MONASH University

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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

HIGHLIGHTS IN THIS ISSUE

WELCOME FROM THE HEAD OF DEPARTMENT

Just as our February 2020 Focus newsletter was released, COVID-19 began to impact us here in Melbourne. We met our new and continuing students for the first day of classes on March 9th, only to have all on campus classes cancelled for the rest of the semester the next day. We had been anticipating this possibility, although it still came as a shock, and rapidly continued our pivot to delivering a fully online educational experience for our students. This required a remarkable and prolonged effort from our professional and academic staff and from our students, as we all learned how to go about teaching, learning, and research in a very new environment.

We observed "ground hog week" during which we repeated the 2nd week of the semester, and then Zoomed, Zigged, and Zagged our way through the term as we adopted new approaches to fit a distance learning reality. Our HDR students, many of them helping us with the transition to online teaching, simultaneously tackled the challenge of keeping their research moving forward without access to a lab. By May, we finally arranged about half-time access for our student's most critical experiments. It was a difficult and challenging semester.

Just when we were emerging from a prolonged season of bushfires that had disrupted our broader chemical engineering family, many of us dealt with personal losses associated with the COVID-19 pandemic. On behalf of the department, I pledge to our students that we will keep supporting and working with you to become excellent Monash Chemical Engineers. Now more than ever, society needs your skills and your passion. We are committed to help you thrive in the ever changing world into which we are emerging.

To our alumni and friends, I know that you have faced many challenges as well this year. Jobs, livelihoods, businesses, and family have been severely affected by COVID-19. We will all be continuing to work through these challenges as 2020 continues. If you are fortunate, as I have been, to continue working in a job you love, and have the resources to do so, please consider joining with me and donating to the Monash University COVID-19 student hardship fund. Full details are provided here in Focus. I assure you that the funds you contribute will provide needed support to very deserving students who are facing serious challenges in their studies due to personal and/or family consequences of the COVID-19 pandemic. Jane and I will personally match the first $1000 of contributions made.

As COVID-19 changes the Australian educational landscape, its challenges demand new approaches to higher education. The pandemic has caused us to develop existing strengths, to think about entirely new approaches, and to re-evaluate our priorities. We have the strongest international Chemical Engineering department in the world with campuses and their amazing students and staff in Melbourne, Kuala Lumpur, and Suzhou; however, this presented unique challenges when our Suzhou campus was quickly shut down, followed by the closing of our Kuala Lumpur and Melbourne campuses. Fortunately, we were able to support each other and rapidly adapted to the required on-line learning environment. Experienced colleagues in Australia and Malaysia combined forces to deliver our core curriculum by working together to provide the best each campus had to offer to OUR chemical engineering students regardless of location. Our new hires in Suzhou – faced with teaching the first offering in Suzhou of our Masters in an online format – worked closely with their Australian colleagues to make certain that all of our Masters students – in Australia or China – were able to take advantage of our talents and experience.

In the midst of our efforts, the Head of the School of Engineering at Monash Malaysia, Professor Anthony Guo, remarked "This is the best we have ever worked together," and he was right. The pandemic forced us to improve; to rely on each other's strengths. We believe the changes that have been wrought are positive and we are excited to carry them forward. Within a month we will be meeting to plan new research collaborations between all of our campuses - now using lessons and relationships forged over the last five months.

This edition of Focus also provides you with updates of significant accomplish and new opportunities arising despite the pandemic. We are pleased to announce that Akshat Tanksale has been named a Fellow of the Institution of Chemical Engineers (IChemE). David Brennan's latest edition of Process Industry Economics has been published. And, new hires from last year, Nicoleta Maynard and John Quinn both had success in the ARC Linkage program. You can also read all about The STEAM Engine Co, a start-up created by Marissa Thomas (B.Eng 2019), to encourage girls into engineering. We also provide research highlights from the labs of Warren Batchelor, Udo Bach, Xiwang Zhang, and a major collaborative effort from Huanting Wang, Xiwang Zhang, Matthew Hill, Lei Jiang, and Benny Freeman. You can find details for all of these – and many more exciting developments – in this issue of Focus.

I am pleased to announce that Paul Webley – a former member of the department from 1996 to 2012 – including a stint as Head of Department – has returned to Monash Chemical Engineering with a new role as the Energy Partnership Director for the Woodside Energy Partnership. Welcome back Paul! We are also excited that Benny Freeman will be joining us in 2021 as a joint appointment with University of Texas at Austin. Benny will be key part of "team membrane" and part of the Monash Centre for Membrane Innovation. Our very own Aditya Putranto (PhD 2013) has returned as a Senior Lecturer to our Malaysian campus, bringing a wealth of expertise in food engineering. Welcome back Aditya!

On behalf of the department, I extend a thank you to the members of our student societies, SMUCE, MEPSS, and MCESS, for their advice and support and help with co-creation of our online educational experience. Your willingness to have frank conversations as we moved through the semester was invaluable.

Finally, we learned of the passing of Owen Potter in late June. Prof. Potter was the founding Chair of the Monash Department of Chemical Engineering and served in that role for 26 years. We include a remembrance of his career as the first article in this issue of Focus. Prof. Potter played a central role in the founding of APPI (now BioPRIA) and we follow the remembrance by two articles on BioPRIA's COVID-19 efforts as wonderful examples of the legacy he left the department. Simon Corrie led a team to invent a new test for the SARS-CoV-2 virus that causes the COIVD-19 disease. The test was designed to be implemented in a high throughput fashion in any hospital or clinic blood lab around the world (ACS Sensors 2020; https://dx.doi.org/10.1021/acssensors.0c01050). Gil Garner led a team to develop new paper-based personal protective equipment (PPE) to help address worldwide lack of supplies, including the hydrocarbon-based materials used to prepare the standard materials.

Mark M. Banaszak Holl
Professor and Head, Department of Chemical Engineering

In Memoriam

Owen Edward Potter AM
1925 - 2020

Emeritus Professor, Chemical Engineering Monash University

It is with great sadness that we report the death of our friend and colleague, Professor Owen Potter, the first Chair of the Department of Chemical Engineering. Professor Potter served the University for 26 years in the role of the Department's Chair. Please keep Professor Potter's family and close colleagues in your thoughts and prayers.

Tribute, Emeritus Professor Owen Edward Potter AM

Emeritus Professor Owen Potter AM, who has died aged 94, was a distinguished chemical engineer and inventor whose outstanding research into drying processes led to a significant reduction in carbon dioxide output at power stations in Victoria and beyond.

Owen was an international figure in his field, renowned for his probing research and scholarship that packed a huge academic punch. An original and remarkable thinker, his steam fluidised bed drying process – with which he could dry particulate solid materials, alumina and brown coal – won him numerous awards and accolades for the impact it made both locally and internationally. His invention, patented in 1981, not only reduced emissions at power stations by 20 per cent, it also decreased boiler size and operating costs.

Owen came to Monash in 1964 as the foundation professor of chemical engineering, also serving as both associate dean and acting dean of engineering during his 26-year tenure.

His leadership was marked by his ability to make quick decisions and craft a strongly-worded memo, and he transformed the department into a centre of excellence. He lived by the trope that “easy is the path that leads to hell”, and therefore took the opposite route. He wouldn’t rest until he ensured his students had a thorough comprehension of a topic, and wouldn’t hold back when disappointed by their performance.

Owen’s feisty feedback exposed the gaps and faults of any work, starkly revealing its mediocrity. Such demands often produced sweat and tears from his students, but in his eyes it was a small price to pay for acquiring and generating knowledge.

During his first decade at the helm, Owen established thriving research programs, and three undergraduate courses in chemical engineering; 10 of the students he supervised were awarded PhDs, and four of them master’s degrees. Meanwhile, the number of chemical engineering academics in Victoria rose from two to more than 20.

Owen’s research was characterised by original ideas and a strong mathematical approach to experimentation. His interest in fluidisation, a physical phenomenon that causes a solid substance to behave as a fluid, began in 1960. The significance of his work was recognised by the University of Manchester, which awarded him a Doctorate of Science in 1974 for his outstanding contribution on the elucidation of the mechanism of gas and solid mixing in fluidised beds, and by Du Pont, which retained him as a consultant on the design of high-pressure gas-liquid reactors.

Owen Edward Potter was born in Brisbane in August, 1925. With an unwavering determination, he set his course towards excellence from a surprisingly young age. As a student, Owen seemed to move seamlessly from one scholarship grant to the next. On leaving school, he

earned a state scholarship to study applied science at the University of Queensland, where he graduated with first-class honours in chemical engineering. He spent the next two years working as a researcher on a training scholarship from CSIRO while studying for a master's degree in applied sciences, awarded in 1950.

In 1949, he was awarded the Queensland University Foundation Travelling Scholarship to study a second master's degree in history and philosophy of science at the University of London.

In less than eight years, Owen had successfully completed a bachelor's degree and two masters' from renowned educational institutions. His academic campaign, however, wasn't yet finished. In 1954, he was offered a teaching post in engineering at Manchester University – a role he used to good advantage to complete a PhD by research in chemical engineering. Unable to find a suitable supervisor to oversee his doctoral research, he directed it himself.

Owen returned to Australia in 1960, as a reader in chemical engineering at the University of Melbourne, soon after assuming concurrently the role of head of the Department of Chemical Engineering at the Royal Melbourne Institute of Technology (RMIT).

Not surprisingly Owen won numerous awards during his lifetime, including the ICI Award for Innovation in Drying (1992), and the Kernot Medal of the University of Melbourne (1993). He was awarded the Centenary Medal in 2003, and in 2013 he was appointed a Member of the Order of Australia (AM) for significant service to chemical engineering, as well as to the Catholic Church.

In addition to his role at Monash, Owen was co-founder and chair of the Victorian Branch of the Institution of Chemical Engineers (ICE), from 1965-67 and 1975-76; secretary/treasurer (1961-65) and chair (1984-86) of the Australian National Committee of the ICE; chair of the Catholic Education Commission of Victoria (1980-89), and fellow of the Australian Academy of Technological Sciences, as well as of Engineers Australia, the Institution of Chemical Engineers, and the Royal Australian Chemical Institute. He was appointed Emeritus Professor in 1991 following his retirement from Monash.

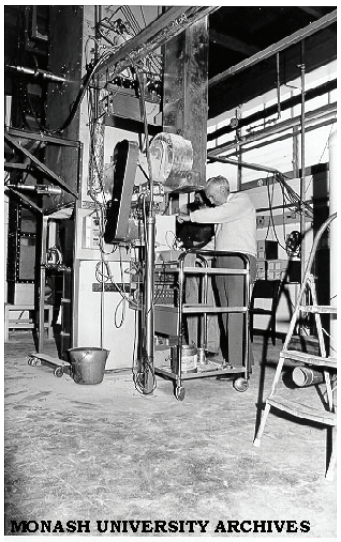
In old age, Owen continued to live as he worked, brushing aside obstacles in his path, believing that fierce advocacy is a critical aspect of true leadership, and that implacable tenacity is sometimes imperative to bring necessary change to long-held but outdated thinking.

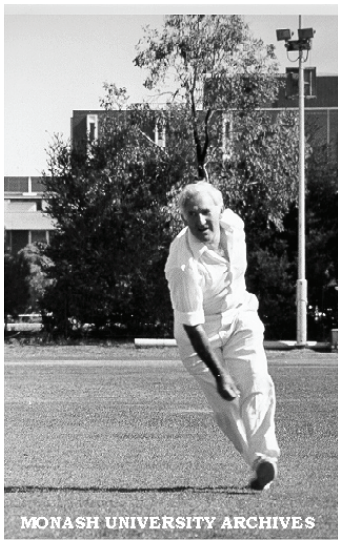
Defying serious illness, his energy and probing mind remained undimmed well into his 90s, when he set up and chaired a family-directed company, OEP Cross-Flow Pty Ltd, its mission to commercialise globally the patents for his invention of a gas particle cross-flow contactor.

He argued that his revolutionary vertical and horizontal contactor designs enabled greatly increased efficiency of solid particles or liquid droplets interacting with gas streams in industrial processes across multiple industry sectors. Such high-efficiency mass and heat transfer and catalytic reactions would, he argued, lead to a global carbon footprint reduction.

In his spare time, he enjoyed studying Latin, going camping with his large family, sailing, and downing a cold beer.

Owen married Julia (Julie) Hanlon in 1952. She died in 2010, and he's survived by seven of their eight children. If the safest road to hell is indeed the gradual, easy one, then Owen Potter must surely have found himself at the gates of heaven.





Professor Potter in the laboratory, 1986; Playing cricket in the Professorial Board cricket match, 1982. Source: Monash University Archives

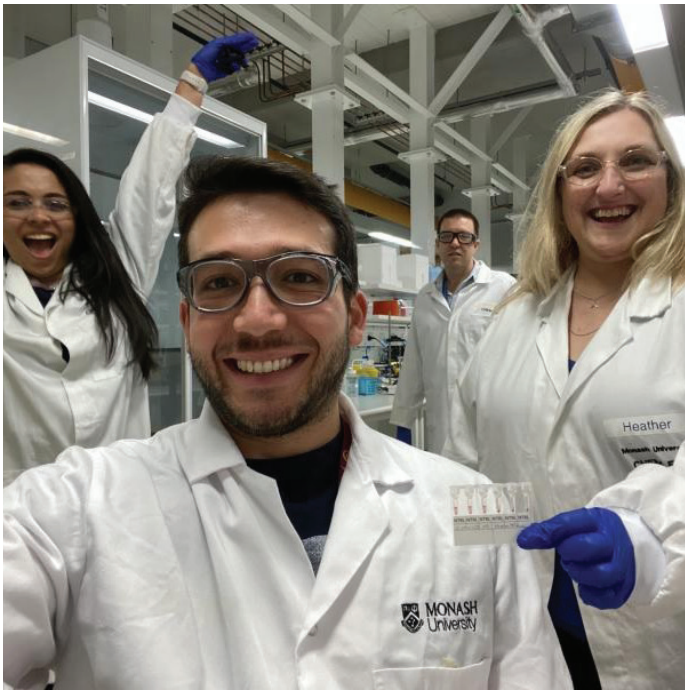
LISTEN: A cinematic model - poem written and narrated by Peter Darvall (audio) about Owen Potter

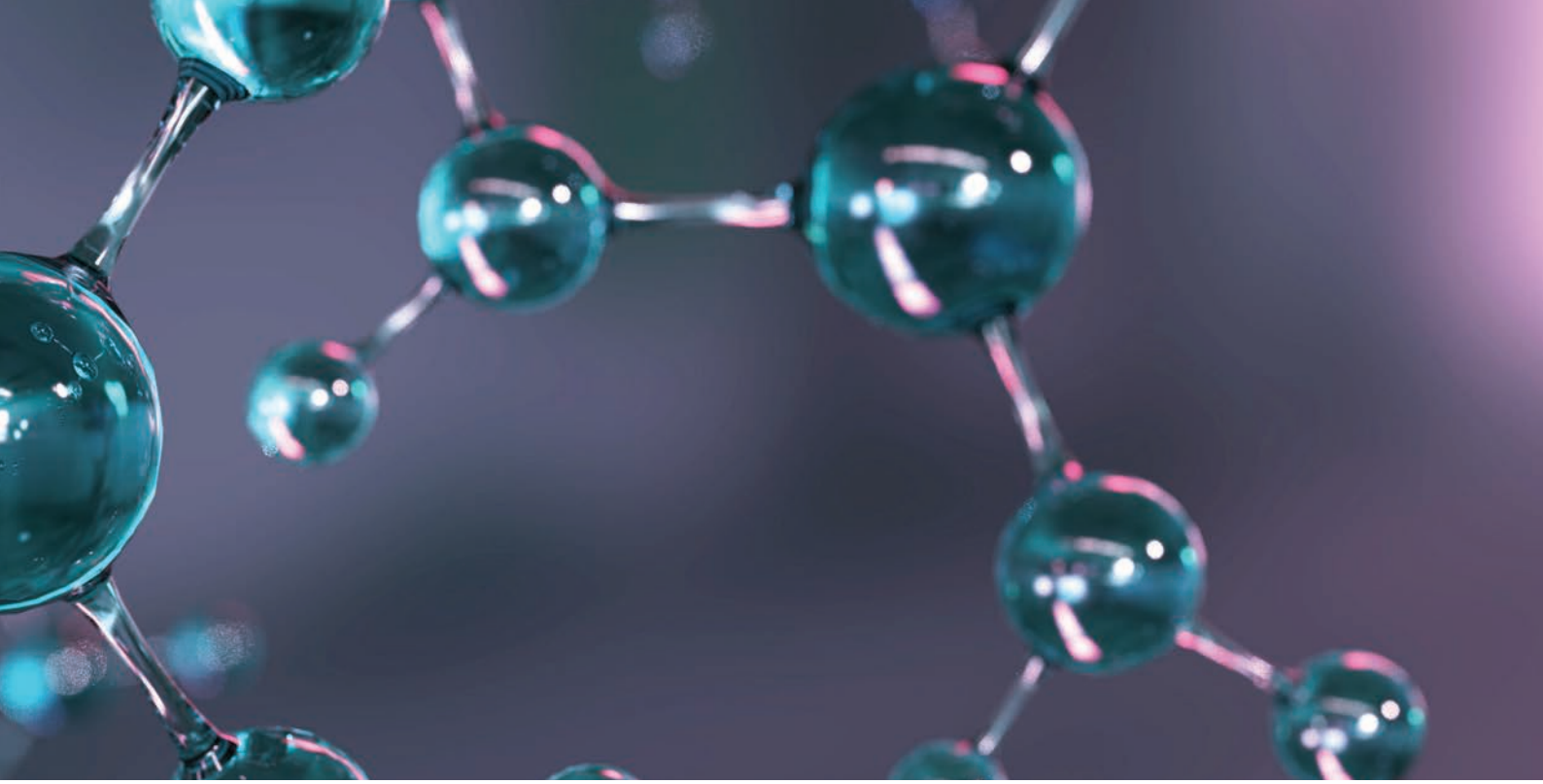
In brief
News highlights

DIAGNOSING COVID-19 ANTIBODIES

The Bioresource Processing Research Institute of Australia (BioPRIA) has had its own Eureka moment. Simon Corrie and team succeeded is detecting COVID-19 in the plasma of an infected patient using the gel card technology available in all hospitals.

Dr Simon Corrie and his team members Professor Gil Garnier, Professor Mark Banaszak Holl and A/Professor Timothy Scott have been awarded funding from The Centre to Impact AMR (@CentreImpactAMR) to work on the COVID19 antibody assay. The funding provided will be used to move the project to the next step, namely widespread blood-typing assays to make COVID19 serology tests and putting in the groundwork to apply the same concepts to completely new tests for diagnostic applications beyond COVID19.



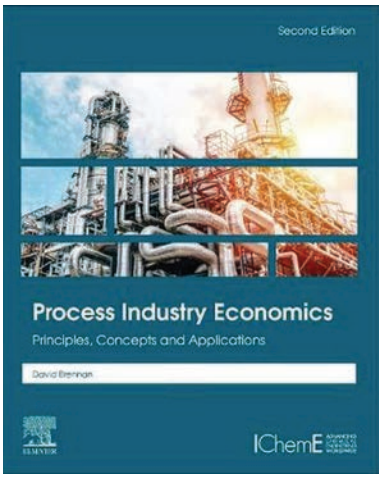


LAMINATED PAPER AS AN INNOVATIVE MATERIAL FOR LEVEL 4 MEDICAL GOWN

Prof Gil Garnier and his team in BioPRIA succeeded in making level 4 isolation gown from paper for the frontline workers.

Because of the COVID-19 pandemic, there is shortage of Personal Protective Equipment (PPE) worldwide which leaves the healthcare workers under immense danger. To overcome this issue, we developed laminated paper-based gown and tested for virus protection. The objective of this study was to evaluate the potential use of laminated paper-based gown for healthcare workers by quantifying the effect of coated layer and base sheet on the performance of the material. The material was optimised for mechanical strength and barrier against virus. Design of the gown was optimised for the feasible manufacture of these gowns at a large scale. This study proposes how the available technologies in the pulp and paper industry can be utilised for production of paper based PPE and studies the properties of such materials to meet the legislations and requirements for this particular application.

NEW BOOK: PROCESS INDUSTRY ECONOMICS. CONCEPTS, PRINCIPLES AND APPLICATIONS, 2ND EDITION



Since retiring in 2007, I have had the privilege of continuing teaching, research and writing within the department. One regular contribution has been the economics aspects of the design project. In my related lecture I have always included a slide identifying what I consider the four pillars of process economics: market evaluation, capital cost estimation, operating cost estimation, and profitability assessment. It was a feature of my previous process economics books, the first published in 1990 by Longman Cheshire with an Australian perspective, the second by IChemE in 1998 with an international perspective, to include separate chapters on these four topics. I have recently been delighted to see multiple battered copies on the shelves at the Hargrave library, indicative of their extensive use by students. In 2018, I was approached by IChemE about writing a new edition of the 1998 book. The new edition was release in June 2020.

My interest in process economics was sparked initially when working as a young graduate at ICI Australia in a chlor-alkali plant. Duties included process design plus developing related expenditure proposals for projects, and later managing operations within the plant where reliability, production output, and operating costs were a priority. Following my industrial work, I joined RMIT in 1970 as a lecturer where my tasks included teaching process economics and managing the design project. Despite my industrial experience I felt I still needed further experience in economic evaluation. In 1977 I was seconded for a year to ICI Australia's planning and development department which was working on an ethylene expansion project. One of my tasks was to explore the optimum capacity of a new ethylene plant. During this task, I learnt that most Australian process plants had increased their production capacities during operating life to meet market growth. This aroused my curiosity into how this had been achieved technically, and the related economic implications. This became the theme of my PhD project at Melbourne University a few years later. My appointment to Monash came in 1989.

Two study leave periods in the 1990's were of further value. In 1992, 6 months at ICI Australia involved assisting with an assessment of the company's economic and environmental performance for various products relative to that of competitors. In 1996, 6 months at Davy John Brown's design office involved analysing the capital cost structure of completed projects to assist with future factored cost estimates. In both cases, the experience was supported by overseas visits to plants and personnel experienced in various aspects of process economics.

My accumulated experience in industry, teaching and research, including supervision of postgraduate students, has been an ongoing stimulus to my further learning. Much of my research has been in combined economic and environmental assessment applied to different industry sectors, while undergraduate design projects have explored alternative technologies, project concepts and site locations for various products.

A feature of the four pillars of economic evaluation referred to earlier is that expertise in each pillar is normally held by separate experts. This highlights the importance of communication and evaluation skills in achieving effective integration of inputs from these experts. The sharing of knowledge and experience from experts, as well as by government, industrial and educational bodies is essential for progress in process industry economics, and is a theme explored in the new book. Other topics explored include mineral and fuel commodities within market evaluation, learning related to technical, economic, environmental, safety and sustainability performance, case studies of investment proposals with sustainability implications, and potential for chemical engineers to contribute to government policy development. I hope to find some battered copies of my new book in the Hargrave library before too long.

David Brennan. Adjunct Associate Professor.

NEW MENTORING GROUP TO BE ESTABLSIHED

The Department has initiated a mentoring program to assist Masters coursework and new HDR students establish themselves at Monash University.

The mentors are volunteers from among the Department's research postgraduate students who want to share their experience and knowledge of studying at Monash, and for many, coming to Australia to study was also an important learning experience that they want to share.

Mentors will receive training and advice before being matched with a coursework or research postgraduate mentee.

The mentoring program has an academic overview committee made up of a range of Department staff to guide the program and mentors.

INTRODUCING MCESS

The Chemical Engineering Masters Student Society (MCESS) is a student run society and was established in the second half of 2019.

MCESS creates a direct communication channel between the coursework based chemical engineering masters students and the chemical engineering academic team.

The broader aims of MCESS includes bridging the gap between classroom and the world outside the classrooms. Hence, in future MCESS aims to work closely with the Department of Chemical Engineering and the Faculty of Engineering to increase student awareness of the available professional opportunities, which may help the students in their professional endeavours. The society creates a unique environment for the coursework masters students to socially connect and network. MCESS is planning to expand their network by joining the various chemical engineering student clubs and socialising with SMUCE (Society of Monash University Chemical Engineers) and CEPA (Chemical Engineering Postgraduate Association). MCESS is currently expanding and is actively recruiting new members. If interested please contact Dr. Parama Banerjee (parama.banerjee@monash.edu), who will liaise you with the MCESS committee members.

A/PROF AKSHAT TANKSALE MADE AN ICHEME FELLOW AND RECEIVES DEAN AWARD

Congratulations to Dr Akshat Tanksale who has been made an IChemE Fellow.

An IChemE Fellowship is the highest grade of membership to the Institute of Chemical Engineers. It recognises Chartered Members who are in a position of senior responsibility in chemical engineering and are likely to have made a significant contribution to the profession through their experience, technical excellence and leadership skills.

Akshat leads the Catalysis for Green Chemicals group at Monash, where his interest is in the field of heterogeneous catalysis for conversion of biomass to fuels and chemicals using nanomaterials. He has published over 45+ peer review papers in high impact journals and he has five patents. Akshat has won numerous awards and fellowships, including the Caltex Award for Excellence in Chemical Engineering by the Australia and New Zealand Federation of Chemical Engineers.

In recognition of Akshat's dedication to teaching, he has received the 2020 Deans Award for Innovation in Learning and Teaching.

A/Prof Akshat Tanksale has led exceptional curriculum development over several years at the Department of Chemical Engineering. He has technologically advanced the teaching and learning resources, especially in 2nd year units and implemented several innovative assessments, which are constructively aligned with the learning activities.

His innovations are appreciated by students and other academic staff members alike. These innovations have been recognised by the Australia and New Zealand Federation of Chemical Engineers by awarding him with the Caltex Award for Excellence in Chemical Engineering in 2018.

Considering the disruptions in semester 1 2020 teaching due to COVID-19, A/Prof Tanksale was the most prepared academic staff in the department and received exceptional commendation by the students for his handling of the crisis.

We congratulate Akshat on this most deserved recognition.

NEW APPOINTMENT

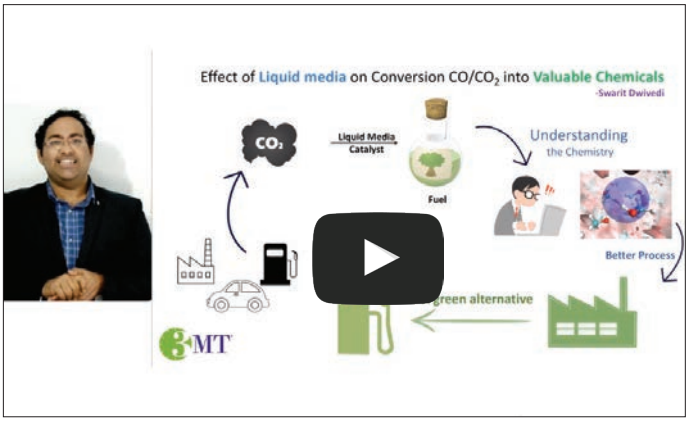
We are pleased to announce that Associate Professor Timothy Scott will be our new Deputy Associate Dean (HDR), working closely with Professor Jacek Jasieniak as Associate Dean Research.

Associate Professor Scott is a Veski Fellow. His research focuses on the kinetics and thermodynamics of radical and dynamic covalent reactions for the fabrication and manipulation of polymers.

He is a world leader and innovator in 3D printing technology.

DEPARTMENT 3 MINUTE THESIS WINNERS

Congratulations to Swarit Dwived who won the judges vote in the Department round and will go on to represent the Chemical Engineering in the Faculty round. Winner of the People's Choice Award was Rabeeh Golmohammadzadeh. Congratulations to all for your excellent presentations. We are already looking forward to next year's competition.



Swarit Dwivedi_3MT Effect of liquid media on conversion of CO/CO_2 into valuable chemicals

Rabeeh Golmohammadzadeh- A world without waste

COVID-19 Student Hardship Appeal

The Vice-Chancellor recently announced an emergency Student Compassionate and Hardship package, to support those in our student community who are suffering financial hardship as a result of the COVID-19 pandemic.

HOW YOU CAN SUPPORT?

These are incredibly challenging times. We understand that many of our people are doing it very tough and experiencing our own personal challenges and financial stress. Not everyone will be in a position to make a donation. But if you are able, and would like to contribute, you can do so by either making a one-off donation on the appeal website.

DONATE HERE

HOW WE QUICKLY AND EFFECTIVELY ADAPTED IN CHEMICAL ENGINEERING

Although only half of the year has gone through, the year 2020 will definitely be marked as a crucial turning point for the Department. Starting from a catastrophic bushfire across the entire country, afterwards we experienced a world-wide coronavirus pandemic which has not yet finished, and even now, no one knows when it will end. Regardless, the Department has made immediate effort and adaptation to the on-line teaching of our courses, in an effective way that maximises the engagement and learning outcomes of the students, from both on-shore and off-shore.

To accommodate students' needs for remote learning and engagement, a number of key activities have been implemented across the Department. For all units, we pre-recorded most of the conceptual material, using quizzes and reflection activities that enable students to self-assess their level of understanding. Students are also given plenty of opportunities to interact with the teaching team and their peers via Zoom Q&A. Not only chaired by the demonstrators and academics, a number of Zoom Q&A are also chaired by our industry lecturers with vast expertise in different Chemical Engineering areas. Our synchronous activities led by passionate demonstrators focus on examples, applications, case-studies and active learning activities that reinforce the fundamentals of each subject and enable students to practice and demonstrate their understanding of the key concepts.

Take the CHE3165 Separation Processes and CHE4173 Sustainable Processing II as the example, the following activities have been implemented successfully in the first Semester of 2020:

- Video recording and offering all the lectures in a flipped mode;
- Redesigning and offering the practical sessions via Zoom breakout room function;
- Providing a one-hour time slot per week for Zoom Q&A with regard to practical sessions and assignments.
- Employing writing tablets and drawing pads for a better annotation throughout the practical sessions and Zoom Q&A;
- Filming and offering the hands-on activities via virtual laboratories and virtual groups.

These activities have been highly recognised by the students.

"A Facebook page was designed where unit news and questions are displayed for all willing to join providing a more comfortable, more accessible and informal platform for discussion. As students, we feel that this platform benefits in our engagement and comfortability in asking for help with a more familiar discussion board." (SMUCE letter to Professor Akshat Tanksale for CHE3165, the 2020 Dean's awardee for Excellence in Teaching and Learning)

I feel like its necessary to say a thank you at the end of this unit. I appreciate a lot on your knowledge and the help you have given me. Unfortunately, I feel upset that I cannot work with you in the future because I will be returning to Malaysia campus. This is definitely the most beneficial unit I have taken in Monash. The assignments you designed are interesting and fun. You have talked about a lot of practical knowledge and guide me on leadership. You are brilliant. A million thanks to you."
(Comments from Students to Mr John Westover for CHE4173)

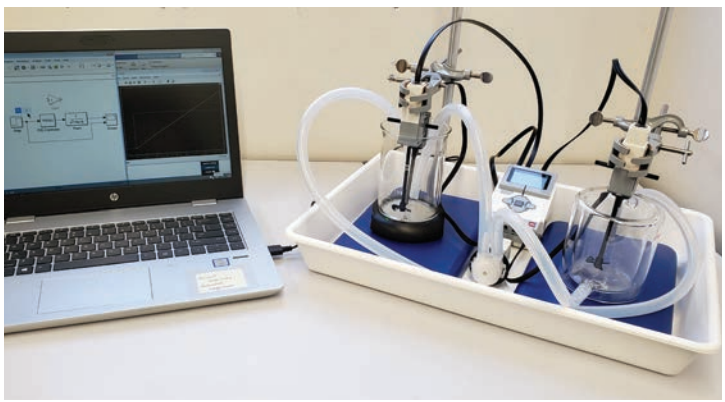
On top of what we have implemented in the first semester, a more interactive lab activity will be designed and offered through CHE3162 Process Control in Semester 2. Led by Dr Joanne Tanner (Clayton) with assistance from Mr John Westover and Dr Poovarasi Balan (Sunway), the teaching team for CHE3162 are making the most of the opportunities presented by online learning, considering all students from both Clayton and Malaysia campuses, as well as those students who are currently unable to return to their location of study, to be a single cohesive cohort.

We will synchronise the campus timetables and plan to arrange international student groups to foster a sense of collegiality and give the students a deeper cultural and social experience.

Hands on experience is one of the most important aspects of studying Engineering at Monash, but is of course one of the hardest activities to deliver remotely. To bridge the gap between physical and virtual, the CHE3162 team is developing a series of kit-based lab activities. We will build the kits at Clayton, but each kit will be remotely accessible and remote controllable. Students will dial in, configure and run the equipment to generate their own process data, with support from an on-site demonstrator. With this method, we can deliver exactly the same high quality experience and education to a student anywhere in the world. We can't wait to try it out and get some feedback from our students in a few weeks!

Last but not the least, we are grateful to all of our students at each for their continued support, constructive feedback and cooperation for an excellent learning in this challenging period. We look forward to working closely with every student and their representative associations including SMUCE and MEPSS.

Article provided by Associate Professor Lian Zhang, on behalf of the Department Head Professor Mark Banaszak Holl, Department Manager Ms Tracy Groves and all the lecturers teaching in Chemical Engineering Department, Monash University



Lego Lab Live - the new online, kit-based lab for CHE3162 uses Lego Mindstorms components. Students will be able to remotely access, configure and run the apparatus themselves, generating their own data and enhancing their learning experience

RESEARCH HIGHLIGHTS

DEVELOPMENT OF A PAPER-BASED MICROFLUIDIC SYSTEM FOR A CONTINUOUS HIGH-FLOW-RATE FLUID MANIPULATION

A new publication in *Analytical Chemistry* describes a system that uses laser-engraving and hydrophobized paper to make a clean-room free, paper-based microfluidic system for separation.

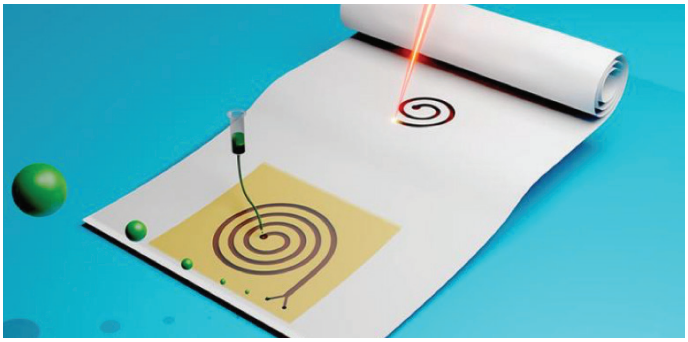
In the study the authors, Mahdi Naseri, George P Simon, and Warren Batchelor describe the development of a disposable paper-based microfluidic system. Unlike its predecessors - that are only capable of processing a small amount of fluid - this can continuously process the fluid at a high flow rate of up to 1.5 mL/min.

The fabrication procedure was clean-room-free and robust, involving the use of a CO_2 laser to engrave the microchannels on a paper substrate, followed by alkenyl ketene dimer treatment to hydrophobize the paper and lamination.

The microchannel down to a minimum depth of ~80 µm with an average roughness of ~8 µm was engraved on the substrate.

As a proof of concept, the applicability of this system to enrich the microparticles based on the inertial focusing mechanism was tested. This new generation of paper-based microfluidic system can be potentially used for the diagnostic applications where the analyte is low in quantity and processing a large volume of fluid sample is required.

Citation: Naseri M, Simon GP, Batchelor W. Development of a Paper-Based Microfluidic System for a Continuous High-Flow-Rate Fluid Manipulation. Anal Chem. 2020;92(10):7307-7316. doi:10.1021/acs.analchem.0c01003



SOLVING THE PLASTICS PROBLEM WITH CHEMICAL ENGINEERING

The world has a significant problem with end-of-life plastics and tyres. There are at least 14 different types of fossil-fuel derived plastics in addition to the so-called bioplastics in use worldwide.

While hard waste plastics can be recycled several times back into a product of some sort, these cannot be recycled to a solid product indefinitely. Furthermore, soft plastics, which have accumulated over several decades are a major environmental problem world wide.

Urgently required is a treatment process that is polymer-agnostic, that can process the solid wastes completely to liquid fuels and gases, recovering monomers to convert them back into polymers or plastics, following the principles of the circular economy. Alternatively, hydrogen could also be developed from these plastic wastes.

Young researchers at Chemical Engineering, Drs Mahmud Kibria and Pramod Sripada, PhD students Imtenan Sayeed and Umer Chaudhry, have improved a catalytic process that can be tweaked to achieve one or the other of these objectives.

While consideration of IP protection is negotiated, they recently tested some of the oils generated using mixed plastic waste from the campus in a diesel engine. By blending with commercial diesel at 40% the engine experienced a smooth start-up and stable engine performance.

Watch a video about the process **here.**

POWERING THE FUTURE WITH REVOLUTIONARY LITHIUM EXTRACTION TECHNIQUE

An international research team has pioneered and patented a new filtration technique that could one day slash lithium extraction times and change the way the future is powered.

The world-first study, published today in the prestigious international journal Nature Materials, presents findings that demonstrate the way in which Metal-Organic Framework (MOF) channels can mimic the filtering function, or 'ion selectivity', of biological ion channels embedded within a cell membrane.

Inspired by the precise filtering capabilities of a living cell, the research team has developed a synthetic MOF-based ion channel membrane that is precisely tuned, in both size and chemistry, to filter lithium ions in an ultra-fast, one-directional and highly selective manner.

This discovery, developed by researchers at Monash University, CSIRO, the University of Melbourne and the University of Texas at Austin, opens up the possibility to create a revolutionary filtering technology that could substantially change the way in which lithium-from-brine extraction is undertaken.

This technology received a worldwide patent in 2019. Energy Exploration Technologies, Inc. (EnergyX) has since executed a worldwide exclusive licence to commercialise the technology.

"Based on this new research, we could one day have the capability to produce simple filters that will take hours to extract lithium from brine, rather than several months to years," said Professor Huanting Wang, co-lead research author and Professor of Chemical Engineering at Monash University.

"Preliminary studies have shown that this technology has a lithium recovery rate of approximately 90 percent—a substantial improvement on 30 percent recovery rate achieved through the current solar evaporation process."

Professor Benny Freeman from the McKetta Department of Chemical Engineering at The University of Texas at Austin, said: "Thanks to the international, interdisciplinary and collaborative team involved in this research, we are discovering new routes to very selective separation membranes.

"We are both enthusiastic and hopeful that the strategy outlined in this paper will provide a clear roadmap for resource recovery and low energy water purification of many different molecular species."

Associate Professor (Jefferson) Zhe Liu from The University of Melbourne said: "The working mechanism of the new MOF-based filtration membrane is particularly interesting, and is a delicate competition between ion partial dehydration and ion affinitive interaction with the functional groups distributed along the MOF nanochannels.

"There is significant potential of designing our MOF-based membrane systems for different types of filtration applications, including for use in lithium-from-brine extraction."

CSIRO and Monash University Associate Professor Matthew Hill said: "We're pleased that our international research collaboration has made a breakthrough that could improve the supply of lithium. This is important for enabling electric vehicles and grid integration of renewable energy sources."

"It's truly an honour to work with such brilliant scientists at all these organisations," said Teague Egan, Founder and CEO of EnergyX.

"This breakthrough invention will literally change the way lithium is produced and how we power our future."

Lithium-from-brine extraction is most common in the Lithium Triangle—a region of the Andes bordering Argentina, Bolivia and Chile, which holds roughly half of the world's lithium reserves—and some sites across the USA.

With the majority of Australia's lithium produced from the mineral spodumene, the new technique could spur on the investigation of Australia's salt lakes for potential lithium production options.

Source: https://www.monash.edu/news/articles/powering-the-future-with-revolutionary-lithium-extraction-technique

3D-PRINTED SYSTEM SPEEDS UP SOLAR CELL TESTING FROM HOURS TO MINUTES

Tests on new designs for next-generation solar cells can now be done in hours instead of days thanks to a new system built by scientists at Australia's Monash University, incorporating 3D-printed key components.

The machine can analyse 16 sample perovskite-based solar cells simultaneously, in parallel, dramatically speeding up the process.

The invention means that the performance and commercial potential of new compounds can be very rapidly evaluated, significantly speeding up the development process.

"Third generation perovskite cells have boosted performance to above 25%, which is almost identical to the efficiency level for conventional silicon-based ones," said project leader Mr Adam Surmiak from the ARC Centre of Excellence in Exciton Science.

"But those results are from laboratory tests on millimetre-sized samples in indoor conditions – and therefore don't take into account a whole range of real-world factors such as environmental conditions, the use to which the cells are put, the manufacturing process, and possible deterioration over time.

"To make proper decisions, we need to know how each different cell design will function at large scales in the real world – and to do that we need a proper data library so we can pick the best candidates to take to that next stage. This new system lets us build that very rapidly and speed up transition from laboratory to fabrication."

Getting the recipe right for perovskite solar cells is regarded as critically important to the transition away from fossil fuels and towards renewable energy generation. They cost about 10 times less than silicon cells and are much cheaper to manufacture.

Rooftop solar panels made from perovskite will pay for themselves within months instead of years, which is the case with present models.

To achieve the high level of precision needed to build the system, PhD candidate Surmiak and his colleagues turned to Monash University's Instrumentation Facility and the Melbourne Centre for Nanofabrication, part of the Australian National Fabrication Facility – highly specialised machining and equipment facilities. There, the researchers' designs were produced using ultra-detailed milling and a 16-micrometre precision 3D printer.

Alongside the development and set-up of this new testing facility, Mr Surmiak was also able to significantly speed up the actual solar cell fabrication process.

The head of the Monash University lab in which Surmiak works, Professor Udo Bach, a Chief Investigator with Exciton Science, described the invention as world-leading.

"Experimental high-throughput concepts will become increasingly important for the discovery of the next generation of energy materials, fueling the transition to a carbon-neutral energy economy," he said.

"Our new set-up has the capacity to test thousands of solar cells in one single day, putting us ahead of practically all other R&D labs worldwide."

Mr Surmiak and Professor Bach worked with Dr Tian Zhang, Dr Jianfeng Lu, Dr Kevin Rietwyk, Dr Sonia Ruiz Raga and Dr David McMeekin, all from Exciton Science.

Source: https://excitonscience.com/news/3d-printed-system-speeds-solar-cell-testing-hours-minutes

STUDY DISCOVERS WORLD FIRST ULTRASOUND-BASED BIOSENSOR TO MONITOR PH IN BIOLOGICAL TISSUES INSIDE LIVING ANIMALS

Chemical Engineering researchers and their colleagues have developed pH-responsive nanoparticles that can be monitored inside the body using externally applied ultrasound transducers. While nanomaterials are often used to increase imaging contrast for ultrasound imaging, highlighting blood vessel anatomy and blood flow in critical organs, they are only detectable for 15-20 minutes, and cannot be used as biosensors. This is the first time that ultrasound-based biosensing has been demonstrated.

In Vivo Biosensing is an emerging field which is focussed on developing technology capable of continuously monitoring critical biomolecules inside living organisms. These biomarkers range from simple electrolytes (e.g. pH, oxygen, glucose, lactate) through to disease-related proteins commonly detected in pathology lab blood tests (e.g. cardiac troponin proteins indicative of heart attacks; C-reactive protein, indicative of infection). The best example of technology that has been commercially successful and which has resulted in improving the quality of live of millions of people is continuous glucose monitoring (CGM) – implantable devices which can detect glucose levels in real time, allowing patients to control insulin levels and prevent life-threatening situations. However, electrodes used for CGM are subject to biofouling, and hence need to replaced often. Also, this approach has never been successfully applied beyond glucose detection. Dr Simon Corrie's Nanosensor Engineering Lab is working to develop alternative approaches, combining biomarker-responsive nanoparticles for implantation which can be detected using externally-applied ultrasound, fluorescence or photoacoustic readers.

Ms Julia Walker is the lead author on the study, recently published in the prestigious journal ACS Sensors, and has recently submitted her PhD under the supervision of Dr Corrie and his colleague, Dr Kristian Kempe, from the Monash Institute for Pharmaceutical Sciences, and in collaboration with Dr Xiaowei Wang and Prof Karlheinz Peter and the Baker Heart and Diabetes Institute. The article was rated so highly that it was nominated for a prestigious ACS Editor's Choice Award, an honour attributed to just one paper per day published by the American Chemical Society (>50,000 articles published in 2019).

The pH-sensitive nanoparticles were prepared by wrapping a pH sensitive polymer film around a silica core, using "layer-by-layer" chemistry. Under normal circumstances, this polymer layer responds to pH changes by swelling or shrinking, effectively doubling the particle size. However, in this case, the polymer is maintained by encasing the sensor in a second silica shell. When exposed to an ultrasound beam, the amount to which the beam is scattered by the particle ("scattering intensity") depends on the rigidity, or density, of the particle. When the pH changes, rather than changing size, the polymer layer changes its local density, which is detected as changes in scattering intensity. Interestingly, a single pH unit change resulted in doubling of the scattering intensity.

After investing the mechanism behind this sensing phenomena, the authors moved on to evaluate pH monitoring in biological tissue. The sensors were initially injected into mouse cadavers, and ultrasound detection applied, to determine if the pH-sensitive scattering signals could be detected through mouse tissue. Changes in pH were simulated by injecting buffers of different pH, and the biosensor successfully detected these changes. Finally, the sensors were injected into the subcutaneous tissue of live mice, and subsequent tissue pH changes induced by buffer injections were again successfully detected. The biosensor also demonstrated reversibility – that is, it could measure both increases and decreases in pH – indicating that real-time, continuous monitoring over hours is possible. Next steps in this research include detecting different analytes, and evaluation the sensors in pre-clinical disease models.

READ FULL PAPER HERE

Ms Julia Walker

A POSSIBLE NEW WAY TO DELIVER CLEAN WATER ULTRATHIN NANOSHEETS FILTER OUT LEAD AND MERCURY

Australian and Chinese researchers have created an ultrathin sieve membrane from 2D nanosheets they say can filter potentially harmful ions such as lead and mercury from water.

Developed with water-stable Metal Organic Frameworks (MOFs), it has high porosity and the potential to deliver clean water for millions of people through purification and desalination processes. It also can be used in the separation of gases and solvents.

Writing in the journal Science Advances, a team led by Australia's Monash University and ANSTO (Australia's Nuclear Science and Technology Organisation) reports that in testing the membrane performed steadily for more than 750 hours using limited energy.

The nanosheets are made from water-stable monolayer aluminium tetra-(4-carboxyphenyl) porphyrin frameworks – termed Al-MOFs –exfoliated to just a nanoscale in thickness: one thousand-millionths of a metre.

That was "a daunting challenge", says research co-leader Xiwang Zhang, because MOF membranes are "typically thick and suffer from insufficient hydrolytic stability".

Polymers are the most widespread membrane materials, largely owing to their easy processability and low cost, the study suggests. However, traditional polymeric membranes for ion separation from water usually contain a dense selective layer, leading to limited selectivity.

Nanoporous membranes, where uniform nanopores act as the sieving role, may overcome this limitation.

The new study, involving analysis, suggests that the intrinsic nanopores of Al-MOFs nanosheets facilitate the ion/water separation by creating vertically aligned channels as the main transport pathway for water molecules.

"We use an instrument called the Powder Diffraction beamline at ANSTO's Australian Synchrotron to understand the difference between the molecular structure of nanosheet samples, and samples at different temperatures, in order to test water purification performance," says ANSTO's Qinfen Gu, the co-lead author.

"The technique, called in-situ, high temperature powder X-ray diffraction characterisation, was conducted on the nanosheets, and during the process there were no obvious variations in the samples at increasing temperature, demonstrating their robustness."

Source: https://cosmosmagazine.com/technology/materials/a-possible-new-way-to-deliver-clean-water/

Image credit: Amir Mukhtar / Getty Images

BOOSTING PHOTOCATALYTIC HYDROGEN PEROXIDE PRODUCTION

The production of hydrogen peroxide ($H_2O_{2)}$ could now be achieved in a more sustainable fashion. In a recent study published in the prestigious international journal *ACS Catalysis*, Professor Xiwang Zhang and his team reported an innovative metal-free photocatalyst that could efficiently generate H_2O_2 from water and oxygen under simulated solar light irradiation.

H_2O_2 is a nexus chemical that is used in diversified industries such as chemical synthesis, paper and pulp, mining, water treatment and detergents. However, currently industrial H2O2 is mainly produced by the anthraquinone process, which requires significant energy input and generates harmful waste.

Sunlight is an abundant, secure and clean energy source on Earth. The development of efficient photocatalyst to harvest and store the solar power can address the global energy challenge and achieve chemical production in a sustainable way.

In this research project, the team prepared an innovative composite photocatalyst PEI/C_3N_4 by grafting the cationic polyethylenimine (PEI) molecules onto C_3N_4 nanosheets. Mechanistic investigation reaveled that PEI endows the photocatalyst high selectivity, which can promote the oxgen reduction to H_2O_2 in photocatalysis process. As such the metal-free photocatalyst exhibits a high H_2O_2 generation activity of 208.1 μmol g^{-1} h^{-1}, with water and purged oxygen gas under simulated solar light irradiation.

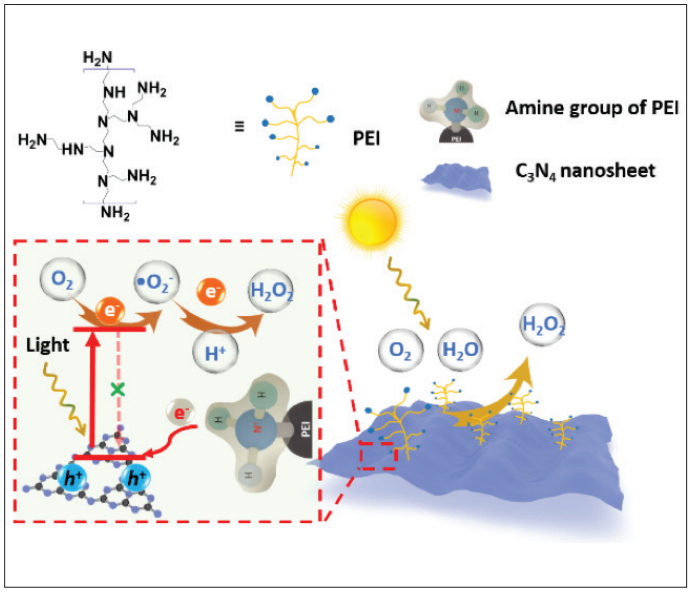
The produced H_2O_2 in this process could be directly used for disinfecting bacteria pathogens in water. According to the team's latest study published in Applied Catalysis B: Environmental, the H_2O_2 generated by this metal-free photocatalyst can kill 99.9999% of *Escherichia coli* in 45 min under simulated solar irradiation.

The interesting findings in this study can give new insights for converting solar energy to useful chemicals.

Citation:

1. ACS Catal. 2020, 10, 3697-3706. https://pubs.acs.org/doi/abs/10.1021/acscatal.9b05247

2. Applied Catalysis B: Environmental 2020, 119095. https://www.sciencedirect.com/science/article/pii/S0926337320305105



GLOBALLY TOP 30

Chemical Engineering at Monash University ranked in the Top 30 world's top universities in latest subject rankings according to Quacquarelli Symonds (QS) World University Rankings by Subject 2020 released in March 2020.

ARC LINKAGE SUCCESS FOR DEPARTMENT RESEARCHERS

MIPS researcher awarded $700k grant to help support leading research

Congratulations to Dr John Quinn from the Monash Institute of Pharmaceutical Sciences (MIPS) on an ARC linkage grant, announced recently.

The linkage project, *Next generation polymeric scaffolds for dual agent delivery (*$711,307), aims to regulate the way in which active agents are released from degradable polymeric scaffolds.

The project is in collaboration with long-standing MIPS industry partner PolyActiva, whose business seeks to apply a unique drug-polymer conjugate technology to enable site specific delivery from materials such as implants, films, or fibres. Professor Tom Davis, who retains a research position at MIPS, is also part of the investigatory team.

Dr John Quinn and his team will provide a novel suite of degradable polymeric scaffolds for releasing multiple active agents, with tailored release profiles by utilising both polymer and small molecule synthesis techniques. The expected outcome is the establishment of design criteria for tailoring the release of active agents from the polymer scaffold. This should provide significant benefits by developing a new technology platform that could be readily adapted to applications in agriculture, pharmaceutical science and veterinary medicine where controlled release is required.

Director of MIPS, Professor Chris Porter, said the additional government funding for this project underlined the Faculty's strength in both drug delivery research and industry partnerships.

"PolyActiva are a long-standing, highly regarded partner of MIPS and this grant really is a testament to the value of that partnership," says Professor Porter.

"On behalf of MIPS, I'd like to congratulate Dr Quinn and Professor Davis, and Dr(s) Tait, Donohue & Valade and the fantastic team at PolyActiva for their success in the latest ARC Linkage funding announcement. We look forward to watching this outstanding research program continue to flourish."

Federal Education Minister, The Honourable Dan Tehan MP, announced that the MIPS project is amongst five initiatives from Monash to receive a Linkage Program/ Project grant, with the University receiving close to $2.5 million in total.

Source: https://www.monash.edu/pharm/about/news/news-listing/2020/monash-researcher-awarded-$700k-grant-to-help-support-leading-research

ABOUT JOHN QUINN

John is an Australian Research Council Future Fellow in the Drug Delivery, Disposition and Dynamics Theme at Monash Institute of Pharmaceutical Sciences.

His research interests in the rational design of new materials promises to create exciting new opportunities for pharmaceutical science. In particular, the development of new excipients that can potentially offset the side-effects and disadvantages of underutilized drugs offers obvious benefits for the health sciences.

BUILDING STEM LITERACY IN THE CLASSROOM

Congratulations to Associate Professor Nicoleta Maynard who is part of the ARC Linkage team awarded the grant.

The project, entitled *Exploring Problem Based Learning (PBL) in Schools,* aims to generate new knowledge about how the principles defining this PBL approach can support primary and secondary teachers to enhance learning opportunities and build STEM literacy. It actively positions teachers as researchers interrogating their practice. Expected project outcomes include a pedagogical framework developed with teachers, and illustrations of practice capturing problem-based learning in a range of school settings. The ARC project will also continue to enrich the exiting collaborations between the Faculties of Engineering and Education at Monash University.

Associate Professor Nicoleta Maynard, one of the team researchers, is looking for-ward to working with her colleagues from the Faculty of Education, Catholic Education leaders in Melbourne and Brisbane secondary teachers and school leadership to enhance STEM education in Australia.

Nicoleta's work and research in the STEM education area has been recognised nationally and internationally with peer review publications, presentations and invitations for participation in technical panels. Her interest in developing school students' interest and understanding in Engineering and Technology by creating and implementing engaging learning environments, has been previously supported by the ARC and Industry through the project 'Igniting Interest and Promoting Understanding in Engineering and Technology among Primary School Students Through Engaging Learning Environments'. The 'STEMinist' Project, a project that Nicoleta and her colleagues from the Faculty of Education at Curtin University conceived and successfully implemented, was a finalist of the 2019 Premier's Science Award as the Chevron Science Engagement Initiative of the Year.

The team consists of Dr Kathy Smith; Professor Amanda Berry; Dr Jennifer Mansfield; Professor Deborah Corrigan; Ms Shelley Waldon; Associate Professor Nicoleta Maynard; Dr Peter Ellerton; and Mr Doug Ashleigh Gray.

ABOUT NICOLETA MAYNARD

Associate Professor Nicoleta Maynard's work and contributions in educational leadership and teaching innovation have been recognised by a number of national and international awards. She is the recipient of the 2016 Caltex Award for Excellence in Teaching, a 2013 Australian Government's Office for Learning and Teaching Citation for Outstanding Contributions to Student Learning and a 2009 Australasian Association for Engineering Education Awards and Engineers Australia Citation Award. Nicoleta's work and research has been recognised nationally and internationally with peer review publications, presentations and invitations for participation in technical panels. She is also the Conceive Design Implement and Operate (CDIO) Chair for Australia and New Zealand.

STUDENT NEWS

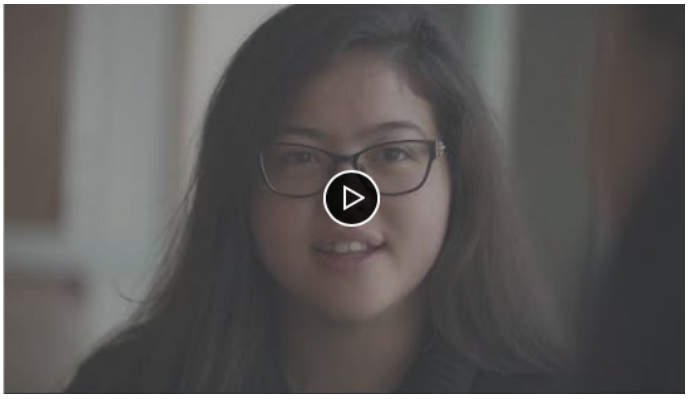
MONASH FUEL FROM WASTE NEWS

Pod cast now live

The very first episode of the Monash Energy Club Podcast *Grind'n the Grid* is out now! This episode tackles the oil war and the positive contribution that reduced oil demand has had on our environment and whether these improvements will mean anything in the long term.

LISTEN HERE.

MONASH FOOD INNOVATION INTERNSHIP



Hear from students about the exciting Monash Food Innovation Internship and find out first-hand the real benefits of participating.

READ MORE HERE

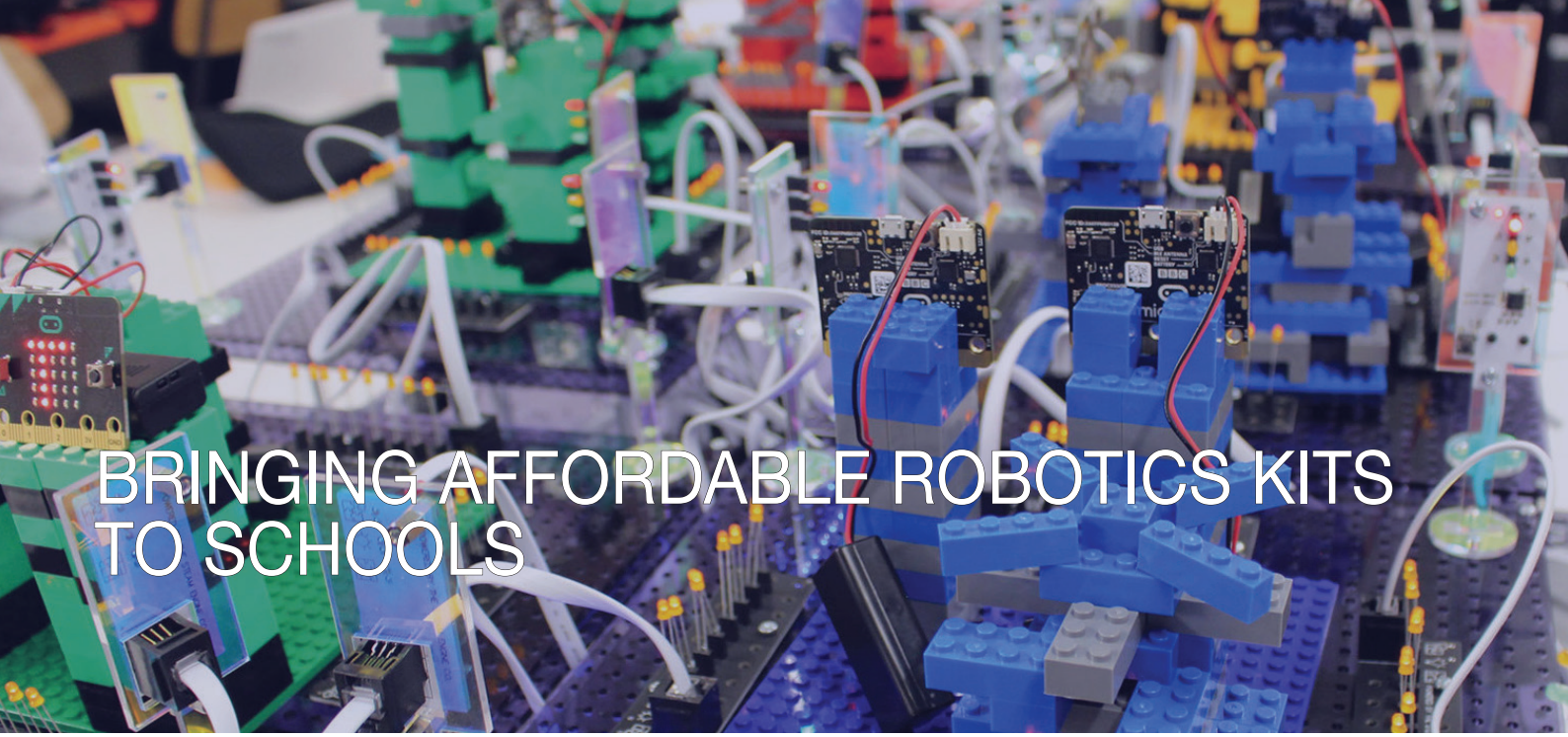
Last year, student Edward Attenborough was lucky enough to take part in the Monash Food Innovation Industry Project. During this three month project, Edward had the opportunity to collaborate with Enterprise Singapore on an exciting, for-credit, food innovation challenge. Working with Life3 Biotech, Edward and his team mates and developed a functional healthy beverage utilising kombucha and micro-algae. They had to develop a prototype, undertake market research and present the product to an industry panel.

"It was an incredible experience and one of the highlights of my Monash degrees', Edward said.

"If you are a Monash student and eligible, I strongly recommend you apply for this amazing, real world project!"

#1 in AUSTRALIA

Chemical Engineering at Monash University is ranked #45 in the GRAS 2020 rankings and #1 for Australia



BRINGING AFFORDABLE ROBOTICS KITS TO SCHOOLS

When chemical engineering student Marissa Thomas realised schools didn't have access to affordable robotics kits, she decided to make her own.

It was while working for not-for-profit technology workshops program Robogals that Marissa Thomas realised there was an obvious missing piece in engineering education for schools.

The Monash University chemical engineering student was running workshops to inspire girls to pursue careers like engineering. And it was working. But there wasn't a lot for the students to do after Robogals left.

"The education kits that we were using in the classroom were really expensive robotics kits," Thomas said.

"Particularly public schools didn't have access to [the kits]. I wanted to create a long-term solution to this problem."

Thomas launched her start-up The STEAM Engine Co. and designed "Violet", a cost-effective and hackable robot to teach coding in Australian schools.

The STEAM Engine Co. has since developed two more digi tech kits; the IT-specific 'bumble-B' robot and 'STEAM City', a race to design a city to win an engineering contract.

Thomas and her team also run engineering workshops for school and university students based around the kits.

The future is female

When The STEAM Engine Co. first launched, the workshops were aimed at both boys and girls. But over time, Thomas says her focus shifted to girls.

"It was just so much more fulfilling when you saw the impact we made on the young girls," she said.

"And the difference in impact has been consistent across our workshops regardless of their school or age."

Most of The STEAM Engine Co.'s facilitators are also female.

"There's something really empowering about being in a room full of women," Thomas said.

"It's like this sense of sisterhood and you can't get enough of it — you can't shake that feeling."

Another driver was reports that the number of women graduating with degrees in engineering has fallen in recent years.

"It's definitely an issue that's still quite prominent," Thomas said.

Thomas herself almost didn't choose engineering. A high-achieving student, she loved maths and science growing up but began to hate it in her final years of high school. She was headed instead for a law and arts degree at university.

"I wanted to change the world and I thought 'I love debating and public speaking, I'd love to pursue something like diplomacy'," Thomas said.

"But my dad — our family's full of engineers — he said, 'look, just do engineering for a year and see how you go'. That's exactly what I did."

Monash University Dean of Engineering Professor Elizabeth Croft said The STEAM Engine Co. is helping to educate students to understand that engineering is about creative design.

"It isn't just paper-based, it isn't just math and physics for the purpose of math and physics," she said.

"It's creative and uses the physical principles about how the world works to generate new designs."

Croft said it's this creative side of engineering that really inspires kids. She believes it's important to empower girls in particular with tech, because they're often not encouraged to pursue engineering careers.

"So, initiatives like Marissa's, which actually get into the heart of that and address the root cause problems, are pretty exciting," she said.

Challenging students

One of The STEAM Engine Co.'s first workshop participants was Monash University environmental engineering student Casey Barczynski. She took part in a four-hour challenge to build STEAM City over two nights in March.

"It's one of my favourite things I have done at uni so far," she said.

"It was such an amazing experience and it was so fun and fresh and new."

Barczynski, who is studying a double degree with science, says the workshop tipped her towards wanting to pursue the engineering side of her degree when she graduates.

"I've done my fair share of group projects but that was the first time that I realised really how invaluable teamwork is," she said.

"It opened up the whole [idea] that engineering isn't just technical; it requires people skills as well."

Thomas graduated from Chemical Engineering at the end of 2019 and plans to focus full-time on The STEAM Engine Co. for six to 12 months.

"I really wanted to work out in the chemical engineering industry," she said.

"But the more I thought about it — I know I would regret not giving The STEAM Engine Co. a really good shot. Particularly with STEAM City, that's a really interesting education kit that we've built that we haven't seen anything like before."

Croft said she is hugely proud of what the students have done.

Follow The STEAM Engine Co. /thesteamengineco

"They have amazing drive and great ability to marry creative design with strong maths, physics, science — and communicate it well," she said.

Croft says Thomas' solutions are clever, innovative and very entrepreneurial.

"I'd watch that space in terms of what she'll be able to do in the future," she said.

Marissa Thomas' three things girls need to get them into engineering

CONFIDENCE

Thomas believes high-achieving girls are particularly susceptible to losing confidence in their own ability to do maths and science when it gets hard. She said supporting girls to shift from a fixed mindset to a growth mindset can help.

AN UNDERSTANDING OF THE PEOPLE SIDE OF ENGINEERING

Thomas said many girls perceive engineering as maths and physics-intensive, without realising that top engineers need great teamwork and communication skills. She believes the people element of the profession can be a big selling point for girls

A CRASH COURSE IN SPATIAL REASONING

Thomas says a lot of girls struggle with spatial skills, which can limit their confidence. She said the STEAM City kit is designed to give students a chance to practice 2D to 3D translation.

This article originally appeared as "Promoting robotics" in the April 2020 edition of create magazine. https://www.createdigital.org.au/engineering-student-affordable-robotics-kits/

REBECCA ONG ON MONASH'S CO-OP PROGRAM

Rebecca recently participated in Monash's Co-op program at PPG Industries Australia Pty Ltd and valued industry experience where she could refine the all-important soft skills which are vital in an increasingly competitive workplace.

"The most significant highlight of my experience was the satisfaction of being able to complete a project with real life impacts and benefits. I also very much enjoyed being able to see and explore a large scale manufacturing plant along with participating in a number of customer site visits. These were topics I had heard about in class at University, but which I hadn't experienced firsthand. Being able to do so was an invaluable experience", Rebecca said

The Co-op program is not just an internship, it promotes continuous learning by alternating study with meaningful work-based learning to provide an enriched experience and equip you for your future career as an engineer. You can explore different industry sectors, understand what it is to be a working engineer, and connect your experience to your studies in a more practical way. You will develop relevant skills and experience that will hold you in good stead when applying for graduate programs. Studies show Co-op students find employment sooner post-graduation, have higher salaries, and are more likely to find a job relevant to their specific degree.

For more information: https://www.monash.edu/engineering/coop

MONASH BREW LAB UPDATE

It's been a busy start to 2020 for the Monash BrewLab, as well as a big shift in activities due to the COVID19 pandemic. The year started off with some new and interesting brews: a Michelada Gose revision, a plum Imperial Stout, a Brut IPA and a Bock, appropriately labelled “Bock to School”. These four beers vary drastically in styles and were picked to challenge the brewers in their knowledge and skills. All four turned out gorgeously, with the final ABV’s being quite accurate to the values expected. As the skills of the team grow over time, we look forward to sharing more of our beers with the public.

However, before we knew it, the pandemic changes caused the freezing of all on campus activity, and our brewing activity ceased in March. Due to these changes, the BrewLab shifted its learning online. The team focused more on social media outreach and supporting the brewing community during these trialling times. The technical team began to create brewing videos for the team members to follow along, as well as develop more online brewing modules. The internal team focused on recruitment and supporting students, whilst the external team jumped into social media, online events and redesigning our merchandise.

Thanks to our online recruitment, the BrewLab was lucky enough to recruit 13 new members from a variety of faculties to the team in May. These new members helped with the online workload and provided some new faces for the team to get to know. All hands meetings continued via zoom every three weeks and the team quickly became acclimated to the online learning. We were also very excited to launch our new website in early June. Check us out at https://www.monashbrewlab.com/ and let us know that you think!

This year saw the first ever Monash BrewLab Trivia Night. This online event hosted over 50 people, with 8 teams going head-to-head for a 6 pack of BrewLab beers. The event went swimmingly, and both the team hosting it and those taking part in it raved about it. Due to the event's success, another trivia night will be taking place during the mid-year break, at 8pm Thursday 16th July. This event is open to everyone and we would love to see you take part with a team. To find out more, check us out on Facebook @MonashBrewLab.

As the BrewLab team looks to the second half of 2020, we are excited to get back into the brewery and apply ourselves to the brewing process once again. With more online events planned for the community, as well as finalising analytical lab and packaging lab spaces, the team is extremely excited to dive in and increase our capacity, as well as the learning opportunities for our students. We look forward to keeping you updated on our progress for the remainder of 2020.

This year, we will also be saying goodbye to two of our long serving managers, Carson Yuan (Deputy External Operations Manager) and Edward Attenborough (External Operations Manager). Both of these managers helped start the BrewLab and have been with us since 2018. Both students graduate with double degrees in July and we wish them all the best for the future.

As always, 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.

Submitted by the Brew Lab team

PHD STUDENT HASAN JUBAER'S RESEARCH TAKES HIM TO POLAND

Hasan Jubaer commenced postgraduate studies at Monash University in November 2016 with a PhD project examining spray drying using computational fluid dynamics.

Spray drying is an established technique to produce high quality powder products in many industries including the dairy industry. During spray drying, controlled agglomeration among particles may lead to improved powder properties, and hence is of great interest to industry, in particular the dairy industry where it is common practice.

However, the process needs to be controlled as excessive agglomeration may adversely affect the product quality. Currently, industry relies upon a trial and error approach owing to the lack of an accurate and efficient modelling approach. While computational fluid dynamics (CFD) proves a suitable platform to pursue the modelling work, reports of an effective and successful agglomeration model are rare, particularly for large scale industrial applications.

Hasan's project aims to fill this knowledge gap. He has developed a new computationally inexpensive model to be implemented in a CFD environment, which can inform about the extent of agglomeration and preserves crucial information pertaining to agglomerate structures.

The inexpensive nature of the model enables it to be applied to large scale spray drying simulations. The model has been successfully validated with experimental data obtained from a lab-scale counter-current dryer. Nevertheless, in order to finalise the model, experimental data on larger dryers were necessary, which warranted a research visit to a facility housing a large-scale dryer with detailed measurement possibilities.

Hasan had the opportunity to travel to Poland in September 2019, and work in the laboratory of Professor Ireneusz Zbicinski at the Lodz University of Technology. The successful week spent with this renowned research group provided Hasan with the extensive experimental data he needed.

The spray dryer was developed by the Department of Heat and Mass Transfer at the Lodz University of Technology and dedicated for various research purposes pertaining to spray drying. The spray tower is equipped with Laser Doppler Anemometry / Phase Doppler Anemometry (LDA / PDA), a sort of facility that is currently not available either at Monash University or any other partner universities.

Such measurements have the potential to provide information regarding not only the air flow patterns but also the change in particle size distributions along the height of the spray tower during the drying is occurring. The trials consisted of runs with atomisations realised with a single nozzle (for reference) as well as two nozzles (to induce forced agglomeration). In addition to the *in-situ* measurements, final powder samples were collected, which underwent particle size distribution measurements and were then investigated under the scanning electron microscopy to obtain further information on the final product.

The obtained data from the trials provided valuable insights into the air flow-patterns and impact of the position of the second nozzle on the powder properties. The data also provide a strong basis for validation as well as identifying the weaknesses of the newly developed agglomeration model.

The findings were in part already reported in the form of a full-paper titled *Analysis of Product Properties in Counter-current Spray Drying with Two Nozzles System,* which has been submitted by Professor Pawel Wawrzyniak for the *International Drying Symposium* 2020 to be held in Worcester, USA.

Hasan's work holds the potential to significantly advance CFD modelling of large scale spray dryers. All progress made towards achieving an accurate predictive tool is of paramount importance to the Australian dairy industry, as it can increase efficiency. The predictive tool can also be used to improve the design of new spray dryers, development of new products and optimisation of existing processes.

Hasan's research visit to Poland has initiated a potentially invaluable collaboration between Monash university and Lodz University of Technology.

Acknowledgments: Hasan's PhD project is supported by the Australia-China Joint Research Centre in Future Dairy Manufacturing (ACJRC) and the Faculty of Engineering at Monash University. The costs of the research visit was covered by Monash travel grant and ACJRC. Last but not least, without the support (all resources required for the trials) provided by the Department of Heat & Mass Transfer at the Lodz University of Technology, the research visit would not have been possible."

EXCHANGE TO SOOCHOW UNIVERSITY

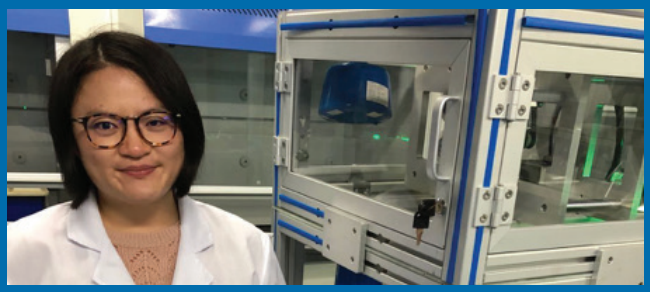
Qianyu was delighted to have this opportunity to complete a research exchange in Soochow University, China, where she continued her work into microencapsulation for improved bioavailability and targeted release of bioactive food ingredients during digestion.

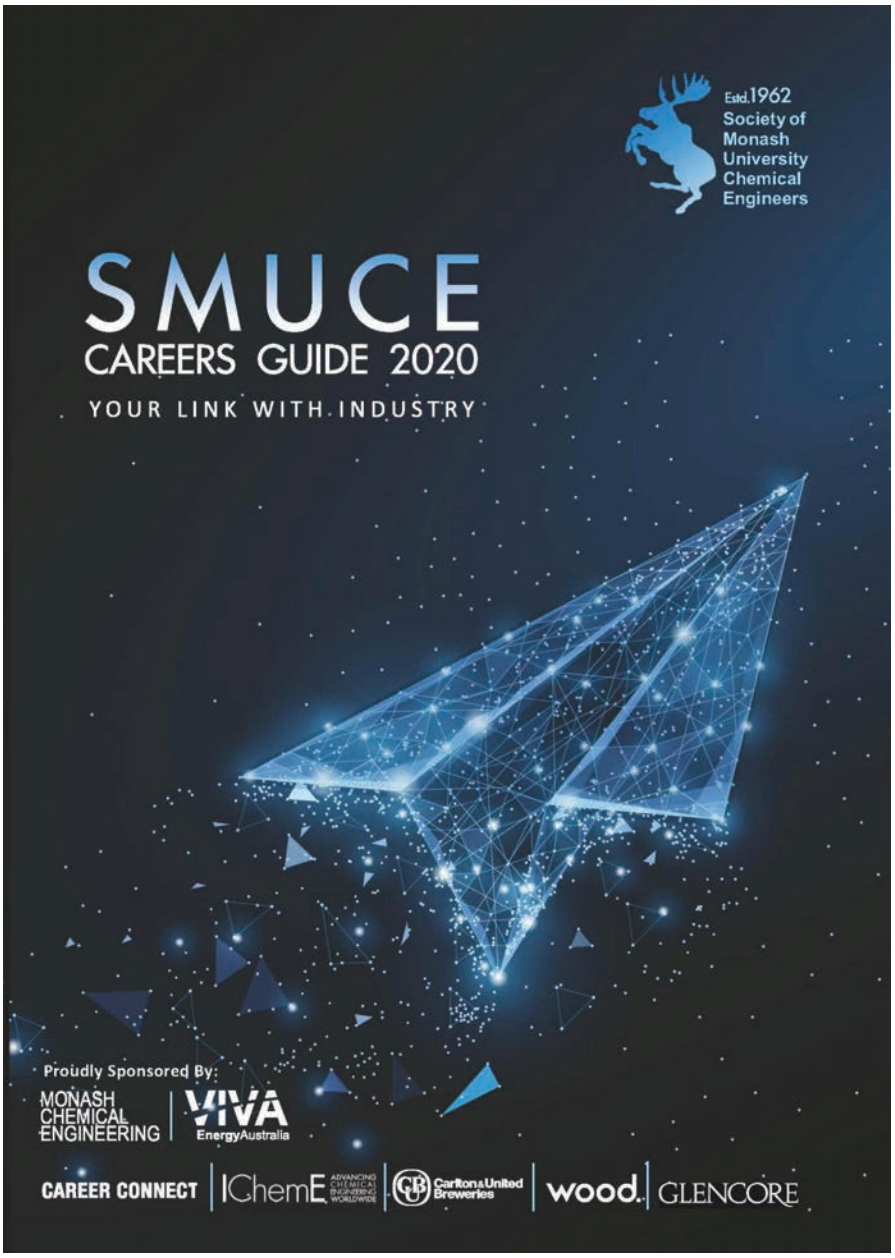
During her exchange in China, she incorporated the curcumin-loaded protein microparticles, fabricated at Monash, into a food matrix (yogurt in this case) and investigated the release characteristics of curcumin using a near real dynamic *in vitro* human stomach system.

Compared to a static beaker digestion method, the dynamic *in vitro* human stomach has a similar stomach morphology, dimension and wrinkled inner structure to those present *in vivo,* and an electromechanical instrument to produce peristaltic contractions.

By using the dynamic *in vitro* human stomach, Qianyu could look into the crucial microscopic processes in food digestion and nutrient release e.g., gastric sieving, gastric emptying, and pH variation of digesta. This led to a deeper insight into the design and formulation of functional foods with improved bioavailability and targeted release to meet the rising demand for health and wellness.

This project is supported by the Australian Government Department of Industry, Innovation, and Science through the Australia-China Science and Research Fund, and is conducted as part of the research program at the Australia-China Joint Research Centre in Future Dairy Manufacturing (http://acjrc.eng.monash.edu/).





SMUCE NEWS

SMUCE is excited to announce the official launch of Careers Guide 2020!

The Guide is a compilation of over 30 Company and Researcher profiles prepared by our Industry Team who have worked tirelessly during lockdown alongside their studies. The Guide will also serve to provide a deep insight in the industry and tips on being a successful chemical engineering graduate.

You can download the electronic copy of the Careers Guide **HERE**

We hope you enjoy the Careers Guide!

SOCIETY OF MONASH UNIVERSITY CHEMICAL ENGINEERS

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

Like us on Facebook www.facebook.com/SocietyOf-MonashUniversityChemicalEngineers/)

MONASH University

ENGINEERING CO-OPERATIVE EDUCATION PROGRAM

Shaping engineering professionals of the future

Work in engineering for paid internships whilst studying.

The Co-op program is not just an internship, it promotes continuous learning by alternating study with meaningful work-based learning to provide an enriched experience and equip you for your future career as an engineer. You can explore different industry sectors, understand what it is to be a working engineer, and connect your experience to your studies in a more practical way.

You will develop relevant skills and experience that will hold you in good stead when applying for graduate programs. Studies show Co-op students find employment sooner post-graduation, have higher salaries, and are more likely to find a job relevant to their specific degree.

How it works

1. Entry to the Co-op program is via a competitive selection process
2. Eligible students will be invited to apply upon completion of the required engineering credit points
3. Once selected, you will attend a compulsory robust employability skills program to ensure you are significantly prepared to work with your Co-op employer
4. Complete one, two or more terms. The Co-op program will be listed on your academic transcript as 0 credit point units
5. Co-op is not for credit but you will remain enrolled in your degree whilst completing each Co-op term
6. You can use your Co-op terms towards your required Continuous Professional Development (CPD) hours in order to graduate

For more information contact us today!

E: eng.coop@monash.edu

monash.edu/engineering/coop

Rebecca Ong

Bachelor of Chemical Engineering (Honours) and Bachelor of Pharmaceutical Science

PPG Industries Australia Pty Ltd

"Co-op is a great opportunity to build up your experience and your resume in the industry whilst refining all-important soft skills which are vital in an increasingly competitive workplace.

The most significant highlight of my experience was the satisfaction of being able to complete a project with real life impacts and benefits. I also very much enjoyed being able to see and explore a large scale manufacturing plant along with participating in a number of customer site visits. These were topics I had heard about in class at University, but which I hadn't experienced firsthand. Being able to do so was an invaluable experience."

NUCANE LIFE

Reserach Masters student Daisy (Yongmei) Sun (supervisors Meng Wai Woo (Main) Cordelia Selomulya, David Kannar and Bernard Chen), was given the opportunity to be part of the Singapore Slingshot Award, and see the development of a product based in part of her research outcomes.

At the conclusion of Daisy's thesis, *Spray Drying of a Novel Low Bulk Density Reduced Sugar Powders*, Nutrition Innovation Singapore developed a low bulk density sugar called Nucane Life, that enables up to 70% reduction in added sugar to some foods. This innovation has stimulated significant industry attention and was recently recognised with 3 Slingshot awards in Singapore. Slingshot is hosted by the Singaporean Government and is a global initiative to recognise excellence in world innovation in 12 industry segments including engineering, food, fintech and medicine. Additionally, the Forward Fooding Group named Nutrition Innovation Singapore as one of the “FoodTech 500” most innovative food and agritech innovators in the world.

Slingshot is hosted by the Singaporean Government and a global initiative to recognise excellence in world innovation in 12 industry segments including engineering, food, fintech and medicine.

After three intense days of pitching and deliberations, SLINGSHOT 2019 successfully concluded on Wednesday, November 13th. From an initial list of 2,400 entries, a selection of 100 global startup finalists had just two minutes to present their disruptive ideas to tier-one industry leaders. Out of those top 100 startups, 12 projects (two per industry) were then selected to continue to the final round in which only one category winners, specific awards and a grand winner were selected..

Nutrition Innovation's global up to 70% sugar reduction technology, Nucane Life was recognised with winning three major awards and $85,000, inclusing the Category Winner Food Technology, the Danone Nutricia Award, adn the Yield Lab Award

"This level of recognition enabled Nucane Life to be one of the most awarded innovations from around the world at Slingshot 2019 and confirms the world-class and world-leading innovation invented by Nutrition Innovation Founder Dr. David Kannar. Our deepest thanks to Slingshot, EnterpriseSG, Danone and The Yield Lab." stated CEO Matthew Godfrey #SLINGSHOT2019

Nutrition Innovation Group has also been listed in the top FoodTechnology companies in the world.

Nutrition Innovation has also been globally recognised by Forward Fooding as one of the leading "FoodTech 500" most innovative food and agritech innovators in the world.

Forward Fooding is a global network of entrepreneurs powered by entrepreneurs that provides the necessary support and velocity to enable collaborations and partnerships between established food organizations and startups.

"Each and every company that made the FoodTech 500 list have, in our opinion, become entrepreneurial success stories worth keeping an eye on, which is why we made it our mission to share them," said Alessio D'Antino Forward Fooding CEO.

"We are delighted that the Nucane healthier sugar solutions and innovations invented by our Founder, Dr. David Kannar, has gained so much international recognition and support from industry-leading experts such as Forward Fooding," said Nutrition Innovation CEO, Matthew Godfrey. "We are proud to be associated with the FoodTech 500 and the other ground-breaking companies that are changing food and making the world healthier and more sustainable."

Masters by Research & PhD Scholarships

Location: Clayton campus **Employment Type:** Full-time

Duration: Masters: 2-year fixed-term appointment, PhD: 3.5-year fixed-term appointment

Remuneration: $29,000 per annum (tax-free stipend) (2020 rate)

The Opportunity

Expressions of interest are sought from outstanding candidates for Masters by Research or PhD study in Chemical Engineering, within the Faculty of Engineering. At Monash Chemical Engineering, we see potential in everything. We thrive in that pivotal space where engineering, chemistry, biology, physics and mathematics intersect. And we're ranked number 1 in Australia for Chemical Engineering – so we're the perfect place to develop your potential. Our Chemical Engineering research and researchers are leading the way. Not only are we the number one Chemical Engineering faculty in Australia – we're among the very best in the world. Research in the Department of Chemical Engineering at Monash is organised into six key areas; Biotechnology, Food, Modelling, Nanomaterials, Fuels and Energy and Membranes.

Candidate Requirements

Applicants will be considered provided they fulfil the criteria for Masters by Research & PhD admission at Monash University. Details of the relevant requirements are available at www.monash.edu/graduate-research/future-students/apply
To be eligible to apply for domestic postgraduate research scholarships an applicant must be an Australian citizen, an Australian Permanent Resident or a New Zealand citizen.

Submit an EOI online

Expressions of Interest shall comprise of:

- A cover letter addressed to your chosen Academic Supervisor that includes a brief statement of applicants suitability. Please review our Academic Research profiles here.
- A Curriculum Vitae
- A full statement of Academic Record, supported by scanned copies of relevant certified documentation if applicable
- Contact details of two academic referees

Note: applicants who already hold a PhD degree will not be considered.

Applicants must show excellent communication and interpersonal skills, and the ability to conduct self-motivated research. They should have either completed or in the process of completing a Bachelors H1 Honours Degree or already hold an H1E Bachelors and/or Masters degree. Shortlisted candidates will be interviewed via Zoom. Successful EOI applicants will be provided with an Invitation to Apply letter for the Domestic scholarship rounds. Candidates who are in the processing of completing their H1 degree will be considered for a Provisional scholarship offer letter. Students who start as a Masters by Research degree will have the option to upgrade to a PhD degree at the 11th month mark based on academic performance.

3291 - Doctor of Philosophy

3292 - Master of Engineering Science (Research)

Domestic scholarship closing dates: Round 4: 31st October 2020, 04:00 p.m. Australian Eastern Daylight Time

Enquiries about the scholarship or application process should be directed to Ms Lilyanne Price

DEPARTMENT NEWS

DEPARTMENT ADMIN UPDATE

Working from home during COVID-19 is an opportunity to create a good routine with short exercise breaks. I personally feel that moving and stretching my body energizes my brain. Working from home is great for work-life balance. It increases ownership and performance. It trains people to be focused and disciplined. I look forward to seeing the productive benefits of trust and empowerment for my team. It is important to cultivate strict routines or working hours, but also be kind to yourself. Wake up at your usual time and go through your usual routine. For me, I use the time usually spent commuting to go for a walk along the beach with my husband and during my normal lunchtime I've been riding by bicycle for exercise to stretch my legs.

The downfall from working from home is that the food is more readily available and I managed to eat way too much and have been baking up a storm. Look out cake club, you will be seeing some of my creations. It's been great to see and keep in contact with the Chem Eng professional team.

Lovely to see the happy faces of my colleagues engaging in work from home. This group of staff are doing daily 15 minute stand up zoom meetings to keep in touch and keep things moving along in the Department during the COVID19 crisis. Working from home can be lonely, so we have had virtual coffee breaks and TGIF with our students and colleagues (with a real fragrant cup of coffee and a gin & tin) my suggestion is keep talking to people so you do not feel isolated during this time. Once a new way of working has been established all over the world, it might be hard to go back to the old ways. Looking forward to being back on campus and catching up with the Chem Eng Family.

In this zoom session above, Professor Mark Banaszak Holl, Dr Lian Zhang, Dr Wenlong Cheng, Dr Timothy Scott, Lilyanne Price, Kim Phu, Laura McManus, Trina Olcorn and Anthony De Girolamo.

Ms Tracy Groves, Department Manager

DEANS GRADUATION MESSAGE

Sadly, Coivid-19 has prevented graduation ceremonies this year. After all that hard work, it is a great disappointment to students to miss this special moment. The Dean of Engineering had a special message for the first Engineering graduates of 2020.

FUTURE DAIRY MANUFACTURING SYMPOSIUM BRINGS NEW INSIGHTS AND OPPORTUNITIES FOR COLLABORATION

The Australia-China Joint Research Centre in Future Dairy Manufacturing recently held its 4th Research Symposium on 28 April 2020, with over 50 industry participants from 16 companies attending virtually across Australia, China and New Zealand.

The Centre was delighted to welcome local and international dairy industry companies to the Symposium, including Mengniu Dairy, Saputo Dairy Australia, Bega Cheese, Burra Foods, Lion Dairy & Drink, Freedom Foods, Fonterra Australia and NZ, DuPont China, Mondelez International China, Corio Bay Dairy Group, CHR Hansen, Austrade, Ausnutria, Dairy Australia, and Australian Dairy Park.

Professor Mark Banaszak Holl (Monash University) opened proceedings with a speech emphasising the benefits of continuing collaboration. “We have pathways for many valuable partnerships,” he said. “Together with partners at UQ, UNSW, Auckland, and Soochow, and Monash in Melbourne, Kuala Lumpur, and Suzhou, we have wonderful opportunities for dairy industry research and innovation in Australia, China, Southeast Asia, and globally.”

Professor Cordelia Selomulya (UNSW) gave an opening speech outlining the way in which the Symposium had responded to the global COVID-19 pandemic, while also expressing her pride in the Centre’s PhD students' research outcomes. Dr Evan Hynd (Department of Industry, Science, Energy and Resources, Australian Government) also provided an overview of how the Australia-China Science and Research Fund is supporting strategic science, technology, innovation and collaboration of mutual benefit to both Australia and China.

Centre Manager Dr Ruohui Lin (Monash University) shared the Centre’s recent achievements throughout 2020 and provided insights into the way in which COVID-19 will impact the Chinese dairy industry in a positive way.

She advised that the consumption of dairy products had increased during the pandemic and is expected to continue rising even as the pandemic subsides. The increase was attributed to the promotion and endorsement of the nutritional and immune-boosting value of dairy products, particularly through official channels or ‘celebrity’-style endorsements by an influential local Public Health Advisor. With people confined to their homes during lockdown, the increase was also attributed to the significant rise in home cooking and baking.

Chaired by Associate Professor Meng Wai Woo and Dr Yong Wang, the Centre’s PhD students delivered updates on the progress of their research, including:

Developing functional dairy products to improve bioavailability and target release by Qianyu Ye (Monash)

Improving thermal stability of probiotics in yoghurt using microencapsulation by Naomi Vinden (UQ)

Novel application in food viscosity reduction by Khanh Phan (UQ)

Innovative membrane processes for desalination and improved rejection by Yang Li (Monash) and Shi Yuan (Monash)

Characterization of solid lipid particle of fish oil and milk fat and its application in ice cream by Mitra Nostratpour (Monash)

By the Symposium's closing remarks, participants from 48 of the 50 industry participants remained engaged, indicating a high level of interest in the Centre's work. Overall, the Symposium provided the setting for numerous engaging and productive conversations, including discussions about the stability of probiotics during the manufacturing process and applications of novel membranes for dairy products. Many participants, including Mengniu Dairy, Fonterra, Bega Cheese, Dairy Australia and Austrade, expressed positive feedback about the event.

Despite the fact that the Centre is approaching the end of its funding agreement in June 2020, the opportunity for continued collaborations and partnerships were emphasised. Professor Banaszak Holl also thanked all the participants, and pointed to the Centre's record of success. "It is in partnership with industry, governments, and other universities in Australia and China, that the researchers in this Centre have solved grand challenges in dairy manufacturing, provided access to the local and international expertise, and helped to create and expand critical markets," he said.

Visit the Australia-China Joint Research Centre in Future Dairy Manufacturing website for further information on the Centre's work.

Watch the Symposium's Part 1 and 2 technical sessions

Part 1

Part 2

WELCOME TO OUR NEW STAFF

Professor Paul Webley

Monash University is pleased to announce the appointment of Professor Paul Webley to the role of Energy Partnership Director for the Woodside Monash Energy Partnership, commencing 15 June, 2020.

Professor Webley joins Monash from the University of Melbourne and has over 15 years' industry and academic experience in the development and management of clean energy technologies, specifically carbon capture.

The role will see Professor Webley lead the Woodside Monash Energy Partnership to progress energy solutions for a lower carbon future. Aligned to the United Nations Sustainable Development Goals, the research and development initiatives of the partnership will focus on leadership and novel technologies in the hydrogen value chain and carbon abatement.

Monash University Deputy Vice-Chancellor and Senior Vice-President (Enterprise and Governance), Professor Ken Sloan, said, "Professor Webley's appointment is an important step in the work of the partnership, which brings together our most brilliant minds working alongside Woodside, an organisation that led the development of the LNG industry in Australia, to discover better and more sustainable ways of working, and make actual progress toward taking the steps in the energy transition possible."

"I am delighted to welcome such an esteemed academic in clean energy technologies to Monash, and am looking forward to Professor Webley's leadership in driving our journey to a clean energy future."

Woodside Vice President Technology, Jason Crusan, welcomed Professor Webley to the partnership: "Professor Webley's experience and knowledge of clean energy technologies, specifically carbon capture, is central to the work of the partnership," he said.

"Woodside and Monash are committed to developing innovative responses to real-world challenges and we recognise that finding a sustainable path to a lower-carbon economy is one of the biggest we face."

Professor Webley's principal research interest in clean energy technologies, including gas separation, energy storage and applications of thermodynamics to improve process efficiency, has seen him at the cutting edge in supporting Australia's lower-carbon energy transition.

His appointment follows the announcement of Woodside Energy and Monash University joining forces to develop a state-of-the-art 'living laboratory' and the long-term research partnership in July 2019.

"I am greatly looking forward to my new role in which I will work closely with Woodside to make significant changes to the future of clean energy in Australia," added Professor Webley.

Professor Benny Freeman

Renowned expert Professor Benny Freeman will be joining the Department in 2021 as a 0.5 FTE academic (split with University of Texas at Austin).

Professor Freeman currently holds William J. (Bill) Murray Jr. Endowed Chair in Engineering in the chemical engineering department at the University of Texas.

His research program explores the relationship between polymer structure, processing and properties. Specifically, his group studies the effect of polymer structure on the solubility, diffusivity, and permeability of small molecules in polymers and polymer-based materials.

Professor Freeman is widely recognised in his field and has received numerous awards, most recent of which include: Reilley Lectureship, University of Notre Dame 2020, Membrane Society of Australasia (MSA) Distinguished Scholar Lectureship 2019, American Chemical Society POLY Fellow 2019, and the American Chemical Society POLY/PMSE Plenary Lecture 2019.

MONASH ACCELORATOR PROGRAM

APPLICATIONS ARE NOW OPEN!
AN EIGHT WEEK PROGRAM FOR EARLY-STAGE TEAMS WITH TRACTION, COMMITTED TO RAPIDLY PROGRESSING AND SCALING THEIR VENTURE.

The Accelerator is a program for Monash University innovators, entrepreneurs and change makers (current students, staff, researchers and alumni) who are working on validated ideas or early stage startups to achieve significant and sustainable growth for their venture.

Over an intensive eight weeks, you will be guided by Entrepreneurs-in-Residence (EiR) and mentors, provided equity-free seed funding and work in a dedicated co-working space to rapidly progress your startup.

The program is flexibly structured to provide you with maximum impact in minimal contact hours, so you can devote your time to growing and developing your venture:

- 1 x weekly Masterclass (compulsory)
- Weekly 1:1 with your dedicated EiR (compulsory)
- Weekly pitch and communication practice (compulsory)
- Accelerator Dinners - a 'reveal all' dinner with a successful founder, mentor, or startup superstar every week
- Dedicated space in the brand new Generator co-working space on Clayton Campus (optional)
- $10,000 in equity-free seed funding per team

The Generator's Accelerator Program has supported 34 early stage ventures to date. Notable alumni include Ally Assist, NextAero, Mindset Health, Tixel, Merry People and Additive Assurance.

Applications are now open and close 11:59pm Sunday 2 August, 2020.

WANT TO FIND OUT MORE?

Book into one of the 'Ask Me Anything' virtual sessions running on Wednesdays from 1-2pm throughout July (1, 8, 15, 22 & 29 July).

MORE INFO HERE

REGISTER HERE

CHEMICAL ENGINEERING AT MONASH SUZHOU

We now have 39 master students under the stream of Monash-SEU master of industry chemical engineering program in 2020.

This program aims to establish a prestigious model for international collaboration for Australia-China in high education. We have established the Energy and Environment Research Centre, and two research labs, Laboratory for Energy and Environmental Conservation, Laboratory of Separation to support this program. We are aiming to maximise the value of natural resources and minimise the environmental effect through the advancement of knowledge and the development of technologies. At the same time, we are aiming to train experts in energy and environment technologies and to build a communication platform for experts to share knowledge and visions.

Semester 1 2020 in Monash Suzhou was successfully completed by delivering online teaching due to the COVID-19. Four fundamental units, CHE5881 Advanced Reaction Engineering, CHE5110 Advanced Thermodynamics, CHE5001 Chemical Engineering Data Analysis and ENG5005 Research Methodology were covered during S1 2020, and all the students were active during the four online units with desirable performance. The lab was established and fully equipped for teaching and demonstration. Chemical Engineering in Monash Suzhou overcame the challenges from COVID-19 and move forward.

CHEMICAL ENGINEERING AT MONASH MALAYSIA

Dr Aditya Putranto recently joined School of Engineering Monash University Malaysia as Senior Lecturer in Chemical Engineering.

Dr Putranto obtained his Bachelor of Chemical Engineering from Bandung Institute of Technology Indonesia, an MSc in Food Engineering from UNSW Australia and PhD in Chemical Engineering from Monash University Australia (where he was awarded Mollie Holman Medal for the best PhD thesis).

Prior to his appointment at Monash University Malaysia, he was Lecturer in Chemical Engineering at Queen's University Belfast UK.

His research area is drying technology, food processing and transport phenomena.

He has been awarded the Outstanding Drying Book Award, Young Drying Scientist, the Hottest paper by Wiley® and Best Paper.

He is also currently Associate Editor of International Journal of Food Engineering.

ALUMNA DR YANG (DAISY) WANG

Department Alumna Dr Yang (Daisy) Wang is currently enjoying her new life in the USA as a postdoctoral researcher based in the College of Chemistry at UC Berkeley.

Daisy completed her PhD at Monash in 2019 under the supervision of Professors Cordelia Selomulya, Huanting Wang and Dongyuan Zhao.

Her thesis examined functional nanomaterials design and fabrication for use in electrochemical conversion of water into hydrogen in the field of renewable energy.

Daisy' efforts during her PhD were acknowledged by the China Scholarship Council and she was recognised as an 'Outstanding Self-financed Student', one of only 500 awards granted each year worldwide.

In her new position, Daisy is working to address the problem of CO_2 emissions by researching the mechanism of converting CO_2 into useful molecules such as ethanol and formic acid, which play key roles in industrial production. Specifically, Daisy is using Nuclear Magnetic Resonance (NMR) techniques to examine how CO_2 interacts with specific polymer-based electrolytes or electrocatalysts, which is crucial to understanding the mechanisms of electrolytes and catalysts for CO_2 conversion.

Daisy also has highly developed skills in materials characterisation using Electron microscopes, including Scanning Electron Microscopy (SEM), (Scanning) Transmission electron microscopy ((S)TEM) and Powder X-ray diffractometer (XRD).

"I am very grateful for the opportunity I had to complete my PhD at Monash University. It is a beautiful place with lovely people and a rich academic atmosphere! I would like to express my sincere gratitude to my PhD supervisors: Professors Cordelia Selomulya, Huanting Wang and Dongyuan Zhao. Their insightful guidance helped me to refine my research skills, and helped me launch my own research career at UC Berkeley, where I can apply all these skills developed during my PhD", Daisy said.


王洋

荣获二〇一九年度国家优秀自费留学生奖学金，特颁证嘉奖，以资鼓励。

CHINA SCHOLARSHIP COUNCIL

Presents the

2019 Chinese Government Award for Outstanding Self-financed Students Abroad

to

Wang Yang

Sheng Jianxue
Secretary-General
China Scholarship Council

Daisy's China Scholarship Council award.

OUR OWN LAUREATE PROFESSOR

Professor Huanting Wang from Monash University's Faculty of Engineering has received a prestigious Australian Research Council (ARC) Laureate Fellowship for his work in nanoporous materials and composite membranes - research that supports innovations in renewable energy, mining and clean water.

The Laureate Fellowship was announced by The Honourable Dan Tehan, Federal Minister for Education, on Monday 6 July 2020. Professor Wang is the Associate Dean (International), Faculty of Engineering; and Director, Monash Centre for Membrane Innovation.

Professor Wang's work focuses on designing new synthetic membranes with ultralow energy consumption, to support the development of new technologies in renewable energy and mining.

"I hope to build world-class research capabilities in the rapidly growing cross-disciplinary field of separation membranes that operate at sub-nanometer scale. My research program will develop advanced materials for applications in the energy economy ranging from renewable hydrogen and biofuels to sustainable lithium mining and recycling technologies," said Professor Wang.

This project will develop world-first membrane technologies to efficiently produce and use energy while reducing environmental impact. The research has a wide range of applications in sustainable energy, including the efficient production and use of hydrogen energy, and highly efficient biofuel production.

The research also supports sustainable manufacture and recycling of lithium-ion batteries. The current lithium extraction technology is environmentally damaging and uses large amounts of chemicals. Lithium batteries are currently not recyclable.

Professor Wang's work in lithium-ion conducting membranes could revolutionise the lithium mining processes and make the lithium battery recycling industry technologically and economically viable. There is potential to commercialise this work through Monash's network of industry partners.

President and Vice-Chancellor, Professor Margaret Gardner AC, congratulated Professor Wang on his success.

"This Australian Research Council Laureate Fellowship for Professor Wang's work shows the strength of Monash University's research and our international reputation for educational excellence and innovation," Professor Gardner said.

"I congratulate Professor Wang on this remarkable achievement."

Provost and Senior Vice-President, Professor Marc Parlange, said the Laureate demonstrated the strength of Professor Wang's sustained contributions toward membrane innovation.

"The Laureate Fellowship is one of the most prestigious research awards in Australia. Today's announcement is singular recognition of the profound importance of Professor Wang's work and its significance in the development of more sustainable energy and mining practices. My warmest congratulations to Professor Wang and to the Faculty of Engineering," Professor Parlange said.

Professor Wang said the Laureate was a testament to his research group at Monash.

"I am thrilled to receive an ARC Australian Laureate Fellowship. This is a great recognition for the efforts that my research group and collaborators have collectively made over many years. Importantly I have been well supported by my colleagues and Monash University," said Professor Wang.

"The Fellowship will allow me to focus on exploring fundamental science on fascinating selective mass transport at the atomic scale and developing new materials and technologies for the renewable energy industry."

Dean of the Faculty of Engineering, Professor Elizabeth Croft, said Professor Wang's world-leading research in the field of nanoporous materials and composite membranes is a quintessential example of the faculty's commitment to the United Nations Sustainable Development Goals, particularly in addressing clean water and sanitation, and affordable and clean energy.

"The Faculty of Engineering is delighted and proud of Professor Wang's award of the Laureate Fellowship, and we congratulate him on this well-deserved recognition of his outstanding research efforts," Professor Croft said.

Source: https://www.monash.edu/news/articles/monash-celebrates-laureate-professor

2020 AIFST JACK KEFFORD AWARD

Congratulations to Dr Sushil Dhita who is the 2020 recipient of the Australian Institute for Food Science and Technology Jack Kefford Award.

The AIFST Annual Awards celebrate the outstanding achievements of our members and colleagues in the food industry and their contribution to the Institute.

The Award is named in honour of Mr Jack Kefford who provided enormous input to the science and technology of food as Officer-in-Charge of the CSIRO Food Research Laboratory

Sushil completed his PhD at The University of Queensland in 2011 and joined Monash University Department of Chemical Engineering in July 2019.

Sushil currently serves as Editor for the Journal Carbohydrate Polymers and is on the Editorial Board of journals Food Hydrocolloids and Food Chemistry

Sushil caries fundamental and applied research on elucidating the structure-property-function-health relationships of food and food ingredients. His stronghold and research interest are on relating the plant molecular structures to macroscopic properties with relevance to food, health, and product development. He uses cross-disciplinary approaches drawing from physics, chemistry, biology, and engineering and uses various in-vitro and in-vivo models to elucidate the fundamental mechanisms beyond the nutritional and processing functionality of food and food ingredients.

FUTURE READY ENGINEERS INITIATIVE

Have you ever considered sharing career insights and advice to the next generation of engineers?

We are accepting Expressions of Interest for the Future Ready Engineers Initiative, a virtual career development session. This opportunity is open to Engineering alumni who have prior industry experience, are open to share your experiences with a group of Engineering students, graduated with an engineering degree(s) from Monash University and are available to attend a virtual session in 2020.

Expressions of Interest close 24th July so make sure you complete the form to not miss out!

The Expressions of interest form is located via this link: https://bit.ly/2M5xJqi

STAY CONNECTED TO MONASH CHEMICAL ENGINEERING

Career Connect can help students become job-ready!

Sign up to *How to create a Linkedin Profile* today and self-select which session you want to attend.

This workshop will cover:

- How to get the most out of your LinkedIn profile (beyond job search and networking)
- How to build your online brand

Once you attend the workshop put your skills into practice and join the Monash Engineering Alumni Linkedin Group and Monash Chemical Engineering LinkedIn Group and help you put your best foot forward as you build your career.

Alumni

For our alumni and friends, join our online communities Monash Engineering Alumni Linkedin Group and Monash Chemical Engineering LinkedIn Group.

A group for all alumni from Chemical Engineering at Monash University to keep in touch with each other, and also with the department.

This includes our former undergraduate students, postgraduate students, as well as academic, technical and professional staff.

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