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FOCUS

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

Chemical Engineering Focus Newsletter

focus

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING

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WELCOME FROM THE HEAD OF DEPARTMENT



The summer season in between semesters has been difficult this year with bushfires burning across Australia. Although we have been less affected at our campus in Clayton, some of our Monash staff and students have acutely felt the impact of the fires. Monash has made available [special counselling and assistance programs](#) as well as a special [grant program for students](#). I urge our community to take advantage of this help as needed.

As the new year got underway, and just as rains finally arrived and the fires have subsided, we have increasingly felt the impact of the spread of corona virus COVID-19. Monash University has responded with a plan designed to keep our student cohorts together and provide all of our students the best experience and opportunity we can provide. The latest news and plans are available on the Monash [COVID-19 fact sheet](#).

In the midst of these challenges, we welcomed Baiqian Dai and Zhikao Li at the beginning of January as new members of our chemical engineering team based full time at our campus in Suzhou, China. They have also been working hard to make the courses available on-line as needed for our Suzhou campus students. We also welcomed John Quinn last term – our first joint hire with the School of Pharmacy and Pharmaceutical Sciences – and Daniella Loesser is joining us in March as our first joint hire with the Faculty of Medicine, Nursing, and Health Sciences as well as Materials Science and Engineering.

The 2019 CEPA conference was expertly run by our PhD students, with a helping hand from the professional staff, and featured interesting presentations from our both our Clayton and Sunway campuses as well as other universities. Our PhD students have also stepped up in terms of helping to program the department's annual Safety Day and a much more active role on the standing Safety Committee.

We've made significant progress on commitments for renovating our undergraduate and masters program teaching spaces with a major donation from the Bioresource Processing Institute of Australia (BioPRIA) Foundation Trustees on behalf of Orora, VISY, Australian Paper, and Norske Skog. This support, and the interaction of leading bioprocessing companies with our students in the planned undergraduate-run pilot plan, chem/bio Maker space, and new chemistry and biology laboratories, is critical to the success of our educational mission. We will keep you posted as we implement these improvements on the next few years. Along with these efforts, we are also delighted to share that Nicoleta Maynard has been appointed Director of Engineering Education by Dean Croft. This role is wonderfully synergistic with our efforts to improve our education offerings in Chemical Engineering and will help us improve – as well as the whole faculty of engineering.

I am particularly excited that you can learn more in this issue about our newest student team dedicated to the conversion of Monash University food waste to biodiesel. Led by students Brian Jong and Ankita Suri, and mentored by Victoria Haritos, they have already recruited 20 students to this new effort. Our student teams are a key part of our strategy to get the students working on important engineering problems, and solving them in meaningful ways with real outcomes, during their time at Uni.

We have also included a number of feature articles to keep you up to date on major new research recognition received by Matthew Hill, Tim Scott, Huanting Wang, and Aibing Yu, including the electing of Huanting to the Australian Academy of Technology and Engineering. Congratulations to all for this recognition of their excellent research programs.

Lastly, the department is very pleased to announce the creation of the Bronwyn Adams and Karen Hapgood Award for the highest achieving female undergraduate engineer. We thank Karen for her continuing support of Monash Chemical Engineering.

Mark M. Banaszak Holl

Professor and Head, Department of Chemical Engineering

PROJECT SINGAPORE - MONASH FOOD INNOVATION

Monash and Enterprise Singapore joined forces in 2019 to influence Australia's food of the future! A groundbreaking Work Integrated Learning Program (WIL) was agreed with Singapore Enterprise with the ambition to span new frontiers in food and beverage with Singaporean small to medium (SME's) enterprises.

In Semester 2, 2019 Monash Food Innovation (MFI) was awarded a prestigious project by Enterprise Singapore to explore the opportunities for eight Singaporean based SMEs to break in to the Australian & New Zealand (ANZ) Food Market. Singaporean businesses wanted to partner with Monash students over an entire semester with the ambition of supplying their food products into Australia.

An interview selected cohort of 24 Monash University students, from the faculties of Engineering, Science and Business undertook a 10 week WIL Program, run by MFI. In teams of three, students studied methodologies and techniques for bettering the odds of success in food innovation. This knowledge enabled them to assess the Singaporean SMEs business ambitions and to develop a product offering that would be aspirational for the ANZ food market. The food companies were a mixture of historical to modern and are all well known in Singapore.

Rice based ice cream, delicious soups, plant based foods, famous dim sims and surimi, cold pressed juices and

delicious baking products were just some of the products proposed. The question was: 'Could these products be ranged and sold in Australia as an ongoing concern?'.

The program culminated in a final Bootcamp week in Australia in September where Singaporean representatives from the eight SMEs joined the 24 students and MFI at Monash University. The MFI devised an intense week of Australian retail immersion, including design sprinting to validate prior thinking, culminating in rapidly generating innovative product ideas and prototypes.

All teams presented their final outputs (accompanied by a professional 3D printed and graphically designed prototype) to a panel of industry and senior university leaders. The winning team, judged to have provided the best solution to their business challenge, won the opportunity to travel (expenses paid) to Singapore for an industry familiarisation trip.

The program and formula was so successful that Enterprise Singapore have invested in repeating the initiative again this year.

This is a wonderful development for Monash students and their integrated learning, and a great success for Monash Food Innovation.

This project perfectly combines enriching the experience of Monash students while also energising food businesses with some new thinking and food solutions they so desperately require.



WORLD CONGRESS ON OILS AND FATS

Our PhD student, Mitra Nosratpour, was recently awarded Nu-Mega travel grant at World Congress on Oils and Fats in February 2020, Sydney, Australia.

Mitra was invited to give a full presentation on the characterisation of thermal and structural behaviour of high DHA fish oil with milkfat in spray chilling conditions at this prestigious conference in front of academic and industry experts in this area. She also had a chance to meet with the people that funded the grant, R&D director of Nu-Mega ingredients Dr Samaneh Ghasemi Fard, and the congress organiser, the president of the Australian American Oil Chemist's Society Dr Matt Miller.

At the Department of Chemical Engineering and under the supervision of Prof Cordelia Selomulya, Mitra's PhD thesis is on "The synergistic effect of milkfat with omega-3 fatty acids", with the aim to improve the oxidative stability of vulnerable omega-3 fatty acids, like fish oil, and to mask the fishy odour that is undesirable for consumers. She will use spray chilling as an encapsulation technique to produce fine particles that consist of fish oil encapsulated by milkfat. The outcomes will provide insight into the effectiveness and use of spray chilling for different oils and fats, and for an improved understanding of different conditions to encapsulate omega-3 oils as a core material, with milk fat as the carrier substance.

To date, her work has shown that fish oil with a small amount of milkfat could maintain the relatively stable characteristics of pure milkfat, but also allow for a high percentage of omega-3 fatty acids to be encapsulated with better stability. Using this encapsulation technique, the final particles comprising fish oil and milkfat have the potential to be used in a wide variety of chilled dairy products like ice cream, chocolate, and others.



DOUBLE RECOGNITION FOR PROFESSOR AIBING YU

November 2019 was a special month for Professor Aibing Yu, PVC and President of Monash Suzhou, winning both the American Institute of Chemical Engineers (AIChE) Thomas Baron Award in Fluid-Particle Systems and the University of Wollongong (UoW) Alumni Award for Research Scholarship.

The AIChE award recognises his outstanding scientific/technical accomplishments that have had a significant impact in the field of fluid particle systems. And the UoW award recognises his scholarly contribution towards his field of research and associated outreach efforts through engagement with industry, at both national and international levels. His contributions are highlighted by some statements in the citation for the awards, as given below:

In a distinguished career spanning more than 30 years, Prof Yu is a world-leading scientist in particle science and technology, and among the globe's most influential experts in chemical and process engineering. His primary expertise lies in particles, working to understand the behaviour of the particulate or granular matter that comprises much of our universe and underpins a wealth of industries and applications.

His research is prolific, interdisciplinary and ground-breaking, leading to >1,000 publications. He has developed seminal modelling and analysis techniques now widely used to study particulate systems, and his computational models have enabled greater understanding and more effective strategies in process design, control and optimisation.

His efforts have created the foundation for subsequent wide-scale research and development programs in sectors as diverse as minerals and metallurgy, materials, chemical, pharmaceutical, nanotechnology, energy and environment. He has attracted in excess of \$75 million in competitive research funding, and collaborates extensively with industry so that his research contributes directly to society.

He was appointed in 2014 to Monash University as Professor, Vice-Chancellor's Professorial Fellow, and Pro Vice-Chancellor and President of Monash Suzhou, a joint venture with China's Southeast University. Sharing his time equally between Australia and China, he is deeply committed to strengthening relationships between the two nations across science and technology, education and cultural exchange. Having graduated >40 postdoc fellows and >100 PhD students, Prof Yu is also a dedicated mentor, inspiring and supporting young researchers.

He is an esteemed global leader in his field, driving advances in research and championing mutually beneficial research partnerships between Australia and China. He has built an enduring legacy of knowledge and collaboration for the benefit of academia, industry and society.

The AIChE and UoW awards are the outstanding additions to the many prestigious fellowships and awards Prof Yu has received in the past. These include the ARC Professorial and Federation Fellowships, UNSW Scientia Professorship and Doctor of Science, AAS Ian Wark Medal, NSW Scientist of the Year, and Top 100 Most Influential Engineers in Australia. He is an elected Fellow of both the Australian Academy of Technological Sciences and Engineering (ATSE) and the Australian Academy of Science (AAS), and a Foreign Academician of the Chinese Academy of Engineering (CAE).



BIOPRIA FOUNDATION INVESTS IN THE FUTURE OF SUSTAINABLE BIOPROCESSING

Monash University chemical engineering students are set to benefit from a generous \$500,000 philanthropic contribution towards the modernisation and refurbishment of their bioprocessing teaching, learning, research and entrepreneurship spaces, in an announcement made at the 2019 Appita Fibre Value Chain Conference in Melbourne.

The contribution, made by the Bioresource Processing Institute of Australia (BioPRIA) Foundation Trustees on behalf of Orora, VISY, Australian Paper and Norske Skog, forms part of a wider \$20-million dollar renovation of the building at 17 Alliance Lane, home to several of the Department of Chemical Engineering's teaching and laboratory spaces at the University's Clayton campus.

The BioPRIA contribution will enable the development of brand new bio-specific teaching facilities including a student-run pilot plant, a dedicated student design and entrepreneurial 'bioMakerSpace' to pursue new student-led product developments, and new laboratory spaces equipped to facilitate bioprocessing research. A physical link, connecting the BioPRIA Pilot facility in the existing BioPRIA building to the new teaching and entrepreneurship spaces next door is also under consideration.

With the demand growing for job-ready engineers with a strong understanding of current industry needs, the BioPRIA contribution will help equip students with the technical, research and entrepreneurial skills to drive future innovation across the pulp, paper and packaging value chain, as well as pursue new biological engineering applications such as new materials and technologies for blood diagnostics.

Chemical Engineering professor and Director of BioPRIA, Professor Gil Garnier, said the contribution both celebrates the 30th anniversary of BioPRIA and extends the model of strategic industrial partnership from the Institute further to the Department of Chemical Engineering, the Faculty of Engineering and Monash University. "It highlights the critical link between education and research in the training of innovative leaders ready to transform our industry, and will accelerate the development of a strong biological engineering program to synergise our world-class chemical, materials, and materials engineering programs, just to

name a few," Professor Garnier said. "I am delighted and honoured to be part of this renewed consortium between the Australian bioprocessing industry and Monash University to build a state of the art experimental facility benefiting all of our students and education programs."

Tim Woods, Chair of The BioPRIA Foundation, said that the pulp and paper industry is a global leader in bio-manufacturing, and has long operated on circular economy principles in Australia. "This major industry investment into Monash University's educational facilities is a recognition of the opportunities for a more sustainable future that bioprocessing can deliver, and highlights the role of collaboration and the importance of industry in creating that future," Mr Woods said. "The business case for this latest investment into BioPRIA was compelling for the Australian pulp and paper industry and speaks loudly of industry's confidence in and commitment to the future."

Dean of Engineering Professor Elizabeth Croft said that the BioPRIA contribution is a generous investment in the future of a strong and viable bio-manufacturing industry in Australia. "We'd like to thank Orora, VISY, Australian Paper, and Norske Skog for their ongoing support of BioPRIA, and the Department of Chemical Engineering's educational and research missions," she said. "This new investment into the future of bioprocessing comes at a crucial moment for industry, as the demand for more sustainable sources for a wide variety of consumer products grows, and new patient-centered approaches to medicine are increasingly required. As a result of this contribution, we now have the opportunity to connect our internationally prominent efforts in bioprocessing research and development to our re-invention of the chemical engineering curriculum, and our full embrace of student training that is green, sustainable, and takes full advantage of the opportunities present in a comprehensive approach to biological engineering."

Professor Croft, Professor Garnier and Head of Chemical Engineering Professor Mark Banaszak Holl were in attendance at the Appita Conference to gratefully accept the contribution.



WORLD'S FIRST LASER INCUBATION CHAMBER FOR BLOOD

BioPRIA researcher Dr Clare Manderson, who in partnership with Haemokinesis recently developed the world's first laser incubation chamber for blood, has received the Immulab Blood Bank Award for her presentation of the work at the Blood 2019 conference. Laser incubation is faster and more sensitive than other heating technologies used in pretransfusion testing. Feedback from the blood transfusion community after the presentation was that the laser incubation system is wanted in laboratories now because it will save lives.

Clare Manderson, PhD
Bioresource Processing Research Institute of Australia (BioPRIA)
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BREAKTHROUGH BATTERY RESEARCH ATTRACTS WIDE MEDIA ATTENTION

Breakthrough research by Mahdokht Shaibani, Mainak Majumder and the Department member Matthew Hill on lithium-sulfur batteries, published originally in *Science Advances*, has now been featured in the *The New Scientist*, *CNN*, *The Age*, *the Independent*, *The Economic Times*, and *the Daily Mail*, along with over 100 other international online publications.

Citation: Shaibani et al. *Science Advances* 03 Jan 2020: Vol. 6, no. 1, eaay2757, DOI: 10.1126/sciadv.aay2757



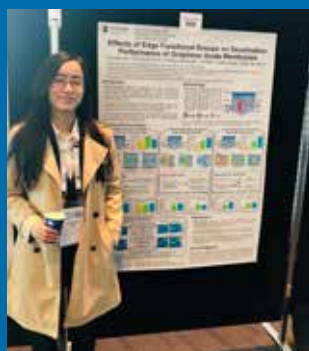
Photo by Steve Johnson on Unsplash

NEW DIRECTOR OF ENGINEERING EDUCATION



Congratulations to A/Prof Nicoleta Maynard on her new role as Director of Engineering Education. In her new position Nicoleta will work closely with academic & professional staff, students and industry focusing on the following topics:

- » Lead curriculum design and program development to strengthen the engineering design across our faculty; provide our students with learning experiences and an environment to conceive, design, implement and operate complex systems using ethical and sustainable principles, in a team-based environment;
- » Establish and lead a community of practice which brings together students, academic staff, and industry partners to explore new design practices;
- » Provide strategic leadership and advice in engineering education research and use the findings to inform our teaching practice and curriculum development.



POSTER AWARD

Our Congratulations to Mr Ruosang Qiu who received a Nanoscale Poster Prize at the 20th International Union of Materials research Societies, International

Conference in Asia, which was held in Perth last September.

Poster title: *Effects of edge functional groups on desalination performance of graphene oxide membranes.*

EXTENDING RESEARCH INNOVATION AND COMMERCIALISATION WITH CHINA AND AUSTRALIA



We continued to foster our Monash Suzhou ties with Southeast University of China at the recent China-Australia High-end Forum on Research Innovation and Commercialisation (RIC) held in Suzhou, China.

The forum brought together key stakeholders from academia, government and industry in Australia and China to discuss critical matters for RIC development, and highlighted the

latest achievements through international collaboration. It focused on key areas such as advanced materials and manufacturing, smart cities, energy and environment, advanced computation in science and engineering, and life and health science.

Among the attendees were the Australian Consul General, Shanghai, Dominic Trindade; representatives from the Australian Embassy in Beijing, the Australian Trade and Investment Commission, and the Victorian government; Wu Qingwen, Party Secretary, Suzhou Industrial Park; and representatives from the China Association for International Science and Technology Cooperation, and the National Natural Science Foundation of China.

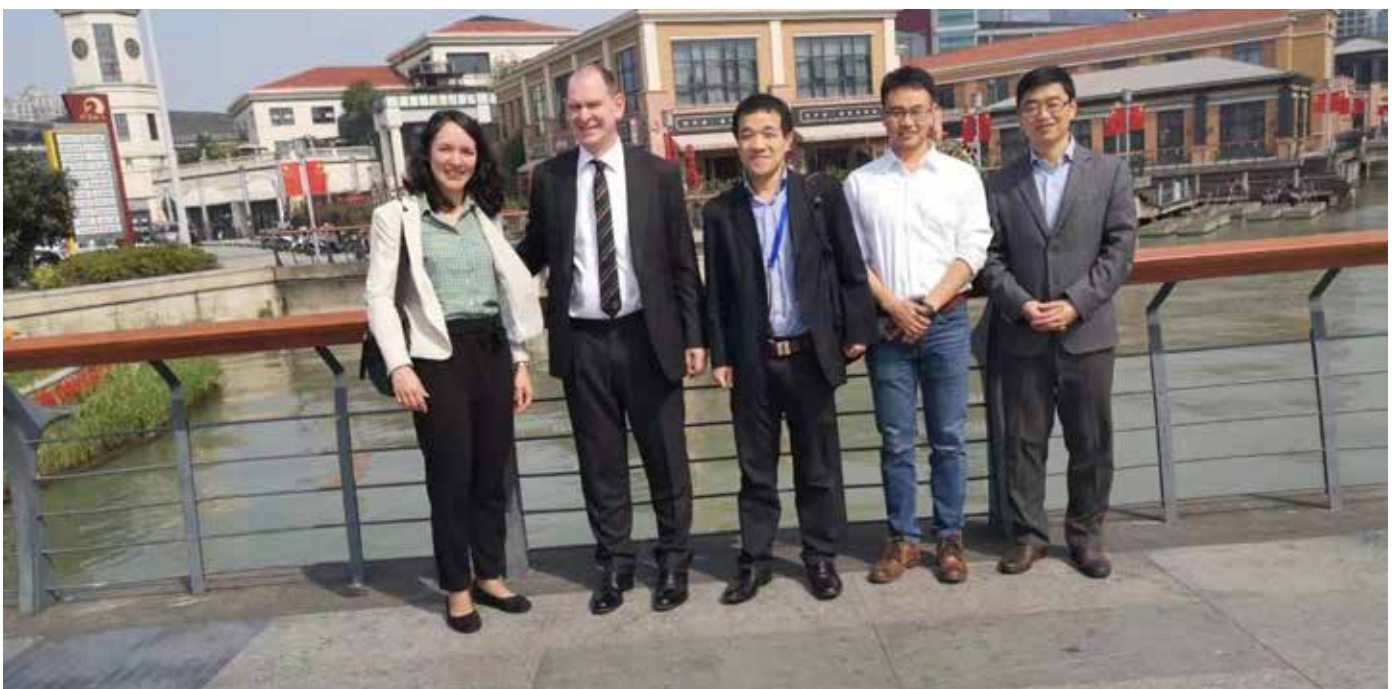
Prominent Chinese and international university leaders present included the President of Southeast University, Professor Guangjun Zhang, representatives from the Chinese Academy of Sciences, the Jiangsu Provincial

Government, Xi'an Jiaotong University, Suzhou University, University of Sydney, University of Melbourne and University of Oxford.

Monash representatives included Provost and Senior Vice-President Professor Marc Parlange, CFO and Senior Vice-President Paul Townsend, Pro Vice-Chancellor and President, Suzhou, Professor Aibing Yu, Vice-Provost (Research and Research Infrastructure) Professor Ian Smith, and Pro-Vice-Chancellor (Academic) Professor Kris Ryan .

Participants had the opportunity to attend 13 sessions, 29 plenaries, 20 keynote and 44 spoken presentations. Among the plenary speakers were ARC Federation/ Laureate Fellows including Professor Frank Caruso from the University of Melbourne, Professor Aibing Yu and Professor James Whisstock from Monash, Professor George Zhao from the University of Queensland, and Professor Shizhang Qiao from the University of Adelaide.

The forum was held in conjunction with the 10th CHINANO Conference and Expo, a nanotechnology business event in China, where Professor Parlange introduced Monash and its research and development strategies at the opening plenary session. Thousands of participants took the opportunity to discuss R&D strategies, showcase cutting-edge knowledge and technology, and develop RIC collaborations.





"Chemistry provides inputs for many manufacturing products and processes, as well as representing a global industry in itself," said Andrews.

The Centre will bring together postgraduate students and post-doctoral fellows and teach them relevant industry skills to be applied with industry partners, as Senator for Victoria, David Van, highlighted.

"Victorian manufacturers will look to the research undertaken at this training centre to better improve their own processes. This will ensure they are at the forefront of environmentally-friendly technology," he said.

This article first appeared on the Manufacturing Monthly website, 15 October 2019, manmonthly.com.au

CENTRE FOR GREEN CHEMISTRY OPENS AT MONASH UNIVERSITY

A new centre for research into green manufacturing will enable Australian manufacturers to adopt environmentally-friendly chemical processes. Congratulations to our Department staff members Akshat Tanksale, Gil Garnier and Laura-Lee Innes, who will contribute to the Training Centre.

Housed at Monash University, the ARC Training Centre for Green Chemistry in Manufacturing brings together researchers from Monash, Flinders, Deakin and Curtin universities.

"New innovations based on green chemistry principles applied in Australian manufacturing will provide technical and professional training for researchers in this space, and lead to new products and processes with strong export potential," said Monash University School of Chemistry Professor Antonio Patti.

The centre for green chemistry comes after a recent announcement of the use of green hydrogen for chemical processes such as the manufacture of ammonia, from the Australian Renewable Energy Agency (ARENA).

As industrial manufacturing represents one area that is difficult to electrify, due to its reliance on process heating to levels that electricity cannot reach, and the use of fossil fuels as feedstocks, the green chemistry represents the potential to bridge this gap and allow manufacturing to decarbonise. Such a differentiating factor could enable Australian manufacturers to compete globally, said Minister for Education, Dan Tehan.

"This new training centre will put Australia at the forefront of using green chemistry, which means another advantage for Australia's manufacturing industry," said Tehan.

Minister for Industry, Science and Technology, Karen Andrews, also noted the potential for green chemistry to develop and grow industries.

CARBON CAPTURE, CONVERSION, AND UTILISATION PROJECT OVERVIEW FROM THE WOODSIDE MONASH ENERGY PARTNERSHIP (WMEP)

Industrially produced carbon dioxide (CO₂) emissions are considered to be the primary cause of global warming and climate change. The Carbon Capture, Conversion, and Utilisation Theme of the Woodside Monash Energy Partnership aims to capture CO₂ using novel technologies, convert it into valuable chemicals or fuels, and utilise them for energy generation; completing the carbon loop.

The main objectives of this Theme are –

- » To reduce the cost of carbon capture, including direct air capture of CO₂, by reducing the costs of capex, energy, and footprint required.
- » Convert the captured CO₂ into intermediate chemicals like synthesis gas, methanol, formaldehyde and its derivatives, and synthetic natural gas by thermocatalytic, low temperature plasma, electrochemical and biochemical methods.

The expected outcomes will produce a number of novel materials and technologies for CO₂ adsorption, catalysis, and reactors for next-generation advanced chemicals and fuel processing.

A/Prof Tanksale from the department is involved in the Carbon Capture, Conversion, and Utilisation Theme. A major focus of his research is CO₂ valorisation and the catalytic conversion of CO₂ into chemicals and fuels.

PROFESSOR HUANTING WANG HONoured WITH PRESTIGIOUS INDUSTRIAL CHEMISTRY AWARD

Professor Huanting Wang has been awarded the 2019 R.K Murphy Medal by the Royal Australian Chemical Institute (RACI) at the Chemeca 2019 Awards of Excellence in Sydney. Professor Wang was honoured by the Institute's Industrial Chemistry Division for his outstanding career achievements in chemical engineering, with his nomination agreed upon unanimously by the selection committee.

Professor Wang's research expertise covers areas such as nanomaterials and membranes, green chemical technology, gas separation, wastewater treatment and water desalination, electrocatalysis and fuel cells. He has made significant contributions to advancing membrane science and technology, with his research group pioneering the development of several new membranes, four of which have recently been licensed for commercial development and deployment.

Professor Wang is also the Associate Dean (International) of the Faculty of Engineering, the Director of the Monash Centre for Membrane Innovation and the Deputy Director of the ARC Research Hub for Energy-Efficient Separation. He is also a Fellow of The Royal Society of Chemistry, a Fellow of The American Institute of Chemical Engineers, and a Council Member of the Aseanian Membrane Society.

"I am honoured to receive the R.K Murphy Medal, and would like to thank the RACI for this award, and acknowledge my group members for their dedication and contributions over many years," Professor Wang said. "This award would not have been possible without the support of all of my collaborators and industry partners."

"Our warmest congratulations to Huanting on receiving this most prestigious award," said Dean of Engineering Professor Elizabeth Croft. "His membrane research is widely recognised internationally and has contributed to important advancements in a broad range of areas, including energy, wastewater treatment and desalination. His research opens up new options to provide clean and safe drinking water and protect the environment from wastewater pollution."



Professor Huanting Wang with Dr Vicki Gardiner, President of RACI and Dr Andrew Jones (RACI, Industrial Chemistry Division Treasurer)

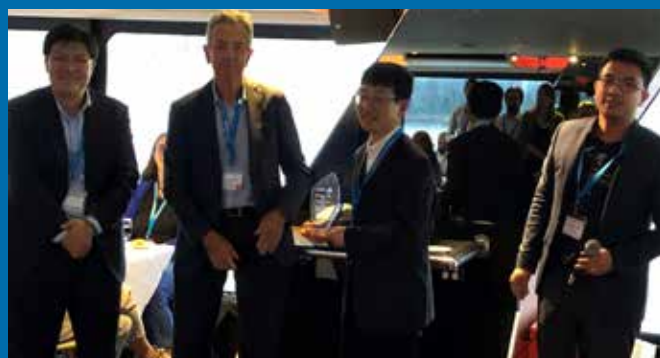


Professor Xiwang Zhang, Professor Mark Banaszak Holl, Professor Huanting Wang and Professor Cordelia Selomulya

MSA TONY FANE AWARD

Professor Wang has also been honoured by the MSA and has received the MSA Tony Fane Award, the most prestigious award offered by the Membrane Society of Australasia.

This award recognises individuals who have made outstanding and distinguished contribution to the advancement of membrane science and technology in Australasia.



(L-R): Prof Hokyong Shon (MSA President), Prof Tony Fane (MSA Patron), Prof Huanting Wang, Dr Leonard Tijng (MSA Director)

PROFESSOR HUANTING WANG ELECTED FELLOW OF THE AUSTRALIAN ACADEMY OF TECHNOLOGY AND ENGINEERING



We are delighted to share the news that Professor Huanting Wang has been elected as a Fellow of the Australian Academy of Technology and Engineering, a wonderful recognition of his contributions to technological innovation in his respective field.

Huanting now joins an esteemed list of Fellows elected by their peers into one of Australia's four Learned Academies, a significant career achievement of which we are very proud. Huanting is internationally recognised for his achievements in the development of advanced membranes for clean water and sustainable separation technologies, and has been a highly successful leader in building university-industry linkages and translating research discoveries into industry practice. The new Fellows will strengthen the Academy's mission to achieve sustainable technological solutions to complex challenges, and advance Australia's prosperity.

Professor Huanting Wang FTSE

A professor in the Department of Chemical Engineering and the faculty's Associate Dean (International) Professor Wang is internationally recognised for his achievements in the development of advanced membranes for clean water and sustainable separation technologies. He has been a highly successful leader in building university-industry linkages

and translating research discoveries into industry practice, with his separation membranes commercialised and deployed in the water, mining and manufacturing industries. He is also the Director of the Monash Centre for Membrane Innovation.

Originally qualified in material science and engineering at the University of Science and Technology of China, he completed a postdoctoral research fellowship in Chemical Engineering at the California Institute of Technology and University of California Riverside.

Professor Wang was awarded an ARC QEII Fellowship in 2004, an ARC Future Fellowship in 2010, and the Royal Australian Chemical Institute R.K. Murphy Medal in 2019. He was a member of the ARC Future Fellowship selection advisory committee in 2011, and a member of the ARC College of Experts in 2012-2015, and a Board Member of the Membrane Society of Australasia (2014-2017). He is a Fellow of The Royal Society of Chemistry, a Fellow of The American Institute of Chemical Engineers, and a Council Member of the Aseanian Membrane Society.

"I'm very happy to be elected as a Fellow of the Academy," said Professor Wang. "It's a wonderful recognition of my team and collaborators and the research work we've undertaken together. I'd like to particularly thank Monash University and the Faculty of Engineering for their strong support of my research. I'm honoured to be recognised, and looking forward to contributing to the important mission of the Academy."

MONASH ENGINEERING GIRLS (MEG)



Monash Engineering Girls (MEG) presents Access All Areas for Year 9 to 11 High School girls on 31st March and 7th April.

Students and parents go behind the scenes and get a feel for the campus and student life.

See our amazing facilities and ask questions about engineering over lunch. If you know someone who'd be keen to join MEG, please share the link below.

For more information and registration: www.monash.edu/engineering/meg

PROFESSOR RAMAN SINGH **GUEST** PROFESSOR AT ETH ZURICH



Professor Raman Singh is currently at ETH Zurich as their Guest Professor for three months (Jan-Mar 2020). ETH is regularly ranked among the 6-8 topmost universities of the world.

The primary purpose of Raman's stay at ETH is to forge a strong collaboration to develop an advanced and comprehensive understanding of the chemical degradation of some lean and most modern magnesium alloys for degradable bioimplant applications in appropriately simulated human body fluid (HBF). The study hinges on the complementary expertise at Monash and ETH Zurich. ETH has developed some of the most modern magnesium alloys for biodegradable implant applications whereas Monash has expertise in investigation of corrosion and corrosion-assisted cracking of magnesium alloys for such applications.

"Health Science" and "Sustainable Development" are the core topics of Monash's Research Agenda that emphasise

"transforming society's response to the core of social issues through expertise in health and wellbeing". An increasing number of people have active lifestyles, and together with an aging population, this increases demand on orthopaedic rehabilitation. Hence, any innovative approach that could translate into reducing medical costs and improve patient convenience is socially fulfilling and commercially attractive.

Magnesium alloys are attractive for their use as construction materials of temporary implants (such plates, wires, screws) and stents, because of their highly attractive properties, e.g., similarity of mechanical properties to human bone and entirely non-toxic nature of magnesium to human physiology. It is intriguing that the very property of magnesium alloys that makes it most unattractive in common engineering applications (i.e., high corrosion rates suitable) makes them attractive as temporary implants. The fact that magnesium alloys can harmlessly corrode away after their service as temporary implants (and any excess magnesium generated as the corrosion product will simply be excreted through the renal system) bestows a unique advantage, i.e., use of magnesium alloys will enable altogether avoiding the second surgical procedure that is invariably undertaken to remove the temporary implants of traditional materials (e.g., Ti alloys) after they have performed their purpose.

Hinging on their complementary expertise respectively in corrosion/corrosion-assisted cracking and development of magnesium alloys, Raman and his ETH host, Professor Jörg Löffler (pictured above) will develop a strong Monash-ETH collaboration to understand corrosion and assisted cracking of magnesium alloys in simulated human-body fluid. Prof Löffler's group at ETH has very recently developed some of the most modern magnesium alloys for biodegradable implant applications.

ANNOUNCING THE INAUGURAL BRONWYN ADAMS AND KAREN HAPGOOD AWARD

The Bronwyn Adams and Karen Hapgood Award is awarded annually to the highest achieving female undergraduate in Chemical Engineering. Bronwyn Adams was the first female chemical engineering graduate from Monash (1971) and in the state of Victoria. Professor Karen Hapgood was the first female staff member (2006) and Head of Department (2012-2016). Bronwyn and Karen are related - their grandmothers were sisters.

Award:

The prize consists of a monetary amount of \$1,000 and an award certificate. It is presented to the successful candidate at a ceremony. The award is provided by the generosity of Professor Karen Hapgood who was the former Head of the Department of Chemical Engineering, Faculty of Engineering, a valued and much respected staff member of Monash University, and a leader for women in Chemical Engineering.

Selection:

The selection criteria reflects the interests of both Bronwyn Adams and Karen Hapgood – their interest in the professional development of young women and their passion for a diverse STEM community. The award is granted to the best female graduating student based on their Honours Weighted Average (HWA), their original contributions to chemical engineering research, and their program leadership including student teams, regardless of the length of time it took them to complete the course or if they have failed a unit at any point.

WATER RESOURCE MANAGEMENT AND SUSTAINABLE PRACTICES IN PERU

Travelling to Peru for 10 days with the GREEN Program has been one of the best decisions I have ever made. I was very fortunate to be able to embark on a journey with like-minded people and be constantly mind blown about the unique landscapes, the delicious dishes and the history of the ancient Inca empire.

I have many highlights from this trip, which includes hiking one of the 8 Wonders of the World, zip-lining through the mountains of Santa Teresa, being immersed in Peruvian culture and making lifelong friendships. However, one of the best parts of this trip was the exclusive access to the water treatment plant and hydro facility. I believe that the industrial visits were extremely valuable and relevant to my chemical engineering degree. It allowed me to solidify the concepts I had learnt at university and become more aware of industrial regulations and practices. From this first hand experience, I am able to return to my final year of university with a clearer understanding of how industry operations are executed in realistic situations.

In addition, a key mission of this program was to develop global awareness of environmental concerns. I will never forget the passion, effort and time our professor and guides put into explaining the underlying environmental and political problems occurring within the country. As we explored the harsh living conditions of various communities and saw the real life issues they face daily, we were able to discuss sustainable practices that could be undertaken. From this exposure we were also able to create an innovative solution towards real world challenges in sustainable development. These capstone projects integrated social, environmental and economic perspectives, which were greatly focused on the United Nations sustainable development goals.

The GREEN Program has encouraged me to be more spontaneous, more environmentally conscious and more aware of the importance of sustainable development and technologies. Not only was I challenged academically and physically, this experience has allowed me to cultivate independence, improve my communication skills, and I have learnt to be more flexible. I have also developed teamwork, time management and leadership skills. My biggest takeaway from this trip is that no matter where I am in life, I should continue to enhance my understanding of the world around me.

Even though this program focused on water resource management, I believe that the sustainable and innovative mindset I have developed can be applied to many other industries. I'm open to every opportunity and excited to grow professionally and personally as I encounter future projects.

Annette Phoa, Bachelor of Pharmaceutical Science and Chemical Engineering (Honours)



RENEWABLE ENERGY INNOVATION AND SUSTAINABILITY

The Green Program is an immersive ten day experience of meeting new people, new cultures, and new ideas. The program inspired me to follow my passion towards renewable energy after gaining a deeper understanding of what sustainability means outside the textbooks and in a real world context.

Firstly, I realised that there are a lot of young people from around the world who are deeply concerned about climate change and eager to change the world. Being surrounded by them for ten days allowed me to get to know them, to understand their ideas and to make unique friendships. Most importantly, working with this group of people for the capstone project and with the guidance of the incredible staff that I met during the program gave me hope that solutions for climate change will happen in the near future. Before the program, I felt hesitant in pursuing a career in sustainability due to poor prospects. However, meeting other students in a similar position as mine with an unwavering spirit gave me the courage to face my last year of engineering with the goal not to compromise pursuing my passion.

Secondly, the Green Program was able to offer a myriad of breathtaking experiences ranging from visits to geothermal plants, hydropower plants, hot springs in the middle of snow, waterfalls, geysers, and icebergs. It was especially memorable to witness the iceberg's constant melting and exponential decay due to warming temperatures. It served as a graphic reminder of the importance of renewable energy and sustainability as a crucial tool to preserve and maintain these environments.

Lastly, Iceland showed me that sustainability has a cultural dimension as important as an engineering one. During the program, we learned about renewable energy concepts like hydropower, geothermal power, and biodiesel. Nevertheless, we also learned Icelandic history and culture which gave a crucial context on why and how Iceland has adopted renewable energy so successfully. Sustainable practices in engineering are directly linked to cultural and social life of Iceland since Icelanders suffer from climate change in a very direct way.

The Green Program taught me that engineers should not only be making sustainable power plants, but also working on changing cultural norms on waste and energy that can influence voters and laws, which can in turn change the energy industry in countries. The Green Program helped me find a big overlap between my two degrees which are engineering and arts, since policy, culture and engineering practices are directly linked with one another. This confirmed that my double degree is more relevant and inspired me to grow in this field professionally pursuing my passion for sustainability all while catching a glimpse of northern lights in the middle of a wonderland of ice.

Maria Angelica Arteaga Jaime
Bachelor of Chemical Engineering and Arts



THE GREEN PROGRAM

The Green Program (TGP) is an award-winning program that is dedicated to educating and empowering future sustainability leaders through experiential education, travel, and adventure.

Created for students, by students, their short-term model for education abroad is driven by a desire to provide purposeful, real-world experience at a fraction of the time and cost of semester-long abroad programs.

99% of alumni say their TGP experience has refined their purpose at work or school and in their life and 95% of TGP alumni stay engaged in sustainability efforts and have gone on to work for forward-thinking companies such as NASA, Tesla, National Geographic, SpaceX, the Environmental Defense Fund, NREL, and more.



To learn more about TGP's 10-day programs abroad and to apply, visit www.thegreenprogram.com

ASSOCIATE PROFESSOR MATTHEW HILL HAS WON THE INAUGURAL DAVID AND VALERIE SOLOMON AWARD

CSIRO and Monash University's Matthew Hill received the Solomon Award for developing 'magic crystals' with dozens of applications from cleaning gases and liquids to mining and drug production.

Cheaper cleaner lithium mining for future cars and batteries is the newest application. It's being developed with US company Energy Exploration Technologies (EnergyX).

The world is moving rapidly to electric cars and battery storage of renewable energy. That will require 10 to 100 times more lithium than we can produce today.

Matthew Hill has taken a Melbourne invention, metal organic frameworks (MOFs) – sometimes called 'magic crystals' – and shown that they can be used to clean air and water, and in all sorts of industrial processes. Now his team at CSIRO (Australia's national science agency) and Monash University has partnered with US company EnergyX to commercialise a new production process that uses MOFs to create lithium.

Matthew received the inaugural David and Valerie Solomon Award, presented by the Australian Academy of Technology and Engineering (ATSE) on Friday, November 29, at an event in Melbourne. David Solomon was the principal inventor of Australia's plastic banknotes, and has developed a range of new technologies used widely in the plastics and polymers industries.

Most of the world's lithium is produced from 'lithium brine' in a labour-intensive process requiring vast evaporation ponds. One facility in Chile, for example, occupies 42 square kilometres. Matthew's technology has the potential to replace 4,000 hectares of pools with a filtration unit just 0.1 square kilometres in size.

His 'magic crystals' are networks of metal atoms linked and separated by carbon-based (organic) compounds. This results in a massive surface area which can be customised to absorb almost anything. They were first made in the late 1980s by chemist Professor Richard Robson at the University of Melbourne, but were hard to make.

Matthew's first effort to make a MOF involved mixing the contents of 40 containers to make just one gram of crystals. Today he and his team can make hundreds of kilograms of them each week.

By 2040 it is estimated that there will be 56 million annual electric vehicle (EV) sales and over 1095 gigawatts of battery energy storage systems in the world, an exponential increase on the two million annual and nine gigawatts recorded in 2018.

Electric vehicles rely on the same lithium-ion battery technology found in phones and laptops.

EnergyX founder and CEO Teague Egan believes that the element will be the single most important and valuable economic commodity for the 21st century.

"The world has never needed these quantities of lithium before, therefore current production methods are not scalable to the magnitude necessary," he says.

"Matthew's disruptive technology allows a transformative shift in the way we can now recover this quintessential resource. It will greatly improve the economics and environmental impact of lithium mining."

Matthew is a fitting winner of the inaugural Solomon Award, says ATSE President Professor Hugh Bradlow FTSE.

"He's taken an interesting quirk of chemistry and turned it into a patented technology that will underpin new industries," he says.

"Lithium mining is just the latest in a long line of applications. Matthew and his team are also working with industry to use these crystals to clean natural gas, clean air in submarines, purify pharmaceuticals and much more."

Matthew notes this is just the tip of the iceberg. "Not only can our MOF membranes separate lithium ions from water so that they can be used to make batteries, we've also shown that we can put these membranes inside lithium batteries and improve their lifetime and capacity. And we're working with a local business, Boron Molecular to scale up manufacturing of our crystals."

Matthew's prize includes \$20,000 in cash and travel support plus mentoring.

<https://www.atse.org.au/news-and-events/article/metal-made-of-holes-wins-chemical-engineer-the-inaugural-solomon-award/>



Matthew Hill receiving his award from David and Valerie Solomon.

STUDY POINTS TO NEW WEAPON IN FIGHT AGAINST LETHAL FUNGI

Researchers at Monash University have gained insights into how nanoparticles could be used to identify the presence of invasive and sometimes deadly microbes, and deliver targeted treatments more effectively.

This study was conducted as an interdisciplinary collaboration between microbiologists, immunologists and engineers led by Dr. Simon Corrie from Monash University's Department of Chemical Engineering and Professor Ana Traven from the Monash Biomedicine Discovery Institute (BDI). It was recently published in the American Chemical Society journal *ACS Applied Interfaces and Material*.

Candida albicans, a commonly found microbe, can turn deadly when it colonises on devices such as catheters implanted in the human body. While commonly found in healthy people, this microbe can become a serious problem for those who are seriously ill or immune-suppressed.

The microbe forms a biofilm when it colonises using, for example, a catheter as a source of infection. It then spreads into the bloodstream to infect internal organs.

"The mortality rate in some patient populations can be as high as 30 to 40 per cent even if you treat people. When it colonises, it's highly resistant to anti-fungal treatments," Professor Traven said.

"The idea is that if you can diagnose this infection early, then you can have a much bigger chance of treating it successfully with current anti-fungal drugs and stopping a full-blown systemic infection, but our current diagnostic methods are lacking. A biosensor to detect early stages of colonisation would be highly beneficial."

The researchers investigated the effects of organosilica nanoparticles of different sizes, concentrations and surface coatings to see whether and how they interacted with both *C. albicans* and with immune cells in the blood.

They found that the nanoparticles bound to fungal cells, but were non-toxic to them.

"They don't kill the microbe, but we can make an anti-fungal particle by binding them to a known anti-fungal drug," Professor Traven said.

The researchers also demonstrated that the particles associate with neutrophils—human white blood cells—in a similar way as they did with *C. albicans*, remaining noncytotoxic towards them.

"We've identified that these nanoparticles, and by inference a number of different types of nanoparticles, can be made to be interactive with cells of interest," Dr. Corrie said.

"We can actually change the surface properties by attaching different things; thereby we can really change the interactions they have with these cells—that's quite significant."

Dr. Corrie said while nanoparticles were being investigated in the treatment of cancer, the use of nanoparticle-based technologies in infectious diseases lags behind the cancer nanomedicine field, despite the great potential for new treatments and diagnostics.

"The other unique thing in this study is that rather than using cells grown in culture, we're also looking at how particles act in whole human blood and with neutrophils extracted from fresh human blood," he said.

Professor Traven said the study had benefited greatly from interdisciplinary collaboration.

"We've brought together labs with expertise in infection, microbiology and immunology with a lab that has expertise in engineering, to do state-of-the-art experiments," she said.

This article first appeared in <https://phys.org/news/2019-11-weapon-lethal-fungi.html> in November 2019

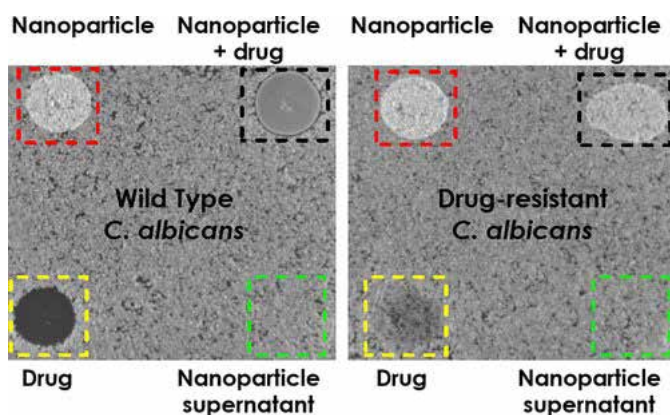


Image credit ACS

CEPA COMMITTEE MAKE FINAL ROUND OF THE 2019 VICE-CHANCELLOR'S AWARD FOR EXCEPTIONAL CONTRIBUTION TO OHS

Kim Phu, Gabriel Huynh, Isaac Pincus and Tracy Groves attended the presentation of the 2019 Vice-Chancellor's Award for Exceptional Contribution to OHS at The Jazz Club at The Ian Potter Centre for Performing Arts last October. The CEPA Committee was invited to attend the ceremony.

The Department's Laboratory Manager has taken a proactive lead and has actively assisted the HoS, Department Manager and Safety Officer with the implementation of new processes for ordering chemicals. This process was reviewed and consulted through the whole department. They have also assisted in the review of the Department Safety manual.

They have supported leading the Department Safety Day and assisted with the change in format to make the day more activity based to improve the promotion of team safety awareness. For example, in 2019, they arranged a role play for numerous safety incidents that could occur when working in the lab environment. They focus on first aid incidents and invite the University First Aider officer/trainer to participate in the event.

We are very proud of their input into this event, as this is the first time PhD students were involved in a Department

Safety Day in this way across the whole University.

The HDR students also participated in the bi-annual safety inspections and took an active role in auditing each lab and offices within the Department, ensuring that all corrective actions are completed and followed up with the Department Safety Officer.

From June 2019, HDR students are now co-chairing the Department Monthly Safety meeting with the Chair of the Department OHS Safety meeting. They are actively engaged in promoting an awareness to colleagues in the Department and identifying hazards and near misses in their areas. Inducting new students in the labs to ensure they are aware of each lab's requirement and training needs is now a high priority, ensuring each person that enters that lab has the appropriate training.

CEPA have also created a research guide for new postgraduate students, which is available in English and Chinese (See our website for a copy of this guide <https://www.monash.edu/engineering/departments/chemical/ohs>) They also actively promote health and wellbeing in the Department by introducing new PhD students each month at the TGIF session on the third Friday of each month.

GREEN IMPACT 2019 – BEL LAB RECEIVES RECOGNITION AND CERTIFICATION



Green Impact is a staff engagement program that targets sustainability in the workplace. The program has just been completed for the second year, with the Green Impact Awards celebration which took place on 26th November, 2019.

Teams from across Monash worked together to implement sustainability initiatives in their work areas and receive points for each action taken. Three teams were awarded top honours with Bioengineering Laboratory (BEL) of chemical engineering receiving a Bronze award for their participation.

The 2019 winners were:

- » GREEN with ENVY – Office and Labs GOLD OFFICE
- » Monash Sustainable Development Institute – GOLD OFFICE
- » Sustainable 407+ – GOLD LABS

Congratulations to all teams that took part. A special mention goes to Elizabeth Stock, who received the Green Impact Staff Champion award for her dedication to sustainability. The program this year welcomed seven new teams, with 1404 actions taken in total – 200 more than in 2018.

The BEL lab looks forward to reviewing their plan and hopefully go on to win the 2020 Green impact award.

NEW STUDENT LOUNGE FOR CHEMICAL ENGINEERING

The CEPA Committee has been awarded funding from the SSAF for the creation of a student lounge to help promote the health and welfare of students. The grant was supported by both undergraduate and post-graduate clubs (CEPA, SMUCE, MEPSS, and Brew Lab Team) and construction will commence in 2020

Currently within the department, there is no dedicated space for both undergraduate and postgraduate students to relax. Therefore, the three societies supporting this project believe that having such a space will benefit all students by providing them a space for them to relax away from the pressure of learning.

The student lounge is to be created from two existing rooms where the funds will be allocated into combining the space into an open area that will be configured and manipulated to accommodate students' needs with the addition of movable walls/dividers/green walls and furniture.

These features support different activities within the room including meetings and social events without interrupting students around them.

The student lounge will be used for committee meetings for any Chemical Engineering societies, a casual and social place for students to hang out, a place for postgraduate and undergraduate student clubs to collaborate in non-academic activities (i.e. board game nights); and host events that can support the welfare of students (i.e. weekly breakfast clubs to promote healthy lifestyles and better mental health). Other features that the room will include for student use are: a large screen TV and other recreational items (i.e. billiards/foosball table etc.), which can be moved when not needed.

In addition to the reconfigurable open space, the room will feature a kitchenette (fridge, electric oven, microwaves, sandwich press and a sink) for undergraduate and postgraduate students to access for their own personal use. The room will include electronic swipe card access to limit access to students within Chemical Engineering.

STUDY BUDDY PROGRAM

The Study Buddy Program is run by the Monash Student Association (MSA) with the aim to match like-minded students with each other to form a study group. Study groups may range from 2 to 5 students.

We find that peer to peer interactions generally decrease as students advance to higher levels. We hope that the Study Buddy Program serves as a platform for peers to meet and connect over shared subjects.

Aims:

- » Enhance student learning and improve academic performance
- » Enable students to connect with like-minded peers
- » Encourage interaction with peers for studying

Who is eligible to sign up? The Study Buddy Program is currently only open to Clayton-based undergraduates in the following faculties for Semester 1, 2020:

- » Pharmacy (Parkville only)
- » Nursing
- » Information Technology
- » Engineering



Visit our website for more information
(msa.monash.edu/services/programs/msa-study-buddy/)

CO-OP PROGRAM

Shaping engineers of the future

Provide students with industry experience and meet your organisations needs through our co-op talent pipeline.

Register your interest
monash.edu/engineering/coop



THE MONASH DIFFERENCE

Monash Engineering qualifications are professionally accredited and internationally recognised. We provide a total experience for our students. We want to teach highly skilled engineers, while developing well-rounded individuals, who are ready for professional life, leadership and success. That's the Monash difference.

Engineering – your way

At Monash, you can complete your engineering qualification in just four years, or study for five years and graduate with a double degree or a masters. Our engineering students complete a common first year to gain a broad understanding of engineering and the different specialisations. And there are plenty of options for you to branch out in your subsequent years of study.

Studying a double degree with Monash is a great choice for students who have a passion for two disciplines and would like to further their career options. Monash Engineering is aligned with nine degrees from other Monash faculties. More and more organisations seek engineering graduates with expertise in multiple areas and Monash Engineering caters for this with the opportunity to complete two degrees, in just five years.

A total learning experience

Great engineers are so much more than just their skills – they're planners, leaders, team players and communicators. At Monash, our engineering courses aim to produce highly skilled engineers who are ready for life, ready for work, ready for the world.

The Monash Engineering Leadership Program, the Work Ready Program, and the Monash Industry Team Initiative, are all designed to help our students become well-rounded engineers, and better develop their strengths and their passions as people. Monash Engineering students are able

to branch out by way of activities such as – studying abroad or joining a club such as the Monash Unmanned Aerial Systems Club (UAS Club).

Learn and do in world-class facilities

Engineering is a hands-on discipline. At Monash, you get the chance to develop your skills in some of the world's best engineering facilities, like the Cave2 immersive visualisation platform, the largest wind tunnel in the Southern Hemisphere, one of the world's most powerful electron microscopes, and the New Horizons Centre – a collaboration between Monash and the CSIRO.

Professionally accredited, globally recognised

Monash Engineering degrees are recognised by a range of professional engineering bodies (depending on the specific degree), including Engineers Australia, The Institution of Chemical Engineers, Engineering Accreditation Council Malaysia, and the Australian Computer Society.

Reading online?

Find out more about the student experience at Monash

Find out more about our facilities

STUDENT & INDUSTRY ENGAGEMENT



We believe there's more to great engineers than excellent technical skills alone. And that's why Monash Engineering provides a range of programs designed to give you the knowledge and skills you'll need to be confident and articulate professionals, and to be well and truly ready to take your excellent engineering skills to your chosen industry.

Reading online?

Find out more about student & industry engagement

VESKI INNOVATION FELLOWSHIP



Associate Professor Timothy Scott was awarded the Victorian Government 2019 Veski Innovation Fellowship to continue his high-impact research into rapid 3D printing processes for transport, manufacturing and production.

The veski innovation fellowships bring individuals with outstanding skills in the fields of science and innovative technology, typically in the top five per cent of their fields to Victoria.

A/Prof Scott returned from the College of Engineering at Michigan University, USA, to take up his position as a senior member of the Department of Chemical Engineering and the Department of Materials Science and Engineering at Monash University to pursue his research project *Multi-Colour*

Irradiation Systems for Ultra-Rapid Additive Manufacturing.

Three-dimensional printing is a cutting-edge technology proving to be tremendously useful during the design and prototype stages of industrial production. Also known as additive manufacturing (AM), the worldwide market has grown by up to 30 per cent per year over the past decade, with revenues from services and products totalling more than USD\$7.3 billion in 2017.

Despite this growth, for 3D printing to truly disrupt global manufacturing, its speed must dramatically increase.

A/Prof Scott has developed an ultra-rapid method of 3D printing. This breakthrough technology is 'one of the first true 3D printers' that uses two beams of light, and light-sensitive resin, to enable high speed, continuous production.

The technique starts with a liquid that is solidified by irradiation with visible or UV light. By patterning that light the method allows you to make three dimensional objects of your choosing. The use of highly viscous, filled resins enable fabrication of composite objects with mechanical and thermal properties far exceeding those of parts made by other contemporary AM approaches.

The biggest potential of this technology will be in the agile manufacturing of low to moderate volume parts quickly and inexpensively. The recent decrease in Victoria's consumer manufacturing sector, including automotive manufacturing, was due in part to the expense of out-dated, large-scale production methods. This approach is ideal for supporting smaller manufacturing production needs in Victoria.

COOPERATIVE RESEARCH AWARD IN POLYMER SCIENCE & ENGINEERING

A/Prof Scott, along with his American colleagues have been recognised for their collaborative research efforts that resulted in a novel technical solution to address the critical problem of shrinkage stress in crosslinked photopolymerised systems using addition fragmentation monomer (AFM) technology and successfully employing this approach to enable several significant product applications.

The collaborative research team is represented by Professor Christopher Bowman (University of Colorado), Professor Timothy Scott (University of Michigan), Dr. Peter Bissinger (3M), Dr. Bradley Craig (3M), Karsten Dede (3M), Dr. Timothy Dunbar (3M), Dr. Adrian Eckert (3M), Dr. Babu Gaddam (3M retiree), Dr. Guy Joly (3M), Dr. Larry Krepski (3M retiree) and Dr. Joe Oxman (3M).

The 2019 Cooperative Research Award in Polymer Science & Engineering recognises the team of researchers from University of Colorado, University of Michigan and 3M,

This cooperation between the University of Colorado, University of Michigan and 3M is a great example of the value of collaboration between academia and industry. Each participant brought complementary strengths to the table. These collaborations take time, commitment, and perseverance on all sides. In the long run, the scientific advancements and new product introductions make such collaborative investments worthwhile.

BIOPROCESS ENGINEERING GROUP

For the first time, postgraduate students from Monash University Malaysia showcased their research in Chemical Engineering Postgraduate Association (CEPA) conference. To encourage the involvement of students in the Department of Chemical Engineering offered the International research mobility grant to five postgraduate students from Monash University Malaysia. Hoe Boon Chin, Lee Jia Min, Kulandai Arokia Rajesh Packiam and Vidya Sundaram are among the recipients of mobility grant who attended and presented their works at the conference. They are from the Bioprocess Engineering Group led by A/P. Dr. Ooi Chien Wei (Edward). The Bioprocess Engineering Group is an interdisciplinary team dedicated to solve problems in bioprocess and biochemical engineering using a range of advanced experimental and computational tools.

The Bioprocess Engineering Group has a broad range of research focuses, from biomolecular engineering to downstream processing. The research projects are fundamentally related to the problems faced by the biochemical engineering sectors, including fine chemical production by biocatalysis, waste valorisation, protein stabilisation, and bioprocess design. Specifically, Bioprocess Engineering Group specialises in aqueous two-phase system (ATPS) as a promising tool of bioseparation, bioprocess integration and emulsification. By securing multiple research grants supported by the government and industry, the members are actively engaged in finding solutions to the grand challenges in biochemical engineering.

The main research interests of the Bioprocess Engineering Group are firmly based on green chemistry and with a particular emphasis on the design and application of

functional ionic liquids (ILs). Third-year PhD students, Boon Chin and Vidya are both interested in applying the computational chemistry and ILs for their project-specific applications. ILs are low-temperature molten salts composed of ions and have been termed as “designer solvents” due to their tunable physicochemical properties. In the last decade, ILs have garnered the interest of many researchers and scientists for their potential in both experimental and theoretical sciences.

Boon Chin has implemented a liquid-liquid extraction (LLE) system to extract carotenoid using ILs from unrefined palm oil. Carotenoids are pigments with antioxidant properties that improve eye health, cardiovascular function, and skin health. Crude palm oil (CPO), which contains α - and β -carotene, is one of the primary sources of carotenoids. Conventionally, the extraction of carotenoids from CPO involves energy-intensive processes and degrades the quality of palm oil. Hence, it is desirable to recover the carotenoids before they are degraded in the refinery of CPO. LLE is a scalable extraction method that can be prospectively used for carotenoid extraction. As LLE in carotenoid extraction relies on the transfer of carotenoids from CPO to the solvent systems, the solvent systems must have high solubility of carotenoid without being miscible with CPO. Boon Chin's PHD project aims to recover carotenoid from CPO using LLE systems made of solvent mixtures. A solvation model was applied in the screening of ILs for carotenoid extraction. In addition, the tunable physicochemical properties of ILs improve the selectivity of carotenoids and the yield of carotenoids in the final product.

Vidya has exploited the ILs for the stabilisation of proteins. Temperature-induced denaturation and the subsequent loss of potency are the two major concerns for pharmaceutical industries producing protein-based therapeutics. The global



biopharma industry collectively spends billions to ship temperature-controlled products. On this account, cold chain equipment (CCE) has become indispensable to the logistics and storage of temperature-controlled proteins. To eliminate the dependence on CCE, Vidya has utilised the biocompatible ILs for thermostablising heat-labile protein. Already in the final phase of her project, Vidya has applied computational methods to study the stabilisation effect of ILs on insulin aspart, the protein-based drug used in the treatment of diabetes. The promising results of her computational analysis are now being validated through experimental techniques. Vidya hopes that such a thermostable formulation of insulin aspart in ILs can improve the quality of life for diabetic patients and reduce the economic burden of the dependence on CCE.

Jia Min's research is related to the emerging application of ATPS in the encapsulation of bioactive compounds. ATPS has been widely applied in the purification and separation of bioactive compounds. 'ATPS emulsion', also known as water-in-water (W/W) emulsion, can be formed from a destabilised ATPS made of biocompatible and food-grade hydrophilic phase-forming components. This phenomenon had further extended the application of ATPS towards the formation of microgel and encapsulation. In her research, she successfully demonstrated the applicability of W/W emulsion in encapsulation of a model protein, enhanced green fluorescent protein using gelatin as the wall material of encapsulation and polyethylene glycol as the continuous phase. This research opens up a new avenue to the encapsulation of bioactive compounds without involvement of oily phase as in the case with oil-in-water emulsion system.

Kulandai, also a final year PhD student, is fascinated by the application machine-learning (ML) to understand complex biological systems. There are patterns everywhere ranging from day-to-day life, for example, what do people buy, why do airfares increase during the holiday season and, even in

science, how do microbial cells respond to environmental cues? Kulandai is currently deciphering the secretion level of recombinant protein using ML-based algorithms. Specifically, he is developing ML models to predict the levels of the foreign protein that can be produced within the periplasm of the well-known bacteria, *Escherichia coli* (E. coli). The ML models consider multiple factors at the levels of cellular expression and fermentation for the robust prediction of protein expression yield. Ultimately, the prediction model will minimise the trial-and-error experimental runs by suggesting the suitable fermentation process conditions for achieving the maximal protein levels in the E. coli periplasm.

About their trip to Monash Clayton Campus and attending the CEPA conference, the students say, "Having been given the opportunity to travel to Clayton campus, we experienced international research environment and our sojourn has been nothing short of a wholesome experience. The mobility grant provided us with an excellent opportunity to present our research to a broader audience. Keynote speakers were stellar, and we enjoyed every moment at the CEPA conference. It was both inspiring and educational to meet and talk to the Head of the Department, Professor Mark Banaszak Holl. A/Professor Victoria Haritos was kind enough to take us on a lab tour where we learnt the facilities at the state of the art laboratories and caught a glimpse of the projects of several PhD students. The experience we gained through intercampus travel has prepared us for the subsequent research works and publications. Apart from enhancing our scientific knowledge, this intercampus travel has been a great experience to establish research networks".

NOMINATIONS NOW OPEN FOR MONASH LIFE MAGAZINE



Submit your idea via our Monash Life story submissions form and help us showcase the inspirational contributions of our diverse alumni community.

All nominations will be considered. To get an idea of what we're after, you can view the latest digital edition of Monash Life here (<https://lens.monash.edu/@monash-life>).

We look forward to reading your nomination and thank you for helping us showcase alumni making a difference.



ARC GRANT SUCCESS

The ARC Discovery Early Career Researcher Awards (DECRA20), ARC Discovery Projects (DP) and ARC Linkage Infrastructure and Equipment Funds (LIEF) have been announced and overall Monash had a stellar year, coming first in Australia in ARC DP grants and in NHMRC funding.

DECRA:

We are pleased to announce that Dr Qianqian Shi (Chemical Engineering) has been awarded a DECRA for her project *2D Janus Nanoparticle Superlattice Sheets*

Discovery projects:

Prof Huanting Wang; Dr Yinlong Zhu: *Integrated composite electrodes for electrochemical synthesis of ammonia*

This project aims to develop multifunctional composite electrodes for electrochemical synthesis of ammonia from water, nitrogen gas and renewable energy under ambient conditions. Hydrophobic subnanometre water channels will be integrated with an electrocatalyst to control supply of water as vapour, thereby effectively minimising hydrogen evolution reaction and enabling high-efficiency ammonia synthesis. Expected outcomes include enhanced capacity in developing electrochemical reaction systems, and new fundamental knowledge of electrocatalyst design and reaction engineering. This should provide significant economic and environmental benefits by developing a sustainable manufacturing technology to transform the century-old ammonia industry.

Prof Wenlong Cheng; Prof Malin Premaratne: *Soft Plasmene Nanosheets for Stretchable Plasmonic Skins*

Conventional plasmonic sensors and devices are rigid, planar, and not stretchable. This project aims to apply plasmene materials developed at Monash's Nanobionics lab to design highly stretchable plasmonic devices (artificial plasmonic skins). Systematic experimental and theoretical studies will be undertaken to understand how the plasmonic skins respond to strains and how they can be used for fabricating novel stretchable devices. Such studies will generate important new knowledge of fabrication, characterisation, and modelling of stretchable plasmene, hence, contributing to Australia's standing in the field of nanotechnology and plasmonics. It may also incubate patentable technologies, bringing potential economic gains.

Prof Cordelia Selomulya; Dr Federico Harte; Prof Xiao Dong Chen - Chemical Engineering: *Towards new functionality in dairy Ingredients*

The Australian dairy industry plays a significant part in the nation's economy, with almost \$3 billion in export revenue in 2016-2017. Powdered dairy products extend shelf life and ease of transport, with >20% annual growth in premium products, such as milk protein concentrates and infant formula powders. This project aims to support the development of value-added dairy powders by investigating the impact of a novel high pressure processing technology in enhancing the properties of dairy powders and/or introducing new functionality. Successful outcomes will help expand the offering of high value dairy ingredients and thus increase the global competitiveness of Australian dairy manufacturing.

Professor Frank Caruso; Dr John Quinn: *Macromolecular Engineering of Functional Metal-Ligand Materials*

Materials self-assembled from metal ions and ligands have a range of important applications, including as advanced coatings, adhesives and catalysts. However, these materials have been largely limited to those assembled from naturally occurring ligands such as phenolics, restricting their properties and function. This project aims to greatly expand the range of accessible properties of metal-phenolic materials by combining self-assembly with advanced polymer synthesis techniques. The expected outcome of the project is a new class of functional materials applicable as self-healing coatings, nanoadhesives and antimicrobial surfaces, thus underpinning next-generation technologies in materials science and nanotechnology.

LIEF:

The LIEF scheme promotes cooperative initiatives that share expensive research infrastructure, equipment and facilities between higher education organisations and industry.

Professor Mainak Majumder; Associate Professor Jacek Jasieniak; Professor Rosanne Guijt; Professor Gil Garnier; Dr Ludovic Dumeé; Dr Rakesh Joshi; Professor Namita Choudhury; Professor Adrian Neild; Associate Professor Mehmet Yuce; Dr Zongli Xie; Associate Professor Davide Deganello; Mr Simon Savage

Integrated Functional Printing Facility for Advanced Material Technologies

Associate Professor Yuerui Lu; Professor Ping Koy Lam; Professor Ian Petersen; Associate Professor Qiaoliang Bao; Professor Dan Li; Professor Warwick Bowen; Associate Professor Wen Lei; Associate Professor Benjamin Buchler; Associate Professor Andrey Miroshnichenko; Dr Sumeet Walia; Professor Wenlong Cheng; Professor Francesca Iacopi; Dr Zongyou Yin; Dr Weiwei Lei; Associate Professor Thomas Volz

Advanced Multifunctional Electro-Opto-Magneto-Mechanical Analysis Platform

Congratulations to all recipients.

PHD SCHOLARSHIP OPPORTUNITY ARC HUB FOR PROCESSING ADVANCED LIGNOCELLULOSIC (PALS)

Location: Clayton campus, Monash University

Employment Type: Full time

Duration: 3-year fixed term appointment

Remuneration: Monash Graduate Scholarship stipend rates apply \$29,000 per year (tax-free). <https://www.monash.edu/graduate-research/future-students/scholarships/stipend>

THE OPPORTUNITY

As part of the ARC Industry Transformation Research Hub for Processing Lignocellulosics into High-Value Products (PALS), a PhD scholarship is available at BioPRIA in the Department of Chemical Engineering at Monash University. Primary supervision will be provided by Dr Joanne Tanner.

The project aims to produce bio-sources xylo-oligosaccharides (XOS) compounds for food and pharmaceutical applications. During this PhD, the successful candidate will develop novel, scalable techniques to consistently hydrolyse hardwood-derived xylans to XOS, separate the XOS mixtures into individual oligomers, and characterise and ascertain the potential applications for the purified XOS. Please see the link for more details: (link to project description).

PALS PhD candidates will benefit from interdisciplinary research, professional skills and networks with Universities and industry. Each PALS PhD project will link with the Australian Bioresource industry acting as advisers. Industrial partners include: Visy, Norske Skog, Orora, Australian Paper, Circa, LEAF Resources and the Government of Tasmania. For more information about BioPRIA and PALS research hub please refer to the following link: <http://www.biopria.com.au/>.

Monash University is the largest university in Australia and ranks in the top 100 universities worldwide. Monash has six globally networked campuses and international alliances in Europe and Asia. The applicant will be based at the Clayton campus in Melbourne.

CANDIDATE REQUIREMENTS

The successful applicant will have a background in either Chemical Engineering, Material Engineering, Chemistry, Mechanical Engineering, Physics or similar. Applicants must have a relevant Honours/Master's degree at a high level (H1 or First-Class Honours degree).

Applicants must fulfil the criteria for PhD admission at Monash University and demonstrate excellent research capability <https://www.monash.edu/graduate-research/future-students/apply>.

To submit an Expression of Interest (EOI) application, please fill this form <https://goo.gl/forms/pYfvQfILv6WrvhY2> and submit the following documents:

Cover letter with brief statement of the applicant's suitability

- Curriculum vitae (CV)
- Full statement of academic record, supported by scanned copies of certified documentation
- Contact details of two academic referees
- Evidence of English language proficiency (international applicants only) such as TOEFL or IELTS. Shortlisted candidates will be interviewed over Skype if necessary. The interviews will be conducted in English.

CLOSING DATE

Applications will be accepted until the project has been filled by a suitable candidate.

PROJECT DETAILS

Title: Production, separation and characterisation of bio-sourced xylo-oligosaccharides

Main Supervisor: Joanne Tanner

Co-Supervisor: TBA

Project Description:

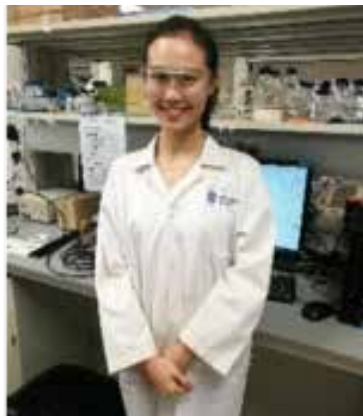
Xylo-oligosaccharides (XOSs) are C5 sugar oligomers that show great potential for application in the agricultural, food and pharmaceutical industries as prebiotic food additives¹ and phyto-pharmaceuticals². These short chain polymers consist of between two and ten xylose units connected by β -1,4 glycosidic bonds and are reported to occur naturally in bamboo, milk, honey, and some fruits and vegetables³. XOSs can also be generated by microbial synthesis⁴, and are produced industrially by chemical or enzymatic hydrolysis of the hemicellulose (xylan) fraction of hardwood-derived lignocellulosic biomass.

Xylan can be extracted from hardwood biomass in various ways, including thermomechanical methods, e.g. steam explosion⁵, hydrothermal treatment⁶, and thermochemical methods, e.g. mild temperature acid and alkali treatments⁷. Regardless of the extraction method, the xylan derived from lignocellulosic biomass is always a complex mixture of polymeric chains comprising 300-5000 sugar monomer units⁸. Subsequent generation, separation and characterisation of XOS from biomass and indeed other sources remains a challenge. Consistent, selective and efficient hydrolysis of long chain xylan polymers to oligomers of chain length between two and ten is difficult, and separation of the inevitably mixed xylo-oligosaccharide products has not been achieved reliably at much above analytical scale, even from a single biomass source. Each different type of lignocellulosic biomass yields a different xylan product made up of different sugar monomers, with different linkages and degrees of polymerisation. Without reliable methods to hydrolyse, separate and characterise biomass-derived xylo-oligosaccharides, it is impossible to fully describe these molecules or to exploit their full potential, as each individual XOS molecule may have vastly different properties and therefore different potential applications.

This project therefore aims to produce pure, sustainable XOS compounds for food and pharmaceutical applications by developing novel, scalable techniques to 1) consistently hydrolyse hardwood-derived xylans to XOS, 2) separate the XOS mixtures into individual oligomers, and 3) characterise and ascertain the potential applications for the purified XOS components.

1. <https://www.sciencedirect.com/science/article/pii/B9780128010204000081>
2. <https://avidscience.com/book/phytopharmaceuticals-and-drug-delivery-approaches/>
3. <https://www.sciencedirect.com/book/9780128040249/the-microbiota-in-gastrointestinal-pathophysiology#book-description>
4. <https://onlinelibrary.wiley.com/doi/full/10.1111/j.1541-4337.2010.00135.x>
5. <https://www.sciencedirect.com/science/article/pii/S0960852419315159?via%3DIhuh>
6. <https://www.sciencedirect.com/science/article/pii/S0896844617303819>
7. <https://www.sciencedirect.com/science/article/abs/pii/S0926669017303758>
8. <https://royalsocietypublishing.org/doi/10.1098/rsif.2012.0341>

MONASH UNIVERSITY MALAYSIA – SUSTAINABLE SOLAR HYDROGEN FUEL PRODUCTION VIA PHOTOELECTROCHEMICAL WATER SPLITTING



Monash University Malaysia School of Engineering's PhD candidate, Wen Cai Ng, is focusing her research on improving energy sustainability and actively tackling environmental-related challenges. Her research work is mainly supervised by Associate Professor Dr. Meng Nan Chong, and revolves

on the rational design of a novel conductive polymer-semiconductor hybridised photoanode for application in a tandem photoelectrochemical (PEC) cell for solar hydrogen (H₂) fuel production from water splitting.

In the pursuit of energy security and minimising the associate greenhouse gas emissions in the long run, which are the key challenges of the modern era, the production of clean and renewable H₂ fuel using only sunlight and water via PEC water splitting is regarded as a potential sustainable processing route in striving towards a low-carbon economy. Nonetheless, a lot of research and development efforts are devoted in addressing the major technical bottleneck of PEC water splitting which is mainly due to the low solar-to-hydrogen (STH) conversion efficiency exhibited by the semiconductor-based photoelectrodes used. Fundamentally, the low STH efficiency of semiconductor-based photoelectrodes is due to the sluggish charge transfer kinetics and rapid charge recombination at the molecular level.

As a world leading young science expert in environmental photocatalysis, Prof. Chong has established his research group at Monash University Malaysia in 2013 with a strong focus on basic and applied photocatalysis for sustainable energy and environmental-related applications. Currently, Prof. Chong's group is actively interfacing nanotechnology

with intensified reactor technology for the photocatalytic synthesis of various solar fuels and high-value chemicals.

Wen Cai graduated with a Bachelor of Engineering with a First Class Honours in Chemical Engineering from Monash University Malaysia in 2017. In the following year, she returned to Monash University Malaysia and joined Prof. Chong's group to pursue her PhD research. Wen Cai's research work is mainly focused on the rational design and synthesis of efficient photoelectrodes for solar H₂ fuel production, with a particular emphasis on Ag₃PO₄-based photoanodes and their nanostructuration and modification strategies. With the state-of-the-art technology and laboratory setup, she has managed to design and synthesise a novel multilayer conductive polymer-semiconductor hybridised photoanode that is capable of achieving a high and unprecedented photocurrent density of 16.34 mA/cm² at 1.4 V vs Ag/AgCl, which is also the highest reported photocurrent density thus far for Ag₃PO₄-based photoanodes. She believes that her research output can potentially help in building a solid foundation for solar PEC water splitting technology with commercialisation potentiality.

On 31st October 2019, Wen Cai had the opportunity to visit Monash University Clayton Campus and participate in the 9th Annual Chemical Engineering Postgraduate Association (CEPA) Conference 2019 under the Department of Chemical Engineering International Research Mobility Grant. During the event, she was able to showcase her research work to a wider scientific community and has received helpful feedback. To further advance her PhD project, she also hopes to create new avenues for potential interdisciplinary collaboration between the two campuses in the near future.

ABOUT ASSOCIATE PROFESSOR DR. MENG NAN CHONG



Associate Professor Chong's research interests are nanotechnology, environmental photocatalysis, sustainable energy and water technology, water resources management and sustainability.

To date, he has published more than 160 publications in high-impact journals, conference proceedings, book chapters, and client consultancy reports and have obtained more than RM 2.3 million in research funding during his tenure at Monash University Malaysia. Assoc. Prof. Chong has completed an eScience project (Project code: 03-02-10-SF0121, 2012-2015) and a FRGS project (Project code: FRGS/1/2014/SG06/MUSM/02/1, 2014-2017).



MONASH UNIVERSITY ANNOUNCES NEW CAMPUS IN INDONESIA

Monash University has been granted approval by the Government of Indonesia to establish the first foreign university campus in Indonesia.

Based in Jakarta, Monash Indonesia will be a postgraduate campus, offering Masters and PhD degrees, as well as executive programs and micro-credentials. It will be research intensive and industry engaged, and operate with the full support of both the Indonesian and Australian governments.

Monash has a long history of engagement in Indonesia and a desire to build deeper links with a thriving and innovative community with great ambitions for education and research.

Monash has an extensive and engaged alumni base of over 10,000; it has expanded the Monash Indonesia Representative Office; it is host of the Australia-Indonesia Centre; and has worked with local Indonesian communities on significant research such as the Revitalising Informal Settlements and their Environments project and the World Mosquito Program.

The campus in Indonesia will enable Monash to significantly add to our existing points of engagement and will make a distinctive contribution to Indonesia's development.

Monash Indonesia will be a wholly Monash-owned, postgraduate, research-oriented and industry-connected campus. It will begin short executive programs later this year and the first intake of Masters students is planned for quarter four 2021. Monash Indonesia students will be awarded a Monash University degree, and there will be opportunities for cross-campus collaboration for research purposes and mobility in education.

It is expected that the University will progressively roll out a suite of Masters and PhD programs, as well as tailored professional and continuing education courses and micro-credentials. It is proposed these will be in areas such as data science and digital technology, infrastructure and urban planning, creative industry and entrepreneurship, and health systems and public health.

Monash Indonesia will not offer undergraduate degrees, rather it will facilitate flows of undergraduate students to other Monash campuses.

The establishment of Monash Indonesia represents an important deepening of the bilateral relationship between Australia and Indonesia, with long-term benefits for both countries in areas of education, research and industry collaboration. In particular, it will facilitate the two-way flow of students and scholars, and innovative ideas and technology.

The opening of Monash Indonesia, the first Australian university based in Indonesia, will enable us to work in and with Indonesian people and their organisations to realise their future opportunities. The physical establishment also serves as a symbol of Monash's commitment to Indonesia and the wider Asian region, as well as stronger research and education links between Indonesia and Australia.

This new Monash campus joins a dynamic network alongside the highly successful Monash University Malaysia, as well as our partnered campuses in Suzhou with SouthEast University and Mumbai with Indian Institute of Technology Bombay.

In establishing this campus, the University is continuing its commitment to being a truly global university.



The Monash BrewLab has been hard at work over the holiday period, with its members brewing some amazing beers ready for 2020. 2019 was the first year of the Monash BrewLab's operation and during the year, the team brewed over 20 beers, received over 200 applications, recruited over 50 students and set itself up as a leader in the brewing science and engineering space.

In August of 2019, the team of just over 20 members opened up more positions for students to join. After receiving a whopping 120 applications, the BrewLab management interviewed and appointed 30 students into the team. From all levels and courses of undergraduate study, to PhD students; the BrewLab has further developed thanks to our volunteers who have quickly and effectively picked up the slack. To welcome in the new members and get the ball rolling, Burnley Brewing hosted a BrewLab welcome event, with their owners Phil and Neil showing the team around the Richmond brewpub and its brewing system.

The second part of 2019 saw the BrewLab feature at a variety of Monash events as well. Serving a variety of beers, BrewLab team members honed their beer pouring and making knowledge to share our creations throughout the University. At the 2019 Vice Chancellor's Research Awards and the Engineering Christmas event, BrewLab beers were served for all to enjoy, receiving much positive feedback from attendants. The team also featured a stall at the Monash Celebrating Engineering event at the Melbourne Museum in September, showing off grains and hops to interested attendees. In December, the BrewLab team held a stall at the Monash Mini Maker Faire, brewing an IPA and showing attendees the brewing process. Educating the Monash community on beer and brewing was an incredible opportunity in 2019 and the team looks forward to continuing to serve beers and show off what it does at events in 2020.

The team presented its first Industry Night in 2019, inviting a number of breweries such as Hawkers, CUB, Little Creatures, Burnley Brewing, Future Mountain and the Public Brewery, as well as beer industry suppliers such as Keg King, Grain & Grape and Bluestone Yeast, to come and see

the work we had been doing. From exploring the lab, taking in our presentation and sampling the beers brewed, the night was a huge success for both the companies and final year students eager to find jobs in this space.

The team also contributed to teaching, namely presenting a lecture on brewing for the undergraduate chemical engineering unit Grand Challenges in Chemical Engineering: Delivering Sustainable Food, Water and Energy (CHE1010), as well as presenting a workshop on brewing for the Master's degree unit Food Engineering and Processing (CHE5889). These presentations enabled the team to upskill its students in presenting what we do to other students, as well as enabled us to nerd out on the chemical engineering in action during the brewing process!

In 2019, the team went on a variety of site visits to different breweries around Melbourne to grow students' understanding of the process and its scalability. Starting with Hawkers Beer in Thornbury, the largest craft beer manufactory in Victoria, the team learnt about large-scale craft and how this was undertaken through clever heat and water integration. Next the team visited CUB's Abbotsford brewery, learning about the large scale brewing and packaging practices, as well as how these large breweries can use sustainable techniques to reduce waste, such as carbon dioxide emission collection. Finally, the team went to Future Mountain in Reservoir, a craft brewery specialising in sour and farmhouse beers. Here we learnt about blending and barrel aging, techniques used by the master craftsmen to create truly different and exciting beers.

Over 20 beers were brewed by the Monash BrewLab in 2019, including Pale Ales, Summer Ales, Stouts, Wheat Beers, IPA's, a NEIPA, a Brown Ale, a Pumpkin Ale, a Lager, a Gose and finally a Belgium Quad. The Belgium Quad was the final brew of the year and was aptly named "S-Quad of 2019" to celebrate the amazing students who had volunteered their time and energy to the BrewLab throughout the year. 20L of this beer was aged in a barrel, giving an oakier flavour to this 10% quad and further developing its complexity. The New Year saw a revisit of the Gose recipe from 2019, honing it further on our brewing system, as well as a plum Imperial Stout to prepare for the winter.

In October of 2019, the BrewLab entered a beer into their first community home-brewing competition, hosted by CSIRO. The team entered in their Brown Ale; a nutty tasting, well balanced 8.2% beer which was perfect for this Oktoberfest competition. To our delight and surprise, the beer came in at second place, beating out 9 other entries from the 22 year competition. In February of 2020, the BrewLab entered in their Brown Ale, French Saison and Stout into the Melbourne Beerfest and are enthusiastically awaiting the results.

But entering beers into competitions was not the only involvement the team had in brewing competitions in 2019; team members also were involved as junior judges in both VicBrew and the Bayside Brewers Oktoberfest. Team members with the most developed palates from the monthly sensory evaluations volunteered at these two events, tasting hundreds of beers and working with senior judges to communicate the flavours and off-flavours they were experiencing. These judging opportunities were invaluable to the team and sensory evaluation continues to be an extremely important quality assurance method in the beer industry; both for brewers and customers.






















Looking back on 2019, it seems incredible that we achieved so much, and this is not including all the financial, legal, marketing, design, technical and administration work in the background. Moving into 2020, the team's mission is to establish a core range of consistently high quality products, and enter into brewing competitions, while developing a positive reputation among the wider Monash base and Victorian brewing community. The team is excited for this year, with a number of collaboration brews with breweries in the works, as well as the establishment of an alumni community centred on brewing. This year the team also hopes to start Australia's first student brewing competition to ignite the passion for brewing in students throughout the country. Finally, in February 2020, the team presented at the CUB & TWE Technology Expo at the Abbotsford Brewery on a collection of conceptual and primary stage research


areas for brewing and its future. The team's presentation was met with thunderous applause and some very exciting future updates!

Thank you to all the students who volunteered their time in 2019, as well as the Department of Chemical Engineering and Faculty of Engineering for their constant support. If you would like to get in touch with us about catering an event, brewing with us or partnering with us financially or through knowledge sharing, please do not hesitate to email us at brewlab@monash.edu.



Sponsorship Package.

	Logo on Website	Facebook Promotion	Tasting Night Invitation	Research Project Opportunities	Feature in Newsletter Article	Logo on Competition Polo	Logo on Beer Label
Bronze \$200+							
Silver \$500+							
Gold \$1000+							
Platinum \$3000+							



Society of Monash University Chemical Engineers

SMUCE IS A STUDENT-RUN SOCIETY AIMING TO BRIDGE THE GAP BETWEEN THE CLASSROOM AND THE WORLD OUTSIDE UNIVERSITY. IT SERVES AS A LINK BETWEEN STUDENTS, ACADEMICS AND INDUSTRY

Through our hugely popular Industry Seminar Series we strive to expose students to the chemical engineering world.

We also work with the Department of Chemical Engineering and Careers Connect to increase student awareness.

Socially, SMUCE organises a number of events to facilitate networking opportunities between students and academic staff.



**FOR MORE INFORMATION, VISIT:
SMUCE.ORG**



SOCIETY OF MONASH UNIVERSITY CHEMICAL ENGINEERS

Linking students with industry

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POSITION AVAILABLE:
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MARCH 26, 2020
12-1 PM
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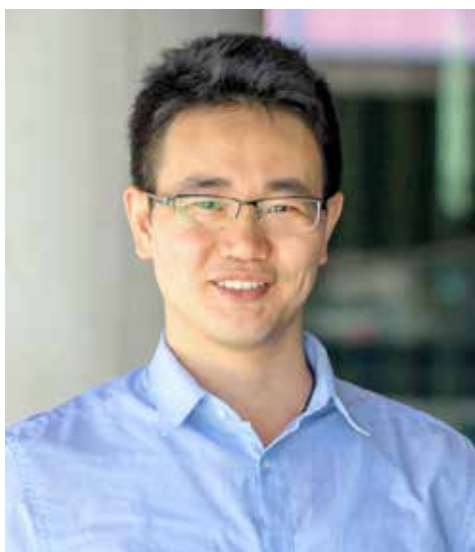
SPONSORSHIP PACKAGES

An important part of SMUCE is the support from companies, which allows us to run events throughout the year. Over the years, we have expanded our network in every relevant industry, run successful seminars, and published company profiles in the annual Careers Guide. We hope you can support us in 2020 so we can continue to do this and more. Our sponsorship packages are as follows*:

SUPPORTER	SILVER	GOLD	PLATINUM
\$0/yr	\$200/yr	\$500/yr	\$700/yr
Careers Guide ✓ Company overview and profile	Careers Guide ✓ Supporter features ✓ Logo on front page ✓ Single-page advertisement	Careers Guide ✓ Silver features ✓ Double Page Advertisement ✓ Opportunity to include an employee/graduate profile	Careers Guide ✓ Gold features ✓ Special acknowledgement ✓ Opportunity to include two employee/graduate profiles
Seminars ✓ Opportunity to conduct a 50-minute seminar with free lunch provided to students and presenter/s	Seminars ✓ Supporter features ✓ Preference of week	Seminars ✓ Silver features ✓ Seminar Priority ✓ Opportunity to conduct a workshop (extending timing of seminar to 100 minutes)	Seminars ✓ Gold features ✓ Improved catering for lunch
SUPPORTER	SILVER	GOLD	PLATINUM
\$0/yr	\$200/yr	\$500/yr	\$700/yr
Industry Night ✓ Invitation to attend the new SMUCE Industry Night	Industry Night ✓ Invitation to attend the new SMUCE Industry Night ✓ Invitation to be a panel member	Industry Night ✓ Silver features ✓ Opportunity to present an introductory presentation for your company	Industry Night ✓ Gold features
Promotions ✓ Job opportunities and internships promoted on Social Media channels (Facebook, LinkedIn, weekly email newsletter) ✓ Logo under Supporters section on website	Promotions ✓ Supporter features ✓ Promotion of company-run seminars, workshops, etc ✓ Distribution of promotional material like fliers or merchandise at our events ✓ Logo on social media banners ✓ Logo under Silver sponsors section on website	Promotions ✓ Silver features ✓ Promotion of company-run social or networking events ✓ Boosted promotion of all events ✓ Logo on SMUCE merchandise ✓ Logo under Gold sponsors section on website	Promotions ✓ Gold features ✓ Logo under Platinum Sponsors section on website ✓ An article and mention by SMUCE on website and other channels

* Sponsorships at other price points can also be arranged. Contact smuce@monashclubs.org for more information

OUR NEW STAFF AT MONASH SUZHOU



Dr Zhikao Li

Dr Zhikao Li has just joined the team in Suzhou as a Lecturer. Dr Li has worked in various research topics related to energy in Australia, China, Saudi Arabia, and United States. His previous role was a Research Associate at The University of Western Australia, where he also completed his PhD.

During his time in Western Australia, his research focus was in the field of natural gas processing, in particular: (1) the purification of natural gas mixture, using membrane, adsorption, and absorption technologies; and (2) physical properties measurement, including gas mixture density, surface tension, viscosity, etc. under high pressure and low temperature conditions.

His research at Monash-Suzhou will leverage membrane technology, adsorption technology, and new technologies to gain fundamental knowledge and develop practical applications in decentralised water purification, seawater desalination, wastewater treatment, soil recovery, and gas processing. The new membrane lab at Monash-Suzhou Campus, where Dr Li will lead research projects covering various membrane types (UF, NF, RO, FO), models (e.g. MBR), as well membrane process optimisation, is currently being established.

Dr Li is looking forward to setting up the new lab at the Suzhou campus within the next half year, building his research team, and seeking opportunities to transform technology through innovative research and collaborations with both academia and industry. His role at Monash Suzhou will also include teaching Master level lectures at Monash-Suzhou Campus and mentoring Master by Research students and PhD students.



Dr Baiqian Dai

Dr Dai is a senior lecturer in Monash Suzhou. He completed a Bachelor of Engineering degree at Wuhan University of Technology (China) in 2006 and a Master of Engineering degree at University of Shanghai for Science and Technology (China) in 2009. He completed his PhD degree from the Department of Chemical Engineering, Monash University in 2017. He has been a postdoctoral research fellow from 2017 to 2019 in Chemical Engineering, Monash University. His research interests include clean coal technology, ash slagging, energy evaluation for process design and fly ash utilisation. He has more than 40 publications in high quality journals in the solid fuel area.

Dr Dai is the course coordinator for Masters of Industrial Engineering in Monash Suzhou. His role includes developing the postgraduate program, optimising the curriculum construction of the Suzhou campus to align with the objectives of Monash, and promoting collaborative multidisciplinary research and industry engagement for inter-campus. Monash Suzhou is located in Suzhou Industrial Park (SIP), which is one of the largest innovation precincts in China and recognised as one of the world's most dynamic places for converting clever research into valuable products.



Dr Dai's research focuses on technologies that can maximise the value of natural resources, utilise renewable energy, and minimise the impact on the environment. His research includes fundamental and generic research in collaboration with industry, other research centres and laboratories, and universities. Using a wide spectrum of fundamental mechanism studies, bench-scale discovery, pilot process development, task-specific simulation and demonstrations, the research is working towards building a clean, low-carbon, safe, efficient and green sustainable energy conversion system.

Dr Dai's hopes to enhance the connection between Monash Suzhou campus and Monash Clayton campus. He also aims to promote Monash Chemical Engineering industry engagement in SIP and commercialise chemical engineering technologies.

OUR NEW STAFF AT MONASH CLAYTON



Dr Daniela Loessner

In March we will welcome Associate Professor Daniela Loessner, who will work with academic staff across the Faculties of Engineering and Medicine. Daniela is looking forward to returning to Australia.

Daniela has Bachelor of Science and Master of Science degrees and a PhD in Natural Sciences (Dr rer nat) from the Faculty of Chemistry, Technical University of Munich, Germany. She has 17 years of academic experience, working as a research scientists and group leader. Until 2017, she was Deputy Director in the Centre for Regenerative Medicine at Queensland University of Technology, where she led the interdisciplinary 3D Cancer Models Team. In March 2017, she was appointed as Reader in Bioengineering and Cancer in the Centre for Tumour Microenvironment, at the Barts Cancer Institute at Queen Mary University of London.

Her research interests are to understand the role of the extracellular and cellular microenvironment in modulating cancer progression and therapy response applying tissue-engineered technologies. Using her multidisciplinary expertise in cell biology, biomedical engineering and translational research she develops

3D platforms by integrating biomechanical and patient-specific characteristics of the tumour microenvironment to test biological therapies.

Daniela's scientific achievements, technologies and leadership have been recognised by a number of national and international awards. For example, she is the recipient of the 2019 Joint E.K. Frey – E.Werle and Henner Graeff Promotion Prize; a 2015 Monash University Engineering Women's Leadership Award; a 2013 Oral Presentation Award at the Victorian Comprehensive Cancer Centre Congress; two Queensland University of Technology Mid-Career and Early-Career Researcher Awards and four Carla Patterson Publication Awards.

Daniela received £2.9M UK research funding as PI and collaborator (CRUK, MRC, Neuroblastoma UK, Worldwide Cancer Research) and \$2.3M Australian competitive research (ARC, NHMRC, Cancer Council, Cancer Australia), industry and cooperative research centre funding. Her work and research has been recognised nationally and internationally with peer-reviewed publications in the areas Engineering, Oncology, Materials Science, Biotechnology, Cell and Molecular Biology (for example Nature Protocols, Biomaterials and Cancer Research); commissioned book chapters; presentations and invited participation in international symposia.



Dr John Quinn

Dr Quinn has joined the Department in a joint appointments as Senior Lecturer & ARC Future Fellow with Chemical Engineering and the Faculty of Pharmacy & Pharmaceutical Sciences.

Dr Quinn's research involves the use of polymer synthesis techniques to develop new excipients that can potentially offset the side-effects and disadvantages of underutilised drugs.

Since 2014, he has been a Senior Research Fellow in the Drug Delivery, Disposition and Dynamics Theme at Monash Institute of Pharmaceutical Sciences, and in 2017 was awarded a Future Fellowship from the ARC. Although his research is oriented toward polymer applications in pharmaceuticals, Dr Quinn's initial undergraduate training was in Industrial Chemistry, and his PhD in Chemical Engineering (both from UNSW). Since July this year he has been jointly appointed to Chemical Engineering. Prior to working at Monash John spent time at the University of Melbourne and outside the university sector, including a number of years working in intellectual property law.

DRIVING SOCIAL INCLUSION THROUGH THE DEPARTMENT'S WEEKEND BUS TRIPS



Many of our students come from international destinations to study at Monash University. Cultural shock and language barriers are just two of the most common challenges faced by international students when they first arrive in Australia, alongside with being away from their family support members. To counteract the effects of this isolation and to try to increase the social participation of our newly enrolled students into our Higher Degree Research (HDR) student community, the Department has decided to hold weekend social events. Some of the social events that are planned during 2020 are weekend bus trips to some of Victoria's most beautiful regional destinations.

We took our first social day trip to Daylesford during February 2020 and the trip was definitely a great experience for all who participated. Daylesford is a popular tourist attraction in Australia and is famous for its natural springs and spa. Although the weather was not in our favour, we still managed to see beautiful places like Lake Daylesford, Hepburn Springs and Sailors Falls.

Additional weekend social events have been planned throughout 2020 with a July trip to Lake Mountain for snow play and an October trip to Phillip Island. Hopefully, we will have much better weather for the next two trips but if not, we will still enjoy the time we spend with each other anyway.



MONASH FOOD WASTE-TO-BIODIESEL TEAM

The Monash Biodiesel Team is a new initiative for undergraduate and postgraduate students led by Chemical Engineering PhD students Brian Jong and Ankita Suri and supported by the Chemical Engineering Department and A/P Victoria Haritos.

The goal is to efficiently convert valuable components in food waste to simple nutrients which serves as food for oleaginous yeast. The yeast convert excess sugars into lipids inside their cells which can be removed and readily converted into biodiesel.

The Monash Biodiesel Team promotes sustainability, waste recovery, renewable energy, biotechnology and bioprocessing and assists students to gain skills in design, problem solving, operations, working in teams and industry-relevant aspects of cost of goods and supply chains. The Team has arranged access to food waste from the Campus Centre and the new Makers Space and has begun generating the simple nutrient stream for yeast cultures.

To date we have recruited and inducted 20 additional student members; most are undergraduate students studying Chemical Engineering but there is a diversity of skills and genders in the team. Once this cohort is up and running there will be a second call for interest and outreach to other Faculties at Monash. For further information or to contact the team please email brian.jong@monash.edu or ankita.suri@monash.edu



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