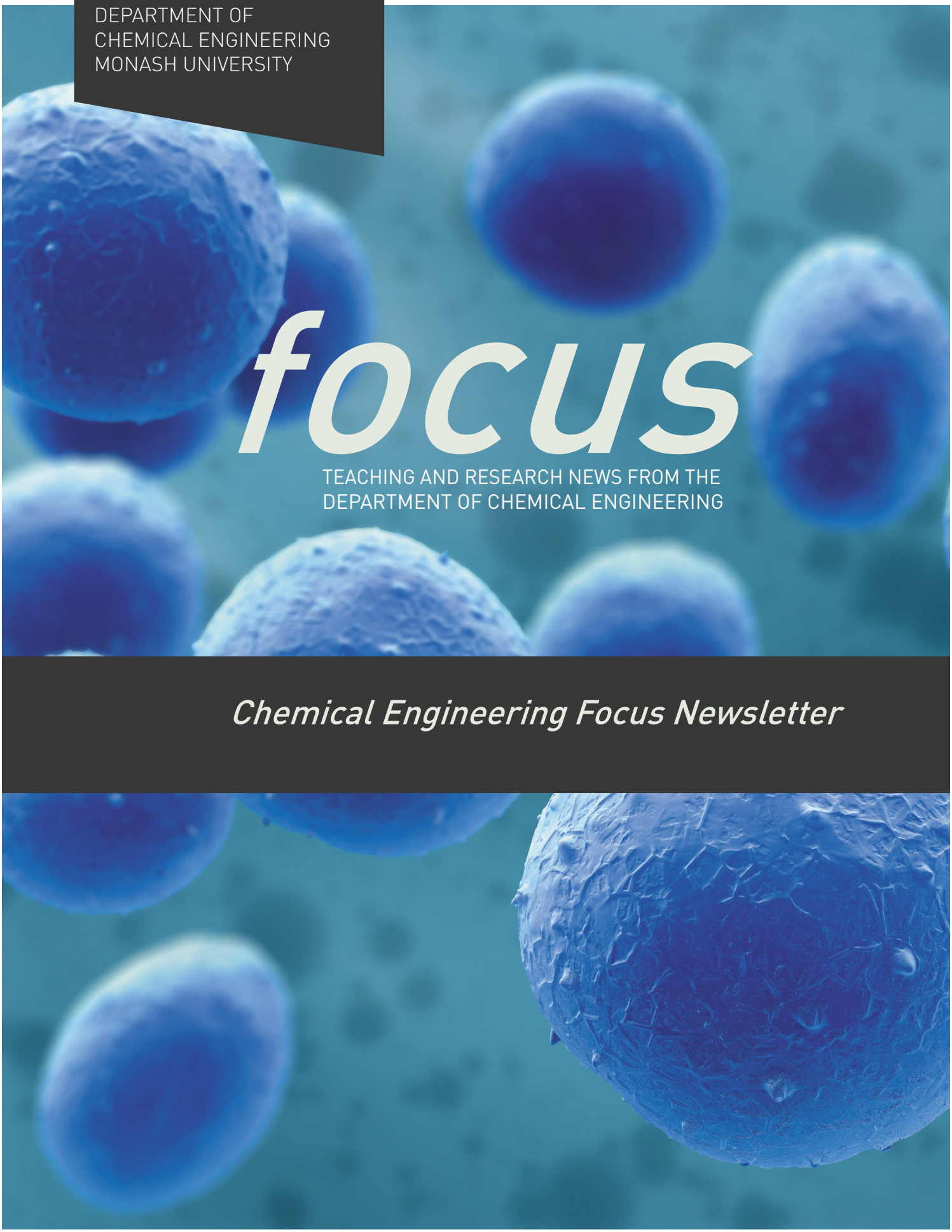
DEPARTMENT OF
CHEMICAL ENGINEERING
MONASH UNIVERSITY



# focus

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

## *Chemical Engineering Focus Newsletter*

MARCH 2016
VOLUME 9, ISSUE 1

MONASH University
Engineering

DEPARTMENT OF
CHEMICAL ENGINEERING
MONASH UNIVERSITY

# focus

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

## HIGHLIGHTS IN THIS ISSUE

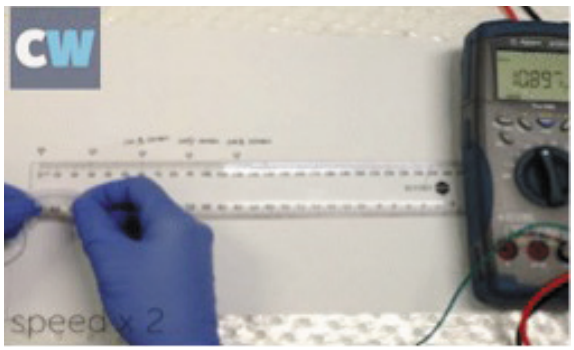


MARCH 2016
VOLUME 9, ISSUE 1

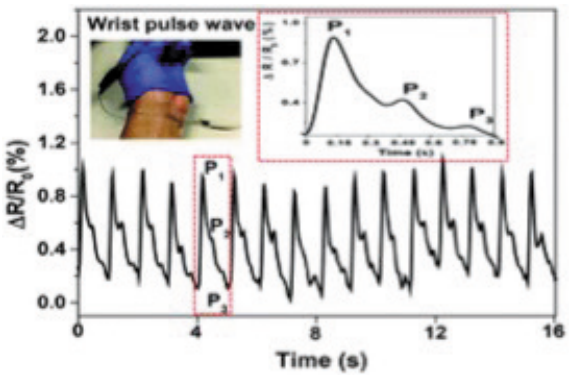
MONASH University
Engineering

# MONASH RESEARCHERS DEVISE IONIC LIQUID MICROBANDS AS HIGHLY DURABLE & WEARABLE BIOMEDICAL SENSORS

> "From our perspective, stretchable electronics should be the ultimate electronic product"




*An ammeter indicates changes in the electric current running through the sensor as it is stretched © Royal Society of Chemistry*




This February *Chemistry World* showcased research led by Monash University's Chemical Engineering's Professor Wenlong Cheng. Professor Cheng and his team of materials scientists and chemical engineers have developed a soft and stretchable device that recognises artery pulses or body movements, relaying the information to a smartphone.

Professor Cheng's work was originally published in *Materials Horizons* (DOI: 10.1039/C5MH00284B) in a paper titled "*Volume-invariant ionic liquid microbands as highly durable wearable biomedical sensors*". He reports that with the surge in the demand for wearable devices with gadgets to monitor body movements, heart rate and sweat metabolites, among other things, many current devices are not truly wearable as they do not sit flush with the skin and therefore do not deform as the body moves.

Professor Cheng used an ionic liquid sealed in a silicon mould to counteract these limitations. They created a durable, waterproof and lightweight device that senses body movements. When the sensor deforms, current running through the device changes while the voltage remains fixed. A smartphone is capable of picking up these variations in resistance, which are unique to each movement. Ionic liquids generally have lower Young's moduli than the elastomeric polymers typically used in electronic devices.

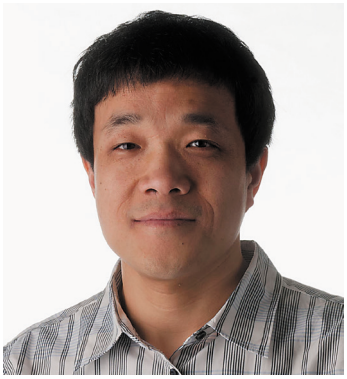
These low moduli allow the sensors to bend without any signs of cracking or loss of conductivity. While Professor Cheng has used a model ionic liquid in this study, his team is also testing a range of hydrophilic and hydrophobic ionic liquids for these sensors.

Professor Cheng foresees a key application for the sensor in monitoring health, in particular for people working at desks on a daily basis, who may be at risk of cervical spondylosis – a form of neck pain. 'From our perspective, stretchable electronics should be the ultimate electronic product.'

A/Professor Xiaodong Chen, an expert in materials science from Nanyang Technological University in Singapore, asserts that the device provides 'a simple strategy to monitor the complex motions of the human body.' Chemical engineer Zhenan Bao, from Stanford University, US, also praises the work, describing the device as a simple and elegant approach, with 'great potential for applications in wearable electronics'.

This article originally appeared in *Chemistry World* on the 12 February 2016

# About Professor Wenlong Cheng



Wenlong Cheng is a professor in the Department of Chemical Engineering at Monash University and a senior Technology Fellow at the Melbourne Centre for Nanofabrication. He earned his PhD from the Chinese Academy of Sciences in 2005 and his BS from Jilin University, China in 1999. He held positions in the Max Planck Institute of Microstructure Physics and the Department of Biological and Environmental Engineering of Cornell University before joining Monash University in 2010.

Professor Cheng's nanobionics research laboratory focuses on the design of well-defined organically-capped metal nanoparticles (nanobionic particles) for applications in Advanced Materials, Electronics, Biology and Energy. We enable this concept through a highly interdisciplinary research program across chemistry, biology, materials science and microelectronic engineering. In particular, the main goals of the nanobionics laboratory is to synthesize plasmonic high-quality nanocrystals and conjugate them with biomolecules; rationally program synthesis of nanobionoic particles; elucidate the fundamental structure-function relationships; develop adaptive energy-harvesting and sensing devices.

Read more

# Abstract from the paper

## Volume-invariant ionic liquid microbands as highly durable wearable biomedical sensors. Materials Horizons (DOI: 10.1039/C5MH00284B)

Yan Wang,[ab] Shu Gong,[ab] Stephen Jia Wang,[cd] George P. Simon[be] and Wenlong Cheng*[abf]

[a]Department of Chemical Engineering, Monash University, Clayton, Australia; [b]New Horizons Research Centre, Monash University, Clayton, Australia; [c]International Tangible Interaction Design Lab, Monash University, Clayton, Australia; [d]Department of Art Design & Architecture, Monash University, Caulfield, Australia; [e]Department of Materials Science and Engineering, Monash University, Clayton, Australia; [f]The Melbourne Centre for Nanofabrication, Clayton, Australia

Most current wearable electronic products are often based on rigid circuit board technologies, limiting their 'true wearability' on the soft human body due to the mechanical mismatch between electronic and biological materials. 'True wearability', which means intimate contact with the soft human body, can only really be achieved by stretchable electronics that can mimic the mechanical features of the human skin. The use of nanomaterials or wavy metal/semiconductor materials represents a promising strategy to achieve stretchable electronic devices, but such devices often experience local material delamination or cracking. In this work, we describe an ionic liquid (IL)-based approach for the fabrication of rubber band-like, stretchable strain sensors, which can circumvent these limitations. Non-volatile and flow properties allow us simply to 'fill and seal' microchannels fabricated by 3D printing to obtain lightweight, waterproof and thermally sensitive wearable sensors. Despite the simplicity of their fabrication, the sensors show excellent performance, including tunable sensitivity, detection of a wide range of strains (0.1–500%), high durability (little change in signal-to-noise ratios after 6 month storage under ambient conditions), an excellent long-term stability of 50 000 life cycles under both low (5%) and high (100%) strains. We further show that our IL-based sensor can accurately identify wrist pulses, and can be woven with commercial rubber bands into colourful bracelets for hand gesture detection, and seamlessly interface with wireless circuitry to allow the detection of cervical movements.

# WOMEN ENGINEERS KICKSTART STEMM

Monash University's Faculty of Engineering recently hosted the inaugural meeting of the Future Women Leaders Conference. The two-day workshop, held on the 26 - 27 November 2015 at the university's Clayton campus in Victoria, was attended by around 50 women engineers from across Australia, New Zealand and Malaysia.

The workshop sought to narrow the gender gap and improve gender diversity among engineering researchers by providing support and practical information to female post-doctorates, lecturers and PhD candidates working in the engineering sector on how to manage the pressures faced by female academic engineers.

"The Future Women Leaders Conference is the first of its kind," said Professor Ana Deletic, Associate Dean of Research at the Faculty of Engineering at Monash.

"The focus is on inspiring women in engineering to pursue an academic career, as well as providing opportunity for them to learn from the success of other female engineers."

Gender diversity is still a major challenge for the science, technology, engineering, mathematics and medicine (STEMM) disciplines in Australia. This is particularly true for engineering, where, according the Workplace Gender Equality Agency (WGEA) report: A strategy for inclusiveness, well-being and diversity in the engineering workplace, women make up less than 12% of the workforce.

The majority of the workshop's attendees are post-doctoral researchers seeking to transition to an academic position. This is a critical time in the life of female research engineers – at this point the gender gap widens significantly.

"We're truly excited about this gathering – we see it as a fundamental step in increasing diversity in engineering," said Professor Karen Hapgood, Head of Department for Chemical Engineering at Monash University and co-chair of the workshop with Professor Deletic.

"The group is likely to form a peer mentoring network as a result of this event, which will provide valuable ongoing support for attendees. Engineering research is a highly competitive field, so this kind of support is particularly beneficial."

The workshop, which featured inspirational stories from successful women engineers from across the country, including Monash Provost and Senior Vice-President Professor Edwina Cornish and Dr Leonie Walsh from The Office of the Lead Scientist in Victoria, sought to address the gender gap by providing valuable insights into the challenges faced by women in engineering.

The networking element of the workshop, according to Professor Deletic, was particularly valuable. "Many attendees had not met other people in their situation, and were eager to talk through the common challenges they face," said Professor Deletic.

Monash University, together with another 32 Australian institutions, is also taking part in the Science in Australia Gender Equity pilot. Launched on 16 September 2015, the pilot is an initiative of the Australian Academy of Science in partnership with the Australian Academy of Technological Sciences and Engineering that seeks to improve gender equity practices, representation and retention in STEMM.

Words sourced by article in Science Meets Business: http://sciencemeetsbusiness.com.au/future-women-leaders/

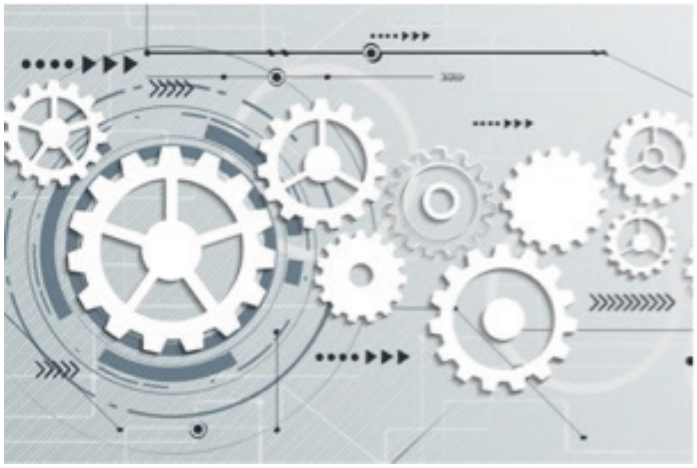
# FACULTY OF ENGINEERING SHINES IN ERA RESULTS

Known as one of Australia's top engineering research institutes, Monash University's Faculty of Engineering is performing well above world standard, according to recent Excellence in Research Australia (ERA) results released by the Australian Research Council (ARC).

The faculty received outstanding results across a diverse range of research fields, with each area of assessment rated above world standard. The vast majority of the assessed fields, including Chemical, Civil, Biomedical, Manufacturing and Materials Engineering, as well as Nanotechnology and Medical Biotechnology received a score of 5, which means the research output is well above world standard.

These excellent results have remained steady since 2012, when the faculty achieved equally impressive scores, and is one of the best results for engineering in Australia.

The ERA framework is a national program administered by the ARC, which identifies and promotes excellence in research activity in Australia's higher education institutions. This is the third round of ERA evaluations, the first of which was held in 2010.



## MASTER OF ADVANCED ENGINEERING

**The Master of Advanced Engineering is the key transitional stage in your career, transforming you into a global leader. Gain a depth of knowledge, mastering the crucial skills to become a leading contributor in your field**.

Customise your degree – the Master of Advanced Engineering offers flexibility to complete your Master degree in just one year, or you can choose a two-year option.

This course is designed to extend your knowledge in your chosen specialisation and advance your leadership and complex problem-solving skills in a cross cultural environment.

LEARN MORE AT www.eng.monash.edu.au/masters/

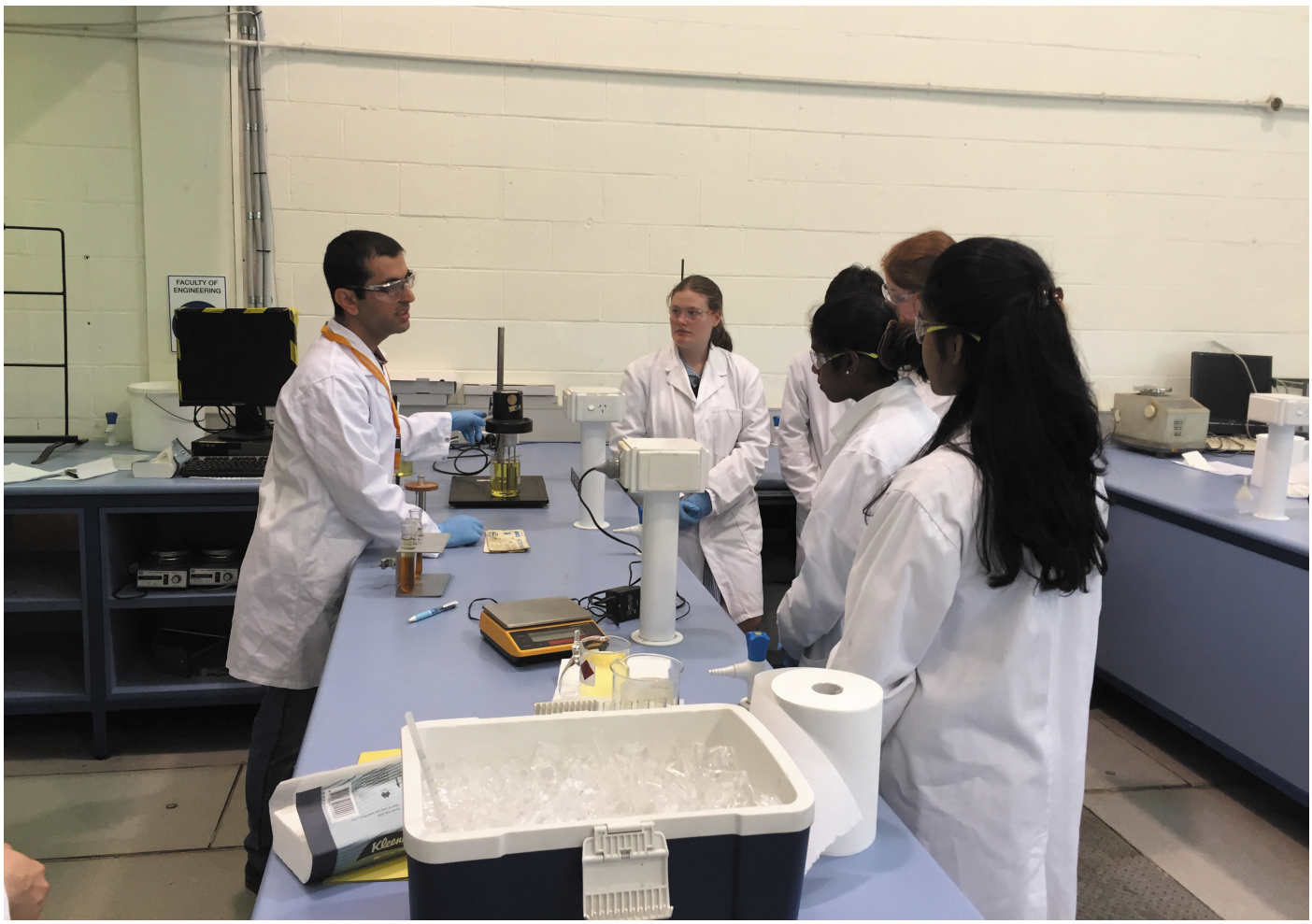
# JMSS IMMERSION DAY

## John Monash Science School 2 December 2015

Around 200 Year 11 students from the John Monash Science School (JMSS) were taken for a range of activities by Monash academics.

The Chemical Engineering workshop led by Dr Akshat Tanksale was very popular amongst students. The theme of the workshop was Bio-fuels: How do we produce sustainable fuels for the future? Negin, Tahereh, Krystel, and Ezzatollah, PhD students in the Department of Chemical Engineering, voluntarily demonstrated the production and characterisation of bio-diesel using fresh vegetable oil. After receiving a general introduction about the biodiesel production and the theory behind that, students in the first station conducted a titration experiment to determine how much catalyst was required to neutralize the free fatty acids present in vegetable oils.

In the second station, they poured the reactants (ethanol, NaOH, oil) into a blender and commenced the reaction by starting the air driven stirrer. Finally, after separating the bio-diesel from its side product (glycerine), students measured the selected fuel properties such as density, viscosity and clouding point for the produced biodiesel and then compared with the properties for the standard biodiesel. This interesting workshop gave students the firsthand experience of the production and characterisation of bio-diesel followed by discussion on how this can be a more sustainable fuel option.



# A WONDERFUL OUTCOME FOR MONASH STUDENT THANKS TO A WOODSIDE SCHOLARSHIP

Most VCE students would be ecstatic with an ATAR of 98.7. and Braybrook College student Mai Duong was pleased and proud. But also bitterly disappointed.

She had been working towards the "perfect score" of 99 because she believed she needed it to stay in Australia.

She lives with her aunt and worked in a shop for 16 hours each weekend to pay for her living costs as she studied Year 12 at Braybrook College in outer Melbourne.

Her parents live in Vietnam and sent her to Australia for a better life.
A score of 98.7 fell short of the mark she needed for a full-fee paying scholarship to university.

Her parents could not afford to pay her tertiary fees, and as an international student, she does not qualify for HECS.

On December 16, when the results came out, she feared she had disappointed her family and would have to return to Vietnam.

After The Age reported on Mai's heartbreaking shortfall, the readership responded spectacularly. Ms Duong was inundated with offers of support.

In the end, she opted to accept a two-thirds scholarship offered to her by resources corporation Woodside. She will now study Engineering at Monash University.

On Thursday at Monash she met her mysterious benefactor, a manager at Woodside who has asked not to be named, in a ceremony in which she was awarded her scholarship.
Mai flew home to see her parents in Vietnam a month ago.

"They told me to keep trying. Now I'm at the beginning."

"I feel quite stressed really. Uni is pretty much different from high school."

"There's a lot of assignments and quizzes and tests."

"I keep having doubts about myself and worries that I won't reach what they expect from me."

This article appeared in The Age and other Fairfax online news sites on the 3 March 2016. Article written by Laim Mannix

http://www.canberratimes.com.au/victoria/engineering-best-outcome-for-student-mai-duong-who-missed-scholarship-by-a-whisker-20160303-gn973r.html

*Mai Duong.  Photo: Penny Stephens*

# NÍN HǍO GREETINGS FROM PETER TSIRIKIS IN CHINA

Nín hǎo! Greetings from Beijing, China's political and cultural centre. I am currently at the National Key Laboratory of Biochemical Engineering, Institute of Process Engineering. The institute is one of the 124 institutions which collectively form the Chinese Academy of Sciences, the linchpin of China's determination to expand and commercialise scientific knowledge.

I am in Beijing as the 2015 Endeavour Australia Cheung Kong Research Fellowship recipient. The Endeavour Australia scholarships and fellowships are internationally competitive, merit-based awards funded by the Australian government to support study, research and professional development in a foreign country.

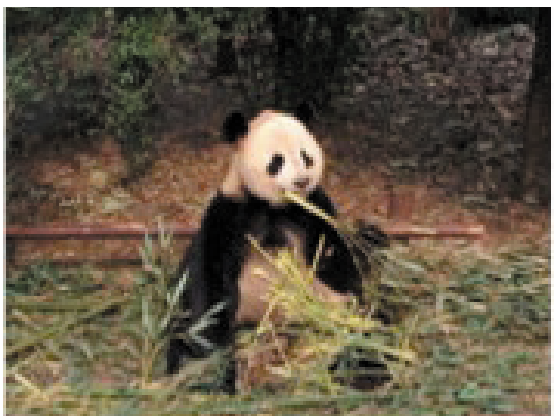
Working with Professor Guanghui Ma, my research has two objectives: one, investigate the biodistribution of nanoparticle vaccines and, two, elucidate the force interaction between particles and cells. The outcomes from this study provide key design criteria in the development of novel nanoparticle immunotherapeutics for the treatment of disease such as cancer.

Experimenting in highly equipped and interconnected laboratories has been a productive and educating experience. I have had the opportunity to use advanced equipment such as atomic force microscopy and multispectral imaging technology to view distinct regions of tissue. It has also been an opportunity to collaborate and share knowledge with fellow research students and technical support staff which has invariably led to greater academic insight and thus higher quality scientific output.

The results from this interdisciplinary and multinational collaboration between Monash University and the Institute of Process Engineering will be presented at leading immunology conferences in Australia and the USA later this year. This outcome achieves the core aim of the endeavour programme: to develop ongoing international research and innovation links between organisations for the greater benefit of society.

However, to describe my Endeavour fellowship purely in an academic context would do an injustice to my experience and the broader objectives of the programme. The fellowship has provided a platform for immense personal growth and development. Through social networking such as Couch Surfing, I have forged friendships with people around the globe. The opportunity to travel has been unparalleled. From watching the city skyline of Chongqing light up to herald the year of the monkey, to observing a giant panda lazily munch fresh bamboo in Chengdu and gasping in awe when hiking the Great Wall in Beijing, I have seen the raw beauty of China.

The opportunity to represent Australia in this programme has been an honour and a richly rewarding experience. I would like to thank my supervisor, Professor Cordelia Selomulya, for entrusting me to establish this international collaboration. My Endeavour programme has been an experience of a life time. I would strongly encourage all eligible applicants to apply.



### ENDEAVOUR SCHOLARSHIPS AND FELLOWSHIPS

The Australian Government Department of Education and Training administers the Endeavour Scholarships and Fellowships. The Endeavour Scholarships and Fellowships aim to build Australia's reputation for excellence in the provision of education and research, support the internationalisation of the Australian higher education and research sectors and offer high-achieving individuals from overseas and Australia opportunities to increase their productivity and expertise in their field.
https://internationaleducation.gov.au

# MONASH CHEMICAL ENGINEERS HARNESS THE POWER OF MILK PROTEIN

Australia and South Dakota are on opposite sides of the world, but collaboration between South Dakota State University (SDSU) dairy scientists and chemical engineers in Australia will make developing new dairy ingredients with specific functional properties easier.

SDSU dairy researchers are using a bench-scale single-droplet spray dryer to determine the exact drying parameters for an ingredient with the desired functional properties. Professor Cordelia Selomulya and her team at Monash University then utilise the data on drying behaviour of different materials to develop a computational fluid dynamics model to predict the range of drying parameters needed to produce a powder with those properties in a spray dryer.

“Our expertise is in manufacturing and functionality; theirs is in engineering and modeling,” said Professor Lloyd Metzer, who leads the SDSU research team. “It’s an ideal collaboration because our areas of expertise are complimentary.”

Former Assistant Professor Hasmukh Patel, who is now a senior principal scientist at Land O’Lakes in Minneapolis, started the project. The SDSU portion of the three-year project, which began in 2014, is supported by a Dairy Management Inc. grant for more than $US250,000. The research focuses on optimizing spray-drying conditions for milk powders and dairy ingredients, such as whole milk powder, whey and milk protein concentrates and isolates and infant formula. Doctoral student Hiral Vora and other SDSU dairy science staff are working on the project.

### Determining desired properties

When it comes to spray-drying, any number of conditions can affect powder properties, including the characteristics of the material being dried, the nozzle type and amount of pressure behind nozzle, the fluid pre-heat temperature and the air inlet and outlet temperature, according to Metzger.

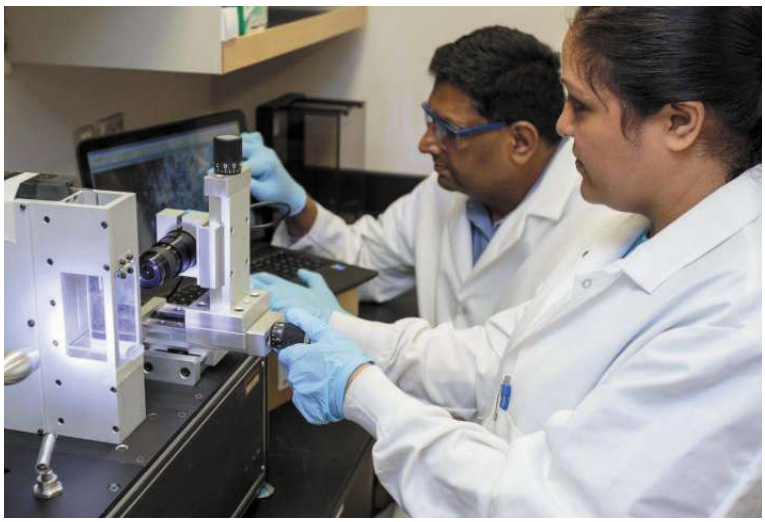
Additionally, the desired powder properties will vary for different products. For instance, in an application like coffee creamer, he pointed out, the powder must dissolve very quickly in hot coffee and it may be required to foam. In other applications like infant formula, the density of the powder is critical to ensure that each scoop of powder has the correct nutrient content. The dairy industry now uses trial and error or past experience to adjust drying conditions to achieve the desired powder characteristics, Metzger explained.

This approach assumes what happens with a small batch using a lab-scale or pilot-scale dryer will work on a larger scale, according to Professor Selomulya. However, she cautioned, “both are complex systems in their own right, so the drying history will be different for each dryer. With the variation of feed formulation in dairy, trial and error is not an effective approach.”

### Developing predictive model

Professor Selomulya and her team will calculate the drying rate of the material using experimental data, such as changes in mass, droplet temperature and size, along with morphological changes, such as skin formation, from the single-droplet dryer combined with a reaction engineering modeling approach. The results will then be used in a computational fluid dynamics model to predict what will happen inside an industrial spray dryer.

“It’s all about trying to simulate on a small scale with the single-particle dryer and relate that to what happens in the big dryer,” Metzger said. The semicommercial-scale dryer at the Davis Dairy Plant will be used to validate the methodology and scale up the models developed. This collaborative effort promises to streamline the process of changing formulations and developing new dairy ingredients— and that could translate into huge savings for the dairy industry.



*Doctoral student Hiral Vora, right, works on the single-droplet spray dryer at an external facility*

# DR MENG WAI WOO WINS YOUNG INVESTIGATOR AWARD


Congratulations to Meng Woo (far right in photo) a recipient of a Young Investigator Award at the 6th Asian Particle Technology Symposium (APT 2015) that took place in Seoul, Korea between 15-18th September 2015.

Up to five awards are presented every 2-3 years to researchers under 40 working in the Asia region on particle technology. Meng was honoured for his work on anti-solvent spray drying.

Meng, who is a lecturer at Monash University in the Department of Chemical Engineering, specialises in spray drying and in the making of functional particles. He undertakes applied research as well as consulting to industry in the dairy and energy sectors on computational Fluid Dynamics.

Current work being undertaken by Meng includes antisolvent precipitation of unique particles in spray drying. Traditional spray dryers focus on the formation of particles by dehydrating individual droplets. This latest branch of spray drying focuses on precipitating the sold particles while still wet creating unique particle morphologies which will exhibit potential applications in the pharmaceutical and food industry.

You may also recognise another face in the photo. Dr Zhangxiong (William) Wu (2nd from right) who completed his PhD at Monash, and is now at Soochow University (China).

William's award was based on his paper on a series of contributions in producing mesoporous particles. The series of contributions include his work at Monash University Department of Chemical Engineering as part of his double PhD and postdoc (working with Professor Cordelia Selomulya) and his work at Fudan University and also the continuation of his research in Soochow University.

## PHD OPPORTUNITY WITH SIRA SUGAR

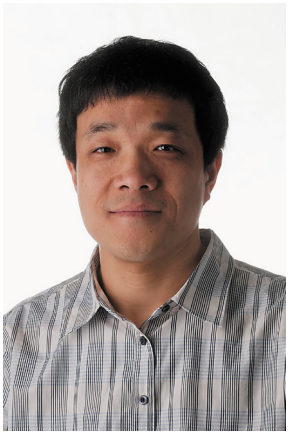
An industry-linked PhD project is available with an innovative sugar company,SIRA Pty Ltd.

The project will focus on the development and production of new SIRA products with unique functional properties via novel processing technologies. A strong background in Chemical Engineering or Mechanical Engineering is required. Additional skills and interest in Food Science and Chemistry are desirable.

Applicants must have H1 equivalent academic record and are eligible to apply for Monash University's scholarships. Applicants must show excellent communication and inter-personal skills, willingness to travel (including regular site visits and industry internship during the course of their projects), and are interested to explore future careers in the food manufacturing industry.

Please send your CV to Ms Lilyanne Price (lilyanne.price@monash.edu)

# WENLONG CHENG APPOINTED TO ARC COLLEGE OF EXPERTS 2016



Wenlong Cheng, Professor and leader of the Nanobionics Group within Monash Chemical Engineering, joins the College of Experts in 2016. This will be a wonderful experience and provide the faculty with a little more insight into the processes.

The role of members of the ARC College of Experts is to play a key role in identifying research excellence, moderating external assessments and recommending fundable proposals. The members are experts of international standing drawn from the Australian research community: from higher education, industry and public sector research organisations.

# ACADEMIC PROGRAMS MANAGER LILYANNE PRICE WINS MONASH EXCELLENCE IN SERVICE AWARD

The 2015 Research Service Excellence Awards were announced in December 2015, and our very own Lilyanne Price won the 'Excellence in Service' award for the exceptional service and administrative support she provides to undergraduate and postgraduate programs within the Department of Chemical Engineering.

Lilyanne was nominated by Professor Wei Shen and Dr Akshat Tanksale who noted her dedication and pastoral care towards the higher degree and research (HDR) students.

Included in the programs Lilyanne established was a 'Buddy' system for all new HDR students in the Department providing them with support and assistance in becoming familiar with the University environment and providing a smooth transition into University life. The program matches current research students (of a related research area) to show the new students around the laboratories, Department and University.

Lilyanne's Award also recognised the work she has undertaken in the implementation of a temporary accommodation package available to all new HDR students, particularly those from overseas. She ensures that the students are aware of services such as free airport pick-up service offered by the University. Finally, Lilyanne's Award recognised her Pastoral care of students in difficulty that is "over and above" what is expected in her position.

# OUTSTANDING RECOGNITION FOR OUR STUDENTS AND RESEARCHERS

## Special commendation to Professor Cordelia Selomulya in Vice Chancellor's Award

The exceptional achievements of Monash academics were celebrated at the Vice-Chancellor's Education and Research Awards Program ceremony on Tuesday 17 November 2015.

President and Vice-Chancellor Professor Margaret Gardner AO presented the Excellence Awards to researchers and educators whose leadership, innovation and commitment have made an outstanding contribution to the University's teaching and research programs.

Cordelia was awarded a special commendation in the Vice-Chancellor's Award for Excellence in Postgraduate Supervision. In the Department of Chemical Engineering, Cordelia leads the Advanced Particle Engineering Laboratory (MAPEL), where she is conducting interdisciplinary research with the Departments of Immunology and Microbiology on the design and delivery of nanoparticle vaccines. Examples include designing a more efficient DNA vaccine delivery system for malaria using magnetic nanoparticles. She also collaborates with researchers from Materials Engineering in designing magnetic nanocomposites for electromagnetic interference shielding and developing new 1st order magnetic nanomaterials for magnetic heating (Prov. Patent AU2013905012).


*Monash Vice Chancellor Prof Margaret Gardner presents Professor Cordelia Selomulya with her special commendation*

## Georgina Catto-Smith awarded Victorian Chemical Engineering Student Achievement Award

Congratulations to Georgina Catto-Smith, who is currently undertaking a double Bachelors Degree, Pharmaceutical Science and Chemical Engineering (Honours). The Awards of Excellence program is annually coordinated by the Federation of Australian and New Zealand Chemical Engineers with the Awards presented at the annual Chemeca dinner.

The Student Achievement Award recognises and encourages chemical engineering students who fully participate in professional and public life. The award is a monetary prize of $500 and a framed certificate, presented on behalf of the Joint Victorian Chemical Engineering Committee (JVCEC).

# Two international acknowledgments for Professor Lei Jiang

*Director General of UNESCO, Irina Bokova, presents Prof Lei Jiang with the UNESCO medal for contributions to the development of nanoscience and nanotechnology*

High international praise for Professor Lei Jiang has included election by The National Academy of Engineering (USA) as a foreign member. In 2016, 80 new members and 22 foreign members were elected, with Lei taking out a foreign membership for his development and commercialisation of superphilic and superphobic coatings.

Election to the National Academy of Engineering is among the highest professional distinctions accorded to an engineer, with Academy membership honouring those who have made outstanding contributions to 'engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature' and to 'the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education'.

Lei, along with the other newly elected Academy members, will be formally inducted during a ceremony at the NAE's Annual Meeting in Washington, DC in October, 2016.

Added to this prestigious nomination, in a ceremony held at UNESCO headquarters in Paris on 5 February 2016, Lei was one of eight eminent scientists awarded the UNESCO Medals for contributions to the development of nanoscience and nanotechnologies. Lei received the UNESCO Medal for his research on the design and fabrication of bio-inspired surfaces with specific wettability. The medal is awarded each year by the Director-General of UNESCO, Irina Bokova, to prominent scientists, public figures and organisations that contributed to the development of nanoscience and nanotechnologies in the spirit of UNESCO's priorities.

# Karinna Saxby, outstanding achievement at the Undergraduate Awards 2015

Congratulations to Karinna Saxby, who was received a the 2015 Undergraduate Award. Karinna undertook a Bachelor of Chemical Engineering (Honours) and Bachelor of Science, choosing Monash because it has a great Engineering program and because it offered the double degree with Science.

"I had a 'crazy, nerdy love of maths' as a teenager" said Karinna, leading to combining her interests and choosing chemical engineering as her engineering field. "Chemical Engineering students can specialise in sustainable processing, biotechnology, or nanotechnology streams. I chose the biotechnology stream as it is a fantastic way of combining both of my disciplines and because I find microbiology and molecular biology particularly interesting," she said.

The Undergraduate Awards (UA) is the world's largest academic awards program, recognising excellent research and original work across the sciences, humanities, business and creative arts. Overall it aims to celebrate and support the world's brightest and most innovative undergraduate students by recognising their best coursework and projects. In 2015, Monash students made 115 submissions and 14 of those were named as Highly Commended which places them in the top 10 percent of this year's 5,117 submissions from students in 255 universities across 39 countries.

Professor Darrell Evans, Vice-Provost (Learning and Teaching) described this as a fantastic achievement. "Seeing Monash undergraduates recognised in this manner on the global stage reinforces the many associated benefits of our students receiving an outstanding learning and teaching experience. Many congratulations to all those who made submissions and to those that achieved highly commended."

Monash's enviable result was further noted by the Undergraduate Award's Executive Director Louise Hodgson who said "that fact that one university has Highly Commended entrants across so many diverse categories is extremely impressive. Congratulations, Monash!"

THE UNDERGRADUATE AWARDS WILL RETURN IN 2016. FURTHER INFORMATION HERE

# ENGINEERING LEADERSHIP PROGRAM RESIDENTIAL

Seven Chemical Engineering students entered the Faculty of Engineering's Award winning Leadership Program in 2016 and started their training with an intensive 3-day residential camp at Foothills Convention Centre (see photo). During the 3-year life of their training, students gain both understanding and skills in many aspects of leadership. They are also eligible to apply for industry and philanthropic scholarships, most of which have mentoring and vacation work opportunities associated with them.

FURTHER INFORMATION ABOUT THE PROGRAM AND HOW TO APPLY CAN BE FOUND AT: http://www.eng.monash.edu.au/current-students/merit/leadership/

STUDENTS' PERSPECTIVE

Coming into the Engineering Leadership Program, I'd hoped to develop my understanding of leadership as well as learn invaluable communication skills that could assist me at university and in my future career. What I got from it was that — and more. The ELP residential was a deeply engaging experience that really motivated me for the year ahead. The speakers presented big questions that provoked interesting discussion and challenged us to think from fresh perspectives. For me, the program was also a great opportunity to meet like-minded students. I would definitely recommend it to other Engineering students.
Maggie Xiaoyu Du

Being accepted into the Monash Engineering Leadership Program, I hoped to continue to develop my foundation of leadership skills and meet like-minded people who similarly wanted to continue to better themselves. Despite being in the program for a short space of time, I have already been left inspired by the numerous benefits this program has to offer.
Being a fourth year student, I can see how these skills would have been useful in my previous experiences and I am now striving to apply them in future experiences. Definitely a program that I would recommend for everyone!
Christopher Schumacher


*Back Row : Assoc Prof Victoria Haritos (Assoc Dean, Student Engagement); Maggie Du; Hudson De Bortoli; Chris Schumacher*
*Front row : Crystal Hall, Rebecca Ong, Samara Smith, Jacinta Poon*

# ARC GRANT SUCCESS FOR XUCHUAN JIANG AND VICTORIA HARITOS

Double success for the Department in the ARC funding round with a Discovery Project and a LIEF grant.

Associate Professor Xuchuan Jiang and Professor Dr Arnaud Brioude were successful in a Discovery Project titled *Development of Metal-Titania Core-Shell Nanostructures for Photocatalysis.* Through this funding, this project is to develop innovative techniques for the synthesis of advanced nanomaterials for pollutant removal and antibacterial applications. Improving the photocatalysis efficiency of titanium oxide (TiO2) is critical in energy and environmental applications. This project aims to develop innovative strategies to prepare metal–TiO2 core-shell nanostructures, in which metals (eg gold, silver) can be used as light absorbers for visible incident light and generate intense electromagnetic fields, thus improving efficiency.

Associate Professor Victoria Haritos; Professor Trevor Lithgow; Associate Professor Bayden Wood; Professor Dr Falk Schreiber; Professor Sagadevan Mundree; Dr Geoffrey Dumsday; Professor Rodney Devenish; Professor Ewan Blanch; Dr Laleh Vash Moghaddam; Dr Oliver Hu were successful in a Linkage Infrastructure, Equipment and Facilities grant (LIEF) for a project titled *High throughput microbial microculture and single cell analysis facility*. This project will support the emerging research area of microbial heterogeneity and variation in response to various conditions. The team plan to establish a facility centred on a 24-microbioreactor system for high throughput microbial culturing. This is designed to be connected to two complementary analysis techniques – flow cytometry and high resolution infra-red microscopy – for the non-destructive measurement of metabolic activities

and mapping of constituents of whole cells. This would help us to determine the variation in response between organisms, to guide cell line development and process optimisation for a wide range of biotechnology applications. Expected outcomes may apply to Australia's brewing, wine, food processing, aquaculture, biofuels, biomedical and biotechnology industries.

# CHEM ENG STUDENTS TAKE PART IN MONASH INDUSTRY TEAM INITIATIVE

Bringing talented students and industry leaders together is the initiative of the Monash Industry Team Initiative (MITI). Multidisciplinary student teams from Monash University are partnered with leading Australian and global industry partners to collaborate and design innovative solutions to real issues in today's business world.

Industry partners host teams of up to four students to undertake a specific project over 12 weeks from December to February. The industry partner, together with the University, define the requirements for the project and the team required, ensuring that students are exposed to relevant learning opportunities throughout the duration of the experience.

Over recent months three Chemical Engineering students have taken part in the program working in leading Australian food based companies. Krystel Li was accepted to work with Devondale Murray Goulburn, Australia's largest dairy foods company with a history spanning over 60 years. Ruohui Lin also worked on a Devondale Murray Gouldburn project, while Zahra Abbasi worked on a project with Burra Foods, an Australian dairy ingredient processor that for over two decades has been producing and marketing value-added dairy products to the global food manufacturing market.

FOR MORE INFORMATION ON MITI VISIT www.miti.monash.edu

# MONASH RESEARCHERS PUBLISH IN NATURE CHEMISTRY

Biao Kong, Xianbiao Wang, Cordelia Selomulya and Dongyuan Zhao are the Monash University co-authors who along with colleagues from China's Fudan Unversity and the National University of Singapore have successfully published in Nature Chemistry.

This work is part of a long-term collaboration between Monash and Fudan University, and it is great to see one of our former PhD students getting such a high profile publication. He was a finalist in the global IChemE awards last month. We congratulate all the authors on this great research highlight!

The paper titled *Incorporation of well-dispersed sub-5-nm graphitic pencil nanodots into ordered mesoporous frameworks*, examines that over the past few decades the direct assembly of optical nanomaterials into ordered mesoporous frameworks has proved to be a considerable challenge.

Here we propose the incorporation of ultrasmall (sub-5-nm) graphitic pencil nanodots into ordered mesoporous frameworks for the fabrication of optoelectronic materials. The nanodots, which were prepared from typical commercial graphite pencils by an electrochemical tailoring process, combine properties such as uniform size (~3 nm), excellent dispersibility and high photoconversion efficiency (~27%). These nanodots were incorporated into a variety of ordered mesoporous frameworks ($TiO_2$, silica, carbon and silica–carbon materials) by co-assembly, driven by hydrogen bonding, with the frameworks' precursors.

The resulting materials showed a high degree of ordering, and a sharp increase in their optical performance (for example, photocurrent density).

We envisage that the large-scale synthesis of ultrasmall carbon nanodots and their incorporation into ordered mesoporous frameworks may facilitate the preparation of materials with a variety of optical properties.

# MONASH PRATO CENTRE HOSTS WORKSHOP ON HYDRODYNAMIC FLUCTUATIONS IN SOFT MATTER SIMULATIONS

With a long standing collaboration between Monash University and the Max Planck Institute, the Monash Prato Centre was the venue for the Hydrodynamic Fluctuations in Soft-Matter Simulation conference held at the Centre between 9-12 February. The conference was co-organised by Monash's Professor Ravi Prakash Jagadeeshan and Professor Burkhard Duenweg from the Max Planck Institute for Polymer Research in Mainz, Germany. Their first encounter came about in 2006 when Burkhard attended a conference organised by Ravi at the Prato Centre, and since then they have worked together on many occasions with both visiting each other's institution as part of an Academic Exchange.

The meeting brought together researchers with different and complementary backgrounds, ranging from physicists to chemical engineers and mathematicians, experts in their respective fields.

Recognition also to the Johannes Gutenberg University of Mainz in Germany and their Professor Friederike Schmid's help in co-organising this event. Sponsorship of the workshop included from CECAM (Centre Européen de Calcul Atomique et Moléculaire).

**WHAT IS SOFT MATTER**

Soft matter is the branch of science dealing with materials that can neither be described as simple solids or liquids, but rather, depending on the circumstance, exhibit properties of both. Examples include dough, foam, toothpaste, paint, ketchup, blood, motor oil, and many other substances of daily life. Modern science seeks to understand the behaviour of these systems on small length and time scales. This insight is of direct practical importance for many applications, for instance, in the design of microfluidic devices used in biomedicine, in food processing, and in the development of pharmaceuticals. Due to their inherent complexity, the theoretical description of these systems relies heavily on computer simulations. A consistent framework necessitates the inclusion of thermal fluctuations, and this poses both conceptual and mathematical challenges. This conference brought together international experts from a variety of disciplines to exchange experience and insights, with the aim of making progress in the development of appropriate models that are theoretically sound and computationally efficient. An accompanying school, consisting of a set of lectures by experts, will be acquainting young scientists with the existing body of knowledge in the field.

# PHD STUDENT UPULIE DIVISEKERA ON SPECIAL EDITION OF ABC'S Q & A

Upulie Divisekera is a molecular biologist and is currently undertaking her PhD at Monash University, Department of Chemical Engineering in the laboratory of Professor Wenlong Chen.

Outside the laboratory, Upulie has earned a reputation as one of the most eloquent science communicators in Australia, and has championed science and its role in everyday discourse for many years. Notably, along with Bernard Kealey and Dr James Smith, she co-founded the highly successful science outreach program, Real Scientists, and communicates science through writing and performance. Upulie is interested in the intersection of science and culture and has written for The Lifted Brow, The Guardian, Sydney Morning Herald and The King's Tribune on science and related topics.

Because of Upilie's expertise in science and communication she was recently invited to take part in a special science edition of ABC's Q &A (aired on Monday 14 March 2016). The panel included renowned physicist and science communicator Brian Greene, Australia's Chief Scientist Alan Finkel, Coast Australia presenter Emma Johnston and Astrophysicist Tamar Davis. The discussion moved from gravitational waves to the importance of basic research and how we should think about managing research capacity in this country. There was also significant discussion about CSIRO cuts, implications of climate change and the ethics and development of artificial intelligence.


LINK – Watch Q&A science episode.

## About Upulie Divisekera

Upulie obtained her degree in molecular biology at the University of Melbourne and is currently pursuing her PhD in Chemical Engineering at Monash University. Over her research career, Upulie has worked in cancer research, materials science, developmental biology and cancer immunotherapies. Her doctoral work is in nanotechnology research, looking at ways in which we can make bespoke nanoparticles for drug delivery. The work is transdisciplinary; and calling on her molecular biology and materials science skillset as well as learning brand new skills to generate new nanoparticles.

## About @realscientists

Real Scientists is a rotational curation account on twitter account that changes "curator" or tweeter every week. Each week a new scientist, clinician, or science writer, artist or communicator 'takes over the account. Upulie set up Real Scientists (@realscientists on twitter) with help from Dr James Smith, an Australian developmental biologist now at Otago University. The idea is to have actual scientists or people who have trained in science and are now in science related fields, or have even left the field, tweet about their work and their lives. The goal is to humanise and normalise science and scientists, to show the range of careers that can come from a science degree, what motivates scientists and most importantly, to make science accessible to the public - the people who fund it. Real scientists takes a broad view of "scientist" and includes people who self-identify as scientists. Currently over 152 science professionals curate, with 50:50 gender parity covering everything from cheetahs to climate change. The account has over 30,000 followers. @realscientists

# Alastair's research experience

Many students towards the end of their degree seek out vacation work in order to gain industry experience, boost their employability and learn more about their chosen career path. Whilst my friends over the summer break donned hard hats, high-vis vests and steel-capped boots I instead nestled into my comfy desk chair wearing my traditional Australian Open tracksuit, and worked under Ravi Jagadeeshan for my Summer Research Project.

Over the course of 12 weeks I worked at Monash University with the supervision of Ravi, PhD student Chandi Sasmal and Owen Kaluza (among others), investigating the various conformations that DNA could exhibit in an elongational flow, specifically in a semi-dilute solution. These various conformations affect the flow properties of the fluid and hence change the way in which these fluids can be used. The goal of my research was to use computational resources to help give evidence towards experimental data gathered by other groups. These findings can be used to approximate other polymer-containing solutions and allow their flow properties to be modelled. This has a great impact on ink-jet printing processes, nanofibre construction and the plastics industry.

I was excited that my project involved me working on something entirely new; whilst properties of both diluted and concentrated protein solutions have been thoroughly investigated, due to the difficult nature of semi-dilute systems, I was doing work that no one had done before. Whilst this was an exciting prospect it also came with some difficulties. There was a very steep learning curve and I was required to do extensive reading in order to bring my knowledge up to a level that was sufficient. This does depend on the exact nature of the project, however what doesn't change is being able to use what you have learnt when conversing with esteemed individuals of those fields.

I was fortunate enough to hear from and speak to international professors who studied these polymer solutions. Working under any researcher will vary, however, personally my supervisor was incredibly busy and as such I only had contact with him every one to two weeks. This was both rewarding, in giving me a sense of independence and freedom, but it also meant I had to be very self-driven and was forced to manage my own time. Additionally, my project involved running simulations which could take hours and during this "free time" it was important to brainstorm about what else I could do that would be useful; often this wasn't directly related to the research but could be beneficial in the long run. After meeting with my supervisor I would discuss my findings and thoughts and he would help me go back to the drawing board, refocus and work out what steps I should take next.

Research work can lead down many potential paths; the most obvious being a PhD. Working closely with a PhD student helped me to understand what was involved in the process, and whilst many students don't get to be involved in the formal writing of their research, I was fortunate enough to see some papers being critiqued before they were submitted to journals. After a PhD you aren't restricted to that field; many will pursue other areas of research and those that were more industry based are often hired for their depth of knowledge and understanding. Research provides fantastic critical thinking skills and also a better understanding of the scientific method, and through these skills many different career options become available.
If you are considering research you should talk to your lecturers. Ask them about their projects and their fields of interest. Decide if those are areas you would like to learn more about and if so, ask about any potential research positions.
A PhD is not an alternative to a job, it is another possible path to a successful career and summer research is a great way to decide if it is right for you.

Written by Alastair Katrivessis
Bachelor of Biomedical Science/Bachelor of Engineering [Chemical Engineering], completion date 2018

# Chris's MITI experience

I have spent the last two summers with MITI being placed in two different dairy companies; Burra Foods (2014/2015) and Fonterra (2015/2016). At the two companies I experienced two completely different projects that applied different sets of skills, but what did stay the same was the enjoyment that came with working and living with a team of four Monash University students.

At Burra Foods we were tasked with applying computational knowledge to develop a program that assisted in the optimisation of the plant's production process, for both short and long term planning. This involved factoring in plant constraints through production data analysis and collaboration with managers, to then model it into the timetabling tool by coding.

At Fonterra, we were brought into tackle the waste water storage issues across the site. As a team we devised multiple strategies to both minimise the amount of waste water produced across site, and maximise the amount of waste water that can be further recycled. The recommendations made have since been implemented by Fonterra and is expected to result in a total increase of 80ML of waste water that can be reused for irrigation.

As I have only completed three of six years of my Bachelor of Chemical Engineering and Bachelor of Pharmaceutical Science double degree, the major benefit of doing vacation work is that I am now certain that I am in the right course. On top of this, since the two projects were so different, I can draw from these experiences when deciding my career path. With a large fraction of MITI projects being based in companies far from Melbourne, there is a high chance of living in a regional area. Since I still live at home, this provided myself with a great chance to learn how to cook, clean and most importantly how to budget.

With MITI continuously looking to increase the number of available projects, there are bound to be more and more fantastic opportunities being offered to students. I highly recommend that all students try and get involved with MITI as you get to enjoy hands on experience, real industry work and spend your time with three people who not only help you learn in the workplace but also become long-lasting friends.

Written by Christopher Schumacher
Bachelor of Biomedical Science/Bachelor of Engineering [Chemical Engineering], completion date 2018
More info at http://miti.monash.edu/

# Luca's industry experience

"How can a student add anything of value, amongst a workforce of incredible, experienced engineers?"; This was one of my main concerns beginning work, however, as it turns out, it was not as hard as I had initially thought. We were told that by the end of our three months we would be experts in our subject matter and this was completely true.

The engineers working alongside me during my 12 weeks of vacation work at ExxonMobil are constantly "firefighting"; dealing with constant process upsets, reliability concerns and other issues that constantly drain their time. This ensures that no day is the same as the last, however this also leaves no opportunity to devote a long period of time to a singular task. I was fortunate enough to have the time to delve completely into the specific projects that were assigned to me and I quickly became well-versed in those areas.

# Luca's industry experience, *cont.*

One of the projects I had was to develop a tool that would allow quick diagnosis of the energy, steam and fuel gas usage within different unit operations in the refinery. The tool itself, conceptually, was quite simple and would allow the engineers to save considerable time each week. I then began to see the catch-22 that affects most workplaces; if a tool could save you an hour a day but would take a week to create, it would be worthwhile in the long run. However, with so many different issues pulling at everyone's time, many of these long term projects are left to the wayside. These types of projects provided a window of opportunity for me to add value even with my limited industry experience.
This ability to singularly focus upon a task was a common theme throughout my time at the refinery. My main project focused upon investigating the level of fouling present within the heat exchanger network. Sound easy? I thought so too initially, however there was a catch; I was to look at the cooling water heat exchangers and there was essentially no temperatures, pressures or flows available for the cooling water streams. This starkly contrasted from what I was used to in tutorials where the questions always had the values you needed, I found instead that sometimes these figures simply do not exist. Throughout the course of the project, I found hundreds of thousands of dollars being lost due to fouling within several heat exchangers, and these would have continued unnoticed had someone not been available to spend 12 weeks focused upon that one task.

One of the most interesting tasks was compiling an initial project nomination to replace a bank of heat exchangers that were not functioning correctly. This was a multi-million dollar project, and it was extremely exciting contacting vendors for quotes, costing civil and construction work and talking to design experts. It reinforced that engineering is not a singular discipline and often requires the assistance of professionals from many fields. What blew my mind was that for a typical engineering project, the equipment cost typically only makes up 25% of the total cost of the project; so to install a $1m piece of equipment, you would expect to pay $4m all up to get it up and running!
The reason I applied to work with ExxonMobil was that every person I had met had a genuine passion for their work. I was not disappointed after starting at the Altona site; the culture there is really something special. Everyone is incredible, and will take the time needed to help and support you. Additionally, the chance to go on a number of team building events, meet experienced members of the company and visit other ExxonMobil sites was something that helped both build me as an individual and cement my career choice.

The time I spent at the Altona site was incredible and gave me an insight into both the oil and gas industry and the role of engineers in the workforce. Most importantly it has given me the confidence that I am able to be a successful engineer in the future and a sense of excitement and anticipation for what lies ahead of me. Although I did not formally need to complete vacation work to complete my degree I found the experience highly rewarding and would encourage all students to seek it out during the their time at university.

Written by Luca Stamatescu
Bachelor of Engineering [Chemical Engineering], completion date 2017

# Becoming a well rounded engineer by Stephan Jacobs

At the start of my final year at university I had a lot of unanswered questions. My grades were decent, I had completed the ever-elusive vacation work, and I had even completed a few research projects but I still felt no closer to a fulfilling career than the day I first set foot on campus. I had heard a lot of perspectives on what makes you an attractive graduate for employers, but I didn't know how to integrate them with my own ideas about how I wanted to live and what I wanted to achieve with my career. Fast forward two years, and I've entered the world of working professionals where I've answered many of the questions I had as a student and, much to my surprise, the best decisions I made as a student were usually the ones that were driven by my own passion and motivation, not by following the "norm".

I currently work for the Australian Energy Market Operator (AEMO), a name very few chemical engineering students know. AEMO is a unique organisation, as it operates the spot markets where energy companies like Origin and AGL buy and sell the electricity and natural gas that power our industries, businesses and homes. Like with any market, the companies who trade on our markets pay us a fee, but we are a not for profit. So how could this possibly relate to engineering? Markets stuff is for commerce students isn't it?

# Becoming a well rounded engineer, *cont.*

I used to think so too, but I was very wrong.

AEMO employs economists, accountants and lawyers, but it also employs plenty of engineers. Its employees have a broad skillset because the range of functions it performs is incredibly diverse. Aside from operating two electricity markets and three gas markets, AEMO also operates most of the high-pressure natural gas system in Victoria (called the Declared Transmission System), and manages the output from power stations and the availability of high voltage transmission lines in the National Electricity Market Power System.

If that wasn't enough, AEMO also produces a number of forecasting and planning reports that are used by industry and Government stakeholders to enable them to understand how trends in consumer behaviour and technology might shape the industry. The team I'm in is responsible for operating the natural gas markets together with the gas transmission system in Victoria. This work requires an in depth understanding of engineering principles but due to the variety of work we do, the skillset of our people is constantly expanding, and that is why I love working here.

When I was at university my cohort thought that an engineering degree would more or less guarantee us a job as an engineer. But that was in 2009. Over the next few years the world economy slowly changed direction and it became clear that the demand for graduates that came from Australia's mining boom was slowing down. Even the oil and gas giants who used to pinch Australia's best graduates drastically reduced their intake and all of a sudden things looked a little less rosy. Many students, including myself, took a long hard look at their selection of subjects and tried to figure out whether all that HECS debt was really worth it.

At this point in time I was at the end of my second year. I could still make changes to my degree but it would cost me time and money. At the end of high school I had struggled to choose between engineering and science, so instead of forcing a decision I enrolled in the Monash double degree. I chose physics and maths for my majors in science because, honestly, that's what I enjoyed. I wanted to understand quantum mechanics, but I also wanted to do some astrophysics units (because space!).

Engineering took a considerable amount more thought, but I finally chose chemical engineering because I figured that everything needs raw materials and where there are raw materials there's a chemical engineer, so chemical engineers must have pretty interesting work. It later turned out that that was a very inaccurate impression of the field, but I'll get to that.
During the abovementioned "long hard look at my degree" I felt a lot of pressure to cut down on the fun stuff in my degree and, instead of learning interesting things, just make my degree a pragmatic training exercise. I didn't succumb to these pressures, and I wish I could tell you that that was the result of my own wisdom, but it wasn't. I just couldn't stand the thought of three years of working like a robot. I didn't mind working hard, I just wanted to work hard on something I enjoyed. So instead of dropping physics and maths I stuck to them and I chose the engineering electives I wanted to do. This ultimately led me to develop skills like logical reasoning and data analysis, which I find incredibly useful today.

I didn't study chemical engineering to join any industry in particular but I was very interested in the reason why some technologies became widely used and others didn't. The question started out as a technical one. Surely, I thought, the technology which is objectively the best will end up becoming the most widespread, but as it turned out I was wrong. And so, from a very engineering focused question, I went searching for answers in fields that are not traditionally associated with engineering. Economic and environmental assessment of a process technology gave me some answers and consequently I developed a keen interest in public policy over the course of my degree, but that was very uncommon for an engineering student. I still remember the blank stares I got when I spoke about energy policy, followed by "cool story bro."

That wasn't my only odd decision. I was one of only five students in my cohort who studied physics together with chemical engineering, and I started attending public lectures about energy policy and economics. Crucially, I only applied for jobs I was genuinely interested in, unlike most of my peers, and after a while this strategy got on my nerves. But when I got offered a job where my odd interests mattered though, I felt like it was all worth it.
So what's the take away from all this? Am I trying to tell you to be like me? No. I've tried to think of a single sentence response to sum it all up, but I can't find one. The truth is that there is no recipe to follow. No slogan. And to some extent I guess that's the point. It's not just about thinking outside the box, it's about disregarding the box entirely and actively piecing the world together for yourself. This much I learned from a mentor whom I met through the Monash Alumni mentoring program (which I highly recommend).

My assigned mentor had studied chemistry at Monash and had worked in the resources industry for a long time. He taught me some important principles of networking, explained how the companies in the private sector make decisions and had a wealth of knowledge about Australia's resources and energy sectors. Probably the most important thing I learned from him at the time though, was how to think about my grades. So let's talk about grades from an engineering perspective. When you want to figure out what's going on in a reactor you can use measurements of temperature, pressure and composition to get some data, but a single parameter's

# Becoming a well rounded engineer, *cont.*

data won't tell you the full story. Instead, your analysis of all the data together is how you figure it out. Your job application is the same thing.

Your resume, academic transcript and cover letter contain data and the managers and recruiters use that to try and figure out your story. They want to know what you're passionate about. They want to know that you can solve problems and write well. They want to know that you're reliable and last, but certainly not least, they want to know that you have people skills. Do your grades alone tell them the whole story? I'll let you be the judge of that.

You have to realise that you have an unimaginable amount of freedom in how you find a job and where you end up working. There is no recipe for finding a job but if you are passionate about an industry or field, let that passion lead you. A good place to start is to find out about Engineers Australia events that cover your industry of interest and attend them. If you can't find any of those, go and have a look on Eventbrite, go and talk to lecturers, even cold call people. There are so many options. The only real guideline I can give you is to learn as much as possible about the field. Why? Because when you start your job you'll have a good idea of what's going on and a by-product of that is the fact that your interviewer will be able to have a real conversation with you about their industry. Believe me when I say that there is nothing, and I mean this, nothing as encouraging as talking to a student who knows their stuff.

And this brings me to a point I'm quite passionate about. Engineers are not valued for solving equations and they don't spend their time in jobs where everything has already been figured out. Instead, engineers, amongst many other professions, solve problems. Difficult ones. We do particularly well solving the sorts of problems that require multidisciplinary skillsets where science and data analysis combine with the global economy and the law. So don't limit yourself by focusing only on the typical areas associated with chemical engineers. Your degree gives you a much more flexible skillset and it's up to you to figure out how you will put it to use.

I attended a Monash Chemical Engineering alumni event in 2015 where I met chemical engineers working for law firms, universities, management consultancies and (oddly enough) chemical companies. What took me by surprise was not just the fact that engineers were in a very diverse range of jobs, but that even the ones who worked as engineers developed new skillsets once they started work. Logistics, intellectual property law, writing skills and stakeholder communications were all in the mix, so it seemed as though a broader skillset was really inevitable. Doing work that requires more than technical skills is not a question of "if" but "when", and the question for you to ask yourself as a student is: When will I start learning accordingly?

Written by Stephan Jacobs
Bachelor of Science/Bachelor of Engineering [Chemical Engineering], completion date 2014

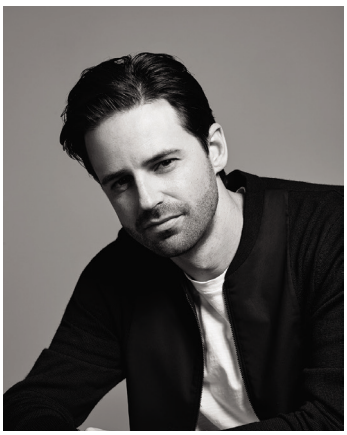

## SOCIETY OF MONASH UNIVERSITY CHEMICAL ENGINEERS

**Linking students with industry**

CONTACT smuce@monashclubs.org
to organise your opportunity to connect with the Chemical Engineering students at Monash University

# MONASH CHEM ENG WELCOMES NEW STAFF

## Dr Matthew Hill



Matthew has joined the department on a 0.5 position, where he is working on crystals that clean gas, water and air, or any material for that matter. With the potential to completely transform the way we dispose of gases like carbon dioxide, His studies are also focused on designing solutions for energy, agriculture, food and manufacturing.
Matthew graduated with a PhD in chemistry from UNSW in 2006 under the supervision of Prof Robert Lamb. He has had a successful and productive career since then. At CSIRO (where also has a 50% appointment) he leads work in the usage of the ultraporous Metal Organic Frameworks (MOFs) for applications in gas storage and separation.

Matthew is an ARC Future Fellow, Eureka Prize winner, Victorian Young Tall Poppy of the Year and the winner of the 2014 Prime Minister's Prize for Science - Malcolm McIntosh Prize for Physical Scientist of the Year. He has over 70 publications and 9 patents.

Read an interview (including video on gas absorption in MOFs) with Matthew at the Conversation.

## Dr Simon Corrie

Simon completed his undergraduate degree in chemical engineering and PhD in physical chemistry at The University of Queensland, before undertaking postdoctoral studies at the HPV Research Laboratory at the University of Washington, Seattle, USA. He recently completed an ARC DECRA Fellowship (2013-2016) in Prof Mark Kendall's group at the Australian Institute for Bioengineering and Nanotechnology at The University of Queensland.

Simon is a chief investigator in the ARC Centre of Excellence in Convergent BioNano Science and Technology, which is based at Monash. His research interests lie in developing nanoparticles and related biomaterials for applications in biosensing, bioassays and medical devices, with work published in the Royal Society of Chemistry and American Chemical society journals.

Simon joined the Chemical Engineering Department as a Senior Lecturer in February 2016, and is now actively recruiting students to undertake Hons/ MPhil/PhD projects within the new Nanosensor Engineering Lab, and as part of the ARC Centre. READ MORE HERE

### CONTACT MONASH CHEMICAL ENGINEERING

**Department of Chemical Engineering**
**Monash University**
**Clayton Victoria 3800**
**Telephone: +61 3 9905 3555**
**Facsimile: +61 3 9905 5686**
**eng.monash.edu.au/chemical**

**WOULD YOUR COMPANY LIKE TO OFFER ANY OF THE FOLLOWING?**

- **Vacation Work Experience to our undergraduate students**
- **Graduate Positions (Undergraduate and Postgraduate)**
- **Speak to undergraduate students at a lunch time seminar about your company**
- **Become a corporate sponsor or donate a student prize**

**Would you like to receive future issues of ChemEng Focus? If so, please email lilyanne.price@monash.edu and we will add you to our newsletter mailing list.**

DEPARTMENT OF
CHEMICAL ENGINEERING
MONASH UNIVERSITY

**eng.monash.edu.au/chemical**

MONASH University
Engineering