Since 1955, NUS Engineering has nurtured thousands of holistic engineers with a global perspective, many of whom lead in technology through high-impact research. Read what two of our alumni are doing to impact Singapore and the world.

**TAN HUI MIN**

Class of 2016, Industrial & Systems Engineering
Industrial Engineer, STMicroelectronics

"After graduating from ISE in 2016, I was fortunate to land myself a job as an Industrial Engineer in a semiconductor firm where I can put all the knowledge that I have learnt through my course of study into a real-life industrial setting. From Systems Thinking to Project Management and Lean Manufacturing, I found the skill sets that ISE taught me highly useful and readily applicable to my day-to-day job functions. ISE is a well-designed programme, which seeks to equip students with essential skill sets sought after by various industries."

**DEREK TAN**

Class of 2009, Electrical Engineering
Co-founder, Vidsee

"As Vidsee’s co-founder, I build a thriving ecosystem that allows Asian content creators and brands to share their stories with the world and reach out to their target audiences. I believe it’s my role to use stories and films as social engines to drive conversations in the digital space. NUS Engineering’s array of exciting courses has allowed me to pursue my passion in both technology and films, giving me an edge to pursue my dreams in the ever-changing digital media economy."

**ALLEN HU DONG**

Class of 2012, Biomedical Engineering
Service Manager, GE Healthcare

"I am currently leading a team of service engineers and overseeing the service delivery of GE Healthcare products in Singapore. My undergraduate study in NUS Biomedical Engineering helped me develop a strong passion in healthcare. It is exciting and fulfilling to work on technologies that enable better patient care. The NUS Biomedical Engineering programme helped me build a solid and all-rounded foundation for my professional career."
COVER STORY

STAR SETS TO PROMOTE SPACE TECHNOLOGY EDUCATION, RESEARCH AND COMMERCIALISATION

NUS Engineering and the DSO National Laboratories (DSO) launched the Satellite Technology and Research Centre (STAR) on 25 January 2018. The new state-of-the-art centre will develop cutting-edge capabilities in distributed satellite systems, with a focus on flying multiple small satellites in formation or a constellation. It will also train undergraduates and graduate students to meet the manpower needs of Singapore’s fledgling space industry.

Supported by the Singapore Economic Development Board (EDB), STAR is helmed by Prof Low Kay Soon, a faculty member from NUS Electrical and Computer Engineering. It aims to be a leader in advanced distributed small satellite systems, and will build multiple small satellites, each weighing less than one tenth of conventional satellites, and fly them together.

In the early years of man’s space exploration, satellites were large in size, extremely expensive, and took years to build. In the past five years, there has been a new paradigm shift towards small satellites — no more than 20kg — and this offers an opportunity for Singapore to carve out a place for itself as a key player in the new satellite application industry.

“Small satellites are relatively cheaper to build, test and launch. They could also be mass produced and they have a much shorter time to market. A fleet of small satellites — flying in formation, swarm or constellation — could possibly cover the whole Earth and reduce latency, hence opening up new services that were not possible in the past,” said STAR Director Prof Low, who is a veteran of Singapore’s satellite programmes.

As STAR aspires to be a leading centre for advanced distributed satellite systems, it will deepen its capabilities and will also work with industry players, both established companies and new startups, by providing its expertise and innovative satellite platform or subsystems. Such partnerships are critical in building a vibrant indigenous high-tech satellite industry in Singapore.

“NUS made its first foray into space in 2015 with the successful launch of two satellites, which demonstrated our strong capabilities in engineering and satellite technologies. The setting up of STAR will further sharpen these strengths and help to nurture a new generation of well-trained engineers and engineer-leaders who are ready to contribute to the space and aerospace industries.”

Prof Chua Kee Chiang
Dean of NUS Engineering

STAR WILL PURSUE ITS MISSION THROUGH THREE STRUCTURED PROGRAMMES:

Education programme
Undergraduate students from NUS Engineering will have the opportunity to undertake satellite and space-related projects offered by STAR. This offers exposure to real-life project applications, and provide the students with valuable multidisciplinary, team-based work experience in the space industry. STAR researchers will also support relevant academic modules, as well as supervise student projects.

Research programme
Researchers at STAR are conducting cutting-edge research in mission design such as collaborative sensing, as well as subsystem and component development, using a precise navigation system with highly accurate clock and efficient power management system, advanced control of satellite propulsion systems, and other sophisticated technology.

Satellite mission programme
STAR aims to develop a fleet of 20kg satellites that can be deployed in space by 2022, for applications such as maritime and aerospace security. The small satellites can also be equipped with other instrument for remote sensing to monitor environmental change and detect forest fires.

Located within the Singapore Wind Tunnel Facility on the NUS Kent Ridge campus, STAR comprises a clean room facility for satellite testing and assembly works, electrostatic discharge controlled laboratories for research and student projects, as well as environmental testing facilities such as a thermal chamber and a vacuum chamber. STAR’s 1,400sqm facility is home to 60 research staff and students.

“STAR will serve as a hub for research, education and commercialisation of expertise and technologies relating to the space industry. For Singapore to gain a strong foothold in this knowledge-intensive sector, it is crucial to develop a vibrant space innovation ecosystem comprising a critical mass of homegrown talents, a thriving space industry, as well as a conducive research environment where scientists, engineers and industry partners jointly innovate and create new technologies to address satellite technology challenges. Leveraging STAR’s capabilities, NUS Engineering can play a key role in shaping Singapore’s future as a spacetech leader.”

Prof Low Kay Soon
Director of STAR

(From left) Prof Low, Prof Chua, Prof Ho and CEO of DSO M Choo Chee Hau at the launch of the Satellite Technology Research Centre (STAR).
NUS ENGINEERING LEADS IN EDUCATION

NUS Engineering has been lauded for its educational leadership in the recently published “Global state of the art in engineering education” report by the Massachusetts Institute of Technology (MIT), the only university outside of the US and northern Europe to feature among the world’s top 10. Cited as a “current and emerging leader in the field”, NUS joins other bigwigs such as QMUL College, MIT and Stanford University in the US, Aalborg University in Denmark, and Delft University of Technology in the Netherlands.

NUS Senior Deputy President and Provost Prof Ho Teck Hua said that the achievement speaks volumes of the commitment and excellent work put in by the University’s outstanding faculty and researchers.

The report is a global review of cutting-edge practice in engineering education informed by interviews with close to 200 thought leaders with knowledge of, and experience with, world-leading engineering programmes. In addition to highlighting leaders in the field, it showcases future directions, opportunities and challenges, as well as case studies from various universities.

According to the report, three trends are likely to define the future of engineering education. They are a greater emphasis on engineering education leadership outside of the US and northern European institutions; a shift towards programmes that integrate student-centred learning with a curriculum focusing on addressing pressing challenges of the 21st century; and a new generation of leaders able to deliver student-centred curricula at scale. The report suggests that in the future, the world’s leading engineering programmes will be those that blend off-campus personalised learning with experiential learning on campus and in work placements.

“It is gratifying to see our efforts in making engineering education more holistic being recognised in this MIT-commissioned report. We firmly believe that a holistic engineering education is the right approach to training engineers with strong technical skills and the creativity and innovativeness needed to tackle complex social, economic and environmental problems of the 21st century.”

Prof Chua Kee Chiang, Dean of NUS Engineering

IN THE TOP 10 GLOBAL UNIVERSITY RANKINGS BY SUBJECT

In the Quacquarelli Symonds (QS) World University Rankings 2018, four NUS Engineering subjects were ranked among the top 10. They are:

<table>
<thead>
<tr>
<th>Subject</th>
<th>World Ranking 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil &amp; Structural Engineering</td>
<td>6</td>
</tr>
<tr>
<td>Materials Science</td>
<td>8</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>9</td>
</tr>
<tr>
<td>Electrical &amp; Electronic Engineering</td>
<td>10</td>
</tr>
</tbody>
</table>

NUS is the only Asian university to gain a position in QS list of 10 best universities worldwide. The University is also ranked in the top 50 for 34 subjects out of the 48 disciplines analysed by QS.

NUS ENGINEERING FACULTY MEMBERS ELEVATED TO IEEE FELLOWS

Assoc Prof Guo Yongxin and Assoc Prof Mehul Motani from NUS Electrical and Computer Engineering were elevated to Institute of Electrical and Electronics Engineers (IEEE) Fellows from 1 January 2018. This is a distinction conferred upon select members who have displayed an outstanding record of accomplishments in their fields of interest.

Assoc Prof Guo was awarded the accolade for his outstanding contributions to wideband printed antennas, in particular with his research relating to small and wideband antennas, wireless power, and MMIC modelling and designs. He served as a General Chair of IEEE IMWS-AMP 2015 and IEEE IMWS-Bio 2013, as well as the Associate Editor for IEEE Journal of Electromagnetics, RF and Microwave in Medicine and Biology (JERM) and IEEE Antennas and Wireless Propagation Letters.

Assoc Prof Motani made significant contributions to fundamental problems in network information theory, the design and optimisation of novel wireless networking algorithms, and deep learning for healthcare applications. He also contributed to the IEEE in numerous capacities, including serving as the Secretary of the IEEE Information Theory Society Board of Governors, and as an Associate Editor for both the IEEE Transactions on Information Theory and the IEEE Transactions on Communications.
ACCOLADES

PAPERS BY NUS ENGINEER IN THE “TOP 25 MOST CITED PAPER” LISTING IN TWO ENERGY JOURNALS

Two papers by Assoc Prof Paveen Linga from NUS Chemical and Biomolecular Engineering, published in 2013 and 2016, are listed among the Top 25 most cited paper in Energy and Applied Energy Journals as of 23 January 2018. This constitutes the top 1% of the more than 6,000 publications in the Journals since 1987.

The first paper published in Energy, titled “Pre-combustion capture of carbon dioxide in a fixed bed reactor using the clathrate hydrate process” (Volume 50, pp. 384-373), has 120 citations and is the 9th most cited paper within the Journal with a field-weighted citation impact (FWCI) of 10.49 (from Scopus as of 23 January 2018).

This paper received this recognition for two consecutive years.

The second paper published in Applied Energy, titled “Review of natural gas hydrates as an energy resource: Prospects and challenges” (Volume 137, pages 1633-1652), was co-authored by Zheng Rong Chong, She-Hern Bryan Yang, Dr Ponruivivat Banu, and supervised by Assoc Prof Linga in collaboration with Prof Xiaosen Li of the Key Laboratory of Gas Hydrate, Guangzhou Institute of Energy Conversion, Chinese Academy of Sciences, China. The paper presented a comprehensive account of the state-of-the-art developments on natural gas hydrates as an energy resource, prospects and challenges in developing technologies to recover energy from this vast resource. It has been cited 141 times, has an FWCI of 28.53 (from the Scopus database as of 23 January 2018), and was the top ranked publication among the 1600 plus articles published in the journal in 2016.

NUS AR LAB TEAM BAGS TOP PRIZE AT THE 2018 HILTI IT COMPETITION

A team from the NUS Augmented Reality (AR) Lab comprising NUS Graduate School for Integrative Sciences and Engineering PhD students Terence Siow, Miko Cheng and He Fan supervised by Lab Directors Assoc Prof Ong Soh Khim and Prof Andrew Nee from NUS Mechanical Engineering, research fellow Wang Xin and researcher Li Wenkai won the Championship at the 2018 HILTI IT Competition held in Kuala Lumpur, Malaysia on 28 March 2018.

Themed Augmented Reality and Internet of Things, the competition’s judging criteria are based on innovation, originality, design, mutual benefit, quality, technical feasibility, sustainability and presentation. A total of 147 entries was received worldwide. Although the competition is in its sixth year, this is the first time that NUS has participated. The winning team received a paid study trip, airfare and five-night stay at one of Hilti’s strategic locations, including the USA and Liechtenstein.

MSWF RESEARCH GRANT FOR NUS ENGINEERING RESEARCHER

Prof Tan Kok Kiong from NUS Electrical and Computer Engineering is one of the four researchers in Singapore to receive grants for innovative research on senior citizen welfare and traffic safety. The Mitsui Sumitomo Insurance Welfare Foundation (MSWF), advocates for budding and interdisciplinary research focused on the growing ageing population and the rising concerns over traffic safety in Asia.

ENGINEERING RESEARCHER RECEIVES $1.5M GRANT FOR NOVEL, MULTIDISCIPLINARY WORK

Prof Lim Chiwee Teck, Principal Investigator at the NUS Mechanobiology Institute and NUS Biomedical Engineering, has been awarded the prestigious Human Frontiers Science Program (HFSP) Research Grant. He and his team of international researchers will receive up to $1.58 million (US$1.2 million) for their novel, multidisciplinary research investigating the collective migration of cells on curved surfaces such as those found on the skin or in the intestinal microbiota.

One of 23 awardees selected out of some 770 applications, the team’s research aims to go deeper into understanding the mechanisms underlying tissue growth and repair. This information could then be applied in the development of improved approaches in tissue engineering and regenerative medicine. Prof Lim’s multinational team includes scientists from the Institut Jacques Monod and Institut Curie in France, as well as the University of Washington in Seattle, USA.

The HFSP Research Awards offer funding support for basic cutting-edge life sciences research studying the complex mechanisms in living organisms using innovative scientific and technological methods. This award specifically recognises and encourages collaborative, interdisciplinary research of scientists across various countries and continents.

Making Singapore a Liveable City

At the launch of the first edition of The Liveability Challenge on 5 April 2018 by Temasek Foundation EcoCity (Temasek) and Eco-Business, Asst Prof Tan Swee Ching from NUS Materials Science and Engineering and other invited guests - Pomeroy Studio’s Jason Pomeroy and Citizen Farm’s Darren Ho - spoke about how they are making Singapore a more liveable city.

The Liveability Challenge is a $1 million search for scalable and impactful solutions to urban problems of waste management and cooling. Asst Prof Tan, who benefitted from a grant by Temasek, has developed a cooling material that is potentially the strongest water-absorbing agent on the market.

Asst Prof Tan will also use his grant to fund tests on surfaces in common areas like parks and classrooms.

He hopes his work will be used to reduce Singapore’s reliance on air-conditioning.
NOVEL WIRELESS LIGHT SWITCH FOR TARGETED CANCER THERAPY

Prof Zhang Yong and Asst Prof John Ho, from NUS Biomedical Engineering and NUS Electrical and Computer Engineering, respectively, have developed a way to wirelessly deliver light into deep regions of the body to activate light-sensitive drugs for Photodynamic Therapy (PDT), a powerful light-induced cancer treatment.

PDT is often limited to surface cancers due to the low penetration of light through biological tissue. The novel wireless approach of light delivery enables PDT to be used on the inner organs of the body with fine control. This technology could potentially enable PDT to be used to treat a wider range of cancers, such as brain and liver cancer. Findings of the NUS Engineering team’s study were published in the scientific journal Proceedings of the National Academy of Sciences (PNAS) on 29 January 2018.

The NUS engineers’ novel approach of enabling PDT to be used for the inner organs of the body is achieved by inserting a tiny wireless device at the target site, extending the spatial and temporal precision of PDT deep within the body. This miniaturised device, which weighs 30mg and is 15mm in size, can be easily implanted, and uses a wireless powering system for light delivery. Once the device has been implanted at the target site, a specialised radio-frequency system wirelessly powers the device and monitors the light-dosing rate. They demonstrated the therapeutic efficacy of this approach by activating photosensitisers through thick tissues (more than three centimetres), which are inaccessible by direct illumination, and by delivering multiple controlled doses of light to suppress tumour growth.

The study was supported by the Singapore Ministry of Education’s Tier 3 grant. The researchers are working on developing nanosystems for targeted delivery of photosensitisers, as well as coming up with minimally invasive techniques for implanting the wireless devices at the target site. They are also looking into integrating sensors for the device to monitor the treatment response in real-time.

Our approach to light delivery will provide significant advantages for treating cancers with PDT in previously inaccessible regions. Powered wirelessly, the tiny implantable device delivers doses of light over long time scales in a programmable and repeatable manner. This could potentially enable the therapies to be tailored by the clinician during the course of treatment.

TURNING OLD CLOTHES INTO MULTIFUNCTIONAL COTTON AEROGELS

A team of researchers from NUS Mechanical Engineering has found new use for old clothes. Led by Assoc Prof Hai Minh Duong and Prof Nhan Phan-Thien, the research team has successfully turned disused cotton fabrics into highly compressible and ultralight weight cotton aerogels that are multifunctional. The cotton aerogels can be used to keep military water bottles cold, as well as control rapid bleeding caused by gunshot wounds or other deeply penetrating wounds which can be life-threatening.

The research team took more than two years to develop and patent its method. There are two major uses for the innovative material. At present, haemorrhage control devices comprise a syringe filled with small capsules of cellulose-based sponge. This is inserted into the wound to release the capsule, which expands and applies pressure on the wound to stop the blood flow. However, the expansion and absorption rates of cellulose-based sponges are still relatively slow. The cotton aerogel pellets developed by the NUS engineers are highly compressible; each pallet can expand to 16 times its size in 4.5 seconds, and absorbs more blood three times faster than existing pallets.

The researchers also worked with DSO National Laboratories to develop a thermal jacket for the military canteens that soldiers use to carry fluids. The jacket, which weighs about 200g, comprises cotton aerogel that is sandwiched between nylon and polyester fabrics. This cotton aerogel-insulated military canteen offers better heat insulation performance compared to commercial insulated water bottles such as FLOE bottles, and is highly comparable to that of vacuum flasks. However, FLOE bottles and vacuum flasks are much heavier and more costly.

The NUS engineers have filed a patent for the novel cotton aerogels, and are exploring opportunities to work with companies to commercialise the technology.

This novel eco-friendly cotton aerogel is a major improvement from the aerogel that our team had previously developed using paper waste. It is highly compressible, hence storage and transportation costs could be greatly reduced. Furthermore, these cotton aerogels can be fabricated within eight hours – this is nine times faster than our earlier invention and about 20 times faster than current commercial fabrication processes. They are also stronger, making them more suitable for mass production. While we have demonstrated novel application of the cotton aerogels for effective haemorrhage control and heat insulation, we will continue to explore new functions for this advanced material.

Assoc Prof Hai Minh Duong, NUS Mechanical Engineering
NUS ENGINEERING SECURES $4.9 MILLION IN PARTNERSHIPS TO DEVELOP NEXT-GENERATION HYBRID FLEXIBLE ELECTRONICS

The Faculty established seven new partnerships under its Hybrid-Integrated Flexible Electronic Systems (HiFES) programme to develop the next-generation electronics. These partnerships, valued at about $4.9 million in total, involve cutting-edge research to develop technologies and devices for applications in areas such as consumer electronics, healthcare, defence and safety surveillance. Leading semiconductor companies such as MediaTek and Soltec, the United States Air Force Office of Scientific Research, as well as Temasek Laboratories at NUS and Solar Energy Research Institute of Singapore at NUS, are among the programme’s new partners.

The $50 million HiFES programme was launched in October 2016 to pioneer innovations that could potentially reshape the electronics industry. Comprising 16 principal investigators and more than 20 researchers with expertise in diverse areas in electronics and materials, HiFES seeks to create hybrid electronic systems by integrating conventional rigid electronics with flexible printable components for a wide range of new applications that includes wearable Internet of Things (IoT), remote sensing, artificial intelligence, and e-health.

HiFES researchers are working with MediaTek to develop a smart, human-wearable interface – in the form of a flexible patch – that can attain precise matching between wearable devices and the location on the human body through advanced system design. This platform technology could be used for interactive media and gaming, activity tracking and healthcare, as well as human-machine natural interfaces, such as on-skin keyboards.

HiFES’ collaboration with Soltec explores the use of strained silicon-on-insulator substrate and layer transfer to develop advanced transistors that could lead to ultra-thin chips – 1,000 times thinner than today’s semiconductor chips – on flexible substrates that can enable next-generation wearable devices.

Projects with other leading partners involve the development of monolithic nanomaterial-based reconfigurable interconnects which could introduce artificial intelligence to flexible electronics, hence enabling machine learning for new wearable medical devices and sensors. Flexible terahertz array sources for safety surveillance and quick detection of chemicals, drugs and explosives are among the exciting material-enabled projects being carried out under the HiFES programme.

Researchers from HiFES are also partnering with the United States Air Force Office of Scientific Research to investigate the impact of thermal effects and mechanical stress on the radio frequency performance of flexible transmit and receive modules. This is an important issue to resolve for antennas and radar systems, especially when the devices are made flexible. Research collaboration between HiFES and Temasek Laboratories at NUS will investigate novel phased array antennas on flexible substrates to enhance wireless communication and remote sensing systems.

A new state-of-the-art facility is being constructed to serve as a research platform to foster greater collaboration between multidisciplinary research groups from within the University, as well as industry and research partners. Equipped with advanced process and material characterisation capabilities, the new facility will enable integration of semiconductor and additive-based processes such as precision 3D printing, and packaging, for new technology prototyping. It is expected to be operational by end 2018.

As we enter the IoT era, innovative, high-value electronics with fast time-to-market will be a key enabler. Leveraging established semiconductor technologies, we believe hybrids of rigid electronics with new soft functional materials will offer an increased palette for technology innovations. We are very excited to work with our new partners to co-create innovative solutions and open up exciting new applications for hybrid flexible technologies. These projects have a strong focus on technology translation and we look forward to developing commercially-ready applications to address real-world challenges.

As a naturally occurring bacterium, Thermoaerobacterium thermosaccharolyticum TG57, isolated from waste generated after harvesting mushrooms, is capable of directly converting cellulose, a plant-based material, to biobutanol.

The research team led by Assoc Prof He Jianzhong from NUS Civil and Environmental Engineering first discovered the novel TG57 strain in 2015. They went on to culture the strain to examine its properties.

Assoc Prof He explained, “The production of biofuels using non-food feedstocks can improve sustainability and reduce costs greatly. In our study, we demonstrated a novel method of directly converting cellulose to biobutanol using the novel TG57 strain. This is a major breakthrough in metabolic engineering and exhibits a foundational milestone in sustainable and cost-effective production of renewable biofuels and chemicals.”

Traditional biofuels are produced from food crops. This approach is costly and competes with food production in the use of land, water, energy and other environmental resources. However, biofuels produced from unprocessed cellulosic materials such as plant biomass, as well as agriculture, horticultural and organic waste, are expected to meet growing energy demands without increasing greenhouse gas emissions resulting from the burning of fossil fuels. These cellulosic materials are in great abundance, environmentally friendly, and economically sustainable.

Among various types of biofuels, biobutanol offers immense potential as a petrol substitute because of its high energy density and superior properties. It can directly replace gasoline in car engines without any modification. However, commercial production of biobutanol has been hampered by the lack of potent microbes capable of converting cellulosic biomass into biofuels. The current technique is costly and also requires complicated chemical pre-treatment.

The novel technique developed by the NUS Engineering team could potentially be a game-changing technology for cost-effective and sustainable biofuel production. The microorganisms in the spent mushroom compost are left to evolve naturally for more than two years to obtain the unique TG57 strain. When cellulose is added, the bacterium digests it to produce butanol as the main product.

The research team will continue to optimise the performance of the TG57 strain, and further engineer it to enhance biobutanol ratio and yield using molecular genetic tools. The findings of the study were published in the scientific journal Science Advances on 23 March 2018.
A NEW APPROACH TO RECYCLING INDUSTRIAL WASTEWATER

Researchers from NUS Engineering have developed a new, low energy and cost-effective approach to wastewater purification. The system, which operates on low electrical power, does not generate secondary waste such as sludge that typically requires costly residual waste processing, and can remove up to 99 per cent recalcitrant impurities from wastewater.

Led by Asst Prof Olivier Patrick Lefebvre from NUS Civil and Environmental Engineering and a Principal Investigator at the Faculty’s Centre for Water Research, the researchers believe the environmentally-friendly invention can help “to raise the overall standard of industrial wastewater treatment”. The system uses electrochemistry to treat water and wastewater, and does not require chemicals to be physically added to the system. This means that the wastewater produced by manufacturing industries could be on a constant loop of reusable water.

Besides benefiting farmiand, electronics and pharmaceutical industries, the new electrochemical system developed by the NUS Engineering team could potentially be utilised by heavy manufacturing industries that require ultrapure water for their processes, such as mining, oil and gas, and textile industries, and the shipping industry for the disinfection of problematic ballast water from ships. It could also be applied to treat micropollutants in domestic wastewater, as well as manage water purity in the various outdoor environments, for instance, controlling algal growth in water bodies and purifying landfill leachate.

The NUS engineers, who have been working on the system since July 2015, applied for two patents for the technology used in the electrochemical system. They are testing the system on more types of industrial wastewater to further refine the design and optimise the efficiency of the system, and will develop superior graphene electrodes that could speed up the system’s purification process. The researchers are also looking to collaborate with industry partners to commercialise the electrochemical system.

NOVEL CHIP FOR FAST, ACCURATE AND LOW COST DISEASE DETECTION

An innovative chip developed by NUS engineers holds promise for a faster and cheaper way to diagnose diseases with high accuracy. Prof Zhang Yong from NUS Biomedical Engineering and his team have developed a tiny microfluidic chip that could effectively detect minute amounts of biomolecules without the need for complex lab equipment.

The innovative microfluidic chip uses only standard lab microscope to spot nano-biomolecules without any fluorescent labels, making this approach highly attractive for use in point-of-care diagnostics. It uses the lateral shifts in the position of the microbead substrate in pillar arrays for quantifying the biomolecules, based on the change in surface forces and size, without the need of any external equipment. Due to the usage of lateral displacement, the nano-biomolecules can be detected in real-time and the detection is significantly faster in comparison to fluorescent label based detection.

To complement the chip technology, the team is developing a portable smartphone-based accessory and microfluidic pump to make the detection platform portable for outside laboratory disease diagnostics. The researchers are further enhancing the technology for commercialisation.

Prof Zhang’s team, comprising Dr Kerwin Kwok Zeming and two NUS PhD students, Thorin Salahi and Swadl Shihana, published their findings in the scientific journal Nature Communications on 28 March 2018. The study was supported by a research grant from the Singapore Ministry of Education.

2018 NUS ENGINEERING AWARDS CEREMONY

NUS Engineering Dean Prof Chua Kee Chong presented awards for research, teaching and service excellence to Engineering faculty members at the Faculty’s Awards Ceremony on 15 March 2018. It was a time to congratulate colleagues and share in their achievements.

The NUS Engineering Service Award was presented for the first time – to Prof Victor Shim – who had served 10 years as Vice-Dean (External Relations and Outreach) for the Faculty. He now serves the University as its Assoc Vice President for the Global Relations Office.

Also a first for the Faculty was the Innovative Teaching Award (Gold) went to a team of faculty members and not an individual. The team from NUS Electrical and Computer Engineering and NUS Mechanical Engineering had worked for a year to develop and implement the Engineering Principles and Practice Programme for first-year students, recognised as the Faculty’s emphasis on experiential learning for all Engineering freshmen.

Below are the 2018 awardees:

Innovative Teaching Award (Bronze) AY2016/2017
Asst Prof Yew Chen Hua, Raye

Innovative Teaching Award (Silver) AY2016/2017
Dr Elliot Law
Dr Minai Kenti Musib

Innovative Teaching Award (Gold) AY2016/2017
EPP TEAM (EC/E DEPARTMENT)
Assoc Prof Abdullah Al Mamun
Assoc Prof Ashish in M Khambadkone
Dr Chua Dingjuan
Assoc Prof Mandar Anil Chitre
Dr Sahoo Sanjib Kumar
Assoc Prof Soh Wee Seng

Innovative Teaching Award (Gold) AY2016/2017
EPP TEAM (ME DEPARTMENT)
Assoc Prof Lim Kian Meng
Assoc Prof Chen Chao Yu, Peter
Assoc Prof Chua Kian Jon, Ernest
Assoc Prof Koh Soo Jin, Adrian
Assoc Prof Teo Chiang Juyi
Assoc Prof Velusamy, Subramaniam

Engineering Educator Award AY2016/2017
Dr Alberto Cornis
Asst Prof Lefebvre, Olivier Patrick
Dr Lim Wei Chuan, Elvin
Dr Sachin Vinayak Jangam
Dr Satyen Gautam

Engineering Educator Award Honour Roll AY2016/2017
Dr Chiu Cheng Hain

Engineering Young Researcher Award 2018
Assoc Prof Qiu Chengwei
Assoc Prof Tan Yan Fu, Vincent
Asst Prof Zhao Dan

Engineering Researcher Award 2018
Assoc Prof Chua Kian Jon, Ernest
Prof Meng Qiang

Highly Cited Researcher 2017
Prof Ge Shuzhi Sam
Prof Lee Jim Yang
Prof Lim Teng Joon
Prof Liu Bin
Prof Sreen Ramakrishna
Assoc Prof Zhang Rui

Engineering Outstanding Service Award 2017
Prof Victor Shim

Dean’s Chair
Assoc Prof Qiu Chengwei
WE NEED MORE FEMALE ENGINEERS

“The belief that women are less adept at engineering is unfounded. Female engineers have the same status as male engineers as the era demanding physical prowess to carry out engineering functions has long passed. There is no reason why society will not accept women as engineers, and there are no challenges that are peculiar to women engineers.”

Assoc Prof Ong Son Khim is a faculty member at NUS Mechanical Engineering, an avid photographer and ardent succulent collector. She is also a strong believer in encouraging more women to join the Science, Technology, Engineering and Mathematics (STEM) fields.

The outspoken go-getter’s lengthy resume serves as a source of inspiration for young women thinking about a STEM career. Only in her 40s, she has racked up an impressive list of accolades to her name. This includes winning the Singapore Women’s Weekly Great Women of Our Time Award in 2015 and being the first woman from Asia to be elected as a Fellow of the International Academy for Production Engineering. She is also the first woman from Southeast Asia to receive the M. Eugene Merchant Outstanding Young Manufacturing Engineer Award by the Society of Manufacturing Engineers, and the first Singaporean to receive the Emerging Leader Award in Academia by the US Society of Women Engineers.

In addition, Assoc Prof Ong was appointed by former Singapore President S R Nathan as a Nominated Member of Parliament in 2005, using her voice to enhance constructive debate on national issues ranging from education to helping low-wage workers.

The homegrown talent graduated from NUS with a PhD in Manufacturing Engineering, her field of study inspired by her factory production jobs during school holidays where she had marvelled at how a manufacturing plant could roll out its products round-the-clock.

Her current work centres largely around augmented reality (AR) technologies — a novel form of human-machine interaction that overlays computer-generated information onto the real-world environment. Among her more prolific projects is a virtual interface system that helps those with limited mobility to control electronic gadgets through head and eyebrow movements, and an application that allows the elderly to call family members simply by pointing their phones at photographs.

However, throughout her engineering journey, she often faced instances of gender bias and inequality. This came not only from male colleagues and students, but females as well, who subconsciously harbourd gender stereotypes. She never shied away from speaking up during such instances.

For this reason, Assoc Prof Ong makes time to give back to the cause close to her heart. “I had very humble beginnings — I never owned a book or toy as a child. I worked as a factory operator in secondary school and gave tuition classes and washed toilets during college. I therefore have a strong desire to help youth, particularly from low-income families, discover the wonders of science and engineer their own constructs for lifelong success.”

She regularly gives talks and interviews encouraging women to join STEM fields, including returning to her alma mater, Ang Mo Kio Secondary School, each year to share her journey. She has also been a STEM Ambassador for the Singapore Committee for UN Women since 2014.

While she acknowledges that there has been a greater drive to raise awareness about STEM careers among parents and schools, Assoc Prof Ong feels more needs to be done to further increase the percentage of females in STEM. This, she says, requires an equalising of the roles of both men and women in society and is why Assoc Prof Ong has no plans of slowing down in her quest to keep on smashing glass ceilings.

**Women bring diversity to engineering and technology - of experience, ideas and approaches. If we do not engage women in STEM, we are ignoring at least 50 per cent of the world’s intellectual talent. Having more women in STEM is a long-term sustainable solution for a greying world population.**

Assoc Prof Ong Sub-Khim, NUS Mechanical Engineering

THE NUS FSAE TEAM IS RANKED NO.13 WORLDWIDE

The NUS FSAE team came in at 13th position worldwide (out of 120 teams) at the annual Formula SAE Internal combustion Challenge held in Michigan, USA (9 to 12 May 2018). It also attained success in the following categories:

- Rank no. 3 in Engineering Design
- Rank no. 3 for Brake Design (The FSAE team received the Akebono Brake Design Award presented by the Akebono Brake Corporation.)
- Rank no. 5 in Race Car Engineering Design
- Rank no. 6 in Acceleration Event (Drag race)
- Rank no. 6 in Marketing Presentation

R18, the latest FSAE race car, boasts features that enhance the car’s racing performance. They include:

- Wireless driver communication system, while the car is on the move,
- Real-time telemetry with Android App for handheld, and
- Quicker automatic gear shift.

Started in 2001, the NUS FSAE race car project is now part of the Innovation & Design Programme (IDP) which is one of the three differentiated pathways for students in NUS Engineering. By getting students from different engineering disciplines to work together on multi-semester projects throughout their candidature, the IDP aims to train entrepreneurial graduates who understand innovation and are able to apply their knowledge and skills to develop innovative technologies and solve problems affecting the community. Students who complete the IDP are awarded a Second Major in Innovation & Design alongside a Bachelor’s degree in an engineering discipline.