Forensics identify victims and terrorists

‘I am sorry, the electricity will be cut off because we’re going to simulate an attack, or emergency exercise, this morning,’ explained Dr Wim Develter, when he suddenly delayed his interview with Mélanide Rouger of European Leuven University Hospitals, will describe the procedures and practices within his work.

Seasoned forensic pathologist Dr Wim Develter has worked on disaster victim identification (DVI) in four major catastrophes, including the terror attacks in Brussels airport in Zaventem, in March 2016.

At the department of Forensic Medicine Department at Leuven University Hospitals, in the Netherlands, he trains forensic pathologists. In its DI and crime scene investigation work, the department organises simulations in which an invasive attack or disaster takes place and the personnel must act accordingly.

In his latest exercise, Develter put mannequins with prostheses in a plane to train staff towards the identification model as well as to test whether Leuven’s facilities were big enough and if everyone was sufficiently trained. ‘We also tested the psychological support for the families. Shortly after that exercise, the Brussels bombings occurred, so we were well prepared,’ he added.

The examination of disaster victims and their remains often begins with CT exams, first to rule out damage. As such, he specialises in forensic medicine in the Department of Forensic Medicine at Leuven University Hospitals. He is also Secretary for the Royal Belgian Society of Legal Medicine.

Memorial for the victims of three bomb attacks at Brussels airport and a metro station. Left forensic scientists trained with damaged mannequins and, below, mock cases to identify victims

showing the pathologists whether the victims were wearing jewellery or metallic devices, such as prostheses, at the time of the disaster, information that can help to identify them. Once this information is gained, the forensic team can track down where he or she received surgery or where objects were bought. Develter could not speak of the contents of the on-going investigation regarding the Brussels attacks at the time of our interview, but he said the identification process of a terrorist or victim is similar. After an attack you have a lot of extra information that can be useful for your investigation. I am one of the leading forensic pathologists in this enquiry, so I cannot say anything about the contents of the investigation because of the instruction’s secrecy,’ he said. However, during
the ECR, he will share his experience in disaster victim identifications in other mass disasters.

As a trained pathologist, Develter strongly believes in focusing on forensic medicine: ‘‘We saw the tsunami in Thailand in 2004 and a decade later, worked on the 2011 earthquake in Japan. In both events, high-end CT imaging proved very helpful in victim identification, but are also very much on the circumstances of the event. When the plane crashes victims could be related to a passenger list, things were far more difficult after the tsunami. It was an open disaster, people were in their swimsuits; they were not wearing any clothes, or had cell phones or keys, there was nothing to identify them.’’

DNA was very important then and we were very lucky that Chun offered free DNA investigations for all victims.

The aftermath of the tsunami, which caused 227,000 people from all over the world to lose their lives, became the catalyst to improve international disaster Victim Identification (DVI) protocols.

‘‘We realised that we needed to have an international protocol because we were all working in multiple and sometimes separate countries, such as Germany and the UK. We wanted to start working on this, and in 2006, we established a protocol, which we named International Criminal Police Organisation (Interpol) in Lyon, France, is responsible for establishing and revising the protocol every four years. Every year Develter and his DVI pathology colleagues participate in an Interpol meeting to discuss the approach to global disasters, and exchange experiences and discuss protocols.

His field has also been beneficially multidisciplinary from popular TV series such as CSI. Forensics became popular a few years ago thanks to these series. ‘‘It’s not just the public; it’s hard to find funding or grants for scientific projects. Though still tough to find funding, the fact that it has helped our discipline. It’s an upward spiral. It’s field is multidisciplinary, among other specialties involving toxicology, microbiology, biochemistry, anthropology and biology and police investigatory skills. You need all these discipines to answer just one question. What happened? That’s why the other fields are also intersted: we’re all working to solve a mystery.’’

The British government has pledged to increase the number of places available at United Kingdom medical schools by 25 per cent by 2018 in a bid to boost the number of home-grown doctors within the National Health Service (NHS). Presently, a quarter of the 150,000 NHS doctors were trained outside the UK but the move is designed to see the country become ‘‘self-sufficient’’ in training doctors with medical school places rising from 6,000 to 7,500 a year. The announcement, made by Health Secretary Jeremy Hunt at the annual Conservative Party conference, comes in the aftermath of Britain’s decision to leave the European Union, sparking fears that it will become harder to recruit doctors from overseas in future.

The announcement was made by Health Secretary Jeremy Hunt at the annual Conservative Party conference, in the aftermath of Britain's decision to leave the European Union, sparking fears that it will become harder to recruit doctors from overseas in future. It was also made against a backdrop of a long-running dispute between the British government and junior doctors over working conditions, which has seen young doctors taking strike action.

With an estimated nine per cent of UK doctors also due to retire within five years, Mr Hunt said: ‘‘We need to prepare the NHS for the future, which means doing something we have never done properly before - training enough doctors. Currently, a quarter of our doctors come from overseas. They do a fantastic job and we have been clear that we want EU nationals who are already here to stay post-Brexit.

‘‘But it is right to import doctors from poorer countries that need them while turning away bright home graduates desperate to study medicine’’

However, as medical degrees take five years to complete, it will be 2024 before the impact of these extra places is felt. The rise in training places will cost £100m from 2018 to 2020 but, in the long-term, the government hopes to recoup money by charging foreign students more than it does now.

In addition, medical students will be expected to work for the NHS for at least four years - or face penalites that mean they have to repay the cost of their training, which currently stands at £220,000 to the taxpayer over the five-year medical degree course.

However, the British Medical Association - which represents NHS doctors - said the plan would not prevent the NHS from needing to recruit overseas staff and urged the government to tackle the causes of the workforce crisis, such as extra workload, demoralised staff and lack of funding.

BMA council chair Mark Porter said: ‘‘This announcement falls far short of what is needed. The Government’s poor workforce planning has meant that the health service is facing huge and predictable staff shortages. We desperately need more doctors, particularly with the Government plans for further seven-day services, but it will take a decade for extra places at medical school to produce more doctors.”

This initiative will not stop the NHS from needing to recruit over seas staff and securing great skill and expertise to the NHS. Without them, our health service would fall behind in the world. The Patients Association in the UK welcomed the plans to drive up the number of British doctors working in the NHS. One of the central quandaries in how the NHS can overcome the challenges it faces in 2016 and reintroducting good sleeping and eating schedules, minimising the intake of sugar while increasing the amount of fruits and vegetables, and practicing physical activity. Eat fives time a day

The best thing to do to keep in shape is to eat five times a day, and reduce portions as the day goes by. ‘‘Some people decide to skip break- fast or dinner, but this is a terrible mistake because you need to distribut e the energy needed by the body without feeling hungry. A trick is to progressively reduce the amount you eat during the day. For instance, start with a strong break- fast, then have a fruit or yoghurt snack, then a healthy lunch, and a healthy selection of almonds (meat/ vegetables) for lunch. Later, you can have a snack followed by a light din- ner because, as the day goes by, you need less energy input, he explained. The key is to use this to be constant and keep up with a routine diet that adequately fits one’s needs, rather than skipping meals. ‘‘It’s a new daily routine for just a few weeks; it’s also useless to reduce the amount of food we consume for a while, because this could endanger our health and badly reflect on our organism.’’

In Spain, the Christmas holiday peri- od is called the days of the Three Kings on 6th January, giving everyone one more week to rel- ax festive delictices, including the delicious chocolate bomb Roscón de Reyes (Three Kings Bread), made with sugar, flour, yeast, eggs, milk, orange extract and salt.

In fact, according to the Vititas Xanit International Hospital in Benalmádena, Andalusia, as much as 80% of the Spanish population put on an extra 1 to 5 kgs each year after Christmas. 

‘‘In Southern Europe every holiday is an excuse to stop taking personal care and break up our healthier routine. Whether it’s Christmas or Easter, people tend to relax and forget about healthy habits,’’ said Dr Rafael Estrada, dietician at the hospital.

‘‘Because many foreigners choose to live in attractive, sunny southern Spain, Estrada tends various national- ities and he acknowledges that cultural differences have an impact on food habits and eating sched- ules, even though many people in the Western world put on a little weight after Christmas. The tradi- tional Spanish way of life – eating and going to sleep late – may seem at odds with a healthy lifestyle. ‘‘We are copped with our work timetables, which affect another lifestyle. Your wife, husband or friends work until 8 p.m., so you want to wait for them to have dinner or go out for a drink.’’

Estrada pointed out. Many Spaniards live in line with the rest of Europe, he said, but some diferent patient profiles he treats at his practice: ‘‘I attend patients with hyperactivity and diabetes,’’ he said, ‘‘as well as very thin patients, chil- dren, sportmen and parents who want to develop better food habits once their child is born.’’

Food disorders are often a manifes- tation of deeper emotional issues and, in that case, a dietary treatment comes hand in hand with psycho- logical therapy.

Christmas, for example, is an emo- tionally packed period and some patients might find it difficult to resist temptations or not compensate with food around that time. ‘‘One thing must prevail here in common is their addiction to sugar, which is partly fed by the food industry. Sugar is the hardest thing to give up. You have to read all the labels carefully when you go gro- cery shopping, and beware of those who read ‘low calorie input’ or ‘0 fat’ because they are typically full of sugar. Be selective is time-con- suming, but there’s truly a need to raise public awareness on this issue. Patients are increasingly aware that they must take care of them- selves and Estrada has been treating an increasing number of patients ever since he began work at the hospital six years ago. ‘‘To recover from celebratory excess, the dietician recommends

Seasonal overindulgence

In the early months of a New Year many of us are tightening our belts after Christmas gastronomic indulgences. However, the belt may not be as long as it used to be and the gym treadmill may be the only answer, Mélisandre Rouger reports

The UK will train more doctors
Down to earth devices

On sale now: a novel monitoring patch tried and tested in the International Space Station. John Brosky reports

Space missions are famous for driving innovation, from Mylar blankets to microchips. So when French scientists learned one of their companions would be aboard the Soyuz MS-03 spacecraft to reach the International Space Station (ISS), they gathered cutting-edge technologies for him to carry into orbit.

On 17 November 2016 the European Space Agency (ESA) astronaut Thomas Pesquet was launched into space with NASA astronaut Peggy Whitson and Russian cosmonaut commander Oleg Novitsky for the six-month Proxima Mission.

Inside Pesquet’s space gear were equipment and materials for two assignments, the Matiss project designed by the French National Centre for Space Studies (CNES), and the ExA’s EveryWear program.

The EveryWear tablet computer serves as the data platform for two devices from BodyCap, a start-up based in Caen, France, which collaborated on a zero-gravity study of wearable technology with the CNES laboratory focusing on microgravity science and the Swiss Institute for Space Medicine and Physiology.

Monitoring sensors

A sensor in the eTACT patch worn by astronaut Pesquet combines activity tracking, skin temperature monitoring and body position detection; data is sent wirelessly in real time or stored on the device for subsequent analysis. The patch can be worn on any body area for some time, monitoring chronic diseases, sleeping patterns and overweight people, for example.

‘As there is no gravity in the ISS, the astronaut needs to be attached to the bed to avoid drifting around the capsule, which makes it difficult to sleep. What becomes important is an ability to quantify movement during his sleep, as this is a very good indicator of sleep quality, a measure of whether he is truly sleeping or is restless,’ explained Sébastien Moussay MD, a co-founder of BodyCap.

The other device from BodyCap is the Blood Pulse Wave sensor finger-worn device to detect changes in the blood pulse of the carotid artery when the astronaut presses his finger against his neck. This tonometer is being used as part of a study of modifications to astronaut Pesquet’s cardiovascular system during long-term exposure to microgravity.

Without the resistance of gravity, the heart does not need to force blood flow to the brain and it progressively weakens, requiring a period of therapy for recovery once Pesquet returns to earth in May 2017.

The pulse wave sensor is a work-in-progress, Moussay pointed out, but eTACT is a CE-approved product with down-to-earth medical applications in programs for the obese and diabetic patients where physical activity is a vital measure, as well as for sleep labs. An example is patient compliance to prescribed physical therapy routines in the period following bariatric surgery.

Connected watches and other activity trackers popular with consumers do not make the grade with clinicians, he said.

‘What’s very important for doctors and medical staff is a measurement of metabolic change linked to activities such as walking and swimming. They are less interested in measuring hand movements of someone playing a video game, which is the data provided by connected watches,’ Moussay explained.

The Matiss project is a test of smart surfaces to resist bacterial colonisation inside the spacecraft with an eye on the future.

‘If we are going to send people to Mars, we don’t want them to get sick on the way, nor do we want them scrubbing and cleaning all the time,’ said Guillaume Nonglaton, the project manager for the Matiss experiment at the Grenoble-based Leti research institute.

Housekeeping in the space station takes up an inordinate amount of the astronauts’ time, which could be better spent performing their scientific mission.

Keen housekeeping is a vital task

Astronaut Pesquet installed four plaques in spots regularly frequented by fellow astronauts, such as the kitchen area. Each plaque holds 20 different samples of hydrophobic materials that will be exposed to the air in order to come in contact with water droplets circulating within it, each possibly carrying bacteria.

The sample surfaces were each designed to repel the droplets so that they remain in the air and can be filtered, rather than being absorbed on a surface where they may take root.

Advanced materials developed for the experiment include a fluorinated thin layer, an organic silica and a biocompatible polymer, all chosen for their hydrophobicity, and ability to be manufactured on an industrial scale.

The materials also have practical benefits back on Earth for germ-free medical device surfaces and even elevator buttons.

Nonglaton: ‘One never knows where the next good idea for practical applications will come from; perhaps this time it will come down from space.’

The EveryWear tablet computer serves as the data platform for two devices from BodyCap, a start-up based in Caen, France, which collaborated on a zero-gravity study of wearable technology with the CNES laboratory focusing on microgravity science and the Swiss Institute for Space Medicine and Physiology.
Dutch healthcare gives and receivers want a higher care level

The report shows that by tearing down the divisions the quality and accessibility of healthcare in the Netherlands remains high and affordable.

Not really new

Divisions are not new; says Jan Peter Heida, partner and consultant of research firm SIRM, which noted three main divisions/partitions:
- Financial divisions, created by the spending of healthcare providers and health insurers, which are determined within different legal frameworks.
- Healthcare for most patient groups is paid via one or more of these budgets.iphoning money from, for example, hospital to primary care proves to be difficult.
- Regulation: Divisions are organised by type of care and type of insurance. This compartmentalised way of thinking leads to undesirable effects. For instance, exempt from VAT makes it less attractive for hospitals to hire specific services (cleaning, accounting).

Notions need revisions

Report: Mark Nicholls

Leading clinicians, scientists, academics and crossbench peers have urged a radical rethink of the approach to health in the United Kingdom.

Against a backdrop of Brexit and the ‘tourest’ state of the NHS, the powerful group has taken the bold step of setting out a manifesto for a ‘health creating society’ across Britain with a fundamental shift in the provision of care from hospitals to the community at its heart.

Heida and his co-leaders of the Lancet, they presented their vision of how the UK can promote and improve health and at the same time care for the country’s economy.

Lord Nigel Crisp, crossbench peer and former NHS Chief Executive said: ‘The NHS faces severe financial constraints, and leaving the EU is likely to exacerbate many problems, including staffing.

‘With a new government comes the opportunity for a clear, bold new strategy. We need a new approach to health that recognises on the one hand the enormous contribution health and biomedical sciences make to the economy and, on the other, that every part of society has a role to play in improving health.’

In the report, entitled Manifesto for a healthy and health-creating society, the authors propose action in four closely linked aims:

1. The UK should strengthen its role as a global centre for health and the biomedical and life sciences, that should be at the centre of the UK’s industrial strategy and vision for the future as an outward facing country and help to shape the future health, prosperity, and security of the UK and the world.

2. The transformation of the health and care system from a hospital-centred and illness-based system to a person-centred and health-based system needs to be accelerated and broader. This will require a massive investment in services in homes and communities and new ways of working with front-line staff, enabled by technology, to manage the complex needs of patients across different services and organisations.

3. The UK needs to develop and implement a strategy of building a health-creating society, supported by all sectors of the economy and the whole of government, that addresses health inequalities. Current plans for health promotion and disease prevention are too small scale and fragmented and need to be replaced by a larger scale, society-wide effort.

4. Health, care, and scientific institutions should help develop and restore a healthy society in the UK, but a health-creating society can only be built in society that itself is healthy.

However, the authors warn the success of the aims will crucially depend on having an effective and sustainable health system which can provide a platform for the development of science, expertise and products.

David Stuckler, Professor of Political Economy and Sociology at Oxford University, said: ‘For too long, we have been locked in a way of thinking that addresses health inequalities. Current plans for health promotion and disease prevention are too small scale and fragmented and need to be replaced by a larger scale, society-wide effort. 4. Health, care, and scientific institutions should help develop and restore a healthy society in the UK, but a health-creating society can only be built in society that itself is healthy.'
In December, reporting was offered to Hans de Boer of VNO-NCW.

Kantar TNS did an additional study (care monitor), in addition to the SIRM study.

1,430 people (18%), representa-tive of the community, were invited to participate in this study. 943 Dutch finally filled in the questionnaire.

151 healthcare professionals (148 doctors, 58 pharmacists and 145 medical specialists) completed the questionnaire.

For this study the CiviQ (Computer Assisted Web Interviewing) method was used.

The average questionnaire com-pletion time was 12 minutes.

The questionnaire for both groups was largely similar. A single question was asked only to healthcare professionals.

The fieldwork ran from 21 February 2016.

Some results

• Compared to the past, 70% of healthcare consumers believe that care has become less patient-centred. Among caregivers that percentage was 44%.

• 45% of consumers see care co-operation worse than before (56% think it better) against 20% of caregivers (80% consider it better now).

• Both healthcare professionals and healthcare consumers identify the fact that the problem is that healthcare professionals are thinking about too many islands.

• More than three quarters of care consumers find it very important, or essential, that something is done to improve collaboration between healthcare providers and healthcare professionals.

• In approximately one percent of the world population are epileptic; in France alone, an estimated 600,000 people regularly experience seizures. During an epileptic event cortical neurons suddenly discharge, forcing their rhythm onto other nerve cells. Epilepsy and always temporary activity differs from per-son to person: it may manifest itself in a wide range of symptoms, from slight jerking of some muscle groups to serious convulsions and impairments of speech, memory, movement and behaviour. Brigitte Dinklage reports.

In the past, research instruments that could gather knowledge on epilepsy were limited because, in about 50 percent of those affected, neither MRI nor electroencephalography (EEG) show any visible brain abnormalities. However, now research-ers at the Centre National de la Recherche Scientifique (CNRS), the national institute of health and med-ical research (Inserm), Aix-Marseille University and the General Hospital Marseille (AP-HM), have succeeded in creating a virtual brain that not only allows modelling the originat-sites and propagation of neuronal brain activity but which can also optimise the planning of surgical interventions.

In 70 percent of epileptic patients the seizures can be managed by medication. When medication is not sufficient, however, surgery has to be considered, says Dr Fabrice Bartolomei, Medical Director of the Department of Neurophysiology at Hôpital de la Timone in Marseille, France. ‘In first step the epilep-togenic zone is identified, in a second step, it is removed or neutralised.’

An MRI head scan is performed to localise the abnormal brain activ-ity. MRI offers both an anatomy snapshot and – helped by the 3-D modellling tractography – the reconstruction of the course of larger neural tracts. A second source of information is EEG. ‘Brain activity is recorded by electrodes which, under general anaesthesia, were implanted into the brain by the neurosurgeon,’ Bartolomei explains. ‘The electrodes are placed in areas the surgeon considers important to understand the origin of an epilep-tic event and its propagation in the brain.’

‘Innovative and less invasive tech-niques are currently being tested, such as magneto-encephalography (MEG), which discovers and maps changes in the magnetic fields on the surface of the skull. An entirely new approach is the virtual brain, which allows to personalise a mathematical model for each indi-vidual patient,’ explains Dr Viktor Jirsa, Director of Neuroscience Systems at CNRS, ‘and provides a visualisation that enables individual simulations.’

As a brain creates a simulation of a patient’s epileptic seizures: Seizures started in the right hippocampus (Channel B1-2) before spreading to the contralateral hippocampus (channel B101) and further spreading in the left temporal lobe (d’après Jirsa et al, 2016).

By visualising brain activity and detecting the origins of an epileptic event and its spread in the brain, the virtual brain technology offers a more precise diagnosis. Surgeons can mark the surgery regions of interest and plan and even test the most effective and least invasive sur-gical cuts. Thus different scenarios and their effects on the brain can be simulated. Bartolomei explains: ‘In a first step the MRI and EEG data are transferred to the model. In a second step, electrical impulses are applied to nodes in the model, par-ticularly in the areas that are most likely epileptogenic. Thus epileptic events can be triggered and vis-ualised in the virtual brain and the source, as well as spread of abnor-mal activity, can be reconstructed.’

In each patient the interaction of nodes in the brain is different. The virtual model allows prediction of the effects of a given surgical intervention at a given node. The surgeon can remove certain areas of the virtual brain and see whether the epileptic events continue to develop, or whether cutting the con-nexions, so to speak, has stopped the event. This technology increases plan-ability and efficacy of epilepsy surgery. The model, however, can-not predict any surgical side effects.

In Marseille, the virtual brain is almost already used to plan inter-ventions. An evaluation of the patients who underwent surgery remains to be done. There is a long way to go for researchers: they need to assess whether the virtual brain indeed provides an accurate picture of the epileptic event.

Bartolomei estimates another 18 to 24 months before the model can be used in a clinical setting. Since, in epilepsy, electrical biomarkers are very specific, transfer of the model to other neurodegenerative diseases will not be easy.

Computer model simulates epileptic events

Simulation of a patient’s epileptic seizures: Seizures started in the right hippocampus (Channel B1-2) before spreading to the contralateral hippocampus (channel B101) and further spreading in the left temporal lobe (d’après Jirsa et al, 2016).

Innovative and less invasive tech-niques are currently being tested, such as magneto-encephalography (MEG), which discovers and maps changes in the magnetic fields on the surface of the skull. An entirely new approach is the virtual brain, which allows to personalise a mathematical model for each indi-vidual patient,’ explains Dr Viktor Jirsa, Director of Neuroscience Systems at CNRS, ‘and provides a visualisation that enables individual simulations.’

Dr Richard Horton, Editor-in-chief of The Lancet, said: ‘It’s time to write of The Lancet, said: ‘It’s time to write.

Professor Sir Robert Lechler, President of the Academy of Medical Royal Colleges; Professor Maureen Baker, Chair of the Royal College of General Practitioners; Professor Simon Wessely, Professor of European Public Health, London School of Hygiene and Tropical Medicine; Heather Henry, Professor at the London School of Hygiene and Tropical Medicine.

As a grassroots organisation of 10,000 individuals and organisations working to improve community health, and Professor Cathy Warwick, Chief Executive of the Royal College of Midwives.
Light emitting diodes (LEDs) and complementary metal oxide semiconductor (CMOS) cameras can be found on a billion smart phones and tablets. In medical systems it is the first to introduce them on a flexible endoscope, the Eluxeo 700 Series. LED is a new light in the closed, dark world where gastroenterologists work. The industry-standard for all other endoscopes is a xenon light source.

The firm’s innovation in applying everyday LEDs is to use four independently controlled light sources, each responding to a specific wavelength across the spectrum from blue-violet at 400 nanometres up to red at 650 nanometres. The ability to alter combinations of spectral wavelengths at the source splits radically from a decade that has seen the widespread use of light filtering to enhance contrast levels and aid clinicians in distinguishing neoplastic lesions from healthy mucosal tissue. This is a next generation endoscope, the first with specific spectral settings to target mucosal layers, and also the first to use CMOS technology, explained Jacques Bergman, specialist in gastroenterology and endoscopic intervention at the Academic Medical Centre in Amsterdam, the Netherlands. ‘LED excitation is new, instead of xenon light in a fibre running down the endoscope, and four light sources presents enormous potential for investigating ways of highlighting disease.’

Endless possibilities

Bergman believes there is no end to the possibilities for this system. ‘These are very promising tools for the assessment of GI diseases,’ added Emmanuel Corson MD, from the University Hospital Nantes, France, ‘and we should validate the clinical impact of this technical achievement.’

In February 2016, a paper published in Clinical Endoscopy directly compared filtering a single xenon light source against combinations of the technologies used by Fujifilm, it demonstrated yet another benefit - adding a greater intensity of white light, while boosting hues in the red region of the spectrum and microvascularature were highlighted. The short wavelength of blue light LED illumination corresponds with the light absorption of haemoglobin at 410 nanometres, which is why microvascularature shows up more brilliantly.

The variable LED combinations can also increase contrast in the 650-nanometre wavelength, which improves detection of inflammation or the delineation of tumour margins. The Eluxeo offers push-button switching between three pre-set modes for white light, blue light, blue light with illumination (BLI) and linked colour imaging (LCI), each holding advantages for detecting, characterising and delineating the margins of diseased tissue. ‘The BLI created by four LEDs provides a high contrast in white light and I believe the contrast enrichment with BLI is the future,’ said Helmut Neumann MD, University of Mainz, Germany. ‘But also, by using this CLI imaging mode, white becomes even more white, while red gets more red, and this becomes a very interesting technology for the early detection of lesions and delineation before performing an endoscopic therapy.’

With a useful life estimated at almost 10,000 hours, LEDs should also prove to be more cost-effective than xenon lamps that need to be changed after 500 hours, according to Ronald Grieger, head of the endoscopy marketing group for Fujifilm Europe.

Making money? 3-D printing prices will drop dramatically; then hospitals will have 3-D printers to customise implants or surgical instruments

The pioneer in additive manufacturing applied to orthopaedic devices is Warsaw, Ind-based Zimmer-Biomet Inc., which began developing the technology 15 years ago. Using what is called a build plate, industrial 3-D printing involves building up micro layers of titanium powder that are burned with a laser to solidify the powder into a metal with nano-precision to match the design model.

By the end of 2015 manufacturers had installed around 500 machines for 3-D printing of implantable prostheses. Whereas in 2010 there were just four 3-D-printed implantable device approvals by the United States Food & Drug Administration, by 2014 twenty-five products had been FDA approved.

According to Kevin Lobo, CEO at orthopaedics leader Stryker Corporation, additive manufacturing is having an impact on our knee business as well as spine, and we have a huge line up of our modifications and prototypes to get into 3-D printer titanium products. In 2016 Stryker began construction of its second 3-D printing facility in Cork, Ireland.

Orthopaedics market specialist Ali Madani, from Avicenne Medical in Paris, said that titanium spinal cages made by additive manufacturing processes constitute the most dynamic orthopaedic segment and that these products are steadily occupying the market share for polymer-based PEEK cages.

In Europe, Madani pointed out that Italy is home to the most advanced companies in additive manufacturing where challenges are being tackled, based in San Daniele del Friuli, and Milan-based Adler Ortho have invested massively in the technology and each year sell thousands of 3-D printed hip cups, shoulder implants, knee tibial plates, or mini-hip stems.

Robin Stamp, the associate manager for Advanced Technology at Stryker Orthopaedics explained that for over 20 years, Stryker has milled and machined metal implants using complicated, multi-step manufacturing processes based on coating materials with rigid requirements that limit design options. ‘What 3-D printing does is give design freedom, an ability to try exotic designs, build channels into the surface, create roughness, give a product any feature needed for essentially the same cost as building a standard model,’ he said. ‘Where we are really seeing a difference is in the speed of design iterations.’

Instead of a product development cycle of 18 to 24 months with a high cost for making changes, he said that today, using additive manufacturing, his group can produce a design and within one week, give the part to a panel of surgeons and rapidly iterate, based on the panel’s suggestions to further develop the design. ‘This is phenomenally powerful,’ he said ‘We are capable of doing so many more iterations, putting much more functionality and creativity into products.’

Report John Broksy

Inexpensive and readily available, 3-D printers accelerate innovation in the design of medical devices from university laboratories to the factory floor.

At the Delft Technical University they call themselves the Bio-Inspired Technology Group, or BiTE. And their claim to fame is in having created DragonFlex, the world’s first 3-D printing technology for use by surgeons, it demonstrated yet another benefit - adding a greater intensity of white light, while boosting hues in the red region of the spectrum and microvascularature were highlighted.

The 3-D printing revolution

Re-named ‘additive manufacturing’ and making products increasingly functional and creative.
Zika birth defects, decrease, but…

ECR 2017 Guest Lecturer Maria de Fatima Vasco Aragao, a radiologist from Pernambuco state, Brazil, has been tracking the Zika virus ever since it broke out in her country in 2015. She will highlight how CT and MRI can help reach diagnosis, especially in the absence of microcephaly. In an exclusive interview with European Hospital correspondent Mélissa de Rouger, the radiologist warned there might be more to come regarding the spectrum of Zika syndrome, with possible outcomes such as epilepsy and cognitive impairment.

‘We do not follow patients routinely in order to prevent sedation of infants and ionising radiation. Control studies are only indicated after identification of clinical signs of a complication, for instance hydrocephalus and seizures.’

‘Microcephaly and brain malformations can be diagnosed with ultrasound during pregnancy.’

‘When a baby is born with microcephaly in an epidemiologic area, the paediatrician and neuropediatrician usually suspect congenital Zika syndrome, whether or not the mother recalls a rash during pregnancy. But we are beginning to see cases in which neuropediatricians don’t suspect congenital Zika syndrome because the babies don’t have microcephaly, but have normal-size heads.’

They undergo MRI examination due to unspecific neurological signs, e.g. delayed neuropsychomotor development and motor deficits. Here, radiologists must be alert, as the indication is not Zika virus or microcephaly, and microcalcifications may be subtle, so could be missed. Not only the presence of calcification, but also its location at the cortical subcortical white matter junction needs to be identified, as it is highly suggestive of congenital Zika syndrome.

Another suggestive finding is malformation of cortical development predominant in the frontal lobes. In addition, these children are around one year and, therefore, specific IgM test for Zika virus can be negative, even if the child has the disease. Therefore, the radiologist’s responsibility is even more important in case of congenital Zika syndrome without microcephaly, to suggest the diagnosis to the paediatrician and neuropediatrician. In these cases, radiology is the only tool we have to make the diagnosis. So radiologists must be alert.

‘Imaging is important, especially in less severe cases, for early detection of congenital Zika syndrome, allowing rehabilitation to start quickly, to help improve their development. If microcephaly is absent and clinical signs appear when infants are several months old, the most important way to diagnose the syndrome is through imaging studies, so radiologists need to detect microcalcifications at the cortical subcortical white matter junction, which can be difficult on MRI, and malformations of cortical development, predominant in the frontal lobes.’

‘Imaging is also important in identifying complications of the disease, such as hydrocephalus, in which the indication for surgery for ventricular dilatation is important, to prevent neurological deterioration.’

How many cases are there?

‘Since its peak in October/November 2015, new cases of congenital Zika syndrome decreased throughout 2016. Two possible explanations: i the population is gradually becoming immune to the virus in north-east Brazil and prevention has become more intense; with people knowing how to protect against the Aedes aegypti, the mosquito responsible for Zika infections. The WHO revealed that, as of 14 December 2016, 75 countries and territories, especially in Latin America, had reported microcephaly and other central nervous system malformations; four were without endemic transmission. After Brazil, Colombia (67) and the USA (57) had most cases.’

Observational studies to understand the spectrum of this syndrome ongoing. ‘The fact that some children do not present with microcephaly but image alterations raises questions of great importance for public health. Perhaps we’ve seen the tip of the iceberg with the most severe brain damage cases associated with microcephaly.’ Researchers want to know the real size of what is submerged, where minor changes without microcephaly could cause future problems, e.g. epilepsy and cognitive impairment.

‘Other groups are trying to evaluate prospectively the risk of developing microcephaly and other abnormalities after Zika infection during pregnancy. Besides congenital microcephaly, neurologic complications have been found in adults. According to the WHO, up to 14 December there was an increase in Guillain-Barre cases and/or laboratory confirmation of Zika virus infection among Guillain-Barre cases in 20 countries. Myelitis and encephalitis have also been identified. As radiologists, we try to help the scientific community to understand the pathophysiological process of the disease.’

Is there hope of a treatment?

‘There is neither specific treatment nor a vaccine. Although vaccination can be developed, a treatment for the lesions caused by the virus is extremely unlikely. This does not mean there is nothing to do. Once the disease is recognised, rehabilitation must begin immediately, especially in less severe cases, to provide the chance of better neuropsychomotor development for the children and support for their families.’

‘Treatment and support must also be directed towards other disease manifestations, – seizure, ophthalmologic and auditory deficits, arthrogryposis and possible complications, e.g. hydrocephaly.’
New ElastO Imaging, real-time shear completes Philips solution for liver a

**NEW: **Evolution 3.0 EPIQ ultrasound upgrade offers high-res PureWave crystal transducer technology, shear wave elastography, contrast enhanced ultrasound, and image fusion. Could you ask for more?

Philips has released the EPIQ Evolution 3.0, an upgrade to its range of high-end ultrasound scanners – and a device that combines a number of innovative technologies to improve image quality and processing. Professor Dirk-André Clevert, head of the Interdisciplinary Ultrasound Centre at Munich University Hospital, explains what sets this new system apart from any competition.

Ask why the specific focus in development of the EPIQ-platform was liver imaging, he pointed out that the liver is the largest and central metabolic organ, with many pathological processes manifesting within it. This applies primarily to tumour metastasisation but also to parenchymal changes other than liver cancer, such as fibrosis or cirrhosis. The liver is therefore an organ of great interest to all medical disciplines for oncological, inflammatory, vascular and parenchymal questions. What does Evolution 3.0 mean in this context?

The special feature is the combination of different advanced elements in one system: high resolution PureWave crystal technology, shear wave elastography technology (ElastQ Imaging), contrast enhanced ultrasound (CEUS) and image fusion. This covers all four mainstays of liver imaging.

The first is image quality, i.e. the B-mode image, which diagnosis hinges on, and for which we require high resolution transducers that can detect even the smallest, deepening lesions. Newly developed data processing algorithms additionally ensure fast image reconstruction.

The second mainstay is contrast enhanced ultrasound, because only the use of contrast media enables us to fully utilise the diagnostic relevance of ultrasound images. The system offers high frequency transducers, providing optimal resolution with sufficient depth of penetration, which can additionally be combined with contrast-enhanced ultrasound. Elastography is the third mainstay ElastQ Imaging is a colour coded, quantitative measuring system to evaluate tissue elasticity in real-time. Rigidty measurements indicate potentially pathological changes not yet visible on the B-mode image, and whether the tissue is becoming softer or harder after treatment. Image fusion is the fourth mainstay. This procedure can sonographically detect pathological changes seen on CT or MRI scans and can substantiate a firm diagnosis.

Other medical device manufacturers offer Ultrasound/CT/MRI image fusion. Does EPIQ have unique capabilities?

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**3-D simulation includes haemodynamics**

New 3-D simulation models that include haemodynamics enable better treatment of hepatic tumours via radio-embolisation, according to eminent Spanish radiologist José Ignacio Bilbao Jaureguizar.

In radio-embolisation, 3-D simulation includes haemodynamics and processing Professor Dirk-André Clevert, head of the Interdisciplinary Ultrasound Centre at Munich University Hospital, explains what sets this new system apart from any competition.

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**Other medical device manufacturers offer Ultrasound/CT/MRI image fusion. Does EPIQ have unique capabilities?**
Another special feature is the ability to acquire more data within the field of view, enabling post-processing, in addition to the data sets already stored. This means that specific, smaller, partial segments of interest, within a larger field of view, can be evaluated and documented later on.

The system also makes a so-called confidence map available, which indicates whether the signal by colour: green means high, yellow means moderate and red means low. It’s therefore always possible to get the best out of the images.

Which trump cards does the new shear wave elastography offer?

‘This technology is primarily used on the curved array transducer. The large measurement window makes it possible not only to view and measure partial liver segments but also to see larger areas of the parenchyma.

Along with colour coding, which indicates whether tissue is hard or soft, a mean numerical value can also be determined. This can be used to monitor treatment and see whether the values are changing.

The system edits the data and converts it directly into a structured patient report, which simply needs to be printed.

José Ignacio Bilbao Jaureguizar is professor of radiology, head of interventional radiology and consultant radiologist at University Clinic of Navarre (UCN) in Pamplona, Spain. He is also former chairman of UCN radiology department. He gained a medical degree at Navarre University’s medical faculty. Training followed in interventional radiology at MD Anderson Cancer Centre, Houston, USA and he received his PhD, cum laude, at Navarre University. His research interests are percutaneous treatment of tumours including chemotherapy and embolisation, especially in liver tumours.

In the future, 3-D simulation models should be tailored to every patient, the technology developed for liver will be very useful here. This will prove of tremendous help in brain cancer surgery for instance. Bilbao added. "We have already set up a CT work shop. Developing a simulation model takes thousands of hours on a super computer. It’s not only about money, but also techniques. It could take years, but things go so fast now, so who knows?"
Big firms forge a new partnership

An alliance between Siemens Healthineers and IBM Watson Health aims to support service providers in the healthcare system, such as hospitals, health networks and other providers. A top-class technical solution consisting of three main components is to help ensure better treatment and care for patients. 'I believe we can make an important contribution towards evidence-based medicine,' says Arthur Kaindl MSc PhD, General Manager of Digital Health Services at Siemens Healthineers.

Devising structured reports

The TLAP wish that many ESR subspecialty societies will step forward to collaborate, work through the open online, template library established by RSNA to select and then validate the clinical content and technical formatting for their respective practice areas. Through the agreement, ESR members have full access on the RSNA website, and not only the ability to download and read material, but also to upload templates as a credential member.

The TLAP wish that many ESR subspecialty societies will step forward to collaborate, work through the open online, template library established by RSNA to select and then validate the clinical content and technical formatting for their respective practice areas. Through the agreement, ESR members have full access on the RSNA website, and not only the ability to download and read material, but also to upload templates as a credential member. The newly established partnership is based on a distinct win-win situation. The respective strengths and domains ideally complement each other. Watson Care Manager, coming into play when the issue is not the medical one but the administrative one, is trying to position itself with respective projects and the resulting predictive analytics, there appears to be a lot of distrust amongst consumers - particularly regarding healthcare data.

Noteworthy technical challenges

Several hurdles must be overcome during implementation of the solution:

1. Quantitative analytics has not yet been sufficiently implemented in radiology; for instance, however, the prerequisite for clean data analysis is the supply of discrete data based on a structured, quantitative evaluation.
2. Although there appears to be a change in awareness, Kaindl says because it is recognised that the referring practitioners often do not have time to read pieces of prose and because inconsistencies are also dangerous.
3. A further requirement for effective implementation is the clean networking of different IT systems, which must be avoided at all costs.
4. The respective strengths and market position in this field. Although Google, for example, is trying to position itself with specific information to respond to specific clinical questions. And it is very effective.'

Yet, there remain multiple challenges to widespread adoption, some of which are uniquely European. 'The difference from the United States is that different countries in Europe not only have different healthcare payment systems,' Neri pointed out. 'There is also a language issue, which is one of the major challenges we face for implementation.'

Here the advantage of structured reporting is that it standardises reporting formats so that even where the language changes, the same information is presented in the same order. A pan-European group, he said, ESR can help diverse societies establish structure, provide guidelines, and give direction.

The radiologist improves communication with other clinicians asking for specific confirmation on radiological finding.

In parallel to this, first will be the promotion of templates by ESR through its diverse activities, and targeted promotion by the specialty societies to its members. Many of these societies are committed to structured reporting, but without examples from the European Society of Gastrointestinal and Abdominal Radiology, the European Society of Oncological Imaging and the European Society of Medical Imaging Informatics. Concurrently, there will be a progressive integration by manufacturers of validated templates into imaging equipment today when a hospital buys a CT scanner, the manufacturer has already pre-loaded imaging protocols, which facilitates the work for a clinician with validated, pre-defined parameters for an examination programmed into the console. PACS vendors can do the same with reporting templates, which will encourage and motivate radiologists to use appropriate reporting formats,' Neri believes.

A third push toward wider implementation will come through multi-disciplinary interactions, such as a radiologist participating on tumour review boards. In these settings, the use of structured reporting is growing because, with the reports, the radiologist improves communication with other clinicians asking for specific confirmation on radiological finding.
Mobile X-ray around the globe

Since launching meX+ DR solutions in 2009 the imaging and X-ray solutions producer medical ECONET has installed the range internationally. Physicians in diverse areas and fields of expertise, medical crews on ships and oil-rigs, paramedics in military ambulances, as well as disaster relief forces in conflict areas, report satisfaction regarding the lightweight and flexible meX+ X-ray devices in their daily work, the manufacturer reports. ‘A highly beneficial factor is the user-friendly handling of the self-explanatory meX+ Image acquisition software, which contains a full integrated positioning guide and proposals for adequate dose values.’

With a specific focus on mobility and flexibility, medical ECONET explains its ‘supplies radiography solutions that are equipped with a worldwide unique hybrid-powered technology. This smart technology allows operation of the meX+ portable X-ray generators by the integrated battery, or by an external power supply, while charging the battery. These durable lithium-ion batteries can produce over 500 exposures, with only one full charge, and generate clean diagnostic images by high frequency technology.’

In addition, the firm’s range of wired and wireless digital radiography detectors come in three imaging sizes (10x12, 14x17, 17x17 inch) and can be provided as customised solutions for mobile, stationary and retrofit applications. ‘And,’ the company adds, ‘due to the equipped wireless file transfer and the Automatic Exposure Detection (AED), the user can work in a most comfortable way without any disturbing cables.’

ElastQ Imaging, real-time Shear wave elastography for definitive tissue stiffness data

PureWave transducer technology for exceptional liver imaging even on challenging patients

Contrast Enhanced Ultrasound for superb liver tissue flow analysis

Image Fusion and Navigation for fast clinical decisions and advanced treatment planning

Now EPIQ with Evolution 3.0 brings a suite of definitive features and capabilities that offer a comprehensive ultrasound solution for liver disease assessment, treatment planning and monitoring.

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Discover Evolution 3.0 at
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Age-appropriate disease? Doesn’t exist

What can we learn from population studies? According to Gabriel Krestin MD PhD there are things that we can un-learn, as well as learn, from population imaging studies.

The Chair of the department of radiology & nuclear medicine at Erasmus University Medical Centre, Krestin also leads the European Population Imaging Infrastructure (EPI2), an initiative of the Dutch Federation of University Medical Centres and Erasmus University. Population imaging is the large-scale application and analysis of medical images to find imaging biomarkers that enable the prediction and early diagnosis of diseases. The EPI2 coordinates data acquisition at diverse locations and times and is a flagship node of the Euro-Biomaging initiative, one of the large distributed life-sciences infrastructures on the European Strategy Roadmap. Pan-European participants include radiologists and research organisations from Austria, Finland, France, Germany, Norway, Sweden, and the United Kingdom.

At the Garmisch MR 2017 Symposium, held in January, Krestin focused on brain imaging in the Rotterdam Scan Study to challenge the widely held concept that there is an age-appropriate approach in medicine. There is no such thing, he stated during our EH interview, defying this largely accepted idea in what he acknowledges is a provocative talk.

“In the past the term “age-appropriate” has been used to relate a lot of alterations to the process of aging. The changes that we attributed to age are, in fact, caused by symptomatic and sometimes pre-clinical or asymptomatic disease. Aging is not a so-called normal process. There is no such thing as a normal aging of the brain. It is not normal that you lose or deteriorate in your brain function with age, that the brain becomes senile.

“What we see is the influence of many external factors, many risk factors, many related diseases, or perhaps of genetic predispositions. But it’s not necessarily the number of years you have lived that lead to these changes.

To population studies, when we started we were looking for very simple things, such as the different volumes of the brain across subjects of different ages. We were taught in medical school that, after adolescence, the number of neurons in the brain stays constant. But population studies have shown that this is not the case. The number of neurons decreases with age, and this decrease is more pronounced in certain brain regions, such as the hippocampus. This is a phenomenon that is not limited to the brain, but also occurs in other organs, such as the liver and the kidneys. The number of neutrons also decreases with age in the heart, which is why MR-conditional cardiac devices are important in elderly patients. These devices allow us to perform MRI scans without the risk of the device moving during the scan, which could lead to inaccurate results.

“The ProMRI Configurator is an online tool that enables physicians to select from a series of MRI requirements for a patient and subsequently generates a recommendation of all suitable MR-conditional cardiac devices and lead configurations available in a particular country, thus helping physicians to choose the most suitable MR-conditional cardiac systems for each patient.

Many of the firm’s implantable cardiac devices are not only MR-conditional but also take advantage of the company’s award-winning MRI Ambidetect functionality. Biotronik reports. ‘This feature allows a device’s built-in sensor to detect an MR environment automatically (within a programmable window of up to 14 days) and to switch the device to and from MRI mode for the duration of an MRI scan. This means that patients implanted with a cardiac device can receive optimal therapy for the maximum amount of time without requiring multiple visits to their physician for manual configuration for MRI scans.’

Its portfolio of MR-conditional devices and systems is extensive, so possible combinations for physicians include radiologists and research organisations from Austria, Finland, France, Germany, Norway, Sweden, and the United Kingdom.

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New system helps physicians to choose suitable devices

12-year population imaging study produces provocative insights

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Another process that we relate to age in the formation of white matter lesions. With some sequences in MRI we can identify those small, high-signal intensities, even if we don't know exactly the histopathology and pathophysiology of these lesions.

We assume that these white matter lesions are related to degeneration, and at the same time, we know that the number and the load of white matter lesions increase with age.

From population imaging studies we learned that white matter lesions are associated with a certain number of risk factors. For instance cardiovascular risk factors, like smoking, hypertension, or diabetes, lead to an increased white matter lesion load. And, finally, we also learned that these white matter lesions are also predictors of certain outcomes, of dementia, but also of stroke.

Still, all of this is only the tip of the iceberg. There's a lot more that we cannot see with our eyes that are under the water line. Let's say. Today we can measure with sensitive tools such as diffusion weighted MRI, the microstructural integrity or damage of the white matter. With these measures, what we find in longitudinal population studies is that even in the non-affected white matter, which appears to be completely normal on conventional MRI images, a change in these diffusion metrics appears long before the white matter lesion becomes visible – years later. On the other hand the microstructure of the white matter is linked to cognition, and damage is associated with impairment of cognition.

We have also done functional connectivity studies and we can see these white matter damages that we attributed to aging are quite extensive. Yet they have nothing to do with age. When we correct for all the risk factors, and a lot of other factors that can play a role, we see that there's not much remaining. Instead of a change with age these aging people are increasingly affected by other diseases or impairments related to cardiovascular risk factors, diabetes, decrease of brain perfusion or impaired microvasculature.

Again, my message is that what we relate to age is not, in fact, due to the so-called normal aging process but is part of a process that has to do with some disease pathophysiology.

The reason that assessment of such imaging alterations becomes important is that these measures are biomarkers that can predict certain outcomes. People who have damage to the microstructure of the white matter, or show a high level of atrophy, or white matter lesions, will have a higher risk to develop dementia or stroke.

Over the past fifty years we have increased life expectancy due to the fact that today we have a much better understanding of these risk factors and thus a better prevention, by decreasing the number of predisposing or external factors.

Gabriel P Krestin

Professor of Radiology and Nuclear Medicine, Department of Radiology, Erasmus MC University Medical Centre in Rotterdam, the Netherlands. A graduate of the University of Cologne, Germany, his residency in radiology was completed in 1988. He was later appointed radiologist and head of the MRI Centre in Zurich University Hospital, Switzerland, where he became associate professor of radiology and head of the clinical radiology service, before moving to his present position.

The human brain is decreasing with age. Yet, when we were looking at volumes of brain structures, measuring grey and white matter, what we saw was that, with increasing age, the grey matter is not changing in volume. It's the white matter that changes in volume. If we look deeper we find that it is not the grey matter that atrophies so much as the white matter.

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Over the past fifty years we have increased life expectancy due to the fact that today we have a much better understanding of these risk factors and thus a better prevention, by decreasing the number of predisposing or external factors.
When the organizers and have stood the test of time. ‘For techniques that might not be the newest, advanced, “somewhat-new” technologies, so they would look like equipment that was new, and what is truly new, but not generally available, to the very newest things,’ he pointed out.

The usefulness of the most readily available radiotracer, 18-FDG, to image brain tumours is limited, he said, because radiotracers based on glucose provide poor image contrast between the tumour and normal brain. Brain tumours and healthy brain tissue both avidly take up the glucose. ‘As a result you need to go to other novel formulations of radiotracers, which are very expensive and have very short half-lives,’ Kucharczyk explained. ‘These necessitate having a cyclotron.’ Similarly, hyper-polarised carbon species carry similar logistical and cost issues of requiring a very expensive carbon hyper-polariser, he added, but they do enable the radiologist to study carbon-based metabolites, such as pyruvate, through its biochemical pathways and potentially assess the effectiveness of therapeutic drugs. But very few people in the world devoted to developing and teaching magnetic resonance to doctors and scientists, and as previous Professor and Chair of the Department of Medical Imaging at the University of Toronto for sixteen years. He is a renowned veteran lecturer with a decades-long record of international lectures. The faculty’s proposed title for the talk was terse, yet ambitious: ‘Brain tumours: what is new?’ Among those attending his presentation, Kucharczyk had predicted that, while many would be interested in and aware of the very newest developments in neuroradiology, most practitioners would not have had access to such equipment and methods, so they would look for advanced, ‘somewhat-new’ techniques that might not be the newest, but are readily available, of proven value, and have stood the test of time. ‘For this reason, I divided the lecture into two, between readily available, useful methods, that may not be extremely new, and what is truly new, but not readily available, is also complicated to analyse, and thus not particularly useful to most radiologists today,’ he explained. ‘I hope both parts of the lecture were of interest to the audience – letting them know what all of them can do today and giving them a taste of what might be useful in the near future.’

After setting a context in reviewing the not-so-new, but well-proven techniques, Kucharczyk advanced into more recent developments in techniques that are sufficiently available for everyone to use, and which are useful for a variety of applications, including diffusion weighted imaging, astrocytosis, perfusion MRI, and MR spectroscopy. The very newest techniques are mostly performed in a research environment to investigate and help solve yet unsolved problems. But, they are not widely practiced because not every medical imaging centre has the hardware, software, cyclotron, combined MRI-PET scanner, carbon hyper-polariser, or specialised personnel to perform these techniques. ‘I don’t think we are there yet with all of the very newest things,’ he pointed out. The usefulness of the most readily available radiotracer, 18-FDG, to image brain tumours is limited, he said, because radiotracers based on glucose provide poor image contrast between the tumour and normal brain. Brain tumours and healthy brain tissue both avidly take up the glucose. ‘As a result you need to go to other novel formulations of radiotracers, which are very expensive and have very short half-lives,’ Kucharczyk explained. ‘These necessitate having a cyclotron.’

MobileDaRt Evolution MX7 series

Digital mobile X-ray systems equipped with a Flat Panel Detector (FPD) are used to examine patients during hospital rounds and for urgent cases in A&E and neonatal intensive care units (NICUs). Leading medical equipment manufacturer Shimadzu (www.shimadzu-medical.eu) reports that its new MobileDaRt Evolution MX7 digital mobile X-ray systems provide ultra-modern and extensive mobile digital radiographic (DR) system functionality. The MX7 series expands the level of support for medical personnel involved in mobile imaging work. The system includes new software functions, an extremely operator-friendly design, and a built-in large 17-inch LCD monitor that increases resolution and also provides better visibility and touch-panel operability.

Storage and more

Other new features include storage space for smaller items as well as grooves in the console top side-walls, to maintain stability while placing a cover over the FPD unit, for example. The MX7 still features the popular smooth and quiet drive system, the ‘all-in-one’ button to freely position the unit with a single button, and the ability to display images in about two seconds after exposure. Shimadzu adds, ‘These help operators to work quickly in typical healthcare environments.’

Trusted performance

The firm reports that, in a customer satisfaction survey by USA-based Research Firm KLAS, Shimadzu MobileDaRt Evolution was acknowledged as the 2016 ‘Category Leader’ in Digital X-ray Mobile. Thus, MobileDaRt Evolution can offer proven first-rate healthcare support. To date, Shimadzu has sold over 3,000 digital mobile X-ray systems worldwide. ‘With the steady growth of digitalisation in clinical environments, MobileDaRt is a globally well-known product appreciated by numerous customers in professional healthcare organisations,’ the manufacturer reports. ‘The 3,000+ units have been installed in more than 60 countries.’ The MX7 features, an integrated power management function Smart seCURE, which gives users a selection of choices to create the best system for their clinical needs. Based on superior communication between the main unit and DR system, this management function utilises the battery more effectively by minimising unnecessary power consumption. In addition to a start-up time of about one minute for the DR system, the system also includes other new features designed to meet the needs of healthcare providers, such as a combination of clinical feedback with highly advanced technologies to meet the highest operator requirements.
The team of the Neonatal Care Unit, Portsmouth Hospital NHS Trust with the
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Radiologists suffer burnout and gender inequality

In an exclusive interview with EH Correspondent Mélisande Rouger, Mauricio Castillo president of the American Roentgen Ray Society (ARRS), spoke about the impact of dissatisfaction and gender discrimination on radiology, with a focus of his Wilicom Konrad Roentgen Lecturer Lecture at ECR 2017.

**Burnout, dissatisfaction and gender inequality are recognised phenomena among physicians, and recent studies reveal they increasingly affect radiologists. ‘We’re hurting in these aspects,’ confirmed Dr Mauricio Castillo, Professor and head of neuroradiology at University at North Carolina, in Chapel Hill, USA.**

Radiologists are among the most exhausted physicians in the USA. In 2011 they earned more than any other specialty and ranked sixth in 2015. ‘We earn more than in 2011, but our salaries have not increased at the rate of other specialties. But we still do very well,’ Castillo argued.

However, only around 50% of radiologists felt fairly compensated and satisfied with their career choices, according to a study conducted among almost 20,000 physicians registered on DOTmed.

**‘I was surprised. But burnout has become even more unpopular among baby boomers retiring in large numbers,’ Castillo observed. In 2013-14, radiology was not even in the top 10 in terms of salary among line medicine applicants, students and residents, according to the Association of American Medical Colleges (AAMC). The unattractive, poor life/work balance experienced in radiology is possibly one of the main reasons why women disregard radiology as a career choice, he suggested; but gender inequality in salary and career advancement may not be far behind.**

Studies in this field show that women in medicine make an average 25-35% less than men for an equal position, and the number of women becoming full professors in medicine is small compared to the number of men. 58% of a medical faculty are men, and only 21% are full professors and 16% are deans, according to the AAMC.

The USA has done the most research on this topic, but the problem is also very much present in Europe and probably the rest of the world, and it should receive more attention from everyone, Castillo believes. In Western Europe and Scandinavian countries the question of gender inequality seems a little less obvious than in the USA. However, when you speak to women in Europe they feel that their inequality of gender is a matter of respect, free time, advancement within the career and between salaries, so this has become an issue there, too.*

* ECR 2017: 1-5 March. Vienna, Austria * ARRS Annual Meeting: 5 April – 5 May. New Orleans, USA.
Trusted cable systems

Ever more imaging devices are characterised by very extensive movement sequences while simultaneously being compact. Both device manufacturers and suppliers must consider mounting dynamic requirements when developing their products and ensure their long-term system integrity.

Furthermore, antimicrobial products are of interest not only for minimally invasive or invasive applications because of the increasingly discussed risk of nosocomial infections, but can also close unwanted gaps in the hygiene chain of medical devices. Systems supplier Leoni reports that it supports customers ‘...as early as the development phase of their medical devices with cable routing, specification, design and manufacture of complex cable systems and ready-to-install subsystems. These solutions for imaging processes decrease installation time while supporting the device properties in providing maximum patient safety, excellent image quality and long-lasting dynamic operation.

Incorporated components conform to either national or international standards, the firm adds, with proven reliability in numerous tests. Leoni adds that the firm itself executes verification and documentation in standard and increasingly complex customised testing procedures as an add-on service for its customers.

In addition to transferring a growing bandwidth, cables and cable systems for imaging devices nowadays must cope with an increasing range of movement. ‘Devices are becoming more mobile; horizontally, vertically and orbitally,’ Leoni points out. ‘Cable breakage and consequently required service calls are as unwanted as ever. The best preparation for durable wiring is optimum routing, as well as the corresponding specification of individual components and the whole system. Involving a solution provider like Leoni in the development phase of an X-ray machine can minimise the interference on the wiring at an early stage.’ As a systems provider, the firm reports that it scrutinises the long-term manoeuvrability of its solutions in extensive tests. ‘Alongside using standard set-ups in compliance with national and international standards (such as UL), Leoni will, on customer request, simulate non-standard movement sequences with prototypes or device models designed in-house. A Leoni add-on-service – basic or complex test set-ups can be established in 2-D or 3-D, and individual components can be rapidly produced by means of 3-D printing. Leoni is thereby able to document and verify the system integrity of its solutions when subjected to customised movement sequences in long-term tests.’

Antimicrobial cables and systems can help to enhance the hygiene of imaging procedures and patient safety. The integration of only a small quantity of a metal oxide to the sheath material significantly reduces contamination to >99.99% on the surface. Similar to the skin’s protective shield of acids, germs, bacteria, viruses and fungi are killed at a pH level of <4. ‘During normal handling (involving contact with sweat and protein), the antimicrobial effect is retained well, throughout a range of times and concentrations,’ Leoni continues. ‘This is an important difference compared to conventional methods using silver or copper.’

A basic principle for wiring is to route hardwearing cables close to the motion sequence. Thorough system solutions for dynamically durable wiring of imaging devices can involve drag chain structures, abrasion-proof bulkhead receptacles, cable reservoir modules or spring return systems to give plastic surfaces an antimicrobial effect, Leoni adds a metal oxide to the polymer during the extrusion or moulding process, which then lowers the pH level on the surface as a result of escaping acid ions.

ENVISION MORE
New Waves in Ultrasound Innovation.

Mindray’s unique patented Zone Sonography Technology Plus (ZST®) is now presenting to you the future of ultrasound imaging. Overcoming many limitations of traditional, digital beamformer process, the ZST® is set to bring the ultrasound image quality to a higher level.
Delivering a new dimension to vascular imaging

Mark Stribling is President and CEO of iVu Imaging Corporation. Stribling introduced an innovative approach with Sofia and set up his own start-up company in Texas. Partnering with Hitachi Ltd. in Tokyo, Japan, Stribling could take Sofia to the next level.

Combining Hitachi’s high-end ARIETTA ultrasound with iVu Imaging has resulted in the Sofia 3-D whole breast ultrasound system. ‘By consistently finding cancers of five millimetres to one centimetre early enough, we are likely to find they are localised to the breast and pre-metastatic,’ explained Mark Stribling, CEO of iVu Imaging Corporation. That’s the goal, to find these occult cancers by surveying the (dense) breast quickly.

It is understood that women with dense breast tissue face a four to six times greater risk of developing breast and pre-metastatic, explained Mark Stribling, CEO of iVu Imaging Corporation. ‘That’s the goal, to find these occult cancers by surveying the (dense) breast quickly.

Following the latest development steps, Sofia now also can be operated in conjunction with Hitachi’s premium performance Arietta platforms. ‘The Arietta platform is the game-changing breakthrough for 3-D whole-breast ultrasound,’ Stribling pointed out. ‘Hitachi ultrasound now enables the Sofia system to scan eight times faster than our first configuration, while at the same time tripling the resolution.’

A full bilateral exam requires just 10 minutes from the moment a patient enters the exam room until she leaves. As a result, clinics equipped with Sofia can schedule more patients for supplemental imaging per day requiring no additional economic and logistic challenges associated with whole-breast ultrasound by using a fully field-radial scanning method, the firm reports. The resulting throughput, efficiency, and patient comfort make Sofia an ideal solution for women with dense breasts.

Sofia also offers women the most comfortable of any breast exam experience, the firm points out. They lie on a padded table and, unlike suffering the breast compression involved in other devices, the breast is positioned in a recessed cone in the table and then, in a single automated radial sweep of only 30-seconds, a full image is acquired. ‘We can present a single breast image at the pixel level, improving intelligibility and, oblique views if desired,’ Stribling said. ‘The result is an average-time of about one minute per breast.’

The 900 images Sofia captures are reconstructed into a 3-D volume that looks more like an MRI image than a conventional ultrasound image, yet with the anatomical detail that ultrasound can provide. ‘This view gives clinicians the ability to review the exam like a breast tomosynthesis or MRI image that they are familiar with. In fact, all our customers who use MRI for supplemental dense breast exams also use Sofia for a second look to confirm findings, because of the number of false positives in MRI images,’ he added.

The automated acquisition also assures consistent and reproducible results, thereby eliminating the user-dependency of manual breast exams using traditional ultrasound. Because the Sofia is powered by the Hitachi Arietta platform premium ultrasound system, it comes equipped with a host of powerful imaging capabilities. Arietta family’s Sympathetic Technology optimises data fidelity along the entire signal handling chain, from transducer to display monitor, the company point out. The system also dynamically focuses at the pixel level, improving resolution and image uniformity. ‘Anything Arietta is capable of doing, the examining clinician can do with Sofia,’ explained Stribling, who added that Hitachi engineers are already working with iVu Imaging to bring an innovative capa­bility to Sofia with automated eFlow Doppler scanning and mapping in 3-D.

Hitachi’s eFlow can depict very specific intra-­nodular vascularity so that we will not only see abnormal anatomical structures but with the push of a button can provide functional information showing any abnormal vascularity, such as angiogenesis,’ Stribling said. ‘This new functionality is not very far away.

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WHAT IS V-FLOW?

Mindray’s new ultrasound system, Recon7, delivers a technology that dynamically visualises blood flow. Called V-Flow, it displays the fluidity with dynamic arrows indicating the flow process, rather than a series of static images, with both the magnitude and direction of the flow measurable at any point in the vessel, avoiding the inconvenience of angiography.

The platform uses an extremely high frequency yet remains flexible due to the availability of arbitrary beamforming methods. Consequently, multiple image lines are obtained after a single transmission. Continuous Doppler transmission can

Speed up the process

Yet supplemental ultrasound exams performed manually to detect hidden cancers are time-consuming, and a good outcome for a woman depends heavily on the experience of the operator handling the probe. To solve these clinical challenges, Stribling introduced an innovative approach with Sofia, an examination table that automates the examination and speeds up the process developed in Texas through his start-up company, iVu Imaging Corporation.

Partnering with Hitachi Ltd. in Tokyo, Japan, Stribling could take Sofia to the next level. In September 2016 he introduced 3-D radial acquisition of whole breast images using a long linear transducer (92mm width), which was then linked to the Hitachi’s Noblus’ ultrasound system.
The greatest impact, he believes, will be in stroke intervention due to evidence suggesting that emboli (elements of thrombus or atherosclerotic material discharged from the plaque and blocking arteries in the brain) are more important in the causation of stroke than stenosis. ‘We’ve found that the volume of plaque is a very important association with stroke symptoms,’ he said. ‘If the risk of stroke is over 5% then, to detect people with carotid plaques, population screening becomes worthwhile. We can use the Resona 7 tomographic ultrasound solution to measure the volume of the plaque.

Resona 7 incorporates a novel ultrasound-based technology called V-Flow which can visualise blood flow and, rather than a series of static images, the fluidity will be displayed with dynamic arrows indicating the flow process. McCollum said it is particularly suited to this latest research, especially with high quality images and Mindray’s flexibility in responding to clinicians’ needs in developing the equipment and associated techniques.

In addition, with IVS performing more than 80,000 vascular ultrasound investigations a year, there is demand for robust and reliable equipment to achieve such high volume.

‘It needs to have excellent image quality and a very good user interface; that’s why we chose Mindray. Resona 7, explained Steven Rogers, an academic clinician with IVS. Pier Imaging provides the tomographic ultrasound device that couples to the Resona 7 to produce the tomographic ultrasound images.’

There are four key research areas the team aims to advance tomographic ultrasound use in the vascular surgical market in addition to aortic aneurysms: carotid plaque volume for plaque vulnerability in the prevention of stroke; arteriovenous fistula for haemodialysis access; vein mapping for cardiac and vascular bypass; tomographic ultrasound angiography to produce angiogram-like images for planning peripheral arterial disease surgery.

For certain aspects at present, previous ultrasound was not good enough to make a surgical decision, which means surgeons have to rely on traditional forms of angiography, whether CT, MR or catheter angiography. ‘Finding an imaging modality that allows us to make surgical decisions, that does not involve radiation and nephrotoxic contrast media, is of the utmost importance to the European market and would save the European economic area a significant amount of money each year.’

‘That’s what we are trying to achieve with the Resona 7 tomographic ultrasound solution. Effectively, it will use both devices to replace angiography as the next step in vascular surgical planning. Being able to view the vascular system in the 3-D, he pointed out, opens up new ways of measuring, monitoring and assessing a range of diseases.”

Steven Rogers is an academic clinician, providing clinical vascular scientist and research associate, his research interests include 3-D ultrasound within vascular surgery, focus on carotid disease, aortic aneurysms, peripheral arterial disease and venous disease. At the Vascular Societies’ Annual Scientific Meeting 2016, Rogers was awarded the Ann Donald Scientist of the Year Award and a prize for Best Presented Paper for his presentation on Tomographic 3-D Ultrasound on peripheral arterial disease.

“Way forward: 3-D tomographic flow imaging (CFM). Compared to conventional ultrasound colour different types of flow in the carotid artery, new method gives much more detail with more angles. This is supported by innovative regression analysis of two angles is applied giving a true velocity with accurate direction calculated via angle-compounding technology, avoiding a transient state, enabling medical personnel to have confidence in when making surgical decisions.”
ECR significantly expands radiographers program

Report: Sylvia Schulz

The job title radiographer has a firm place in many European and non-European countries. The academic training reflects the complex range of responsibilities the role entails. Michaela Rosenblattl M.Ed, who heads the radiology degree course program at the University of Applied Sciences in Wiener Neustadt, Vienna, reports on the Austrian situation. As president of the Austrian Society of Radiological Technologists (trasustria), a founder member of the European Federation of Radiographer Societies (EFRS), also presents a European perspective.

Since 1960, Austrian training for this profession has been open to all students to have passed their Matura (equivalent to A-levels), Rosenblattl explains. In those days, training centres were mostly affiliated to hospitals. The Bologna Process, a pan-European harmonisation of degree courses and degrees and trans-national academic reform, aiming to achieve international mobility for students, accelerated further developments. In 2004 the title ‘radiographer’ was officially introduced (in Austria) and, in 2005, training was integrated into the universities for applied sciences. The degree course is now available at seven of these universities across Austria.

Radiology department assistants can perform less challenging radiological tasks, requiring fewer qualifications. They work closely with radiographers and are only allowed to carry out certain procedures, such as bone density measurements and mammograms. Radiographers are on a level with doctors. Doctors can avail themselves of our competencies when required,’ Rosenblattl says. The Law on Higher Medical Technical Services (MTHS) governs the profession; doctors are regulated by Medical Law.

Accordingly, radiographers in Austria have extensive competencies. Since 2004 they have been entitled to administer contrast media and, since 2012 they have also been able to administer radiopharmaceuticals. ‘Dosage calculation has always been part of our duties. The application is obviously always carried out in agreement with doctors, with the degree of risk governing the intensity of this cooperation. It is important that doctors are available in case of any incidents,’ explains Rosenblattl.

What’s best for a radiographer: the clinic or industry?

Report: Marcel Rasch

What is the best role for a radiographer? To work in a hospital or industry?

‘It’s a daily challenge,’ he confirms. In the ECR’s Rising Star Session he describes ‘Working in the industry’. Earlier, he outlined his experiences for European Hospital.

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You can’t compare an apple with an orange

Usually radiographers work in a clinical environment, are specialised in CT, MR or ultrasound and take care of patients and their treatment. Not so Patrick Doherty, Siemens Healthcare Regional Business Manager, Dublin undergraduate who worked in a University Hospital for five years before switching to work within the healthcare industry. Conclusion? ‘It’s a daily challenge,’ he confirms. In the ECR’s Rising Star Session he describes ‘Working in the industry’. Earlier, he outlined his experiences for European Hospital.

Europe, Siemens Healthcare Regional Business Manager Patrick Doherty pointed out that, for a start, countries use a different term for radiographers – e.g. radiological technicians. In European countries the educational approach for radiographers and radiological technicians differ very considerably,’ he added. ‘There appears to be no established standard yet and indeed it seems to be difficult to agree on an educational standard. ‘I did my undergraduate degree in Dublin – on a four-year undergraduate degree program – the only one in Ireland for diagnostic radiography. In the United Kingdom there is a three-year undergraduate program, but this can vary based on content. And in other countries, such as the USA, where they call radiological technicians MTAs, one undergoes an educational diploma in a particular area of a radiological department, for example general X-ray scanning, and this is what they do after examination, all day, every day – general X-ray scanning.

‘I didn’t understand why things should be so difficult in Germany all countries,’ she observes. In many non-European countries, including Australia, training is also organised on an academic basis. ‘And the situation in Nigeria, with an entire institute being managed by a radiographer.’

The academic organisations also offer its own programs to promote further training. ‘More importantly, an exchange across national borders is possible.’ Rosenblattl pointed out that, for a start, countries use a different term for radiographers – e.g. radiological technicians. ‘In the United Kingdom there is a three-year undergraduate program, but this can vary based on content. And in other countries, such as the USA, where they call radiological technicians MTAs, one undergoes an educational diploma in a particular area of a radiological department, for example general X-ray scanning, and this is what they do after examination, all day, every day – general X-ray scanning.

Training for radiographers is academically based in almost all European countries. Rosenblattl points out. Only Germany and Spain lag behind, with the latter now amend it. ‘I don’t understand why things should be so difficult in Germany all countries,’ she observes. In many non-European countries, including Australia, training is also organised on an academic basis. ‘And the situation in Nigeria, with an entire institute being managed by a radiographer.’

The academic organisations also offer its own programs to promote further training. ‘More importantly, an exchange across national borders is possible.’

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EUROPEAN HOSPITAL Vol 26 Issue 1/17
The role of a radiographer assistant

Michaela Rosenblatt M.Ed heads the radiology degree course program at the University of Applied Sciences in Wiener Neustadt, Vienna, and is president of the Austrian Society of Radiological Technologists (Stamm).

Welcome. As mentioned, Austria is a founder member of the European Federation of Radiographer Societies (EFRS). The EFRS represents more than 100,000 radiographers in member organisations across Europe and supports the ECR, which hosts the Educational Wing Annual Meeting with an integrated program for students of radiography. The ECR is important for exchange amongst our members,” Rosenblatt points out. “We are pleased that the program for radiographers has been significantly expanded this year.

Breath in. Hold your breath. Then we press the button – the times when this brief summation could be made about a radiography department assistant’s (RDA) work are long gone. As an imaging support worker, the radiology assistant helps qualified radiographers with procedures such as biopsies, and also performs clerical tasks, such as handling appointments.

With rapid technological and innovative advances in radiology, plus transformation of the field, this assisting role has developed increasing importance and is now an essential part of the smooth operation of radiology, nuclear medicine, radiotherapy and medical physics. Responsibilities in radiology are manifold, needing a multi-talented approach.

An RDA’s tasks fall into three main areas: Financial management and examination. They manage patients from admission to discharge, acting as a constant contact for reassurance and information during radiology department visits, as well as transcribing between wards and departments.

Radiology assistants also help to maintain image processing systems and equipment and report on faulty equipment. They assist the radiographer in logistics, such as the management of materials needed for the radiological process. Some have a huge degree of responsibility being, for example, authorised to order materials costing as much as a luxury car.

An RDA also needs concentration and precision to help perform the rising numbers of complex examinations and interventional procedures. Incorrect or improperly processed images lead to wrong diagnoses, or more work if the formatting must be redone – losing time and costing more. In other words, the quality of a radiography assistant’s work can underpin fast, precise diagnosis.

Last but not least, good teamwork is a vital prerequisite for any successful radiography assistant, by relating well with radiology department colleagues, physicians, nurses, auxiliaries, porters and all others involved in patients’ welfare.

Patricia Doherty is Regional Business Manager Western Europe and Africa at the Advanced Radiology department at Siemens Healthineers in Forchheim, Germany. She gained her radiography undergraduate and master’s degree at University of Dublin School of Medicine, Ireland.

It is trying to do for our patients to make medical decisions faster, easier and more informed. Having been on the clinical side I can appreciate quicker what already has been achieved by the industry. You cannot compare the clinical to the industrial environment. This is like comparing an apple with an orange.

“My personal message about the advantages and disadvantages of working in the industry is a very realistic one: There exists a perception in the clinical environment that people in industry have a good life, because they may receive benefits like a company car, bonuses, and the company supports you very well. Yes, that’s right. However, the industry is, in fact, a tough environment; it’s challenging. For example you might not have to work a night on call but the working days are typically longer than those in the clinical world.

‘The step to change from a clinical environment to industry should not be undertaken just because you want a company car. It sounds great to travel the world, go to conferences and events, but those are elements of the job that you can have. But, I would encourage the thinking that these are the primary benefits of working in the industry.

‘There is a high application rate of clinical based people who want to go into industry, with the majority staying in their original position for only about three years, before they either return to the clinical environment or move within the company. That’s what I have seen personally.”

The responsible for the EFRS Educational Wing Annual Meeting is Michaela Rosenblatt M.Ed. For further information, please contact Michaela Rosenblatt M.Ed at mrosenblatt@efs-radiographers.org.

Save the date

8th EFRS Educational Wing Annual Meeting & the seminar “Educational Developments in Radiography” on Wednesday 1st March

EFRS radiography student meeting “The future is in our hands: stay involved, make a difference” on Thursday 2nd March

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Radiographer calls for increased cooperation with radiologists

By Millisande Rouger

The increased demand for imaging studies and medical shortages have put strain on radiology services while technological advances enabled other medical disciplines to perform their own imaging examinations. To hold their ground, radiologists and radiographers must work together and develop common strategies, an expert will argue during a dedicated professional challenges session organized by the European Federation of Radiographers Societies (EFRS) and the European Society of Radiology (ESR) at ECR 2017.

Workforce shortages, workload increase, workplace changes, new technologies and budget challenges put quality of medical imaging and radiology at risk,” Dr. Graciano Paulo, professor of Medical Imaging & Radiotherapy at Coimbra Health School in Portugal, said.

Assessing opportunities and challenges facing radiography and radiology has become mandatory because medical imaging is being taken over by other specialists, Paulo, co-founder of the EFRS, explained.

“While the number of medical imaging procedures has increased sharply over the past fifteen years, there is evidence of a shortage in the number of radiologists and radiographers. This can only mean that the imaging procedures are being fragmented and slowly being taken over by others. Cardiologists, orthopaedists and many other specialists now perform their own interventional procedures and imaging investigations. Technology is becoming more available, smaller and easier to use so the boundaries of the profession are disappearing,” he said.

Many experts agree that radiologists need to have more contact with patients and within the clinical team to secure their position.

One solution would be to delegate part of their workload to radiographers, Paulo suggested.

“Training an advanced-practice radiographer to work in close cooperation with a radiologist would enhance patient care and increase the visibility of the radiologist. The radiologist would have more time to do clinical work and interact with patients and his peers instead of sitting behind his/her screen filling reports,” he told.

In some countries like the UK, where the number exams is increasing every year, radiographers already fill in the imaging report for plain abdominal imaging and work in cooperation with the radiologist.

“The radiographer has a special position in the imaging process and this role could benefit both the patient and the radiologist, according to Paulo.

“The radiographers are gatekeepers to radiological equipment and mediate between patients, patients and radiologists. Allowing and improving skill mix and joint procedures between radiologists and radiographers can give the radiologist more time to do clinical work and meet the patient,” he said.

Radiology, an increasingly desertified specialty, would become more approachable; similarly, young people would decide to become radiographers if training included disease knowledge, Paulo believes.

“If we manage to bring the two professions closer, we could develop a new paradigm in the way we provide service to the patient, this will go beyond them, in both cases, not only two years. Almost everywhere else, radiographers must train four years (240 ECTS). Many Spanish radiographers are actually training in Portugal to have their skills recognised internationally. So we are currently working on convincing the Spanish government of the necessity of training radiographers more appropriately,” he said.

Besides, imaging services need to use a common coding system across Europe to make sure they are comparing the same type of data, regardless of the country or institution. Departments should also adopt workflow performance metrics, clinical indicators and organisational protocols, audit and accreditation systems, Paulo recommended.

Pivotal role in patient care for radiographers

By Mark Nicholls

Delivering consistent levels of education and training throughout Europe remains an important challenge as radiographers play an increasingly pivotal role in patient care and patient safety.

As the European Congress of Radiology in Vienna prepares to hold a record number of sessions for radiographers, including many focused on the evolving roles of radiographers, Dr Jonathan McNulty, vice-president of the European Federation of Radiographer Societies (EFRS), believes that delivering Europe-wide levels of education, qualification and training for radiographers is critical in raising standards of care, diagnostics, therapeutics and patient safety.

Acknowledged that, whilst radiographers in Europe are generally well educated, and often trained to masters or doctoral level, access to bachelor degree level training in some countries is still limited.

In Europe, the quality of imaging services is generally good, however, there are some discrepancies so far, and the EFRS is working closely with the European Union to try to work with radiographers, national societies and education institutions to enhance the education and training of radiographers,” McNulty added.

On the other hand, ECR 2017 has a strong education and scientific program for radiographers, including a number of sessions delivered with partner organisations and, this year, ECR is recognised as the official congress for the EFRS for medical imaging.

There are sessions looking at professional challenges, patient safety and courses across all specialities areas of radiography.

McNulty, from the School of Medicine at University College Dublin, also stressed the importance of using the skills of radiographers to their full potential. There remain issues in countries around Europe where the knowledge and skills of radiographers are not used to their full potential.

“While radiographers have the knowledge and the ability in some nations, in others their role has advanced significantly with the introduction of new technology. It is important to recognize the experience and responsibility with some working as advanced practitioners or the equivalent of consultant radiographers,” he continued, but there’s a very good evidence base showing that when radiographers are used more effectively when challenged and allowed to take more advanced roles - there can be improved patient outcomes as well, so there is a big benefit to the patient from better utilising the workforce across Europe.

The European Society of Radiology and EFRS have a Memorandum of Understanding as a blueprint for greater cooperation between ACR and the EFRS. Doctors are playing these ever greater roles in radiology services.

Radiographers are a key part in the jigsaw, which makes for a modern state-of-the-art diagnostic and therapeutic service being provided by radiology departments,” he said.

“It is essential that radiographers are the experts in terms of the technology that is at the heart of a modern radiology department and radiographers have the key role to play in optimising the use of that technology.

An equally essential role - that people can often overlook - is that radiographers work closely with their patients. They interact with them on a daily basis and have an important role to play in patient care and patient safety in a modern imaging department.

“it is an imaging modality using ionising radiation, they make sure the radiation dose to the patient is minimised. From being seen as a technical skill, they are seen as the experts in that area who can really get the most out of the technology and they have an important role in patient care, patient management and in a safe way as well.”

What is also important, he added, is that radiographers - whether diagnostic or therapeutic radiographers - must work to raise the profile, the identity and profile of their profession among the public and other members of the health service.”

Graciano Paulo is a full time professor of medical imaging & radiotherapy and vice president of IPC-Escola Superior de Tecnologia de Saúde in Coimbra, Portugal. He is a co-founder and past president of the European Federation of Radiographers Societies (EFRS). Dr Paulo has a bachelor’s degree in radiology, a master’s degree in health economics, and a PhD in health sciences. His main area of research is radiation protection.

“With these pillars, we would be able to increase the visibility and recognition of radiology in health-care systems. But we can only do this together in Europe,” he said.

In the end, the future of medical imaging will depend on both professionals’ capability of working as a team, based on roles and responsibilities, bearing in mind that the patient should be always in the center of the process, with a holistic approach, he added.

“We should be proactive in finding a way to enable to be reactive, at that point, it will be too late.’

Dr Jonathan McNulty is an Assistant Professor and Head of Subject, Radiography, in the School of Medicine, University College Dublin, Ireland where he oversees the BSc Radiography programme along with over 20 postgraduate programmes and as a University Fellow in Teaching and Academic Development, he has led University-wide educational projects, both internally and externally.

He is currently sitting on the Board of the European Federation of Radiographer Societies (EFRS) and currently chairs the EFRS. McNulty has delivered more than 100 conference presentations and contributed to over 50 journal articles, he has held significant national and international research grants. His research interests include medical and healthcare education, optimisation and benefit-risk communication, neuroimaging and image perception.

McNulty said a team approach and closer collaboration with other health professionals remained important in terms of achieving patient safety and the best clinical outcomes. McNulty is presenting a session, looking at the challenges in education and training and implementing the theory of patient safety in imaging.

He said a challenge lay in achieving agreement on the scope of practice between the two professions.

‘A message I’d like to get across at ECR is to make people reflect on what we are actually doing in our educational programmes, in clinical practice, and to identify patient safety-related deficits which may exist and what steps we might be able to take to try and address some of those areas.”
Facing up to many new challenges

Medical laboratories must be pro-active in how they are to meet the new challenges being presented to the sector, according to Dr William Morice from the renowned Mayo Clinic in America.

Report: Mark Nichols

With clinical laboratory medicine providers facing a number of challenges across various health systems and countries, Morice offered a USA perspective from his role as Professor and Chair of the Department of Laboratory Medicine and Pathology at the Mayo Clinic and Rochester, USA, and President of Mayo Medical Laboratories.

In his presentation – Leadership challenges for laboratory medicine – delivered during the Frontiers in Laboratory Medicine conference FILM 2017, held in Birmingham, UK, he suggested laboratories need to reach out to partners, offering their knowledge to a wider sphere and also seek to exert influence if they are to take a leadership, rather than a ‘back-office’, role.

He was speaking as clinical laboratory medicine service providers face ‘intermingled with challenging’ times ahead, against a backdrop of rising demand, falling reimbursement, technological innovation, enhanced quality and governance, and the need to recruit and retain a skilled workforce.

He looked at how the changing USA’s healthcare environment was impacting on the Mayo Clinic and Mayo Medical Laboratories.

Laboratories have seen rapid growth, but there have been utilisation issues, a drive to reduce spending and then a need to look at the consolidation of lab activity in the United States.

For example, laboratories loom with the FDA proposing a ‘risk-based’ classification system for laboratory-developed tests and the as yet unknown changes that might arrive under the new very Presidency of Donald Trump.

Morice told delegates that, within the laboratory medicine sector globally, they are to meet the new challenges being presented to the sector, according to Dr William Morice from the renowned Mayo Clinic in America. (continued on page 24)
the blood are easy to obtain, and tumour cells (CTC) or circulating Liquid biopsy samples of circulating such as the brain or the lungs, are patient. Moreover, certain regions, albeit it has a major drawback: sue biopsy is the gold standard, diagnostic procedure available for the potential of liquid biopsy and make this are required to exploit the potential of liquid biopsy and make this procedure diagnostic for oncology.

In current cancer diagnostics tissue biopsy is the gold standard, albeit it has a major drawback: invasive sampling is risky for the patient. Moreover, certain regions, such as the brain or the lungs, are difficult to access with a biopsy needle and the interventions cannot easily and immediately be repeated. Liquid biopsy samples of circulating tumour cells (CTC) or circulating cell-free tumour DNA (cfDNA) in the blood are easy to obtain, and after thorough validation, can complement the invasive tissue biopsy.

Professor Pantel explains the hopes and objectives associated with liquid biopsy: "In oncology, our major aim is to detect a tumour as early as possible since early detection immensely increases the chances to cure the cancer. What we envision in fact is screening every person from the age of 40 for all major tumour types in order to be able to react quickly. Furthermore we are interested in issues such as cancer progression and the development of metastases."

For Professor Pantel's oncology team, as for research teams in many other clinical disciplines, therapy monitoring plays a crucial role. Cancer therapies are stressful for the patient and incredibly expensive; patients as well as the health-care system would benefit from discontinuing unsuccessful treatments. Research on therapeutic response includes the precise identification of the target groups for certain therapies and aims to obtain insights into resistance mechanisms – where and in which patients do they develop?

In view of these objectives R&D today is looking for liquid biopsy tests with a broad range of applications. As the generation tests are commercially available and are being used successfully but Professor Pantel warns against exaggerated optimism. He is sure it will take a while before the "ideal" blood test is found. "We have to aim for particularly high specificity because the older we get the more mutations our cells develop. Most of them are entirely harmless and won't lead to cancer, even when they are found on tumour cells. False-positives are especially vicious as they mean we see indications of cancer cells where there is no reason for concern. At the same time certain tumour types cannot yet be identified with the minute precision we find."

Professor Kriegsmann focused his presentation on cell-free tumour DNA (cfDNA). The concentration of cfDNA in cell fragments is increased in the presence of certain diseases, including certain types of some cancer. Thus, cfDNA is used as a diagnostic biomarker.

Tumour composition is heterogeneous: This is why a standard tissue biopsy cannot detect aggressive tumour clones. Liquid biopsy finds DNA molecules of the entire tumour. It might thus be a valuable complement of tissue biopsies. cfDNA also provides important information in prenatal diagnostics, in transplant medicine and with regard to autoimmune diseases.

Today, says Professor Kriegsmann, NGS has become part of the standard workflow in mutation analyses. The MassARRAY technology, however, is a sensitive and cost-effective alternative to NGS in comprehensive and clinically relevant mutations. With its high sensitivity, robustness and a quick availability of this method, it is easy to perform and requires little "hands-on time" compared to NGS.

At the seminar, Professor Kriegsmann presented his impressive images to illustrate the progress that has been achieved in the field. But he also addressed the problems and limitations of liquid biopsy; for example when "false readings" can happen. Promising studies demonstrated the ability of liquid biopsy to quickly and reliably detect resistance mutations in lung cancer. Liquid biopsy further provides sensitive and fast analysis of KRAS and BRAF mutations which in turn allows the design of individualized therapies for patients with colorectal cancer.

"The availability of a new and highly sensitive DNA analysis method enables oncology researchers to chart entirely new analytics territory. Liquid biopsy, particularly with the so-called detect cfDNA, shows immense potential to complement the diagnosis of primary tumours. Today there is no standardised comprehensive quality management that covers all steps from sampling to sample processing and reading the results – which is an essential component of all analytic methods used for diagnostic purposes. Due to the easy availability of blood and the automation potential of the analyzers, liquid biopsy can be a valuable complement to standardized histopathology methods – it is a highly sensitive and fast method, particularly in view of the fact that no tissue samples need to be obtained." Professor Kriegsmann concluded.

**Circulating biomarkers - the great white hope of liquid biopsy**

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**Professor Jörg Kriegsmann**

MD. phil. a specialist in Pathology, is co-founder and head of the Medical Supply Centre for Histology, Cytology and Molecular Diagnostics in Trier, co-founder and partner of the cross-regional professional association for histology, cytology and molecular diagnostics in Trier, Düren and Düsseldorf.

**About six years ago, liquid biopsy appeared on the diagnostic lab stage. Last December, a seminar organized by the Institute of Tumour Biology at University Hospital in Frankfurt, Germany, was set to explore the enormous potential of this new healthcare method. European Hospital talked about the promise of liquid biopsy – and about its risks – with Professor Dr Klaus Pantel, Director of the Institute of Tumour Biology at University Hospital Hamburg-Eppendorf, a pioneer in liquid biopsy, and Professor Dr Jörg Kriegsmann, Medical Director at the Medical Service Center for Histology, Cytology and Molecular Diagnostics, Trier, Germany.**

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Ascertaining the value of microRNA

Michael Krassnitzer reports on a new approach in molecular diagnostics introduced during the IASLC World Conference in Vienna

‘Molecular diagnostics is the basis of increasingly individualised and therefore more effective treatment for lung cancer,’ explained Professor Robert Piker MD, President of the 17th World Conference in December organised by the International Association for the Study of Lung Cancer IASLC.

One of the objectives of molecular diagnostics is to detect certain mutations in tumor DNA, which can be used to predict whether particular treatments will be successful. A study presented at the conference demonstrated that the analysis of DNA is not the only procedure that molecular diagnostics needs to rely on. In the case of pleural mesothelioma, a rare but dangerous type of cancer, microRNA can be used to help select the best treatment strategies. MicroRNAs are small molecules of genetic material that serve as important regulation mechanisms for gene activity, specifically for switching genes off. Swiss and Australian researchers have succeeded in the development of a score based on six microRNAs that could be used as a decision aid in the treatment of mesothelioma.

Pleural mesothelioma develops in the layers of tissue that wrap the lungs. Among patients, there is one group with a markedly longer survival rate than others. Dr. Michaela B. Kirschner, at the Department of Thoracic Surgery, University Hospital Zurich and colleagues at the Asbestos Diseases Research Institute, in Sydney, have introduced the miR-Score, a prognosis marker for mesothelioma that can be used to identify these patients.

The researchers examined and analysed the miR-Score of pleural mesothelioma patients prior to, and after chemotherapy, using tissue samples obtained either for the purpose of diagnosis or during tumour surgery – i.e. radical removal of the pleura, lung, pericardium and parts of the diaphragm. Radical tumour surgery can increase the rate of survival, with induction chemotherapy aimed at reducing the tumour burden prior to surgery. The miR-Score was determined under these conditions through examination of the microRNA from 34 tissue samples obtained during diagnostic examinations (i.e. prior to chemotherapy) and 34 tissue samples obtained during surgery – i.e. after induction chemotherapy.

Chemotherapy is aimed at causing maximum damage to, or death of, the tumour tissue. The question was therefore whether microRNAs from the tissue samples removed and examined for diagnosis also remain significant for the prognosis of the expected disease progression after chemotherapy (and after surgery).

The analysis showed that, although chemotherapy changed some of the micro-RNAs in the miR-Score, two of them (miR-30e and miR-221) were basically resistant. If they can be detected in the diagnostic tissue sample, this can very likely be used to help assess a patient’s prognosis,’ Kirschner reports. The next objective is to determine how the administration of different cancer drugs (cisplatin, pemetrexed, gemcitabine) affects micro-RNAs because different chemotherapeutic agents have different effects on the malignant cells.

Between 15 and 20 cases (depending on country statistics) of mesothelioma per million are diagnosed in Europe annually. Compared to non-small cell lung cancer, for example, this type of cancer is rare but, due to its aggressiveness, is one of the lung cancers with the worst prognosis. It has been clearly documented that exposure to asbestos fibre is the cause of most cases of pleural mesothelioma.
Identifying fundamental mechanisms in cancer progression

Proteomic mass spectrometry

Scientists at a UK university are using the power of mass spectrometry to research critical processes in human prostate cancer, Mark Nicholls reports

Dr David Boocock is leading a group at the John van Geest Cancer Research Centre at Nottingham Trent University, with a key research focus on the discovery of new markers that can predict prostate cancer metastasis. The research will feed into the immunotherapy stream of the centre.

“We have been working on creating and characterising a model that can help us predict prostate cancer metastasis,” he explained. “To do this we have cloned prostate cancer cell lines to generate new cell lines that have varying degrees of EMT (epithelial to mesenchymal transition), which is thought to be a critical process in cancer invasion and migration that relates to metastasis.”

“We generated a cell line that undergoes a ‘spontaneous’ transition from epithelial to mesenchymal phenotype, which we believe may better represent the biological process in cancer than current methodologies that use exogenous factors to induce EMT in vitro.”

This work was recently published in Nature Publishing Group’s Scientific Reports (http://www.nature.com/articles/srep06553).

For his research Dr Boocock, Senior Research Fellow and Group Leader in Clinical Proteomics and Biological Mass Spectrometry in the John van Geest Cancer Research Centre, primarily uses proteomic mass spectrometry (Next-Gen Proteomics) to look for differentially expressed proteins between different samples. At the most basic, it’s comparing cancer and non-cancer samples to identify cancer-related proteins, he explained, “but, we also have looked at response to therapy and prediction of disease status.”

“To do this, we use quantitative mass spectrometry to measure the differential expression of the peptides/fragments of proteins following high performance liquid chromatography (HPLC) of the complex samples.”

Boocock reports significant findings result from the model developed in the present work, which provide a valuable resource for the investigation of EMT in human prostate cancer.

“Unlike artificially-induced models of EMT, he added, the EMT derived cells in this study express endogenous levels of EMT-associated proteins. As such, these clones can be utilised to derive an authentic EMT signature, which could be extended to clinical applications. These cells have been studied in vivo, using a mouse xenograft model, which showed that the clone with high spontaneous EMT gives rise to a much larger, faster growing tumour.”

“For the studies, the instrumentation from Sciex, used by Boocock, includes the TripleTOF 6600 and 5600+ mass spectrometers, along with the Exiqent 400 series nanoLC HPLC system.”

He said the TripleTOF system allows him to identify 3-5,500 proteins in a complex cell lysate with an hour’s gradient and then use the information to create a ‘spectral’ or ‘ion’ library for that specific sample type.

From there, using a different technique called SWATH, or Data Independent Acquisition (DIA), his team can gain quantitative information on every protein in the sample (up to 4,500 in an hour’s LC gradient). This enables us very quickly to run a batch of samples with two or more classifications - cancer; non-cancer, or aggressive vs. non-aggressive, for example - and get a relative quantitative readout for each protein.

“Sciex provides an excellent cloud based software platform (OneOmics), which has revolutionised the laboratory throughput and allows us to upload our raw data and process it far faster than would be possible locally, with a great user interface.”

At present, while the studies are at an early stage, a next step is the continuation of the work with novel prostate cancer cell clones. With the full transcriptomic and proteomic (SWATH) characterisation of the cell lines under way and several key molecular drivers of EMT and metastasis already identified from the date, the group is working toward further publications in the near future.

“These clones provide a significant resource and considerable scope for future studies that are focused on interrogating the fundamental mechanisms involved in cancer progression. They will also be of significant value for studies based on biomarker discovery and the identification of drug-able or immune therapeutic targets that can be exploited to develop new approaches for prostate cancer treatment and management.”

Examples of four clone prostate cancer cell line spheres with differing levels of EMT.

The green stain shows cells with high levels of vimentin, a mesenchymal marker, and red/orange shows E-cadherin, an epithelial marker, all cells show blue (DAPI) nuclear stain.
Virologists are today’s universal necessities

Globalisation has been a defining term in this 21st century: with almost anybody able to visit any place at any time, diseases, viruses and bacteria can be travel companions. Thus virology is gaining increased attention. Walter Depner interviewed Professor Barbara Gärtner, President of the German Association of Virology, about the issues and challenges arising from this development.

Virology, as an independent discipline, is not necessarily in the public eye, but is increasingly becoming more important – for all intents and purposes. The pathogens will spread as human mobility increases and vector-borne diseases will definitely spread, too. Another issue to deal with in the future is close contact between humans and animals. Many diseases that turn into epidemics are originally zoonoses, meaning they developed in animals, for example, influenza. Large-scale – industrial – livestock farming increasingly happens in so-called developing countries. We import those products, which exacerbates the problem.

Close cooperation with other disciplines, such as microbiology, hygiene and other clinical fields seems to be vital.

With people being ever more mobile, viruses and diseases also travel. What does that mean for national medical societies?

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Cancer diagnosis is likely to take a dramatic shift from scanning

# Liquid biopsies challenge imaging

Novel blood or urine tests can now detect a tumour and but might in future be able to say what type of cancer is developing in which organ, John Brosky reports

During the meeting of United European Gastroenterology, Sarah Bohndiek PhD was tasked with arguing against the rapidly emerg- ing class of liquid biopsies that are challenging traditional imaging diagnostics techniques. But, she just couldn't bring herself to do it. ‘Liquid biopsies are incredibly relevant,’ said Bohndiek, a Group Leader at the University of Cambridge, England, who, as a physicist, was expected to promote the merits of scanners over chemistry kits.

‘The evidence for these tests is building. The technologies are increasingly sensitive and there is evidence that, through epigenetics, we may even be able to work out the specific organ of origin,’ she said.

The term liquid biopsies covers an ever-widening number of diagnostic tests kits, some using blood samples, others urine samples. Thanks to the convergence of powerful computer processing with the discoveries of genomic, proteomic and metabo-lomic biomarkers, these simple tests have the potential to identify a specific cancer and even stage the severity of tumour development.

‘There is a veritable gold rush under way as companies complete clinical phase testing of novel assays, includ- ing Johnson & Johnson’s Janssen Diagnostics and Genomic Health in the United States, MDxHealth based in Herstal, Belgium and Berlin-based Epigenomics. In the pathology of colorectal cancer alone, a successful liquid biopsy test could capture a market opportunity estimated at US$2 billion. Bohndiek believes that, as these tests are likely to become more widely adopted for first-line screening than traditional diagnostics such as X-ray mammography, while using whole body imaging or endoscopy to detect tumours will become a second line of testing.

Shifting image for imagers

‘There will be a bit of a shift in how we see ourselves as imagers, perhaps the imaging community will see the advances of these liquid biopsies as an affront in coming years,’ she said. ‘Traditionally, we have been the go-to technology for early diagnostics in screening programmes, but I think it is likely that a liquid biopsy of some sort will become the go to technology.’

The benefit to healthcare systems will be cost savings as patients migrate from specialised centres back to the primary care setting where these tests can be adminis- tered.

For example, colorectal cancer screening using the gold standard of colonoscopy creates long queues of patients, especially in public payer systems, such as the United Kingdom’s National Health Service, she pointed out. ‘There are very long waiting lists at specialised centres, which is not very good if our goal is to detect cancer early.’

This is where the two diagnostics are complimentary and not com- petitive, she said, allowing a rapid movement for the patient through the pathway.

Once disease is detected the role of imaging is to specifically map the tumors, determine those with a high risk of progression, then guide interventions and monitor the effec- tiveness of treatment.

About a third of the work in the Cambridge lab that Bohndiek directs is dedicated to developing endo- scopic technology.

# Analysing images pixel by pixel

Sometimes innovations face a long journey before becoming a final product. This particularly applies to medical displays – due to very high quality demands and strong regulations that are mandatory in this segment.

In the past, the Japanese display vendor Totoku implemented a couple of innovations into its products, among them Dynamic Gamma. In many cases, safe diagnosis needs simultaneous onscreen display of Grayscale and colour images. This is a real challenge because Grayscale and colour images require different gamma curves. Grayscale images require DICOM and colour images are best displayed with a Gamma of 2.2. This is where Dynamic Gamma shows it advantage.

‘Dynamic Gamma,’ explains Marcel Herrmann, Totoku’s Marketing Manager, ‘analyses the screen content pixel by pixel and applies different gamma curves to each pixel, even when working with moving images in real time. Using the latest hardware technology we can handle this without delay, even though it requires millions of opera- tions per second.’

For an optimal display of differently coloured images, each individual pixel is read out separately.

Brighter is not always better

From the beginning customers wanted highly bright colour dis- plays. However, such brightness is not always helpful, for example in case of text processing or reporting,’ Herrmann pointed out. ‘The automatic text mode detects those bright areas and reduces their brightness. Any other area remains untouched, which enables continuous precise diagnosis. This works like Dynamic Gamma without any configuration from user side.’

These functions are added to all current i2 units from Totoku.

Ideally, Grayscale and colour images are displayed together on a monitor.

Improving image processing

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