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Jan - Feb 2020

Endovascular surgery

Researchers make breakthrough with magnetized catheter guidance

Hydrogel for heart repair

First-in-man trial shows VentriGel safe for humans

Eradicating polio

Global leaders meet in Abu Dhabi, pledge $2.6bn for endgame strategy

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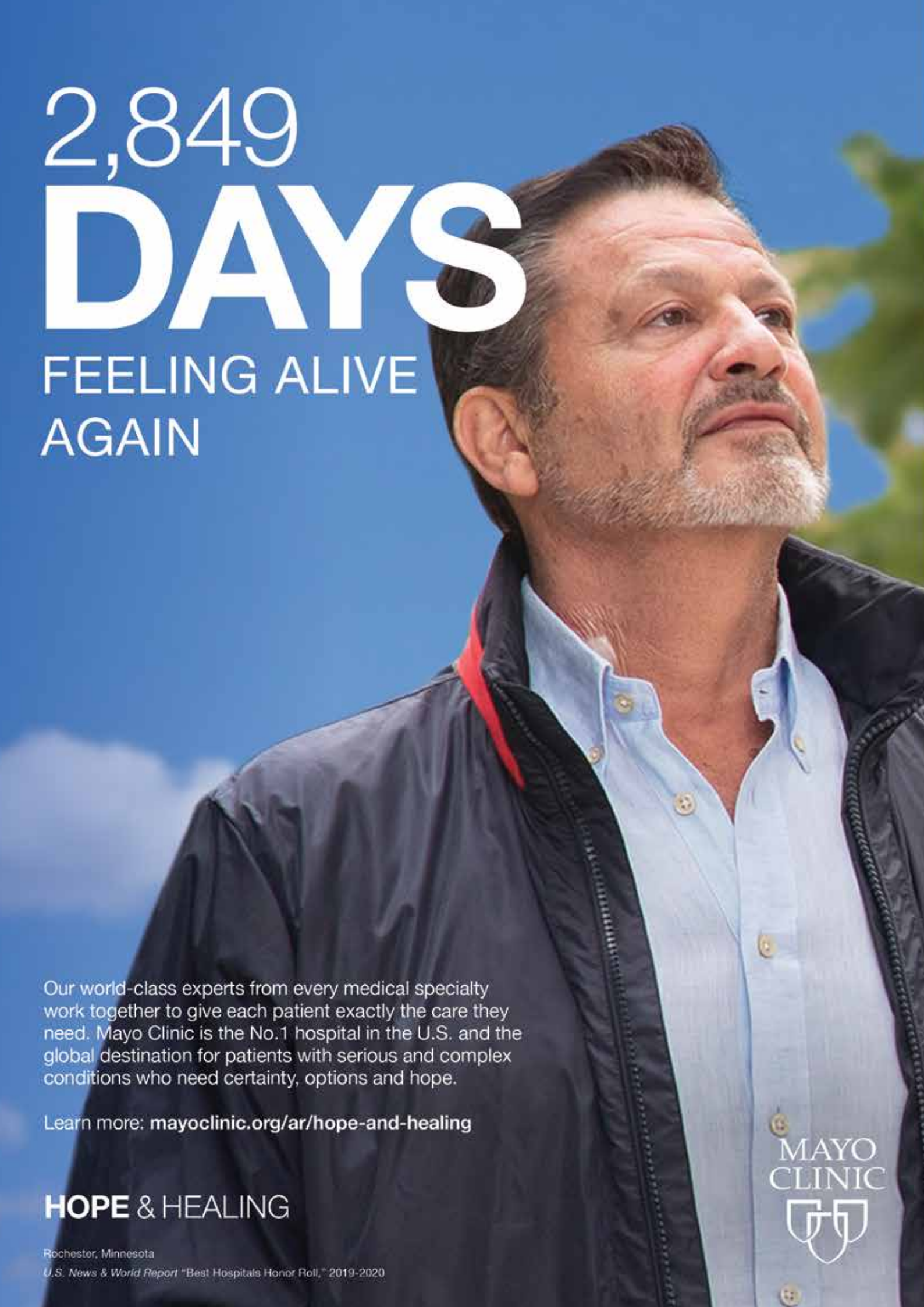
- Mediclinic Middle East achieves company-wide JCI accreditation
- WHO: Kids worldwide not physically active enough
- 140,000 die from measles as cases surge globally

Bahrain BD3, **Egypt** £E40, **Iran** IRR75, **Iraq** IQD9,400, **Jordan** JD5, **Kuwait** KD3, **Lebanon** LBP12,000, **Oman** RO3, **Qatar** QR30, **Saudi Arabia** SR30, **Syria** £S400, **UAE** Dh30, **Yemen** YR1,600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Prognosis

A new decade

Welcome to 2020 and a new decade. Looking at some of the outstanding advances in healthcare and technological innovations made over the past decade, the next decade will surely see many new and potentially revolutionary developments to benefit humanity. But we are also faced with a number of serious challenges. Most notably is the mission to foster greater equity of access to healthcare and the reduction of a wide range of diseases as set out in the all-important goals of the United Nations 2030 Agenda for Sustainable Development. With political will and the just allocation of resources these profound and far-reaching goals will be achievable.

In our focus on cardiology in this issue we look at a number of research breakthroughs in the field. In particular, we look at a novel development in instrument guidance for endovascular surgery where researchers use the fringe magnetic field generated by an MRI scanner to guide a magnetized catheter to reach difficult-to-access vascular locations. We also look briefly at an ambitious study that is trying to restore the neural connections that are lost during heart transplants, thus improving the life expectancy of patients. Another study of interest is a first-in-man-trial which has shown that a novel hydrogel that can be used to repair damaged heart tissue is safe to inject in humans.

Also in this issue, we report on a meeting of global leaders in Abu Dhabi who pledged $2.6 billion in an effort to finally eradicate polio. Wild polio only circulates in two countries: Pakistan and Afghanistan, and final concerted push has the potential to completely wipe-out the debilitating disease, as was achieved with smallpox several decades ago.

We report on a wide range of healthcare news. One example is a report on a new study which developed and validated a tool for assessing children's overall addiction to digital devices. The study found that more than 12% of children ages 9-12 years were at risk of addiction to digital devices for uses including video gaming, social media, and texting. You'll find many more interesting and informative reports in our news pages.

On 27-30 January the Arab Health 2020 exhibition will take place in Dubai. The event is the the largest gathering of healthcare and trade professionals in the MENA region – with more than 55,000 visitors and 4,250 exhibitors from over 150 countries. We look forward to seeing many of the new products and services that will be launched at the show.

We wish all our readers good health, happiness and prosperity for this new decade – from the team at *Middle East Health*.

Callan Emery
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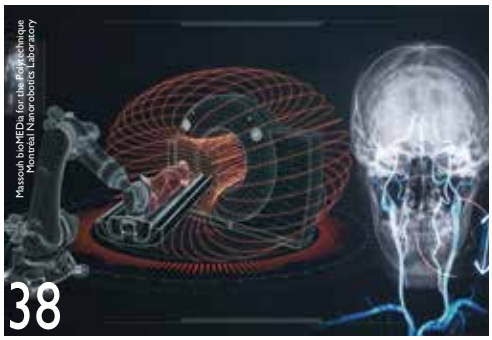

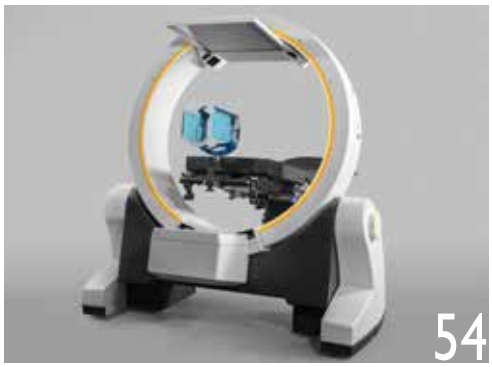

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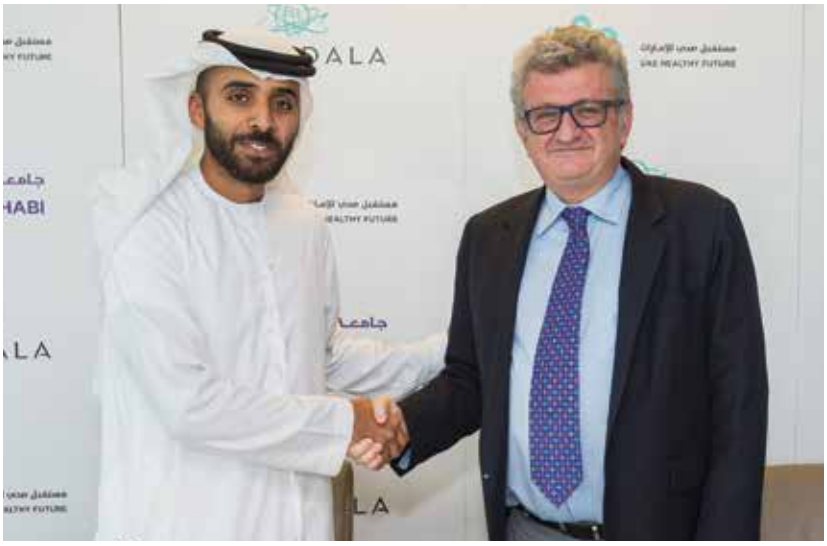

Abdulla Abdul Aziz Al Shamsi, Head of Mubadala Healthcare and Fabio Piano NYU Abu Dhabi Provost sign MoU to collaborate on the UAE Healthy Future Study.

Mubadala Healthcare signs MoU to collaborate on UAE Healthy Future Study

Mubadala Healthcare and NYU Abu Dhabi (NYUAD) have signed a Memorandum of Understanding (MoU) to collaborate on the UAE Healthy Future Study (UAEHF), supporting one of the key Abu Dhabi Vision 2030 objectives of establishing the emirate as a significant knowledge hub in the region.

The MoU reaffirms the parties' commitment to continue working together on this long-term study which specifically explores the genetic and lifestyle determinants of chronic diseases among Emiratis, to produce meaningful research on chronic disease causes and prevention that is specific to the UAE. To date 1,800 participants in the study have been generated through the collaboration with Cleveland Clinic Abu Dhabi, Healthpoint and Capital Health Screening Center, partof Mubadala Healthcare network.

Eng. Abdulla Abdul Aziz Al Shamsi, Head of Mubadala Healthcare said: "By partnering with highly regarded academic, industrial and investment institutions, we can help to develop an ecosystem of world-class healthcare education, medical research and innovation that will ultimately empower healthcare professionals and improve patient outcomes.

"We already have an excellent working relationship with NYUAD cooperating on medical research, so we look forward to extending this and collaborating in areas such as innovation in medical devices and education."

According to the MoU, the two parties will discuss and identify potential synergies and areas for collaboration within healthcare, including research on population health and improving patient outcomes, education and development of talent in the field, and innovations in digital health and medical devices.

NYUAD Provost Fabio Piano said: "As a global university in and of Abu Dhabi, this collaboration is significant to NYU Abu Dhabi as it helps us in supporting Abu Dhabi Vision 2030 objectives, advancing Abu Dhabi as a center of research, ideas, and innovation, while promoting a healthier future for the UAE. This agreement is a milestone for NYUAD's Public Health Research Centre and its pioneering UAE Healthy Future study. One that will enable our researchers to expand their efforts, increase the pool of potential participants, and extend the reach and impact of this important longterm health study."

Al Shamsi added: "In terms of the MoU, both parties will also explore opportunities to cooperate across a broad range of healthcare issues as Mubadala Healthcare has facilities that cover the entire healthcare continuum, from disease prevention and diagnosis, to emergency and long-term care."

Mubadala Healthcare assets include Imperial College London Diabetes Centre, Cleveland Clinic Abu Dhabi, Healthpoint, Amana Healthcare, National Reference Laboratories, Capital Health Screening Centre, and Abu Dhabi Telemedicine.

To date, over 7,000 Emiratis have signed up to take part in the UAE Healthy Future Study, with an aim of reaching 20,000 by March 2021.

- To learn more about the study, visit *http://uaehealthyfuture.ae*

Mediclinic Middle East achieves JCI accreditation for all hospitals and clinics

Mediclinic Middle East, one of the UAE's leading private healthcare groups, has recently completed its first companywide Joint Commission International (JCI) accreditation initiative, with all seven hospitals and 21 clinics in Dubai, Abu Dhabi and Al Ain receiving JCI accreditation.

JCI is considered the gold standard in healthcare accreditation and the most rigorous evaluator of international standards in quality and patient safety.

The successful accreditation process means that patients at every Mediclinic Middle East facility in the UAE can be assured of the highest levels of service, safety and healthcare quality, benchmarked against global best practice.

David Hadley, CEO of Mediclinic Middle East, said: "Mediclinic Middle East's focus on ethical, high quality, international standard healthcare services has been recognised by JCI in this groupwide accreditation. A huge amount of time and effort has been invested in making sure that all our hospitals and clinics can withstand the rigorous assessmentcarried out by JCI, and underlines our commitment to providing a superior level of service to all our patients."

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Cleveland Clinic Abu Dhabi introduces new minimally invasive treatment for heart valve defect

Patients at Cleveland Clinic Abu Dhabi have become some of the first people outside Europe to benefit from an innovative new procedure to correct mitral valve regurgitation, a life-threatening heart defect.

The new procedure is a minimally invasive alternative to open heart surgery, enabling physicians to correct mitral valve regurgitation in high-risk patients. Doctors access the patient's heart through a vein in their leg and implant a device to repair their heart valve while it is still beating. This approach leads to much faster recovery times, with patients able to be discharged within one day of surgery.

Cleveland Clinic Abu Dhabi's location within the UAE – which benefits from its balance between European and US regulatory systems – ensured that it was among the first hospitals in the world to introduce the procedure after clinical trials. This enabled two Emirati national patients to receive the new procedure ahead of even patients in the US, reflecting the fast pace of development of the nation's healthcare sector.

The first of their kind procedures were performed by Dr Rakesh Suri, CEO of Cleveland Clinic Abu Dhabi and a leading expert on mitral valve repair, and Dr Mahmoud Traina, an interventional cardiologist at Cleveland Clinic Abu Dhabi. They benefitted from live imaging support from Dr Ahmed Bafadel, who specializes in cardiac imaging.

"A tremendous benefit of practicing in Abu Dhabi is how responsive the regulators are to the needs of the local community. When we approached them about this procedure and presented our supporting evidence, we got approval in just a few weeks. That speed means that our patients are able to access the innovative procedures when they need it, and benefit from new treatments much earlier than they might be in other parts of the world," says Dr Mahmoud Traina.

Moza Al Kaabi, a 71-year-old mother of 18 became the first patient in the UAE to benefit from the new treatment. Her valve problems had significantly affected her quality of life over the last 12 months, leaving her unable to perform routine daily tasks and leading to repeated hospital stays. She was prioritized to receive this new procedure since issues with her kidneys meant that other treatments – such as transplant surgery – were not realistic options.

"The day after my surgery I was amazed, I could walk around and even climbed a flight of stairs for the first time in years. I thank God for my recovery, and I am very proud that our leaders have provided a hospital like Cleveland Clinic Abu Dhabi here in the UAE," says Moza.

Following her successful treatment, Moza is now able to be placed on the kidney transplant list, providing a much brighter future for her and her family.

"Moza is a perfect example of the type of patient that can benefit from this treatment. Not only will she benefit in terms of quality of life thanks to a properly functioning mitral valve, she is now eligible for a kidney transplant that will further improve her quality of life," concludes Dr Traina.

Cleveland Clinic Abu Dhabi, part of Mubadala's network of world-class healthcare providers, is a multispecialty hospital on Al Maryah Island in Abu Dhabi, UAE. Cleveland Clinic Abu Dhabi is a unique and unparalleled extension of US-based Cleveland Clinic's model of care, specifically designed to address a range of complex and critical care requirements unique to the Abu Dhabi population.

Malaffi, region's first Health Information Exchange platform, reaches new milestone

Malaffi, the region's first Health Information Exchange (HIE) platform, created in partnership between the Department of Health – Abu Dhabi (DOH) and Injazat Data Systems, has announced in November that Abu Dhabi Health Services Company (SEHA) and Mediclinic Al Noor Hospital are now fully onboarded to Malaffi. That brings the total number of current users of Malaffi to over 15,000. Malaffi has onboarded 346 facilities, which represents 60% of hospital beds in Abu Dhabi, and the platform now safely and securely houses 35 million unique patient records.

Speaking about this milestone for Abu Dhabi, H.E. Mohammed Hamad Al Hameli, Undersecretary of the Department of Health of Abu Dhabi, said: "We are firmly committed to providing the best healthcare solutions and technologies to the people of Abu Dhabi. Through connecting both the private and public sector in Abu Dhabi, this signifies an extremely important and unique milestone as it is a goal that many Health Information Exchange platforms aspire to achieve globally. We look forward to paving the way for even more milestones

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in the coming months as we create a more connected healthcare system and ultimately achieving "a healthier Abu Dhabi".

With this latest update of Malaffi, laboratory results are available as part of the Malaffi file. About 70% of clinical decisions are based on laboratory results, and this will significantly improve the clinical value of Malaffi, by improving the efficiency and accuracy of the diagnosis and reducing unnecessary duplication of tests.

Atif Al Braiki, the Chief Executive Officer of Abu Dhabi Health Data Services, the operator of Malaffi, said: "We have identified the need for the efficient, safe and secure sharing of patient health information between different healthcare providers in order to further promote a healthy nation. We see this as a shared goal within the healthcare network in Abu Dhabi, as leading providers such as SEHA and Mediclinic Al Noor Hospital now join us in full support. We have developed a phased approach to successfully implement Malaffi, and strongly urge providers to be a part of this exciting new chapter for our evolving healthcare landscape in Abu Dhabi.

"SEHA has always been the driver of information technology and innovation. We are now delighted to be amongst the early adopters of Malaffi. As the largest public network of healthcare providers in Abu Dhabi and UAE, we are proud to support the vision of the DOH for connected private and public healthcare in Abu Dhabi through Malaffi. This initiative will bring enormous benefits for our patients in the Emirate. As Malaffi evolves to onboard more providers and include more clinical information, we anticipate increased efficiencies within the healthcare sector over the coming years," added Dr Gareth Goodier, Group Chief Executive Officer, SEHA.

"We applaud the Department of Health – Abu Dhabi for the initiative to create Malaffi," concludes David Hadley, Chief Executive Officer of Mediclinic Middle East. "We, at Mediclinic, fully stand behind it. Mediclinic Al Noor Hospital is the first from our network to join Malaffi, and we are looking forward to the soon onboarding of our other facilities in Abu Dhabi, so our users and patients can reap its benefits. We truly believe this milestone marks an exciting time of transformation for the healthcare sector in Abu Dhabi."

Priory Group opens behavioural care facilities in Middle East

UK-based Priory Group – the leading provider of behavioural care in the UK – is poised for expansion across the region, with Will Goodwin, Priory Chief Operating Officer, lauding the Middle East as offering "one of the most exciting and dynamic healthcare markets in the world".

The Group, which cares for around 30,000 people a year in the UK for conditions including depression, anxiety, eating disorders and self-harm, has experienced a strong start in the UAE since opening its Wellbeing Centre in Dubai two years ago. Last year it also opened its first autism school outside the UK in Abu Dhabi, and is now planning its next steps for growth.

"It can be a daunting prospect for any business to open in a new market, but we've been hugely impressed by the level of support received from government organisations and regulatory bodies in the UAE," said Goodwin. "There is an appetite to attract high quality international operators, especially where there are gaps in the provision of niche medical services.

The Priory's decision to open in Dubai was also made easier by the availability of experienced medical practitioners. "The high standard of living attracts high calibre personnel, and we've been able to maintain high retention levels because of the strength of our brand and the continuous professional development that we're able to offer," adds Goodwin.

The Wellbeing Centre is focused on providing mental health support and expertise, and its arrival coincided with an awakening about mental health issues among both the public and private sectors. The traditional stigma associated with mental ill

Will Goodwin, Priory Chief Operating Officer

health has begun to dissipate worldwide, with recognition that the best way to tackle the issue, and to support a healthy and productive population, is to address it head on. Evidence of this can be found in the 'Dubai Mental Health Strategy', launched in 2018, which recognises the prevalence and increase in demand for mental health services.

"More insurance providers are now including mental health services, and via the Health Strategy I believe that it may become part of mandatory health cover in Dubai, which we would support as this will further increase availability for a wider audience", said Goodwin.

Despite the vast diversity of cultures and nationalities in the UAE, the mental health issues of patients are generally similar to those supported in the Priory Group's home market, with depression, stress and anxiety the most common conditions. However, similar to the UK, an increased prevalence of body dysmorphia, eating disorders and low self-esteem is being recognised, which can often be associated with the pervasive influence of social media and, moving forward, has the potential to generate a much greater need for mental health services in both adults and young people alike.

Additionally, the large expatriate population here is often lacking in the supportive structure of family and friends, which can have a detrimental effect on their emotional health and wellbeing, with feelings of isolation and loneliness extremely common. MEH

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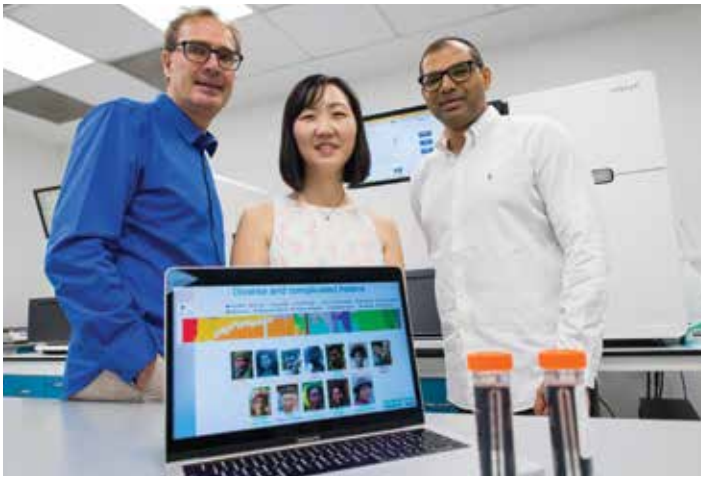


(L-R) NTU Prof Schuster, Asst Prof Kim and GenomeAsia 100K Exec Chairman Mr Pratapneni, discussing the results of the genome study involved the use of the high-throughput DNA sequencers at NTU and the other companies.

Asia-wide genome mapping project reveals insights into Asian ancestry and genetic diversity

After a global genetic comparison, a team of international scientists has discovered that Asia has at least 10 ancestral lineages, whereas northern Europe has a single ancestral lineage.

In their first study reported in *Nature*, the GenomeAsia 100K consortium analysed the genomes of 1,739 people, which represents the widest coverage of genetic diversity in Asia to date.

The study covers 64 different countries and provides what the authors call "the first comprehensive genetic map for Asia" that will guide scientists in studying diseases unique to Asians, improve precision medicine and identify drugs that may carry higher risk of adverse reactions for certain ethnic groups.

Despite forming over 40% of the world's population, Asian people have previously accounted for only six per cent of the world's recorded genome sequences.

Mahesh Pratapneni, Executive Chairman of GenomeAsia 100K, said: "The publication of this pilot study is a first milestone for GenomeAsia 100K, which is an unprecedented collaboration between academia and industry leaders in the field of genomics. We are certain more partners will join GenomeAsia 100K to accelerate medical breakthroughs for people of Asian heritage."

The goal of GenomeAsia 100K, which launched in 2016, is to better understand the genome diversity of Asian ethnicities by sequencing 100,000 genomes of people living in Asia. It is a non-profit consortium hosted by Nanyang Technological University, Singapore (NTU Singapore), the only academic member. Its three other members are Macrogen based in South Korea, Genentech, a member of the Roche Group in United States, and MedGenome from India/US.

NTU Professor Stephan C. Schuster, the consortium's scientific chairman and a co-leader of the study, explained the significance of GenomeAsia 100K's initial findings on the vast genomic diversity in Asia: "To put it into context, imagine we looked at all people of European and based on the level of their genetic diversity, observed that they could all be grouped into just one ancestral lineage or population. Now, if we took that same approach with our new data from people of Asian, then based on the much higher levels of genetic diversity observed we would say that there are 10 different ancestral groups or lineages in Asia."

Prof Schuster added: "GenomeAsia 100K is a significant and far-reaching project that will affect the well-being and health of Asians worldwide, and it is a great honour for Singapore and NTU to be hosting it."

Sam Santhosh, Chairman and CEO of MedGenome, the largest genomics and molecular diagnostics provider in South Asia with facilities in the US, Singapore and across India, said: "We are excited that over 1000 whole genome sequence data from the Indian sub-continent will now be available to researchers; this is an initial step in covering the underrepresented geographies."

Prof Jeong-Sun Seo, at Seoul National University Bundang Hospital Consortium scientific co-chair and Chairman of Macrogen, said: "I hope this Asian-focused study serves as a stepping stone for the democratisation of health care and precision medicine in Asia."

Knowing a person's population group and their predisposition to drugs is extremely important if personalised medicine is to work, stressed Prof Schuster: "For precision medicine to be precise, you need to know precisely who you are."

NTU Asst Prof Hie Lim Kim, who leads the project's efforts in population genetics, added: "Only by sequencing the entire genome of an individual can a person's ancestry and genetic background be known. Their genome explains why some people are afflicted by certain diseases while others aren't. Scientists know that there is no single drug that works well for everybody and our latest findings not only reinforce this, but suggest how specific groups could be harmed by specific medicines."

Moving forward, the GenomeAsia 100K will continue to collect and analyse up to 100,000 genomes from all of Asia's geographic regions, in order to fill in the gaps on the world's genetic map and to account for Asia's unexpected genetic diversity.

- **doi**: 10.1038/s41586-019-1793-z

Researchers develop new tool to assess digital addiction in children

A new study developed and validated a tool for assessing children's overall addiction to digital devices. The study, which found that more than 12% of children ages 9-12 years were at risk of addiction to digital devices for uses including video gaming, social media, and texting, is published in *Cyberpsychology, Behavior, and Social Networking*.

The article entitled "The Digital Addiction Scale for Children: Development and Validation" was coauthored by Nazir Hawi and Maya Samaha, Notre Dame University–Louaize

(Mosbeh, Lebanon), and Mark Griffiths, Nottingham Trent University (UK).

The researchers based the The Digital Addiction Scale for Children (DASC) on the nine diagnostic criteria for addiction. They also mapped it onto six core addiction criteria: preoccupation, tolerance, withdrawal, mood modification, conflict, and relapse. They included three additional criteria: problems (with life necessities that could become uncontrollable due to digital addiction, such as sleep, discord with parents, or academic achievement); deception (how children lie to their parents about the amount of time and what they do on their digital devices); and displacement (parental feelings of disconnectedness from their children that result in compromising the family unit).

"Using validated scales, many paediatricians proactively screen their patients for problematic and risky internet use and internet gaming disorder to identify and address issues that may negatively affect child and adolescent health and wellbeing. The DASC may prove a useful assessment tool for clinicians to also consider," says Editor-in-Chief Brenda K. Wiederhold, PhD, MBA, BCB, BCN, Interactive Media Institute, San Diego, California and Virtual Reality Medical Institute, Brussels, Belgium.

- **doi**: 10.1089/cyber.2019.0132

Johns Hopkins launches 'ImmunoEngineering' hub

If the saying that two heads are better than one is true, then joining two fields of science may be better than one to spur more advances in medicine. With a US$6.7 million, five-year grant from the US National Institutes of Health, Johns Hopkins Medicine researchers will bring together immunologists, oncologists and biomedical engineers in an effort to build new tools to treat cancer and autoimmune diseases.

Engineers have long been collaborating with scientists to develop new medical devices and tools, but recent advances in technology have helped scientists expand engineering concepts into fields once the sole domain of specialists. According to Johns Hopkins immunologist and lead investigator Jonathan Schneck, M.D., Ph.D., before now, engineering and immunology researchers worked together on various projects in an ad hoc way. The new Johns Hopkins Translational ImmunoEngineering (JH-TIE) Biotechnology Research Center aims to formalize the blend of engineering and immunology. Scientists have dubbed this "ImmunoEngineering".

"When scientists work across disciplines, that's when major advances in the fields happen," says Schneck, professor of pathology, medicine and oncology at the Johns Hopkins University School of Medicine and member of the Johns Hopkins Kimmel Cancer Center. "The advances in immunotherapy have been beacons in the darkness, but they haven't answered everything. This is an opportunity to catalyze the next breakthroughs that we need."

Among the projects scientists will be working on is the creation of artificial immune cells that educate the immune system about how and where to find cancer cells, setting the stage for an immune system attack on malignant cells.

Schneck says such immune cells, called antigen presenting cells, act as conductors in the symphony of the immune system. "One part of the system needs to lead the orchestra, instructing other cells when and where to integrate. Otherwise, it's a cacophony of sounds," he explains.

Other areas of research include using nanomaterials to program immune cells to fight disease, and analyzing how immune cells absorb, or metabolize, nutrients that affect their ability to stave off disease.

Leaders of the new centre also plan to train other scientists in the immunoengineering field and educate the next generation of immunoengineers through workshops, online materials and scientific meetings.

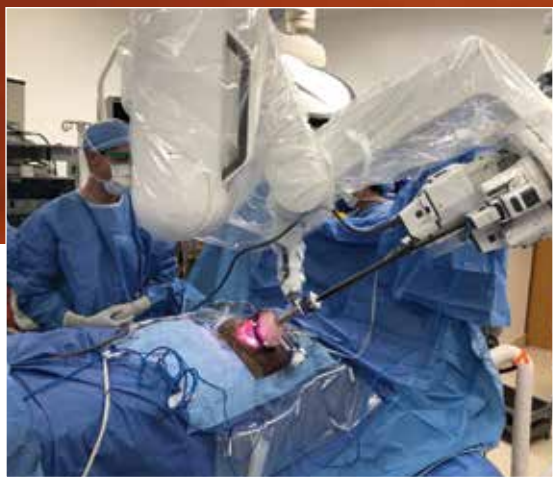
Pakistan becomes first country to introduce new typhoid vaccine into routine immunisation program

On November 15, 2019, Pakistan announced it would become the first country in the world to introduce the typhoid conjugate vaccine (TCV) – now recommended by the WHO – into its routine immunization program. It is the first typhoid vaccine that can be given to children as young as 6 months of age and confers longer term protection against typhoid. The government of Pakistan is launching the vaccine introduction with a campaign in Sindh Province, which is the centre of an ongoing extensively drug-resistant (XDR) typhoid outbreak that began in November 2016.

"Children are disproportionately affected by typhoid and its associated complications, and we strongly believe that TCV would protect our children against potentially fatal disease of typhoid," said Dr Zafar Mirza, Special Assistant to the Prime Minister on Health. "Starting with Sindh Province, where the need is most urgent, the government of Pakistan has planned a phased national introduction strategy with strong, coordinated support from global and local partners."

In 2017, 63% of typhoid cases and 70% of typhoid deaths in Pakistan were among children younger than 15 years of age. With funding support from Gavi, the Vaccine Alliance, the vaccine introduction began with a two-week vaccination campaign targeting 10 million children 9 months to 15 years old in urban areas of Sindh Province. It will be followed by a transition to routine immunization of 9-month-old infants in all parts of the province once the campaign ends. The vaccine will be introduced in neighbouring Punjab Province and Islamabad this year and then nationally in 2021.

"Typhoid is a highly contagious disease that spreads more quickly and easily when people live in crowded neighbourhoods with weak water and sanitation infrastructure. Beginning the vaccination in urban areas is critical in preventing the disease among the communities most at risk," said Dr Azra Fazal Pechuho, Provincial Minister of Sindh for Health, and Population Welfare. "Typhoid is preventable. Prevention through vaccination is one of the most effective interventions to reduce typhoid infections." The government is also promoting WASH solutions (water,



sanitation and hygiene) alongside TCV introduction.

Typhoid, a serious illness caused by *Salmonella Typhi*, is spread through contaminated food and water and disproportionally impacts children and low-resource communities in Asia and sub-Saharan Africa. The Global Burden of Disease study estimates that, in 2017, there were nearly 11 million typhoid cases and more than 116,000 typhoid deaths worldwide.

"A typhoid conjugate vaccine offers a very good solution to protect children from falling ill and from drug-resistant typhoid. We commend the government of Pakistan for prioritizing the health of children with the introduction of the vaccine. We also commend the Federal Pakistan and Sindh governments for the tremendous efforts they have made to reach every child during this important campaign," said Dr. Palitha Mahipala, WHO Representative in Pakistan.

Pakistan's current extensively drug resistant (XDR) outbreak of typhoid, which has infected more than 10,000 people, mostly in Sindh province, is the first-ever reported outbreak of typhoid resistant to the drug ceftriazone. Not only is the strain resistant to ceftriazone, the standard treatment in many parts of the world, but it is also resistant to all but one oral antibiotic for typhoid, making it increasingly challenging and costly to treat. The new vaccine has been successfully and safely used as part of the outbreak response in Sindh Province since April 2019.

The WHO issued its formal recommendation in support of typhoid conjugate vaccine introduction in March 2018. In anticipation of the availability of typhoid conjugate vaccines, Gavi earmarked US$85 million to support eligible countries with the introduction of typhoid conjugate vaccines into their routine immunization programs.

"Before the discovery of antibiotics, typhoid would kill as many as one in five people who contracted it," said Dr Seth Berkley, CEO of Gavi. "The rise of extreme drug resistant typhoid risks bringing us back to levels of mortality not seen since the 19th century, posing a risk to all of us. That's why typhoid conjugate vaccine is so important and why the government of Pakistan deserves praise for being the first to introduce this lifesaver into its routine immunization program."

Liberia and Zimbabwe are also preparing to introduce the typhoid conjugate vaccine this year with Gavi support, and several other countries are considering use of the vaccine as they review data on the incidence of typhoid in their countries.

- A research paper published December 5 in *The New England Journal of Medicine* <**doi**: 10.1056/NEJMoa1905047> found that the new typhoid vaccine showed excellent results in a trial in Nepal. The researchers found in their Phase 3 Efficacy Analysis of a Typhoid Conjugate Vaccine (TCV) Trial in Nepal that "a single dose of TCV was associated with a reduction of 81.6% in the incidence of typhoid fever among the children in our trial. This protection is higher than that of Vi polysaccharide vaccine, which was estimated to have 65% efficacy in a trial in India and 35% efficacy in a trial in Pakistan, and it is higher than that associated with live attenuated oral typhoid vaccines."

Surgeons perform world's first Robotic Single-Port Kidney Transplant

Cleveland Clinic has become the first hospital in the world to successfully perform a robotic single-port kidney transplant, which enables all surgical instruments and the donor kidney to be placed through one small abdominal incision.

The Glickman Urological & Kidney Institute surgical team included Jihad Kaouk, M.D., director of the Center for Robotic and Image Guided Surgery; Alvin Wee, M.D., surgical director of Renal Transplantation; Mohamed Eltemamy, M.D.; David Goldfarb, M.D.; and Eric Miller, M.D. These surgeons combined their collective expertise in minimally invasive, robotic, and kidney transplant surgery to successfully complete the operation in October.

Dr Kaouk and his team were the first in the US to successfully perform robotic single-port prostatectomy and kidney cancer surgery in September 2018. This latest surgical technique provides evidence that the single-port approach is feasible not only for patients with cancer, but also for patients who are in need of a kidney transplant.

"The aim was not only to make a smaller incision, but also to minimize the area in which the operation was performed by limiting the number of cuts inside the patient," said Dr Kaouk. "This resulted in minimal post-operative pain and no opioids needed after surgery."

The robotic single-port platform may provide an alternative option for the appropriate patient, including patients with obesity or challenging anatomy. During the operation, the surgical team created a small four-centimeter incision on the patient's abdomen. The surgeon then used the single-port robot to prepare the site for the donor kidney, connect the blood vessels, and lastly reconstruct the urinary drainage, before suturing the incision.

"The robotic single-port approach is very promising," said Dr Wee. "We are looking forward to continuing to refine this technique and our team is optimistic that this minimally invasive surgery can add to our range of options for kidney transplantation."

Emilio Poggio, M.D., medical director of the Kidney Transplant Program, said: "Kidney transplantation continues to be the best treatment option for patients with end-stage kidney disease and it is a very dynamic field where innovation brings new opportunities for personalized care. As such, this first robotic single-port kidney transplant adds cutting edge practice to the care of these patients."

Georges Haber, M.D., chair of urology in the Glickman Urological and Kidney Institute, said: "Kidney transplantation is a life-changing event for patients, many of whose quality of life has been negatively impacted by having to receive dialysis three times a week while waiting for a donor. This technique allows patients to regain their quality of life more rapidly. Using the latest technology to help our patients live a full life is the true spirit of innovation which we foster within the department of urology here at Cleveland Clinic." MEH

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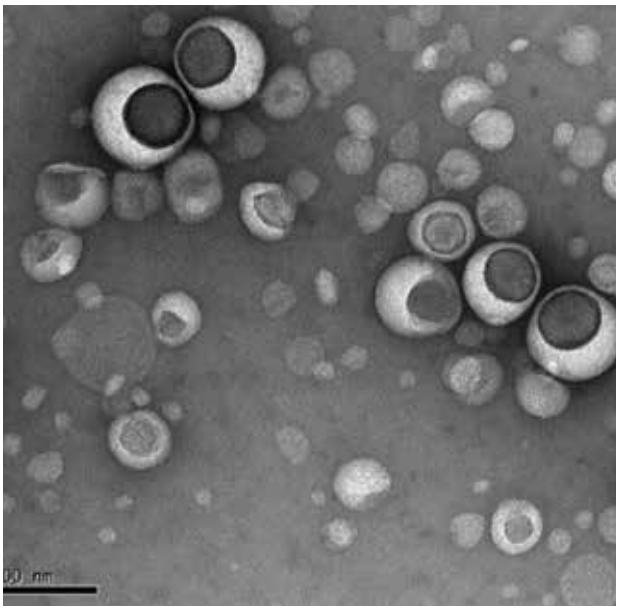


Liposomes under electron microscope

Liposomes may be way to transport drugs across blood-brain barrier

Swarms of nanoparticles which are 15,000 times smaller than a pinhead may be able to deliver vital drugs to the brain, offering new hope to patients in the early stages of a stroke.

The research, carried out at The University of Manchester, shows that tiny vesicles called liposomes, just 100 nanometres in diameter can translocate through the damaged blood brain barrier following stroke.

And that may offer a way to get vital drugs to the lesions to stop further damage.

The brain is the only organ to have its own security system: a tightly packed network of blood vessels and barriers that allow the entry of essential nutrients while blocking other potentially harmful substances.

However, the barrier also blocks lifesaving drugs, rendering it difficult to treat a range of conditions including stroke.

Now the research carried out on mice and published in the journal *ACS Nano*, shows that liposomes can potentially transport life-saving drugs across the barrier.

The researchers were able to generate microscopic pictures of the brain tissue using state of the art imaging techniques, showing the nanomaterial is a viable transporter.

Up to now, scientists haven't yet devised a reliable way to deliver drugs to damaged brain efficiently – one of the last frontiers in medical science.

But now the team show that following a stroke event, liposomes are able to penetrate the brain by being transported across the tightly packed endothelial cells by using pouch-like structures known as caveolae.

That means doctors might one day be able to protect tissue in the acute phases of a stroke, by delivering drugs – still being developed – that can protect brain's neurons from further injury.

In the days following a stroke, when neurons have died, the researchers showed that liposomes are also able to penetrate the brain to help promote the repair of neurons.

Liposomes are made from lipids which are long chains of oily or waxy organic molecules found in all living things.

Stuart Allan Professor of Neuroscience from The University of Manchester said: "The discovery that nanomaterials may be able to facilitate the treatment of stroke is exciting: scientists have long been grappling with the difficulties of treating brain injuries and diseases."

"The brain blood barrier is a major frontier in neurology, so the prospect of being able to cross it may have applications to other conditions as well – though clearly, much more work needs to be done."

Dr Zahraa Al-Ahmady, Honorary Research Fellow at The University of Manchester and a Senior Lecturer at Nottingham Trent University, said: "Liposomes are a tried and tested method of delivering drugs to the body – and are currently used to treat patients, for example, to target cancer drugs into the tumour at high doses which increase their concentration relative to other parts of the body."

Professor Kostas Kostarelos, Chair of Nanomedicine at The University of Manchester said: "This discovery is an important milestone on the use of liposomes for yet another debilitating disease, such as stroke. Liposomes have had a tremendous impact on offering treatment options in oncology, vaccination, lung and skin disease since they were first discovered by British haematologist Alec Bangham, FRS in 1965."

- **doi**: 10.1021/acsnano.9b01808

Bionic pacemaker slows progression of heart failure

Using brain circuits made in silicon, scientists have alleviated symptoms of heart failure by reinstating the body's natural heart rhythm. This study published in *The Journal of Physiology* holds great potential for designing more effective pacemakers in the future.

In people living with heart failure pacemakers are often fitted to either speed up the heart or to overcome electrical conduction problems between different chambers of the heart. There is no cure for heart failure; its progression is only slowed by current medication.

The heartbeat is never constant; it varies with every breath. It speeds up when you inhale and slows down when you exhale. This difference in heart rate is known as respiratory sinus arrhythmia. Researchers at the Universities of Bath and Bristol have adopted this arrhythmia in a novel bionic pacemaker and applied it to a heart in heart failure. They found that this new form of heart pacing dramatically increases the efficiency of the heart.

Normally, pacemakers don't listen to signals from our bodies; they simply pace the heart at a monotonous, regular rate. These researchers, however, built a pacemaker that reads the body's own breathing signals to speed up and slow down the heart every breath.

Dr Erin O'Callaghan, School of Physiology, Pharmacology and Neuroscience, Biomedical Sciences, University of Bristol and lead author of the study, said: "We used state-of-the-art high-resolution echocardiography to monitor the heart's performance during respiratory sinus arrhythmia pacing in rats with heart failure. Within two weeks there was a 20% increase in blood pumped by the heart which was not the case when we used conventional pacemakers."

Dr Ed Duncan, consultant cardiologist from the Bristol Heart Institute said: "We are very excited by this large response. This approach may represent a novel therapy in addition to those already available for the treatment of heart failure."

Professor Julian Paton, School of Physiology, Pharmacology and Neuroscience, Biomedical Sciences, University of Bristol and senior author on the study, remarked: "Our findings give hope for heart failure patients and may revolutionise the future design of cardiac pacemakers. Our next step in the research is to find out if respiratory sinus arrhythmia can reverse heart failure in human patients, as it has done in rats."

- **doi**: 10.1113/JP277293

Mouse study shows nerve signalling pathway critical to healing bone fractures

Sticks and stones may break one's bones, but healing them requires the production of a protein signal that stimulates the generation, growth and spread of vital nerve cells, or neurons, throughout the injured area. That's the finding of a recent Johns Hopkins Medicine study that used mice to demonstrate what likely takes place during human fracture repair as well.

"A better understanding of how nerve cells work in bones could spur the development of neuron regenerating therapies for people with diseases where nerve damage is common, such as diabetic neuropathy," says Aaron W. James, M.D., Ph.D., associate professor of pathology at the Johns Hopkins University School of Medicine and co-senior author of the study described in the *Journal of Clinical Investigation*.

"Typically, people with these conditions also have problems with bone repair," he adds.

Essentially, the scientists say their results in mice demonstrate that, at the fracture point, two proteins – one called tropomyosin receptor kinase-A, or TrkA, and the other known as nerve growth factor, or NGF – bind together to signal the start of innervation, the supplying of nerves, and subsequently, new bone. They say that this process may be similar to the mechanism for human bone repair.

"We showed that when TrkA, and in turn, NGF, were removed from the process, there was a dramatic reduction not only in innervation but also in the three follow-up activities critical to successful recovery from a fracture: blood vessel formation, production of bone-synthesizing cells and mineralization of new bone," says James. "In fact, the drop overall in these indicators of bone repair was between 60% and 80%."

First identified in the 1950s, NGF is now known to direct the growth, maintenance, proliferation and preservation of neurons throughout the body. It also helps neurons alert the brain when tissues, including bones, are experiencing pain from injury or disease. Studying this connection, James says, is what led researchers to suspect that NGF also might play a key role in skeletal repair.

"When drug companies in recent years developed and conducted human trials of anti-NGF agents to reduce pain from arthritis and other disorders, they found that a number of patients suffered unusual bone fractures," says Johns Hopkins researcher and co-senior author Thomas Clemens, Ph.D. "Other studies around the same time showed that the bones of children with a rare genetic mutation preventing the production of TrkA may not heal well after injury, suggesting a connection between this signalling pathway and bone repair mechanisms."

A 2016 study conducted by Clemens and others provided some of the first evidence that NGF promotes the ingrowth of nerves during the development of long bones in a mouse, and that without it, proper bone formation is hampered. The current study was designed to better define how NGF-TrkA signalling might be involved.

To accomplish this, James, Clemens and their colleagues studied mice with stress fractures of the ulna, the forelimb bone equivalent to the thinner and longer of the two bones in the human arm.

For their experimental groups, the researchers used two different methods to block neural ingrowth during repair. One group of mice were genetically bred not to respond to TrkA and given a drug that inactivates chemical signalling by the protein. The second group of mice were given a drug that kills the nerve fibres.

"Among the mice lacking TrkA signalling, there was a significant reduction – as much as 80% compared with a control group of normal functioning mice – in the number of nerve fibres that appeared at the fracture site," James says. "We also saw fewer osteoblasts [bone-producing cells] and in turn, less mineralization of new bone."

"These results indicate that fracture repair is truly dependent on the neural signalling directed by TrkA-expressing nerve fibres," he explains.

The researchers next plan to study how the NGF-TrkA signalling pathway and the resulting skeletal repair process respond when dealing with the removal of a bone segment, rather than just a break.

"This will help us learn if the signalling we linked to bone repair in mice controls that process for larger or more extensive injuries in a way similar to what we observed in small stress fractures," Clemens says.

Along with James and Clemens, the other members of the research team from the Johns Hopkins University School of Medicine are lead author Zhu Li, Ph.D.; Carolyn Meyers; Leslie Chang, M.D.; Seungyong Lee, Ph.D.; and Ahmet Hoke, M.D., Ph.D. The team also includes Zhi Li, of the Baltimore Veterans Affairs Medical Center, and Ryan Tomlinson, Ph.D., of Thomas Jefferson

(From left) NTU Assoc Prof Julien Lescar, Dr Abbas El Sahili, PhD student Jia Huan and Dr Xinlei Qian, who imaged and analysed an enzyme that could be key to disabling respiratory syncytial virus (RSV) and human metapneumovirus (HMPV), both which currently have no effective cure or vaccine.

University in Philadelphia.

Funding for the study was provided by the National Institutes of Health's National Institute of Arthritis and Musculoskeletal and Skin Diseases (Grants R01 AR070773, K08 AR068316 and R01 AR068934), the National Institutes of Health's National Institute of Dental and Craniofacial Research (Grant R21 DE027922), the Department of Defense, the American Cancer Society Research Scholar Grant, the Maryland Stem Cell Research Foundation, the Musculoskeletal Transplant Foundation, the Veterans Affairs Merit Award, and the Senior Research Career Scientist Award.

- **doi**: 10.1172/JCI128428

Phase 1 trial of first MERS vaccine shows strong immune response

The Center for Infectious Disease Research and Policy (CIDRAP) reports that results from the world's first phase 1 trial of a vaccine against MERS-CoV (Middle East respiratory syndrome coronavirus) demonstrated a strong immune response after two doses and a good safety profile. The trial involved 75 US Army volunteers and was published recently in *The Lancet Infectious Diseases*.

The study, conducted at Walter Reed Medical Center, assessed three doses of GLS-5300 MERS coronavirus vaccine, given to healthy adults ages 18 to 50 over a 3-month period. Twenty-five participants received 0.67 milligrams (mg) of the DNA vaccine, 25 got 2-mg injections, and the final group received 6 mg of the vaccine.

No major safety events were recorded, and seroconversion occurred in 59 (86%) of 69 participants and 61 (94%) of 65 participants after two and three vaccinations, respectively, the authors said. "There were no differences in immune responses between dose groups after 6 weeks. At week 60, vaccine-induced humoral and cellular responses were detected in 51 (77%) of 66 participants and 42 (64%) of 66, respectively," the authors wrote.

The authors concluded the data support the further development of GLS-5300 vaccine. In a commentary on the study, In-Kyu Yoon, PhD, and Jerome H. Kim, PhD, of the International Vaccine Institute in South Korea said: "Completion of the phase 1 trial of GLS-5300 represents an incremental but important step in the development of vaccines against emerging viral global threats."

- **doi**: 10.1016/S1473-3099(19)30266-X

Scientists uncover structure of key pneumonia virus enzyme, suggesting a route for new antiviral treatments

A team of molecular and structural biologists from Nanyang Technological University, Singapore (NTU Singapore) have found a potential new route to disabling respiratory syncytial virus (RSV) and human metapneumovirus (HMPV) after elucidating the structure of one of its key components.

RSV and HMPV are two closely related viruses causing severe and life-threatening respiratory diseases such as pneumonia and bronchiolitis in premature babies and infants, the elderly, and anyone with a weak immune system.

According to UNICEF, pneumonia killed a child somewhere in the world every 39 seconds in 2018, but there are no vaccines or effective antiviral therapies against it.

As they infect human cells, HMPV and RSV commandeer the cell's machinery to make copies of themselves. To initiate the process, special proteins released by the virus interact with each other to make distinct protein complexes.

Writing in *Nature*, Dr Julien Lescar from NTU's School of Biological Sciences and his team report how they have used cryo-electron microscopy to image the molecular structure of one of these large complexes, an enzyme called HMPV L:P polymerase.

Cryo-electron microscopy uses an advanced electron-scanning microscope, which can image a cryogenically frozen sample down to the sub-nanometre range, about ten times smaller than a strand of human DNA or one million times smaller than the width of a human hair.

The NTU images captured the enzyme at a resolution of 3.7 Angstrom, or 0.37 nanometres. Based on these two-dimensional pictures, the team then built three-dimensional computer models of the proteins' L:P molecular structures.

Analysis of these model structures revealed key sites for molecules to interact at, offering new targets for designing antiviral molecules against both viruses.

Dr Lescar, who is a Principal Investigator at the NTU Institute of Structural Biology, said with this detailed structural knowledge, researchers can now hope to develop inhibitors that disrupt the enzymatic activities of HPMV L:P protein and potentially block infection by the virus.

"We hope that our work will help researchers in pharma and academia around the world to design much needed therapies for difficult viral infections that often lead to antibiotic-resistant bacterial infections," said Dr Lescar, an Associate Professor at NTU's School of Biological Sciences.

Since the HMPV proteins they studied are essentially unchanged through evolution and very similar to those of RSV and other virus species belonging to the Pneumorivridae family, the scientists hope that inhibitors developed against HPMV could also work against a broad spectrum of viruses involved in respiratory diseases, and inform similar quests against other viral diseases.

- **doi**: 10.1038/s41586-019-1759-1

Promising results from Zika vaccine trial

Researchers from The University of Texas Medical Branch at Galveston showed, for the first time, that a single, higher dose of vaccination to a pregnant mouse safely

protects both her and her foetus from the Zika virus.

The researchers found that a single, less potent dose was not enough to protect the foetus. The findings are currently available in *Nature Communications*.

"Preventing birth defects in developing foetuses is an important goal of the Zika virus vaccine but studies on vaccinations in pregnant females have been lacking, raising a number of important questions that are critical to the clinical development and regulatory approval of Zika vaccines," said UTMB's Pei-Yong Shi, senior author and the I. H. Kempner professor at the department of biochemistry and molecular biology. "Could vaccination during pregnancy protect against infection and transmission to the foetus? Does pregnancy affect immune responses to Zika vaccination? Does maternal immunity from vaccination during pregnancy protect newborns against infection?"

Shi and his laboratory previously developed a Zika vaccine and continue studies to improve its efficacy.

In addition to protecting both mother and foetus, Shi said that the researchers also learned that their live-attenuated vaccine has an excellent safety profile in pregnant female mice and her foetus. For example, they saw no adverse effects on pregnancy, foetal development or infant behaviour. They also found that pregnancy weakens the mother's immune response to the vaccination, suggesting that that a higher dose of the vaccine or a more immunogenic vaccine is needed during pregnancy. Taken together, their results suggest that their vaccine may be considered for both pregnant and non-pregnant people.

- doi: 10.1038/s41467-019-13589-1

Combination gene therapy treats multiple age-related diseases in mice

As we age, our bodies tend to develop diseases like heart failure, kidney failure, diabetes, and obesity, and the presence of any one disease increases the risk of developing others. In traditional drug development, a drug usually only targets one condition, largely ignoring the interconnectedness of age-related diseases, such as obesity, diabetes, and heart failure, and requiring patients to take multiple drugs, which increases the risk of negative side effects.

A new study from the Wyss Institute for Biologically Inspired Engineering at Harvard University and Harvard Medical School (HMS) reports that a single administration of an adeno-associated virus (AAV)-based gene therapy delivering combinations of three longevity-associated genes to mice dramatically improved or completely reversed multiple age-related diseases, suggesting that a systems-level approach to treating such diseases could improve overall health and lifespan. The research is reported in *PNAS*.

The study was conducted in the lab of Wyss Core Faculty member George Church, Ph.D. as part of Davidsohn's postdoctoral research into the genetics of aging. Davidsohn, Church, and their co-authors honed in on three genes that had previously been shown to confer increased health and lifespan benefits when their expression was modified in genetically engineered mice: FGF21, sTGF R2, and Klotho. They hypothesized that providing extra copies of those genes to non-engineered mice via gene therapy would similarly combat age-related diseases and confer health benefits.

The team created separate gene therapy constructs for each gene using the AAV8 serotype as a delivery vehicle, and injected them into mouse models of obesity, type II diabetes, heart failure, and renal failure both individually and in combination with the other genes to see if there was a synergistic beneficial effect.

FGF21 alone caused complete reversal of weight gain and type II diabetes in obese, diabetic mice following a single gene therapy administration, and its combination with sTGF R2 reduced kidney atrophy by 75% in mice with renal fibrosis. Heart function in mice with heart failure improved by 58% when they were given sTGF R2 alone or in combination with either of the other two genes, showing that a combined therapeutic treatment of FGF21 and sTGF R2 could successfully treat all four age-related conditions, therefore improving health and survival. Administering all three genes together resulted in slightly worse outcomes, likely from an adverse interaction between FGF21 and Klotho, which remains to be studied.

Importantly, the injected genes remained separate from the animals' native genomes, did not modify their natural DNA, and could not be passed to future generations or between living animals.

"Achieving these results in non-transgenic mice is a major step toward being able to develop this treatment into a therapy, and co-administering multiple disease-addressing genes could help alleviate the immune issues that could arise from the alternative of delivering multiple, separate gene therapies for each disease," said Church, who is also a Professor of Genetics at HMS and Professor of Health Sciences and Technology at Harvard and MIT. "This research marks a milestone in being able to effectively treat the many diseases associated with aging, and perhaps could lead to a means of addressing aging itself."

Church, Davidsohn, and co-author Daniel Oliver, M.B.A. are co-founders of Rejuvenate Bio, a biotechnology company that is pursuing gene therapy treatments for dogs. Each holds equity in Rejuvenate Bio. "The finding that targeting one or two key genes has therapeutic effects in multiple diseases makes enormous sense from the perspective of pathophysiology, but this is not how drugs are normally developed. This ability to tackle several age-related diseases at once using gene therapy offers a potential path to make aging a more manageable and less debilitating process," said Wyss Founding Director Donald Ingber, M.D., Ph.D., who is also the Judah Folkman Professor of Vascular Biology at HMS and the Vascular Biology Program at Boston Children's Hospital, as well as Professor of Bioengineering at Harvard's John A. Paulson School of Engineering and Applied Sciences. "We are excited to see how this research progresses in the future." MEH

New study finds majority of adolescents worldwide are not sufficiently physically active, putting their health at risk

The first ever global trends for adolescent insufficient physical activity show that urgent action is needed to increase physical activity levels in girls and boys aged 11 to 17 years. The study, published in *The Lancet Child & Adolescent Health* journal and produced by researchers from the World Health Organization (WHO), finds that more than 80% of school-going adolescents globally did not meet current recommendations of at least one hour of physical activity per day – including 85% of girls and 78% of boys.

The study – which is based on data reported by 1.6 million 11 to 17-year-old students – finds that across all 146 countries studied between 2001-2016 girls were less active than boys in all but four (Tonga, Samoa, Afghanistan and Zambia).

The difference in the proportion of boys and girls meeting the recommendations was greater than 10 percentage points in almost one in three countries in 2016 (29%, 43 of 146 countries), with the biggest gaps seen in the United States of America and Ireland (more than 15 percentage points). Most countries in the study (73%, 107 of 146) saw this gender gap widen between 2001-2016.

The authors say that levels of insufficient physical activity in adolescents continue to be extremely high, compromising their current and future health. "Urgent policy action to increase physical activity is needed now, particularly to promote and retain girls' participation in physical activity," says study author Dr Regina Guthold, WHO.

The health benefits of a physically active lifestyle during adolescence include improved cardiorespiratory and muscular fitness, bone and cardiometabolic health, and positive effects on weight. There is also growing evidence that physical activity has a positive impact on cognitive development and socializing. Current evidence suggests that many of these benefits continue into adulthood.

To achieve these benefits, the WHO recommends for adolescents to do moderate or vigorous physical activity for an hour or more each day.

The authors estimated how many 11- to 17-year-olds do not meet this recommendation by analysing data collected through school-based surveys on physical activity levels. The assessment included all types of physical activity, such as time spent in active play, recreation and sports, active domestic chores, walking and cycling or other types of active transportation, physical education and planned exercise.

To improve levels of physical activity among adolescents, the study recommends that:

- Urgent scaling up is needed of known effective policies and programmes to increase physical activity in adolescents;
- Multisectoral action is needed to offer opportunities for young people to be active, involving education, urban planning, road safety and others;

The highest levels of society, including national, city and local leaders, should promote the importance of physical activity for the health and well-being of all people, including adolescents.

"The study highlights that young people have the right to play and should be provided with the opportunities to realise their right to physical and mental health and wellbeing," says co-author Dr Fiona Bull, WHO. "Strong political will and action can address the fact that four in every five adolescents do not experience the enjoyment and social, physical, and mental health benefits of regular physical activity. Policy makers and stakeholders should be encouraged to act now for the health of this and future young generations."

For girls, the lowest levels of insufficient activity were seen in Bangladesh and India, and are potentially explained by societal factors, such as increased domestic chores in the home for girls.

"The trend of girls being less active than boys is concerning," said study co-author Leanne Riley, WHO. "More opportunities to meet the needs and interests of girls are needed to attract and sustain their participation in physical activity through adolescence and into adulthood."

To increase physical activity for young people, governments need to identify and address the many causes and inequities –

social, economic, cultural, technological, and environmental – that can perpetuate the differences between boys and girls, the authors said.

"Countries must develop or update their policies and allocate the necessary resources to increase physical activity," says Dr Bull. "Policies should increase all forms of physical activity, including through physical education that develops physical literacy, more sports, active play and recreation opportunities – as well as providing safe environments so young people can walk and cycle independently. Comprehensive action requires engagement with multiple sectors and stakeholders, including schools, families, sport and recreation providers, urban planners, and city and community leaders."

More than 140,000 die from measles as cases surge worldwide

Worldwide more than 140,000 people died from measles in 2018, according to new estimates from the World Health Organization (WHO) and the United States Centers for Diseases Control and Prevention (CDC). These deaths occurred as measles cases surged globally, amidst devastating outbreaks in all regions.

Most deaths were among children under 5 years of age. Babies and very young children are at greatest risk from measles infections, with potential complications including pneumonia and encephalitis (a swelling of the brain), as well as lifelong disability – permanent brain damage, blindness or hearing loss.

Recently published evidence shows that contracting the measles virus can have further long-term health impacts, with the virus damaging the immune system's memory for months or even years following infection. This 'immune amnesia' leaves survivors vulnerable to other potentially deadly diseases, like influenza or severe diarrhoea, by harming the body's immune defences.

"The fact that any child dies from a vaccine-preventable disease like measles is frankly an outrage and a collective failure to protect the world's most vulnerable children," said Dr Tedros Adhanom Ghebreysus, Director-General of the World Health Organization. "To save lives, we must ensure everyone can benefit from vaccines - which means investing in immunization and quality health care as a right for all."

Measles is preventable through vaccination. However, vaccination rates globally have stagnated for almost a decade. WHO and UNICEF estimate that 86% of children globally received the first dose of measles vaccine through their country's routine vaccination services in 2018, and fewer than 70% received the second recommended dose.

Worldwide, coverage with measles vaccine is not adequate to prevent outbreaks. WHO recommends that 95% vaccination coverage with two doses of measles vaccine is needed in each country and all communities to protect populations from the disease.

Estimating the total number of cases and deaths globally and by region, the report finds that the worst impacts of measles were in sub-Saharan Africa, where many children have persistently missed out on vaccination.

In 2018, the most affected countries – the countries with the highest incidence rate of the disease – were Democratic Republic of the Congo (DRC), Liberia, Madagascar, Somalia and Ukraine. These five countries accounted for almost half of all measles cases worldwide.

"We've had a safe and effective measles vaccine for over 50 years," said Dr Robert Linkins, Branch Chief of Accelerated Disease Control and Vaccine Preventable Disease Surveillance at the CDC, and Chair of the Measles & Rubella Initiative. "These estimates remind us that every child, everywhere needs this life-saving vaccine. We must turn this trend around and stop these preventable deaths by improving measles vaccine access and coverage."

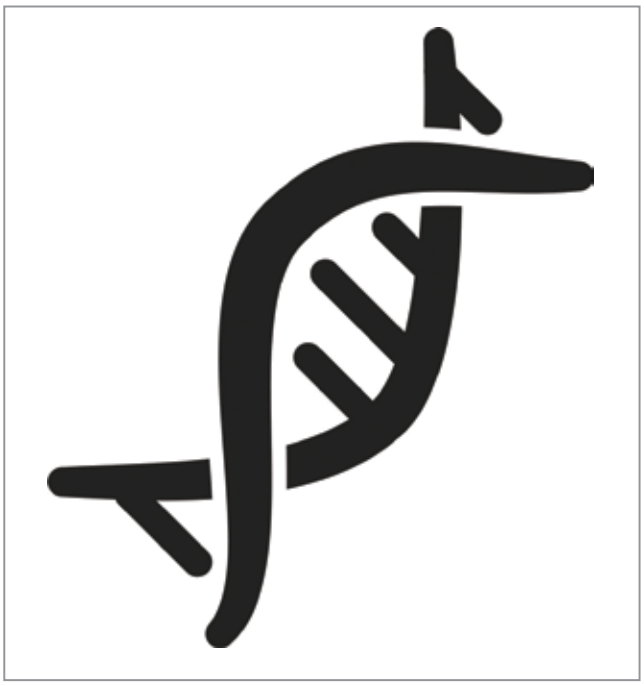
While the greatest effects have been in the poorest countries, some wealthier countries have also been battling measles outbreaks, with significant ramifications for people's health.

This year, the United States reported its highest number of cases in 25 years, while four countries in Europe – Albania, Czechia, Greece and the United Kingdom – lost their measles elimination status in 2018 following protracted outbreaks of the disease. This happens if measles re-enters a country after it has been declared eliminated, and if transmission is sustained continuously in the country for more than a year.

The Measles & Rubella Initiative (M&RI) – which includes the American Red Cross, CDC, UNICEF, the United Nations Foundation and WHO – as well as Gavi, the Vaccine Alliance, are helping countries respond to measles outbreaks, such as through emergency vaccination campaigns.

In addition to rapidly immunizing against measles, outbreak response also includes efforts to reduce the risk of death through timely treatment, especially for related complications like pneumonia. With partners, WHO is therefore providing support to help countries manage cases, including training health workers in effective care for children suffering the effects of the disease.

"This latest data show that we are unfortunately backsliding in our progress against an easily-preventable disease: measles," said Kathy Calvin, President and CEO of the United Nations Foundation. "But we can turn the tide against these outbreaks through collective action, robust political commitment, and closing critical funding gaps. Working together works – it's the only way we will be able to reach everyone, everywhere with life-saving vaccines and services and, more broadly, reach the UN's Sustainable Development Goals."



Developing global standards for governance and oversight of human genome editing – Comment by WHO expert Advisory Committee

In the wake of the dramatic announcement in November 2018 of the birth of the world's first genome edited babies, the World Health Organization (WHO) convened an Expert Advisory Committee on Human Genome Editing. The Committee was formally established in February 2019 and given a clear mandate to examine the scientific, ethical, social and legal challenges associated with human genome editing in both somatic cells and cells of the germline, including early embryos. More specifically, the Committee was tasked by the Director General Dr Tedros Adhanom Ghebreyesus to advise and make recommendations on appropriate governance mechanisms.

The Committee is comprised of 18 members coming from all parts of the world, representing a broad range of disciplines, expertise, and experience. Since their first meeting in March 2019 they have embarked on an ambitious program of work. This has resulted in a number of concrete initiatives including the creation of a registry to provide a transparent and structured mechanism for collecting and curating details of planned and ongoing developments in both germline and somatic genome editing research, including clinical trials. This registry, which is now being piloted on a WHO platform, will allow everyone to know what genome editing research is being undertaken and where.

In the midst of the Committee's ongoing work, Dr Denis Rebrikov, a Russian molecular biologist, announced plans to pursue heritable human genome editing. Initially, the plan was to genetically modify the CCR5 gene to provide resistance to HIV. This plan was later modified as the focus shifted to the genetic modification of the GJB2 gene to prevent a type of hereditary deafness. In response to these concerning news reports, in August 2019, the WHO Director General issued a statement calling on all nations to support the work of the WHO and to desist from permitting research on heritable human genome editing within their borders: *Human germline genome editing poses unique and unprecedented ethical and technical challenges. I have accepted the interim recommendations of WHO's Expert Advisory Committee that regulatory authorities in all countries should not allow any further work in this area until its implications have been properly considered.*

A few months later, in October 2019, consistent with the position of the WHO and its Expert Advisory Committee, the Ministry of Health of the Russian Federation announced that "any clinical use of editing technologies of the genome of human embryos and germ cells is premature". The Ministry also endorsed the WHO perspective that it would be irresponsible and unacceptable to use genome edited embryos to initiate human pregnancies. Finally, and most importantly, the Ministry of Health explicitly stated that the WHO position, "supported by the Russian Federation, should be decisive in the formation of country policies in this area".

This strong statement by the Ministry of Health of the Russian Federation is a reassuring example of how seriously some countries are taking the rapid developments in the science of genome editing, especially human germline editing, and its ethical ramifications. Consider, for example, the recent publication on prime editing which involves making changes to a single base pair into any other, altering several base pairs at once, or inducing small precise deletions or insertions. This is an exciting technology that may enhance our ability to make precise alterations in DNA sequences in living cells.

The Russian statement in support of the WHO's ongoing work sets an important example for regulatory authorities committed to assisting with the development of a global framework for the coordination of regulation, legislation and policies governing frontier science. We are not advocating for a single mechanism but a governance framework that can:

- identify relevant issues, a range of specific mechanisms to address them, and be developed in collaboration with the widest possible range of institutions, organizations and peoples.
- Be scalable, sustainable and appropriate for use at the international, regional, national and local levels.
- Work in parts of the world where there is traditionally weaker regulation of scientific and clinical research and practice, and where genome editing may not yet be pursued or invested in with great intensity.

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• Provide those with specific governance roles for human genome editing with the tools and guidance they need.

Plans to date are for a governance framework grounded in the following guiding principles:

• Transparency – to be understood as a commitment to share information on what is happening, how and why it is necessary, including the Committee's own processes and outcomes;

• Inclusivity – to be understood as a commitment to draw on the full contributions of all parts of global society, thereby providing diverse points of view, skill sets and additional methods of program management and measurement;

• Responsible stewardship of science – to be understood as a commitment to follow good practice in scientific and clinical conduct, attempting to maximize potential benefits and minimize potential harm;

• Fairness – to be understood as a commitment to fair dealings in relation to all persons and groups, and equal access to opportunities and potential benefits; and

• Social justice – to be understood in relation to a commitment to celebrate and promote diversity by rejecting patterns of discrimination based on personal or group characteristics including gender, race, ethnicity, sexuality, age, and disability.

Consistent with these principles is a commitment to better understand what effective public and community engagement should look like when developing governance mechanisms for human genome editing. The Expert Advisory Committee is exploring how we can expand the views and perspectives that feed into our work and are organizing consultations on these issues.

Collectively, we have a responsibility to make the best use of emerging technologies to improve the health and well-being of all people everywhere. This can be achieved only through collaborative effort on a global scale; no lone scientist or lone country should seek to impose their standards on the global.

Commission advises WHO on combatting noncommunicable diseases

At a meeting in Muscat, Oman on 10 December, the WHO Independent High-level Commission on noncommunicable diseases handed eight recommendations to WHO's Director-General, Dr Tedros Adhanom Ghebreyesus, that could save millions of lives and promote mental health.

The Commission was convened by Dr Tedros in October 2017 to identify innovative ways to curb the world's leading causes of death: cardiovascular disease, cancers, diabetes, respiratory diseases and mental health conditions.

The Commission highlighted that noncommunicable diseases still account for more than 70% of deaths and stressed that, "progress against NCDs and mental health conditions must be greatly accelerated if the 2030 Agenda is to succeed." It also noted that many countries face challenges and need more support to implement solutions.

The report laid out a set of eight recommendations for WHO:

• Encourage Heads of State and Government to fulfil their commitment to provide strategic leadership by involving all relevant government departments, businesses, civil society groups as well as health professionals and people at risk from or suffering from NCDs and mental health conditions.

• Support countries in efforts to empower individuals to make healthy choices, including by ensuring that the environment is conducive to living a healthy life, and that people receive the information they need to make healthy choices.

• Encourage countries to invest in the prevention and control of NCDs and mental health conditions as a key opportunity to enhance human capital and accelerate economic growth.

• Advise countries to include services to prevent and treat NCDs and mental health as essential components of Universal Health Coverage.

> Noncommunicable diseases still account for more than 70% of deaths. Progress against NCDs and mental health conditions must be greatly accelerated if the 2030 Agenda is to succeed.

• Ensure that no one falls into poverty because they have to pay for health care out of their own pockets through the provision of adequate social protection for everyone.

• Increase engagement with businesses and provide technical support to Member States so they can mount effective national responses to NCDs and mental health conditions.

• Encourage governments to promote meaningful engagement with civil society.

• Advocate for the establishment of a multi-donor trust fund to support countries in activities to reduce NCDs and promote mental health.

The Report was launched in Muscat, Oman at the WHO Global Meeting to Accelerate Progress on NCDs and Mental Health in front of more than 600 people coming from governments, UN agencies, civil society, private sector, philanthropies, and academia.

The first report of the Commission, "Time to deliver" was released in June 2018 and focused on challenges and recommendations to Heads of State and government, civil society, and private sector. The second report of the commission builds on their previous work, giving possible solutions to WHO's core work in promoting and monitoring global action against NCDs.

Every year, 41 million people die from NCDs, 15 million of them between the ages of 30 and 69. Despite the many proven solutions, progress has been slow and uneven globally.

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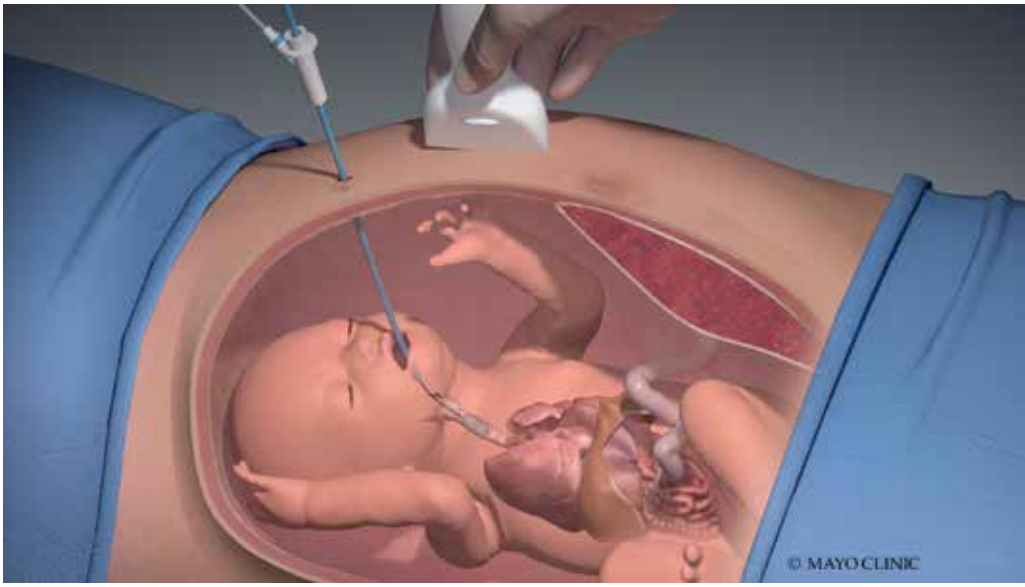
Mayo Clinic pioneers advances in fetal surgery



Mayo Clinic is pioneering advances in fetal surgery, allowing for earlier intervention to manage congenital anomalies. Although rare, these anomalies – including pulmonary hypoplasia in congenital diaphragmatic hernia (CDH) and fetal lower urinary tract obstruction (LUTO) – carry significant risk of mortality and disability.

"Typically, these problems have been treated after birth. But we are committed to developing surgical methods to reverse these conditions in utero and improve fetal development," says Rodrigo Ruano, M.D., Ph.D., chair of Maternal and Fetal Medicine at Mayo Clinic in Rochester, Minnesota.

Fetal surgery requires a multidisciplinary team with specialists in maternal-fetal medicine, pediatric surgery, neonatology, radiology and anesthesiology, as well as pediatric otolaryngology, nephrology, urology and neurosurgery, as needed. As a major tertiary medical center, Mayo Clinic Children's Center has the expertise to manage these complex patients, including providing both maternal and pediatric anesthesia. "We also work to establish collaborative relationships, so we can share care with the patient's home physician," Dr. Ruano says.

Novel therapy for CDH

Mayo Clinic has demonstrated the feasibility and safety of fetal endoscopic tracheal occlusion for severe CDH resulting in pulmonary hypoplasia, a life-threatening anomaly. The novel procedure is performed percutaneously with ultrasound-guided uterine access and fetoscopic deployment of a detachable tracheal balloon at 26 to 30 weeks of gestation. The balloon is intended to remain in place until about 34 weeks of gestation, when it is removed, preferentially through a fetoscopic procedure. The treatment optimizes parenchymal growth, improving pulmonary hypoplasia and vascular remodeling.

"Our experience indicates that fetuses with severe CDH have higher survival rates when treated prenatally, and Mayo Clinic has established a successful multidisciplinary fetoscopic tracheal occlusion program," Dr. Ruano says. "Although we have seen the beneficial effects of the tracheal balloon, we don't yet understand the mechanism for lung regrowth as part of in utero regenerative medicine. Our research on the regenerative principles of the lungs continues."

Prenatal management of LUTO

Mayo Clinic Children's Center is one of the few centers with a multidisciplinary program to treat LUTO prenatally. Depending on the nature of the blockage, treatment might consist of cystoscopy, vesicoamniotic shunting or operative cystoscopy. The shunting procedure entails the placement of a shunt in the fetal bladder to allow urine to flow from the bladder to the amniotic cavity; the shunt remains in place until birth.

Dr. Ruano participated in a study that reported a survival rate of 86 percent for fetuses with LUTO who had prenatal intervention; about two-thirds of the surviving infants had normal renal function at six-month follow-up. "Without prenatal treatment, the outlook for fetuses with LUTO is very poor. But we have lacked a standardized classification of LUTO to guide prenatal intervention," Dr. Ruano says.

Dr. Ruano developed a prenatal evaluation that estimates renal function by combining urinary biochemistry profiles and the ultrasound characteristics of fetal kidneys. When indicated, prenatal intervention occurs as early as possible after the LUTO diagnosis, often within two days. For children born with compromised renal function, the Mayo Clinic Children's Center can provide care after birth, including surgical correction of LUTO, renal monitoring, and dialysis or kidney transplant.

We care for the whole patient throughout the patient's life, starting before birth," Dr. Ruano says. "Mayo Clinic is committed to advancing care in this area."

Mayo Clinic, which includes Mayo Clinic Children's Center, is the medical center most recognized as a top choice for patients and families by *U.S. News & World Report* and many other ranking organizations.

• For more information or to make an appointment, visit: *mayoclinic.org/international* or *mayoclinic.org/arabic*

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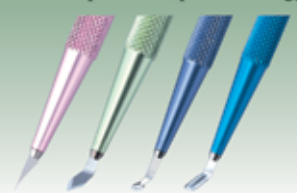

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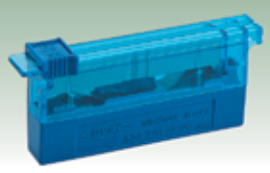

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Dr Simon Davies, consultant interventional cardiologist

TAVI – a lifesaving non-surgical alternative for patients with faulty valves

Experts at Royal Brompton and Harefield Hospitals Specialist Care, London, have led the way in recent years to develop new lifesaving alternatives for patients with faulty valves. The transcatheter aortic valve implantation procedure (TAVI) is an innovative option suited to patients who are at increased risk from conventional open-heart surgery, or who might benefit from a minimally invasive approach.

TAVI is mainly used to correct aortic stenosis, sometimes with aortic regurgitation. Royal Brompton and Harefield Hospitals run the largest transcatheter aortic valve implantation programme in the UK, carrying out hundredsof TAVIs since its start in 2007.

Aortic stenosis

The aortic valve is the outlet valve from the main pumping chamber, and it controls the blood flowing out of the heart and to the body. Aortic stenosis is the most common and serious form of valve disease. With advancing age, the valve can become progressively stiff and narrow as a result of calcium. As blood flow through the valve becomes significantly restricted, symptoms can include breathlessness, chest pain, fainting and palpitations.

TAVI procedure

The only effective long-term treatment for aortic stenosis is to replace the aortic valve, therefore, TAVI is a lifesaving nonsurgical alternative for many patients.

Dr Simon Davies, consultant interventional cardiologist, explains: "For those suffering from aortic stenosis, one of the only options in the past for treatment was open heart surgery to replace the valves that are failing. The TAVI procedure is a less invasive form of aortic valve replacement, whereby a new aortic valve can be implanted either via the arteries in the groin, the arm, directly into the aorta or via a small cut in the chest."

During the procedure, a catheter is guided through an artery to the patient's heart using special scanning equipment. The new valve is then placed within the narrowed aortic valve and expanded to relieve the obstruction.

Since this method does not require the breast bone to be cut or open-heart surgery to be performed, it is less traumatic than conventional surgical aortic valve replacement. This procedure should cure aortic stenosis, so reducing the risk of heart failure and any shortness of breath, chest pain or fainting.

The experienced team at RB&HH has expertise with many of the different TAVI devices currently available. They are also able to use TAVI to treat previously implanted surgical aortic valves that are showing signs of degeneration.

Expert team approach

The multi-disciplinary approach adopted by the transcatheter valve team has led to RB&HH experts pushing boundaries and routinely carrying out increasingly complex operations with excellent outcomes.

• To find out more, email: *privatepatients@rbht.nhs.uk* or visit: *rbhh-specialistcare.co.uk*.

Smart sensor floor helps prevent falls in elderly care centres

When a frail person gets up to walk, the sensor floor automatically calls the nurse for support

According to the WHO, more than a third of senior citizens over 70 years old falls each year. Moreover, one out of five falls causes a serious injury, such as broken bones or a head trauma. For older people, the risk of dying after a hip fracture is particularly high, making falls the 2nd leading cause of unintentional fatal injury after road traffic injuries worldwide.

Therefore, it is essential to protect seniors from falling. Fall prevention can be achieved effectively by offering frail persons a helping hand in critical situations. For example, smart sensor floors in senior rooms are able to detect dangerous situations and alert the nursing staff for support. As soon as someone with high risk of falling starts to get up from bed or walks towards the bathroom, the sensors detect the activity and react accordingly: an orientation light is switched on automatically and the caregivers receive a message. Especially at night, when the ward is only sparsely occupied, such warnings to the staff are extremely helpful.

According to a study by Elsi at the Kustaankartano Hospital in Helsinki, Finland, a sensor floor helped to reduce the number of falls during the day by 22%, a considerable rate. An even greater improvement was achieved at night. Indeed, the nightly falls were reduced by 75% compared to the time without sensor flooring. A truly ground-breaking and measurable success! For seniors, fall prevention is a major contribution to improving their quality of life. And the staff can confidently carry out their work, knowing that they will be alerted by the sensor floor in an emergency situation. The nursing home "Wohnen am Schlossanger" close to Munich, Germany had a similar experience. The caregivers have been using SensFloor from Future-Shape since 2015. As a result, the number of falls decreased noticeably, which led to the success of the sensor floor system. Today, senior relatives prefer waiting until a room with SensFloor becomes available instead of accommodating their loved ones into a room without SensFloor. Irmgard Kaleve, director of the Schlossanger residential home, confirms: "With a sensor floor, elderly people can maintain their independence and health for much longer."

Each of us wants to age actively and with dignity. Technologies such as sensor floors helps this wish come true. The future of care begins now.

- SensFloor live demonstrations at Arab Health 2020 booth **#H7.E11**.
- SensFloor is represented in the Middle East by 7 Dwarfs FZCO, *info@7dwarfs.net*.

Photo: Markus Spiske

Climate risks to health are growing but funding for safeguards is lacking

Safeguarding human health from climate change impacts is more urgent than ever, yet most countries are not acting fully on their own plans to achieve this, according to the first global snapshot of progress on climate change and health. The new report draws on data from 101 countries surveyed by the World Health Organization (WHO) and reported in the *2018 WHO Health and Climate Change Survey Report*.

Countries are increasingly prioritising climate change and health, with half of the countries surveyed having developed a national health and climate change strategy or plan. Worryingly, only about 38% have finances in place to even partially implement their national strategy of plan, and fewer than 10% channelling resources to implement it completely. "Climate change is not only racking up a bill for future generations to pay, it's a price that people are paying for now with their health," said Dr Tedros Adhanom Ghebreyesus, Director-General of the World Health Organization. "It is a moral imperative that countries have the resources they need to act against climate change and safeguard health now and in the future."

> Climate change is not only racking up a bill for future generations to pay, it's a price that people are paying for now with their health.

Forty-eight percent of countries have conducted an assessment of the climate risks to public health. The most common climate sensitive health risks were identified by countries as heat stress, injury or death from extreme weather events, food, water and vector-borne diseases (such as cholera, dengue or malaria). However, about 60% of these countries report that the assessment findings have had little or no influence on the allocation of human and financial resources to meet their adaptation priorities for protecting health. Mainstreaming health in national and international climate processes could help access the necessary funds.

WHO launches online training on climate and health

The World Health Organization (WHO) has launched an online training course entitled "Climate Negotiations for Health Professionals".

The course is structured to give participants a good understanding of the UN climate change negotiations and the main topics being discussed at COP25 in Madrid early December and beyond, as well as how to include the health aspects of climate change in the UN climate negotiations. This course is addressed to health professionals or health experts who are attending the climate negotiations, to interested health advocates, and to the general public interested to follow or participate in the COP.

The Climate and Health course is freely available on an online course platform: *https://eliademy.com/app/a/courses/2d33348284*.

The course takes around 2-4 hours to complete. It is divided into 6 modules, which are:

- Introduction to health and climate;
- History of the UN climate negotiations;
- The Paris Agreement;
- Current negotiation topics;
- Health in the UN climate negotiations;
- Health in negotiation streams.

Upon completing the course, participants will have to go through a final test and will receive a certificate of completion.

The course was jointly developed by WHO and Climate Tracker, <*http://climatetracker.org*> an NGO supporting young environmental journalists, and hopes to support the global health community in meaningfully engaging with international climate processes.

International climate finance

The survey found that countries have difficulties in accessing international climate finance to protect the health of their people. Over 75% reported a lack of information on opportunities to access climate finance, over 60% a lack of connection of health actors to the climate finance processes, and over 50% a lack of capacity to prepare proposals.

While two-thirds of current Nationally Determined Contributions (NDCs) to the Paris Agreement mention health, and the health sector is among the five sectors most often described as vulnerable to climate change, this has not resulted in the necessary level of implementation and support.

In addition, previous work has shown that the value of health gains from reducing carbon emissions would be approximately double the cost of implementing these actions at global level, and meeting the goals of the Paris Agreement could save about a million lives a year worldwide by 2050 through reductions in air pollution alone.

However, many countries are not able to take advantage of this potential. The survey shows that less than 25% of countries have clear collaborations between health and the key sectors driving climate change and air pollution; transportation, electricity generation and household energy.

The health gains that would result from cutting carbon emissions are rarely reflected in national climate commitments, with only one-fifth of NDCs mentioning health in the context of emissions reductions and 1 in 10 NDCs mentioning the expected health gains.

"For the Paris Agreement to be effective to protect people's health, all levels of government need to prioritize building health system resilience to climate change, and a growing number of national governments are clearly headed in that direction," said Dr Maria Neira, Director, Department of Environment, Climate Change and Health, World Health Organization.

"By systematically including health in Nationally Determined Contributions – as well as National Adaptation Plans, climate finance pledges, and other National Communications to the UNFCCC – the Paris Agreement could become the strongest international health agreement of the century."

But there are gaps that urgently need to be addressed. One is getting countries from making plans to implementing them by addressing barriers to action, such as making sure the health sector is included in climate change processes and ensuring that they have the capacity and support to access the finance they need.

Another is to get health factored into the decision-making processes that have implications for cutting carbon emissions and other sustainability goals, and to take account of the health gains that result from taking climate action.

on the WEB WHO Health and Climate Change Survey report
https://tinyurl.com/shyu9t4

HH Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces (2nd row C) stands for a photograph, during the Reaching the Last Mile Forum, at the Louvre Abu Dhabi. Seen with Bill Gates, Co-chair and Trustee of Bill & Melinda Gates Foundation (front row 6th R) and HRH Prince Alwaleed bin Talal bin Abdulaziz Al Saud, Chairman of the Kingdom Holding Company (front row 5th R).

Global leaders pledge $2.6bn for polio endgame strategy

Countries and partners announce commitments to vaccinate 450 million children against polio each year and to overcome barriers to reaching every child

Global leaders convened at the Reaching the Last Mile (RLM) Forum in Abu Dhabi in November to affirm their commitment to eradicate polio and pledge US$2.6 billion as part of the first phase of the funding needed to implement the Global Polio Eradication Initiative's Polio Endgame Strategy 2019-2023.

This pledging event comes on the heels of a major announcement in October last year that the world has eradicated two of the three wild poliovirus strains, leaving only wild poliovirus type 1 (WPV1) still in circulation. Additionally, Nigeria – the last country in Africa to have cases of wild polio – has not seen wild polio since 2016 and the entire WHO African region could be certified wild polio-free in 2020. Thanks to the dedicated efforts of health workers, governments, donors and partners, wild polio only circulates in two countries: Pakistan and Afghanistan.

"From supporting one of the world's largest health workforces, to reaching every last child with vaccines, the Global Polio Eradication Initiative is not only moving us closer to a polio-free world, it's also building essential health infrastructure to address a range of other health needs," said Dr Tedros Adhanom Ghebreyesus,

A polio vaccinator in Lahore, Pakistan marks the finger of a child who has been immunized against the disease.

Director-General of the World Health Organization and Chair of the Polio Oversight Board. "We are grateful for the generous pledges and thank governments, donors and partners for standing with us. In particular, I would like to thank His Highness Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi for hosting the GPEI pledging moment and for his long-term support for polio eradication."

The Global Polio Eradication Initiative is a public-private partnership led by national governments with six core partners – the World Health Organization (WHO), Rotary International, the US Centers for Disease Control and Prevention (CDC), UNICEF, the Bill & Melinda Gates Foundation and, most recently, Gavi, the Vaccine Alliance.

The commitments come at a critical time for the polio eradication effort. Barriers to reaching every child – including inconsistent campaign quality, insecurity, conflict, massive mobile populations, and, in some instances, parental refusal to the vaccine – have led to ongoing transmission of the wild poliovirus in Pakistan and Afghanistan. Further, low immunity to the virus in parts of Africa and Asia where not all children are vaccinated has sparked outbreaks of a rare form of the virus. To surmount these obstacles and protect 450 million children from polio every year, governments and donors announced significant new financial commitments toward the $3.27 billion needed to support the Polio Endgame Strategy.

A diverse array of donors

Pledges are from a diverse array of donors, including: US$160 million from the host of the pledging moment His Highness Sheikh Mohamed bin Zayed Al Nahyan, Crown Prince of Abu Dhabi; countries, including US$514.8 million from the United Kingdom, US$215.92 million from the United States, US$160 million from the Islamic Republic of Pakistan, US$105.05 million from Germany, US$84.17 million from the Federal Government of Nigeria, US$10.83 million from Norway, US$10.29 million from Australia, US$7.4 million from Japan, US$2.22 million from Luxembourg, US$1.34 million from New Zealand, US$116,000 from Spain, and US$10,000 from Liechtenstein; GPEI partners, including US$1.08 billion from the Bill & Melinda Gates Foundation and US$150 million from Rotary International; philanthropic organizations, including US$50 million from Bloomberg Philanthropies, US$25 million from Dalio Philanthropies, US$15 million from the Tahir Foundation, US$6.4 million from the United Nations Foundation, US$2 million from Alwaleed Philanthropies, US$1 million from the Charina Endowment Fund, and US$1 million from Ningxia Yanbao Charity Foundation; and the private sector, including US$1 million from Ahmed Al Abdulla Group, US$1 million from Al Ansari Exchange, and US$340,000 from Kasta Technologies.

"We are proud to host the GPEI pledging moment in Abu Dhabi and thank all the attendees for their continued commitment to the eradication of polio," said Her Excellency Reem Al Hashimy, UAE Cabinet Member and Minister of State for International Cooperation. "Since launching in 2014, the Emirates Polio Campaign has delivered more than 430 million polio vaccines in some of the most remote areas of Pakistan. We remain firm in our mission to reach every last child and believe together we can consign polio to the pages of history."

In addition to overcoming barriers to reach every child, this funding will ensure the resources and infrastructure built by the GPEI can support other health needs today and in the future. Polio workers deliver Vitamin A supplements, provide other vaccines like those for measles and yellow fever, counsel new mothers on breastfeeding, and strengthen disease surveillance systems to anticipate and respond to outbreaks. As part of its commitment to advance gender equality and women's empowerment, the GPEI is also working to ensure equal participation of women at all levels of the programme.

The future of polio eradication hinges on support and engagement at all levels of the programme – from individuals to communities to local and national governments to donors. If the strategies needed to reach and vaccinate children are fully implemented and funded, we are confident that we can deliver a world where no child lives in fear of polio.

on the WEB Polio Endgame Strategy
http://polioeradication.org/who-we-are/polio-endgame-strategy-2019-2023/

Empowering mucosal healing with an engineered probiotic gut patch

A genetically programmed living hydrogel material facilitates intestinal wound healing and could be developed as a probiotic therapy for patients with inflammatory bowel disease. **Benjamin Boettner** reports.

About 1.6 million people in the US alone currently have lifelong and incurable Inflammatory Bowel Disease (IBD) including Crohn's disease and ulcerative colitis, and 70,000 new cases are diagnosed in the US each year. IBD patients suffer from pain, extreme discomfort, and many other symptoms caused by continuously relapsing and remitting inflammatory lesions in the layer of cells that lines the intestinal lumen (mucosa). The exact causes for IBD still are poorly understood, but it is clear that a misdirected immune system is at work, and that certain components of the microbial community in our gut, known as the intestinal microbiome, and environmental factors contribute to its destructive forces.

While anti-inflammatory drugs can dampen acute inflammation and antibiotics can fight local infections when IBD episodes flare up, their use also comes at a cost. Anti-inflammatory drugs can have severe side effects and antibiotics can disrupt the beneficial parts of the microbiome on which we depend for many of our body's functions. Importantly, there are no wound treatments available that could be applied to inflamed lesions directly from inside the gut lumen in order to speed up the healing process and minimize the use of those drugs.

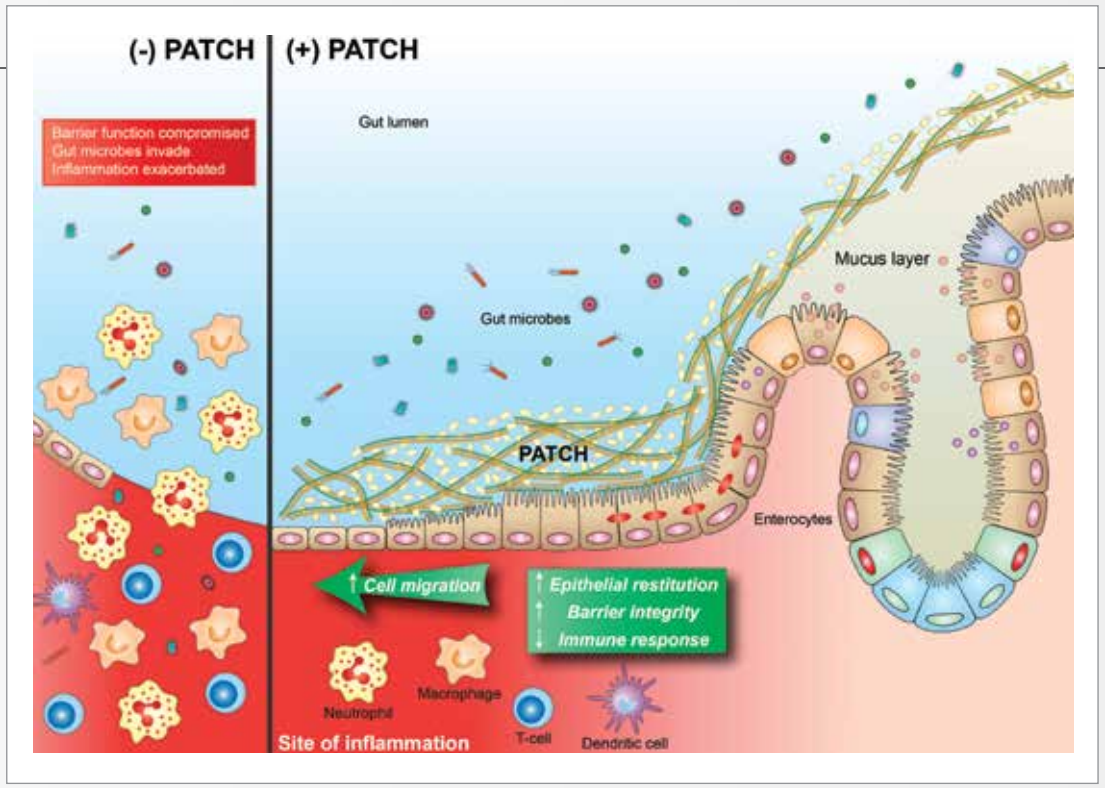
Now, a research team at Harvard's Wyss Institute for Biologically Inspired Engineering led by Neel Joshi, Ph.D., has developed a living material approach that uses a strain of genetically engineered *E.coli* Nissle gut bacteria as a locally acting probiotic. The engineered bacteria produce a network of nanofibers that directly binds to mucus to fill inflamed areas like a patch, shielding them from gut microbes and environmental factors. This probiotic-based therapeutic strategy protected mice against the effects of colitis induced by a chemical agent and promoted mucosal healing. Their findings are reported in *Nature Communications*.

> This powerful and simple approach could potentially impact the lives of thousands of patients with IBD for whom there is no disease-specific cure available. It also is a testament to the creativity and vision of the Wyss Institute's 'Living Cellular Devices' initiative that engineers living cells to perform key therapeutic and diagnostic tasks in our bodies.

"With this 'living therapeutics' approach, we created multivalent biomaterials that are secreted by resident engineered bacteria on-site and attach to many mucus proteins at a time – firmly adhering to the viscous and otherwise moving mucus layer, which is a challenging thing to do," said Joshi. "The 'Probiotic Associated Therapeutic Curli Hybrids' (PATCH) approach, as we named it, creates a biocompatible, mucoadhesive coating that functions as a stable, self-regenerating band-aid and provides biological cues for mucosal healing." Joshi presently is a Core Faculty member of the Wyss Institute and Associate Professor at Harvard's Paulson School of Engineering and Applied Sciences (SEAS), and will shortly be appointed as a Professor at Northeastern University in Boston.

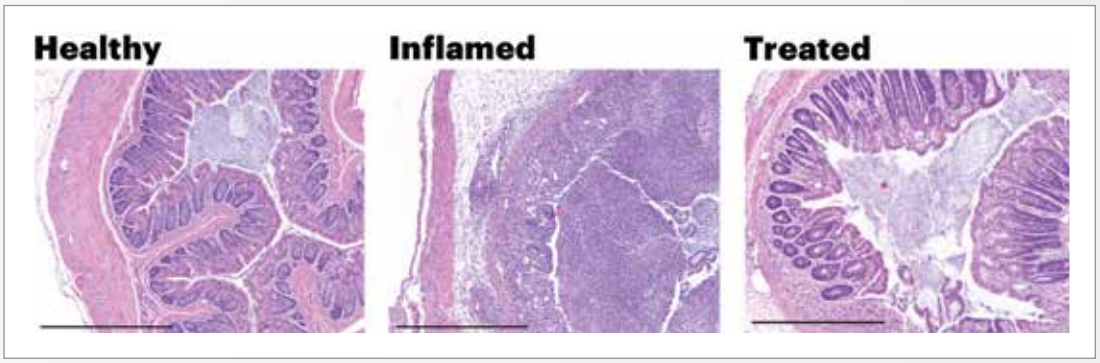
In previous work, Joshi's group has demonstrated that self-regenerating bacterial hydrogels firmly attached to mucosal surfaces *ex vivo*, and, when orally given to mice, withstood the harsh pH and digestive conditions of the stomach and small intestine without affecting the health of the animals. To fabricate them, his team programmed a laboratory *E. coli* strain to synthesize and secrete a modified CsgA protein, which as part of E. coli's "curli" system assembles into long nanofibers at the outer surface of the bacteria.

"To enable mucus adhesion, we fused CsgA to the mucus-binding domain of different human trefoil factors (TFFs), proteins that occur naturally in the intestinal mucosa and bind to mucins, the major mucus proteins present there. The secreted fusion proteins form a water-storing mesh with tunable hydrogel



Wyss Institute at Harvard University

Inflammatory lesions destroy epithelial cells that function as a barrier between the inside of the gut (lumen) and the rest of the body (left). This loss of barrier function leads to a feedback cycle of worsening inflammation fueled by bacteria and other particles crossing the barrier. PATCH is a bioactive material synthesized by engineered probiotic bacteria that helps to maintain gut barrier function even in the presence of inflammatory insults, thereby helping to keep bacteria and other particulates in the lumen and ameliorating the symptoms of inflammation (right).



Wyss Institute at Harvard University

These images show histological cross sections of colon from mice used as a disease model for colitis. The colons of injured mice (middle) lose the characteristic columnar cell structure of the healthy gut (left). When treated with PATCH, the mouse colons were able to maintain a healthy morphology even in the presence of inflammatory insults.

properties," said co-author Anna Duraj-Thatte, Ph.D., a postdoctoral fellow working with Joshi. "This turned out to be a simple and robust strategy to produce self-renewing, mucoadhesive materials with long residence times in the mouse intestinal tract."

In their new study, the team further built on these findings by introducing the machinery for producing one of the mucoadhesive hydrogels based on TFF3 into an *E. coli* Nissle strain that is a normal gut bacterium which can thrive in the colon and cecum sections of the intestinal tract affected by IBD, and is currently sold in many commercial probiotic formulations.

"We found that the newly engineered Nissle bacteria, when given orally, also populated and resided in the intestinal tract, and that their curli fibers integrated with the intestinal mucus layer," said first-author Pichet Praveschotinunt, who is a graduate student mentored by Joshi.

"When we induced colitis in the colons of mice by orally administering the chemical dextran sodium sulfate, animals that had received the PATCH-generating *E. coli* Nissle strain by daily rectal administration starting three days prior to chemical treatment, had significantly faster healing and lower inflammatory responses, which caused them to lose much less weight and recover faster compared to control animals," said Praveschotinunt. "Their colon epithelial mucosa displayed a more normal morphology and lower numbers of infiltrating immune cells".

Joshi and his team think that their approach could be developed as a companion therapy to existing anti-inflammatory, immuno-suppressant, and antibiotic therapies to help minimize patients' exposure to the drugs and potentially provide protection against IBD relapses.

"This powerful and simple approach could potentially impact the lives of thousands of patients with IBD for whom there is no disease-specific cure available. It also is a testament to the creativity and vision of the Wyss Institute's 'Living Cellular Devices' initiative that engineers living cells to perform key therapeutic and diagnostic tasks in our bodies," said Wyss Institute Founding Director Donald Ingber, M.D., Ph.D., who is also the Judah Folkman Professor of Vascular Biology at HMS, the Vascular Biology Program at Boston Children's Hospital, and Professor of Bioengineering at SEAS.

Additional authors on the study are Wyss Institute researchers Ilia Gelfat, Franziska Bahl, and David B. Chou, M.D., Ph.D. The study was supported by a grant from the National Institutes of Health, funds by Harvard's Wyss Institute for Biologically Inspired Engineering and the Blavatnik Biomedical Accelerator, and a royal Thai government scholarship.

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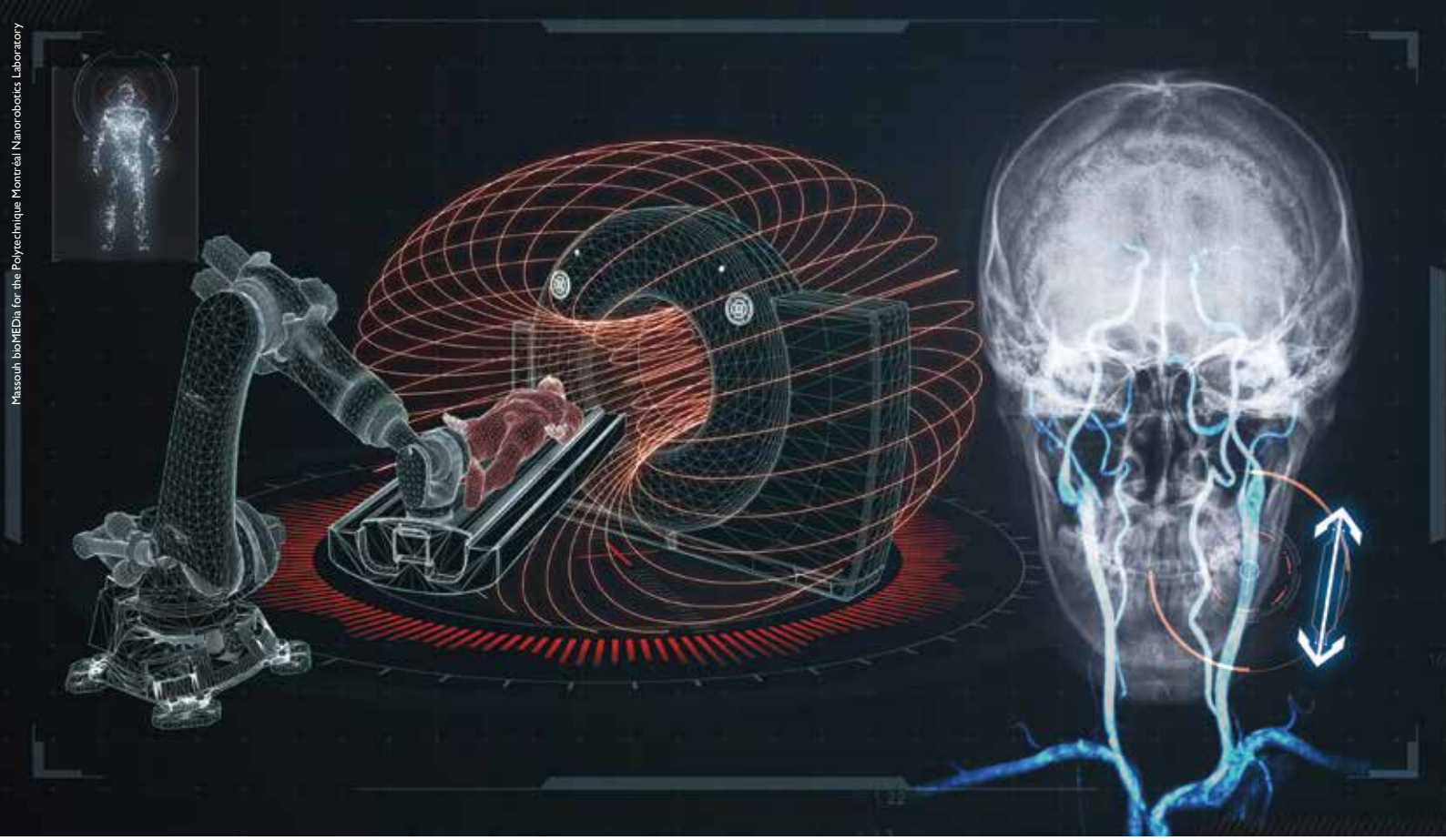

Researchers make breakthrough in instrument guidance for endovascular surgery

A team led by Professor Sylvain Martel at the Polytechnique Montréal Nanorobotics Laboratory has developed a novel approach to tackling one of the biggest challenges of endovascular surgery: how to reach the most difficult-to-access physiological locations. Their solution is a robotic platform that uses the fringe field generated by the superconducting magnet of a clinical magnetic resonance imaging (MRI) scanner to guide medical instruments through deeper and more complex vascular structures. *Middle East Health* reports.

Imagine having to push a wire as thin as a human hair deeper and deeper inside a very long, very narrow tube full of twists and turns. The wire's lack of rigidity, along with the friction forces exerted on the walls of the tube, will eventually render the manoeuvre impossible, with the wire ending up folded on itself and stuck in a turn of the tube. This is exactly the challenge facing surgeons who seek to perform minimally invasive procedures in ever-deeper parts of the human body by steering a guidewire or other instrumentation (such as a catheter) through narrow, tortuous networks of blood vessels.

It is possible, however, to harness a directional pulling force to complement the pushing force, countering the friction forces inside the blood vessel and moving the instrument much farther. The tip of the device is magnetized, and pulled along inside the vessels by the attraction force of another magnet. Only a powerful superconducting magnet outside the patient's body can provide the extra attraction needed to steer the magnetized device as far as possible. There is one piece of modern hospital equipment that can play that role: an MRI scanner, which has a superconducting magnet that generates a field tens of thousands of times stronger than that of the Earth.

The magnetic field inside the tunnel of an MRI scanner, however, is uniform; this is key to how patient imaging is performed. That uniformity poses a problem: to pull the tip of the instrument through the labyrinthine vascular structures, the guiding magnetic field must be modulated to the greatest possible amplitude and then be decreased as quickly as possible.

Pondering that problem, Prof Martel had the idea of using not the main magnetic field present inside the MRI machine tunnel, but the so-called fringe field outside the machine.

"Manufacturers of MRI scanners will normally reduce the fringe field to the minimum," he explains. "The result is a very-high-amplitude field that decays

very rapidly. For us, that fringe field represents an excellent solution that is far superior to the best existing magnetic guidance approaches, and it is in a peripheral space conducive to human-scale interventions. To the best of our knowledge, this is the first time that an MRI fringe field has been used for a medical application," he adds.

Move the patient rather than the field

To steer an instrument deep within blood vessels, not only is a strong attraction force required, but that force must be oriented to pull the magnetic tip of the instrument in various directions inside the vessels. Because of the MRI scanner's size and weight, it's impossible to move it to change the direction of the magnetic field. To get around that issue, the patient is moved in the vicinity of the MRI machine instead. The platform developed by Professor Martel's team uses a robotic table positioned within the fringe field next to the scanner.

The table, designed by Arash Azizi – the lead author of the article and a biomedical engineering PhD candidate whose thesis advisor is Prof Martel – can move on all axes to position and orient the patient according to the direction in which the instrument must be guided through their body. The table automatically changes direction and orientation to position the patient optimally for the successive stages of the instrument's journey thanks to a system that maps the directional forces of the MRI scanner's magnetic field – a technique that Prof Martel has dubbed Fringe Field Navigation (FFN).

An in-vivo study of FFN with X-ray mapping demonstrated the capacity of the system for efficient and minimally invasive steering of extremely small-diameter instruments deep within complex vascular structures that were hitherto inaccessible using known methods.

Robotic solution

This robotic solution, which greatly outperforms manual procedures as well as existing magnetic field-based platforms, enables endovascular interventional procedures in very deep, and therefore currently inaccessible, regions of the human body.

The method promises to broaden possibilities for application of various medical procedures including diagnosis, imaging and local treatments. Among other things, it could serve to assist surgeons in procedures requiring the least invasive methods possible, including treatment of brain damage such as an aneurysm or a stroke.

• **doi**: 10.1126/scirobotics.aax7342

AI helps find signs of heart disease on lung cancer screens

Artificial intelligence (AI) provides an automated and accurate tool to measure a common marker of heart disease in patients getting chest CT scans for lung cancer screening, according to a study presented at the annual meeting of the Radiological Society of North America (RSNA) last year.

Low-dose chest CT is approved for lung cancer screening in high-risk people, such as long-time smokers. While these CT scans are intended to diagnose lung cancer, coronary artery calcium, a measure of plaque in the arteries, is also visible on CT. The coronary artery calcium score derived from CT is a well-established measure that helps doctors decide who should get cholesterol-lowering statins.

"The new cholesterol guidelines encourage using the calcium score to help physicians and patients decide whether to take a statin," said study co-senior author Michael T. Lu, M.D., M.P.H., director of AI in the Cardiovascular Imaging Research Center (CIRC) at Massachusetts General Hospital (MGH) in Boston. "For select patients at intermediate risk of heart disease, if the calcium score is 0, statin can be deferred. If the calcium score is high, then those patients should be on a statin."

Despite its prognostic value, coronary artery calcium is not routinely measured in low-dose CT lung screening, as the measurements require dedicated software and add time to the interpretation.

"If our tool detects a lot of coronary artery calcium in a patient, then maybe we can send that patient to a specialist for follow up," said lead author Roman Zeleznik, M.Sc., B.Sc., from the Artificial Intelligence in Medicine (AIM) Program at Boston's Brigham and Women's Hospital (BWH) and Dana-Farber Cancer Institute. "This would make it easier for patients to get appropriate treatment."

The research team, which represents a close collaboration between MGH's CIRC and AIM at BWH, recently developed and tested a technique that uses deep learning, a sophisticated type of AI, to automatically measure coronary artery calcium on chest CT images. They trained the deep learning system on cardiac CTs and chest CTs in which the coronary artery calcium had been measured manually. They then tested the system on CT scans from thousands of heavy smokers, age 55-74, who were part of the National Lung Screening Trial (NLST), a major study that established CT's value in providing early detection of lung cancer.

The results showed that the deep learning-derived coronary

artery calcium scores corresponded closely to those of human readers. In addition, there was a significant association between deep learning calcium scores and cardiovascular death over follow-up of 6.5 years.

"There's information about cardiovascular health on these CT scans," Dr Lu said. "This is an automated way to extract that information, which can help patients and physicians make decisions about preventative therapy."

For instance, automated coronary calcium quantification could be used to segregate people into high- and low-risk groups.

The deep learning system runs in the background and adds no time to the exam. The system's ability to automate coronary calcium assessment could be a boon to research, as it can evaluate large numbers of patients in a much less time than it would take human readers.

It could also have value outside of the lung screening population. The research team has already demonstrated its effectiveness in people with stable and acute chest pain.

"We have a tool that in the future can be used on almost every chest scan to generate very clinically relevant information for a large number of patients," said study co-senior author Hugo Aerts, Ph.D., director of the AIM Program at BWH.

The research team has already demonstrated similar results in clinical trial populations in patients with stable (PROMISE Trial) and acute (ROMICAT trial) chest pain.

Women most affected by vascular complications of diabetes

Women are most affected by the vascular complications of diabetes – a situation likely to escalate in the coming decades, reports a paper published in the *European Journal of Preventive Cardiology*, a journal of the European Society of Cardiology (ESC).

Cardiovascular disease occurs 15 years earlier in patients with diabetes and is their main cause of morbidity and mortality. In women, the links between diabetes and cardiovascular disease are particularly potent.

Globally, there are more deaths due to diabetes in women than in men (2.1 versus 1.8 million annually) – this excess risk is mainly due to the higher risk of cardiovascular death in women.

Coronary heart disease is the most frequently reported form of cardiovascular disease and the most lethal one. Women with diabetes are at a 1.81-fold risk of death from coronary heart disease compared to women without diabetes. Men with diabetes have a 1.48-fold risk of death from coronary heart disease compared to men without diabetes.

Peripheral artery disease – which can ultimately lead to foot amputation – is the most common initial manifestation of cardiovascular disease in patients with type 2 diabetes. Its prevalence is 1.8-fold higher in women compared to men.

Heart failure is the second most common initial manifestation of cardiovascular disease in type 2 diabetes. Women with diabetes are five times more likely to get heart failure than women without diabetes. Men with diabetes are two times more likely to get heart failure than men without diabetes.

Research is ongoing to explain these differences between women and men. One possible reason for the higher heart failure risk could be that a specific form is more common in women generally and is the type most likely to affect patients with diabetes. This form is called heart failure with preserved ejection fraction, where the heart maintains its pump function but has increased stiffness causing impaired relaxation after contraction.

In both women and men, a healthy lifestyle is the cornerstone to preventing diabetes; once people have diabetes, it is fundamental to stopping the cardiovascular complications.

Senior author Professor Joline Beulens, of Amsterdam University Medical Centre, the Netherlands said: "With the increased levels of obesity in our society we have seen an enormous rise in the prevalence of diabetes. We know that type 2 diabetes is a lifestyle-related disease, so we can halt the trajectory with better behaviours."

"Lifestyle management is the first line of treatment for patients with diabetes," said Prof Beulens. "If lifestyle doesn't sufficiently control glucose levels and the risk of complications, then glucose-lowering treatment should be initiated as the second line of therapy."

ESC diabetes guidelines advise patients with diabetes and pre-diabetes to:

- Quit smoking.
- Reduce calorie intake to lower excessive body weight.
- Adopt a Mediterranean diet supplemented with olive oil and/or nuts to lower the risk of cardiovascular events.
- Avoid alcohol.
- Do moderate-to-vigorous physical activity (a combination of aerobic and resistance exercise) at least 150 minutes per week to prevent/control diabetes – unless contraindicated, such as in patients with severe comorbidities or limited life expectancy.

Prof Beulens said: "Patients with diabetes remain at significantly higher cardiovascular risk compared to people without diabetes. There is an urgent need to better identify, monitor, and control diabetes to prevent the devastating cardiovascular complications."

- **doi**: 10.1093/eurheartj/ehz486

Researchers attempt to restore neural connections lost in heart transplants

An ambitious study is trying to restore the neural connections that are lost during heart transplants, thus improving the life expectancy of patients

The world's first human-to-human heart transplant is dated 3 December 1967, operated by the surgeon Christiaan Barnard in Cape Town, South Africa, on patient Louis Washkansky.

Fifty-two years later an international team of researchers is trying to revolutionise this medical field, offering a hi-tech solution to tackle the dangerous side effects for patients.

Guido Giudetti, a biologist specialising in neurobiology at the Sant'Anna School of Advanced Studies in Pisa, Italy, explains: "In this neuroengineering project we want to take a transplanted heart and restore its lost neural connections. This is very important, since the nerves that connect the heart to the brain regulate the pulse."

"The control nerve is called vagus. When active, it has the function of slowing the heartbeat. Nowadays, a patient who has had a conventional transplant is like a driver in a car which is stuck at 110 km/h. Their heart pulse remains the same whether they are sleeping, walking or doing physical activity. In the long run this situation leads to lower quality of life as the fast-beating, uncontrollable heart eventually gets tired."

The project is called NeuHeart, and is supported by the EU programme Future and Emerging Technologies (FET). Giudetti admits: "We are trying to do something that no one has ever tried to do. That's why we say that it is a 'moon shot'. At a certain point we looked at each other and said: 'Do we realise that we are trying to make Iron Man?' He is a superhero who uses a special technology to help him stay alive because his heart has suffered some damage."

The solution studied by the researchers is a smart neuroprosthesis that will electronically control the denervated heart, through a regenerative neural interface and sensors.

Giudetti concludes: "The FET programme has given us the confidence to carry out a high-risk/high-gain research. The anatomy of the vagus nerve itself is not well known, and this is something that we will study specifically in this project. We may not achieve our aim, but firstly we will have developed technologies, and secondly, if the research is successful, we will literally change the paradigm of heart transplants." MEH

Deeper understanding of irregular heartbeat may lead to more effective treatment

Researchers at Imperial College London have shown how the chaotic electrical signals underlying irregular heart rhythms lead to the failure of standard treatments.

By modelling how electrical signals on the inside and the outside of the heart move across the muscle, the researchers have suggested why corrective surgery is not currently always beneficial.

The insight could improve surgery for some, by better targeting areas of the heart responsible, and could avoid unnecessary surgery for others, where intervention is unlikely to help.

Atrial fibrillation (AF) is the most common heart rhythm abnormality and is projected to affect about two percent of the global population by 2050. It is the leading cause of stroke, but treatment options are limited.

The current most common treatment is a surgery to burn areas of the heart from the inside thought to be responsible for the irregularity. However, the surgery, known as catheter ablation, is only effective in about 50 percent of patients.

Clinicians in the US recently observed that AF is associated with different patterns of electrical pulses on the inside and the outside the heart, which were previously thought to be incompatible.

Now, a team of physicists and cardiologists at Imperial have developed a model of AF that explains how these differing patterns arise and what causes them. The model can further be used to explain why some patients do not benefit from AF surgery.

For example, the model predicts that the current method of burning the heart from the inside might fail if the sources underlying AF originate on the outside of the heart. For these patients, surgery could be optimised to increase the chances of being successful and reducing symptoms.

The model also predicts that for some patients, the heart muscle is so damaged that regardless of how often the source of AF is destroyed, a new location will always emerge that disrupts the regular rhythm.

For these patients, surgery is likely to be an unnecessary risk, as well as being costly for the healthcare system. The team say new treatments should be developed for these patients.

The team's model is currently based on theories in physics, which match well with observations of electrical pulses from earlier studies.

They are now beginning to work with real data from patients undergoing treatment to pinpoint where in the heart to target using current surgical techniques. This could increase the success rate of current techniques and reduce the time needed for each patient to undergo surgery.

Lead author Max Falkenberg, a PhD student in the Department of Physics at Imperial, said: "Our model helps explain why many patients have unsuccessful surgery, and associates this failure with a number of risk factors such as obesity. We hope that with further development, the model could help us determine for which patients surgery is an unnecessary risk, and which would benefit from surgery if the right regions of the heart are targeted."

Professor Kim Christensen, who supervised the project, said: "Atrial fibrillation is a fascinating example of how a natural complex phenomenon might actually have a relatively simple origin. A long-standing collaboration between physicists and cardiologists at Imperial has managed to overcome persistent barriers to bridging the disciplines and we are now reaping the fruits of that endeavour.

"We are truly excited about the future potential clinical applications of our findings for personalised treatment of atrial fibrillation." MEH

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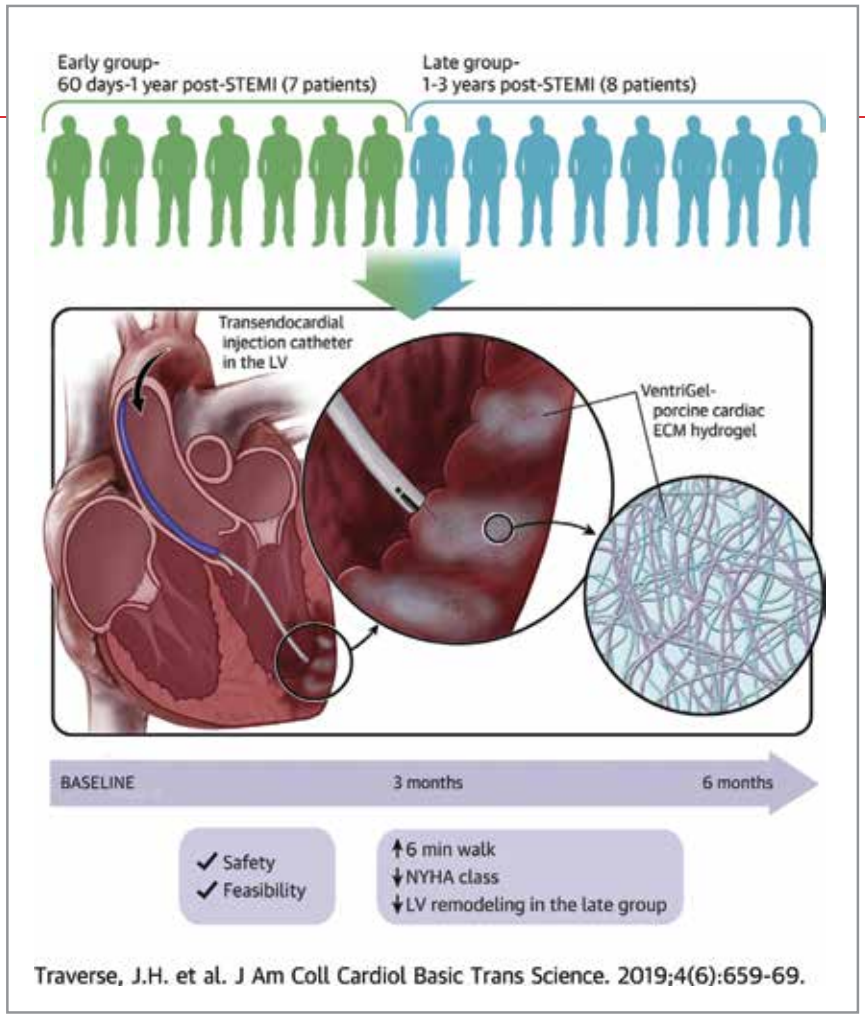
First-in-man trial shows hydrogel to repair heart is safe to inject in humans



Ventrix, a University of California San Diego spin-off company, has successfully conducted a first-in-human, FDA-approved Phase 1 clinical trial of an injectable hydrogel that aims to repair damage and restore cardiac function in heart failure patients who previously suffered a heart attack.

The trial is the first to test a hydrogel designed to repair cardiac tissue. It is also the first to test a hydrogel made from the natural scaffolding of cardiac muscle tissue, also known as extracellular matrix, or ECM. This is significant because ECM hydrogels have been shown in preclinical studies to potentially be effective for other conditions, such as poor blood circulation due to peripheral artery disease. The trial showed that the hydrogel, known as VentriGel, can be safely injected via catheter into patients who had suffered a heart attack in the past 2 to 36 months.

"Although the study was designed to evaluate safety and feasibility and not designed to show whether VentriGel effectively helps improve heart function, we observed some improvements in patients," said Karen Christman, the paper's senior author and a professor of bioengineering in the Jacobs School of Engineering and the Institute of Engineering in Medicine at UC San Diego. "For example, patients could walk longer distances. We also observed signs of improving heart function in patients who experienced a heart attack more than one year prior to treatment."

Researchers from Ventrix, led by Christman, report their findings in the September 11, 2019 issue of the *Journal of the American College of Cardiology: Basic to Translational Science*. Dr Jay Traverse at Minneapolis Heart Institute was the lead clinical investigator.

After a heart attack, scar tissue develops, which diminishes muscle function and leads to heart failure. This is where VentriGel comes in. Once injected in damaged cardiac muscle, VentriGel forms a scaffold that acts as a reparative environment where healthy cells migrate, leading to increases in cardiac muscle, less scar tissue, and improvements in heart function.

VentriGel was invented by Christman and her team, then licensed from UC San Diego and developed by Ventrix, Inc, which was cofounded by CEO Adam Kinsey and Christman.

VentriGel is made from cardiac connective tissue taken from pigs, which is stripped of heart muscle cells through a cleansing process. It is then freeze-dried and milled into powder form, and then liquefied into a fluid that can be easily injected into heart muscle in a minimally invasive procedure that does not require surgery. Once it hits body temperature, the liquid turns into a semi-solid, porous gel.

The Phase 1 trial evaluated the gel in 15 patients who sustained moderate damage in the left ventricle chamber of the heart following a heart attack. Each patient received up to 18 injections of VentriGel into the damaged region via catheter. Researchers followed the patients for six months after treatment. All patients completed the full follow-up.

Twelve of the 15 patients were men. All 15 were experiencing mild to moderate heart failure following a heart attack. Half had suffered a heart attack within the past year.

Patients took a six-minute walking test as well as a heart function assessment and a heart health questionnaire before the injections. They retook the tests three and six months later. In addition, patients underwent an MRI at three and six months after the procedures.

Ventrix is now gearing up for a Phase 2 clinical trial that will expand on this successful first-in-human study. They are planning a larger, randomized trial that will evaluate how effectively VentriGel can improve cardiac function and quality of life for patients experiencing heart failure.

• **doi**: 10.1016/j.jacbts.2019.07.012

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The Division of Cardiothoracic Surgery at the University of Nebraska Medical Center is one of the top academic heart and chestsurgery divisions in the United States. Our team of 12 cardiothoracic surgeons perform advanced cardiac and thoracic procedures, several only performed at select institutions worldwide. We perform more than 800 heart operations each year, with overall excellent outcomes as graded by Vizient and the Society of Thoracic Surgery Database. The division specializes in mechanical circulatory support including left ventricular assist devices (LVAD) and heart transplantation for the most critically ill patients with heart failure. For those with biventricular heart failure, our team has implanted the total artificial heart as a bridge to transplant. Patients with advanced lung diseases are offered complex care by a multidisciplinary team and, if suitable, lung transplantation.

The division ranks in the top 4% of U.S. institutions for treating patients with complex mitral valve disease. Our surgical experts are able to repair more than 95% of prolapsing valves with excellent short and long term results. With our cardiology partners, we perform new endovascular procedures for mitral valve disease including the Mitraclip. We have a busy and experienced team performing transcatheter aortic valve replacements.

Combined with our colleagues in Vascular Surgery and Cardiology, we have a multidisciplinary aortic program that offers advanced open and endovascular options for patients with aneurysms, dissections and genetic aortic conditions (*NebraskaMed.com/Heart/Aortic-conditions*).

Michael J. Moulton, MD, Thoracic and Cardiac Surgery

The section of thoracic surgery within the Division of Cardiothoracic Surgery has a robust clinical program performing video-assisted thoracic operations (VATS) for pulmonary resection of lung cancer and, in conjunction with the Division of Surgical Oncology, minimally invasive esophagectomy.

Surgeons in the division train the next generation of cardiothoracic surgeons in our residency program and participate and lead national clinical trials. Our group was a leading enroller in the MOMENTUM Heartmate III LVAD trial and John Um, MD, was an author on the *New England Journal* of Medicine article *(https://www.nejm.org/doi/full/10.1056/NEJMoa1900486)*.

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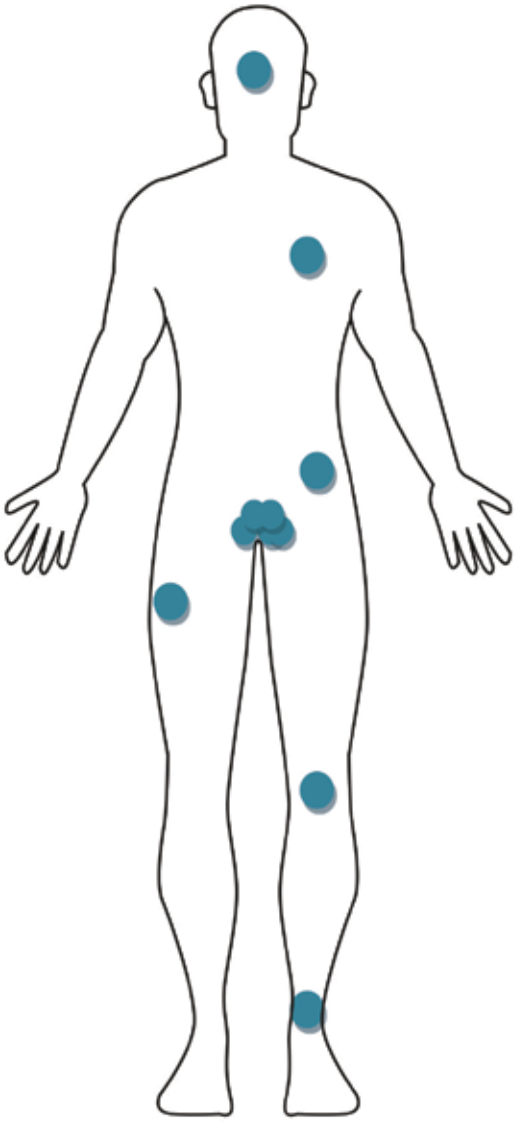

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American Hospital Dubai performs first TAVI procedure

Transcutaneous Aortic Valve Implantation

Severe disease of the aortic valve, the main valve in the heart, can be very debilitating to patients, limiting them from performing simple regular daily activities. Symptoms can range from extreme shortness of breath to multiple fainting episodes, intense chest pains and, in extreme cases, sudden death.

Traditionally, the only solution for this problem was to replace the aortic valve through open-heart surgery. This is a major operation involving opening the chest wall cavity and requiring general anesthesia followed by a very long rehabilitation period which could take up to three months.

Now, this problem can be resolved completely with excellent results through a minor procedure performed through a small incision in the groin done under local anesthesia. This minimally invasive method allows the replacement of the valve without the need for open heart surgery. The recovery period is only 1-2 days and the patient will notice a major and immediate difference just four hours after the procedure. They will be walking the same day and be home within 2 days.

This method is called "TAVI" – Transcutaneous Aortic Valve Implantation. It has been proven in multiple studies to be extremely effective with minimal risks. TAVI is now approved for all patients with severe aortic valve stenosis (narrowing).

In 2020, nearly all patients with severe aortic valve stenosis can be treated with the TAVI procedure.

American Hospital Dubai has performed its first Transcutaneous Aortic Valve Implantation (TAVI) procedure on a 91-year-old man. The TAVI procedure replaces the aortic valve in the cases of severe aortic valve stenosis.

The American Hospital Dubai conducted the procedure on October 16 and the patient is reported to be stable. Only 5 per cent of patients, worldwide, who have undergone the TAVI procedure, are more than 90 years of age.

Dr. Firas Alani, consultant interventional and structural heart specialist, American Hospital Dubai.

The aortic valve is the primary and most crucial valve among the four heart valves. The narrowing of this valve has a detrimental effect on the function of the heart which can limit simple daily activities. Symptoms can range from extreme shortness of breath to multiple fainting episodes, from intense chest pains to sudden death. By replacing the aortic valve, a patient is able to enjoy a normal life once again.

Globally, around 30 to 60 per cent of patients with this condition are not offered open surgical aortic valve replacement heart surgery due to the high risk associated with it. But TAVI is a minimal invasive therapy that benefits such patients who would have been otherwise left untreated.

TAVI allows the interventional cardiologist with the assistance of a heart surgeon to insert an artificial valve inside the diseased aortic valve through a 3 to 5 mm incision in the groin area. The procedure is done in the majority of cases under local anesthesia and takes approximately 60 minutes. Patients can walk approximately eight hours after the procedure and remain in the hospital for an average of one to two days.

TAVI guarantees rapid recovery, as compared to open-heart surgery that has a long and debilitating post-operative recovery period which can last anywhere from 1-3 months. Under local anesthesia and with a minimally invasive approach, the TAVI procedure incurs minimal risks with excellent results that are comparable to open surgical aortic valve replacement.

Dr. Firas Alani, consultant interventional and structural heart specialist at the American Hospital Dubai, said: "The patient had a long-standing history of heart disease. He had an open-heart surgery with coronary bypass 25 years prior to presentation, myocardial infarction and ischemic cardiomyopathy (Ejection Fraction 30-35%) and atrial fibrillation. In the two months prior to presentation, he started noticing increasing shortness of breath that limited him in many ways from performing simple daily activities. He was referred to the American Hospital Dubai for evaluation."

Subsequent screening of the patient revealed severe symptomatic aortic valve stenosis with evidence of active heart failure and atrial fibrillation. For the following two weeks, the American Hospital Dubai medical team improved some of his symptoms by modifying and optimizing his medical therapy regimen.

"This showed some improvement in his symptomatology, however, his continued limitation in performing routine daily activities, such as changing clothes or even walking for short distances, still proved to be a challenge. After consulting a team of heart surgeons, we decided to go ahead with aortic valve replacement. His case was not suitable for open surgical aortic valve replacement due to the extreme high risks related to his coexisting medical conditions. Therefore, we opted for TAVI," said Dr. Alani.

The procedure was done successfully, and immediately after the procedure, the patient noticed a significant improvement in his symptoms and was discharged in stable condition after two days. MEH

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Collaborative care approach leads to creative, lifesaving treatment for Olivia Henderson

Olivia Henderson came to Baylor St. Luke's Medical Center from another hospital, in cardiac shock and with limited options. There was concern the 79-year-old was having a heart attack, a stroke and an aortic valve issue all at the same time. Her case was high risk, as the magnitude of surgery needed – from fixing the aortic valve to clearing several coronary blockages with a recent stroke and severely calcified aorta – was too complicated of a procedure for her health and survival.

On one hand, there was an urgency to get something – anything – done. On the other, Olivia was going to need an extensive amount of operating time and given the combination of her recent stroke and complications, completing the standard surgical repair all in one sitting was prohibitively high-risk.

However, Baylor St. Luke's Medical Center physicians worked to turn a non-operative, high-risk case into an operative, low-risk case using their expertise and innovation.

A multidisciplinary team of experts convened, as is typical for high-risk surgical cases, to develop a plan of action and alternatives. Dr. Srikanth Koneru, imaging expert; Dr. Mahboob Alam, Olivia's cardiologist; Dr. Gabriel Loor and Dr. Kenneth Liao, surgical leads; and Dr. Guilherme Silva and Dr. Loor, the Trans-femoral Aortic Valve Replacement (TAVR) team examined Olivia's failing heart and medical history, and the benefits and risks of the options available to her. The findings were limited but promising.

Since Olivia took care of herself and was in relatively good health, the physicians determined she could handle multiple procedures if they were separated, with sufficient recovery time in between. This would avoid circulatory arrest, cardiopulmonary bypass and would significantly expedite her recovery while reducing the risk of another stroke. Circulatory arrest (temporarily stopping circulation by cooling the body) and cardiopulmonary bypass (machinery used to route blood from the patient to an oxygenation source and delivered back to the body) are both common surgical techniques but are stressful for the elderly population and best avoided in this situation.

Baylor St. Luke's Medical Center McNair Campus

Dr. Guilherme Silva

Dr. Srikanth Koneru

Dr. Kenneth Liao

Dr. Alam Mahboob

Dr. Gabriel Loor

Yet, completing a TAVR procedure days after a robotic-assisted bypass surgery is rare and, to our knowledge, would be one of the first in the Texas Medical Center, but it was what Olivia needed to survive.

The physicians treated her non-surgically for a few days, allowing her to gain strength. When it came time for the bypass, Dr. Liao, one of the most well-known surgeons for robotic bypass surgery, completed a robotically assisted single bypass. Olivia did remarkably well, with a minimal stay in the hospital.

As she recovered and became stronger through physical therapy, Olivia was ready for the second stage. Drs. Silva and Loor worked together to deploy a new trans-femoral aortic valve. This procedure repaired the malfunctioning valve without opening her chest, which lowered the risk of having a repeat operation and reopening the site of the previous surgery.

Considering Olivia's complicated condition when first arriving, the team at Baylor St. Luke's took a multidisciplinary approach combining the expertise and innovation, of leaders in four different subspecialties within cardiology. This unique collaborative, full-team approach turned a non-operative, high-risk case into an operative, low-risk case, in order to provide Olivia with the best chance at life. MEH

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Located in Fort Worth, Texas, Cook Children's Medical Center is part of one of the largest pediatric health care systems in the United States, known for expert specialty care and highly advanced medical technologies. To help fulfil their promise, Cook Children's created "Family-Centered Care" to help patients and families from the Gulf Counties to feel more like they're at home.

Family is the Center of a child's whole world. Parents and family members are the source of a child's strength, courage and comfort and so is Cook Children's Team for each of the families that are visiting Cook Children's facilities.

Sometimes, finding the best pediatric speciality care means families need to travel outside of their home country, look for a long-term accommodation, deal with the linguistic barrier and take care of logistical issues.

Cook Children's International Patient Services department is here to provide the best experience and to extend their assistance to all family members. The International team includes a dedicated, multilingual team of care providers who can help with all the details so families can focus on their child's health. This team works to meet each individual family's needs, including coordinating travel plans, accommodation and other services as needed.

The Language and Interpreter Service is a great facility for all the guests. Cook Children's believe that language should never be a barrier to providing medical care to a child.

Children and their families who receive care from Cook Children's come from many cultures and ethnic backgrounds. To help them understand their child's illness and treatment, we provide language assistance for non-English speaking or hearing-impaired children and families.

Cook Children's Team participate in the daily care of the patient by giving the families information about tests, medicines or patient care they need to understand. This ensures better quality, safety and ultimately better outcomes for every child, every day.

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Brainlab's Loop-X

Innovations in imaging

Computed Tomography (CT) technology continues to advance each year. Several manufacturers are now focussing not only on improving the technology to reduce radiation, but also to make the devices less expensive and thus increase access to this extremely useful imaging modality which finds application in many spheres of healthcare. In this article we review a selection of recently launched CT scanners.

Brainlab's intraoperative Loop-X

Although not strictly CT, Brainlab's new Loop-X imaging robot builds on the broad utility of X-ray-based 2D and 3D imaging in the O.R., and aims to provide a surgerycentric digital platform for every surgery. Beyond diagnostic imaging, the intelligent device can capture partial information, "digitizing" anatomical intraoperative changes in order to update a "digital model" of the patient previously generated by aggregating pre-operative images.

Brainlab unveiled their new mobile intraoperative imaging robot in September. The Loop-X imaging robot has been developed by medPhoton in close partnership with Brainlab. The company says it has co-funded its development and become the exclusive distributor of Loop-X imaging robot.

The Loop-X device is designed for 2D and 3D imaging, combining ultrahigh resolution with extra-low doses, and proprietary technology to image with interlaced energies for soft-tissue visualization.

The Loop-X robotic architecture introduces a new standard in flexibility, adding additional degrees of freedom to any surgical procedure: By automating imaging workflow steps and robotically moving with the procedure and on command, the system is in sync with other devices like robotic arms and with the surgeon and staff.

The non-isocentric movement and collimation capabilities allow for the imaging of structures that are much larger (for example in diameter) and much smaller (reducing radiation exposure) than what is possible with the typical CT or 3D C-arm.

The Loop-X imaging robot can be integrated with Brainlab technology as well as third party products through an open interface, maximizing interoperability and data integration.

Commenting on the device Stefan Vilsmeier, President and Chief Executive Officer, Brainlab., said: "For Brainlab, Loop-X is a critical milestone in contributing disruptive innovations in spinal surgery. It provides us with an even stronger foundation for leveraging emerging technologies such as AI, big data, cloud computing, augmented reality and spatial computing."

Part of the overarching Brainlab Digital Surgery portfolio, Loop-X imaging robot increases the depth and breadth of the company's offering and supports a broad range of surgical applications.

Building on the broad utility of X-raybased 2D and 3D imaging in the O.R., Brainlab aims to provide a surgerycentric digital platform for every surgery. Beyond diagnostic imaging, the intelligent device can capture partial information, "digitizing" anatomical intraoperative changes in order to update a "digital model" of the patient previously generated by aggregating pre-operative images.

The device weighs only 440 kg and has a large gantry opening of 148 cm enabling patients to be positioned flexibly – from paediatric to obese – for a large range of indications with an adaptive field of view.

Robotic function facts:

- Smart laser projections remove the intraop imaging 'fiddle factor'. By defining the level of interest on a 2D image, Loop-X robotically supports localization and projects both the incision start andend points directly onto the patient's skin.
- The detector and imaging source move independently enabling nonisocentric imaging. Patients don't need to be positioned in the center of the gantry since the system moves the scan area to the region of interest.
- Screw placement verification is a critical yet often time-consuming task in surgery. Instrument guided imaging allows Loop-X to robotically follow the pointer or a pre-planned screw and position itself for AP, lateral or even oblique 2D verification scans.
- For more information, visit *brainlab.com/loop-X*.

Siemens Somatom On.Site

Siemens Healthineers Somatom On.site

Siemens Healthineers presented their new mobile head CT scanner, Somatom On.site at RSNA iin Chicago in November.

Instead of patients having to be transferred to the radiology department for a CT scan, the new mobile system from Siemens Healthineers now allows the scanner to be taken to the ICU so that patients can be examined from their bedside. This removes the need for complicated patient transportation that involves multiple staff members and a high risk for the patient.

Commenting on the new CT scanner,Dr Philipp Fischer, Head of Computed Tomography at Siemens Healthineers, said: "Somatom On.site is a fundamentally new approach to performing CT head scans for patients in intensive care. The combination of mobility, user-friendliness, and consistent image quality enables unprecedented levels of patient safety. At the same time, healthcare providers can make even more optimal use of their staff and CT fleet."

Siemens explains that using the system is extremely easy. The headboard of the bed is removed, and the patient remains in bed and connected to all the necessary devices. The positioning aids, such as the integrated shoulder board and head holder, guarantee that the patient is comfortably and stably positioned at the isocenter. This enables consistent image quality. After image acquisition, the patient is removed from the head holder and returned to the original position. The diagnostic data is sent directly to the radiology department's Picture Archiving and Control System (PACS). The entire process requires very little staff involvement and only takes a few minutes.

It can also considerably reduce the risk to patients: Staff no longer have to swap patients from fixed devices (such as ventilators) to portable ones, then transport and scan the patient, then reattach the fixed devices.

The scanner's mobile concept includes a camera that displays the area in front of the device in real time on the integrated touchscreen. Users are supported by a motorized scanner trolley that enables intuitive and precise deployment in small spaces. The telescopic gantry helps to make scanning in patient rooms safe: The gantry itself is self-shielded; and the innovative telescopic design means that, during the scan, the tube and detector move away from the patient bore at the front, which further reduces scatter radiation. Moreover, attachable radiation shields covering the front and back bore openings complete the radiation-protection concept and significantly reduce radiation exposure for nearby patients and staff.

During the scan itself, the front gantry cover stays still while the inner gantry element moves on the fixed scanner trolley. The patient is not affected by the movement at all, which also protects the tubes (such as intravenous catheters) to

which he or she is connected. The scanner trolley also does not move during imaging, which prevents motion-induced image artefacts. The combination of this design and a specially developed X-ray tube help to deliver consistent image quality.

The scanner also features a revolutionary usability concept: myExam Companion guides users of all levels of experience through neuro exams and helps them achieve consistent results for diagnosis.

myExam Companion

Siemens is also marketing their Somatom X.cite CT scanner with the inclusion of their new myExam Companion.

myExam Companion is a new user guidance system using AI, which guides the user through the workflow using specific questions. It makes use of available patient data, such as sex, height, and age, and combines these with additional patient-specific information gathered by asking the user specific questions, for example about the presence of metal implants or the ability of patients to hold their breath. The scanner then optimizes the scan parameters accordingly to ensure the best possible result. In combination, these innovations help structure workflow more efficiently, smooth out differences in experience between the MTRAs, and achieve extremely high-quality results even in difficult diagnostic situations.

André Hartung, President Diagnostic Imaging at Siemens Healthineers, said: "We are driving the digital transformation of radiology through constant innovation of our devices. At the same time, we offer – for example through remote solutions – more and more ways for our partners to create high-quality diagnostics. Somatom X.cite and myExam Companion are a big step for our imaging portfolio and follows our plan for intelligent user support." Dr Fischer added: "Staff shortages, insufficient time, the development of standards for high quality diagnostics and decision support, and patient well-being are major challenges in the day-to-day business of radiology. With Somatom X.cite and myExam Companion, we're equipping our customers with unique tools to effectively overcome these hurdles."

Canon's Aquilion ONE / PRISM

Canon Medical introduces Aquilion ONE / PRISM Edition

Canon Medical has introduced Aquilion ONE / PRISM Edition, a spectral CT system designed for deep intelligence. The scanner combines Canon Medical's Advanced intelligent Clear IQ Engine (AiCE) with Deep Learning Spectral Reconstruction imaging capabilities.

The advanced system integrates artificial intelligence (AI) technology to maximize conventional and spectral CT capabilities and automated workflows while providing intelligent clinical insights to assist physicians in making more informed decisions across the patient's care cycle.

Features on this CT scanner include:

- The intelligent Clear IQ Engine (AiCE) Deep Learning Reconstruction (DLR) is an innovative approach to CT reconstruction that uses deep learning to distinguish true signal from noise to deliver sharp, clear and distinct images at fast speeds. Trained using vast amounts of high-quality image data, AiCE provides enhanced anatomical resolution across the whole body including brain, lung, cardiac and musculoskeletal systems.
- Deep Learning Spectral Imaging enables physicians to make a more confident diagnosis through Spectral insights. Not only does it harness the temporal benefits of rapid kV switching with patient-specific mA modulation, full field of view acquisition and 16 cm of coverage, it combines them with a DLR to deliver excellent energy separation and low-noise properties. The fully integrated end-to-end workflow is easy to use and can be incorporated into routine protocols.
- All new CT Fluoroscopy (CTF) Interface conducts fast, focused interventional procedures with the new hybrid CTF interface that enables oneperson operation thanks to ergonomically designed controls and a versatile touchscreen tablet.

Erin Angel, managing director, CT Business Unit, Canon Medical Systems USA, commented: "The intelligent technologies that make up the Aquilion ONE / PRISM Edition give healthcare providers the clinical confidence they need to reach new heights – from both a clinical and business perspective. Canon Medical's deep learning reconstruction technology is pushing routine diagnostic imaging into the age of AI assisted imaging, revolutionizing patient care by enabling improved diagnostic confidence. We are committed to delivering products that aren't just a glimpse into the future of imaging – they are the future of imaging." MEH

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Researchers use AI with routine CT scans to predict how well lung cancer patients will respond to immunotherapy

Scientists from the Case Western Reserve University digital imaging lab, already pioneering the use of artificial intelligence (AI) to predict whether chemotherapy will be successful, can now determine which lung-cancer patients will benefit from expensive immunotherapy.

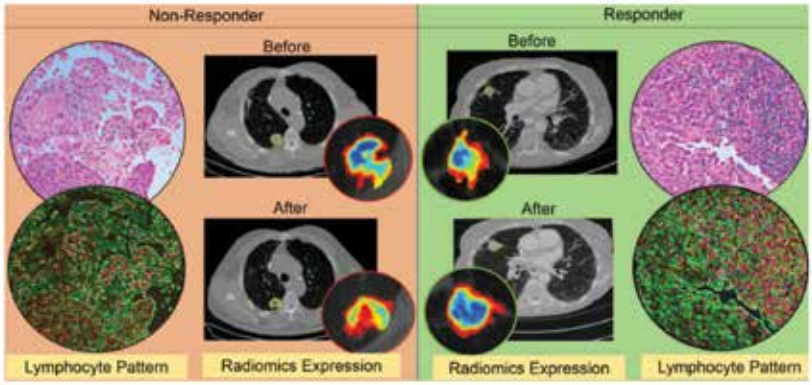
And, once again, they're doing it by teaching a computer to find previously unseen changes in patterns in CT scans taken when the lung cancer is first diagnosed compared to scans taken after the first two to three cycles of immunotherapy treatment. And, as with previous work, those changes have been discovered both inside, and outside, the tumour, a signature of the lab's recent research.

"This is no flash in the pan – this research really seems to be reflecting something about the very biology of the disease, about which is the more aggressive phenotype, and that's information oncologists do not currently have," said Anant Madabhushi, whose Center for Computational Imaging and Personalized Diagnostics (CCIPD) has become a global leader in the detection, diagnosis and characterization of various cancers and other diseases by meshing medical imaging, machine learning and AI.

Currently, only about 20% of all cancer patients will actually benefit from immunotherapy, a treatment that differs from chemotherapy in that it uses drugs to help your immune system fight cancer, while chemotherapy uses drugs to directly kill cancer cells, according to the National Cancer Institute.

Madabhushi said the recent work by his lab would help oncologists know which patients would actually benefit from the therapy, and who would not.

"Even though immunotherapy has changed the entire ecosystem of cancer, it also remains extremely expensive – about $200,000 per patient, per year," Madabhushi said. "That's part of the financial toxicity that comes along with cancer and results in about 42% of all new diagnosed cancer patients losing their life savings within a year of diagnosis."



The figure shows differences in CT radiomic patterns before and after initiation of checkpoint inhibitor therapy.

Having a tool based on the research being done now by his lab would go a long way toward "doing a better job of matching up which patients will respond to immunotherapy instead of throwing $800,000 down the drain," he added, referencing the four patients out of five who will not benefit, multiplied by annual estimated cost.

The new research was published in November 2019 issue of the journal *Cancer Immunology Research*.

Khorrami, a graduate student working at the CCIPD, said one of the more significant advances in the research was the ability of the computer program to note the changes in texture, volume and shape of a given lesion, not just its size.

"This is important because when a doctor decides based on CT images alone whether a patient has responded to therapy, it is often based on the size of the lesion," Khorrami said. "We have found that textural change is a better predictor of whether the therapy is working.

"Sometimes, for example, the nodule may appear larger after therapy because of another reason, say a broken vessel inside the tumour – but the therapy is actually working. Now, we have a way of knowing that."

Prasanna, a postdoctoral research associate in Madabhushi's lab, said the study also showed that the results were consistent across scans of patients treated at two different sites and with three different types of immunotherapy agents.

"This is a demonstration of the fundamental value of the program, that our machine-learning model could predict response in patients treated with different immune checkpoint inhibitors," he said. "We are dealing with a fundamental biological principal."

Prasanna said the initial study used CT scans from 50 patients to train the computer and create a mathematical algorithm to identify the changes in the lesion. He said the next step will be to test the program on cases obtained from other sites and across different immunotherapy agents.

Additionally, Madabhushi said, researchers were able show that the patterns on the CT scans which were most associated with a positive response to treatment and with overall patient survival were also later found to be closely associated with the arrangement of immune cells on the original diagnostic biopsies of those patients.

This suggests that those CT scans actually appear to capture the immune response elicited by the tumours against the invasion of the cancer and that the ones with the strongest immune response were showing the most significant textural change and most importantly, would best respond to the immunotherapy, he said.

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Medical Fair Asia 2020 continues to bring future-ready solutions to the region

- Enhanced Community Care Pavilion to showcase large-scale rehabilitative equipment and technology for community hospitals
- Start-up Park to provide ideal go-to-market ecosystem for companies looking for partnership and collaboration
- Industry-led conferences covering trending topics

Strengthening its position as the region's leading medical and healthcare exhibition, the 13th edition of MEDICAL FAIR ASIA will deliver its largest procurement and sourcing platform to date, when it brings together a comprehensive range of equipment, technology and supplies for the hospital, diagnostic, pharmaceutical, medical and rehabilitation sectors from more than 1,200 exhibitors from 60 countries and regions. The 3-day exhibition is the region's leading event for all those involved in medical and healthcare, and provides a one-stop marketplace to showcase over 12,000 healthcare products and innovations.

Mirroring industry trends and global statistics which point to Asia's rapidly ageing population, the focus on healthcare for the aged and technological innovations in the healthcare economy will be key themes at MEDICAL FAIR ASIA 2020.

Highlights at MEDICAL FAIR ASIA 2020:

• Community Care Pavilion focused on rehabilitation and prevention

The Asia-Pacific region is undergoing profound and rapid population changes. All countries in Asia and the Pacific are in the process of ageing at an unprecedented pace, for instance a quarter of Asia's population will be aged 60 years of age by 2050, while almost 50 percent of Singaporeans will be aged 65 years or older by the same time. Against this fast changing demographic, making a comeback with an enhanced focus on rehabilitative equipment, products and solutions, particularly for the aged, is the Community Care Pavilion - a comprehensive platform featuring a wideranging suite of geriatric-related products and preventive healthcare solutions, as well as rehabilitative equipment, physiotherapy solutions, orthopaedic devices, new robotic technology for mobility, assistive technology, to smart fabrics and wearable technology.

• Start-Up Park for innovative maturing healthcare start-ups

The Start-Up Park will once again provide a dedicated platform for innovative, maturing healthcare and medical start-up companies looking to find business partners, network and meet industry professionals, so as to accelerate their growth. The Start-Up Park will play a significant role as an enabler of the entrepreneurial ecosystem that encourages medical and health innovation in Singapore.

Complementing the Start-up Park will be a series of fireside chats and panel discussions by international thought leaders and stakeholders, who will share start-up experiences, best practices, and a range of topical issues.

• Thought leadership and knowledgesharing programmes

• MEDICAL FAIR ASIA MEDICINE + SPORTS CONFERENCE

9 Sep 2020

Returning for the third instalment, the 1-day conference will bring together regional as well as international, leading sports medicine and sports science experts, physiotherapists, professional athletes, sports techies and visionaries for an interdisciplinary dialogue on innovative approaches in prevention, training, regeneration and rehabilitation.

• 2nd Paradigm Shifts in Healthcare Symposium

– Prehabilitation in Community Health

10 & 11 Sep 2020

After the resounding reception of Paradigm Shifts in Healthcare Symposium in 2018, the second edition will continue this successful streak and continue discussions on ways to overcome challenges as healthcare models move beyond hospitals to communities. Over two half-days, this symposium will focus on how communities can help prepare and enhance an individual's functional capacity for better surgical outcomes even when surgery is not imminent, with the aim of improving postoperative outcomes.

Co-location with MEDICAL MANUFACTURING ASIA 2020

– 5th Manufacturing Processes for Medical Technology Exhibition and Conference

Synergistically co-located with MEDICAL FAIR ASIA 2020, once again is the specialist exhibition – MEDICAL MANUFACTURING ASIA, which is now into its 5th edition, and has gained momentum as the region's leading exhibition for Asia's MedTech and medical manufacturing processes sectors. Jointly organised by Messe Düsseldorf Asia and Singapore Precision Engineering & Technology Association (SPETA), the exhibition will feature a robust product range from upstream to downstream processes in the MedTech sectors - from new materials, components, micro and nanotechnology, testing systems and services, to substance and components for medical technology. Complementing MEDICAL FAIR ASIA, together both exhibitions represent the entire end-to-end value chain from medical manufacturing processes and machinery, to finished products and components. At the last edition of the co-located exhibitions, 14,000 trade visitors from 70 countries visited MEDICAL FAIR ASIA, while over 6,000 from 54 countries visited MEDICAL MANUFACTURING ASIA.

The Southeast Asian market offers a diverse range of business opportunities for potential exhibitors and visitors, making MEDICAL FAIR ASIA 2020 the ideal platform for companies to do business, network and share best practices. With more companies keen on strengthening and gaining a foothold in the Southeast Asian market, interested exhibitors are encouraged to submit their space application forms early.

- For more information on the exhibition, please visit *www.medicalfair-asia.com*

Clinical excellence in the heart of London

Guy's and St Thomas'
Private Healthcare

Guy's and St Thomas' Private Healthcare provides private patients with a unique combination of outstanding clinical care with the comfort of a private facility located in central London.

Our Private Patient Services are part of Guy's and St Thomas' NHS Foundation Trust, one of the safest and largest NHS Trusts in the UK. The Trust comprises two of London's best-known and most prestigious teaching hospitals and has an unrivalled history of high-quality patient apple care, clinical excellence and innovation.

In our 900 years, our ground-breaking research has resulted in innovations that benefit all patients – including the first blood transfusion in 1818 and the world's first mitral heart valve replacement on a beating heart in 2014. Our pioneering research continues to this day.

We welcome patients from around the world and offer an extensive range of clinical services to provide lifelong care for the whole family. From routine to complex care, we support patients from before birth to childhood and into adult life. As we're part of Guy's and St Thomas',patients have full access to comprehensive NHS services and the latest technology, all of which is hugely reassuring. With consultant-led care supported by highly trained multidisciplinary teams of nurses and specialists we deliver the highest standards of care to our patients.

Our centres of excellence are internationally renowned and are at the forefront of innovation. They include specialist paediatrics at the world-renowned Evelina London Children's Hospital; renal transplantation; specialist respiratory services for Extra-Corporeal Membrane Oxygenation (ECMO); cardiovascular services; fertility treatments; maternity services; and the world-renowned St John's Institute of Dermatology.

Evelina London is celebrating its 150th anniversary and is honoured to have had several royal visits, starting in 1890 with the Prince and Princess of Wales and more recently the Duchess of Cambridge who became Evelina London's patron in 2018.

Evelina London is noted for its worldclass expertise in foetal cardiology, cardiac intervention, cardiac MRI and complex cardiac surgery. It hosts one of the largest foetal cardiology units in Europe and is one of the first centres in the UK to offer many cardiac surgical procedures. We are pioneering new techniques such as foetal cardiac MRI and the use of artificial intelligence in advanced cardiac imaging.

The Assisted Conception Unit at Guy's Hospital is known worldwide as an innovator in fertility treatments and our preimplantation genetic diagnosis service is one of the largest in the country. Our outstanding renal transplant service specialises in complex cases with expertise in robotic surgery. We have one of the largest and most established kidney units in the world and one of the largest paediatric transplant programmes. We have the largest and most active living kidney donation programme as well as the UK's largest antibody incompatible transplant programme.

For private patients of every nationality, their experience with us is reassuring, caring and respectful. From initial enquiry to treatment and recovery, the process is seamless – and helped by our dedicated international team of onsite Arabic-speakers. They provide an integral personal service to ensure that the cultural, religious and language needs of our patients are met with sensitivity and understanding.

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Visit us at Arab Health, Hall 2, stand **E13**.

Innovative hospital beds and cabinets with German engineering and design

The Stiegelmeyer-Group has been recording increasing sales for years. The company equips hospitals and nursing homes with high-quality beds and furniture. The subsidiary Burmeier supports people in homecare with modern, home-like beds. Lifestyle beds for private customers combine high quality of life and intoxicating design.

"We are focused on global growth," says Georgios Kampisiulis Kemmler, chairman of the managing board. "Our new products have been enthusiastically received at national and international trade fairs." The company currently manufactures more than 125,000 beds per year and employs around 1,100 people. Headquartered in Herford, Germany, further production sites are located in Nordhausen, Germany, as well as Stolno and Kepno in Poland.

Beds and furniture from Stiegelmeyer are a safe investment for every facility. The company has been family-run since its foundation in 1900 and stands for quality and reliability – in Germany and world-wide. Sales companies operate in France, Poland, the Netherlands, Belgium, Finland and South Africa. Stiegelmeyer products are exported to over 60 countries. In production, the company uses state-of-the-art technology while at the same time protecting the environment. The service division also impresses with a spare parts availability of 15 years.

Highlights

The current highlights of Stiegelmeyer's Hospital division are the Evario hospital bed and the new Quado bedside cabinet. Together, the two products make an attractive pair for many hospital rooms. Thanks to its intelligent modular system, the Evario hospital bed is suitable for all types of wards. Various control options, safety side systems, castors, headboards and footboards, external dimensions and optional scales create a flexible bed, suitable for general wards as well as premium rooms and ICUs. The bed reduces the workload of nursing staff with its effortless operation and its large height adjustment range from 35 to 91 cm, which allows ergonomic back-friendly working.

The new, slim-line Quado bedside cabinet from Stiegelmeyer is perfect for use in narrower hospital or care rooms. At the same time, it has such a flexible design that users still have plenty of space for storing and placing personal belongings. During development of the Quado, the greatest effort was put into making optimum use of the available space. Two compartments and a drawer can be accessed from both sides and can hold two 1½ litre drink bottles, for example. The optional lockable drawer is also suitable for larger wallets and purses. The compact miracle Quado also makes a big impression with its second major advantage: It is very mobile. If a bed is moved to another room or ward, the lightweight Quado can simply be hooked onto the head or footboard of most Stiegelmeyer hospital beds, such as Evario, and transported along with the bed.

Both, the Evario hospital bed and the Quado bedside cabinet are easy to clean and thus support hospitals in their fight against multi-resistant pathogens. Made from large-format plastic elements, the Quado can be cleaned easily and thoroughly – both by automatic reprocessing and by hand. The compartments have large radii and the entire design comprises flat surfaces with few niches. The clear design and optional machine-washable version of the Evario add to its excellent hygiene properties. These two modern products reduce the strain on personnel, promote the recovery of patients and, thanks to a high level of comfort and an elegant appearance, improve the external perception of the hospital.

- Visit Stiegelmeyer at Arab Health 2020 booth number: **SA.D30**.

Dr Abdalla Abdelrahman Al Hajiri shows off the Vigilant X4 CRT-D prior to implantation.

Mediclinic Welcare Hospital team successfully implants cardiac resynchronisation therapy device

A 63-year-old male from Dubai presented at Mediclinic Welcare Hospital with breathing difficulties and swelling of his lower foot. He suffered breathing difficulties with minimal exertion, such as walking and changing his clothes. His appetite was poor and he had suffered significant weight loss. His condition was evaluated with blood tests, chest x-ray, ECG and echocardiography. He was diagnosed with coronary artery disease, advanced heart failure and renal failure – and was at high risk of sudden cardiac death.

After discussion with the patient and his family, he agreed to undergo implantation of an intracardiac defibrillator in combination with a cardiac resynchronisation therapy device (CRT-D).

Three weeks after presentation, the implant procedure was performed under local anaesthesia by Dr Abdalla Abdelrahman Al Hajiri in the cardiac catheterisation laboratory in Mediclinic Welcare Hospital. A 9 cm incision was made in the upper part of the chest (a pocket) and three special wires were delivered through the neck vein into the chambers of the heart, with one special wire placed in the heart vein. Boston Scientific's Vigilant X4 CRT-D was inserted in the pocket and the wound was closed. The device was then programmed to optimise the heart synchrony to improve the heart performance of the patient.

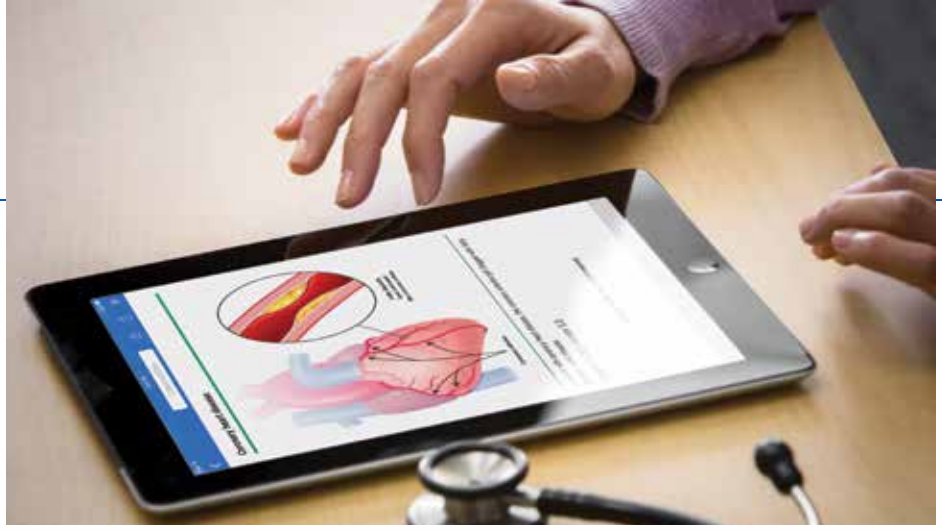
The device is capable providing a shock to restart the patient's heart if it stops.

Dr Al Hajiri said procedure was successful and without complications and the patient was discharged home the next day after checking and programming of the device.

He added that this the first time this device had been implanted in a patient in the UAE.

Two weeks following device implantation, the patient felt much better. His symptoms improved considerably. He was able to walk for longer duration, sleep and enjoy food. The Vigilant X4 CRT-D is an advanced cardiac resynchronisation device enabling remote monitoring, heart failure diagnostics, patient diagnostics, heart failure therapy, pacing therapy, tachyarrythmia therapy, safety under 1.5T MRI imaging, among numerous other capabilities. MEH

Wolters Kluwer



How clinical decision support solution UpToDate® is helping Dr. Sulaiman Al Habib Medical Group deliver world-class healthcare

The Dr. Sulaiman Al Habib Medical Group (HMG) was founded in 1995 and currently operates several regional facilities in the Kingdom of Saudi Arabia, United Arab Emirates, and the Kingdom of Bahrain. Over the years HMG has received international and national recognition from *Forbes* Magazine, the Arab Health Awards, The Middle East HR Excellence Award, the Middle East Insights Quality Service Award, MEED, CPQ, HIMSS, CAP, CBAHI, and APIC.

Dr. Bilal Ahmad Bhatt, Medical Administrator for HMG, currently manages the physicians in one hospital and one medical centre located in the UAE, with a total of 200 beds and 135 clinicians. Dr. Bhatt supervised the integration of UpToDate for use by all of HMG's facilities across the region.

Providing evidence-based care

UpToDate incorporates the collective clinical domain expertise of more than 6,900 physician authors, editors and peer reviewers. With this knowledge base at their fingertips, physicians can make diagnoses and treatment recommendations with a high level of confidence for even the most difficult cases. UpToDate can be used with the patient during consultation or to prepare before each patient meeting. Studies have shown that clinicians change decisions between 20% and 30% of the time after consulting UpToDate.

"My role is to manage the physicians in our hospital, and to make sure they have all the necessary tools to provide the very best patient care," explains Dr. Bhatt. "We believe that UpToDate provides a vast amount of evidence-based information, and it is also really user-friendly. Physicians are able to access best practices and acquire the relevant evidence required for any clinical scenario that they may have in order to optimize patient care."

Dr. Bilal Ahmad Bhatt, Medical Administrator for Dr. Sulaiman Al Habib Medical Group

Evaluating and improving clinical processes

In an effort to streamline clinical processes, Dr. Bhatt helped develop a clinical governance model to measure clinical effectiveness. He wrote clinical practice guidelines based on the most frequent diagnoses from each department. When developing new protocols, Dr. Bhatt uses UpToDate to view the latest information and guidelines, especially from the United Kingdom.

"Personally, this is how I benefit mostly from UpToDate, as I am able to get the right information easily, and I am able to transfer my knowledge to other people in the hospital, which ultimately results in the patient receiving the best care," adds Dr. Bhatt.

Controlling healthcare costs

In addition to providing comprehensive coverage across 25 medical specialties, UpToDate also provides graphics, medical calculators, and patient information to help clinicians provide the highest quality care.

"If a doctor is using UpToDate he will provide the most appropriate care," says Dr. Bhatt. "Ultimately, UpToDate can help improve healthcare quality by avoiding complications, re-admissions, and length of stay in the hospital – all of which helps to minimize healthcare costs."

Supporting a patient-centered approach to care

During patient encounters, clinicians can consult UpToDate to facilitate clinical decisions and determine the optimal course of care. Clinicians can also access patient education materials that can be provided and reviewed with patients, further supporting the hospital's patient-centered approach to care.

"My job as a medical administrator is to ensure that each and every patient in our hospital gets the very best medical care possible. I would recommend UpToDate in a heartbeat. In fact, I always remind my colleagues to use UpToDate, as it really impacts the quality of patient care."

About Wolters Kluwer

Wolters Kluwer provides trusted clinical technology and evidence-based solutions that engage clinicians, patients, researchers, students, and the next generation of healthcare providers. With a focus on clinical effectiveness, lifelong learning, and clinical intelligence, our proven solutions drive effective decision-making and consistent outcomes across the continuum of care.

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Together for a healthier world

Comics can help patients feel less anxious, results of new research show

Before undergoing surgery, patients must be fully informed about what the procedure entails. The complex nature of the information involved means that patients often feel overwhelmed rather than well informed. Researchers from Charité – Universitätsmedizin Berlin have been able to show that patients scheduled to undergo cardiac catheterization may find comic-style information helpful. The researchers' comic-style booklet was shown to help patient comprehension and reduce anxiety. Results from this study have been published in the *Annals of Internal Medicine*.

The purpose of the informed consent procedure is to enable patients to make an autonomous decision for or against a specific type of treatment. As part of this process, patients are provided with details of what the procedure entails. They also receive advice regarding expected medical benefits and potential risks involved. However, patients with coronary heart disease have been shown to not fully grasp the basic procedural steps involved in cardiac catheterization even after undergoing this informed consent procedure. Because of this, patients were also unable to evaluate the benefits of this procedure.

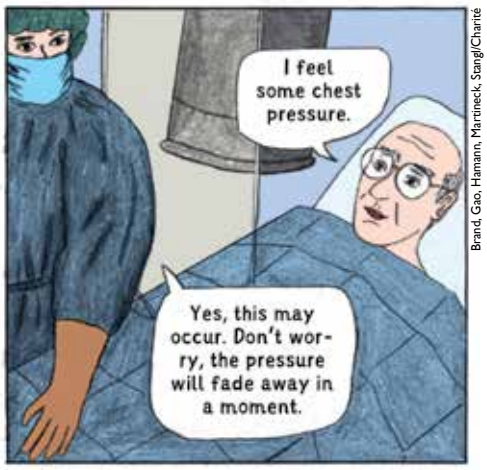
"Inspired by the notion that 'a picture is worth more than a thousand words', we wanted to use graphical representations to help patients understand the procedural details provided as part of the informed consent procedure," explains Prof. Dr. Verena Stangl of the Medical Department, Division of Cardiology and Angiology on Campus Charité Mitte. Prof. Stangl worked alongside Dr. Anna Brand, the study's other lead investigator and a fellow cardiologist to develop a 15-page comic-style booklet which explains the most common procedure in the field of cardiology – cardiac catheterization, followed by (where required) the insertion of a stent to open a narrowed or blocked artery. "What our pilot study showed was patients who received this comic-style felt better prepared for surgery," explains Prof. Stangl.

The team of researchers recruited a total of 121 patients scheduled to undergo cardiac catheterization. Patients then either underwent the standard informed consent procedure or standard informed consent with additional comic-style information. Using a range of questionnaires, which were administered both before and after the informed consent procedure, the researchers then assessed levels of comprehension and anxiety as well as satisfaction with the consenting process.

Three categories

The comic-style booklet proved useful in all three categories. When presented with questions on procedural details, risks and postoperative advice, patients who also received the comic-style information booklet were able to provide correct answers to nearly 12 out of a total of 13 questions on average. This compared with a mean score of approximately 9 out of 13 questions in patients who had undergone standard informed consent alone. Patients in the comic-style information group also reported feeling less anxious after their informed consent procedure. Overall, approximately 72 percent of participants were satisfied with the comic-based information booklet and reported feeling well prepared for cardiac catheterization. This compared with only 41 percent of participants in the standard informed consent group.

"A comic-style presentation enables the simultaneous visual and textual processing of complex information. This has been shown to enhance comprehension in different learner types," says Dr. Brand. "The comic-based approach also enables readers to process the information presented at their own speed." Dr. Brand adds: "For the first time, our study showed that comic-based medical information can be a highly effective addition to the medical consenting process. We want to use future research to test whether similar positive effects can be achieved in patients undergoing other medical procedures."



Comics can help patients feel less anxious before cardiac catheterization.

Comic-based information on cardiac catheterization

Both the concept and manuscript for the comic-based information booklet were developed by science communication specialist Alexandra Hamann, who worked in close consultation with the two medical experts, Prof. Stangl and Dr. Brand. The illustrator Sophia Martineck used the manuscript to develop the comic-style booklet. The project was funded by the Friede Springer Foundation. The comic-style information will be used as part of the informed consent procedure prior to cardiac catheterization.

REF: Brand A et al., Medical Graphic Narratives to Improve Patient Comprehension and Periprocedural Anxiety Before Coronary Angiography and Percutaneous Coronary Intervention: A Randomized Trial. *Ann Intern Med.* 2019 Apr 9.

- **doi**: 10.7326/M18-2976

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Diagnostics in your hand

Handheld electrochemical sensors are part of the daily routine for millions of people with diabetes around the globe who monitor their blood sugar levels with electric glucometers. While such sensors have revolutionized at-home medical testing for diabetics, they have not yet been successfully applied to diagnosing other conditions. Sensors like glucometers detect glucose in blood based on the activity of an enzyme, and there are only a limited number of enzymes that can be used to sense biomarkers of human disease. An alternative detection strategy based on binding events between antibodies and their molecular targets have been investigated to expand the use of electrochemical sensors for medicine, but these sensors fall victim to the rapid accumulation of "fouling" substances from biological fluids on their conductive surfaces, which deactivate them. Existing antifouling coatings are difficult to mass-manufacture, suffer from quality and consistency issues, and are not very effective.

Now, a new diagnostic platform technology developed by researchers at the Wyss Institute for Biologically Inspired Engineering at Harvard University known as "eRapid" enables the creation of low-cost, handheld electrochemical devices that can simultaneously detect a broad range of biomarkers with high sensitivity and selectivity in complex biological fluids, using as little as a single drop of blood. The technology is described in the newest issue of *Nature Nanotechnology*.

"As long as an antibody exists for a given target molecule, eRapid can detect it," said co-author Pawan Jolly, Ph.D., a Senior Research Scientist at the Wyss Institute. "By solving the biofouling problem with a simple yet robust design, we are now able to easily mass-produce biochemical sensors for a wide variety of applications at low-cost."

The team demonstrated the commercial utility of this approach by creating a multiplexed sensor with three separate electrodes, each coated with the BSA/gold nanowire matrix and a layer of antibodies against a specific clinically relevant target molecule: interleukin 6 (IL6), insulin, or glucagon. When they incubated the sensor with the respective target molecules in undiluted human plasma, they observed excellent electrical signals with picogram-per-mL sensitivity. Conversely, electrodes coated with a published "PEG-SAM" anti-fouling coating failed to produce distinct signals, indicating that they had been irreversibly fouled by off-target molecules in human plasma samples. In addition, the BSA/gold-nanowire-coated sensors can be washed and reused multiple times with minimal signal loss, allowing serial monitoring of biomarkers easily and at low cost.

Since then, the Wyss team has been able to detect more than a dozen different biomarkers ranging from 100 Da to 150,000 Da in size with eRapid, and they are continuing to experiment with conductive nanomaterials to optimize the electrode coating and the system's performance, as well as reduce the cost even further. They are actively exploring commercialization options for eRapid in the handheld point-of-care diagnostics space, but also hope to extend the coating and sensor technology platform to other targets and contexts, including in-hospital diagnostics, environmental toxin sensing, small molecule detection, and implantable medical devices. MEH

Canon unveils premium Cartesion Prime PET/CT

At RSNA 2019 in Chicago, Canon unveiled a new premium digital PET/CT scanner – the Cartesion Prime PET/CT.

The Cartesion *Prime* Digital PET/CT system is comprised of Canon Medical's new premium SiPM PET detector and the Aquilion Prime SP CT system for optimal PET/CT imaging and workflow with a patient and operator-centric design, along with innovative features, including:

- Advanced silicon photomultiplier design with one-to-one coupling for increased clinical confidence.
- Fast Time-of-Flight resolution for high quality images and increased productivity.
- Large axial field of view to provide fast scans and a comfortable experience for patients. The large axial field of view also improves the scanner's sensitivity which can be used for dose efficiencies that can impact patients and operators.
- Air-cooling technologies that support more attractive siting and long-term maintenance requirements compared to water-cooled systems.

Tim Nicholson, managing director, Molecular Imaging Business Unit, Canon Medical Systems USA, commented: "This advanced technology has led to image quality improvements, while optimizing dose efficiency to reduce patient risk and speeding up acquisition time for improved throughput. These innovations are part of Canon Medical's commitment to continually provide meaningful improvement for today's care, and for the future."

- For more info, visit: *https://global.medical.canon*

Capsa Healthcare introduces automated dispensing cabinets

CAPSAHEALTHCARE

The NexsysADC from Capsa Healthcare is an innovative automated dispensing cabinet that features unique technology to help facilities manage controlled medications and starter doses. NexsysADC dramatically improves current manual methods for safely storing and dispensing medications and supplies in the patient care environment.

The NexsysADC offers a robust cloud solution for superior information management. Pharmacy and facility management have oversight to what medication is stored inside each cabinet, who is accessing it, and what medication is dispensed for a patient or procedure. For added security, NexsysADC features built-in tamper-evidence technology.

The NexsysADC is available in a main cabinet and 4T model to provide the medication security you need in a size to meet your storage requirements. The NexsysADC full cabinet model supports larger patient populations and formularies. Each 10-tier cabinet is highly configurable and will store up to 400 medications.

The NexsysADC 4T provides the same security as the full cabinet in a space-saving countertop size to accommodate smaller formularies, patient populations, and budgets. The 4-tier cabinet will store up to 150 medications. With the Nexsys 4T installed at the point-of-care, the right medication is always on hand at the exact time it is needed for the patient.

NexsysADC is highly flexible and configurable to meet the needs for a host of healthcare settings. Both models accommodate any packaging type including unit doses, syringes, patches and liquids, and provide full reporting of inventory data, user activity and billing.

- Capsa Healthcare will feature the NexsysADC main cabinet and the NexsysADC 4T at Arab Health, Booth # S3.F54, January 27-30 in Dubai. Visit the Capsa booth to learn more about NexsysADC.
- For more info, visit: *www.capsahealthcare.com*

Intraoperative 3D imaging with the Ziehm Vision RFD 3D

Building on more than 12 years of experience in 3D imaging, the Ziehm

Vision RFD 3D features not only proven a-Si technology, but now also the cutting edge CMOSline[1]. Bundling 2D and 3D functionality for greater intraoperative control, it reduces the need for postoperative CT scans and costly corrective surgeries. The system is equipped with ZIR (Ziehm Iterative Reconstruction) to minimize fan and metal artifacts in 3D reconstruction, so far only known from CT imaging. This makes the Vision RFD 3D ideal for high-end orthopedic, trauma and spinal interventions as well as for demanding multidisciplinary use.

[1]CMOSline represents a system configuration that is based on a Ziehm Imaging CMOS flat-panel detector.

- For more information, visit: *www.ziehm.com*
- Visit Ziehm Imaging at Arab Health 2020, booth: **S1.C30**

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Samsung unveils new ultrasound – RS85 Prestige

Samsung Electronics unveiled its latest ultrasound device at RSNA 2019 in Chicago.

Their new ultrasound – RS85 Prestige – is evolved version of the RS85 and comes with new imaging architecture and value-added features.

Imaging Architecture

- **Crystal Architecture™** – an imaging architecture that combines CrystalBeam™ beamformer and CrystalPure™ imaging engine, combined with the S-Vue Transducer™ which provides crystal clear images.
- **CrystalBeam™** – a new beamforming technology which delivers high-quality image resolution and increased uniformity of images.
- **CrystalPure™** – Samsung's latest ultrasound imaging engine with enhanced 2D image processing and color signal processing, offering outstanding image performance and efficient workflow in complex cases.

Value Added Features

- **MV-Flow™** with LumiFlow™ – offers a detailed view of blood flow in relation to the surrounding tissues with enhanced spatial and temporal resolutions and provides three-dimensional visualization with continuous and 3D-like vascular images.
- **ShadowHDR™** – provides a shadow suppressed image, which is especially useful in capturing highly attenuated regions behind bony structures.
- **PureVision™** – an image processing function that produces clear images with uniformity by performing Speckle Noise Suppression and Edge Enhancement on B-mode.

Dongsoo Jun, President of Health & Medical Equipment Business at Samsung Electronics and CEO of Samsung Medison, said: "Samsung is continuing its commitment to deliver meaningful innovation in medical imaging, responding to customer' ever complex healthcare needs. We plan to continue our rapid pace of new innovation for the radiology market." MEH

Ethicon launches Vistaseal Fibrin Sealant to manage surgical bleeding

Ethicon, a Johnson & Johnson Medical Devices Company, has launched Vistaseal Fibrin Sealant to help surgeons manage bleeding during surgery. Vistaseal Fibrin Sealant (Human) contains a combination of fibrinogen and thrombin, clotting proteins found in human plasma. When applied to the bleeding site, it forms a rapid, adherent, and durable clot and has been demonstrated to sustain haemostasis, even in high-risk patients.

The sealant is indicated as an adjunct to haemostasis for mild to moderate bleeding in adults undergoing surgery when control of bleeding by standard surgical techniques (such as suture, ligature, and cautery) are ineffective or impractical. Vistaseal is effective in patients treated with heparin (blood thinner).

Vistaseal is the first fibrin sealant exclusively designed to be sprayed without gas in both open and minimally invasive procedures, and it comes in pre-filled syringes. This eliminates some of the steps required for set-up with gas and may save valuable time in the operating room. The Vistaseal Dual Applicator tip is also uniquely malleable enabling access to difficult anatomy and enhanced spray control.

The product is the first innovation to emerge from Ethicon's strategic partnership with plasma industry leader Grifols, which developed the Vistaseal Fibrin Sealant (Human) and licensed it to Ethicon. The collaboration combines Ethicon's expertise in developing device technology with Grifols' ability to produce critical plasma-based therapies.

Oray Boston, President, Global Biosurgery, Ethicon, said: "Vistaseal is the latest addition to our broad portfolio of primary and adjunctive hemostat solutions that address the growing and wide-ranging challenges surgeons face in managing bleeding."

- For more info, visit: *www.jnjmedicaldevices.com/en-US/product/vistaseal-fibrin-sealant-human*

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Eko releases next generation CORE Stethoscope

Eko has recently released the second generation of its CORE stethoscope. The new CORE features powerful amplification and active noise cancellation that enables doctors and nurses to hear heart and lung sounds with greater clarity and screen patients for heart disease more effectively.

Two hundred years after its invention, the stethoscope is still the most heavily relied upon cardiac and pulmonary screening tool. With a sleeker design, unprecedented active noise cancellation, and forthcoming decision support algorithms, the second-generation CORE will elevate what clinicians already use in every physical exam and close gaps in care created in part by analog stethoscopes.

"The better we can hear and the better we can screen, the better we can care for our patients," said Dr Steve Pham, VP of Clinical Research at Eko and an Emergency Medicine Physician. "The CORE, coupled with Eko's software, helps convert the device into a powerful cardiopulmonary screening tool."

The second-generation CORE will be available on Eko's website to healthcare providers as an attachment to their existing stethoscope (sold as the CORE Digital Attachment) or as a fully assembled digital stethoscope (sold as the CORE Digital Stethoscope).

CORE Digital Attachment and CORE Digital Stethoscope features include:

- Active noise-cancellation, perfect for honing in on heart and lung sounds in loud settings
- 40x sound amplification with seven volume settings, for enhanced clarity of critical sounds
- Easy toggling between acoustic and digital modes
- Lithium-ion battery with 10-hour life and micro-USB charging
- Wireless Bluetooth connection to Eko's software

Eko's software allows users to capture, analyze and share sound data:

- Save 15, 30, 60 or 120-second recordings with "one click" recording button
- View sound waveforms and phonocardiograms
- Eko's screening algorithms will assist clinicians in analyzing heart sounds for pathologic murmurs and valvular heart diseases
- Share recordings with colleagues for a second opinion or live stream cardiology-grade sounds with an Eko Enterprise plan, which powers reliable real-time connections between clinicians and patients, or between clinicians for second opinions. MEH

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Siemens showcases AI Apps for automatic MRI image segmentation

At RSNA 2019 in Chicago, Siemens Healthineers introduced two software assistants based on artificial intelligence (AI) that are designed to free radiologists from the burden of performing routine activities during magnetic resonance imaging (MRI) examinations in the body regions brain and prostate.

AI-Rad Companion Brain MR for Morphometry Analysis automatically segments the brain in MRI images, measures brain volume, and marks volume deviations in result tables used by neurologists for diagnosis and treatment.

AI-Rad Companion Prostate MR for Biopsy Support automatically segments the outer contour of the prostate on MRI images and enables radiologists to mark lesions, so that it's easier for their colleagues in Urology to perform targeted prostate biopsies. Both new applications can be used on MRI scanners from different manufacturers and are available on teamplay, the cloud-based healthcare platform from Siemens Healthineers.

"With the new AI-based assistants, we are expanding our diagnostic offering to help our customers increase efficiency and improve the quality of care. We firmly believe that AI will help physicians deal with their workload and benefit patients by helping achieve an improved, patient-focused decision-making process," said Peter Koerte, Head of Digital Health at Siemens Healthineers. "We demonstrated this when we introduced the first application of the AI-Rad Companion focusing on CT for the chest body region. Further applications for radiography and radio oncology will follow for the AI-Rad Companion family."

Morphometry analysis

The AI-Rad Companion Brain MR for Morphometry Analysis supports brain volumetry, which is performed in clinical practice for example in cases of suspected dementia. Previously, segmentation and comparison to the norm were performed manually or only semi-automatically.

Based on AI algorithms, the AI-Rad Companion Brain MR for Morphometry Analysis can automatically identify about 50 brain segments on MRI images, measure their volumes, and compare the results to data in a normative reference database for brain morphometry made available by the Alzheimer's Disease Neuroimaging Initiative (ADNI). AI-Rad Companion Brain MR for Morphometry Analysis feeds the results into a report where deviations from the norm are automatically marked. This means that radiologists can provide the neurology department with objective, quantitative data that's relevant to differential diagnosis and therapy management. Patient care can also be improved by generating reports faster and in a more standardized and evidence-based form.

Biopsy support

Prostate cancer is the second-most common malignant cancer (after lung cancer) affecting males world-wide. Both the European Association of Urology (EAU) and the National Institute of Clinical Excellence (NICE), UK, provide evidence-based guidelines for diagnosing and treating prostate cancer, and in the past 12 months they've incorporated the primary diagnosis of prostate cancer using MRI and MRI/ultrasound fusion biopsy in their guidelines. Previously, urologists had to identify the suspected cancer areas using written reports and pictograms of the prostate provided by the radiologist based on the MRI examinations, and then try to take tissue samples accurately from the areas in question using ultrasound-guided biopsy. For the fusion procedure, the prostate had to be manually segmented in the MRI images, which can take up to five minutes per patient.

AI-Rad Companion Prostate MR for Biopsy Support automatically segments the outer contour of the prostate, which can cut the time needed for this routine activity down to just a few seconds. The radiologist then simply marks the suspect areas and hands the annotated MRI images to the urologist for fusion with the ultrasound images during the biopsy. Targeted, MRI-supported biopsies like this can make it easier for the urologist to detect significant prostate carcinomas and improve the quality of patient care.

The new applications in the product family AI-Rad Companion can be used on MRI scanners from different manufacturers. They are cloud-based and use the certified, secure teamplay infrastructure. The software is seamlessly integrated into the existing clinical workflow and complies with DICOM standards. The clinical images and all supporting information can be made automatically available in the PACS depending on the radiologists' requirements.

- For more info, visit: *www.healthcare.siemens.com*

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The Four Points by Sheraton Sheikh Zayed Road, Dubai harmoniously blends impeccable hospitality with painstaking attention to detail for the evolved, modern breed of international explorers. The 4-Star hotel is impressively designed with steel and glass façade and welcomes guests to its contemporary interiors, marked by captivating decor accents and state-of-the-art facilities. The 43-storey hotel stands at an enviable location – the bustling Sheikh Zayed Road. Situated in the heart of the city's central business district, the hotel is only 15 minutes from Dubai International Airport and is conveniently located near the Dubai International Finance Center.

ACCOMODATION

The city hotel boasts 384 spaciously designed guestrooms including 1, 2, 3 bedroom suites equipped with modern amenities, contemporary furnishing and the signature Four Points by Sheraton Comfort Bed.

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Charlie's Restaurant and Bar: Whether you're looking for a spot to unwind with a chilled beverage or catch up on sports, Charlie's Restaurant and Bar welcomes guests to its relaxed, cozy interiors.

Luigi's: Recreating indulgent flavours from Italy's gastronomic heritage, Luigi's welcomes guests to its warm, cozy ambience.

Pascal Tepper, Sheikh Zayed Road: Dine-in cafe opening soon in Four Points by Sheraton, Sheikh Zayed Road. The café-restaurant brings a contemporary take on the traditional French dine-in bakery, with oven-fresh bread, Viennoiseries, quality hot and cold dishes, as well as a range of chocolates and dessert pastries.

MEETINGS & EVENTS

With 5 exclusively planned meeting and banquet spaces, the hotel's 2,260 sq ft event space can be customized to different layouts to host business meetings and events of varying complexity. The dedicated space is as versatile as it is eye-catching, promising a classy, elegant venue for any occasion.

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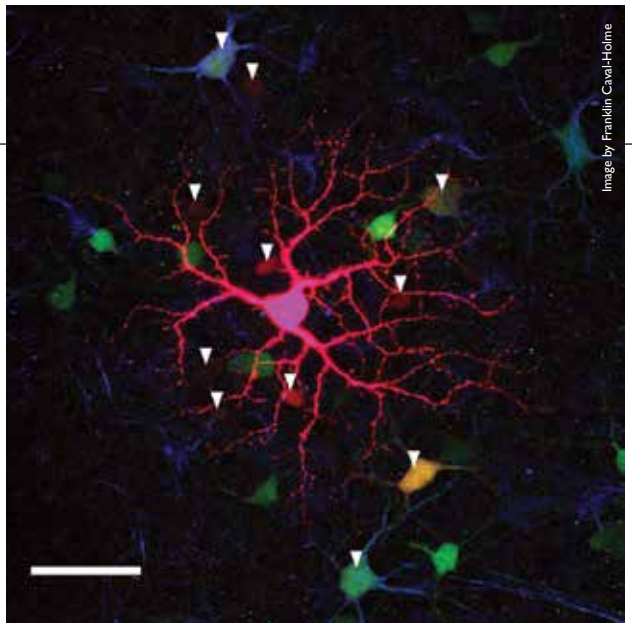
Babies in the womb may see more than we thought



An intrinsically photosensitive retinal ganglion cell (ipRGC) as it would appear if you looked at a mouse's retina through the pupil. The white arrows point to the many different types of cells it networks with: other subtypes of ipRGC cell (red, blue and green) and retinal cells that are not ipRGCs (red). The white bar is 50 micrometres long, approximately the diameter of a human hair.

By the second trimester, long before a baby's eyes can see images, they can detect light.

But the light-sensitive cells in the developing retina – the thin sheet of brain-like tissue at the back of the eye – were thought to be simple on-off switches, presumably there to set up the 24-hour, day-night rhythms parents hope their baby will follow.

University of California, Berkeley, scientists have now found evidence that these simple cells actually talk to one another as part of an interconnected network that gives the retina more light sensitivity than once thought, and that may enhance the influence of light on behaviour and brain development in unsuspected ways.

In the developing eye, perhaps 3% of ganglion cells – the cells in the retina that send messages through the optic nerve into the brain – are sensitive to light and, to date, researchers have found about six different subtypes that communicate with various places in the brain. Some talk to the suprachiasmatic nucleus to tune our internal clock to the day-night cycle. Others send signals to the area that makes our pupils constrict in bright light.

But others connect with surprising areas: the perihabenula, which regulates mood, and the amygdala, which deals with emotions.

In mice and monkeys, recent evidence suggests that these ganglion cells also talk with one another through electrical connections called gap junctions, implying much more complexity in immature rodent and primate eyes than imagined.

"Given the variety of these ganglion cells and that they project to many different parts of the brain, it makes me wonder whether they play a role in how the retina connects up to the brain," said Marla Feller, a UC Berkeley professor of molecular and cell biology and senior author of a paper in the journal *Current Biology*. "Maybe not for visual circuits, but for non-vision behaviours. Not only the pupillary light reflex and circadian rhythms, but possibly explaining problems like light-induced migraines, or why light therapy works for depression."

Parallel systems in developing retina

The cells, called intrinsically photosensitive retinal ganglion cells (ipRGCs), were discovered only 10 years ago, surprising those like Feller who had been studying the developing retina for nearly 20 years. She played a major role, along with her mentor, Carla Shatz of Stanford University, in showing that spontaneous electrical activity in the eye during development – so-called retinal waves – is critical for setting up the correct brain networks to process images later on.

Hence her interest in the ipRGCs that seemed to function in parallel with spontaneous retinal waves in the developing retina.

"We thought they (mouse pups and the human foetus) were blind at this point in development," said Feller, the Paul Licht Distinguished Professor in Biological Sciences and a member of UC Berkeley's Helen Wills Neuroscience Institute. "We thought that the ganglion cells were there in the developing eye, that they are connected to the brain, but that they were not really connected to much of the rest of the retina, at that point. Now, it turns out they are connected to each other, which was a surprising thing."

UC Berkeley graduate student Franklin Caval-Holme combined two-photon calcium imaging, whole-cell electrical recording, pharmacology and anatomical techniques to show that the six types of ipRGCs in the newborn mouse retina link up electrically, via gap junctions, to form a retinal network that the researchers found not only detects light, but responds to the intensity of the light, which can vary nearly a billionfold.

Gap junction circuits were critical for light sensitivity in some ipRGC subtypes, but not others, providing a potential avenue to determine which ipRGC subtypes provide the signal for specific non-visual behaviours that light evokes.

"Aversion to light, which pups develop very early, is intensity-dependent," suggesting that these neural circuits could be involved in light-aversion behaviour, Caval-Holme said. "We don't know which of these ipRGC subtypes in the neonatal retina actually contributes to the behaviour, so it will be very interesting to see what role all these different subtypes have."

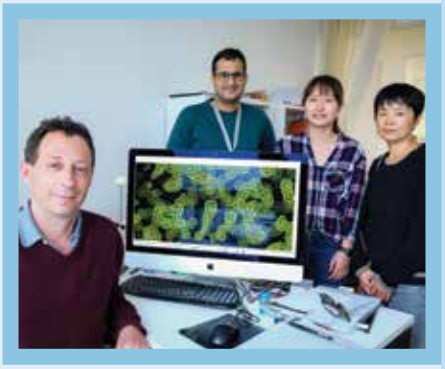
The researchers also found evidence that the circuit tunes itself in a way that could adapt to the intensity of light, which probably has an important role in development, Feller said.

"In the past, people demonstrated that these light-sensitive cells are important for things like the development of the blood vessels in the retina and light entrainment of circadian rhythms, but those were kind of a light on/light off response, where you need some light or no light," she said. "This seems to argue that they are actually trying to code for many different intensities of light, encoding much more information than people had previously thought." MEH

Agenda

Selected schedule of regional medical meetings, conferences and exhibitions

Event	Date / City	Contact
January 2020		
Arab Health	27-30 January 2020 Dubai, UAE	*https://www.arabhealthonline.com*
February 2020		
World Congress on Physical Therapy and Rehabilitation Medicine	22-23 February 2020 Dubai, UAE	*https://physicaltherapyconferences.org*
Case Based Approach to Controversies in Cardiovascular Disease	28-29 Feb 2020 Dubai, UAE	*http://cvuae.com/*
Middle East Health Leadership Program	29 Feb – 2 March 2020 Abu Dhabi	*https://www.insead.edu/executive-education/partner-programmes/middle-east-health-leadership-programme*
March 2020		
Annual Conference on Women's Health, Reproduction and Fertility	16-17 March 2020 Dubai, UAE	*https://reproduction.conferenceseries.com/europe/*
UAE International Conference on Antimicrobial Resistance (ICAMR)	19-20 March 2020 Dubai, UAE	*http://icamr-uae.com*
April 2020		
Emirates Critical Care Conference	April 2-4, 2020 Dubai, UAE	*www.eccc-dubai.com*
International Congress for Joint Reconstruction	April 2-4, 2020 Dubai, UAE	*www.icjrmiddleeast.com*
Biotechnology World Congress	April 6-7, 2020 Dubai, UAE	*https://10times.com/biotechnology-world-congress*
World Congress on Women's Health and Midwifery	April 6-7, 2020 Dubai, UAE	*womenshealth.pulsusconference.com*
Plenareno Depression Conference 2020	April 13-14, 2020 Dubai, UAE	*https://depression.plenareno.com/*
Plenareno Heart Congress 2020	April 13-14, 2020 Dubai, UAE	*https://heart.plenareno.com/*
Plenareno Pediatrics and Neonatology Conference 2020	April 13-14, 2020 Dubai, UAE	*https://pediatrics.plenareno.com/*



Agenda

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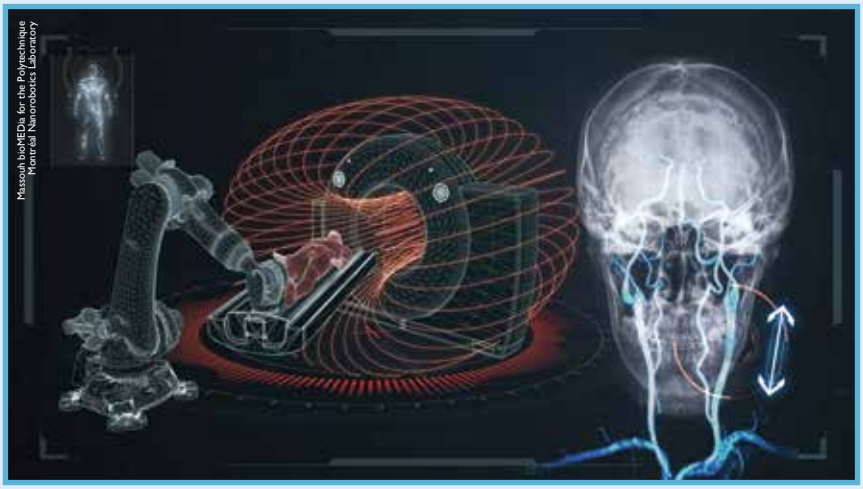		
Plenareno Diabetes, Obesity and Cholesterol Metabolism Conference 2020	April 13-14, 2020 Dubai, UAE	*https://metabolicdiseases.plenareno.com/*
International Conference on Infectious Diseases	April 22-23, 2020 Dubai, UAE	*https://researchlake.com/conferences/infectious-diseases*
■ May 2020		
Heart & Diabetes Conference	May 11-12, 2020 Dubai, UAE	*http://heartdiabetesconference.com*
■ June 2020		
International Conference on Neurology and Cardiology	June 1-3, 2020 Dubai, UAE	*www.citationsinternational.com/neurology-cardiology-2020-dubai*
		

List your conference:
If you have upcoming conference/exhibition details which you would like to list in the agenda, please email the details to the editor: *editor@MiddleEastHealthMag.com*

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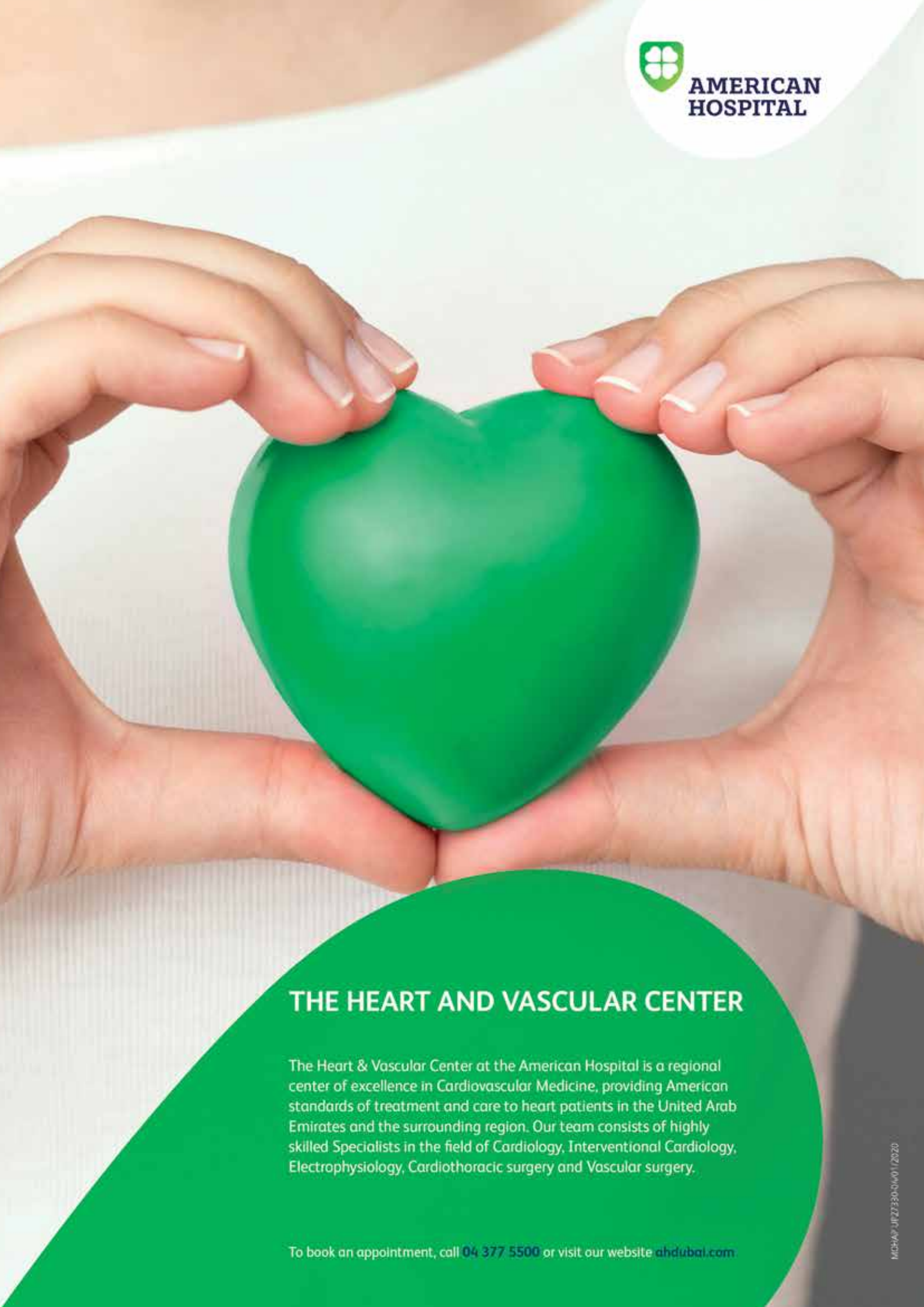
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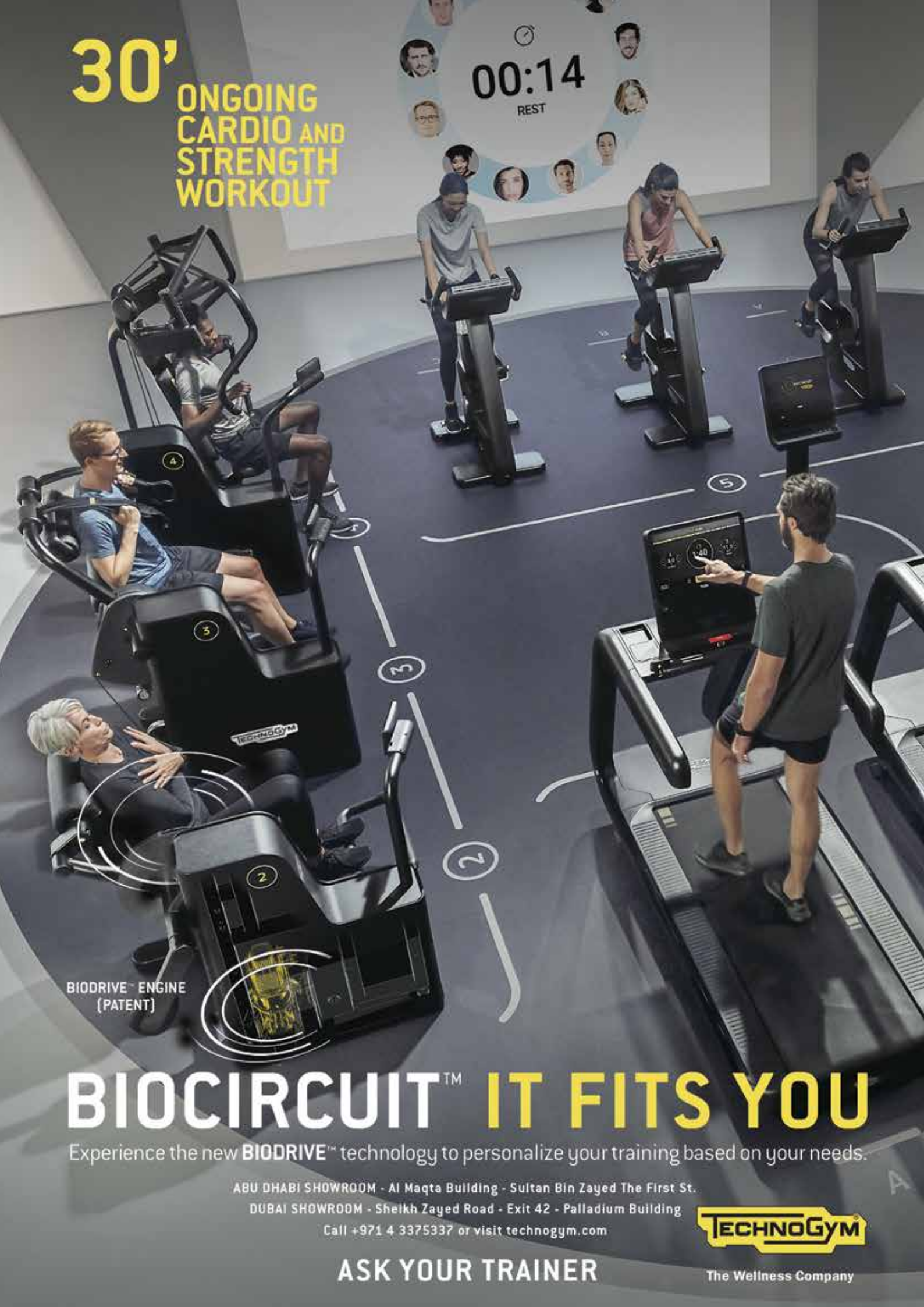

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