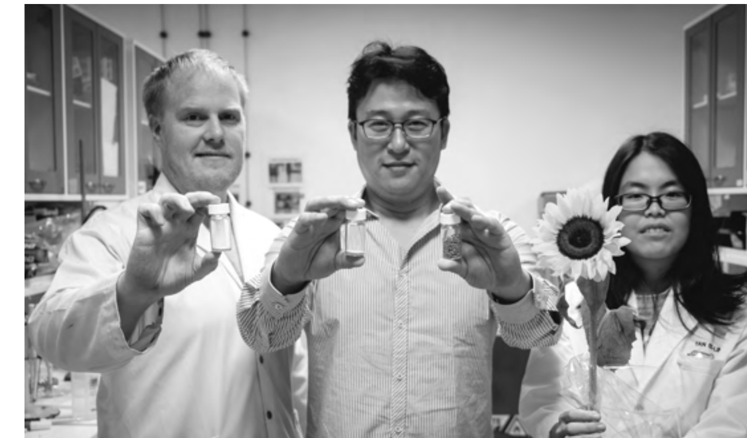
RIE news

Your guide to Research, Innovation, & Enterprise in Singapore



Pollen Power

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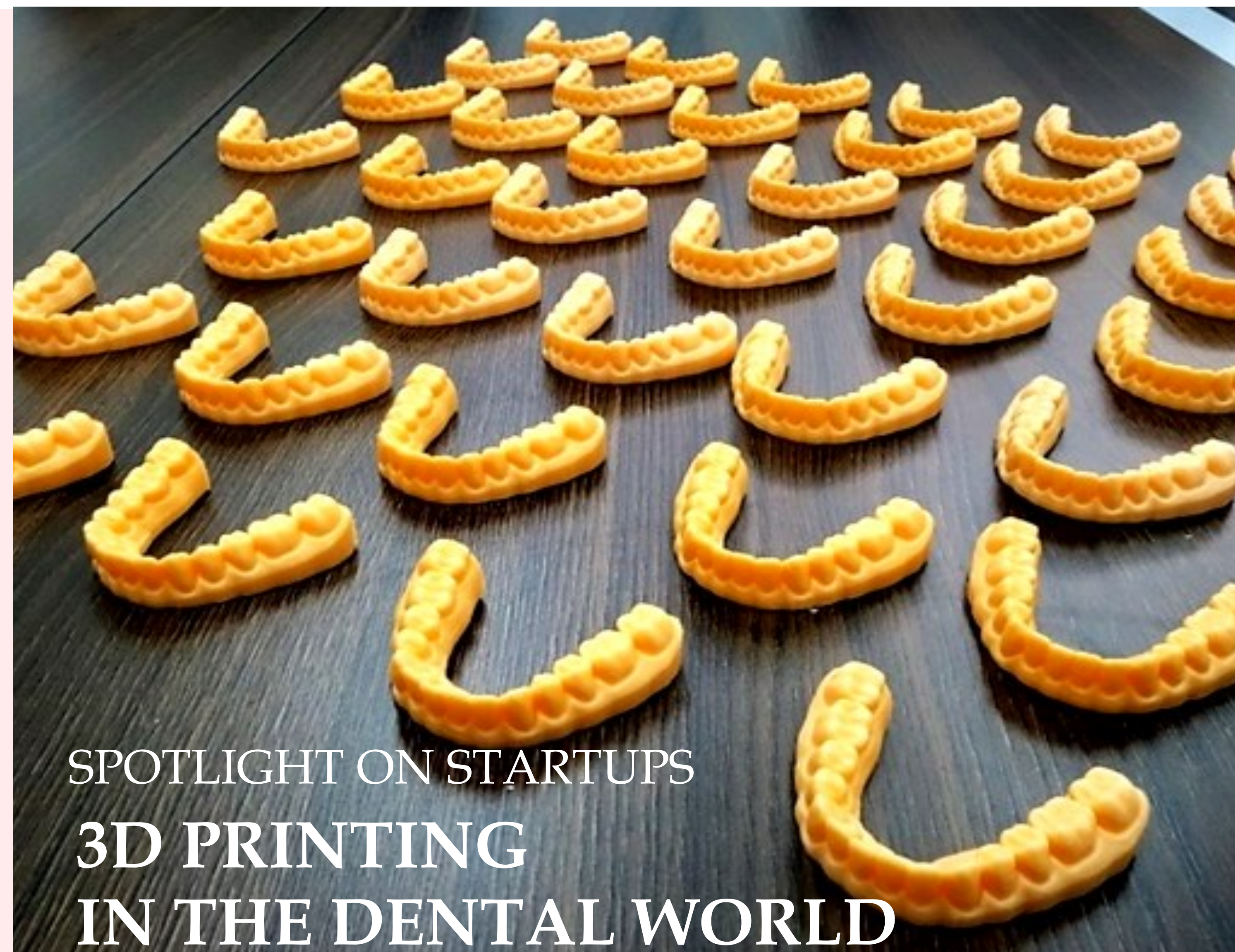


SPOTLIGHT ON STARTUPS

3D PRINTING IN THE DENTAL WORLD

ISSUE 1 / APRIL 2018

Researchers from the NUS Food Science and Technology Programme behind the development of novel magnetic nanoparticles that can speed up the screening of pesticide residues in vegetables. Photo: NUS

Be rid of pesticides!

SYNTHETIC pesticides such as pyrethroids are widely used in farming to control agricultural pests. However, long-term consumption of fruits and vegetables with pesticide residues can lead to adverse health effects.

NUS researchers have identified a way to rapidly detect minute amount of pesticide in agricultural crops. They have developed magnetic nanoparticles that can effectively extract pyrethroid residue from vegetable crops for analysis via simple magnetic separation.

This innovation allows analysis to be completed in less than two hours, and is able to detect pyrethroids at a concentration level of as low as 0.02 nanogram per gram of vegetables.

Membrane tech for companies

THE National Research Foundation has set up a national consortium on membrane science and technology. The Singapore National Membrane Consortium, or SG-MEM, will help companies access the latest membrane technology in our research institutes. Companies will have access to world-class research laboratories and facilities located at the research institutes to manufacture, assemble and test membranes to bring R&D to market.

Currently, 15 SMEs, LLEs and MNCs have joined the consortium, including Shell, Sembcorp, and Aquaporin-Asia.

Linking transport option and toxic particle inhalation

RESEARCHERS at the Singapore-MIT Alliance for Research and Technology (SMART) have found that taking the MRT is the cleanest way to get around in Orchard Road. Commuters taking the train breathe in 60% less fine particles and over 80% less ultrafine particles compared to walking. Taking the bus or taxi can also reduce the intake of these harmful particles, but to a lesser extent.

The study found that the absence of combustion sources in train system and the use of efficient ventilation and air conditioning in stations seemed effective in reducing particle levels. In addition, screen doors at platforms that open simultaneously with train doors reduce the movement of harmful particles from inside the tunnel onto the train platform, where commuters wait for their trains.

Broccoli anyone?

IMAGINE eating a healthy mix of engineered bacteria and broccoli to prevent or treat colorectal cancer. New research findings from NUS' Synthetic Biology for Clinical and Technological Innovation have found that this concoction could kill off 95 per cent of lab-cultured colon cancer cells. The researchers have shown that engineered microbes can prevent carcinogenesis and promote the regression of colorectal cancer through a cruciferous vegetable diet.

Story Source and Photos: NTU Singapore

THE SMALL BUT MIGHTY POLLEN GRAIN

Scientists at Nanyang Technological University are working to uncover the potentials of the humble pollen grain.

The wall of a pollen grain is nature's evolutionary solution to protect a plant's sensitive genetic materials from harsh environmental conditions. It ensures reproductive success in plants and presents itself as a source of biocompatible and robust material to scientists. The NTU Translational Science Group has been looking deep into the material properties of the pollen wall to see how it can be used to develop products that can benefit mankind.

In drug development, pollen can be used in its natural form, or processed to create hollow non-allergenic drug capsules. Compounds loaded into pollen capsules are protected from oxidation and UV degradation and can be released quickly or slowly through co-encapsulation. Pollen is also biodegradable and has no limiting regulation for use as an ingredient for human consumption.

The NTU team has developed and obtained patent for the world's most advanced pollen-based microencapsulation technology. In addition to its use as a drug capsule, the technology can be applied in other areas such as in agricultural products for controlled delivery of fertilisers, and as a natural exfoliant in skincare products.

This research was supported under the National Research Foundation Singapore's Competitive Research Programme, which funds use-inspired basic research based on scientific excellence.

DESIRE TO DISRUPT

SINGAPORE biotechnology company Tychan announced it has developed the first antibody for Zika that is now ready for human trials. Named Tyzivumab, the Zika therapeutics is developed in a record time of nine months and has been proven safe and effective in animals. The short development cycle of the therapeutics is made possible by the company's novel approach that integrates drug development and bio-manufacturing processes.

We catch up with Dr Chionh Yok Hian, who is part of the team working on the Zika antibody. Yok Hian was named one of MIT Technology Review's Innovators under 35 Asia Pacific 2018.

First of all, congratulations on being named one of MIT Technology Review's Innovators under 35 Asia Pacific 2018. What do you think is the best motivator that helps in your quest for scientific discovery and change?

I find using scientific discoveries to make the infectious disease epidemics of the future a minor nuisance, rather than a major health crisis, to be my greatest motivation. My belief – that science is our best tool in solving the challenges we face globally – allows me to imagine, create, innovate, explore and test new ideas that better existing systems and frameworks.

Can you share more about your research in Tychan?

At Tychan, we aim to rapidly develop therapeutic solutions against emerging viruses. This will allow us to bring potentially life-saving treatments to patients during outbreaks. I facilitate this process through my exploration of radically different science-based regulatory frameworks that will enable us to expedite regulatory approvals of therapeutics while meeting the stringent safety and efficacy requirements that are in place today.

My research aims to disrupt the conventional biologics development process using integrated analytics – that is, if we measure certain procedures often and frequently enough we can model, predict and expedite the process. Thanks to advances in technology and fundamental basic science of antibody-viral interactions, therapeutic antibodies can be designed in silico. This advancement has the potential to catapult a candidate from discovery into development very rapidly.

In biologics development, we have not obtained the same level of fundamental understanding of the advanced biomanufacturing processes required for biologics production to the extent that enables us to generate optimal formulations, maximise yields and shorten timelines. I seek to address this knowledge gap at Tychan.

In the case of our anti-Zika virus drug, we got the development time down to 9 months. This is just the first rendition. Through a series of progressive and systematic improvements, which we will design, engineer, and pilot, our goal is to bring a promising drug to clinical trials in weeks rather than months.

Okay, so Tychan hopes to shorten the time required to bring a candidate therapy from design to clinical trials from months to weeks. Why are you interested in this problem?

I trained as a Systems Biologist and did my PhD with the Singapore-MIT Alliance for Research and Technology Infectious Diseases Interdisciplinary Research Group (SMART ID). During my PhD, I discovered underlying properties within the genetic code that enables pathogens to survive environmental stress.

Upon graduation, I was challenged by my PhD supervisor at MIT, Professor Peter Dedon, to create the job I wanted. Thus, when I was given the opportunity to help build Tychan, I challenged myself to do just that: create a job that I am both passionate about and will benefit society at large.

I was fortunate to be in the right place, at the right time, with the right ideas. When I was approached by Dr. Ram Sasisekharan from MIT, a veteran in biologics development, and Dr. Ooi Eng Eong from Duke-NUS Medical School, one of the world's leading experts in flavivirus infections, we were all asking a similar question - why can't we bring effective therapeutics to patients within the timeframe of a public health emergency or outbreak?

We wanted a company that could tap into existing knowledge and regulatory support to address health crises with rapid, effective solutions. This need has hitherto been unmet and is often thought to be the status-quo. This simply does not make sense. For instance, more than 1.5 million individuals, some of whom are Singaporeans, have been infected by Zika virus worldwide. More than 3000 of the victims are babies who suffer from virus-associated microcephaly. Now imagine if a cure had been available within months of the outbreak in Brazil, how many lives could have been changed for the better.

What are some of the challenges that Tychan has to overcome to be a leader in this field?

It is always an uphill battle to challenge the current paradigms and dogma, particularly those that are heavily regulated. Every system has its limitations, and if the current one does not meet our needs, let's create one that does. There is a need in many fields to change the way we bring things forward. The path for bringing a therapeutic to market is no different.

Akin to the concept of technological leapfrogging, in order for Tychan to become a leader in the field of drug development and regulatory sciences, we need to adapt the tools and best practices from outside our field and contextualise them in a pragmatic manner.

To give you a concrete example, to bring our anti-Zika therapeutic to patients quickly, we made heavy use of computational methods in drug design. We know precisely how we wanted the therapy to work and thus working backwards, we looked at what had worked previously, and used modeling to determine what the final drug should look like. All that remains is to make it and test it out. This phase is not regulated; thus the challenges are rooted in addressing potential scientific knowledge gaps.

Yok Hian with his colleagues at Tychan. They were fellow researchers at the Singapore-MIT Alliance for Research and Technology (SMART) before joining Tychan. Photo: SMART

To accelerate manufacturing, which is heavily regulated, we defined a desired target product profile early on and used consensus processes and analytics to measure the product parameters without having to spend time developing new assays or alternative processes. During an infectious disease outbreak, we will be able to go straight from rational product design to accelerated manufacturing followed by innovative regulatory paths to quickly move a therapeutic to clinical trials.

Yes, we do get push-back from those who have pre-existing notions on how processes are expected to be performed. Manufacturers and contract research organisations would ask us, "Are you sure you want to take this risk?" We answered, "Yes we do, or we won't make the timeline". When we measure individual processes well, the data will speak for itself. After analysis, we will take a step back, look at the whole system and ask, 'How can we make it better?'. That is when we disrupt it with the goal of producing a product of equivalent quality or better – with the data to back it up.

So far, the regulators in Singapore are receptive of this new approach. This is how we can make drugs available quickly and provide it to those who need it.

Here, we work closely with our research collaborators – Duke-NUS, SMART, NTU and SIT to move our initiatives forward. Tychan is far from being a leader in the field, but someday, we hope to be there.

Before Tychan, you were doing research with SMART. Can you tell us a bit more on your work there?

I was fortunate to make some contributions to the exciting new field of epitranscriptomics. This was my area of research for my PhD under the SMART Infectious Diseases interdisciplinary research group.

I investigated the missing links in molecular biology: why genes are coded in peculiar ways and why are there more than 4 basic bases - alphabets if you will - in ribonucleic acids (RNA). The genes in the genome can be thought of as an instruction manual for how things are made. But genetic information alone does not tell one how much of the gene's product to make, or how and when to make them. For instance, if you tell me to jump, I'll say "how high?" and "when?" .

I wanted to see if there was a code within the genetic code, a certain cadence, or usage of words that give the gene product contextual meaning in the cellular system. And I found that specific RNAs are biochemically modified to decode the primary message at different efficiencies under different conditions, allowing for the scheduling of gene expression. In other words, I took a very deep dive into the alphabet soup of RNA chemistry and figured out how they came together as a biological system.

Next, I went on to test my ideas on mycobacteria, a family of bacteria, which causes tuberculosis. As it turns out, these bacteria use the epitranscriptomic program I described to control how they survive in humans. By tweaking the programming, I showed that it is possible to kill drug resistant bacteria under conditions that they would normally survive.

Looking ahead, what upcoming developments in your field do you think would be the most significant?

Obviously, I will be blatantly biased and say predictive data analytics (which is the focus of my current work), supported by machine learning, the internet of things and artificial intelligence, will play a transformative role in drug development and manufacturing.
Other developments are the advances in synthetic and systems biology that are now coming together, from mature genome-editing technologies – such as CRISPR-Cas 9 – to cheaper, faster and deeper "omics" platforms. These scientific advances will further accelerate growth in the already booming biologics sector.

What are the best and worst points in your career?

In many ways, my professional journey has only just begun. As a Singaporean who did most of my schooling locally, I still fondly recall making my valedictorian speech for the National University of Singapore's Graduate School of Medicine less than 2 years ago. Another high point in my career is the opportunity to deliver a speech at EmTech Asia 2018.

What is on your wish list for the new year?

At Tychan, our immediate focus is to complete our ongoing clinical trials for our first-in-class anti-Zika therapeutic. We are also looking to expand our core competencies and lay the groundwork to further our

Current research on the first Zika antibody at Tychan builds on the research conducted at the Singapore-MIT Alliance for Research and Technology (SMART), a research centre set up by the Massachusetts Institute of Technology (MIT) and the National Research Foundation (Singapore).

DENTAL REVOLUTION

Ever wondered how dental aligners are made? A group of university peers came together to build a company that 3D prints dental moulds, which are used to make clear aligners to correct teeth positioning.

Structo's printers can produce moulds like these at a high speed, without compromising on quality. The moulds are then used by dental professionals to make clear aligners to correct teeth positioning. Photo: Structo

SIX years ago at the National University of Singapore, a group of like-minded university peers specialising in mechanical engineering decided to build the next innovative product out of their bare hands.

As part of their final year project, Huub van Esbroeck, Devansh Sharma, Chin Kah Fai and Lam Siu Hon put their heads together, with the aim to create a new technology that can improve existing manufacturing methods.

Their hard work paid off when they successfully created a new 3D printing technology they call Mask Stereolithography (MSLA), an improvement upon existing Stereolithography technology. With MSLA, they started their company, Structo.

Stereolithography is one of several methods used to create 3D-printed objects. It is the process by which 3D printing machines convert liquid plastic into solid objects.

Recalling the early days of the company, Huub said that the team was "lost" as to which application Structo would print. They considered various applications like automotive, aerospace, architecture, and footwear, to see where their MSLA technology could fit. Huub said that when they first began, it was "purely about the technology, without much regard for commercialisation and applications."

For the young entrepreneurs, the choice to focus on using their technology to print dental applications came almost 18 months after the company was formed.

Huub recalled that it was serendipity that one of their first customers happened to be a dentist, and from there the team discovered the perfect fit between their technology and the requirements of dental applications.

Today, Structo's 3D printers can achieve speeds much higher than conventional SLA printers without compromising on print quality, thus helping dental professionals save on production costs. For example, they print moulds that are used by dental professionals to make clear aligners to correct teeth positioning.

In the past two years, the startup made significant progress in expanding the business. Since 2016, United States-based Glidewell Laboratories, one of the world's largest dental laboratories, has been using Structo's printers in their round-the-clock production.

...DENTAL REVOLUTION

Structo's Chief Technology Officer Boyle Suwono and Co-founder Huub van Esbroeck with NRF Chairman DPM Teo Chee Hean during a visit to Structo's premises. Photo: Ministry of Communications and Information

This is something that Huub describes as a true testament of the team's hard work, and validation that Structo is delivering products that meet the industry's needs. In 2017, besides increasing its revenue, the startup also more than doubled its staff strength to 40. It now has its printers installed in five continents around the world.

Structo has obtained investments from SPRING Singapore's investment arm Spring Seeds Capital and early stage venture capital firm Wavemaker Partners.

Despite their success, the team views Structo as a constant work-in-progress, and have found mentorship to be an incredibly important aspect of their entrepreneurship journey.

"For us, this has been really helpful in avoiding preventable mistakes along the way that we would definitely have made without the guidance from more senior and experienced advisers," Huub said.

Huub also recalled that in the beginning, it was through an innovation grant from the university that allowed them, as students, to explore the technology and develop a prototype that demonstrated some business viability. He said that the grant was a stepping stone for them to be able to raise more funding from investors to continue building the company.

What's next for Structo? Huub shared that the team hopes to continue helping dental professionals be more efficient with the dental appliance manufacturing process, as this leads to lower production costs, thus making dental treatment more accessible to a wider demographic.

He said: "The best part about 3D printing and the dental industry is that it is only getting started. There is still so much room for innovation and novel ideas. With the help of our stakeholders, we will continue to innovate and hopefully deliver more products that will be able to solve more problems."

IN PURSUIT OF HIGHLY EFFICIENT SOLAR CELLS

A Singapore scientist wants to break new ground with perovskite solar cells

MANY countries around the world have turned to solar power as a source of clean and renewable energy. In Singapore, solar energy is the most promising renewable energy source due to its availability and potential for wide scale deployment.

What is lesser known is that typical commercial solar cells can achieve an efficiency of only 15% , which means that 15% of sunlight is converted into electricity while the other 85% gets lost. Even perovskite solar cell, touted as a revolutionary breakthrough in the field of solar energy, can ideally reach an efficiency of only 33%.

Now, this boundary could be pushed further as a NTU scientist has found a theoretical way to achieve an efficiency of up to 66%.

Associate Professor Sum Tze Chien first used femtosecond lasers – very fast lasers that work at 100 billion times faster than a camera flash – to map out the pathways of how energy gets lost in solar cells.

His next step was to find a solution to reduce the amount of sunlight that gets lost. This happens when electric charge-carrying particles (hot-carriers) in the perovskite layer of solar cells lose energy as heat and cool down while transporting solar energy.

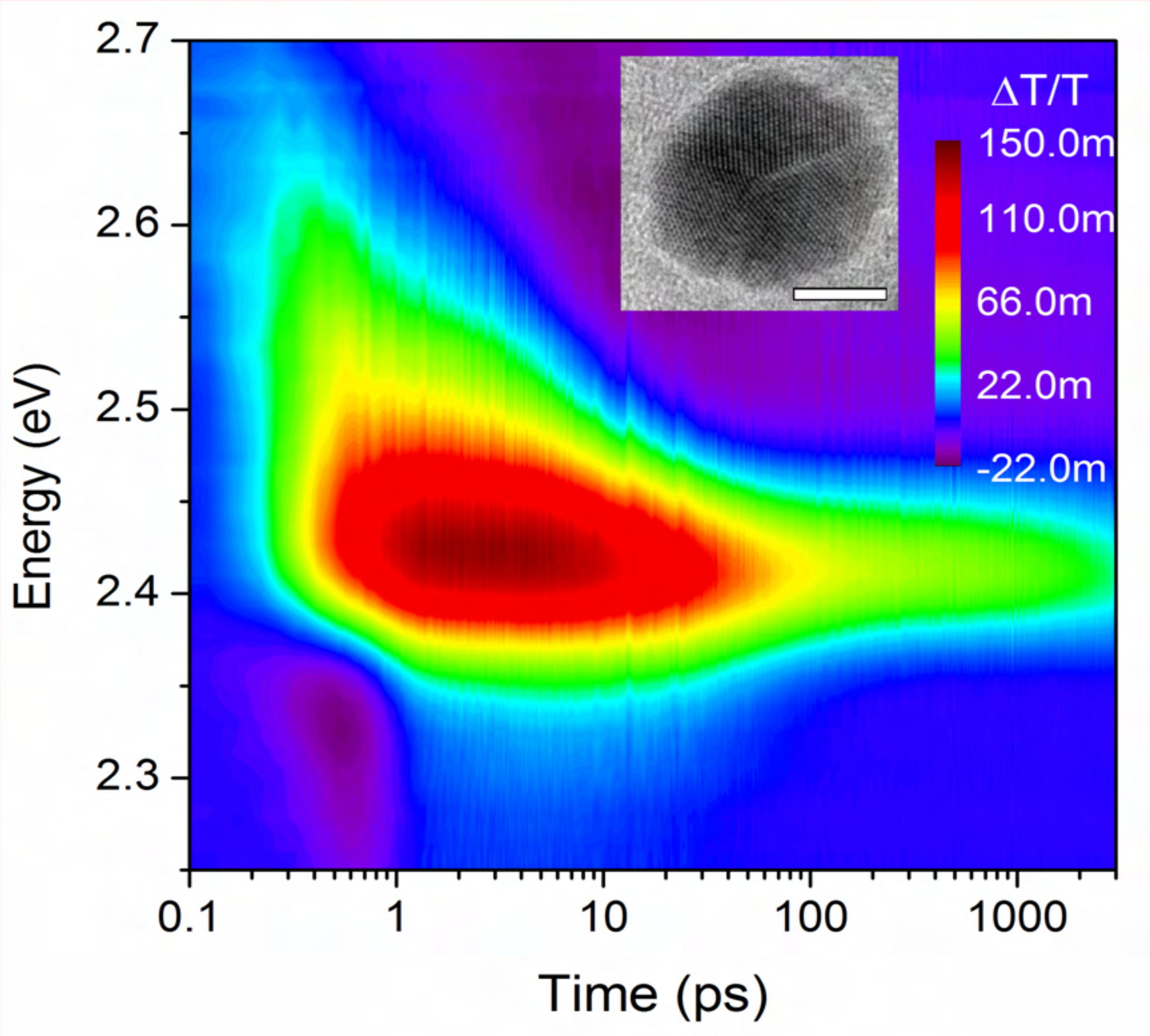
The key in increasing efficiency is hence to slow down the cooling process, by 'recycling' and recapturing the lost heat. By using colloidal perovskite nanocrystals, which are smaller than 10 nanometres in size (or 10,000 times smaller than a strand of hair), the hot-carriers cannot dissipate heat fast enough due to a bottleneck effect. The hot-carriers get reheated again, which significantly slows down the cooling process.

Associate Professor Sum said that by slowing down the cooling process by as much as 100 times, a much greater part of sunlight can be harvested for electricity. Theoretically, this could increase the efficiency of perovskite solar cells to 66%, which means low-cost and high-efficiency solar cells could become a reality.

He is presently working towards creating a perovskite solar cell that reaches 40% efficiency, by designing efficient pathways to channel the hot-carriers from the perovskite nanocrystals to the electrical contacts of the solar cell. The challenge is to minimise losses along these channels to make a prototype hot-carrier perovskite solar cell.

In 2012, perovskites achieved more than 10% efficiency and gained international attention in the scientific community as a viable material for solar cells. Scientists then did not know why perovskites work so

Associate Professor Sum Tze Chien with spectrometers used to track the hot carrier cooling processes in perovskite nanocrystals. Photo: NTU



This figure shows a pseudo-colour transient absorption spectrum of perovskite nanocrystals near its energy bandgap, showing how the pervoskite nanocrystals absorb light energy and then transfer the energy as they recover in a short time. Inset shows a transmission electron microscope image of one of the perovskite nanocrystals (white scale bar = 5 nanometers). Photo: Associate Professor Sum Tze Chien

efficiently. Associate Professor Sum and his team were the first to uncover perovskites' secrets of transporting electric charges very efficiently over long distances. His groundbreaking work was subsequently published in one of the world's top scientific journals, *Science*, in October 2013.

Since then, he has been using femtosecond lasers in his research to understand and optimise the energy harvesting processes to create high-efficiency solar cells. In 2017, he was awarded the National Research Foundation Investigatorship award, which provides opportunities for established researchers in their mid-career to pursue ground-breaking research.

He said: "The National Research Foundation Investigatorship award will allow me to further develop this idea and hopefully translate it into a disruptive technology that will place Singapore on the world map of photovoltaics."

Aspiring to be a world leader in the field of perovskite optoelectronics, Associate Professor Sum seeks to leverage the fundamental scientific discoveries and engineering innovations from perovskites to develop deep tech applications for Singapore and the world.

He has since filed a patent on his discovery of slow hot carrier cooling in colloidal perovskite nanocrystals, as well as several other patents in perovskite lasing, perovskite spintronics and perovskite nanoparticles for nonlinear imaging.

"I firmly believe that low-cost photovoltaic technologies will address one of mankind's greatest challenges of curbing greenhouse emissions while satisfying our energy needs from clean sustainable sources. Low-cost photovoltaic technology is also the key to securing Singapore's energy security and future," he said.

The NRF Investigatorship is designed to support excellent Principal Investigators who have a track record of research achievements that identify them as leaders in their respective fields of research.

MYSTERY OF THE NANOSCOPE

SINCE the invention of the optical microscope in the 17th century, scientists and doctors have used it to magnify and study tissues, cells and micro-organisms that cannot be seen with our naked eye. However, microscopes can only show objects up to 200 nm in size, which means there are still many objects too small to be seen.

One example is viruses. Coronaviruses, the cause of viral outbreaks like the severe acute respiratory syndrome (SARS), measure between 100 and 140 nanometres in diameter and can only be seen using nanoscopes.

Scientists can use microscopy techniques to push the boundaries of a regular microscope, such as treating samples with fluorescent molecules to enhance the imaging. However, these invasive methods are less than ideal as they can modify biological specimens in the process.

An invention from researchers at the National University of Singapore's Department of Electrical and Computer Engineering has made it easy and cheap to upgrade microscopes to nanoscopes using just miniature glass spheres. An added bonus – it can even image live biological specimens under natural light without damaging or harming the specimens.

Professor Hong Ming Hui, one of the lead researchers involved in the invention, shared that the miniature glass spheres – known as microspheres – act like tiny magnifying glasses to enhance the resolution of a microscope by 10 times.

The interaction between the microspheres and the specimens is then captured by an optical detector. Piecing together the images from the separate microspheres to create an enhanced and zoomed-in image of the specimen can provide scientists with greater insight, beyond what a regular microscope is capable of.

In fact, this invention set a new world record for optical microscopy technology in 2016, by showing precise details of specimens that are only 23 nanometres in length.

By modifying regular microscopes, this invention also means that the resulting nanoscope is easy to operate and does not require special user training. It can be used by science teachers in schools, inspection workers in chemical and electronic factories, doctors and nurses for early diagnosis of viral outbreaks, as well as for scientific research in laboratories.

The patented design has been recognised in Singapore and internationally, having received the Prestigious Engineering Achievement Award 2016 from the Institution of Engineers Singapore (IES), and the Outstanding Engineering Achievement Award 2016 by the Association of Southeast Asian Nations (ASEAN).

Spurred by a belief that technological innovation should be used to improve people's lives, Professor Hong went on to commercialise the technology through a spin-off company called Phaos Technology Pte Ltd – which means "light" in Greek.

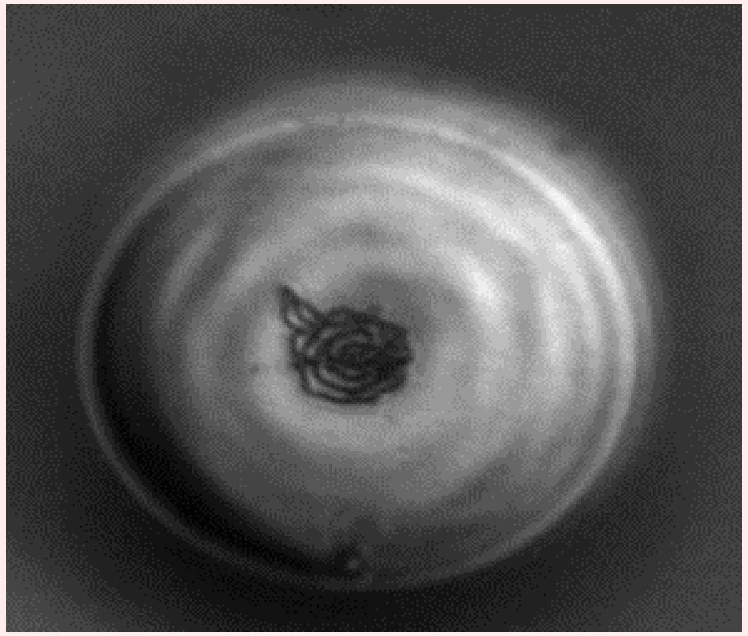


Image of a flower seen from a nanoscope. The size of the nano-flower is one micrometre. Photo: Professor Hong Ming Hui

Since Phaos Technology was established in March 2017, it has received positive feedback and strong order numbers from businesses. Companies in microelectronics, biomedicine and education have also expressed interest in research collaborations and technology commercialisation. Phaos Technology is expected to record an increased order of over a hundred optical nanoscopes in three years, and occupy a piece of the global market share

This research was supported under the National Research Foundation Singapore's Competitive Research Programme.

BIO-BASED ECONOMY GAINS MOMENTUM

THE National Research Foundation Singapore announced a new $25 million Synthetic Biology R&D Programme to advance Singapore's synthetic biology research agenda and expertise.

Over the past few years, Singapore has invested significantly to strengthen synthetic biology research capabilities here. It has since developed an expertise in the field with our deep research knowledge and talent. The new Synthetic Biology R&D Programme seeks to build on existing research capabilities and ensure the translation of research outcomes for clinical and industrial use. For example, the programme will look into the production of rare fatty acids through bio-based methods to meet industrial needs for this biochemical.

Associate Professor Matthew Chang from the National University of Singapore's Synthetic Biology for Clinical and Technological Innovation research programme tells us the potentials of synthetic biology research for Singapore.

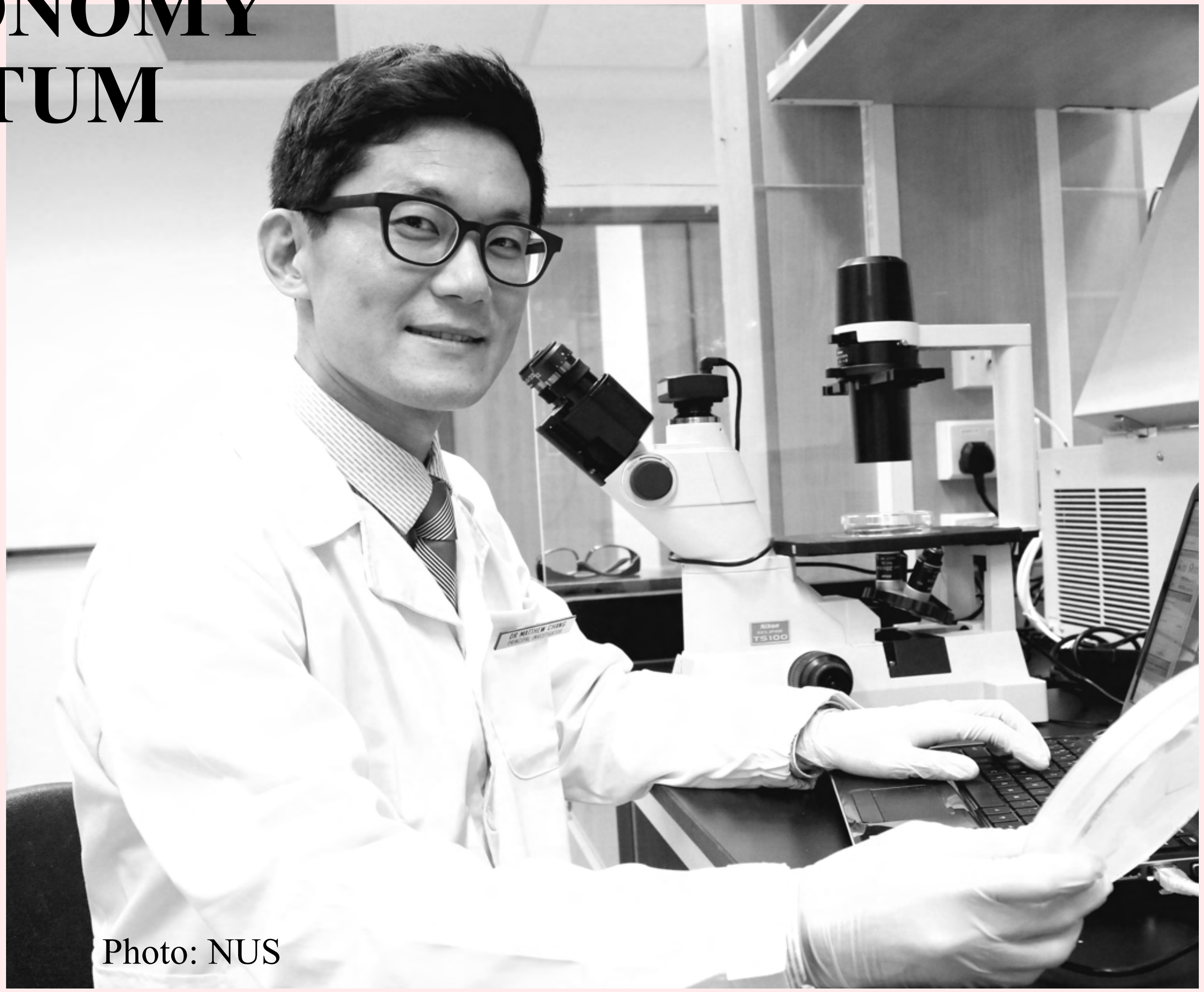


Photo: NUS

Can you explain to our readers what is synthetic biology?

Synthetic biology is often referred to as the engineering of biology. Scientists take parts of natural biological systems, understand and simplify them, and use these parts as building blocks to create new functions in a microorganism or cell.

Simply put, it is the design and building of biological systems to improve existing functions or introduce new purposes.

How would Singapore benefit from developing a bio-based economy?

Given that fossil resources are dwindling and set to become ever more costly in financial and environmental terms, the world is increasingly aware that our current fossil-based economy is unsustainable.

A bio-based economy can reduce broad-scale dependency on fossil fuels not only for energy applications but more importantly for biochemicals, biomaterials and bioplastic production.

Singapore is well-positioned to develop a bio-based economy as its location in the heart of Southeast Asia offers accessibility to renewable biological resources such as biomass derived from agricultural and industrial waste. Development of a bio-based economy in Singapore can promote technological innovations that can give rise to new products, services and jobs, fueling economic activities in a burgeoning field that holds much promise.

How does synthetic biology R&D help to boost economic growth? Any successful examples so far?

There is growing recognition of the potential of synthetic biology in contributing to the bio-based economy. In particular, synthetic biology R&D can accelerate existing efforts to translate academic research into useful applications in the areas of healthcare, food, energy and the environment.

One successful example is the establishment of the Singapore Consortium for Synthetic Biology (SINERGY). By consolidating Singapore's capabilities in synthetic biology, and harnessing synergies across industry sectors, SINERGY is positioned to create a vibrant and globally connected community that can drive the bio-based economy in Singapore.

Technical interactions and co-development between industry, universities and research institutes will not only boost the translation of synthetic biology for industrial applications but will augment the development of skilled manpower needed to support the bio-economy.

Can you tell us more about your project to synthesise rare fatty acids biologically? How would the public or industries benefit from such a development?

Rare fatty acids are fatty acids that are scarcely produced in nature. As they are important versatile precursors in the chemical manufacturing industry and can also serve as nutrient supplements, rare fatty acids command a large market demand. Unlike abundant fatty acids which can be obtained at low cost from natural sources, such as palm oil, bulk extraction of rare fatty acids from natural sources is impractical.

"Singapore is well-positioned to develop a bio-based economy as its location in the heart of Southeast Asia offers accessibility to renewable biological resources such as biomass derived from agricultural and industrial waste."

- Associate Professor Matthew Chang

Currently, rare fatty acids are synthesised chemically from fossil resources via harsh, energy-intensive processes that results in high manufacturing costs. Thus, by developing efficient and economical bio-based methods for the production of rare fatty acids, the availability of rare fatty acids will be comparable to that of abundant fatty acids, offering a comprehensive profile of fatty acids to meet the needs of the chemical industry.

The project to produce rare fatty acids biologically aims to develop a microbial platform for high-level production of rare fatty acids.

Increasing the availability of rare fatty acids is highly advantageous to the chemical and pharmaceutical manufacturing industry as it boosts the chemical feedstock and can potentially lower production costs. The project can also benefit industries by training manpower for bio-based manufacturing and positioning Singapore to capture the large profitable market in the production of rare fatty acids, which has yet to be capitalised.

In addition, this project can benefit society by improving food safety through the development of bio-based production of food ingredients, thereby reducing reliance on chemically-produced components in food products.

Over the past few years, Singapore has built up strong synthetic biology research capabilities and expertise in the local ecosystem, primarily through NRF's Biological Design Tools and Applications (BDTA) thematic grant call and its Competitive Research Programme (CRP). In 2015, NUS set up the Synthetic Biology for Clinical and Technological Innovation (SynCTI) research programme to develop novel biological and biologically-based systems with advanced clinical and industrial applications. In 2016, the Singapore Consortium for Synthetic Biology (SINERGY) was launched to translate research outcomes under the BDTA, CRP and SynCTI into industry applications.

RIE news is an e-magazine produced by the National Research Foundation Singapore.
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