

ChemEng *focus*

TEACHING AND RESEARCH NEWS FROM THE
DEPARTMENT OF CHEMICAL ENGINEERING,
MONASH UNIVERSITY

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DAIRY INNOVATION  AUSTRALIA

Alumni Awards 2009

Over 220 people turned out to celebrate the annual Faculty of Engineering Alumni Awards at the Clayton campus. This was the second year that the alumni event was run. Engineering alumni were able to reconnect with former classmates and establish new friendships and networking opportunities.

The evening started with short speeches by the Dean, Professor Tam Sridhar, the Chair of the Monash Engineering Foundation, Dr Peter Rogers, and Tim Leach, president of the Monash Engineering Student Society. All speakers encouraged those present to become involved with their alma mater and contribute to the education of a new generation of Engineering graduates.

The presentation of the Alumni Awards was a highlight of the evening. Two key winners were from Chemical Engineering. **The “Alumni of the Year” award went to Frank Miller**, and was accepted by his son Craig Miller (see photo). Frank Miller was one of the earliest graduates in Engineering from the Clayton Campus. He had an outstanding international



Prof Paul Webley (left) presenting the “Alumni of the Year” award to Frank Miller’s son, Craig Miller (right).

career, reaching CEO and Director level positions within Australia and overseas. He is a distinguished leader, has overseen major export programs involving significant capital investment, worked with various levels of government to develop and restructure business, redevelop disused sites and he has taken great pride in creating jobs and the development of people. Although retired, his leadership continues today in his community interest.

The “Early Career Alumni” of the year went to Dr Jenny Ho. See page 2 for her biography. Congratulations to both of our alumni winners.

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2009 Early Career Alumni - Dr Jenny Ho

Dr Jenny Ho has distinguished herself as a researcher who is filled with passion, enthusiasm and excitement for her work. Dr Ho completed her doctoral dissertation on the topic "Synthesis of Inorganic-Biodegradable Polymer Composite Microspheres for Controlled Delivery of a DNA Prime-Protein Boost Vaccine", a research which has very immediate and eminent applications for the future use of DNA molecules as human therapeutic vectors.

Jenny is innovative and productive and has established enviable academic



Prof Paul Webley (left) presenting the "Early Career Alumni" award to Dr Jenny Ho (right).

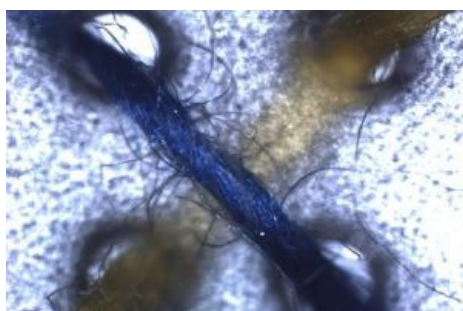
credentials through the publication of numerous internationally recognised journal papers, conference papers and awards. In 2008 she won the Schlumberger Faculty for the Future Fellowship, a prestigious international award which was presented to role models and talented women in science and engineering.

Jenny was a Senior Research Fellow in the Dept of Chemical Engineering, and is about to take up a new post-doctoral position with Prof. Hsueh-Chia Chang at the University of Notre Dame, Pennsylvania, USA.

Thread as a versatile material for low-cost microfluidic diagnostics

Wei Shen and colleagues have reported **the first use of ordinary cotton thread and sewing needles to literally stitch together a microfluidic analytical device** — microscopic technology that can transport fluids for medical tests and other purposes in a lab-on-a-chip. The chips shrink room-sized diagnostic testing equipment down to the size of a postage stamp, and promise revolutionary applications in medicine, environmental sensing, and other areas.

Low-cost "lab-on-a-chip" diagnostic tests has become an attractive area of research. Existing devices require etching microscopic channels onto slivers of silicon, glass, ceramics, or metal in a costly, complicated process. Wei Shen's team set out to find an alternative, and did so with cotton thread, which wicks fluids



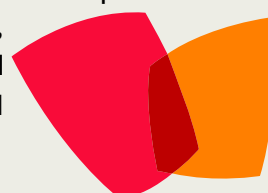
Close up image of cotton thread.

along its tiny fibers.

They stitched thread into paper to form microfluidic sensors capable of detecting and measuring substances released in the urine of patients with several human medical conditions. "The fabrication of thread-based microfluidic devices is simple and relatively low cost because it requires only sewing needles or household sewing machines," Wei Shen said. "Our results demonstrate that thread is a suitable material for fabricating microfluidic diagnostic devices for monitoring human health, environment and food safety,

especially for the population in less-industrialized areas or remote regions."

An advantage of using thread or thread with other porous materials such as paper to fabricate microfluidic devices is that these devices can be fabricated with basic tools; the reliance on modern equipment is reduced. Certain simple devices may even be fabricated by a skilled work force within the textile industry in developing regions. The low-cost, flexible and versatile nature of thread will allow this ancient material to have new applications in disposable microfluidic devices, advanced textile and personal care products, healthcare, and environmental sensors.



Professor Wenlong Cheng joins the department

We would like to welcome Associate Professor Wenlong Cheng to Monash. Wenlong earned his Bachelor of Science degree in chemistry from Jilin University (China) and his PhD in physical chemistry from the Chinese Academy of Sciences (China). His doctoral research focused on the innovative topics on electrochemical nanotechnology including nanoparticle-mediated electron transfer, nanoparticle-modified electrode, confined self-assembly, and Plasmonics.

Prof. Cheng has previously held a position at the Max Planck Institute of Microstructure Physics in Germany and his most recent position was at Cornell University in the Department of Biological and Environmental Engineering.

Wenlong moved to Australia and joined Monash in February 2010. His research interests include electrochemical nanotechnology, nanomaterials (including ordered nanoporous materials, zero- and one-dimensional materials), nucleic acid engineering, and bio-directed nanomaterials synthesis. Prof. Cheng has published 25 articles in well-respected peer-reviewed



journals including *Nature Materials* and *Nature Nanotechnology*, and has been awarded a US patent. He is also the author of three book chapters.

Prof. Cheng's main research goal at Monash University is to build a nanobiophysics research program by

combining advanced nanotechnology with biotechnology. In particular, he will concentrate on the design and development of next-generation nanobiomaterials for soft, implantable energy-harvesting devices for energy and environmental applications. He is currently seeking bright students to join his lab to work on a few exciting projects in the nanobiotechnology field.

Wenlong will also teach our undergraduate students in CHE3161 Chemistry and Chemical Thermodynamics, and contribute to CHE4162 Particle Technology.

Finding the good oil in waste wood

A team from the engineering and arts faculties will develop a system to produce competitively-priced chemicals and alternative diesel fuels from second-generation feedstocks such as waste construction wood and plantation residues.

Professor Gil Garnier from the Department of Chemical Engineering and Associate Professor Damon Honnery from the Department of Mechanical Engineering will lead the three-year \$1.4 million project, which has been funded by the Federal Government Department of Resources, Energy and Tourism and the Renewable Oil Corporation.

The team will develop a pyrolysis biorefinery at the Clayton campus to produce the alternative fuels.

The subsequent fuels will then undergo a series of engine and vehicle tests as well as be examined for their ability



to provide carbon, energy and financial savings to ensure they are sustainable for commercial use.

The research is a major step forward in the ongoing development of alternative fuels for the transport sector. Professor Garnier said

the Monash team was one of only a few in the world capable of conducting the research.

"Our team has the necessary skills to research and develop alternative fuels from the feedstock right through to their point of use in a vehicle," Professor Garnier said.





New research into 'greener' coal

Monash University will lead three new Victorian Government-funded research projects focused on developing new technologies to cut greenhouse gas emissions from brown coal.

Monash University researchers Associate Professor Sankar Bhattacharya from the Department of Chemical Engineering and Associate Professor Alan Chaffee from the Department of Chemistry will lead the multi-partner projects.

The project will investigate whether carbon from Victorian brown coal can be used to capture carbon dioxide from coal and gas-fired electricity generation ready for storage and whether Victorian brown coal can be heated and chemically treated to be like coking coal, which is used in the production of steel. In addition, the project will study the gasification of brown coal and ways to improve the synthetic gas produced to develop exportable and value-added products.

Associate Professor Bhattacharya said the projects reflected the strong international interest in brown coal and the Victorian gov-



ernment's efforts for cleaner and more efficient utilisation of brown coal. The projects will provide training for three postgraduate students and a number of undergraduate students.

"The funding commitment shows that Monash is leading the way when it comes to brown coal research," Associate Professor Bhattacharya said.

The commitment of more than \$700,000 to drive energy resources innovation and find new and cleaner ways to use brown coal was made by Victorian Premier John Brumby in the La Trobe

Valley earlier this month.

"A clean environment is crucial for a strong future and that's why our Government is committed to making Victoria a leader in energy-sector innovation," Mr Brumby said.

Japan's Kyushu Electric Power Company (KEPCO) is contributing \$250,000 a year for the next three years to complementary projects based in Japan that will also research Victorian brown coal in association with Monash researchers.

Project partners include HRL Developments, CSIRO, Auschar and the University of Melbourne.

Masters thesis award

The 2009 "Vice-Chancellor's commendation for Masters thesis excellence" was awarded to Ms. Shan Liu. Shan's project was supervised by Dr Michael Danquah, and looked at the development of a polymeric system for in vivo delivery of a model DNA-based malaria vaccine candidate. DNA vaccines show better immunological and socio-economic merits than conventional vaccines, but have routinely failed human clinical trials due to the difficulty of delivering intact DNA molecules to cells.



Shan's work resulted in the formulation of smart polymer microparticles, capable of protecting DNA molecules from premature degradation in order to improve the efficacy of DNA vaccines in general.



Meet our undergrad students.

‘Stoney’ Wang

Bachelor of Chemical Engineering

Stone is currently studying Chemical Engineering at Monash University's Clayton campus. He was attracted to Monash because of the various options available to students and the university's good international reputation.

"Studying something that is so closely related to industry and problem solving is always worth spending time on in my opinion. Chemical Engineering is relevant to almost all the other branches of engineering. I am extremely motivated by the idea of developing and commercialising future energy solutions such as solar power, liquefied hydrogen and fuel cells. Chemical Engineering provides a good foundation in these sorts of technologies," Stone says. Within Chemical Engineering, Stone is specialising in nanotechnology, an exciting field that will undoubtedly become very prominent in the future. Outside of university, Stone keeps occupied by volunteering wherever possible. He is particularly active with Engineers Without Borders.



As an international student, Stone has found that Melbourne is full of friendly and diverse people. Stone has also enjoyed the challenges associated with being completely independent. After graduating, conducting research overseas is on the horizon for Stone. "I will try to gain one to two years of industrial experience in Australia and then would like to do some sort of research

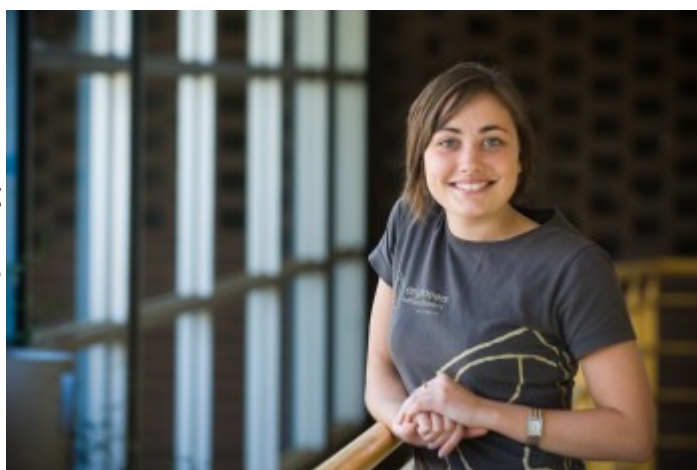
Alison Slater

Bachelor of Biomedical Science and Bachelor of Chemical Engineering

Alison is studying one of the many double degree combinations on offer at Monash, a Bachelor of Engineering (Chemical) and a Bachelor of Biomedical Science. "Maths was always my thing, as was science, but I also want to be able to make a positive impact with my career and engineering will allow me to do that".

Alison says that the opportunities at Monash are fantastic. "Being accepted for a really interesting research project has been a highlight for me. It involves studying enzymes which could eventually be applied to the healing of spinal injuries - it's challenging and so exciting!"

Getting involved and making a difference is important to Alison. "I am currently the president of Engineers Without Borders at Monash. We do all sorts of community activities including assisting in the production of a biodiesel plant on campus, helping to fix computers to give to underprivileged students and sending engineering



textbooks to students in Afghanistan."

Volunteering overseas after graduating is on the horizon for Alison. "I plan to volunteer as a chemical engineer, possibly in the water and sanitation area."





Alumni Profile: John Sanderson

PhD in Chemical Engineering

Graduating Year: 2002

Senior Environmental Engineer, Earth Systems

I did my PhD on fluidized beds with Professor Martin Rhodes, and finished in 2002. Upon completing my PhD, I moved on to a Post-Doctoral fellowship at CSIRO in an area directly related to my PhD studies. After several years at CSIRO undertaking research in brown coal gasification and consulting to the mineral processing industry, I moved into the renewable power, greenhouse and energy auditing space, in which I continue with my present role at Earth Systems.

Assisting a diverse range of organisations (everything from large mine operations and chemical process plants to commercial banks and historic buildings) with energy efficiency



improvements and GHG emission reductions is a challenging and dynamic process. Achieving tangible benefits requires much more than “desktop” consulting, it requires a hands-on approach working with engineers and managers on site to understand the day-to-day challenges relevant to their particular industry and

circumstance.

Looking back, I feel it was the excellent technical support and the availability of large-scale research equipment at Monash Chemical Engineering during my PhD that gave me a good grounding in the practical and hands-on aspects of engineering and has led to my confidence in going beyond the bounds of many consultants and getting my hands dirty in the field. My recent involvement in the design and operation of biomass pyrolysis and gasification processes has included some very challenging technical problems but has also resulted in some great design

solutions.

With growth in the Cleantech sector continuing, recent work has taken me to Japan, Europe, North America and Papua New Guinea. However, living in a small country town (and “telecommuting” regularly) it is projects in regional Australia which I enjoy the most.

Would you like to be featured in a future Alumni profile issue? Please email lilyanne.price@eng.monash.edu.au

First paper “dipstick” test for determining blood type

Prof Gil Garnier, Director of the Australian Pulp and Paper Institute, and colleagues have reported the development of the first 'dipstick' test for instantly determining a person's blood type at a cost of just a few cents. Their test involves placing a drop of blood on a specially treated paper strip and could be a boon to health care in developing countries. The test also could be useful in veterinary medicine, for typing animals' blood in the field.

Determining a patient's blood type is critical for successful blood transfusions, which save millions of lives each year worldwide. There are four main blood

types: A, B, AB, and O. Use of the wrong blood type in a patient can be fatal. Current methods for determining blood type require the use of sophisticated instruments that are not available in many poor parts of the world.

Gil's prototype paper test strips are impregnated with antibodies to the antigens on red blood cells that determine blood type. In lab tests using blood samples from human volunteers, the scientists showed that a drop of blood placed on the strip caused a color change that indicated blood type. The results were as accurate as conventional blood typing. The new paper test could promote health in developing countries.

NEWS in brief.....



- Congratulations to our recent PhD graduates (Dec 2009 – April 2010): Chrestella Wardjiman (supervised by Prof Rhodes), Nicky Eshtiaghi (supervised by Dr Hapgood), & Mohammad Mohidus Samad Khan (supervised by Prof Garnier.)
- Congratulations to our recent Masters graduates (Dec 2009 – April 2010): Lin Wang (supervised by A/Prof Shen), & Zhe Liu (supervised by Prof Chen)
- Dr Karen Hapgood, Dr Cordelia Selomulya and postgraduate student Yuan Fang gave a “virtual” presentation at the World Congress of Particle Technology in Germany in April, after the volcanic ash cloud prevented their attendance. Instead, they sent over a quicktime movie of their slides and talk, which was enjoyed by the delegates who managed to attend.
- Dr Lian Zhang, Ms Niken Wijaya and Dr Rosalie Hocking (Monash Centre for Synchrotron Science), were successful in securing funding from an ARC LIEF grant and from the Australian Synchrotron to use high-energy X-ray Adsorption Spectroscopy (XAS) at Australian National Beamline Facility (ANBF) in Japan, to quantify the oxidation state of potentially toxic chromium in coal fly ash. They will travel to Tsukuba Japan in June .
- Rajprathab Gopiraj won the 2009 Pratt Prize for the best undergraduate design project in Victoria. Entries from Monash, Melbourne and RMIT were reviewed by a panel of experienced industry judges working in operations and design roles. The award was presented at the JVCEC annual student design night in May.
- Prof Dong Chen has been invited to give a plenary presentation at the 10th Netherlands Symposium on Process Technology (NPS10), which will be held October 25 -27.
- Congratulations to Kate Malcolm, department secretary, on her lovely wedding this month to Craig Jones
- Congratulations to Wren Schoppe, Undergraduate Affairs Advisor, on the birth of her daughter Izabel.

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