

# Asia Nano Forum NEWSLETTER

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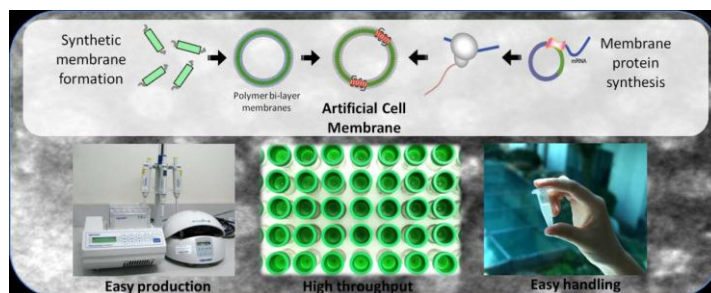
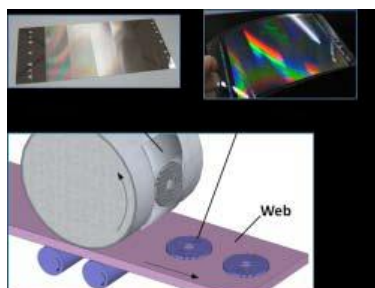
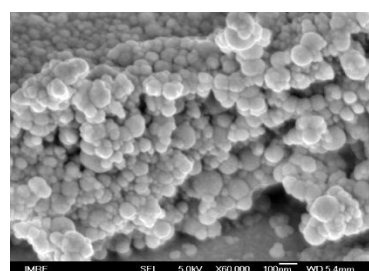
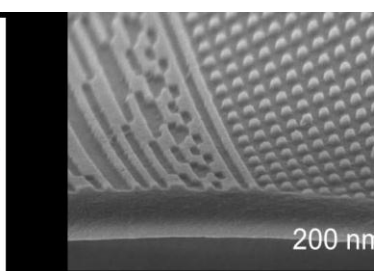
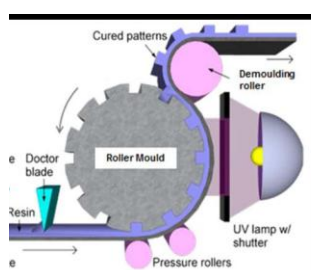
**ANF Secretariat, Singapore**

**July 2014**

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## NEWS

### ✧ Partnerships/Collaborations

#### Japan (Source: AIST)

##### ◆ *New system for using AIST-SCR open facilities*

A new system has been established that allows people to make use of AIST's open facilities. We encourage people to make use of this new system. Use of an application form and standard responses based on a user agreement makes the procedure for using the SCR easy.

In principle, intellectual property rights obtained by the user through use of the facilities belong to the user. There are clear rules about the management of confidential information. Costs can be easily estimated based on a unit price list. This system is initially being applied to the SCR, but there are plans to expand the system to apply to other open facilities.

The super cleanroom (SCR) provides process equipment for the fabrication of general-purpose semiconductor integrated circuits using 300 mm and 100 mm silicon wafers. Research and development, as well as individual process modules and stand-alone processes can be performed utilizing the process menu shown below.

We also provide support for development of new techniques by offering advice on the use of pre-cleaning and contamination control. Processes currently available:

- For CMOS (300 mm wafers)
- Bulk & SOI Lg ~65 nm transistor processes
- 2-level Cu damascene metallization
- 1000Tr small circuit processes with gate length of 130nm – 250nm (in preparation)
- For Si-photonics (300 mm wafers)
- Processes for passive Si-Photonics components
- Active Si-Photonics component processes (in preparation)



[Website](#) of Open Research Facility Coordination Office, Tsukuba Innovation Arena Headquarters, National Institute of Advanced Industrial Science and Technology (AIST),.

#### Malaysia (Source: Nano Malaysia)

##### ◆ *Malaysia-Australia Network Workshop*

June 2013 - Malaysia and Australia shared expertise in the field of solar energy during the Malaysia-Australia Network Workshop at the University of Western Sydney (UWS), recently led by Prof. Dato' Dr. Zul Azhar Zahid Jamal, Universiti Malaysia Perlis (UniMAP). Six other participants are Prof. Shamsul Baharin Jamaludin and Dr. Muhammad Asri Idris from UniMAP, Assoc. Prof Dr. Nafarizal Nayan and Dr. Mohd Zainizan Shahdan from Universiti Tun Hussein Onn Malaysia (UTHM), Prof. Pauzi Mohd Zakaria from Universiti Putra Malaysia (UPM) and Dr. Al-Khalid Hj. Othman from Universiti Malaysia Sarawak (UNIMAS). This collaboration gained support from the

Malaysian consulate who attended the ceremony. In addition, the Australian Renewable Energy Agency (ARENA), a potential contributor within the network in Australia, was also present to express their support. The UWS party described in detail the direction of this collaboration which they projected to last for a period of six years. The Australian Nuclear Science and Technology Organisation (ANSTO), which became part of the UWS network, offered many services that could be utilized for this collaborative network. The services include advanced characterization of surface materials such as *Small Angle X-ray scattering (SAXS)* and *Small Angle Neutron Scattering (Quokka)*.

◆ *NanoMalaysia Berhad (NMB)'s collaboration with IBM Research Australia*

July 2013- NanoMalaysia Berhad (NMB)'s collaboration with IBM Research Australia and University Malaysia of Computer Science and Engineering (UniMy) will include the forming of the National Centre of Excellence (CoE) in Computational Sciences with a focus on supporting research activities in various computational modelling in nanotechnology. NMB will collaborate with IBM and UniMy on several platforms including providing a commercialisation platform and industrial relations for the CoE. UniMy is proposed to provide human capital whilst IBM to provide support in the form of hardware supplies and facilities. In addition, clear outcomes in Intellectual Properties (IPs) and publications are identified as one of the goals from the collaboration with forums or workshops.

◆ *August 2013 - NanoMalaysia Berhad (NMB)'s collaboration with Helmut Fisher*

NanoMalaysia Berhad (NMB)'s collaboration with Helmut Fisher to set up a shared service laboratory facility, to be known as Helmut Fischer NanoMalaysia Technology Laboratory for Nano Scale Testing & Measurement (“HF-NM NANOLAB”), at NanoMalaysia Berhad, located in Iskandar Malaysia, South Johor or any other geographical area deemed fit for the proposed laboratory in Malaysia. The investment for this HF-NM NANOLAB facility is for the acquisition, maintenance and operation over three (3) years period, of the laboratory hardware, software and services, supplied by Helmut Fischer, with investment from the Government of Malaysia and Helmut Fisher. This lab facility will be the first of such shared service nano-scale precision testing laboratory outside of Europe. NMB has executed a MoU on the March 2014 and the MoU was signed by the CEO of HF (Switzerland).

◆ *August 2013 – NanoMalaysia Berhad (NMB) and IBM have signed a joint development agreement*

NanoMalaysia Berhad (NMB) and IBM have signed a joint development agreement (JDA) to create nanogel star polymer based materials that will ease access to antimicrobial coatings and drug delivery applications in the healthcare industry. IBM Research will provide training for Malaysian scientists at its Almaden Research Centre in the United States. This research and development programme will be conducted over three years. NMB will select up to 36 researchers to participate in this programme on six month rotations at IBM's Almaden Research Centre in an exchange programme that will provide researchers with a platform to increase their skills, gain first-hand knowledge in an international researchers as well as gain crucial experience in research areas which are critical to industrial need and the advancement of technology in Malaysia. The first team of five researchers have been sent to the IBM research laboratories in Almaden and returned in March 2014.

In February 2014, the second team of six researchers has been sent to IBM Almaden's research lab to conduct research on anti-microbial coating and drug delivery application using star polymer. The joint work on platform development and testing will be an iterative process, to identify the most viable materials candidate. These researchers will explore

novel candidates to antimicrobial films, and gels, exploiting living polymerization, polymer modification chemistry, etc. The team will provide synthesis, characterization and early microbiology testing feedback to Malaysia regarding the novel candidates.

♦ *NanoMalaysia Berhad's collaboration with University Technology PETRONAS*

March 2014 – NanoMalaysia Berhad (NMB) and University Technology PETRONAS (UTP) have signed a MoU for the “Cooper-Nanotubes Nanocomposite Thermal Management Technology Transfer and Commercialisation”. This will play an important role in the development and roll out of thermal management of the LED industry in Malaysia. It is to exploit UTP's background technology and technology know-how by forming a general framework for new business development with potential business partners of new invention and/or innovation of nanotechnology product through various commercialisation processes. An achievement such as this will be beneficial to many sectors such as electronics, automotive & IT among others.

**New Zealand** (Source: Univ. of Canterbury)

♦ *MOU signed between the MacDiarmid Institute and Publons:*

Publons is a Wellington-based startup company launched by one of the MacDiarmid Institute's alumni – Andrew Preston. Publons' mission is to speed up science through better peer review. Essentially they want to ensure that your research has greater impact, and that the peer review process is open, transparent and you get credit for doing it. Joint strategic interest in building an active MacDiarmid Institute alumni that generates and delivers benefits from/to all members, facilitating and supporting start-up company growth in the high tech sector, promulgating best practice experiential education and delivering the greatest impact from scientific research. ([source](#))

**Singapore** (Source: IMRE)

♦ *Materials Centre of Innovation established to benefit SMEs*

The new Materials Centre of Innovation was launched to help small and medium - sized enterprises by making advanced materials technology accessible to them. This collaboration by IMRE and SPRING Singapore will offer solutions or create new products for commercialisation while assisting local SMEs in breaking new ground through the development of proof-of-concepts, product prototyping or fabrication scaling. The Materials COI will be the seventh Centre of Innovation in Singapore and is expected to support over 450 SMEs across a variety of industries in Singapore.

The Materials Center of Innovation (MCOI) at the Institute of Materials Research and Engineering (IMRE) was established in partnership with SPRING with the mission of helping local businesses better utilize technology innovation to increase their productivity and further their economic growth.

At the MCOI our aim is to help businesses get the best from the materials they use in their product or service. We believe that understanding the material properties and how to tailor them to best suit the application is critical to success.

Local SMEs can take advantage of the materials expertise of the MCOI to address a particular problem or challenge they face. Additionally, SME's can utilize the materials technologies that have already been developed within MCOI and IMRE.

◆ *A\*STAR'S IMRE ties up with Japanese consumer care giant for more environmentally-friendly household products*

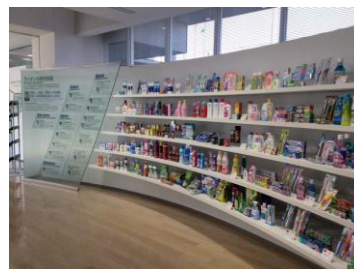
LION Corporation, one of Japan's largest multinational companies will be working with A\*STAR's Institute of Materials Research and Engineering (IMRE) to develop safer, anti-odour and anti-bacteria household products that eliminate the use of harmful biocides.

A\*STAR scientists and LION Corporation are using a multi-purpose, highly customisable molecule and all natural material formulations to develop products that keep laundry smelling fresh and kill bacteria, without relying on chemical biocides that are found in some current household products. Such a move also prevents the growth of biocide-resistant bacteria in the long run. Legislation is being debated in the USA to ban such biocides in the future<sup>1</sup>.

<sup>1</sup> Safety and Effectiveness of Consumer Antiseptics; Topical Antimicrobial Drug Products for Over-the-Counter Human Use; Proposed Amendment of the Tentative Final Monograph; Reopening of Administrative Record; A proposed rule by the US Food and Drug Administration; 17 December 2013.

LION, a major manufacturer of detergents, soaps, medications, oral hygiene products and other toiletries, will leverage IMRE's technology to develop new improved formulations for their products. The company signed a Research Collaboration Agreement (RCA) with IMRE to develop this technology. This agreement is the first of its kind for LION in Singapore. Both organisations are also looking to set up a joint laboratory at IMRE where scientists from IMRE and LION can work on the project together.

Most household products are a mix of surfactants for removing dirt, fragrance enhancers and chemical biocides to kill germs. Some of the surfactants and chemical biocides ultimately leach into the environment through water run-off. IMRE has been working on a host of all-purpose, natural polymers that are more environmentally friendly as part of IMRE's Consumer Care Technology Programme. The multi-purpose molecule being used in the project is one of more than a hundred proprietary molecules that IMRE has accumulated in its fast-growing polymer bank.



"The specially created polymer molecules and materials used in the project are unique to IMRE," says the lead IMRE researcher for the project, Dr Loh Xian Jun, who is also the Programme Manager for A\*STAR's Personal Care Programme. Dr Loh explains that the highly stable and customisable base polymer molecule can be "accessorised" with different polymer chains to suit different purposes. Such base polymers form the backbone for a multitude of different molecular combinations that can be tailor-made to suit different functions, from anti-bacteria to fragrance-enhancement, in one molecule. "We are building a library of such multi-purpose molecules that can be pulled out at any time to cater to specific needs of different companies."

"LION has been promoting its international operations with a focus on Asia, and we have been keeping our eye on Singapore as a regional R&D hub," says Dr Toshio Kakui, Director and Executive Officer of LION Corporation.

“A\*STAR’s IMRE, a research institute with first-rate polymer technologies, has a good reputation and has collaborated with a variety of companies around the world. Therefore, LION is confident that this research collaboration with IMRE will lead to an enhancement of LION’s own technological capabilities and development of innovative products.”

“People know LION because their products penetrate almost every household, from detergents to shampoo, and from mouthwash to toothpaste. Isn’t it a wonderful opportunity to collaborate with a company as innovative and successful as LION?” says Prof Andy Hor, Executive Director of IMRE. “This is how we see the benefit of research in polymers and gels – shaping lives and improving living”.

The research team expects development of the new formulation to be completed by the second half of 2015.

## Taiwan (Source: NPNT)

### ◆ NPNT, Taiwan joins the M-ERA.NET Call 2013

NPNT is one of the observers and the first partner from Asia for [M-ERA.NET](#) --- the European joint strategic program, which is developed by a network of national and regional funding organizations, systematically advised by external high-level experts selected from the European RTD community. [M-ERA.NET Call 2012](#) selected 23 full proposals for funding, and Taiwan is participating in 2 of the projects. This year, Taiwan has 5 full proposals submitted for [M-ERA.NET Call 2013](#).

## Thailand (Source: NANOTEC)

### ◆ The official Royal opening of new NANOTEC Complex

On 31 March 2014, Her Royal Highness Princess Maha Chakri Sirindhorn presided over the official opening of new NANOTEC Complex, at Innovation Cluster 2 (INC2), Thailand Science Park. A team of researcher from NANOTEC Characterization



Laboratory applied the AFM-Raman Spectroscopy to draw the nanoscale imaging of HRH’s signature as a highlight of the opening ceremony. The royal visit program included a visit as follow;

### ◆ Thailand-SKKU Nanotechnology Workshop

NANOTEC in collaboration with Sungkyunkwan University-SKKU (Korea) organized Thailand-SKKU Nanotechnology Workshop on 15-16 January 2014, at Thailand Science Park. The event aimed to strengthen scientific collaboration between the two countries.



The workshop was one of the research exchange activities that would be implemented to enhance the nanotechnology research capabilities of both countries. There were specific research topics that are of much interest to Korean and Thai researchers. The workshop consisted of scientific presentations and discussions in order to explore collaboration and opportunities for scholarships by both countries.

## ✧ Commercialization

### Iran (Source: INIC)

#### ◆ *Iran lab Expo 2014 receives \$65 million order for Nanotechnology Devices*

The second “Exhibition of Laboratory Devices and Materials Made in Iran” was held in Tehran International Permanent Fairground on 27-30 April 2014, and 195 companies presented more than 4,000 products in the exhibition. Among 195 companies that participated in the Exhibition, 33 equipment manufacturing companies active in the field of nanotechnology presented over 200 laboratorial and industrial devices that are commonly used in nanotechnology. According to the secretariat of the second “Exhibition of Laboratory Devices and Materials Made in Iran”, a sum total of 2,632 invoices – approximately \$65 million worth – have been registered to purchase nanotechnology devices presented in the exhibition.

Among the devices there were presented in the field of nanotechnology in the exhibition, mention can be made of products such as scanning tunneling microscope, atomic force microscope, vibrating sample magnetometer, electrospinning, capillary electrophoresis, various coating and deposition systems, gas and two-dimensional chromatography equipment, porosimetry and specific area measurement systems, and metallic nano-colloid and nanopowder production equipment.

The majority of the products have been produced based on Iran Nanotechnology Initiative Council’s plans and support, and 46 devices have succeeded in the acquirement of nanoscale certificate. The total number of invoices to purchase nanotechnology equipment in the First Exhibition of Laboratory Devices and Materials Made in Iran was 550, which was held in April 2013.

#### ◆ *Iran to Hold 2nd Prototype Nanotechnology Products Competition*

The second competition of Iran Prototype Nanotechnology Products will be held in 2014. In line with supporting the commercialization of the achievements of Iranian researchers, Iran Nanotechnology Initiative Council supports the production of prototype by university students, university professors, researchers, technologists, and knowledge-based companies in the field of nanotechnology in form of Prototype Producing Competition.

To this end, a special zone was allocated to the demonstration of the chosen prototypes in the Sixth Iran Nano Festival. The second competition will be held in 2014, and the best plans will be displayed in the Seventh Iran Nano Festival.

In addition to rewarding the best plans, Iran Nanotechnology Initiative Council will support the commercialization of the plans that succeed in attracting an investor during the festival.

Prototype competition provides the researchers and small companies with the opportunity to put on display their innovative products, especially to people who are interested, visitors, industrialists, and investors so they can take advantage from investment chances.

### Malaysia (Source: Nano Malaysia)

- ◆ *Universiti Malaysia Sabah (UMS) will be a commercialisation research centre in the field of nanotechnology,*

July 2013- Universiti Malaysia Sabah (UMS) will be a commercialisation research centre in the field of nanotechnology, following its recent collaboration with the Tokyo Institute of Technology (TITEC). UMS vice-chancellor, Professor Datuk Dr. Mohd Harun Abdullah, who led a delegation to Tokyo recently to discuss commercialising nanotechnology products, particularly nanofibres and nanomembranes, shared that in the meeting with TITEC's executive vice-president, Professor Kiyoshi Okada, both parties have agreed that UMS will be the research site for commercialisation efforts. Oil and gas-based companies in Malaysia identified to become collaborative partners in this initiative. Nanofibre products could be used as oil spill absorbing materials, while nanomembrane products could be used for the distillation of sea water and industrial liquid waste to produce clean water. A study by UMS and TITEC found that nanofibres could absorb up to 50g of oil per gram of fibre in less than 30 seconds. The system is expected to clean oil spill at a rate of one tonne of oil per hour. In the distillation process, the nanomembrane is also expected to save energy by more than 50 per cent compared to reverse osmosis systems.

- ◆ *NanoMalaysia Berhad (NMB) has engaged with Biotech Corporation Malaysia (BiotechCorp) to tap prospective business ventures*

October 2013 - NanoMalaysia Berhad (NMB) has engaged with Biotech Corporation Malaysia (BiotechCorp) to tap prospective business ventures between NMB and BiotechCorp. A Confidential Non-Disclosure Agreement (CNDA) has been signed and a joint workshop with Biotech Corporation was organised on the 6<sup>th</sup> November 2013. This workshop was jointly organised by BiotechCorp, Universiti Sains Malaysia (USM) and NanoMalaysia Berhad (NMB) and designed to become a high level brainstorming session between government agencies, researchers from local research institutions, and local industrial players. The main goal of the workshop is to verify and validate a few nano-biotechnology products under the BiotechCorp Nanotechnology Platform in the fields of medical (non-oncology) and non-medical as well as to identify the possible applications and commercialisation paths of three (3) nanoparticles technologies licensed to BiotechCorp and five (5) applications developed by USM researchers.

- ◆ *NanoMalaysia Berhad (NMB)'s collaboration with Malaysian Debt Venture (MDV)*

July 2013 - NanoMalaysia Berhad (NMB)'s collaboration with Malaysian Debt Venture (MDV) to collaborate and assist various financing schemes available under its arms, including Syariah Compliant Financial programmes to facilitate pre-commercialisation, commercialisation and/or adaptation of nanotechnology.

### **New Zealand** (Source: Univ. of Canterbury)

- ◆ *Global partnership for New Government funded research*

A New Zealand Government-funded research project has signed a partnership agreement with GE Healthcare, the world's largest medical technology company, to work together on a ground-breaking medical imaging product. MARS spectral imaging is a revolutionary x-ray technology project developed as a collaborative effort, led by the Universities of Canterbury and Otago based in Christchurch. The Ministry of Business, Innovation and Employment (MBIE) has invested \$4 million over 6.5 years in the project through its High Value Manufacturing Services Research Fund. ([Source](#))

♦ *Alumnus appointed CEO*

*Dr Ojas Mahapatra, who recently finished his doctorate in Physics at University of Canterbury, has been offered the role of the CEO of a Dunedin based company Photonic Innovations Ltd. He was supervised and mentored by Prof Simon Brown in his doctoral research. Photonic Innovations Ltd is a spin out from University of Otago that aims to commercialize a novel gas detection technology developed jointly at The Dodd Walls Centre for Quantum Science and Technology and Department of Physics. The gas detection technology boasts of very high accuracy, fast response time, calibration and maintenance free features and it virtually eliminates false alarms (a common issue with most gas detector currently in the market). Ojas joined the Physics department at the University of Canterbury in 2010 after completing Master degree from SRM University, India ([Source](#))*

**Singapore** (Source: IMRE)

♦ *Made-in-Singapore glasses-free 3D film on mobile devices wins prestigious Engineering Prize*

EyeFly3D, the screen protector that turns ordinary mobile devices into 3D viewing platforms won the Technology Innovation category in the Institution of Engineers Singapore (IES) Prestigious Engineering Achievement Awards 2013. The award recognises Singapore-based engineering projects that demonstrate outstanding engineering skill and help better the quality of life. The win is also a testament to the ingenuity and creativity of A\*STAR and Temasek Polytechnic (TP) scientists in turning lab research into a viable consumer product. <sup>1</sup>

Launched earlier this year, EyeFly3D, the first glasses-free 3D accessory for smartphones, has just picked up its first award from IES. The technology is based on a simple concept of taking a regular plastic film and engineering about half a million uniform-sized mini lenses onto its surface, turning the plastic into an add-on screen protector that produces unprecedented, distortion-free, brilliant 3D content on mobile devices. Unlike some thicker glasses-free 3D filters, this award-winning technology does not affect the touchscreen sensitivity, brightness and resolution of the smartphones. At a mere 0.1mm, EyeFly3D is the first glasses-free 3D accessory that can display content in both portrait and landscape mode, doing away with the need for cumbersome 3D glasses and power-draining and costly built-in 3D screens.

For this engineering feat, scientists from A\*STAR's IMRE and TP employ a combination of materials nanotechnology and integrated software, using a unique nanoimprinting process on the plastic - akin to making a waffle - to create an array of high resolution lenses. The engineered lenses are so small that they are barely visible to the human eye and do not impact the visual quality of mobile screens as seen through the plastic. Hence users can enjoy both seamless 2D and 3D effects on the same screen protector, compared to other films available in the market that may distort normal screen visuals. Coupled with the proprietary TP-developed software applications for both the Apple iOS and Android platforms, mobile device users are able to play 3D content via the film, in both landscape and portrait formats, and these applications also allow 2D pictures taken to be converted into 3D. A software development kit is currently underway to enable game developers to convert their existing games into 3D versions.

Entrepreneurship support and vital funding from A\*STAR's commercialisation arm, ETPL, were the main drivers in translating the nanoimprint research into a consumer product by driving proof-of-concept prototypes and generating market interest at major events like Singapore's TechVenture 2012 and the premier Consumer Electronics Show at Las

Vegas this year.

“The award is a testament to an engineering breakthrough that has provided a local Singaporean company the opportunity to lead on the world stage. It also shows how Singapore can couple its creativity into a commercial proposition,” said Nanoveu Pte Ltd Founder and CEO, Mr Alfred Chong. Nanoveu will be rolling the product out to Europe, the USA, Japan and Australia in time for Christmas this year. China and other Asian markets will quickly follow in early 2014.

“We get a lot of positive attention wherever we demonstrate EyeFly3D,” added Mr Chong. “We think the biggest game changer will be our iPad model which is scheduled for release in Q1, 2014.” At the moment EyeFly3D is available for the iPhone 5 and 4S models and the iPod Touch 5. The company is planning to release new models for the iPhone 5C and 5S and selected Android phones by the end of the year. Since its launch in April 2013, EyeFly3D has been sold to consumers in over 61 countries.

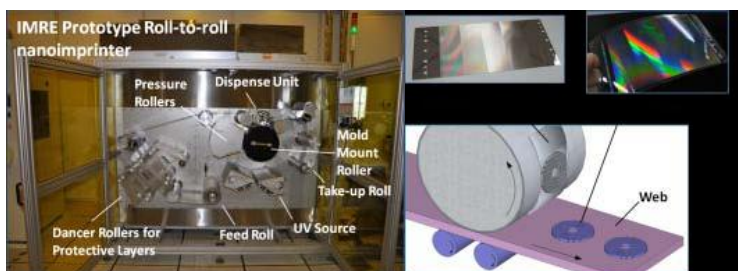
“EyeFly3D demonstrates how we can turn innovative research into competitive technologies and ultimately, products that benefit consumers. The versatile and industry ready nanoimprinting technique allows us to rapidly develop research concepts and designs into functional prototypes that can easily be adapted to mass production,” explained Dr Jaslyn Law, part of the award-winning team and the IMRE scientist who developed the base technology together with TP researchers.

Temasek Polytechnic's Deputy Principal, Mrs Lay-Tan Siok Lie, said: “This project emphasises our continuous commitment to developing and bringing cutting edge technology from lab to market, in close collaboration with our key partners. We are indeed delighted to have been given this award, which endorses our effort in always pushing the boundaries of technology through research & development, while raising the capability of our staff and students in the process. Temasek Polytechnic will continue to strive to add value to the R&D landscape in Singapore through its Centres of Excellence.”

◆ *Paving the way for real-world nanotechnology products*

A\*STAR's new Nanoimprint Foundry will bridge the gap between laboratory-based nanotechnologies and real-world products. This is the first time that Singapore nanotechnology suppliers and manufacturers have been brought together to speed up productisation of nanoimprinting, a technology that imbues ordinary surfaces with unique properties for applications in sectors like consumer care, biomedical devices, optics, filtration, displays and maritime.

Adhesives that leave no sticky residue, ‘skins’ that keep medical instruments germ-free, new anti-reflective protectors for displays or surfaces that prevent barnacles from attaching to ships. These are just some of the products that nanoimprinting technology



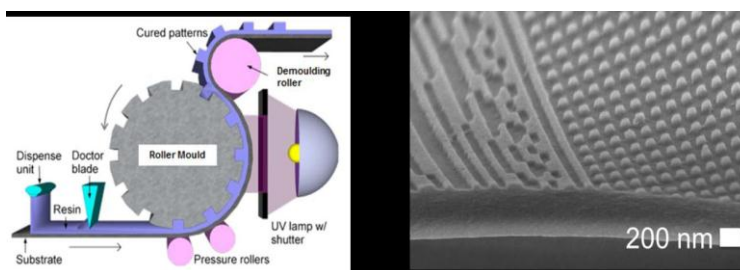
A\*STAR's Nanoimprint Foundry

is capable of producing. A\*STAR's Institute of Materials Research and Engineering (IMRE) and its partners launched a new Nanoimprint Foundry that will develop, test-bed and prototype specially engineered plastics and surfaces for the

specific purpose of commercialising the technologies. Possible applications of nanoimprint technology include dry adhesives, aesthetic packaging, contact lenses, biomedical cell scaffolds, anti-frost surfaces and anti-bacteria materials.

The multi-party investment will bring together national research organisations, suppliers and manufacturers spanning the nanotechnology value chain, and government agencies to promote the technology. The Foundry is part of a masterplan spearheaded by A\*STAR to push translational research and accelerate commercialisation of home-grown technologies. In partnership with other A\*STAR research institutes, IMRE will work with companies like Toshiba Machines Co Ltd, EV Group, NTT Advanced Technology Corporation, NIL Technology ApS, Kyodo International Inc., micro resist technology GmbH, Nanoveu Pte Ltd and Solves Innovative Technology Pte Ltd to produce prototypes for real-world products and applications. The Foundry and its partners will also work closely with Singapore's Economic Development Board (EDB) and SPRING to promote its nanoimprint applications to industry as part of the plans to build up Singapore's high-value manufacturing capabilities.

“We can help companies develop up to 20,000 samples for proof-of-concept and pilot production allowing manufacturers to shorten the product cycle but minus the heavy capital R&D investment”, said Dr Karen Chong, the IMRE scientist who is



Roll-to-roll processing – Nanoimprinting on a large scale

heading the Foundry. Dr Chong added that the Foundry will be a one-stop shop for companies seeking to conceive, design and develop solutions for new, revolutionary products based on the versatile nanoimprint technology.

“The Foundry gives us the tools for creating real products that target industry end users and ultimately consumers”, explained Mr Masayuki Yagi, Director & General Manager, Advanced Machinery Business Unit, Toshiba Machines Co Ltd, Japan on why the company chose to participate in the initiative. “Toshiba Machines and the Foundry will aim to deliver innovative engineering solutions based on nanoimprint and be the best partner for leading industries”.

According to Mr Koh Teng Kwee, Director of Solves Innovative Technology Pte Ltd, “Working with IMRE since ICON 11, I am sure IMRE's nanoimprint technology and know-how is now ready for industrial adoption. In my opinion, IMRE is able to provide everything needed for a new product realisation involving nanoimprinting.”

“There is a billion-dollar, virtually untapped market for new advanced nanotechnology products that can make use of what the Foundry has to offer”, said Prof Andy Hor, Executive Director for IMRE, adding that the initiative will hasten the industrialisation of nanoimprinting in this lucrative market segment. In consumer care for example, the global market for contact lenses - where nanoimprint technology can be used to produce new functionalities like multi-coloured lenses - is expected to grow to USD 11.7 billion by 2015<sup>2</sup>.

“The Foundry is the first one-stop shop to pull different value chain partners together to offer solutions based on nanoimprint through equipment, moulds, materials and applications to end user companies”, said Dr Tan Geok Leng, Executive Director of A\*STAR's Science and Engineering Research Council which oversees a number of the research

institutes dedicated to the physical sciences and engineering. “The new Foundry is part of Singapore’s strategy to create a new, advanced high-value manufacturing sector to support its growing knowledge-based economy.”

“As part of EDB’s vision to position Singapore as an Advanced Manufacturing Hub, we will continue to work with companies to co-create and adopt advanced manufacturing technologies. We see this new Research Foundry as one of the key infrastructures to strengthen nanoscale-manufacturing capabilities in Singapore”, said Mr Yi-Hsen Gian, Director (i3), Economic Development Board (EDB), and Singapore.

The Foundry was launched on 30 September 2013 during a ceremony that also saw collaboration agreements signed between A\*STAR and its industry partners.

- ◆ *New packaging plastic that protects as good as aluminium foil ~Tera-Barrier Films invents alternative stretchable plastic for prolonging shelf-life of pharmaceuticals, food and electronics*

Tera-Barrier Films (TBF) Pte Ltd, a spin-off company from A\*STAR’s Institute of Materials Research and Engineering’s (IMRE), has invented a new plastic film using a revolutionary nano-inspired process that makes the material thinner but as effective as aluminium foil in keeping air and moisture at bay. The stretchable plastic could be an alternative for prolonging shelf-life of pharmaceuticals, food and electronics, bridging the gap of aluminium foil and transparent oxide films.

The new plastic by TBF has one of the lowest moisture vapour transmission rates (*mvtr*), preventing air and moisture from penetrating the layer. The plastic has an air and moisture barrier that is about 10 times better than the transparent oxide barriers which are currently being used to package food and medicines owing to its uniquely encapsulated nanoparticle layer. The film has been validated by a number of companies and potential commercialisation partners.

TBF’s 700nm encapsulated nanoparticle barrier films - which are thinner than a strand of human hair - have high transparency and are also stretchable, features not possible with aluminium-based packaging material. Inorganic barrier thin films are highly transparent but have lower barrier property and are not stretchable. TBF’s films will allow see-through packing and a longer shelf-life for a wide range of products from high-end electronics to perishable goods. Stretchability is another attractive feature in facilitating simple packaging processes.

Aluminium as a metal has very high oxygen and moisture barrier properties, but aluminium-based packaging comes at a higher processing cost, is opaque, non-stretchable, and interferes with electronics, making the integration of components like RFID devices difficult. TBF’s new stretchable thin films are cost effective and transparent, with barrier properties comparable to that of aluminium foil.

“TBF’s strategy is to bridge the gap between aluminium foil and transparent oxide films by creating new packaging structures for the niche applications in the food, medical, pharmaceuticals and electronics markets,” said Mr Senthil Ramadas, Director & Chief Technology Officer of TBF. “The secret behind TBF’s film lies in our patented encapsulated nanoparticle layer that consists of nanoparticles in polymer shells”.

Conventional multilayer barrier plastics have successive layers of barrier plastic films to enhance the impermeability to air and moisture but they have not achieved higher barrier properties. TBF’s film uses minimal layers as its encapsulated nanoparticles increase the packing density of nanoparticles, which in turn makes it extremely difficult for

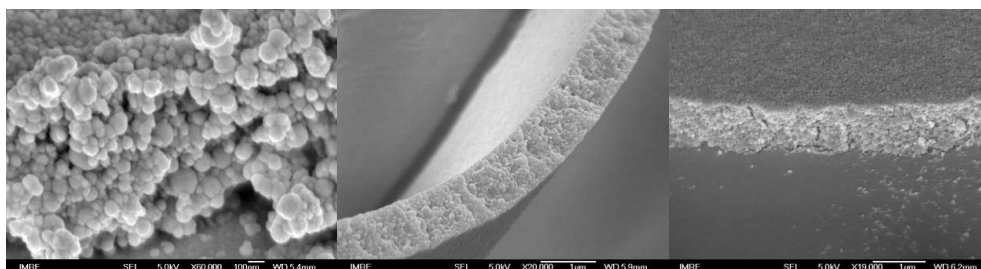
water and oxygen molecules to pass through the film. The encapsulated nanoparticles also actively adsorb and react with water and oxygen molecules to trap them, thus further lowering the amount of moisture and air passing through the film.

“The innovation creates a whole new generation of packaging materials that add new and superior functions for use in high value products such as medicine”, says Professor Andy Hor, Executive Director of A\*STAR’s IMRE from where the unique barrier film technology was initially developed, incubated and spun-off. “We are glad to see our scientist-entrepreneurs advancing an IMRE-born technology and are looking forward to seeing it make an impact in the market”.

“The University of Tokyo confirmed TBF’s barrier film performance at 10-6g/m<sup>2</sup>/day”, said Mr. Nakazawa, Managing Director, KISCO (Asia) Pte. Ltd. “There has been very favourable response from our potential customers in a spectrum of industries wishing to benefit by incorporating TBF’s superior barrier films into their products, these applications range from food and medical packaging to high end PV, lighting and display sectors where TBF’s barrier films excel.”

TBF was recently recognised by leading Global Growth consulting firm, Frost & Sullivan as the ‘2013 Global Next Generation Technology Company of the Year in the field of Barrier Films’ due to its novel approach of developing innovative technology for its patented barrier material and barrier stack technology that enhances the performance and reliability of barrier films. TBF has pioneered a unique and innovative technology for developing barrier films, by using nanoparticles to plug the defects in the barrier oxide layer, thereby enhancing barrier effectiveness and at the same time, reducing the number of barrier layers needed.

TBF’s reduced number of barrier layers and lower material costs, as compared to conventional barrier film technologies, brings in tremendous cost efficiencies into TBF’s manufacturing process. With TBF’s unique technology and low cost, access to newer applications like Quantum dot color filters, Vacuum Insulated Panels (VIPs), Food & Medical Packaging has been made possible in addition to the conventional application areas like OLED displays or lighting and flexible Solar cells. This opens up a wide spectrum of opportunities for the barrier films market and TBF’s barrier films are well positioned to address the needs from these new and emerging applications.



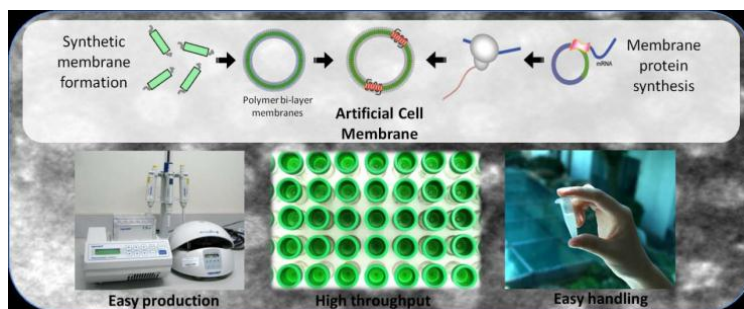
The encapsulated nanoparticles layer (centre and right) consists of nanoparticles encapsulated by an organic species (left) via a self-assembly method in which the nanoparticles concentration is very high - up to 70% to 80% by weight.

◆ *Start-up markets artificial cell membranes that can speed up drug discovery*

ACM Biolabs, a spin-off company from A\*STAR's Institute of Materials Research and Engineering (IMRE), will market novel plastic cell membranes to be used as low-cost, easily maintained drug targets that help shorten the drug discovery process. What usually takes weeks or even months can now be done in a matter of days using these new materials. Combined with a robust scalability to large scale quantities, ACM's artificial cell membranes may cut costs in the initial phase of drug discovery by up to two-thirds.

Artificial cell membranes (ACMs) are customised synthetic cell membranes that mimic live, targeted membrane proteins. The new technology allows the production of membrane proteins without the need for the specially controlled environments, conditions and training that is required in current live cell culture laboratories. ACM Biolabs' products, which can be tailor-made to a pharmaceutical company's specific drug testing requirements, are produced rapidly and are stable over a long period, leading to significantly reduced costs and streamlining of the currently tedious and cumbersome drug discovery process. The patented artificial cell membrane technology was first developed at A\*STAR's IMRE in 2009 by integrating biology with innovative materials science know-how and is now licensed to ACM Biolabs.

Cells communicate with each other and exchange vital molecules through their 'skin' or membranes, facilitated by specific proteins, or membrane proteins. Disruption of the communication pattern can lead to diseases such as



cancer, diabetes, obesity, and Parkinson's Disease. Understanding How the artificial cell membranes are formed and their advantages over existing live cell culture methods.

the working of membrane proteins is critical in creating medicines to combat diseases. ACM Biolabs has adapted natural cellular processes to invent a simple yet functional system, where synthetic materials are engineered to host membrane proteins. These include some membrane proteins that cannot currently be produced in a stable form using today's cell-based technology, i.e. the so-called 'hard targets'.

"Our proprietary artificial cell membrane technology is a unique combination of engineered polymer materials and biology that gives pharmaceutical companies a faster, cheaper alternative to current drug discovery methods," said Dr Madhavan Nallani, a former IMRE scientist who is the founder and now the Director of ACM Biolabs, which produces these patented artificial cell membranes with customised membrane proteins.

"Our aim is to lower the entry barrier for more companies and labs to screen novel drugs, or test existing drugs on novel targets", added Dr Nallani. "ACM Biolabs believes that our product can reduce the risk from some of the more daunting phases in the drug discovery process and allows the creation of a new generation of innovative drugs."

"The commercialisation of this technology is an excellent example of A\*STAR's plan to push lab-based research into the marketplace," said Prof Andy Hor, Executive Director of IMRE. "The success of this spin-off is also part of our

efforts to create a generation of scientist-entrepreneurs that can help lead Singapore's charge in a future knowledge-based economy".

ACM Biolabs targets the drug discovery industry, especially the life science tools market, which is worth an estimated US\$42 billion<sup>1</sup> currently. Its technology will significantly impact the membrane protein related assays in the cell biology sector, which accounts for a third of the life science tools industry revenue and is expected to reach US\$15 billion<sup>2</sup> by 2015. The market potential is huge, especially for disruptive technologies like Artificial Cell Membranes, since the majority of known membrane proteins have yet to be explored as drug targets partly due to the difficulties in studying them in live cells. This serves as a validation for the company's technology and also grows the company's acceptance as a market provider of products and partner for expertise in membrane protein targets.

The award-winning Artificial Cell Membrane technology was first recognised as a finalist in the prestigious Asian Innovation Awards 2011 organised by The Wall Street Journal Asia. ACM Biolabs went on to win the "Most Innovative Start-up" award for its potential application in membrane protein drug screening analysis at the Action Community for Entrepreneurship (ACE)-ETPL Investor Forum held in June 2012. ACM Biolabs has also recently secured a SPRING Technology Enterprise Commercialisation Scheme (TECS) Proof-of-Value grant worth S\$500,000 to help grow the start-up.

## Taiwan (Source: NPNT)

### ◆ MOEA, nanoMark Progress

- Passed 52 certification standards, 39 Companies with 1490 products



The nanoMark enhances the overall enterprise competitiveness. The nano has been promoted for 10 years and has cumulative fruitful results. From 2004 to 2014, there are already 39 companies, 1490 products that passed the nanoMark certification. The results of a market research indicated that not only can the nanoMark help the companies who have passed the nanoMark certification increase their "corporate image", gain customer affirmative and promote "market sales", it can even increase the selling price of their products by 20%. (Information/Photo source: MOEA, nanoMark website).

## Thailand (Source: NANOTEC)

### ◆ QAcnes attracts local business

QAcnes anti acne pad made from nano encapsulation of mangosten extract gave a business pitch to over 50 companies' representatives this morning at Thailand Science Park. The aim of the pitch is to attract interested companies to consider entering into a business discussion either as research collaborators and/or technology licensing agreement. Dr. Phikunthong Kopermsub and Dr. Suvimol Surassmo researchers from Nano-Delivery System Lab at NANOTEC presented technical information on nano encapsulation and electrospinning process.

“The nano encapsulation of the mangosten extract helps in easing the discomfort associated with acne and leaves no scare marks to the end-user” said Dr. Phikunthong. “One of the key strength of QAcnes pad is that it is breathable which is achievable by using electrospinning process”. Also speaking at the business pitch was Dr. Sirasak Tepakum, Deputy Executive Director who gave an educational talk on “Nanotechnology and its Application to everyday life”.

QAcnes from NANOTEC received both the Best Presentation Award and Outstanding Investor’s Choice Award at the recent NSTDA Investor’s Day 2012 held on September 20 in Bangkok

## Vietnam (Source: VAST)

### ◆ CUMARGOLD

Curcumin, a naturally occurring polyphenolic compound, is known to have a wide range of therapeutic and pharmacological properties. Although it is a considerably promising compound, its poor water solubility and fast degradation profile make it compromise over its bioavailability way below the threshold level on administration. Over a period of time, a lot of emphasis has been given to improve the biodistribution of native curcumin, but it is only recently that the application of the field of nanotherapeutics has significantly improved its therapeutic efficacy.

This is through the cooperation between researchers from VAST (Vietnam Academy of Science and Technology ) and MEDIPLANTEX (Vietnam national pharmaceutical joint-stock company) the development and commercialization of nanoformulations of curcumin, known as the "CUMARGOLD" was successfully launched.



## ✧ New Education/Research Programs

## Indonesia (Source: MNI)

### ◆ Fornano (National Nanotechnology Forum) in Palembang

Fornano “Utilizing Nanotechnology for Increasing Quality of Indonesia Environment” held on May 3th in Palembang. Attended by more than 350 bachelor students from many universities in Indonesia as participants, Fornano discussed about nanotechnology and its contribution to make healthier and cleaner environment. One of introduced nanotechnology was nanobubble as water treatment method. In this event, SNC (Sriwijaya Nano Club) is legally welcomed as part of NWI (nano World Indonesia) Family. SNC will be student organization in Sriwijaya University to gather student who interested in Nanotechnology and a forum for discussing about it.



### ◆ Youth Nano World Indonesia Regional III East Java to Support ASEAN Economic Community 2015

In collaboration with many universities in Indonesia, Youth

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Nano World Indonesia Regional III East Java promotes the readiness of the deployment and development of Nanotechnology among young generation in Indonesia. Our objective is to build ASEAN Students Nano Club to face AEC 2015. ASEAN Students Nano Club will be an organization for ASEAN young nanotechnology researchers to learn about the state-of-the-art nanotech advancements and global development updates, to collaborate with interdisciplinary team members beyond nation border, and to explore the culture of local host. It will provide a unique opportunity for ASEAN youth to communicate, make network, inspire each other, share learning and invent technologies and design products which contribute to a sustainable planet through nano-innovations. What we have done in Indonesia to initiated Youth Nanotechnology Movement are:

Conduct Event of National Nano World Indonesia and Nano Club Indonesia with Brawijaya University (Brawijaya Nano Club) and ITS University (Nanokits ITS) to gathers all of East Java young generations to form Nanotechnology Journal Club which is a club to discuss about nanotechnology researches.

Developing a research about Nanofertilizer collaborate with Brawijaya University (Brawijaya Nano Club) and Malang University.

Developing a research about combination of Nano Herbs and Co-chemotherapy agents collaborate with Jember University and Airlangga University to develop nano particles made from Indonesian unique herbs.

Participating in National competitions and actively participated in International scale of nanotechnology students conferences.

## **Iran** (Source: INIC)

### ◆ *Over 25,000 Students Participate in 5th Students Olympiads for Nanoscience, Nanotechnology in Iran*

The Fifth Students' Olympiads for Nanoscience and Nanotechnology was held on 24 April 2014, with the concurrent participation of more than 25,000 students across the country.

Similar to the previous Olympiads, this year's Olympiad was held in two stages in forms of a theoretical examination at the national level, and in the second stage, a practical camp for those who qualify in the first stage. Final winners will be chosen by taking into account the examinations taken in the second stage.

Nanotechnology simulation course will be held in the practical camp in the second stage by expert professors. The evaluation of this course will be effective in choosing the winners of the Olympiad too. Students' Olympiads for Nanoscience and Nanotechnology is held by Iran Nanotechnology Initiative Council to discover talented students, help the stabilization of human resources training in the field of nanotechnology and create an atmosphere for the Islamic Republic of Iran to hold a good ranking among the top countries in the field of basic education of nanotechnology.

Growth in number of participants in this event is shown in graph below:



- ◆ *Over 6,200 Contestants Participate in 4th National Nanotechnology Competition in Iran*

National Nanotechnology Competition was held on 9 May 2014 with the participation of 6,240 contestants from various universities across Iran. The competition was held in exam centers in 23 provinces of Iran.

Chemistry, physics, chemical engineering, materials engineering, biology and mechanical engineering with 1,329, 570, 394, 392, 321, and 309 contestants respectively were among the top majors in which contestants had been registered to take part in the competition. The results of the Fourth National Nanotechnology Competition will be announced in the first half of June 2014, and the winners will be awarded by receiving cash money and financial credit to be provided with analytical services from laboratories that are members of Nanotechnology Laboratory Network.

- ◆ *Educational Nano Labs*

As a collaboration between INIC and Ministry of Education, a program for establishment of educational nanotechnology laboratories for high school students has been initiated. Up to now, seven educational nano labs has been established. The laboratories are equipped with instruments such as scanning tunneling microscope, electro-spinning, wire electrical explosion and desktop sputtering. The program aims at facilitating practical nanotechnology training and boosting and directing research oriented education in high schools.

## **Malaysia** (Source: Nano Malaysia)

- ◆ *The proposed of establishment of NanoMalaysia Institute for Innovative Technology (NanoMITe)*

March 2014 – The proposed of establishment of NanoMalaysia Institute for Innovative Technology (NanoMITe) to facilitate the formation of the NanoMalaysia Institute for Innovative Technology (NanoMITe) Consortium, which brings together researchers from world-renowned universities, such as Harvard University, Stanford University and Massachusetts Institute of Technology (MIT). The Consortium has received the endorsement of the Honourable Prime Minister during its tabling by the Second Minister of Education at the Global Science and Innovation Advisory Council (GSIAC) Meeting in San Francisco in September 2013.

## **New Zealand** (Source: Univ. of Canterbury)

- ◆ *Dickinson a “STEM superstar”*

PBS (America) has profiled MacDiarmid Institute Investigator Dr Michelle Dickinson as one of the "best and brightest" STEM (science, technology, engineering, mathematics) superstars. "Knowing that what you do can make a difference to the world's future and you can help to solve big issues is one of the more humbling aspects of STEM, and it means you go home every day with an immensely satisfying feeling in your heart. - Michelle Dickinson. ([Source](#))



- ◆ *Nanocamp 2014*

The 6th edition of Nanocamp, a week-long science camp sponsored by The MacDiarmid Institute for students starting their last year of high school in 2014 was held successfully at Wellington in Jan 2014. The selection process to be admitted to Nanocamp is extremely competitive, with the best science students in



the country contending for just fifteen places. During Nanocamp week the institute was buzzing with activity and the contagious enthusiasm of the Nanocampers. The camp kicked off with a welcome from Director, Prof Kate McGrath, who set the scene by giving a brief overview of nanoscience. The scientific programme for this year featured (in order of appearance): Nanoscience basics, , Spintronics, Magnetic Resonance Imaging in material science, Raman single-molecule detection, Deformable lego - creating 3D structures using molecules, David Flynn, Electron microscopy, Microfabrication & clean room, Nanoelectronics, Rob Keyzers, Smells and Flavours, Food and Mouse Traps: The importance of volatile molecules in food and pest control, Ultrafast laser spectroscopy, Lightning with LEDs. The students also spent one day at Callaghan Innovation and GNS Science, where they learned about superhydrophobics, photonics, and superconductivity. ([Source](#))

## **Taiwan** (Source: NPNT)

### ◆ *Development of a Virtual Transmission Electron Microscope Laboratory for Educational Applications*

In this study, a virtual TEM laboratory was developed to help students learn how to analyze the 3D crystal structures of materials such as diamond and graphite according to their diffraction patterns.



Figure 1: The virtual TEM model (left) and the real TEM (right)

## **Thailand** (Source: NANOTEC)

### ◆ NANOTEC researcher awarded the Franco-Thai Junior Research Fellowship

Dr. Pongtanawat Khemthong, NANOTEC researcher from Nanomaterials for Energy and Catalysis Laboratory (NEC) awarded the Franco-Thai Junior Research Fellowship Program 2014 for his research entitled “ Development of an in situ XAS cell to monitor the formation of crystalline metal phosphate-phosphide catalysts during the hydrotreating processes “.

The project duration of this fellowship lasts for six months under the supervision of Prof. Dr. Christophe Geantet who is the director of the Institut de recherches sur la catalyse et l'environnement of Lyon, France.

### ◆ The exhibition of NANOTEC Flagship program:

NANOTEC has identified 10 flagship programs which it considers are in response to both national and NSTDA priorities. The flagship programs are:

**Future Energy:** Develop renewable energy technology based on local resources to promote Thailand's energy security and sustainability.

**Clean Air:** Improve air quality for better life of Thai people

**NANO-Textile:** Improve and increase value chain the Thai textile industry

**Smart soil & Fertilizer:** Increase efficiency of economy plant crop by nanotechnology

**Smart Health:** Increase efficiency of disease diagnostic tests for better health

**NANO-MARKS:** Develop industrial standards for nano-products in Thailand

**Food Quality:** Improve and monitor quality for Thai Food by nanotechnology

**Mosquito Control:** Research and development of anti-mosquito products by saving life of Thai

**Clean Water:** Develop water purification system for improving water quality for Thai people

**Treasure from Thai Silk:** Research and development of Thai silk peptides for cosmeceutical products

These flagship programs will utilize the 3 core platform technologies: Materials synthesis by design, Nano encapsulation and delivery systems, and Nano fabrication and manufacturing.

## ✧ General News

### China

#### Indonesia (Source: MNI)

##### ◆ *Indonesia Nano Summit 2014, Big Joint Event of Indonesian Nanotechnology*

Indonesian Institute of Science (LIPI) represented by Innovation Center of LIPI feels the urge to develop local science-based industries in order to support economy of Indonesia. LIPI agree to join for organizing Indonesia Nano Summit 2014, as appreciation for many nanotechnology researchers and institutions, with Indonesian Society for Nanotechnology (MNI). Beside LIPI and MNI, many universities join together in conducting this event, such as University of Indonesia, State University of Jakarta, etc. Indonesia Nano Summit 2014 in conjunction with 3rd International Conference on Advanced Material and Practical Nanotechnology (ICAMPN) is expected to be a first step in growing awareness to develop new competitive local science-based industries especially based on nanotechnology for increasing value of Indonesia Natural Resources.

#### Iran (Source: INIC)

##### ◆ *Iran Holds Int'l Nano Safety Congress*

The International Iran Nano Safety Congress organized by Iran Nano Safety Network of Iran Nanotechnology Initiative Council was held in Tehran University of Medical Sciences on 19 February 2014. Different world states, including South Africa, the United States, China, Denmark, South Korea, India, Italy and Hungary participated in the two-day congress.

“Iran Nano Safety Congress covered all aspects of safety in nanomaterials, including human health, safety in working places, and environmental safety. It also provided an opportunity for researchers to share data and experience about the toxicity of nanomaterials,” Dr. Ghazi Khansari, the chairman of the committee of Iran Nano Safety Congress, said.

Among the scopes that were discussed in the congress, mention can be made of evaluation of exposure, methodology, characterization, tracking and monitoring, job and environmental safety, toxicology, ecotoxicology, and studying lifecycle and standardization and regulations.

“Iran Nano Safety Network of Iran Nanotechnology Initiative Council organized Iran Nano Safety Congress to identify people who are active in this field, and to exchange data to increase the potential in the field of nanotechnology safety in all aspects, and the importance and necessity of safety in nanotechnology products,” he continued.

◆ *5th International Conference on Nanostructures (ICNS5)*

After organizing four successful conferences in 2006, 2008, 2010 and 2012, the 5th International Conference on Nanostructures (ICNS5), was held in Kish International Convention Center and Sharif University of Technology International Campus in Kish Island from 6 to 9 March 2014. The Conference was devoted to the state of the art in nanostructures and nanosciences, latest progresses in experimental techniques, theoretical studies and emerging applications of new nanomaterials. The conference is organized jointly by the Institute for Nanoscience and Nanotechnology in the main campus of Sharif University of Technology in Tehran and its International Campus in Kish Island and was supported by INIC. Iran Nanotechnology Initiative Council arranged a few workshops in related fields during the conference.

Overall, it brought a great opportunity for professionals within the academic, research and industrial communities to exchange and share their experiences as well as the latest scientific findings and technology development.

**Malaysia** (Source: Nano Malaysia)

◆ *World Innovation Forum Kuala Lumpur 2013 (WIFKL2013)*

November 2013 – NanoMalaysia Berhad (NMB) has participated in the World Innovation Forum Kuala Lumpur 2013 (WIFKL2013) as a strategic partner. WIFKL2013 is jointly organized by the Ministry of Science, Technology and Innovation (MOSTI) and the Malaysian Innovation Foundation (YIM). It is a more targeted event in line with the theme of “The Future We Desire”. All programmes was aligned to the theme and YIM was looking at a seamless yet holistic participation from all industries without much demarcation from one another. WIFKL2013 was divided into seven (7) core events which are One-on-one session; Plenary Session; i-LABS Session; Exhibition; Satellite Events; ASEAN-EU Ministerial Round Table Discussion; and Awards Night. NanoMalaysia opened a pavilion and had 24 booths from the nanotechnology ecosystem represented at the event. NMB also coordinated the nanotechnology industry cross sectoral lab.

**New Zealand** (Source: Univ. of Canterbury)

◆ *Professor Alison Downard, University of Canterbury, who was recently announced as the winner of the 2014 Electrochemistry Division of the Royal Australian Chemistry Institute's Stokes Medal.*

The R.H. Stokes Medal is awarded for distinguished research in the field of electrochemistry carried out mainly in Australasia. Past recipients include R.H. Stokes, R. Mills, R. Woods, Alan M. Bond, B. Welch, I.M. Ritchie, Stephen Fletcher, Gordon Wallace, David Rand, Sam Adeloju, and Justin Gooding.

◆ *Professor Richard Blaikie, University of Otago who was awarded the 2013 Hector Medal by the Royal Society of New Zealand.*

**Singapore** (Source: IMRE)

- ◆ *Top chemistry conference returns to Singapore to celebrate the past, present and future of chemistry in Asia*

The 15<sup>th</sup> Asian Chemical Congress (15 ACC) makes its way back to Singapore after nearly three decades. The prestigious biennial event has been hosted across Asia since its inauguration in Singapore in 1985 and has been instrumental in bridging the links between major chemistry societies in the East and West. This year's hallmark event will also feature many firsts which pay tribute to past and present scientific talent, and lays the foundation for nurturing future scientists.

Singapore, 20 August 2013 – With three Nobel Laureates in Chemistry<sup>1</sup>, more than half a dozen heads of major regional and international chemistry societies, editors from leading chemistry-based journals and the participation of local junior college students, Singapore's 15 ACC is set to be one of the most watched chemistry conferences this year. Some 1,600 scientists from across the globe will be joined by more than 100 Singapore students who will present their research projects to seasoned scientists during the conference organised by the Singapore National Institute of Chemistry (SNIC). A\*STAR's Institute of Materials Research and Engineering (IMRE) and Institute of Chemical and Engineering Sciences (ICES) lend support as co-organisers of the conference together with local universities and regional chemical societies.

The conference has been hosted over 14 times in countries around the Asian region and Australia. This year's conference will focus on the driving force behind chemistry innovations – the research talents of the past, present and the future. The 15 ACC will feature for the first time, lectures by 'Pioneers of Asia', 'Asian Rising Stars', and an 'Editors' Forum' featuring editors of major chemistry-related journals. Also, unique to such conferences, the '1<sup>st</sup> Asian Chemistry Research Fair' will be held to showcase some 100 poster research projects by budding secondary school, junior college and polytechnic 'scientists' from across Singapore. In addition, the event will host the 'Asia America Chemical Symposium', jointly organised by an intercontinental committee from the American Chemical Society (ACS) and the Federation of Asian Chemical Societies (FACS).

The conference is a timely reminder of the importance that chemistry plays in daily life and how it can advance the future of technologies. Chemistry is an essential element in creating anything from shampoos to the latest light emitting diode (LED) TVs or in the distillation of raw petroleum to power the world. More than that, advances in chemistry have given it a new role in shaping the future by tackling current global challenges such as the need for better healthcare, sustainability and 'green' research. New chemistry has allowed the development of organic solar cells for harnessing power, water treatment technologies via filtration and desalination, and new building materials that have less raw materials, are stronger but are lighter and can withstand extreme conditions.

"The earth is under great stress. Chemistry is the underpinning science that could provide solutions for three of the biggest challenges facing the world today – energy, environment and health – which makes the value of this conference much more evident," said conference chairperson, Professor Andy Hor, President of SNIC and Executive Director of A\*STAR's IMRE. "The return of the prestigious ACC to its birthplace after more than 20 years is a milestone and a testament to how far this nation has gone in terms of science and research."

"Singapore has always had a high regard for the Asian Chemical Congress as it has always provided a platform for us to come together and to look forward, examining how the latest discoveries in chemistry can enable us to address the

many challenges facing society in Singapore and around the world,” said Dr Keith Carpenter, Executive Director of A\*STAR’s ICES, which is also a co-organiser of this conference.

## **Thailand** (Source: NANOTEC)

### ◆ Thailand Pavilion at nano tech 2014 in Japan

Thailand exhibited Thailand Pavilion under the theme “Creative Lifestyle & Culture at the 13<sup>th</sup> International Nanotechnology Exhibition and Conference (nano tech 2014), 28-30 January 2014 at Tokyo Big Sight. Thailand Pavilion was one of the 600 exhibitors from 30 countries exhibiting nanotechnology highlights products from NANOTEC and 8 Thai private sector partners. Leading the Thailand Team is Prof. Pairash Thajchayapong, Chairman of NANOTEC Executive Board and Dr. Thaweesak Koanantakul, President of NSTDA.

“Given the significant importance of this annual event, it is necessary for NANOTEC a member of NSTDA and its private sector partners to continue to fly the Thai flag” said Prof. Sirirurg Songsivilai, Executive Director of NANOTEC. “The main goal of Thailand’s participation is for networking, national exposure, information gathering, and the ultimate goal is research/commercial collaboration”. Prof. Sirirurg echoed the saying that “Rome was not build in one day” so is research/commercial collaboration which requires nurturing of relationships. The Thai private sector partners participated in numerous business matching discussions which will continue after the conference is concluded.

In addition to exhibiting and giving press interviews with Chemical Daily and Nikkei Shimbun, Prof. Sirirurg Songsivilai, Executive Director NANOTEC and Mr. Boonrux Saphyakhajon, Executive Director Bureau 2, Thailand Board of Investment (BOI) will team up to give a presentation on “Advancing Nanotechnology Development in Thailand” at the Seed and Need Seminar which is part of the conference program.



## **Taiwan** (Source: NPNT)

### ◆ NPNT-Tyndall Joint Workshop on Nanotechnology, Taiwan

This joint workshop was held at the National Chiao-Tung University (NCTU) on December 6th. This workshop was to enhance the closed relationship between National Program on Nanotechnology (NPNT) and Tyndall National Institute, Ireland. The speakers from both sides have given speech in several topics related in nanoelectronics, which also created a lively interaction with all the attendees.



## RESEARCH BREAKTHROUGHS

### Australia (Source: DIISRTE)

- ◆ *New microscope for traceable nanoscale length measurements developed at NMIA*

SYDNEY: The National Measurement Institute Australia (NMIA) has developed a metrological scanning probe microscope that establishes a direct link between Australia's legal unit of length, the metre, and practical nanoscale length measurements. It will give Australian industry, researchers and the community confidence when making decisions where nanoscale accuracy is paramount. NMIA's microscope uses five laser interferometers to measure the motion of a sample surface relative to a fixed sensor. The resulting image is used to measure the distance between features on the sample surface with nanometre accuracy, transforming them into traceable 'nano-rulers' that can be used to calibrate other scanning probe and electron microscopes used by researchers and industry. ([Source](#))

### Iran (Source: INIC)

- ◆ *Iranian Researchers Make Progress in Production of Leishmaniasis Vaccine*

Iranian pharmaceutical researchers from Mashhad University of Medical Sciences obtained promising results for the production of a vaccine to treat Leishmaniasis.

The vaccine has a simple and cost-effective production method, and if the research stages are complete, it will create hope for the industrial production of the vaccine in the country.

Dr. Mahmood Reza Ja'fari, a member of the Scientific Board of Mashhad University of Medical Sciences, explained about the research, and said, "Leishmaniasis is one of the common diseases between human and animals, which is caused by parasites. Depending on the parasite type and immunity respond of the host, the severity of the diseases varies from a limited skin infection to fatal level. Although numerous researches have so far been carried out all over the world, there is still no vaccine for Leishmaniasis in the market. Therefore, the invention of a vaccine for Leishmaniasis was out main objective of this research."

Injection of the vaccine into a group of mice (BALB/c mice) triggered their cell immune system. The produced vaccine is very effective in the protection of the mice against the parasitic disease. BALB/c mice are much more sensitive to Leishmaniasis parasite; therefore, if a vaccine is effective on the mice, it will surely be more effective on humans who are stronger against Leishmaniasis infection.

According to Dr. Ja'fari, since the produced nanoliposome is small in size, most of them are absorbed by lymphatic system subcutaneous injection, and they are gathered in lymphatic nodes by APC cells with very high performance. Then, antigens dissolved in liposome are released in APC cell. It triggers cell immune system, and protects mice against the challenge with the living parasite of Leishmaniasis. The researchers are currently studying the stabilization of the produced vaccine. After achieving this goal, the nanoliposome should be produced in clean environment and the required certificates should be attained. Then, clinical tests will be carried out on patients.

All the requirements for industrial production of the vaccine are available in the country. Results of the research have been published in Acta Tropica, vol. 128, issue 3, August 2013, pp. 528-535.

◆ *Iran holds 7th rank in nanotechnology publication by March 2014*

As shown in the table below from statnano.com, Iran holds 7th world rank in nanotechnology publications by March 2014.

Rank	Country	Nano-article	Share	Rank	Country	Nano-article	Share
1	China	6858	32.50%	16	Singapore	365	1.73%
2	USA	3520	16.68%	17	Brazil	283	1.34%
3	India	1654	7.84%	18	Poland	272	1.29%
4	South Korea	1293	6.13%	19	Saudi Arabia	271	1.28%
5	Japan	1229	5.82%	20	Malaysia	260	1.23%
6	Germany	1141	5.41%	21	Turkey	244	1.16%
7	Iran	1036	4.91%	22	Sweden	228	1.08%
8	France	854	4.05%	23	Switzerland	225	1.07%
9	UK	698	3.31%	24	Netherlands	224	1.06%
10	Spain	686	3.25%	25	Belgium	220	1.04%
11	Italy	620	2.94%	26	Egypt	194	0.92%
12	Taiwan	588	2.79%	27	Mexico	167	0.79%
13	Australia	529	2.51%	28	Portugal	164	0.78%
14	Russia	481	2.28%	29	Denmark	144	0.68%
15	Canada	454	2.15%	30	Finland	141	0.67%

Graph below shows the growth of nanotechnology publication in Iran in past 13 years.

◆ *Iran's 2nd Proposed Int'l Standard on Nanotechnology Approved*

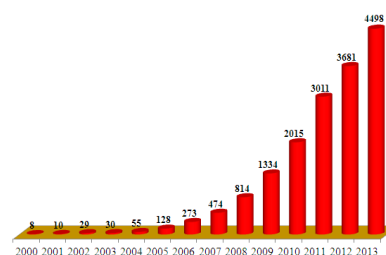
“Determination of muramic acid as a biomarker for silver nanoparticles activity” standard which was proposed three years ago by Standardization

Committee of Iran Nanotechnology Initiative Council to the

Nanotechnology International Standardization Committee (ISO/TC229), developed in various stages of compiling standards and defended in different meetings was approved in the final stage of voting (DTS stage) and was published as ISO/TS 16550:2014.

The compilation and development of the standard began three years ago by a university team with the support of Iran Nanotechnology Initiative Council by carrying out laboratorial research. During these years, various experts from different countries were introduced to supervise the compilation of the standard. The suggestions of the experts were evaluated and approved by the project supervisor of the proposed standard.

A new method has been presented in the standard, which can quantitatively and precisely determine the activity of silver nanoparticles. The standard can be used for the determination of antibacterial properties of products based on silver nanoparticles.



Another standard entitled “Definitions for the evaluation of science, technology, and innovation indices” is currently being compiled in ISO under the supervision of Iran.

## **New Zealand** (Source: Univ. of Canterbury)

### ◆ *Chief Science Advisor*

*The Ministry of Business, Innovation and Employment has appointed Professor Jim Metson to the position of Chief Science Advisor. Science and innovation are central components in the Government’s agenda to improve business productivity and the quality of life for New Zealanders, and underpin New Zealand’s economic success,” Deputy Chief Executive Paul Stocks said. "As the Ministry responsible for science, we deliver policy and services that develop and support a high-performing science and innovation ecosystem. The Chief Science Advisor role provides a critical connection between the Ministry and the scientific community, and will ensure that the Ministry stays well connected with science issues.” Professor Metson is Deputy Dean of Science at Auckland University. His two-year term is a part-time secondment from the university, and will allow him to retain invaluable ongoing links to the community.*

[\(Source\)](#)

### ◆ *New book: Protein nanostructures in food - Should we be worried? - Trends in Food Science and Technology*

Raynes, J.K., Carver, J.A., Gras, S.L., Gerrard, J.A. ISSN: 09242244 DOI: 10.1016/j.tifs.2014.02.003

Nanotechnology promises to affect many aspects of our lives with its development being greeted with both excitement and fear. The debate concerning nanotechnology has echoed that of genetically engineered organisms and their introduction into the environment and the food chain. Nanotechnology offers many potential advantages in the processing and manufacture of foods: enhanced bioavailability, colour and flavour; novel food textures; new delivery mechanisms; and access to biosensors to enhance food safety. In fact, many of the foods we have been consuming for centuries already contain nanostructures, leading many to assume that they are safe. The extent to which novel nanostructures may afford new risks has not been adequately resolved, however, leading to concern within some consumer groups. In this article, we use proteins as a case study to explore our current understanding of nanostructures in foods and the extent to which novel nanostructures may introduce new properties. It is well recognised that some protein nanostructures are toxic and are associated with disease, so there is legitimate concern as to whether such species should be deliberately introduced into our foods. This review highlights current literature on protein nanostructures in food and possible risks associated with their use. We aim to provide a balanced assessment to inform future decision-making regarding the utilisation of nanostructures in food.

### ◆ *New Publication : Versatile multi-functionalization of protein nanofibrils for biosensor applications*

Sasso, L., Suei, S., Domigan, L., Healy, J., Nock, V., Williams, M.A.K. and Gerrard, J.A., *Nanoscale* 6(3): 1629-1634. <http://dx.doi.org/10.1039/C3NR05752F>

Protein nanofibrils offer advantages over other nanostructures due to the ease in their self-assembly and the versatility of surface chemistry available. Yet, an efficient and general methodology for their post-assembly functionalization remains a significant challenge. We introduce a generic approach, based on biotinylation and thiolation, for the multi-functionalization of protein nanofibrils self-assembled from whey proteins. Biochemical characterization shows

the effects of the functionalization onto the nanofibrils' surface, giving insights into the changes in surface chemistry of the nanostructures. We show how these methods can be used to decorate whey protein nanofibrils with several components such as fluorescent quantum dots, enzymes, and metal nanoparticles. A multi-functionalization approach is used, as a proof of principle, for the development of a glucose biosensor platform, where the protein nanofibrils act as nanoscaffolds for glucose oxidase. Biotinylation is used for enzyme attachment and thiolation for nanoscaffold anchoring onto a gold electrode surface. Characterization via cyclic voltammetry shows an increase in glucose-oxidase mediated current response due to thiol-metal interactions with the gold electrode. The presented approach for protein nanofibril multi-functionalization is novel and has the potential of being applied to other protein nanostructures with similar surface chemistry.

## **Singapore** (Source: IMRE)

### ♦ *CREATING A WATER LAYER FOR A CLEARER VIEW*

Scientists at IMRE have invented a new permanent surface coating that attracts water instead of repelling it, for a better, clearer view. The patented technology simplifies the coating process, making it more cost-effective for manufacturers.

When it comes to fogged up glassware or windows, the best way to keep a clear view seems to be by wiping the water droplets away constantly or having coatings that prevent the water from sticking to the glass. However, scientists at A\*STAR's Institute of Materials Research and Engineering (IMRE) have discovered that doing just the opposite - collecting the water to create a uniform, thin, transparent layer - actually helps produce a better, clearer view.

IMRE has invented a new technology, CleanClear, which is a durable and permanent ceramic coating that is transparent and superhydrophilic, which means it attracts water instead of repelling it. This creates a layer of water that prevents fogging on glass or plastic surfaces, and keeps surfaces cleaner for a longer period of time. Water-forming coatings create an additional uniform water layer to produce a better view as opposed to water-repelling technologies that form water droplets which impair vision.

Reduced visibility from fogged up glass or plastic surfaces is a common problem in wet or humid environments, and affects a multitude of products such as car windshields, spectacles, goggles, and even covers for cookware. The majority of solutions rely on water-repelling coatings. Unfortunately, current coatings are not durable and most have to be re-applied regularly.

### **How the technology works**

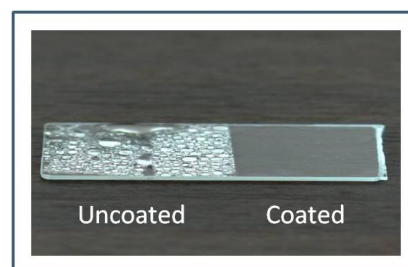
The new patented technology from A\*STAR's IMRE is a one-time ceramic coating that can be applied onto glass or plastic materials at processing temperatures below 100°C. This is important as it makes the coating process simpler and ultimately, more cost-effective. Currently, commonly used chemical coatings degrade easily with continued usage and have to be re-applied. IMRE's new ceramic coating is durable, permanent and only needs to be applied once. Although there are also other similar "water-loving" coatings, these are often processed at much higher temperatures and can only be activated by ultraviolet (UV) rays or sunlight.

Large multinational companies also use alternative coatings like titanium dioxide (TiO<sub>2</sub>) to produce self-cleaning glass surfaces that prevent dirt and dust from sticking. However, the TiO<sub>2</sub> ceramic coats can only be applied on surfaces during the manufacturing process at temperatures above 600°C. This limits their application to hard materials like glass. CleanClear can be adapted to multiple surfaces and materials, ranging from glass to plastics. TiO<sub>2</sub> coatings are also activated by sunlight but IMRE's new coating does not require activation and continues to function even at night and in low-light, indoor environments.

There are many useful applications for IMRE's "water-loving" surface. For example, it can be applied on car windshields, mirrors and motorcycle visors, allowing for better visibility in the rain. Coating building exteriors with this new material allows for self-cleaning during rain. Due to its adaptability for application on various surfaces besides glass, this could also result in potential cost savings. CleanClear can also be applied to consumer products to reduce condensation on glass covers for pots, food containers and hot food displays.

"Conventional technologies mainly use organic-based materials and some with nanoparticles but these don't last long, and need to be re-coated from time to time. The CleanClear process makes the coating part of the surface – permanently," said Dr Gregory Goh, the lead scientist from IMRE who developed the technology last year.

"CleanClear could be used to help create a sort of a clear 'vision shield' for today's car windshields during heavy rain," added Dr Goh. "Or we could use it to replace current daytime, UV light activated coatings with an all-day, all-night CleanClear coat on building facades to keep glass cleaner."



The uncoated section (left) of a glass slide is peppered with water droplets whereas the coated section (right) has a thin film of water that makes the glass clear.

## **Thailand** (Source: NANOTEC)

### ◆ *NANOTEC Smart Soil mobile unit*

*This project is under the Smart Soil and Fertilizer Flagship Program.* Prof. Markus Antonietti (NANOTEC International Advisory Board member) and researchers from Nanomaterials for Energy and Catalysis Laboratory and Hybrid Nanostructure and Nanocomposites Laboratory have been working on the Smart Soil project. Smart Soil is produced through a hydrothermal bioconversion process using water hyacinth that clogs Thai canals as raw materials. Researchers utilize nanotechnology mainly to control the nutrient usage as the plant needed and to improve the soil quality by minimizing the chemical fertilizer uses and increasing its organic matter.

## **Taiwan** (Source: NPNT)

### ◆ *Design of Physical Games For Learning The Lotus Effect*

This study used virtual reality (VR) technology to develop two physical games, namely "Water Drop in the Maze" and "Cleaning the Dust", to show the macroscopic and microscopic structures of lotus leaves respectively.



Figure 2. The question before starting the game.



Figure 3. The scene of a virtual lotus pond



Figure 4. A water drop on the lotus leaf



Figure 5. Playing "Water Drop in the Maze"

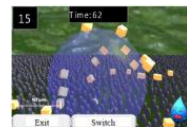


Figure 6. Playing "Cleaning the Dust"

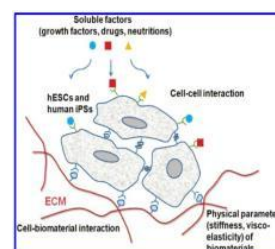


Figure 7. Explaining principles of lotus effect

◆ *Physical cues of biomaterials guide stem cell differentiation fate*

Akon Higuchi, Qing-Dong Ling, Yung Chang, Shih-Tien Hsu, and Akihiro Umezawa, Chemical Reviews, 113 (5), pp 3297–3328 FEB 7 2013

Schematic representation of the microenvironment and niches of hESCs and human iPSCs and their regulation by the following factors: several soluble factors, such as growth factors or cytokines, nutrients, and bioactive molecules; cell-cell interaction; cell-biomacromolecule (or biomaterial) interaction; and (4) physical factors, such as rigidity, of the environment.



# ASIA NANO FORUM SOCIETY NEWSLETTER

ISSUE No.24 July 2014

## EVENTS - 2014

Date	Avenue	Events
Jan.27	Tsukuba, Japan	<b>the 10th Asia Nano Forum Summit</b> <a href="http://www.asia-anf.org/ANFSummitMeeting.php">www.asia-anf.org/ANFSummitMeeting.php</a>
Jan.29 -31	Tokyo, Japan	<b>nanotech Japan 2014 - The 13th International Nanotechnology Exhibition and Conference</b> <a href="http://www.nanotechexpo.jp/">www.nanotechexpo.jp/</a>
Feb. 2-6	Adelaide, Australia	<b>23rd Australian Conference on Microscopy and Microanalysis, International Conference on Nanoscience and Nanotechnology (ACMM 23 /ICONN2014)</b> <a href="http://www.aomevents.com/ACMMICONN">www.aomevents.com/ACMMICONN</a>
Feb. 19-20	Tehren, Iran	<b>Iran NanoSafety Congress 2014 (INSC 2014)</b> <a href="http://www.irannano.org/nano/index.php?ctrl=section&amp;actn=get_section&amp;lang=2&amp;id=49">www.irannano.org/nano/index.php?ctrl=section&amp;actn=get_section&amp;lang=2&amp;id=49</a>
Mar. 6-9	Kish Island, Iran	<b>5th International Conference on Nanostructures</b> <a href="http://www.nanosharif.ir/page.asp?id=301">http://www.nanosharif.ir/page.asp?id=301</a>
Mar. 8-9	Hyderabad, India	<b>International Conference on Materials Processing and Characterization</b> <a href="http://www.icmpc.com/">www.icmpc.com/</a>
Mar. 26-28	2014, Krems, Austria	<b>BioNanoMed 2014</b> <a href="http://www.bionanomed.at/">www.bionanomed.at/</a>
May 13-16	Kuala Lumpur, Malaysia	<b>9th International Materials Technology Conference &amp; Exhibition</b> <a href="http://www.imtce2014.com/">www.imtce2014.com/</a>
Jul. 2-4	Seoul, Korea	<b>Nano Korea 2014 - The 12th International Nanotech Symposium &amp; Nano - Convergence EXPO</b> <a href="http://www.symposium.nanokorea.or.kr">www.symposium.nanokorea.or.kr</a>
Aug. 14-16	Jakarta, Indonesia	<b>3rd International Conference on Advanced Material and Practical Nanotechnology</b> <a href="http://www.icampn.nano.or.id">www.icampn.nano.or.id</a>
Sep. 24-27	Suzhou, China	<b>CHINANNO Conference&amp;EXPO 2014</b> <a href="http://www.chinanosz.com/">www.chinanosz.com/</a>
Sep. 24-25	Suzhou, China	<b>Asia Nano Forum Summit 2014</b> <a href="http://www.asia-anf.org/ANFSummitMeetingDetail.php?Id=70">www.asia-anf.org/ANFSummitMeetingDetail.php?Id=70</a>
Oct. 2-4	Taipei, Taiwan	<b>2013 Taiwan Nano Week</b> <a href="http://www.nano.tca.org.tw/index.php?lang=e">www.nano.tca.org.tw/index.php?lang=e</a>
Oct. 6-10	Tehran, Iran	<b>Iran Nano Festival 2014</b> <a href="http://www.festival.nano.ir/">www.http://www.festival.nano.ir/</a>
Oct.8-15	Tehran, Iran	<b>Asia Nanotech Camp 2014</b> <a href="http://www.asia-anf.org/ANFGroup_EG.php">www.asia-anf.org/ANFGroup_EG.php</a>

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Oct. 11-12	Tehran, Iran	<b>International Forum on Nanotechnology Economy</b> <a href="http://www.ifne.nano.ir/index.php?lang=2">www.ifne.nano.ir/index.php?lang=2</a>
Oct. 14-15	Pune, <b>India</b>	<b>Nanocon 2014 - Smart Materials, Composites, Applications and New Inventions</b> <a href="http://www.bvunanocon.com/">www.bvunanocon.com/</a>
Oct. 21-23	Beijing, <b>China</b>	<b>The 5th International Conference on Flexible and Printed Electronics (ICFPE)</b> <a href="http://www.icfpe2014.org/">www.icfpe2014.org/</a>
Oct.26-28	Pathumthani, <b>Thailand</b>	<b>The 4th Thailand International Nanotechnology Conference (NanoThailand 2014)</b> <a href="http://www.nano-thailand.com/2014/index1.php">www.nano-thailand.com/2014/index1.php</a>
Nov.2-6	Ha Long City, <b>Vietnam</b>	<b>7th International Workshop on Advanced Materials Science and Nanotechnology, IWAMSN 2014)</b> <a href="http://www.iwamsn2014.ac.vn/">www.iwamsn2014.ac.vn/</a>
Feb. 8-12, 2015	Nelson, <b>New Zealand</b>	<b>Advanced Materials and Nanotechnology 7 (AMN7)</b> <a href="http://www.macdiarmid.ac.nz">www.macdiarmid.ac.nz</a>
Mar. 8-11 2015	Kish Island, <b>Iran</b>	<b>Asia Nano Forum Conference 2015 (ANFC2015)</b> <a href="http://www.anfc2015.net/">www.anfc2015.net/</a>
Aug., 2015	<b>Singapore</b>	<b>Asia Nano Forum Summit 2015</b>
Aug., 2015	<b>Singapore</b>	<b>Asia Nanotech Camp 2015</b>