada, provided an opportunity to take stock. For European Hospital, Professor André Clevert, Director 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.

Experts present CEUS insights

Interview: Mélissa Rouge

‘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 subsystemise 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 movies, banking, or healthcare. 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 entrepreneurship 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? ‘Uniklinik 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- of-the-future, e-health is becoming healthcare. 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 receiving this ‘innovation’? ‘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 production generates as much data as a hospital. So big data has an important 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 diagnosis 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.

Currenty, 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 information 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 existing gene panels are algorithmically matched to phenotypes. Recently we’ve helped a kid with a rare disease 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
Ultrasound device can now be smartphone size

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.

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!

Professor Dirk-André Clevert began his career at the MR-Studies Institute Westend in the city of his birth, Berlin, Germany, and in the Department for Internal Medicine at the Charité University Campus Grunower. He then worked as a specialist registrar in the Department of Radiology at Patzcu Hospital for three years. In 2003, he moved to Munich to join the newly founded (2004) Interdisciplinary Centre for Ultrasound at the Grosshadern Campus, University Hospital Munich. The centre coordinates all ultrasound activities in the hospital. As course director and congress president, he organises national and international ultrasound courses and congresses. On the 80th founding anniversary of the Medical Faculty of Tbilisi State Medical University, as head of the Interdisciplinary Ultrasound Centre, the professor was awarded an honorary doctorate.

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E-health developments in Spain

Esaul, the Spanish annual event, took place in Madrid at the end of November with 200 on-site partici- pants, a live streamed room with 2000 viewers on Twitter and a general audience.

Melisende Bouger 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.

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 entrepre- neurs to show their ideas 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 other rules, in marketing and in this case – to edu- cate and rehabilitate, has definitely consolidated. When we organised our first conference on videogames 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 edu- cation 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 technol- ogies at the University Centre for Technology and Digital Art (U-Tad). Universia Foundation and IT com- pany 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 industries like banking or finance, which really integrated Big Data. Healthcare insurance companies and hospitals are using large amounts of data to improve their profits and knowledge of patients and HC professionals’ behaviour, but much more could be done.

‘One of the big issues is data safety, which is increasingly threatened by massive cyber attacks and the system’s many vulnerabili- ties.

‘In terms of disease prediction in Spain, we have interesting initiatives that use Big Data to locate bloodmo- biles, detect genes linked to disease and even predict disease risk by sending an early warning picture; the focus of start-up Scan4Us.’

Virtual and augmented reality

‘Most initiatives involving virtual reality (VR) and augmented real- ity (AR) aim to update healthcare knowledge, but many now also focus on phobia treatment and motor rehabilitation.

‘For example, the Spanish com- pany Prounas uses VR to treat fear of flying, driving or speaking in public. The Foren Centre in Madrid uses neurorehabilitation based on VR and has already achieved results in patients with disease or trauma induced motor lesions.’

Social media challenges in healthcare

‘The main challenge for profession- als is to find value in training and communication with other special- ists, and to improve communication with the patient. Many say they lack the time to do so, but the efficient use of social media enables time saving and improved work and busi- ness perspectives.

‘Patients need to make themselves heard. Some associations receive a lot of echo on all their activities because they are very present on social media, while others remain invisible to the public eye and only once in a while publish something.’

Wearables

‘Smart materials are becoming basic to control risk, not only in cardiac patients in a non-intrusive way, but also in healthy patients who prac- tice sports and want to avoid a big scare.’

Chatbots as a solution to Google searches

‘Chatbots use is taking off and their potential is increasing. The number of interactions. They will be key in the future,’ Mateos pre- dicted.

Report: Mark Nicholls

The NHS in the UK aims to be paper- less by 2020. While some observers may regard this timescale as ambig- uous, other NHS trusts are well advanced in the transition toward a fully digital environment.

One leader in the field, Oxford University Hospitals NHS Foundation Trust, is about to go live with its first fully digital ward and also in the process of making all nursing docu- mentation digital across the entire organisation and then to make the remaining of medical documenta- tion digital, with a target to be paperless within two years.

‘Yet to reach this stage of digi- tal maturity, the trust’s Chief Information and Digital Officer Peter Knight acknowledges it has been a long journey with a num- ber of people driving the project with leadership and determination over the past few years.

Speaking about what it takes to be a truly digital healthcare facility, he said: ‘It is not only a vision to where you want to get to, but that vision will not necessarily stay static because technology moves rapidly. Part of the focus is to make sure you keep up to date with technology and that is really impor- tant in the cyber security space, for example. What you have to remem- ber is that you are building the digi- tal DNA of the organisation.

‘Establishing a patient administra- tion system is a critical first step and then building a clinically-based delivery point and collection of clini- cal data from that. Oxford University Hospitals has already seen digita- lisation implemented in the emergency department and a neuro intensive care unit that is completely paper- less, with all documentation online with the electronic patient record (EPR).

‘We have built clinical func- tionality - being able to order medi- cation and tests are fundamental to that model of delivery,’ Knight explained, adding that an important facet is to offer positive apps that clinicians can use intuitively.

‘Additionally, the transition to digi- tal has population health opportuni- ties and the chance to bring clinical records together - whether from pri- mary, secondary or community care into the core system to see the lon- gitudinal record of the patient. From that, there are population manage- ment opportunities and using the data to manage conditions – such as COPD or diabetes – more effectively in the community, with a preventive and well-being agenda and lighten- ing pressure on the hospital system.

‘Before joining the United Kingdom’s Department of Health in 2007, Peter Knight headed the introduction of Cerner at the Winchester and Eastleigh National Health Trust, among his other operational and board responsibilities. He became Deputy Director at the Department of Health for Research Contracting, Information Intelligence and Stakeholder Engagement, working under Professor Dame Sally Davies, the Chief Medical Officer, until 2016. He is now Chief Information and Digital Officer and an Executive Director of Oxford University Hospitals NHS Foundation Trust, and a Senior Fellow of Health Informatics at the Nuffield Department of Population Health, University of Oxford.

Other benefits are in managing the organisation and flow of patients and enabling patients to access the system and their records, book appointments, talk to clinical teams and record information such as a pre-operative assessment or post-operative discharge. (EPR).

‘With clinicians able to access records and imagery, from wherever they are, they gain a faster, bet- ter service.

‘However, the Chief Information and Digital Officer stressed the importance of guarding against ‘overloading’ clinicians and staff with digital data as they transition.

‘With the digital transition, cyber security remains a critical issue, especially after some NHS units were among organisations affect- ed in the global cyber attack last May. ‘When that attack on the NHS occurred,’ said Knight, ‘we survived because we take cyber security seri- ously. We are clear that with 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 things not opening or emails which look ‘dodgy’, but we can never be complacent.’

‘With the current emphasis on University Hospitals NHS Trust aiming to become paperless within two years, it is already moving towards most 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 towards fully digital, Knight has a clear message for them: ‘Make digi- tal the core of your business.

‘To us, success will be defined, ‘It will enable you to manage your patients and healthcare risks 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.’
Knowledge dissemination is key to defeating cancer, says renowned expert

Half of cancers can be avoided if institutions would exchange knowledge, according to Josel Garcia, executive director of the University of Texas MD Anderson Cancer Center in Houston, who opened the Center'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 what we think comes next and cure and what is going to be the next silver bullet. In 20-30 years from now I think we are going to look back and say: you guys did it wrong.

For instance, health professionals know about a disease but do not have a value for a person's health. In population healthcare we can only talk of pathology: it's a pathologic-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 way to do 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 trans-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 us 10 to 15 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.

On the US level the centre has managed to influence change in some of the main regulatory agencies. "Preventing cancer, for instance by forbidding young people's access to tanning beds, is a known risk factor for melanoma in younger populations."

"This remains a significant challenge in the US, according to Garcia. "We have a trillion dollar system which is 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 teleconsultation in nutrition, exercise, smoking, prevention, TV 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 those specialists are cruelly 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...
Analytics meets diagnostics

Up to the early 18th century, essentially medical diagnostics was limited to uroscopy – the observation of a urine sample in a uroscopy 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 them together.

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 not ours, 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! In the worst case, this can affect an entire series of devices and may necessitate a product recall. As we know from the automotive industry, this can quickly assume alarming proportions. However, this is not the only reason why accurate operation is a top priority. Coagulation diagnostics is an extremely sensitive field because incorrect treatment with anticoagulants can be life-threatening,” he warns.

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 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.

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 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 stabilility in mind. ‘We carry out extensive life-time measurements and test and record the stability of the measurement optics, the heaters and all other parts potentially prone to wear and tear,' Hötzl explains. ‘However, it’s even more important to maintain good working relationships with distributors and customers to find out exactly how 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.’

A brief history of mass spectrometry

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 co-operation makes sense.’

In the 1950s, Keller had completed postgraduate 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 Laboratory Medicine.

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
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 (matthias.weber@labor-karlsruhe.de), 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, metabolic 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.’

Dr Matthias Weber is a Consultant in Laboratory Medicine and General Medicine, as well as Clinical Mass Spectrometry in Karlsruhe, Germany.
Capital investment and IT capacity are hurdles

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 fields.

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 (RCPPath) 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 curriculum requirements are constantly being reviewed, not just for digital pathology but also for information technology and pathology, and we are looking at training modules that will support that.’ During her coming three-year tenure as RCPPath 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.’

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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. With the POC Connect app, users can select any colour from RGB or CMYK and adjust the colour saturation, hue and brightness,’ Herrmann explains. ‘In addition, a tolerance for the settings can be specified for each channel!’

Same colour impression on all displays

However, to take full advantage of the monitor’s possibilities regular calibration is important – particularly for pathology the display must reproduce undistorted colours. It is important that all monitors within a workflow display the characteristics the same. ‘All of this is supported by our new calibration kit CALI16 on the JD-C240,’ Herrmann points out. ‘For the first time, we’ll be able to profile all displays within a hospital and thus ensure a uniform image impression across all departments.

The CALI16 also supports the 5-D Look Up Table of the JVC JD-C240.

A new display and calibration kit

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