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EUROPEAN HOSPITAL @ MEDICA®

SPECIAL NEWS ISSUE : MEDICAL | TECHNICAL | PHARMACEUTICAL | INDUSTRIAL

DÜSSELDORF | MONDAY 12.11.2018

Exploring the human microbiome

During the International Forum for Laboratory Medicine, being held at MEDICA 2018, one seminar will focus on infectious diseases. Professor André Gessner, from the Medical Microbiology and Hygiene Department at Regensburg University, will lecture on 'The human microbiome, an explosive 'climate' topic,' he explained to EH reporter Walter Depner.

WD: Generally you know the kind of audience you face during gatherings of specialists in your field. However, there's no certainty about who will be among the MEDICA delegates attending your lecture. Could this make your job difficult or perhaps more exciting?

AG: I have given many lectures to heterogeneous audiences and find the challenge of explaining complex relationships in the most comprehensible way to be very exciting and positive.

Often, I have received very stimulating questions – especially from colleagues in other fields.

About three years ago, at the University of Regensburg, you lectured on The Intestinal Microbiom as the Centre of Health and Illness, and included in the invitations physicians, chemists, nutritionists, microbiologists, dieticians, technical consultants and health journalists – a very heterogeneous audience. Could that experience help with the Düsseldorf seminar?

Yes, certainly. The conference is a good example for what the participants see as a successful interdisciplinary forum.

Modern medicine and healthcare demands an interdisciplinary approach. Do such events, as in Regensburg and now Dusseldorf, help to reach this goal?

The challenge is to transmit the latest scientific knowledge, with a critical appraisal, in such a way that it is well understood and to 'condense' without over-simplification, which distorts the information. For me it is important to stay realistic and above all not to raise hopes among physicians and their patients too early that cannot (yet) be fulfilled.

There is considerable focus on the role of microbial intestinal flora as a basic component for staying healthy. You have described modern, high-throughput sequencing technology as a source of dramatic knowledge growth. Why?

Without high throughput sequencing technology, together with appropriately qualified bioinformatics, microbiome analysis would be impossible.

It was this technology that first made this enormous knowledge growth possible – currently more than 65,000 publications in just over ten years.

Are their approaches going in the right direction?

The technological potential in analysis is developing rapidly. Here we need improved standardisation of analyses, quality controls and hope to gain ever increasing 'read lengths', that is to say DNA sections that can be sequenced in one piece, lower sequencing error rates and naturally lower costs for examinations.

Especially important here is also a significantly better comprehension of the functional relationships between microbiome and various diseases, so that rational new therapies can be developed in the future.

Along with interdisciplinary scope, the internationality question plays an important role. What is the state of cooperation, exchange in research, teaching and practice?

Microbiome research is particularly characterised by numerous already well-established international cooperation efforts, among academic institutions such as universities, and increasingly among very many firms.

The exchange is extremely intensive, not only through scientific publications but also via Internet fora and more than a dozen international congresses annually on microbiome topics.

Having studied medicine and molecular biology at the University of Hamburg, **Professor André Gessner** received his medical doctorate in infection immunology and a PhD in molecular virology. Following five years' basic research at the Heinrich-Pette Institute, Hamburg, he established his research group at the University of Erlangen, where he qualified as a specialist in medical microbiology and infectious disease epidemiology. His scientific work focuses on molecular infection immunology, infectious diseases and the role of the microbiome for diseases. He is an expert and reviewer for several international journals and scientific societies and, between 2008 and 2010 he received four calls regarding chairs for medical microbiology. Since 2010 he has been a professor and director of the Institute for Medical Microbiology and Hygiene at Regensburg University, where 150 employees focus on all aspects of infectious diseases. In 2015, Gessner became the Dean of research at the Regensburg medical faculty.

DON'T MISS

MEDICA'S LABMED FORUM

- **Monday, 12 Nov 2018 10.45 – 11.15 a.m.**

The human microbiome – diagnostic and therapeutic aspects

Speaker: Prof. André Gessner, Director of the Institute for Medical Microbiology and Hygiene at Regensburg University

Seeking greater trade in medical devices

Ambassador Grenell visits USA Pavilions

Today Richard Grenell, the USA's Ambassador to Germany, is visiting Medica to support over 500 U.S. firms exhibiting here and to conduct bilateral discussions with key industry stakeholders. Grenell is particularly interested in how the Medical Device and In Vitro Diagnostic Medical Device Regulations will affect USA and European manufacturers.

Medical devices are a key USA export to global markets, especially in the European Union. Discussions will focus on regulatory compliance in the EU and USA and how their respective regulatory regimes can be designed to facilitate more trade between the two trading partners, reducing the administrative burden to manufacturers, while still ensuring patient safety.

The USA's presence at the show is demonstrated at the country's Department of Commerce pavilion in Hall 16. Trade specialists from over fifteen countries, including Japan, China, France and Saudi Arabia, are at the pavilion to advise US firms on how to expand in foreign markets and are hosting business delegations from their respective countries.

USA Consul General Fiona Evans and Commercial Consul Ken Walsh are accompanying Grenell during his Medica Tour.

He is also meeting representatives from 15 States located in USA Pavilions in Halls 3, 8 and 16, and rounding off his visit with discussions with the leaders of ZVEI and Johnson & Johnson medical devices.

Ambassador Richard Grenell is meeting US representatives

An asset to improve cancer management

Liquid biopsy has enormous potential

Report: Mark Nicholls

It is non-invasive, delivers a chance of early diagnosis, prognostic information and sequential monitoring, and, believes Professor Francesco Salvatore, the enormous potential of liquid biopsies has still to be reached. However, the positive results obtained so far have 'opened the door to a promising new multifaceted group of tumour markers, at present collectively designated "liquid biopsy",' he explained.

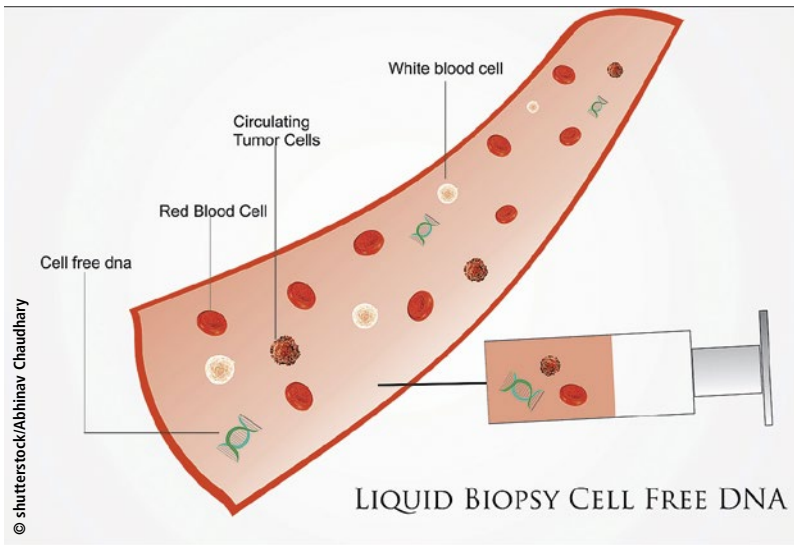
While liquid biopsy is a relatively new term, Salvatore suggested the real essence of its meaning is much older in laboratory medicine: haemochromocytometric analysis to search for altered blood cells was one of the first tests used in medical diagnostics and thus can be considered the first real liquid biopsy.

With the test later extended to molecular aspects of nucleic acids (DNA and RNA) in terms of their quali-quantitative analyses, the diagnostic performance of oncohaematological tests became more sensitive. Today, femtomole amounts of specific nucleic acid sequences are routinely used in leukaemia and lymphoma patients.

In 1997, Salvatore's group was among the first to produce evidence of the presence of RNA sequences in the blood of patients with solid tumours. Soon after, the molecular analysis of nucleic acids was integrated into pathology practice.

The concept of liquid biopsy is evolving, he said, with clinical trials under way with various technologies – such as next generation sequencing of nucleic acids and other high productivity 'omics, analyses – to try to reach high diagnostic sensitivity in body fluids.

With cellular and molecular markers that can be visualised, analysed and investigated, there is great potential for cancer treatment. 'Since cancer is a genetically driven disorder the sequencing of tumour derived DNA and RNA is very promising, not only in terms of understanding the pathogenesis of cancer, but also in the early identification and monitoring of tumour derived material thereby acting as biomarkers of the affected tissue or organ.'



One of the benefits of liquid biopsy, he added, is the ability to identify tumour-associated cells and molecules within body fluids, primarily blood, at the earliest opportunity – leading to better prognosis.

'Obviously, this procedure must be accompanied by highly sensitive methodology that can capture even minute amounts of material. Consequently, nucleic acid sequences, which may be amplified also in the case of a tumour, are crucial for an early diagnosis,' the professor pointed out.

Because it is minimally-invasive – unlike needle biopsy – the liquid biopsy approach can be repeated and used to monitor tumour progression and therapy.

Other advantages of liquid biopsy include: prognostic information; easy sequential monitoring; planning treatment monitoring; identification of molecular modifications before and during tumour development; RNAseq studies; detection of infectious agents; and post trauma monitoring, plus the technological advantage of increased sensitivity and specificity of nucleic acid NGS and other products of omic sciences.

Among the tumour components that are shed into the circulation, Salvatore explained, the three that are most likely to be clinically useful and have the greatest potential are:

Quality and innovation from the Czech Republic

Hello! You are in

The Czech Ministry of Industry and Trade and some special medical firms are eager to meet delegates and visitors for an early evening get together on Tuesday, 13 November at Medica. The companies include:

Advanced Medical Solutions develops, manufactures and sells diagnostic and therapeutic devices that include portable ultrasound and occlusion plethysmography with powerful software for arterial, venous and lymphatic diagnostics.

Biomag manufactures pulsed magnetic therapy devices and its patented 3-D Pulse magnetic therapy has a quality verified by professionals in 30 countries all over the world, the firm reports.

Brno University of Technology focuses on scientific research and putting unique ideas into action.

Eyrina produces a semi-automatic non-mydriatic fundus camera.

Special Medical Technology mainly develops and manufactures devices for electro- and cryosurgery, with a broad range of applications in many fields. Devices are developed and manufactured in the Czech Republic and approved according to EU standards.

Synthesia produces naturally-based oxidised cellulose for biomedical and technical use. Its products are sold commercially under the brand name OKCEL.

VUP Medical has more than 60 years in research and innovative medical equipment design, and focuses on implantable and non-implantable medical devices.

Watek technology produces ultra-clean water primarily for medical, laboratory and pharmaceutical industry use. 'Water treatment systems are designed in accordance with strict quality standards,' the Watek confirms.

Compex/Jett Medical manufactures the deviceJett Plasma Lift Medical – the first patented direct current plasma device to examine skin. The product is manufactured entirely in the Czech Republic.

circulating tumour cells, circulating tumour DNA, and tumour-derived exosomes.

'Evidence is increasingly appearing regarding the possibility of using these cells and cell components as markers of early diagnosis, recurrence and metastatic spreading, which will also serve to characterise tumour material at molecular level with a view to customised treatment,' he said, predicting that this could see clinical advances over the next decade, in the fight against cancer diseases.

This would be seen particularly in the standardisation of samples from patients affected by tumours; their conservation; transport to specialised analytical centres and storage in certified biobanks; continuous improvements in technological approaches and methods in terms of increased analytical sensitivity and the detection of minute variations; as well as advances in sophisticated bioinformatic tools and methodologies that can help cancer scientists to identify novel gene pathogenic variations.

However, markers have, so far, been approved for only a few examples of specific tumour types and therapy.

Convinced there is a bright future for new tumour markers – at present collectively designated 'liquid biopsy' – he said that, in time, liquid biopsy tests should gradually acquire the 'canonical characteristics' of laboratory medicine, of standardisation, reproducibility, correct mutational analysis, high sensitivity and specificity, and be validated in internal and external quality controls.

Francesco Salvatore is Emeritus Professor of Human Biochemistry at the University of Naples, Italy, and until recently was President and Scientific Director of CEINGE -Biotecnologie Avanzate, a biotechnology research consortium with over 200 researchers and core facilities for post-genomic research applied to biomedicine.

He is the founder of the CEINE centre and is an active PI at the institution.

Over 400 publications bear his name, including more than 200 original papers, mostly published in international peer-reviewed journals.

His many prestigious awards include the Gold Medal from the Ministry of University and Scientific Research and the Gold Medal from National Academy of Sciences.

vited!

YOUR INVITATION

Quality & Innovations from the Czech Republic

- **Monday, 12 Nov 2018 4.30 p.m. Place: The Czech Pavilion. Hall 16 / Stand E58**

Global Biomedica develops and manufactures titanium spinal and orthopaedic implants using innovative industrial 3-D printing technology.

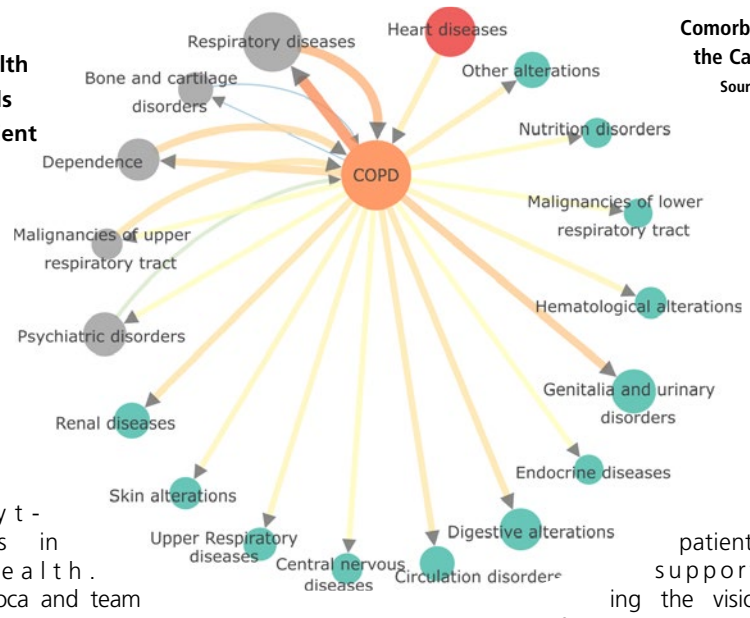
Kettex Development manufactures a video endoscope system for urological examinations, which the firm reports has 'the most advanced technology and outstanding picture quality'.

Medin, a traditional Czech manufacturer of medical devices and implants, Medin products are developed and innovated in collaboration with physicians.

Zdravopro manufactures and sells medical devices and aids for seniors, rehabilitation, paraplegics and people recovering from injuries.

Predictive potential of Big Data in the lab

Big Data can be a critical tool in helping clinicians develop advanced patient health risk assessment and stratification models as well as leading to a new level of patient empowerment, reports Mark Nicholls.



Comorbidity Network diagram for elderly COPD in the Catalan population, 2018.
Source: Ákos Tényi

Professor Josep Roca outlined the benefits of Big Data in a laboratory context during the European Federation of Clinical Chemistry and Laboratory Medicine (EFLM) Strategic Conference held in Mannheim, Germany, this June. Under the heading 'Big Data for prediction in the lab', he discussed how disruption through biomedical informatics technologies and how using Big data for prediction is bringing about paradigm changes for diagnostics.

Stressing the importance of health systems relying on health-related date and analytical tools, he told European Hospital: 'An ideal healthcare setting should facilitate an optimal support to care decisions and delivery by reducing the complexity of the massive amount of multi-disciplinary data being produced every day and should improve efficiency of health outcomes both in terms of well-being and expenditures. 'Such a health system relies on the availability of health-related data and analytics tools.'

During the session, Roca – Professor of Medicine at the University of Barcelona and senior consultant at Hospital Clínic of Barcelona – analysed the three forces currently driving profound healthcare transformations:

- changes in biomedical knowledge
- the burden of chronic conditions
- the need for generating healthcare efficiencies.

Roca also addressed the role of data science in the current health scenario, as well as opportunities and barriers we are facing for adoption of big data analytics in health. Roca and team have been using Big Data to collect data for projections on the healthcare impact of chronic obstructive pulmonary disease (COPD) over the next 15 years (see diagram).

Enhanced clinical predictive modelling, he said, and personalised diagnostic and treatment tools – such as clinical decision support systems and patient decision support systems – can contribute to the acceleration of transfer of scientific evidence to practice, helping in the identification of gaps in care and in targeting interventions to the most appropriate sub-populations of patients. 'Overall, the unique potential of information from health data within a digital health framework is the enhanced extraction/generation of novel knowledge through the integration of multiple information sources,' Roca added.

'Development of new models for patient stratification based on this foundation would help to define the most appropriate action plan for patients, supporting the vision of personalised healthcare. Moreover, deployment of big data analytics in an integrated care setting should contribute to patient empowerment through efficient patient decision support systems.'

In terms of clinical outcome, the potential of Big Data is that it can support healthcare professionals in the development of patient health risk assessment and stratification models, integrating health information from informal care, formal healthcare and biomedical research, while creating new knowledge on disease mechanisms.

In turn, Roca suggests, this will generate healthcare efficiencies and facilitate patient empowerment provided that an appropriate implementation setting is achieved.

However, he notes that barriers and opportunities to enable the potential of Big Data applications in health have been reported recently in several publications. His view is that four strategic areas need to be addressed to face these current challenges: cloud-based tools and services; enhanced clinical predictive modelling; implementation and evaluation; and governance and regulatory aspects.

His conclusion: 'A proper implementation strategy, tackling privacy and regulatory constraints, would highly contribute to enhance healthcare outcomes and patient experience of care while reducing costs and improving the health of populations.'

Josep Roca MD is Professor of Medicine at the University of Barcelona, senior consultant at Hospital Clínic of Barcelona and senior researcher at IDIBAPS in Spain, as well as Adjunct Professor at the University of Southern Denmark (Odense). He is the author of more than 300 original articles in peer-reviewed journals and several book chapters, review articles and books. His two main interests are chronic patients management (integrated care and systems medicine) and gas exchange and skeletal muscle bioenergetics in chronic patients.

The all-in-one molecular laboratory system

Walkaway automation

The lab-in-the-box design of LabTurbo SP-qPCR All-in-one system offers true automation for the molecular laboratory, the manufacturer reports, adding that this 'delivers testing confidence and laboratory efficiency'.

'LabTurbo fully automates the complete workflow of molecular diagnostic laboratories. The sample-to-result procedure includes: automatic sample transfer from primary tubes, DNA/RNA extraction, PCR reaction setup, qPCR thermocycling, and qPCR result analysis with graphs,' the company explains. 'As a true walkaway system, you can simply put the samples on LabTurbo system and the final results will be ready for report in three hours.'

Taigen is at Medica Hall 17 / Stand C61

LabTurbo is ideal for automating highly complex nucleic acid diagnostics procedure, the manufacturer adds. 'It integrates nucleic acid purification, quantification with qPCR, and normalisation into a complete procedure. It can also fully automate the bisulfide conversion process for methylated DNA purification for epigenetics.' The system also detects viral load in serum/plasma samples with qPCR nucleic acid quantification to overcome the challenge of undetectable nucleic acid concentration range by spectrometer. 'For example,' LabTurbo reports, 'the system performs GADPH quantification, DNA concentration normalisation, and PCR setup in an integrated procedure for completely automated diagnostic procedure. This is also ideal for non-invasive prenatal diagnosis (NIPD) with digital PCR technology.'

The LabTurbo complete automation covers applications such as infectious disease screening, virus detection (HIV/HBV/HCV), bacteria detection, HLA-typing, personalised medicine, and many more. 'The versatile system is suitable for target detection from whole blood, serum/plasma, saliva, swab, biological fluids, tissues, cells, and etc,' the firm reports.

The company's products support FDA-approved nucleic acid testing for infectious disease screening in human blood. 'The advanced automation, consistent performance, and reliable results from LabTurbo systems are the keystone for the routine infectious screening in US blood supply.'

Healthcare products and services from Northern Ireland are exported to over 150 countries

Northern Ireland has a proven track record in developing world-class products and services for the healthcare industry. It's one reason why we've developed as a leading life and health sciences region.

We have a strong tradition of technological innovation and are at the forefront of convergent technologies, merging electronics, telecommunications and the internet with medical devices and services for personal healthcare.

What's more we are customer focused and have a mindset that means we always go the extra mile.

If you want more innovative healthcare technologies, then visit the Northern Ireland pavilion at **MEDICA, Hall 16/F10-1.**

Northern Ireland. Altogether more.

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Molecular diagnostics and antibiotic stewardship

Screening with multiplexed kits

Antibiotic stewardship is becoming a critical concern in hospitals as antibiotic resistance spreads globally and some organisms become resistant to antibiotics of last resort. Molecular diagnostics can play a role in antibiotic stewardship programs by providing timely and accurate advice to clinicians on which antibiotics to use, Professor Keith Stanley advises.

Antibiotic resistance in the European Union is estimated to result in 25,000 deaths per annum and costs 1.5 billion euros in healthcare costs and productivity losses. Yet, more worrying is the emergence of bacteria with plasmid-borne resistance against colistin - an antibiotic of last resort.

For Gram-positive bacteria the variety of resistance genes is limited and molecular diagnostics can provide useful information about treatment of a patient shortly after a blood culture bottle flags as positive.

The situation for Gram-negative bacteria is more complicated as there are a large number of resistance genes, many of which can be transmitted between different bacterial species. The CDC has listed carbapenem-resistant Enterobacteriaceae (CRE) as an urgent threat in antimicrobial resistance and a number of companies manufacture molecular diagnostic kits which can identify the five major types of resistance in a few hours.

Those kits are useful for routine screening, but for epidemiology or infection control a highly multiplexed molecular diagnostic kit is required that encompasses a large number of minor as well as major CRE genes. It is likely that the highly multiplexed kits will become the norm for screening applications, as well giving hospitals immediate access to infection control issues.

Ideally, diagnostic tests should advise the clinician of the best clinical strategy rather than just informing about the content of individual sequences of resistance gene found in the sample. This requires a more complex strategy where the spectrum of resistance genes that would preclude use of a particular antimicrobial agent are tested. If all genes that might give resistance to that class of antibiotic are missing, then treatment with that drug is recommended.

Because the number of resistance genes is large a probability consideration based on epidemiology has to be included so that a clinical course can be recommended with a certain probability of success. This type of analysis requires a highly multiplexed PCR system which can detect multiple sequences from a single sample (see figure).

This approach was recently carried out for difficult to treat urinary tract infections and might be the forerunner of similar tests for other conditions. Improved antibiotic stewardship could be well served if the microbiologist can advise the best antibiotic to use, thus preventing over prescription of last resort antibiotics in critical hospital settings.

The issue is whether a result can be obtained fast enough to be of value, and what probability of success would be acceptable to the clinician. In this context, the ability to detect the presence of bacteria and resistance gene in EDTA blood before culture is an important step forward.

Microbial resistance is also becoming of major importance in sexually transmitted infections. Mycoplasma genitalium is not easy to culture, so nucleic acid testing is the only feasible route for diagnosis of resistance. Unfortunately, macrolide resistance has become widespread and is very common in some patient groups. A particular concern is Neisseria gonorrhoeae, which has recently been given 'superbug' status having acquired resistance to ceftriaxone, which is the last remaining option for first-line treatment. The rise of resistance in STIs argues for more complex STI diagnostic screening encompassing both infectious agent and resistance genes.

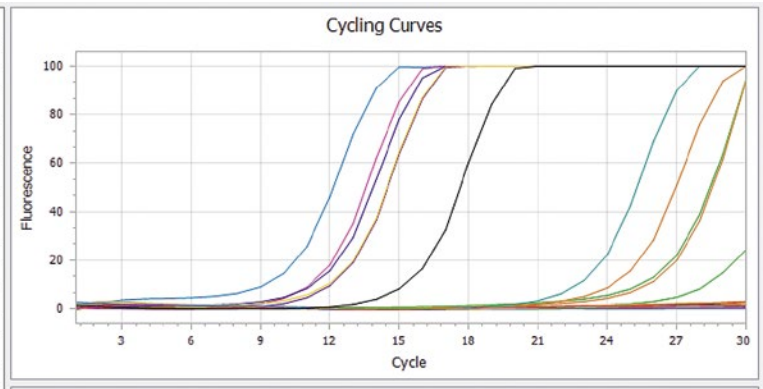
Before his move to Australia, **Professor Keith Stanley** was an academic at the University of Cambridge and the European Molecular Biology Laboratory. After he invented Multiplex Tandem PCR, which enables quantitative analysis of large multiplexes, he launched the molecular diagnostics company AusDiagnostics, which works closely with customers to develop novel diagnostic solutions.

A highly multiplexed assay for bacterial ID and resistance genes can be used to predict a possible treatment based on knowledge of the epidemiology of infections. Note the 'Diagnosis' at the bottom left hand side of the results screen.

Results — Template ID: 9EF9

No.	Sample	Gene	Call	Concentration
A10	68051	Enterobacteriacaies	Present	375,996
B10	68051	Enterococcus	Present	11
C10	68051	Strep		
D10	68051	Staphylococcus		
E10	68051	pan-Pseudomonas	Present	9
F10	68051	oxa 1	Present	146,658
G10	68051	OXA-48 like		
H10	68051	dfrA		
A11	68051	dfrA_	Present (dfrA17)	133,183
B11	68051	aminoglycosides	Present (aac6'-1b)	30
C11	68051	KPC		
D11	68051	vim/NDM		
E11	68051	gyrA1	Present (gyrA1-R)	82,783
F11	68051	KP parC		
G11	68051	pan-TEM	Present	83
H11	68051	pan-SHV		
A12	68051	CTX-M group 1	Present	78,928
B12	68051	CTX-M group 9		
C12	68051	pan-CMY		
D12	68051	aadB		
E12	68051	aacC1		
F12	68051	aacC3		
G12	68051	aacC2		
H12	68051	SPIKE	Present	10,000

Diagnosis
Patient may respond to i.v. Gentamycin



Looking for the stamp of quality?

Enter the UK's global pla

Over in the United Kingdom Pavilion (Hall 16) you can expect quality among the latest medical devices, diagnostic software and digitally-enabled technologies produced by nearly 100 pioneering British health technology companies.

'With over 97,000 people working in the UK's HealthTech sector, it's the life sciences' biggest employer, and its importance has rightfully been recognised by the UK Government, forming a key component of their industrial strategy,' reports The Association of British HealthTech Industries (ABHI), which leads the pavilion and supports the exhibitors.

With such activity set to bolster what is already an incredibly strong industry, UK companies are now looking for the right trading opportunities to export their technologies and develop new business.

'The UK has long been a leader in healthcare. We have world class universities, dynamic companies and the biggest single-payer health system on the planet, all adding up to what is an incredible ecosystem of innovation and medical excellence,' Paul Benton, International Managing Director of ABHI, underlines. 'It's why overseas companies want to partner with our UK manufacturers and it's the reason the UK carries significant weight when it comes to exploring international markets. It is, in short, a stamp of quality and we are proud to be at Medica once again to showcase many examples of this.'

'Medica attracts over 5,000 exhibitors from 70 countries and plays host to tens of thousands of visitors every year. It is a prime opportunity for United Kingdom's medical companies

The United Kingdom Pavilion is at Medica Hall 16 / Stand G19-4

The pocket-size lactate monitor

The new Lactate Scout 4 hand-held analyser for rapid field-based lactate measurement.

Made by EKF Diagnostics, the Lactate Scout 4 hand-held analyser is a fast, accurate sports performance monitoring device designed for use as a training companion for individuals or sports teams.

This year at Medica the manufacturer is showing the new analyser plus many POC testing devices, including the recently FDA cleared DiaSpect Tm haemoglobin analyser and Quo-Lab® HbA1c analyser that was successfully evaluated in a study by the *European Reference Laboratory for Glycohemoglobin* and published in the Journal of Diabetes Science and Technology.

Measuring lactate helps to define workout intensities for maximum fat catabolism, increases in endurance, and to avoid critical over-exhaustion. 'Its use will help rapidly to determine optimum training programs, define training zones, and avoid inefficient training regimes, EKF reports, adding that the product is ideal for field training due to being pocket-size, and weighing just 60g, with a simple push-button navigation and e-paper screen that can be read easily in any light conditions.

The device is quick to use, requiring no calibration – and a result comes in 10 seconds with only a 0.2 µl capillary blood sample.

There is also Bluetooth connectivity to all major brands of heart rate monitor. Heart rate data can be collected and collated using the step test function to provide in-depth analysis of performance. Up to 500 lactate results can also be stored, all of which are compensated for the influence of low and high haematocrit levels. And, the firm reports, 'The Lactate Scout 4 can undertake 1,000 tests using just two CR2450 lithium batteries.'

Visitors to EKF's stand will also see other hand-held devices, including the DiaSpect Tm haemoglobin analyser for rapid anaemia screening. This has received U.S. FDA 510(k) clearance and CLIA waiver for use in POC settings, such as doctors' offices, clinics and other non-traditional laboratory locations. Haemoglobin measurements (precision: CV ≤1%) come within two seconds from a whole-blood sample.

POC analysers and reagents for diabetes care include the Quo-Lab and Quo-Test glycated haemoglobin (HbA1c) analysers designed to deliver four-minute results. Both analysers have been demonstrated to deliver lab-accurate HbA1c results from finger prick or venous whole blood in recent evaluation studies undertaken by the European Reference Laboratory for Glycohemoglobin.

EKF is at Medica Hall 3 / Stand C70

atform

to meet customers, develop relationships and forge new business,' adds ABHI, which is now in its 30th year and represents 280 member companies in the UK.

High-quality transducers made for a few dollars

Coming: Cut-price ultrasound

Engineers have developed a new high-quality ultrasound transducer that could dramatically lower the cost of ultrasound systems.

Report: Mark Nicholls

The innovation – created by a team from the University of British Columbia in Vancouver, Canada – is portable, wearable and can potentially be powered by a smartphone and the study team feel it will have benefits for making ultrasound more widely available, particularly in developing countries

Study lead, Dr Carlos Gerardo, from the university's Department of Electrical and Computer Engineering, points out that, whilst ultrasound is safe, non-invasive and the world's number one medical imaging modality, high quality hospital ultrasound systems remain expensive. 'This limits the number of machines available in a hospital and therefore creates long waiting times for patients,' he explained, 'so, we thought about a way to create high quality ultrasound transducers at a reduced price.'

Hospital ultrasound machines currently use piezoelectric crystals as their transducers – effectively small ceramic tiles which, when a voltage is applied to them, expand and contract, generating ultrasound waves.

'Conversely, these piezoelectric crystals generate electrical voltages when they are squeezed by external ultrasound waves; these voltages are then read by a computer and an image is displayed on a computer screen,' Gerardo explained. 'For our research, we replaced the traditional piezoelectric transducers with new drum-based CMUT technology using low-cost materials. This resulted in a simple fabrication process to create high-quality transducers for only a few dollars.'

Transducer drums have typically been made out of rigid silicon materials that require costly, environment-controlled manufacturing processes. However, the high manufacturing costs of CMUTs - capacitive micromachined ultrasonic transducers – has been countered by the researchers by the use of plastic-like materials instead of semiconductors.

Gerardo explained that, by using a photosensitive polymer resin called SU-8, with fewer fabrication steps, the cost was dramatically reduced, and with the added bonus that the plastic-like materials actually boosted the device sensitivity. 'This enabled the creation of high-quality ultrasound transducers for biomedical application at very low costs,' he pointed out.

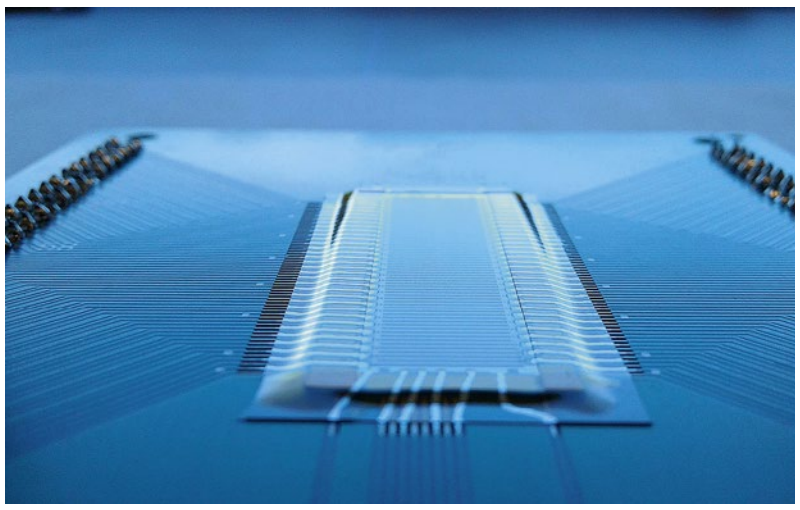
'Our technology uses tiny vibrating drums made of polymers (poly-CMUTs), each with a diameter of around 1/10th of a millimetre. We have thousands of these drums in our transducer that vibrate at the same time and produce ultrasound waves.

'The benefit for the medical field is that this technology has the potential to reduce the current cost of ultrasound machines used in hospitals. If the cost of the machine is reduced, then a hospital can afford to buy more ultrasound systems and reduce the waiting times for patients.'

The team envisages creating an ultrasound system cheap enough for family doctors to conduct ultrasound scans for immediate – and early – diagnosis, instead of referring patients to an ultrasound clinic or hospital. 'Imagine a family doctor could immediately confirm the presence of a breast cancer or a heart problem in the same room using a portable (and ultra-cheap) ultrasound scanner connected to a smartphone,' he suggested.

Hospital grade ultrasound systems cost more than $100,000, while cheaper versions are $20,000 and recently Butterfly Network has unveiled i-Phone compatible ultrasound that will cost $2,000, but the Vancouver development could see ultrasound-type equipment fall to as cheap as $100. 'We envisage creating a portable ultrasound system so affordable that people at home can acquire it,' Gerardo confirmed. 'The reason we say it can be powered by a smartphone is the low voltage levels required to operate it. We use 12V, but it can be reduced to less than that, for instance we operated these transducers in our lab using a 9V battery.

'This transducer has the potential to reduce the costs of high-end ultrasound machines and enhance their performance. People in developing countries and struggling economies will benefit the most, as they will have the opportunity to acquire high-performance ultrasound systems for an extremely affordable price.'



CMUT enlarged under microscope (above) and CMUT linear array (left).

The transducers also couple more naturally into soft tissues, which in turn increases efficiency. They can also be fabricated small enough to be mounted on a stent to look at the interior of veins and arteries, Gerardo suggested, or be fabricated in large areas to cover large portions of skin and create an even clearer ultrasound image.

The new transducer created by Gerardo, working with Professors Robert Rohling and Edmond Cretu, has involved hundreds of hours spent over the past three years in the university's microfabrication lab.

While the new transducer is being regularly updated with fresh prototypes, the electronic circuitry and software remains in development and researchers acknowledge the most challenging element will lie ahead in liaison with regulatory authorities and proving the effectiveness of the probe in clinical trials.

Contrast-enhanced ultrasound for renal masses

Report: Mark Nicholls

Contrast enhanced ultrasound (CEUS) has proved in trials to be more accurate than computed tomography and MRI and can help eliminate the need for unnecessary biopsies and surgery.

Led by Dr Richard Barr, Professor of Radiology at Northeast Ohio Medical University, the team has been using CEUS since 1999 and, for the specific study, focused on 721 patients referred for contrast-enhanced ultrasound (US) with 1018 indeterminate renal masses between then and 2010. Following CEUS examinations, 367 of the patients were spared biopsy, surgery or close follow-up. 'Because all malignant renal masses have blood flow, if no enhancement is present, they are benign 100%,' Barr explained. 'If we exclude vascular abnormalities and infections – usually identified clinically – most masses with blood flow are malignant. Therefore, using CEUS, we can confirm a mass is benign without a biopsy or surgery.'

CEUS uses liquid suspensions of biocompatible microbubbles, which are slightly smaller than red blood cells, and are injected into an arm vein during an ultrasound scan. Each has a unique sonographic characteristic, enabling radiologists to use specific ultrasound contrast to see a contrast-only image, as well a standard image at the same time. CEUS does not expose patients to ionising radiation and the microbubbles present no risk of kidney or liver damage.

Indeterminate renal masses are a common clinical problem with more than half of patients aged over 50 estimated to have at least one renal mass. Many renal masses are found incidentally during an imaging examination and most are benign simple cysts.

The purpose of the research, 'Evaluation of Indeterminate Renal Masses with Contrast-enhanced US: A Diagnostic Performance Study', was to determine the use of contrast material-enhanced ultrasonography in the characterisation of indeterminate renal masses.

With 100% sensitivity, the results offered a conclusion that CEUS evaluation is a highly-sensitive and specific method for characterisation of indeterminate renal masses. 'Because we can 100% confirm a lesion is benign, no surgery or biopsy is needed. That is the big benefit for patients,' Barr added. 'We have followed our first 1,018 cases now for 10 years and none of the renal masses without blood flow became malignant.

'Also, positive patients can be treated and not watched to see if lesions grow. As for clinicians, they can be confident in the diagnosis and not have to be concerned about following up the patient.'

In terms of diagnosis, he said they can predict with high probability if a mass is benign or malignant, though acknowledged that in terms of specific diagnoses more work is needed.

Overall, the Northeast Ohio team has collected an additional 2,000 cases and is working on additional features to determine whether they can provide a histologic diagnosis of the malignancies.

'Some renal cancers are very slow growing,' Barr noted. 'If we can select these out, older patients may not need to have surgery or treatment but just be watched to make sure the lesion is not growing.'

With findings that show CEUS is a 'very robust technique with an extremely high predictive value,' Barr concluded: 'CEUS, which is available worldwide, is more accurate than CT and MRI because we have a contrast only image, so we can see very small amounts of contrast.

'Ultrasound also has a much smaller slice thickness, so we can identify 1mm enhancing nodules within a renal mass. CEUS can be used in patients with renal failure.'

Dr Richard Barr is President of Radiology Consultants Inc. in Ohio and a Professor of Radiology at North-eastern Ohio Medical University, Youngstown, Ohio. The research is performed at Southwoods Imaging in Youngstown, Ohio. His more than 100 scientific articles show particular interests in breast imaging, contrast-enhanced ultrasound, and elastography. He has also published two elastography books, plus several book chapters. From January, he will be the editor-in-chief of the Journal of Ultrasound in Medicine.

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Artificial intelligence system imp heart disease diagnosis

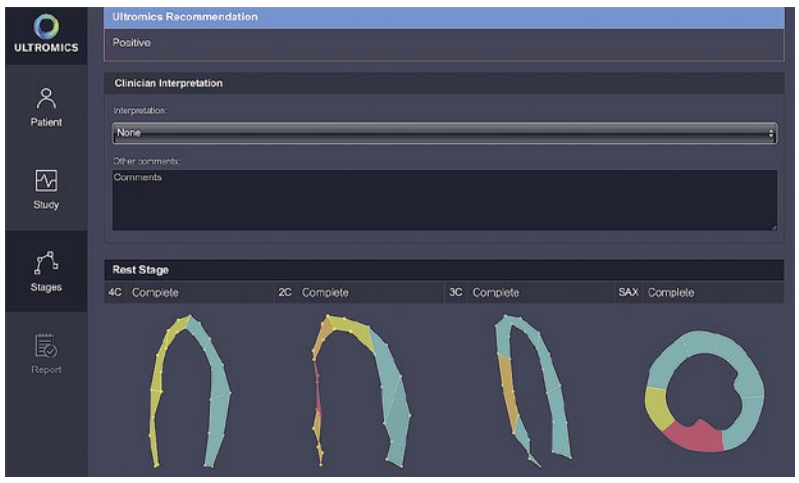
Cardiologists in the UK are trialling an artificial intelligence (AI) system that will help better diagnose heart disease.

Report: Mark Nicholls

Devised by researchers from the University of Oxford, it can predict heart disease and cardiac events from ultrasound stress test images with initial results showing that the AI system is far more accurate than conventional techniques.

Paul Leeson, Professor of Cardiovascular Medicine at the University of Oxford - who leads the development team with PhD student Ross Upton - said the system is currently being trialled in a "real world cardiology" environment in 15 units across the UK to formally assess its effectiveness and accuracy ahead of a formal publication of the results and a clinical roll-out.

With current examination techniques, it is estimated that the diagnosis is wrong in up to 20% of cases, leading to patients either being sent home with the risk of having a cardiac event, or undergoing unnecessary procedures.



The Ultromics stress echo diagnostic support system generates a recommendation of positive if abnormalities in heart function are detected. The colour maps below identify where the disease is located in the left ventricle with colour coding to describe the severity of abnormalities detected

The new AI system, developed from ongoing research studies at the University of Oxford Cardiovascular Research Facility, is set to significantly improve upon that. The company developing the technology is called Ultromics and the stress echo analysis software is called Echuity and is ultrasound vendor neutral in that it works with images from any of the major ultrasound manufacturers. The process to construct the diagnostic algorithm involved extracting thousands of parameters from echocardiogram images and using machine learning to determine which parameters were most diagnostic of coronary artery disease. From that, the system gives a diagnostic recommendation to the clinician on whether it believes there is the risk of a patient having a heart attack or not, and identifies the location of disease.

Professor Leeson, who is also a Consultant Cardiologist at the John Radcliffe Hospital and Professor of Cardiovascular Medicine at the University of Oxford, said: "Ultrasound and stress echo are one of the most widely used imaging modalities to investigate heart disease. At the moment as cardiologists, we look at these images and try and identify changes with the eye. We are pretty good at doing that but my feeling was that we could do this better."

By revisiting images and working with returning patients, they have been able to extract additional information to look at different biomarkers and approaches to try to improve stress echo findings.

He continued: "With a particular focus on ultrasound image data, we have broken that down into different bits to see what parameters we can pull out of these echo images. Because we had follow up extending over many years we were able to take that ultrasound imagery and see what features are predicting who has events and who does not when a patient comes forward for stress echo. With knowledge of background history and what happens to them subsequently, you can start to pick out very interesting predictors of who gets disease and who does not."

What emerged were good imaging biomarkers that could be applied prospectively within an algorithm to identify individuals who are most likely to suffer heart disease or have a cardiac event.

From images of the heart, the team developed ways of applying these techniques to provide accurate and a consistent results. To date, the system has an accuracy level equivalent to the best performing clinicians of a one in 10 error rate, but the researchers are keen to rigorously test this. That involved comparing how accurately clinicians are predicting outcome with how accurately the machine algorithm approach predicts outcome in 15 cardiology departments.

However, Professor Leeson stressed: "We know we can get good results based on the data we have from our centre. What we want to do at this stage is confirm that the automated approach consistently produces at least as good results as the best quality operator.

"Of course, the cardiologist will still need to decide what to tell the patient and work out what the best management plan for the patient may be, but for the patient, increased accuracy may save unnecessary inva-

When and when not to prescribe antibiotics

Ultrasound aids o infection diagnos

Although traditionally an imaging modality, ultrasound also has applications as a measurement tool. An innovative application is to assess ear infections.

Otitis Media (OM), a middle ear infection, is the number one indication for antibiotic prescriptions for children and the leading cause for surgery. This problem is global. Nearly every child will suffer at least one middle ear infection severe enough to see a health professional, and most will suffer repeat occurrences – up to a dozen or more in childhood.

Otonexus is at Medica Hall 16 / Stand D10-1

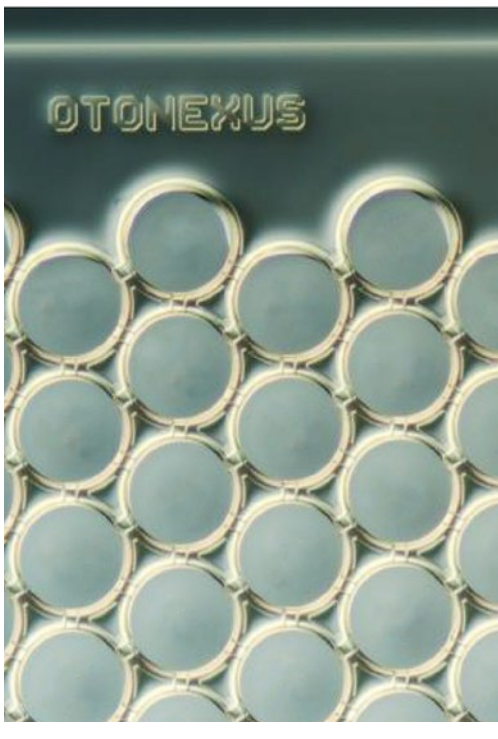
Multiple studies (including from the CDC) show diagnostic error rates averaging 50 percent, particularly in the key differentiation of viral from bacterial infection, and whether an antibiotic is appropriate. Thus, patients are often given the wrong treatment and are referred to specialists more often than necessary. The problems from excessive antibiotic use are well known. Additionally, under-diagnosis can result in surgery or permanent hearing loss.

The current tool used to diagnose middle ear infections is the otoscope, which is essentially a magnifying lens, battery, and light source – a virtually unchanged system since its introduction decades ago. With the otoscope, the clinician can only view the tympanic membrane (ear drum). However, accurately characterising the contents of the middle ear, on the other side of the membrane, is key to the accurate diagnosis and treatment of OM.

A new device under development at OtoNexus Medical Technologies (Seattle, WA, USA) has the familiar form factor of a traditional otoscope, but uses a novel air-coupled ultrasound technology to provide the data physicians need to instantly and accurately assess middle ear infections, the company reports. 'This allows them to accurately differentiate when and when not to prescribe antibiotics.'

OtoNexus has partnered with Fraunhofer-IPMS (Dresden, Germany) – a global leader in MEMS development and manufacturing – to create a unique transducer, a type of CMUT (capacitive micromachined ultrasound transducer).

'Unlike traditional ultrasound transducers needing gel or water coupling, these new CMUTs are



optimised to operate through air in the human ear canal,' the company reports. 'Furthermore, they are manufactured using semiconductor fabrication methods, making them easy to mass produce and far less expensive. Using these novel transducers, along with hardware and algorithmic innovations, OtoNexus

proves

Paul Leeson is Professor of Cardiovascular Medicine at the University of Oxford and a Consultant Cardiologist at the John Radcliffe Hospital. He heads the Preventive Cardiology Research Group at the Oxford Cardiovascular Clinical Research Facility, which aims to improve identification and prevention of heart disease in young people via: novel markers of early disease, young adult cardiovascular prevention trials, and artificial intelligence.

sive procedures such as angiograms.

"It will also see less patients being sent home with coronary artery disease when they should have been sent for angiograms."

With about 60,000 heart scans carried out annually, with 12,000 misdiagnosed, the cost to the NHS is £600m in unnecessary operations and the treatment of people who had heart attacks following an all-clear scan. With AI making more accurate diagnoses, the team believes this system could save the NHS more than £300 million a year with the reduction in misdiagnosis.

ear

sis

will place a high-precision ultrasound device in the hands of paediatricians, designed specifically to their needs and utilising their current workflow.'

otonexus MEDICAL TECHNOLOGIES

Biomedical designers must increase safety

Cut device-related pressure ulcers

Whilst acknowledging that state-of-the-art bioengineering approaches are being applied in preventing Medical Device Related Pressure Ulcers (MDRPUs), Professor Amit Gefen, from the Department of Biomedical Engineering at Tel Aviv University, believes there are gaps in knowledge and technology in this area and therefore more must be done to improve patient care and avoid additional healthcare costs.

During a 'Wound Care from Innovations to Clinical Trials' (WCICT 2018) conference held in Edinburgh last June his 'Gaps in technology in prevention of MDRPUs' presentation analysed approaches to mitigate the problem and discussed emerging technological solutions.

'MDRPUs are injuries associated with the use of devices and equipment applied for diagnostic or therapeutic purposes, where the injury has the same configuration as the applied device,' explained Gefen, who is also the WCICT president. 'In intensive care units, MDRPUs caused by endotracheal and nasogastric tubes are common, both in adult and paediatric settings.'

MDRPUs, which, by definition, are hospital-acquired pressure ulcers (HAPUs) and considered in many countries to be an adverse event, may also be associated with the use of electrodes and wiring, pulse oximeters, catheters, compression stockings, and even bedpans.

'Studying the root causes of MDRPUs and effective means to mitigate their risk will lead to improved quality of life for patients and considerable cost savings which can otherwise be invested in further prevention and treatment of the primary comorbidity,' Gefen pointed out. 'Development of experimental and computational biomechanical models is essential for creating laboratory standards to test the safety of medical devices which come in contact with the surface of the body.'

His team in Tel Aviv has developed experimental systems equipped with thin flexible force sensors, as well as models of adult and paediatric patient heads to simulate tissue loads during interactions with devices, such as tubing, electrodes and wiring, masks and head supports. 'These physical and computational three-dimensional anatomical model systems facilitate rigorous empirical and simulation-based investigations of commonly encountered conditions and scenarios at which MDPRUs may occur,' he explained.

'Based on our findings,' he continued, 'we feel that the design of many edical devices and equipment used in ICUs should be revisited, since currently, there appears to be no attention to the safety of use with regard to the device-associated pressure ulcer risk.'

Gefen suggests that much can be done concerning the engineering design of device structures, selection of materials and integration of mechanisms that minimise the risk. Tubes, wires, electrodes and other equipment can be made safer, he said, and selection of more adequate, softer materials and devices, such as development of soft electrodes made of conducting textiles and similar ideas, can reduce the occurrence of MDRPUs.

Several examples were discussed during Professor Gefen's presentation, based on data from the team's recent experiments and computer simulations of scenarios where there is high risk for MDRPUs.

© shutterstock/Tyler Olson

Amit Gefen is Professor of Biomedical Engineering and the Herbert J Berman Chair in Vascular Bioengineering in the Department of Biomedical Engineering, Faculty of Engineering, at Tel Aviv University in Israel. He is also President of the Wound Care from Innovations to Clinical Trials (WCICT 2018) conference, which was held in Edinburgh.

Exploring new technologies

Advanced materials (particularly smart materials and structures), sensors and tele-monitoring systems, physiological signal analysis and data management, all have a role to play.

HAPUs are commonly considered an adverse event. MDRPUs, which are always HAPUs, compromise patient safety, lead to increased costs for potential additional hospitalisation days, interventions and treatments to manage the MDRPU condition, and also in association with the risk of litigation costs.

'From all perspectives,' he continued, 'the best strategy is prevention and dedicated technologies, including investments in new technologies, are required for that,' Gefen concludes.

'Medical Device Related Pressure Ulcers are a major portion of HAPUs and hence, mitigating MDRPUs will save vast financial and physical resources to medical facilities, which could potentially be invested elsewhere, for the benefit of patients, care givers and society.'

Focus on lighting

Yet again the lighting manufacturer ACEM, based in Bologna, Italy, has produced a new and valued medical lighting system – the focusable ACEMSO15F – aimed for use in diagnostics, minor surgery, intensive care and more.

ACEM is at Medica Hall 10 / Stand B60

This offers:

- 110,000 lux light intensity
- An IR-free light beam
- Light beam focusing
- Colour temperature (CCT) of 4,500 K
- Colour rendering index (CRI) of 97
- Low power consumption (25 W).
- The LED arrangement produces uniform, homogeneous and shadowless light.

Physically, the round, functional, wall, ceiling or trolley mounted ACEMSO15F is easy to grip and move and, for sterilisation, the handle is removable.

The optional ABPS rechargeable battery powered system provides use during emergency situations, humanitarian interventions, sudden black-outs, in field hospitals without UPS or power generators, and other conditions.

The ABPS matches the powered performance, and a control panel on the structure allows management of the residual charge, the type of power supply, recharge status and electrical power supply presence.

New medical cameras and displays

Detailed resolution, accurate colour reproduction, high brightness.

Designing medical imaging systems for surgical, ophthalmology and microscope-mounting applications, Ikegami Tsushinki Co. Ltd, from Tokyo, Japan, is showing the latest additions to its range of medical cameras and medical-grade displays.

'The new MKC-X800 is a progressive-scan camera with an ultra-high-sensitivity 4K-native CMOS imager,' Ikegami reports. 'Measuring just 34 x 40 x 40 mm, the camera head connects to a control unit giving access to functions such as mirror, flip and rotate, image correction and scene file access. The MKC-X800 can output in a variety of signal formats, such as quad-link 3G-SDI, HDMI 2.0. or 12G-SDI. Originated for the professional broadcast sector, the 12G SDI signal format allows easy 4K connection over a single coax cable,' the report concludes.

'These new cameras are ideal for capturing the precise colour and image detail of surgical operations,' says Zeljko Romanic, Industrial & Medical Video Division Manager at Ikegami Electronics (Europe) GmbH. 'The MKC-X800 can be mounted on a lightweight support stand or boom and is designed for easy setup by medical staff, allowing the entire system to operate automatically.'

The company also offers a diversified range of medical grade displays. 'The combination of 4K ultra-high definition imaging and the enhanced dynamic range display capabilities increases the quality threshold now possible in video signal reproduction,' Ikegami notes. 'Top of the range are the 27-inch 4K high luminance model MLW-2750UHD and 31-inch 4K 2D/3D model MLW-3110U, each delivering an unsurpassed 4096 x 2160 resolution. Both displays incorporate 12G-SDI and HDMI 2.0 inputs. Additional features include a new IPS panel with LED back lighting, multi-display modes, full-flat front panel design and full compliance with medical safety directives.'

For storage applications, the Ikegami MDR-600HD digital video recorder can capture still images and Full-HD 1920 x 1080 video to its 500 gigabyte integral hard drive, or to USB-plus-in flash/HDD. 'The recorder includes an easy-to-operate front control panel with a built-in 3.5-inch full colour LCD screen, hygienic membrane control buttons and easy-access forward-facing USB ports,' Ikegami adds. 'Operating features include still image capture, content search and image data transfer. A barcode reader, foot switch, remote controller and USB card reader are available as options.'

Ikegami is at Medica Hall 10 / Stand B12

The ophthalmic eyeball scanner

Echo-Son S.A. is showing PIROP, its state-of-the-art ophthalmic ultrasonic device for biometry, visualisation and pachymetry of eyeballs (A+B+P Scan). 'The user interface is based on touch screen technology, which makes operation easy and user-friendly,' the Polish firm reports, adding this summary:

- A-SCAN – Ocular Lens Biometrics. A digital 'A-scan' tool for ophthalmology, biometry and lens power calculation of intra-ocular implants. Complete and quick biometry ; measurement of all eye types; IOL formulas; post refractive formulas; IOL power calculation comparison; contact and immersion methods.
- B-SCAN – Eye examination modern 'B-scan' tool for ophthalmology, interior eyeball imaging, retina, optic nerve etc. Probe frequency – 12/15 MHz.
- PACHYMETER (P-SCAN) – Ocular Cornea biometrics. The up-to-date ultrasonic pachymeter (corneal thickness biometrics) has a very high sampling frequency (400 MHz) – a significant increase in measurement accuracy. Resolution 1 µm ; 20 MHz probe operating frequency.

Echo-Son S.A. is at Medica Hall 9 / Stand B42

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Foreign patients could be better understood

App helps to break language barrier

Language difficulties become even greater when a patient is foreign and in need of medical care. To improve communication between international patients and medical staff, a new translation app – Medicospeaker – is undergoing its first in-hospital tests at Muenster University Hospital (UKM) in Germany. The system aims to translate dynamic conversation processes, explained Lukas Fortmeier, CEO of Medicospeaker who, as a trained nurse, is clearly familiar with language barriers in care giving.

During the app's development, phrases from everyday hospital life were linked to conversation processes in collaboration with medical staff and translated into 15 flexibly selectable languages.

The conversations depict everyday nursing processes according to Juchli's scientific model.

Nurses can thus hold admission interviews with a patient in his/her own language, as well as use the app in various care situations and communicate quickly and specifically in emergencies. Additionally, the patient can communicate different needs at any time, the manufacturer pointed out. 'We expect the application in everyday clinical use at the UKM to provide us with important empirical values that will help us further develop the app,' Fortmeier said.

Vincent Hofbauer MD, who heads the International Patient Management Unit at Muenster, added that the app 'offers an innovative and promising opportunity to simplify communication between our patients and our medical staff at any time and without interpreters.' Thereby lies the financial saving: interpreters can become expensive and are not readily available.

Medicospeaker is at Medica Hall 15 / Stand B57-14

The application is available in app stores for Android and iOS.

In addition to the language app, the producer, Medicosolution, also bundles innovative solutions for digital healthcare. Added to its portfolio are Asset Tracking, a system to avoid physically searching for assets and over-provisioning of equipment; Vital Tracking to monitor vital signs and localisation of patients, and Indoor Navigation.

Details: www.medicospeaker.com

New mobile ultrasound units

Known globally, the French firm Quantel Medical SAS (Lumibird Group subsidiary) specialises in solid-state and fibre technology lasers and ultrasound systems 'with a strong emphasis on research and development resulting in many first-to-market product introductions and OEM solutions,' the company reports.

This year, the manufacturer is showing a new range of Point-of-Care ultrasound – EvoTouch and EvoTouch+, two mobile units offering high resolution image quality, the company adds, 'specifically designed to assist health professionals such as anaesthesiologists, emergency doctors, general practitioners, physiotherapists or midwifes.'

Quantel is at Medica Hall 9 / Stand B47

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MEDICA'S LABMED FORUM 2018

- **Monday, 12 Nov 10.30 – 10.45 a.m.**

Hot topics in infectious diseases
PD Dr. med. Beniam Ghebremedhin
Universität Witten/Herdecke, HELIOS Universitätsklinikum Wuppertal

- **Wednesday, 14 Nov 10.30 – 10.45 a.m.**

Hot topics in cardiology
Prof. Dr. med. Stefan Holdenrieder
Deutsches Herzzentrum München und Universität Bonn

MEDICA'S CONNECTED HEALTHCARE FORUM

- **Tuesday, 13 Nov 2018 12.00 – 12.20 p.m.**

Health prevention via artificial intelligence
Elisa Gava, Navispace AG, Project Manager
Till Osswald, Microsoft, Senior industry Solution Executive Healthcare

Understanding the brain and optimising how it works

Brain-computer interfaces

A world where machines can be controlled by thought alone - such is the promise of so-called brain-computer interfaces (BCI). BCIs are both hardware and software communication systems that read brain and nerve signals, convert those into electrical signals and translate human thoughts into machine commands.

Research success for the MoreGrasp consortium: With the help of reprocessed brain signals the mental control of neuroprostheses will be considerably simplified in future

Developers of BCIs rely on artificial intelligence, neural network models and big data to mitigate the effects of Alzheimer's, Parkinson's, epilepsy, and other neurodegenerative conditions, to develop even better prostheses, or ultimately to improve the human cognition. Examples…

The beginning of the MoreGrasp project was marked by the idea of a ground-breaking further development of grasp neuroprosthetics activated by thought control. The aim was to develop a sensoric grasp neuroprosthesis to support daily life activities of people living with severe to completely impaired hand function due to spinal cord injuries. The motor function of the neuroprosthesis was to be intuitively controlled by means of a brain-computer interface with emphasis on natural motor patterns.

After the three-year project came to an end, the breakthrough was reported by members of the project consortium, led by Gernot Müller-Putz, head of the Institute of Neural Engineering at TU Graz, which include the University of Heidelberg, University of Glasgow, two companies – Medel Medizinische Elektronik and Bitbrain – as well as the Know Centre.

'In tetraplegia, all circuits in the brain and muscles in the body areas concerned are still intact, but the neurological connection between the brain and limb is interrupted. We bypass this by communicating via a computer, which in turn passes on the command to the muscles,' explains Gernot Müller-Putz, head of the Institute of Neural Engineering at TU Graz. The muscles are controlled and encouraged to move by electrodes attached to the outside of the arm and they can, for example, trigger the closing and opening of the fingers.

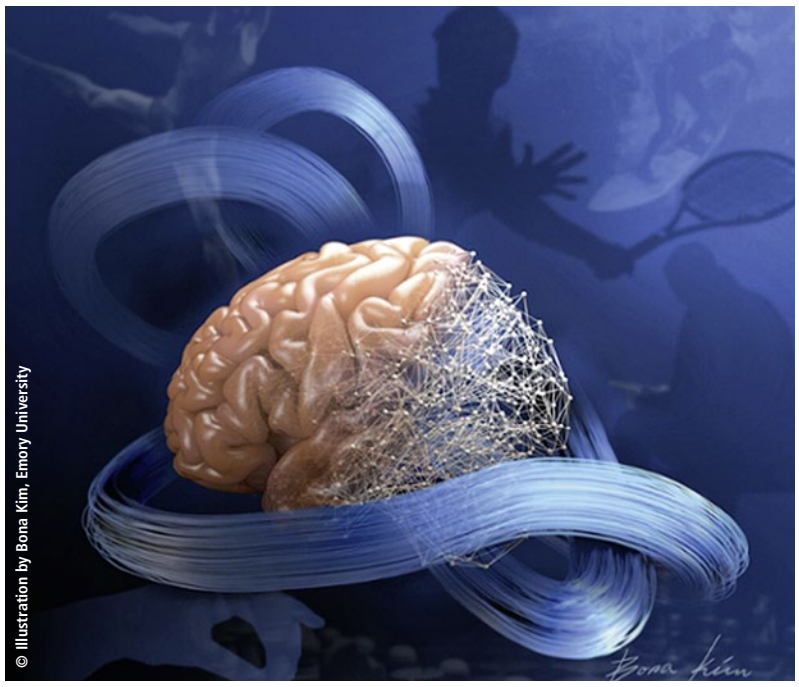
This mental 'detour' of any movement pattern, so long as it is clearly distinguishable, is no longer necessary, as Müller-Putz explains. 'We now use so-called "attempted movement".' In doing so, the test subject attempts to carry out the movement – for instance, to grasp a glass of water. Due to the tetraplegia, the occurring brain signal is not passed on, but can be measured through an EEG and processed by the computer system. Müller-Putz is extremely pleased with the success of the research. 'We are now working with signals that only differ from each other very slightly; nevertheless we manage to control the neuroprosthesis successfully. For users, this results in a completely new possibility of making movement sequences easier – especially during training.'

How does the brain talk with our arm? The body doesn't use English, or any other spoken language. Biomedical engineers are developing methods for decoding the conversation, by analysing electrical patterns in the motor control areas of the brain.

In this study, the researchers at the Emory University leveraged advances from the field of 'deep learning'. The computing approaches, which use artificial neural networks, let researchers uncover patterns in complex data sets that have previously been overlooked, lead author Dr Chethan Pandarinath points out.

The research team developed an approach to allow their artificial neural networks to mimic the biological networks that make our everyday movements possible. In doing so, the researchers gained a much better understanding of what the biological networks were doing. Eventually, these techniques could help paralysed people to move their limbs, or improve the treatment of people with Parkinson's, says Pandarinath, an assistant professor in the Wallace H Coulter Department of Biomedical Engineering at Georgia Tech and Emory University, USA.

For someone who has a spinal cord injury, the new technology could power 'brain-machine interfaces' that discern the intent behind the brain's signals and directly stimulate someone's muscles. 'In the past, brain-machine interfaces have mostly worked by trying to decode very high-level commands, such as, "I want to move my arm to the right, or left",' Pandarinath points out. 'With these new innovations, we believe we'll actually be able to decode subtle signals related to the control of muscles, and make brain-machine interfaces that behave much more like a person's own limbs.



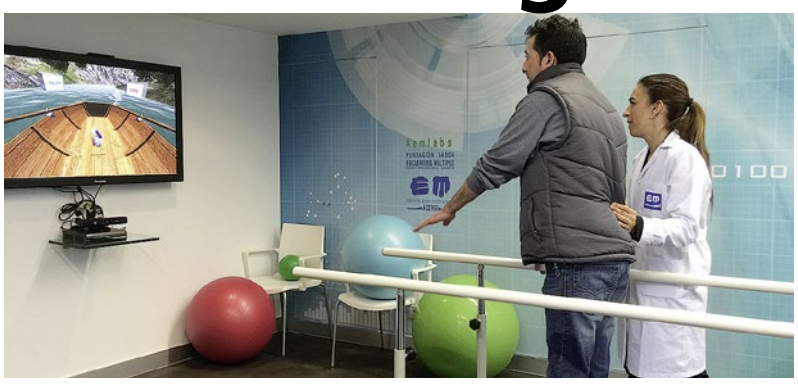
Biomedical engineers are developing methods to decode the conversation between brain and arm, by analysing electrical patterns in the motor control areas of the brain

Rehabilitation becomes a game

Evolv Rehabilitation Tech is at Medica Hall 4 / Stand F10

Spanish firm Evolv Rehabilitation Technologies S.L. reports that its flagship product, VirtualRehab, is a pioneering CE certified rehabilitation platform that uses virtual reality, motion capture systems, and 'gamification'.

'VirtualRehab has been used by thousands of patients of all ages and levels of ability in over 100 rehabilitation centres in 20 countries,' the tech firm adds. 'Developed in conjunction with leading international neurologists, therapists and researchers, VirtualRehab helps people of all disability levels to have rehabilitation in clinics as well as at home through game-like task-specific activities.



Exoskeleton enables autonomous walking

'Wandercraft's exo is the first autonomous walk exoskeleton. It is also the first to have the potential to restore outpatient autonomy,' the maker reports. 'Delivering autonomous and realistic ambulation requires two complementary technologies: dynamic robotics algorithms and mechatronics, that accommodate unbalanced situations during the stride and calculate trajectories and foot placement at each point of the gait cycle to re-create balance; then 12 actuated degrees of freedom, to allow physiological movements.'

The manufacturer adds that its 2018 Rehab Centre version offers:

- Autonomous walk and sitting/standing manoeuvres, without crutches.
- Eliminates strain upon upper body from use of crutches, allowing for medical hypotheses on the impact of higher treatment repetition and intensity, without upper limb damage or excessive energy consumption.
- More realistic patient posture and gait, allowing for hypotheses on the impact of better leveraging neural plasticity.

A strong emphasis has been put on a patient's tolerance of the exo, to allow repeated, frequent therapy sessions. In the first clinical trials, patients remained several hours in a row in the exo under medical supervision, with no significant fatigue nor skin lesions.

'Medical teams working with Wandercraft plan to leverage the exo's unique self-balancing and gait realism to validate hypotheses on its potential to increase treatment efficacy in three areas,' the firm adds:

- Rehabilitation, with hypotheses on factors such as: a more realistic gait; increased doses allowed by the absence of strain on upper limbs and lower energy consumption; could enable more efficient and effective rehabilitation.
- Addressing associated diseases resulting from sedentary life in a wheelchair, with hypotheses on the impact of more realistic gait and potentially higher doses of treatment.

Wandercraft SAS is at Medica Hall 4 / Stand H22

Junior radiologists must learn about intelligent tools

The rising dawn of information specialists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Recent developments in artificial intelligence (AI) created a veritable hype. However, that initial awe was increasingly mixed with apprehension about the potential effects of AI on healthcare. In radiology bleak dystopias are conjured up with AI replacing the human radiologist. A scenario that Dr Felix Nensa, consultant at the Institute of Diagnostic and Interventional Radiology and Neuroradiology at University Essen, Germany, considers premature to say the least. 'Artificial intelligence will not replace the radiologist,' he told European Hospital correspondent Sascha Keutel, adding: 'Rather, radiologists who do not use AI will be replaced by those who do'.

Deep Learning as an AI method is developing swiftly and today offers a superior approach to medical image analysis. In radiology it has become indispensable. Nevertheless the use of AI is under scrutiny and often the question arises 'Should we be scared of AI? But 'Who are "we"?' asks Nensa, and points out that the use of AI will have a different impact on different actors in healthcare.

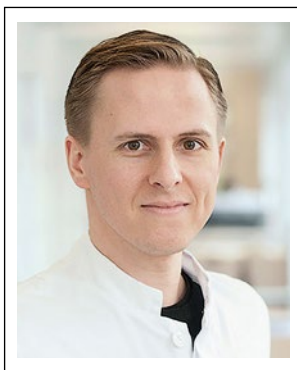
Man and machine – a powerful team

Over recent years, data volumes in radiology, particularly in multi-slice imaging, have exploded. Radiology facilities would profit immensely from systems that can read multi-slice images quickly. 'Radiologists are comparatively expensive specialists but, after all, they are human beings. AI applications can take over tedious tasks, such as counting and measuring metastases and/or enhance the diagnostic precision of such tasks. In the end the patients will benefit,' Nensa points out, adding: 'For our society that would be a great success, because it would mean better and maybe even cheaper healthcare.'

However, such benefits can only be realised with physicians who do not feel threatened by these developments and accept AI in their daily routine. 'Obviously the ways radiologists work will change. AI will definitely become part of our professional life, for example to diagnose simple cases or to perform repetitive tasks,' Nensa predicts. There is no reason to feel threatened, he underlines, because after all the tasks of a radiologist involve far more than reading images. Radiologists work on tumour boards, they treat diseases, e.g. with local ablations or interventional radiology, they arrive at diagnoses by analysing images and the medical history of patients and they talk to patients. 'These are all activities that are not easily automated. Thus neither radiologists nor specialist physicians in other disciplines need to be worried about their job.'

Nensa compares the situation to the introduction of autopilot systems in aviation: the technology did not replace human pilots but expanded their job description. If an airport is adequately equipped, aircraft can take off and land autonomously. 'But honestly, who would dare take a plane without a pilot?' Nensa asks. 'AI is helpful when it comes to procedures that have been learned and practised thousands of times. But the moment something unexpected happens it's by no means certain that an AI system will take the right decision. You remember the pilot a few years ago who landed his plane on the Hudson River? Would an autopilot system have been able to do this? Most certainly not!'

How will AI affect diagnostics, treatment and workflow? 'I venture a guess that, in the long run, the diagnostic disciplines will move closer together. It's been predicted before that radiologists and pathologists will evolve into information specialists. This will also hold true for lab and nuclear medicine to the extent that they are involved in diagnostics. Such a clinical information specialist will be in charge of diagnostics and cover all these areas. Consequently, specialists in other areas will focus on therapy.'



Dr Felix Nensa is a consultant at the Institute of Diagnostic and Interventional Radiology and Neuroradiology at University Essen in Germany. Before entering university, he worked as a freelance developer for the Research Institute for Diagnosis and Treatment of Early Lung Cancer at Augusta Hospital, Bochum, where he wrote a diagnostic software program for automated sputum cytometry. Nensa enrolled in a distance learning program in computer science when undertaking his medical studies at Ruhr University Bochum.

The curriculum must adapt

The role of AI instruments in radiology is hotly debated – which has led to statements such this, in 2016 by Geoffrey Hinton, that the radiologist training should be stopped immediately. 'I most strongly disagree. I'm entirely convinced that, in 2021, we will need even more radiologists than are currently in training.'

Nonetheless, Nensa urges that the curriculum be revamped. 'New training programs have to prepare medical students for this new reality. We need to teach junior radiologists how intelligent tools works and how they can help improve healthcare and how radiologists effectively monitor the application of these tools.'

The system enables treatment sessions with autonomous standing up, maintaining standing balance with intrinsic perturbations, walking, turning, sitting down. Patient transfer, donning and doffing are reported to be easy and safe. Training times are short. The bio-compatible user interface and braces allow for frequent rehab sessions

'Associated diseases may include conditions related to cardiovascular, joint restrictions, digestion and urinary, overweight and posture, possibly bone density and self-image.

The Rehab Centre version is being industrialised, should be CE marked end-2018 as a Class IIa medical device and then will be commercialised in Europe,' the maker adds.

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