

# iHealthtech

A Newsletter of the Institute for Health Innovation & Technology, National University of Singapore (NUS)

December 2021 Issue #6



NEWS IN FOCUS

## Asia's Most Influential Scientist Award



iHealthtech Director Prof Lim Chwee Teck was named "Asia's Most Influential Scientist" at the 7th Fortune Times Awards Ceremony, held on 25 Nov 2021, for his distinguished academic achievements, significance of

inventions, and role model to inspire younger scientists to dare to innovate, explore the truth of science, and constantly forge ahead. The award also recognises many of his research works that were made newsworthy,

well-written business stories in the press and, more importantly, his commendable contributions to society.



## Chief Defence Scientist Mr Tan Peng Yam visits iHealthtech

Chief Defence Scientist Mr Tan Peng Yam from the Ministry of Defence visited the recent expansion of iHealthtech at the new E7 Engineering in Medicine Building. He was accompanied by NUS Deputy President

(Research & Technology) Prof Chen Tsuhan, Office of the Senior Deputy President and Provost Senior Director (Strategic Initiatives & Alliances) Mr George Loh and Prof Lim Chwee Teck during the visit. Mr Tan had a

warm interaction with our principal investigators and researchers to understand the latest cutting-edge technologies developed in the lab.

## World's first blood test for real-time monitoring of cancer treatment and detection

The technique, termed extracellular vesicle monitoring of small-molecule chemical occupancy and protein expression (ExoSCOPE), was developed by Asst Prof Shao Huilin and her research team. ExoSCOPE utilises the advantage of extracellular vesicles (EVs) secreted by cancer cells and circulating in the blood as a reflective indicator of drug effectiveness in solid tumours. The method will help the doctors make a better and timely evaluation for a cancer treatment plan.



Pan, S., Zhang, Y., Shao, H. *et al.*, *Nat Nanotech*, 2021.



Gao, Y., Nguyen, D.T., Lim, C.T. *et al.*, *Sci Adv*, 2021.

## Telehealth for chronic wounds patients made possible

VeCare is an innovative smart bandage platform developed by a research team led by Prof Lim Chwee Teck to help patients with chronic wounds. The bandage consists of a smart wearable sensor that can remotely conduct a real-time point-of-care assessment of chronic wounds via an app. The sensor can detect temperature, pH, bacteria type and inflammatory factors specific to chronic wounds within 15 minutes, hence enabling timely and precise medical interventions for wound healing.

## A newly engineered material for robots smart sensing

Artificially innervated foam, or AiFoam, is a smart material engineered by Asst Prof Benjamin Tee and his research team. The sponge-like material is soft, self-repairable, and stretchable to more than two times its length. The material will enable robots to interact intelligently with their complex surrounding and grasp any delicate object through a sense of touch like a human.



Guo, H., Tan, Y.J. Tee, B.C.K. *et al.*, *Nat Comm*, 2021.



### New startup

Sunbirdbio is iHealthtech's latest startup company to focus on engineering and commercialising advanced molecular diagnostics. The company was founded by Asst Prof Shao Huilin with the vision to improve lives by providing accurate diagnosis and timely treatment to patients with neurodegenerative diseases.

## Engineering in Medicine Initiative

Interdisciplinary collaboration is the key to innovation. Engineering in Medicine Funding Initiative by the National University Health System (NUHS) and NUS Faculty of Engineering supports collaboration between engineers and clinicians to identify innovative solutions that have the potential to improve or transform healthcare. Prof Lim Chwee Teck, Assoc Prof Ali Asgar Bhagat, and Asst Profs Benjamin Tee and John Ho, are currently participating in three new projects on developing telehealth for glaucoma management, personal asthma monitoring, and real-time onsite molecular Helicobacter testing.





Photo credit: James Dyson Foundation

## HOPES emerges as The James Dyson Award 2021 international winner

Glaucoma is an eye disease that can lead to blindness due to abnormally high pressure that damages the optic nerve. Testing of fluid pressure in the eye requires anaesthesia for the patient. To simplify the testing procedures, PhD students Yu Kelu, Li Si, and Research Assistant David Lee from the research lab of Asst Prof Benjamin Tee have developed a low-cost eye pressure testing device that combines AI and electronic skin technology called Home Eye Pressure E-skin Sensor (HOPES). Their innovation was recognised by The James Dyson Award 2021!

## Prof Lim Chwee Teck elected as Fellow of the ASEAN Academy of Engineering & Technology

Prof Lim Chwee Teck was elected as a Fellow of the ASEAN Academy of Engineering & Technology. The Fellowship is awarded to eminent individuals from academia, research institutes, industry, and government who have demonstrated successful leadership or outstanding contributions to the engineering and technology fields and play an important role in the overall development of the ASEAN region.

## Healthy Longevity Global Grand Challenge Award: Adult gamified fitness programme

World Health Organization reported that more than 1.4 billion of the world's adult population do not have enough physical activity, impacting their health, well-being, and quality of life. Dr Yeo Joo Chuan from iHealthtech and Dr Wee Seng Kwee from Rehabilitation Research Institute of Singapore (RRIS), Nanyang Technological University, have developed a gamified fitness programme that utilises a smart sleeve to monitor joint movement and muscle activity. Their goal is to help reduce the trend of insufficient physical activity for adults. The proposal has won the 2021 Healthy Longevity Global Grand Challenge award.

## Highly Cited Researchers 2021

Prof Lim Chwee Teck, Assoc Prof Roger Ho, and Asst Prof Benjamin Tee are recognised as Highly Cited Researchers 2021 in Clarivate's Web of Science citation index. The index ranked the top 1 per cent of highly cited scientists in their respective fields of research.



## Prestige 40 Under 40 Class of 2021

Asst Prof Andy Tay is the Presidential Young Professor at the Department of Biomedical Engineering and Principal Investigator at iHealthtech. His research focuses on engineering chimeric antigen receptor T-cell (CAR-T) for cancer immunotherapy. His work has been recognised by multiple international research awards. Notably, he was named World Economic Forum's Young Scientist in 2020 and Forbes 30 Under 30 (US/Canada). Dr Tay is also an advocate of science outreach and communication, which help to promote STEM education and train young science educators. He was selected for his contributions to science and education as the recipient of Prestige 40 Under 40 Class of 2021.



## InfinityGlove™ Team bags 2021 IES Prestigious Engineering Achievement Award

Behind every innovative technology, there is a team of hardworking scientists! Prof Lim Chwee Teck, Dr Yeo Joo Chuan, and Microtube Technologies Acting Chief Product Officer Dr Du Kang received the Institution of Engineers, Singapore (IES) Prestigious Engineering Achievement Award during the World Engineers Summit 2021 Conference Dinner held on 11 November 2021 at the Resorts World Sentosa. Their winning project "InfinityGlove™ – Smart Sensorized Glove for Gaming and Healthcare" was evaluated based on engineering practice, environmental aspects, technological innovation, and societal impact.

Kalidasan, K., Yang, X., Ho, J. S. *et al.*, Wirelessly operated bioelectronic sutures for the monitoring of deep surgical wounds, **Nature Biomedical Engineering** (2021)

Zhao, H., Zhang, Y., Shao, H. *et al.*, Accessible detection of SARS-CoV-2 through molecular nanostructures and automated microfluidics, **Biosensors and Bioelectronics** (2021)

Tay, A.K.P., Melosh, N. Mechanical Stimulation after Centrifuge-Free Nano-Electroporative Transfection Is Efficient and Maintains Long-Term T Cell Functionalities, **Small** (2021)

Chen, Y. Sundah, N.R., Shao, H. *et al.*, Collaborative Equilibrium Coupling of Catalytic DNA Nanostructures Enables Programmable Detection of SARS-CoV-2, **Advanced Science** (2021)

Wang, Z., Zhao, H., Shao, H. *et al.*, Surfactant-guided spatial assembly of nano-architectures for molecular profiling of extracellular vesicles, **Nature Communications** (2021)

Li, Z., Tian, X., Ho, J.S. *et al.*, Metasurfaces for bioelectronics and healthcare, **Nature Electronics** (2021)

Gao, Y., Nguyen, D.T., Lim, C.T. *et al.*, A flexible multiplexed immunosensor for point-of-care in situ wound monitoring, **Science Advances** (2021)

Chen, S., Qi, J., Lim, C.T. *et al.*, Flexible Wearable Sensors for Cardiovascular Health Monitoring, **Advanced Healthcare Materials** (2021)

Kumar, A.R.K., Shou, Y., Andy Tay, A.K.P., *et al.*, Materials for Improving Immune Cell Transfection, **Advanced Materials** (2021)

Sundah, N.R., Natalia, A., Shao, H. *et al.*, Catalytic amplification by transition-state molecular switches for direct and sensitive detection of SARS-CoV-2, **Science Advances** (2021)

Belotti, Y., Jokhun, D.S., Lim, C.T. *et al.*, Machine learning based approach to pH imaging and classification of single cancer cells, **APL Bioengineering** (2021)

Pan, S., Zhang, Y., Shao, H. *et al.*, Extracellular vesicle drug occupancy enables real-time monitoring of targeted cancer therapy, **Nature Nanotechnology** (2021)



Photo credit: A\*STAR

## Transforming the Perspective of Traditional Medicine

In the 1780s, an Italian scientist, Luigi Galvani, did revolutionary experiments to show the movements of a frog leg when electricity was passed through it. In 1958, the first cardiac pacemaker using low-energy electrical pulses was implanted into a 43-year-old man to prolong his life. Traditionally, medicine uses pharmaceutical drugs to treat patients and increase life expectancy. Today, bioelectronics is an emerging field of technology and the new medicine to study, diagnose, treat diseases and retain our quality of life.

### A young innovator

Dr John Ho, iHealthtech Principal Investigator and Asst Professor from the Department of

Electrical and Computing Engineering, focuses his research on developing bioelectronic tools to solve health challenges. He was named the recipient of the prestigious Young Scientist Award from the Singapore National Academy of Science (SNAS) in 2020 for his achievements in advancing and integrating wireless technologies with biosystems.

### Inventions for medicine and health

Can you imagine superheroes in movies without a special suit that can do at least one or two wonders to fight the villains? Perhaps Dr Ho can offer you one of his inventions, a smart suit to keep you in tip-top conditions for your health or athletic performance. The smart suit can monitor

## PI PROFILE

vital signs, capture body movements and posture through multiple sensors on the suit, all powered by just a smartphone in your pocket! His other inventions include bioelectronic sutures to monitor deep wounds, implantable miniature and controllable light switches to selectively suppress targeted tumour activity by activating light-sensitive drugs deep in the body.

Dr Ho's vision of future medicine is to free us from confining our healthcare to clinics or hospitals. A power-efficient bioelectronic sensor can continuously monitor a patient's health condition, upload the data to an app that can remotely alert a doctor if any abnormality in health condition happens. The engineering of wireless technology to efficiently deliver power and receive data from sensors is critical in making the bioelectronic technology suitable for long term health studying and monitoring.

### Inspiration and creativity

When Dr Ho was asked about how he creates innovative technologies, he said: "Like any good magic trick, there is the effect and the method. You might first think of an amazing effect, and then put together the pieces to create it. Or you might first think of an ingenious method, and then use it to bring about the best possible effect. In the same way, I find that inspiration can come from both the applications or the technology, and often it requires thinking in both directions."