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DEPARTMENT OF CHEMICAL ENGINEERING
MONASH UNIVERSITY

ChemEng focus

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Inside this issue:

Professor Aibing Yu joins the Department of Chemical Engineering

Professor Aibing Yu has joined the Department of Chemical Engineering as Pro Vice-Chancellor and President of its new Monash University-Southeast University Joint Research Institute in Suzhou, China.

Professor Aibing Yu

Monash is the only Australian university to be granted a licence to operate in China, one of the world's largest and fastest-growing economies. The establishment of the Monash University-Southeast University Joint Research Institute will complement the Joint Graduate School (Suzhou), which officially opened in October 2013.This key leadership position comes at a crucial time when China is increasingly important to Australia's economic future. Both universities have world-recognised strengths in engineering, health and science. The collaboration with SEU will strengthen the University's reputation for being innovative and internationally focused.

"We are delighted to welcome Professor Aibing Yu to the Department of Chemical Engineering. He will provide leadership and on the ground support, facilitating the University's partnership with Southeast University (SEU)," Professor Sridhar said.

"This initiative will produce postgraduates and researchers with ideas to change people's lives in the region and the world for the better. Professor Yu's extensive research experience will ensure we achieve this vision."

Professor Yu joins Monash from the University of New South Wales, where he was the Scientia Professor of the School of Materials Science and Engineering. Commencing in April, he reports to Academic Vice President (China and India) Professor Tam Sridhar. Professor Yu has also been appointed a Vice-Chancellor's Professorial Fellow of Monash.

The Monash University-Southeast University Joint Graduate School and Joint Research Institute are based at the Suzhou Industrial Park (SIP) – one of the largest innovation precincts in China. A hub of 21st century brainpower, it hosts more than 100 Fortune 500 companies and 15 international universities and research institutes.

Professor Aibing Yu joins the Department of Chemical Engineering continued….

Specialising in process metallurgy, Professor Aibing Yu obtained a BEng in 1982, a MEng in 1985 from North-eastern University, a PhD in 1990 from the University of Wollongong (UoW), and a DSc in 2007 from the University of New South Wales (UNSW). He is a recipient of a number of prestigious awards and fellowships including ARC Federation Fellowship, Josef Kapitan Award from Iron and Steel Society (ISS), Ian Wark Medal from Australian Academy of Science, Exxon Mobil Award from Australian and New Zealand Federation of Chemical Engineers, and NSW Scientist of Year 2010. He was elected to the Australian Academy of Technological Sciences and Engineering (ATSE) in 2004, and to the Australian Academy of Science (AAS) in 2011.

Monash University-Southeast University Joint Graduate School

Chinese Government Award for Outstanding Self-Financed Students Abroad

Three students studying within the Department of Chemical Engineering, Faculty of Engineering at Monash University have been awarded Chinese non-government sponsored student scholarships from the China Scholarship Council.

The China Scholarship Council is the Chinese Ministry of Education's non-profit organisation that provides student financial aid to Chinese citizens and foreigners to study abroad or in China.

Developed in 2003, the awards are based on academic merit and encourage international students to achieve first-class results during their studies. Awardees receive $6000US to further develop or finance their studies.

The award further encourages international students to return to China for work or to serve the country in other channels after receiving their degree abroad.

This year, a total of 518 awards were given worldwide, with 44 Chinese students in Australia receiving awards. Of the 44 students in Australian, eleven are engaged with studies at Monash University and three are studying Chemical Engineering with the Faculty of Engineering.

The ceremony for Victoria was held in 29th April, 2014 in the Chinese consulate-general of Melbourne. Congratulations to Mr. Jielong Su, Ms. Yue Tang and Ms. Miaosi Li for their outstanding achievements.

To be eligible for the Chinese Government award for outstanding self-financed students abroad, the student must be studying a PhD degree, be under the age of 40 and self-financed.

Generation of cardiomyocytes using Liquid Marble as the culture system

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FULL PAPER

Cardiogenesis of Embryonic Stem Cells with Liquid Marble Micro-Bioreactor

Fatemeh Sarvi, Kanika Jain, Tina Arbatan, Paul J. Verma, Kerry Hourigan, Mark C. Thompson, Wei Shen,* and Peggy P. Y. Chan*

A liquid marble micro-bioreactor is prepared by placing a drop of murine embryonic stem cell (ESC) (Oct4B2-ESC) suspension onto a polytetrafluoroethylene (PTFE) particle bed. The Oct4B2-ESC aggregates to form embryoid bodies (EBs) with relatively uniform size and shape in a liquid marble within 3 d. For the first time, the feasibility of differentiating ESC into cardiac lineages within liquid marbles is being investigated. Without the addition of growth factors, suspended EBs from liquid marbles express various precardiac mesoderm markers including Flk-1, Gata4, and Nkx2.5. Some of the suspended EBs exhibit spontaneous contraction. These results indicate that the liquid marble provides a suitable microenvironment to induce EB formation and spontaneous cardiac mesoderm differentiation. Some of the EBs are subsequently plated onto gelatin-coated tissue culture dishes. Plated EBs express mature cardiac markers atrial myosin light chain 2a (MLC2a) and ventricular myosin light chain (MLC2v), and the cardiac structural marker α-actinin. More than 80% of the plated EBs exhibit spontaneous contraction and express mature cardiomyocyte marker cardiac troponin T (cTnT), indicating that these EBs have differentiated into functional cardiomyocytes. Together, these results demonstrate that the liquid-marble technique is an easily employed, cost effective, and efficient approach to generate EBs and facilitating their cardiogenesis.

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1. Introduction

Adult hearts have a very limited capacity for self-regeneration after myocardial infarction (MI; heart attack). Transplanted stem cells or progenitor cells have the capacity to repair infarcted myocardium.[1,2] Pluripotent embryonic stem cell (ESC), isolated from the inner cell mass of a developing blastocyst,[3] possess the ability to self-renew, and have the potential to differentiate into various cell lineages, including all three germ layers[4] and cardiomyocytes.[5] The ability to engineer these ESC genetically, together with their ability to differentiate into cardiomyocytes in vitro, makes them valuable and promising cell sources for cell therapy, tissue engineering, and regenerative medicine.[6] Forming 3D embryoid-like cell aggregates, known as embryoid bodies (EBs), is a key step for the in vitro differentiation of ESC.[7] Indeed, an EB consists of three germ layers (ectodermal, mesodermal, and endodermal tissues) that emulate the features of a developing embryo,[8,9] thereby providing a valuable tool for various embryogenesis studies.[9,10]

Several methods have been employed to form EBs from ESC and to subsequently differentiate them into cardiomyocytes. These include hanging-drop culture,[9] spinner flask,[11] centrifuge-forced aggregation,[12] and suspension culture in a low-adherence vessel.[9,13] The hanging drop method is the most commonly used technique for EB formation, in which an ESC suspension was placed on the inner surface of a Petri dish lid. EBs can be formed after inverting the lid due to the balance of gravitational and surface tension forces. Changing the droplet volume and seeding density can tune the size of the EBs. However, the hanging drop method is labor intensive and time consuming. It is also practically impossible to perform medium exchange using this method. In addition, the drop volume is limited to less than 50 μL, thereby making it incapable of supporting large-scale production.[9] Rotation-based methods, such as the spinner flask and centrifuge-forced aggregation methods, can facilitate the large-scale production. However, these methods require costly equipment; moreover, the shear stress induced by the rotation may reduce cell viability, and disrupt cell–cell signaling and the subsequent cell differentiation. The method based on suspension culturing using conventional low-adherence vessels has limited control over size, shape, and uniformity of EBs.[13]

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Adult hearts have a very limited capacity for self-regeneration after a heart attack. However, researchers from the Department of Chemical Engineering, Department of Mechanical Engineering at Monash University and the Micro/Nanophysics Research Laboratory at RMIT University have joined forces in a collaborative research project to tap the possibility of building highly efficient bio reactors to generate heart muscle cells (cardiomyocytes) for repairing the damaged myocardium caused by the heart attack. The project is entitled "Generation of cardiomyocytes using Liquid Marble as the culture system".

Liquid marble is an interfacial phenomenon first described by Aussillous in her *Nature* paper in 2001; it is a liquid drop covered by fine solid particles of nano- or micro-meters in size that are hydrophobic and not wettable by the liquid. The covering particles adhere to the surface of the liquid drop, isolating it from the supporting surface, so that it can roll on a table like a marble. The liquid marble shell, formed by the covering hydrophobic particles, allows gas exchange between the interior liquid and the surrounding environment. The team's research also showed that nutrients could be transported into the liquid marble following basic reactor engineering designs. Thus, liquid marble provides a micro-environment for cell culture and can be engineered into micro bioreactors. What makes the liquid marble reactor so well-suited for cell culture is that the liquid marble shell resists adhesion of cells; this effect forces the cells to form 3D spheroid bodies. This unique property facilitates cell culturing to be controlled within liquid marbles. The group has previously reported the production of 3D cancer-cell spheroids using liquid marble micro-bioreactors.

Taking a leap further, the group investigated the capability of liquid marbles to induce embryoid bodies (EB) formation from embryonic stem cells (ESCs) and their subsequent differentiation into cardiomyocytes. The researchers plated EBs obtained from the liquid marble micro reactor and developed them into synchronized beating heart muscle cells. By examining gene expression, protein expression and contraction characteristics, the research team demonstrates that liquid marbles provides a promising platform to facilitate cardiogenesis. The cardiomyocytes generated via this liquid marble micro reactor could provide a continuous source of donor cardiomyocytes for cell replacement therapy for damaged hearts. Furthermore, this technology would also be highly beneficial to provide cardiomyocytes for use in cardiac drug discovery programs and safety testing. This research highlights the strength of inter-disciplinary collaboration.

The full journal article, which has recently been accepted for publication and rated as a "VIP publication" by Advanced Healthcare Materials, can be viewed here

My life after my Chemical Engineering Degree by James Walter Bachelor of Science/Bachelor of Engineering (Chem Eng) 2011

I finished my degree at Monash at the end of 2011 graduating with a double Bachelor Degree in Engineering (Chemical) and Science (Chemistry).

My final year was a very busy one which included the CHE4180 Research and the CHE4170 Design projects. I thoroughly enjoyed these two units. In addition to my final year, I was also the president of SMUCE (The Society of Monash University Chemical Engineers). In this role I and my other club Committee Members organised regular industry and career related seminars where students could come and learn about industry opportunities available to chemical engineers. In hindsight, the year flashed by so quickly. However, I'm sure there were times when I was studying late in to the night, that I thought this drudgery could not end soon enough!

With my degree fresh off the press, I left Victoria and started work with Orica's Graduate Program. This program gave me a three year program with annual rotations through different areas of the business. Orica is a world leader in the manufacture and supply of commercial explosives, mining services and chemicals to the global mining industry. For my first rotation I moved to Newcastle NSW to one of the main Research and Development hubs for Orica. During my time there I worked on a project to develop new explosives and explosive delivery systems. Part of the work involved

Field trials testing new explosives, and the craters it can create

characterising the product's performance, and yes in case you were wondering, in the explosives world this means blasting. We conducted many series of surface firing trials primarily to measure the Velocity of Detonation (VOD) of the explosive, which were eventually further scaled up into multi tonne prototype blasts within operational coal mines in the nearby Hunter Valley. This rotation was an amazing introduction into the professional working world and gave an opportunity to use my core engineering skill base in a way that I never knew existed. This experience was just the first taste of what would come.

Working in the Hunter Valley

For my second rotation I was based at Orica's Yarwun Ammonium Nitrate (AN) and Chemicals Complex (CC), just north of Gladstone in Central Queensland. Here I was able to apply and develop my core chemical engineering skill base, using specific areas such as process control, pumps (extremely important on a plant...make sure you pay attention to these lectures!), fluid mechanics, separation processes and even simple (on the surface at least) mass and energy balances. Immediately, I hit the ground running and was responsible for all Outer Battery Limit systems within the AN complex, with the largest assets being the site wide steam header and also the Cooling Tower systems for the AN complex. Along with creating process improvements and conducting analytical investigations, I also worked within the AN plants themselves, troubleshooting AN reactor control systems and AN plant start up sequences. This rotation taught me the importance of working within diverse teams that include plant operators, maintenance crews, and also other engineers from mechanical, electrical and control backgrounds. Without my foundations of engineering knowledge from Monash my success in this role would simply not have been possible.

My life after my Chemical Engineering Degree - James Walter continued

Inspecting key vessels during site shutdowns

My third rotation has by far been the most challenging as I was lucky enough to be able to move to South America for an international rotation. Currently I am working within Initiating Systems and Electronic Blast Systems Marketing in the Latin American business based in Santiago, Chile. So far this has been a huge challenge not just for the change of continent and language but also the change in work. Rather than working in a plant or on a firing range my main role is to lead a project to commercialise new blasting technology into the region. This has been a huge opportunity to learn new skills (and languages) and how a global business works, whilst still keeping one finger on my engineering background working with many different functions (including engineers).

None of these experiences would have been possible without my engineering degree. It's not just the technical knowledge of process engineering and design, thermodynamics, fluid mechanics, heat integration and so on that I have needed but also the way in which engineering teaches you to think. To be able to look at seemingly large and complex problems, break them down into smaller solvable pieces, technically assess each scenario and ultimately deliver a real and logical solution is what I believe engineering is all about. My engineering degree has not just taught me these skills but also the ability to adapt and learn in what is now a fast paced and changing world. My time at Monash was a great experience and has really opened the doors to the true global nature of the engineering profession and I encourage all of you reading this article to make the most of the opportunities your engineering degree may give you.

Success in the 2014 BCIA Research Scholarships applications

BCIA's prestigious postgraduate research scholarships are developing the nation's future scientists and are part of BCIA's commitment to strategic investment in skills development to secure the scientific, engineering and trades expertise required for the development of new low-emissions brown coal technologies.

At the beginning of 2014, BCIA invited PhD candidates at Australia's leading universities to submit applications for research scholarship funding. The PhD Top-Up Scholarships are valued at $10,000 per annum (for a maximum of three years), of which $7,000 p.a. will be paid as a stipend to the PhD student and $3,000 p.a. will be allocated to support travel and other research costs.

Applications for BCIA postgraduate research scholarships were assessed by the BCIA Research Advisory Committee and reviewed by the BCIA Board who awarded the scholarships.

BCIA Chair, Gerry Morvell, said: "The BCIA PhD research scholarships demonstrate the wealth of emerging talent in our scientific community and are a significant component of our investment in leading-edge research and development that will underpin our capacity to tackle environmental challenges associated with the exploitation of brown coal."

The three recipients of the 2014 BCIA PhD Research Scholarships are:

- **Mr Baiqian Dai**, research topic: "Coal Blending Combustion and Gasification – the Mixing of Beneficiated Brown Coal and High-Rank Bituminous Coal"
- **Mr Anthony De Girolamo**, research topic: "Developing an advanced computer modelling program for the prediction of brown coal ash slagging/fouling propensity under oxy-fuel combustion mode"
- **Mr Tao Xu**, research topic: "Development of Oxygen-blown Entrained Flow Gasification for use with a range of Victorian brown coals"

Mr Bai and Mr De Girolamo are supervised by Dr Lian Zhang and Mr Xu is supervised by Professor Sankar Bhattacharya.

Congratulations to all three students on their wonderful achievement. We wish you every success in your chosen research area.

Nothing is impossible, but I did nothing every day
Thesis review by Elaine Fung [Ph.D]

Thesis title: "Nickel aluminate reinforced porous ceramic hollow fibre membranes"

Supervisors: Professor Huanting Wang, Dr Jianfeng Yao

"Nothing is impossible" has been a famous and great quote over years, which has encouraged so many miserable individuals, helped to brighten up dark times of some people and has been a strong motivation in all areas of research.

Back in my high school, a good friend of mine extended this saying to "Nothing is impossible, but I do nothing every day". I laugh whenever this interesting quote pops up in my mind. This is because you can interpret this saying in two different ways - The entire meaning of the quote all depends on if you take the first "nothing" as adjective or a noun. The former makes it a description of someone's laziness; the other makes the first half and second half of this sentence oppose each other.

Not long after the start of my PhD degree in early 2012, I came up with another way of playing with the meaning of this quote to relate it to my research life. For many researchers the saying, "Nothing is impossible" is a motivation to work harder towards a goal. "I do nothing every day", on the other hand, realistically stated the net outcome of my research work, because the amount of things I created always equals to the amount of things I had to break!

The main focus of my research project is on the fabrication of high strength ceramic membranes. Ceramics are suitable to be used to filter undesired components in mixtures because of their strong resistance to temperature and chemical attack. Increasing the strength of ceramic membranes could avoid membrane cracking under fluid pressure and hence ensure the efficient removal of unwanted components and long service life of the membrane. The way to show how strong the ceramic membranes I made are to measure the force required to break them.

In general, researchers do their upmost to protect their samples, such as placing them in secure containers to protect them from any possible damage, yet I have been treating my samples in a completely different way. I have purposely placed them in a machine that applied force on them to snap them. Economically, net gain = gain – loss; mathematically, difference = final value – original value; scientifically, change = condition after experiment – condition before experiment.

The number of samples I made every day equals to the amount of samples I had to break by the end of the day, when directly applying this to any of the above formulae, the daily net gain, difference and change I did equalled to zero. This validates the second half of the quote – "I do nothing every day".

As my PhD study has come to an end, I finally see something that I have created, and for once, would not be physically broken by my own hands – four final copies of my thesis! The end result of my thesis. High performance ceramic membranes with enhanced strength, which would extend the boundaries of separation technology - a small step forward in the scientific world of research towards improving application in many industrial processes that involve harsh conditions such as high temperatures and concentrated organic solvents because of their high thermal and chemical stability.

The knowledge, experience and personal growth I have gained over the last few years of my PhD study, although not being something that physically exists, are valuable and long lasting.

You can review the journal articles which are a result of Elaine's research at Monash University here:

Investigation of reinforcement of porous alumina by nickel aluminate spinel for its use as ceramic membrane
Fung, Yi-Lan Elaine, Wang, Huanting
JOURNAL OF MEMBRANE SCIENCE, Volume: 444, Pages: 252-258, DOI: 10.1016/j.memsci.2013.05.025
http://www.sciencedirect.com/science/article/pii/S0376738813004122

Nickel aluminate spinel reinforced ceramic hollow fibre membrane
Fung, Yi-Lan Elaine, Wang, Huanting
JOURNAL OF MEMBRANE SCIENCE, Volume: 450, Pages: 418-424, DOI: 10.1016/j.memsci.2013.09.036
http://www.sciencedirect.com/science/article/pii/S0376738813007618

2014 ARC Linkage successes

Congratulations to Associate Professor Cordelia Selomulya and Dr Meng Wai Woo, Professor Huanting Wang, Professor Aibing Yu and their respective collaborators for their successful Linkage Projects grants. The funding amounts are the ARC components - the industry funds are additional.

LP140100922
Selomulya, Cordelia; Woo, Meng Wai; Patel, Hasmukh; Agarwal, Shantanu

Total ARC: $310,000 with Institute of Dairy Ingredients Processing at South Dakota State University

This project is a joint international effort between Monash University, the Institute of Dairy Ingredients Processing at South Dakota State University, and the Dairy Research Institute to address challenges in achieving optimum spray drying conditions for heat sensitive dairy powders, such as milk protein concentrates and whey powders. The new modelling tool aims to help in predicting effective spray drying conditions to produce powders with improved solubility, emulsification, and heat stability properties. It is expected that the dairy industry will benefit from the use of this technology to deliver milk powders with improved quality, functionality, and shelf-life.

LP140100051
Wang, Huanting; Simon, George P; Hou, Hongjuan; Xiang, Shunhua

Total ARC: $450,000 with BaoSteel

This project aims to develop dual-functionality, temperature-responsive polymer hydrogels as draw agents for continuous, forward osmosis wastewater treatment processes. It intends to use low–and-medium temperature waste heat as a green input into the process and thus significantly reduce the costs of wastewater treatment, and fresh water consumption, whilst effectively utilising waste heat generated in the manufacturing industry. The outcomes of this research aim to provide a unique opportunity for Australian researchers to become world leaders in the rapidly- emerging, energy-efficient forward osmosis technology which is very relevant not only to wastewater treatment, but also to desalination.

LP140100785
Yu, Prof Aibing B; Li, Mr Yuchuan

Total ARC: $440,000.00 with Kunming Iron & Steel Holding Co. Ltd. (KISC)

This project aims to develop a virtual experimental blast furnace based on advanced discrete particle simulation technique. It is intended that the model furnace will be used to study the flow and thermo-chemical behaviour in iron making, quantify the effects of key variables related to raw material and operational conditions, and formulate strategies for optimum process design and control under different conditions. The findings aim to be very useful to comprehensively assess the performance of Australian minerals in iron making, improve the energy efficiency and reduce carbon dioxide emission in the steel industry, and enhance the competitiveness of the Australian economy.

LP140100786
Yu, Prof Aibing B; Jiang, A/Prof Xuchuan; Zhang, Ms Zhibo

Total ARC: $690,000.00 with Kunming Iron & Steel Holding Co. Ltd. (KISC)

This project aims to develop innovative strategies for the synthesis and thin film coating of vanadium dioxide nanoparticles, and understand the fundamentals through a comprehensive experimental and theoretical program. The findings aim to then be directly used in developing smart windows that have many applications in various industries. The project aims to significantly expand the knowledge creativity and research capability of Australia, and add value to its rich resource of vanadium oxides in advanced material manufacturing.

French Company Experience Program at Biomérieux by Sally Yue

Sally Yue [Masters]
French Company Experience Program Scholarship recipient (2014)

BTF (bioMerieux) is a small production facility and I was able to get to know people from all aspects of the business. It was extremely interesting to hear everyone's views on work and study, not to mention the recommendations I got on which places to visit. Outside of work, I also had two great housemates and some friends who I haven't seen since they moved to Sydney after graduation. Hence, weekends tend to be filled up extremely quickly!

I had some great times in Sydney: having high tea at the Queen Victoria building with my housemate, trying the famous deep fried mars bar at Bondi beach which sounds and looks quite bad but tasted surprisingly good, macarons at Adriano Zumbo's, and fresh seafood at Sydney Fish Market. It wasn't all about food, I also found time to visit Madame Tussauds, the Sydney Aquarium, the Sydney Tower/Eye, and the Wildlife sea sanctuary where there was a three flipper turtle. It proved that even with three flippers, it could swim surprisingly fast and be extremely difficult to photograph.

Sally Yue and Ivanna Setiadi
Having High Tea at the Queen Victoria building in NSW

The next part of my adventure was in Lyon, France at the bioMérieux head office in Marcy l'étoile. Unlike BTF which produced just one product, the product plant at Marcy was significantly larger and produced a range of products for clinical and industry use. The bioMérieux industries sector, which I was part, cater for rapid quantitative and qualitative identification of micro-organisms in industry. I was introduced to the principles of quality control and the sort of tests and regulations required by different global pharmacopoeias, FDA, GMP and ISO. The information definitely made me review the complexity of a manufacturing process and the levels of control which is required throughout. As I was working in the pharmaceutics group, the regulations were extremely stringent, and for every step, a quality check was required.

Lyon in general is not a huge city and everything tends to border the two rivers (Saône and Rhône) which run through the centre and join in the area known as the Presqu'ile confluence. While everything is extremely compact there is a lot to see and as one of the famous gastronomy centres of the world, there is also an abundance of restaurants and food to try. The pastries are among some of the best I've ever tried. The millefeuille (a multi-layer cream/custard/pastry) from Pignol near the Bellecour plaza was amazing as are the macaroons.

Then there's also the local Lyonnaise Bouchon cuisine. Strange is the only word I can really think to describe the traditional dishes, which seems to concentrate on using various internal organs of animals. One of their main specialty is a deep fried tripe dish which I was wasn't brave enough to try, instead opting to pick something like veal tongue and head (below) which I thought would be cut into small enough pieces so I wouldn't be able to tell what it is. To my absolute horror, that was not the case, and ended with me just taking a picture and not being able to stomach the food. Lucky for me the entree was an egg stew which turned out to be quite delicious.

French Company Experience Program at Biomérieux continued from previous page

I also found out quite early on that a lot of the famous restaurants are quite small and require booking in advance, however, many famous chefs including Paul Bocuse also runs these restaurants known as brasseries. The closest translation I've been able to find is a cafe, although it is significantly more formal than those found in Australia and most people tend to go in and order a full two or three course meal. Having said that though, I think the concept of an informal cafe is lost on the French, who love their food a lot and even at work, lunch times tend to take over an hour as the cafeteria provides a selection of mains, salads, desserts, fruits, cheeses and yogurts. The food from the brasseries is quite good and one of the must try dishes in Lyon is the traditional quenelle brochet (pike dumpling) in crayfish sauce.

There are of course many attractions as well. The architecture is amazing and a few of my favourites are the Fontaine Jacobins (fountain in Jacobin plaza - above), the Hôtel de Ville (town hall) and the Musée des Beaux Arts (museum of fine arts), which also used to be the Palais de Saint-Pierre. Since arriving in Lyon, I was also able to fit in a day trip to Annecy, which is near the border of Switzerland and is in the French Alps area. The Lake Annecy has to be one of the most beautiful areas I have ever seen. The river Thiou which is the shortest river in France, at 5 km, long runs through the town and feeds into Lake Annecy. The water is pristine and mini cobblestone walkways lead from one area to another with the

two sides connected by multiple stone bridges. The area is also rich with history and there are a few castles in the area.

The experience to date has been extremely eye-opening and I'm exceptionally glad to be able to take the time to work and travel in both Sydney and France. While the two cultures are extremely different (one of the major things I can't understand is why none of the French shops seems to open on Sundays), the things I've learnt working at bioMérieux, the friends I've made and the places I've seen have been priceless.

Among 100 applications received for the program, only six students in Australia received an Internship position in a French company established in Australia, with 3 months in Sydney and 3 months in France. I was the only student from Monash University to receive this scholarship this year.

I was selected by bioMérieux, one of the 14 companies partners of this Program. Monash University funded my return air fair ticket to France.

The French Company Experience Program was advertised through the G08, the ATN, the French Australian Chamber of Commerce and Industry and the French Embassy websites.

If you are interested in applying for the 2015 French Company Experience Program, further information can be found on the French Embassy website and the Campus France Australie website. Applications for the 2015 French Company Experience Program will be opened at the beginning of September 2014. I encourage you to apply. You will come home with Une vie de souvenirs.

2013 Faculty of Engineering Undergraduate Awards Announced

The Faculty of Engineering has recognised the outstanding achievements of students at the Annual Engineering Awards held on 24th June 2014 at the Novotel Melbourne Glen Waverley.

Dr Kris Ryan congratulated award recipients and spoke about the excellence achieved by Monash Engineering students. "Monash Engineering attracts some of the brightest students, where we strive to create a high quality learning environment. Our goal is to attract the best minds of each generation and educate the future leaders of our profession. It is through our students that we ensure that our legacy reaches much beyond our lifetime."

During the ceremony, the Faculty of Engineering Awards Guest Speaker, Megan Wheatley gave an inspirational talk to the awards recipients. Megan Wheatley is not only a Monash Alumni but also a member of the the Monash Engineering Foundation Board which aims to encourage and promote excellence in education, study, teaching and research in the Faculty [http://www.eng.monash.edu.au/about/foundation/].

"Firstly, I would like to offer my heartfelt congratulations to all the award recipients. You are here because you are exceptional. And with these awards, you are joining the ranks of the best and brightest that Monash engineering has to offer. Also thank you to all the individuals and companies behind the awards. Your generous contributions are so important to supporting the brightest students, and continuing to elevate the standing of Monash engineering.

CHANGING WORLD

Tomorrow is a significant day for me. I will be turning 40 years old. Now 40 is one of those milestones where you reflect on your life and the world you live in. And you also think about what the future will bring. One thing is for sure – the world is changing. 40 years ago, global population was around 4 billion. In the next decade, this will increase to 8 billion.

This means that:

- *Growing energy demand will put pressure on existing power systems*
- *Access to clean and reliable sources of water will become increasingly challenging in many parts of the world*
- *Infrastructure will be needed to ensure the efficient delivery of transport services and manage congestion*
- *Averting dangerous climate change will require a huge shift away from carbon polluting activities*
- *Health care advances will become even more reliant on technology*

Closer to home, we are seeing a shifting industrial landscape with the closure of Ford and Toyota, and we are yet to see the emergence of the new industries needed to maintain a diverse and resilient economy.

Addressing these challenges will require clever engineering solutions.

And it is the award winners in this room, who are being recognised for their achievements, who could be the engineers that shape the world.

FOOT IN THE DOOR

When I was at university, I was very worried that I wouldn't even get work experience.

In the end, my first engineering job came about through a combination of desperation, luck, and pity.

And I was desperate. I had had an offer from a truck repair company, after a very awkward interview conducted in an office plastered with pictures of scantily clad women.

And I was very lucky. I managed, by some fluke to connect with an engineer with an established career, in the sector of my dreams. And finally this engineer, a Melbourne University graduate, had a particular view about what made a proper engineer, and a recruitment policy to match. But when he discovered that I didn't ride a bike, didn't have a beard, and – worst of all (in his opinion) – I was a Monash engineer, he felt so sorry for me that he offered me a job.

After hearing all this, you may be surprised to hear that I didn't win any awards when I was at university.

As award winners you have been given something of great value. By officially recognising that you are exceptional Monash and the generous individuals and companies in this room are providing you with an advantage.

Hopefully, none of you will have to go to the lengths that I did to secure a job when you graduate. Your award will help open doors – and help you secure career opportunities.

But you will see that, over time, the importance of university awards will be overtaken by the strength of your experience and your networks.

NETWORKS

Ever since that first foot in the door, every professional opportunity, and every career success I have had has been as a result of my networks.

I want to share with you two examples.

In 2008 I found myself in Number 10 Downing Street developing energy efficiency policy with the Prime Minister's special advisor. For someone working in the area of sustainable energy policy, this was an incredible position to be in. I wasn't the best energy efficiency policy guru in the UK – of course I had to have proven expertise – but that wasn't why I was there. I was there because I had worked with the CEO of the UK Business Council for Sustainable Energy (UKBCSE) on one of his visits to Australia, and based on his knowledge of both my experience and how I worked, I was subsequently offered a role as his Head of Policy for the UKBCSE based in London.

In early 2010 I had a meeting with the Deputy Prime Ministers Chief of Staff in Canberra about the Renewable Energy Target.

Continued from previous page

At the time, the RET was broken –the market had been flooded with domestic solar water heaters which had stalled investment in large-scale generating technologies like wind. This meeting resulted in significant changes to the RET, which unlocked millions of dollars of investment in renewable projects. Again – I am not the most brilliant renewable energy mind Australia has ever seen, and I wouldn't have been the only person to think of this particular policy solution. But I had developed a good working relationship with a senior bureaucrat in the Victorian Government – who had then been promoted to Canberra. This meant I was able to have the right conversation at the right time to good effect.

In both these cases my network had enabled me to make a difference.

WHAT you know is your foundation.

But WHO you know can open doors, create opportunities, and expand your influence.

AWARD RECIPIENTS

When I look at the award recipients tonight, I see a very special group of students.

Now this is important.

You will be a very influential group in the future. You will be in key positions in a range of sectors, and your decisions will inspire others, and will help shape society.

And with positions of influence comes responsibility – and part of this responsibility will be to each other, and part of this responsibility will be to the next generation of engineers.

WHAT WE WANT

I recently joined the Monash Engineering Foundation Board, which was set up to encourage and promote excellence.

We recognise that Monash engineering's continued success depends on a number of things: a clear vision, brilliant teachers, exceptional students, industry relevance and an actively engaged alumni community.

We have a remarkable Dean with an exciting and compelling vision.

The students here tonight demonstrate that Monash engineering is attracting the cream of the crop, and educating them well.

Through the leadership development and industry team initiative programs, the relevance of Monash engineers to industry is being strengthened and reinforced. Which leaves alumni engagement – and this is an area that now has the focused attention of the Monash Engineering Foundation and the faculty. And this is what we want to see:

- *We want all of you to be connected to each other for life.*
- *We want all of you to be connected to Monash for life.*
- *And we want these connections to be active and dynamic.*

There will be times when you will benefit, such as attending networking events, having access to information about the latest research, and accessing career development activities.
And there will also be opportunities to give back, such as through mentoring, hosting events or donations. In the future, it might be you that's making awards like these possible.

While the Foundation and the Faculty are working to make it easier for alumni to remain connected - ultimately the success of your connections and networks will depend on you.

CONCLUSION

And as the lazier speakers like to do, I would like to finish with someone else's words. "When it comes to the future, there are three kinds of people: those who let it happen, those who make it happen, and those who wonder what happened." It is the clever engineers that will make the future that we want to happen.

Congratulations on your award, good luck with your careers. And please, stay connected."

The Department of Chemical Engineering wishes to congratulate the following undergraduate Chemical Engineering students on their wonderful achievements.

The **2013 ExxonMobil Awards for Excellence** [Presenter: Michael Anderson]. This prize was awarded to **Alexander Grufas** [Eng/Sci] and **Ilia Lyamin** [Eng]. The ExxonMobil Awards for Excellence are presented to undergraduate students in their penultimate year in any engineering discipline who display outstanding all-round performance.

The **2013 Jenkins Family "Follow your Dream Bursary"** [Presenter: David Jenkins]. This prize was awarded to **Jordan Carter** [Eng]. . When his father passed away David Jenkins decided to donate the proceeds from his estate to the Faculty of Engineering at Monash in the form of an annual scholarship. David says that he made this decision "To recognise the education opportunities that my parents did not have and to benefit others in the same circumstances." This bursary is awarded to a third year Chemical Engineering student based on academic and equity criteria.

The **2013 Owen Potter Award for Chemical Engineering Excellence** [Presenter: Karen Hapgood]**.** This prize was awarded to **Liam Powles** [BSc/BE]. This award was instituted in 1991 in recognition of the contribution made by the foundation Professor, Owen Potter, not only to the Department of Chemical Engineering but to the chemical engineering profession in Australia generally. A prize and a medallion is presented annually to the top first class honours graduate.

The **2013 Yong Cher Biau Memorial Award** [Presenter: Carlos Tiu]. This prize was awarded to **Matthew Kube** [Eng/Sci]. Datuk Yong Ah Pwi, Malaysia, offers this prize in memory of his late son, Yong Cher Biau, who passed away having completed almost three quarters of a successful BE (Chemical) degree. The prize is awarded annually to the top student in level three in the Department of Chemical Engineering achieving a first class honours standard.

The Awards ceremony was followed by cocktails which gave the award recipients and their guests an opportunity to network with the distinguished industry guests.

Chemical Engineering students are a strong presence at Low Rank Coal Symposium

The 3rd International Low Rank Coal Industry Symposium was held at the Grand Hyatt in April earlier this year, and is a highly reputable conference attracting many international delegates.

The conference aims to bring together academics, industry representatives and key policy makers to discuss current and future of low rank coal use around the globe. It also serves to showcase the latest advances in research and pilot scale applications. Of these, much interest was roused by the DICE (Direct Injection Carbon Engine) project, funded by BCIA (Brown Coal Innovation Australia).

As always, Victoria's vast reserves of brown coal were on show. To this end, the symposium was well represented by Monash University's Chemical Engineering staff and students with posters from the Energy, Fuels and Reaction Engineering Research Group who specialise in utilisation of Victorian brown coal from the Latrobe Valley.

Poster topics included entrained flow gasification, oxy-fuel fluidised bed combustion, fluidised bed drying of coal, dimethyl ether synthesis from coal, slag viscosity modelling, and use in direct carbon fuel cells.

The wide-ranging topics and alternative utilisation of Victorian brown coal from this research group sparked great interest from the international community attending and provided a fantastic networking opportunity.

Poster presenters (from left): David Stokie, Sunaina Dayal, Bayzid Kazi, Sharmen Rajendran, Tao Xu, Bithi Roy (also attended: Adam Rady)

News in brief

Congratulations to **Biao Kong** who recently received a student travel bursary. The bursary was jointly funded by the Australasian Particle Technology Society (APTS) and the Australia-China Joint Research Centre for Minerals, Metallurgy and Materials (3-M Centre). The awards was presented to Biao Kong on Wednesday 21 May 2014 by A/Prof Cordelia Selomulya (President, APTS) and Prof. Aibing Yu (Director, 3-M Centre). The bursarie, one of three awards allocated to students, allowed Biao Kong to present his winning paper "*Porous Bio-antenna from Nanocube Particles Interfacial Assembly*" at the 7th World Congress on Particle Technology (WCPT 7) which was held in Beijing, China on 19-22 May 2014.

Congratulations to the wining team of the 'National Student Environmental Engineering and Sustainability Award' organised by the Sustainable Engineering Society. The Sustainable Engineering Society is committed to promoting the practice of engineering in accordance with a sustainability ethic that leads to sustainable development. To encourage the development of a sustainability ethic throughout Australia, the Society offers annual State Environmental Engineering and Sustainability Award to undergraduate students. The winning student project from each state is then eligible to be entered in the National Student Environmental Engineering and Sustainability Award. The winner of the National Award will be given the opportunity to present their paper at the SENG biennial conference. The 4th year project was entered by **Kirilly Wagstaff, Daniel Wielechowski**, **Makarios Wong, Jimmy Nguyen, Richard Arthur and Ngoc Thuy Trang Truong**. The project was supervised by Professor Gil Garnier.

Society of Monash University Chemical Engineers (SMUCE), 2014

The Society of Monash University Chemical Engineers (SMUCE) is a student run society aiming to help and engage with the chemical engineering student community. SMUCE aims to bridge the gap between the classrooms and the world outside university. It serves as a link between students, academics and industry.

SMUCE Industry Seminar Series

For many years, SMUCE has been actively networking with industry representatives and companies with the purpose of organising industry seminars. Each week, SMUCE invites a different company to Monash to inform students about who they are and what they do, to showcase their employees' experiences with their company and to advertise potential employment opportunities. These seminars are a fantastic chance for Monash University students to learn about the different companies in the chemical engineering sector, to network and to ask about the experiences of people who were students themselves not so long ago. Please contact the Industry Vice President, Kim Sho at kbsho1@student.monash.edu to find out more on available dates for scheduled seminar.

Vacation Employment Day

Vacation employment provides an invaluable opportunity for students to apply their chemical engineering knowledge to an industry environment. This experience can be highly beneficial when seeking future employment or considering career prospects upon graduation. On the 24th July 2014, SMUCE will be hosting their annual Vacation Employment Day. This day provides students with insight as to what vacation employment entails, as well as the most effective ways to apply for a position. Exxon Mobil, NES Global Talent and Monash Employment and Careers Development will deliver presentations offering advice regarding career planning, possible career pathways for graduate chemical engineers as well as career opportunities offered by their company.

Peer Mentoring Program

After much positive feedback from students, SMUCE will be continuing the Peer Mentoring Program in Semester 2. Every fortnight, first and second year students, as well as 2+2 students, are invited to spend an hour connecting with more experienced students from a range of year levels. This is done by means of open, informal conversations in which students exchange advice, share their experiences and broaden their peer-based networks. To become involved in the program as a mentee, keep an eye out for the SMUCE team in lectures and read our weekly emails for session times and locations. No sign up is required – just show up on the day! To join the mentor team, email smuce@monashclubs.org for more information.

Group Up

We understand that engineering units can be challenging and that is frustrating to struggle alone while doing them. GroupUp is a new SMUCE initiative that runs group study sessions prior to tests and assignments. It allows students to work together tackling challenging units. This semester, GroupUp will applied for various units and students will be informed further about it.

Social Events

There is some exciting news on the horizon for the social scene for SMUCE. We are currently planning a combined pub crawl with MAMEC in the early weeks of semester. Further information will be released shortly so keep your eyes open! Planning is also well underway for our Annual Gala Dinner, which will be held on Thursday the 25th of September (the last Thursday before the mid-semester break) at the Brighton Savoy. More information including ticket sales and theme will be advertised soon. Tickets will be $75 for members and $85 for non-members and are inclusive of a three course meal and unlimited beer and wine.

Kim Sho

Industry Vice President [2014]

SMUCE

Society of Monash University Chemical Engineers

C/O Department of Chemical Engineering,

Building 35, Room 226

Monash University, Clayton Campus 3800

Society of Monash University Chemical Engineers (SMUCE) 2014 Committee

President	William Huggett
Vice President (Social)	Alexandra Gummer
Vice President (Academic)	James Cavallo
Vice President (Industry)	Kim Sho
Treasurer	Ilia Lyamin
Secretary	Georgia Jaffray
4th Year Reps	Fatema Abbas Husain Monica Montanaro Timothy Cottew
3rd Year Reps	Cameron Ekins Alex Grufas Jason Wu
2nd Year Reps	Laura De Rango Michael Lam James Ng
SMUCE office	located opposite the E1-E3 lecture theatres (ground floor of Building 32)
Email	smuce@monashclubs.org
Check out SMUCE on	Facebook

Connecting Monash Chemical Engineering students with Industry

The Society of Monash University Chemical Engineers (SMUCE) is the student organisation responsible for linking together industry, the Monash Chemical Engineering Department and Monash students. Throughout the year, SMUCE invites industry members to talk to students about their company, being a chemical engineer and to inform students about possible career opportunities. There are also promotional opportunities available such as listing in the **SMUCE 2014 Careers Guide**. If your company would like to connect with SMUCE and Monash Chemical Engineering students, please contact Kim Sho, Industry Vice President.

Kim Sho

Industry Vice President [2014]

SMUCE

Society of Monash University Chemical Engineers

C/O Department of Chemical Engineering,

Building 35, Room 226

Monash University, Clayton Campus 3800

The Department welcomes the following new HDR students starting their degree [April —July 2014]

PhD:

- **Miss Yan Liang** [Supervisors: Prof Huanting Wang and Dr Xinyi Zhang] **Research Topic:** Facial synthesis of palladium-based alloy nanoparticles for hydrazine electrooxidation
- **Ms Praveena Raj** [Supervisors: Dr Warren Jeffrey Batchelor and Prof Gil Garnier] **Research Topic:** Green recyclable membranes for ultrafilration
- **Ms Hui Zhu** [Supervisors: Prof Aibing Yu and Dr Shibo Kuang (external)] **Research Topic:** Particle Fluid Flow in Microchannel
- **Ms Yuan Wang** [Supervisors: Prof Aibing Yu and Dr Kaiwei Chu (external)] **Research Topic:** CFD-DEM Modelling of Particle-Fluid Flow in Human Body
- **Mr Zhaoyang Li** [Supervisors: Prof Aibing Yu and Dr Shibo Kuang (external)] **Research Topic:** Modeling and analysis of blast furnace (BF) ironmaking processes for improving energy efficiency
- **Mr Zheng Qi** [Supervisors: Prof Aibing Yu and Dr Shibo Kuang (external)] **Research Topic:** Application of lattice-Boltzmann (LB) model for nanofluids based on GPUs
- **Miss Ranwen Ou** [Supervisors: Prof Huanting Wang and Dr Jianfeng Yao] **Research Topic:** A novel forward osmosis membrane: high flux PES-SPPO membrane as support layer
- **Miss Qianqian Shi** [Supervisors: Associate Professor Wenlong Cheng and Prof Malin Harindhu Premaratne (Electrical & computer Systems Engineering)] **Research Topic:** Tailoring Sizes and Shapes of Nanoparticles for High Electrocatalytic Selectivity and Activity
- **Mr Zyad Al-Mohammed** [Supervisors: Associate Professor Cordelia Selomulya, Professor Huanting Wang and Professor George Simon (Materials Engineering)] **Research Topic:** Sustainable fabrication of functional nanostructured composites for potential membrane applications

Masters:

- **Ms Uthpala Manavi Garusinghe** [Supervisors: Dr Warren Jeffrey Batchelor and Prof Gil Garnier] **Research Topic:** Production of composites using nanoparticles and its effect on mechanical testings.

Congratulations to the following HDR student who completed their degree [April — July 2014]

PhD:

- **Dr Yi Chen,** Thesis Title: "Design and applications of plasmonic superlattice nanomembrane" [Supervisor: Wenlong Cheng]
- **Dr Yue Tang,** Thesis Title: "Functional nano-metallic electrodes for applications in electrocatalysis and flexible electronics" [Supervisor: Wenlong Cheng]
- **Dr David Robert Ballerini,** Thesis Title: "Thread as a substrate for microfluidic diagnostics" [Supervisor: Wei Shen and Bradley Ladewig]
- **Dr Dominic Agyei,** Thesis Title: "Bioprocesssing and immobilization of cell envelope proteinases from Lactobacillus delbrueckii subsp. lactis 313, for protein degradation" [Supervisor: Dr Lizhong He, Dr Michael James, Dr Ravichandra Potumarthi and Dr Michael Danquah]

Company participation?

Would your company like to offer any of the following?

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

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

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