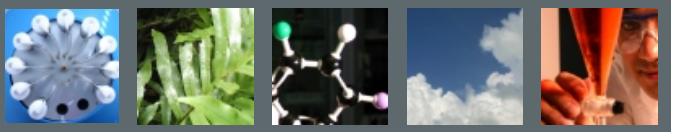
Green Chem in Oz



Centre for Green Chemistry Newsletter #13 Jun 2005

From the Director

Professor Milton Hearn

Over the past months, the Centre has welcomed four new staff members - two post-doctoral fellows, Dr Phei Lok and Dr Chunfang Zhang and two Research Assistants, Ms Eva Campi and Mr Kirk Truong. The Centre also welcomes five new postgraduate students, Shahana Chowdhury, Yvette Cole, Nayana De Silva, Bandar Fadhel and Agron Mataj. All of these new members of the Centre have made excellent starts with their projects.

Dr Carsten Voss from the University of Bielefeld, Germany, visited the Centre for two weeks in February. During this time, he gave four seminars regarding new facets of the production and purification of pDNAs destined for therapeutic applications. This exchange is part of our collaboration with the Centre for Fermentation Engineering at the University of Bielefeld, who are utilising the advanced "green" separation technologies developed here at the Centre for Green Chemistry. In addition, Ms Tanja Vollmer, a Bielefeld student, spent six months at the Centre for Green Chemistry studying towards her Diploma as part of a collaborative project.

Dr Xian-jun Bi

Dr Xian-jun Bi, an academic from the Chemical and Engineering College, Yunnan Normal University, Kunming, China, spent five months from November 2004 to March 2005, at the Centre as a visiting scholar. In collaboration with Luke Higham, Dr Janet Scott and Dr Chris Strauss, he explored applications of microwave heating to the synthesis of organic compounds in water.

Professor Tom Goodwin

We were very pleased to welcome Tom Goodwin, Professor of Chemistry, Hendrix College, Arizona, USA, on a short visit to the Centre. Tom presented an excellent seminar on "Green Chemistry and Grey Elephants", describing his work in developing a green organic chemistry curriculum for Hendrix College, as well as highlights of his work in elephant conservation. Tom specialises in the study of elephant pheremone communication and is a passionate advocate of green chemistry.

In November the Centre hosted a half day Seminar, sponsored by John Morris Scientific, on microwave technology. Dr Chris Strauss presented a lecture on the development of microwave chemistry whilst Mr Camillo Pirola from Milestone mls (Italy) showcased a range of commercially available equipment to participants from academia and industry.

In December, the Centre was well represented at the Annual Synthesis Symposium held at Melbourne University. Mr Luke Higham delivered a student lecture whilst posters were presented by Ms Moira Tucker, Ms Marilena Giarrusso, Mr Anthony Rosamilia (2), Mr Philip Wallis and Ms Katrina Booth. Concurrently, at the RACI's 12th Analytical and Environmental Division Symposium held at RMIT, Ms Isidora Freris delivered a poster on her research on the separation of chiral alcohols. A few days later, at the 3rd Australian New Zealand Soils Conference held at the University of Sydney, Mr Wallis presented a lecture entitled, "Transformation Catalysed by Clays: Model Reactions for Carbon Sequestration in Soils".

All of our research collaborations with industry have proceeded on schedule with key milestones achieved over the past months. In a subsequent newsletter, I will highlight how this nexus between the discovery aspects of the Centre's research program, its applied dimensions and translation to industrial application are assisting the centre achieve its Mission.

Milton Hearn

Green Chemistry Symposium

A very successful Symposium was held in the Shine Dome of the Australian Academy of Science on 20 April. Over one hundred enthusiastic participants representing senior management in industry, government and academia attended and heard a series of stimulating presentations from international speakers, Professor Paul Anastas, one of the founders of the Green Chemistry, Dr Everett Baucom and Dr Joseph Timko from US industry, Professor Pietro Tundo from the INCA consortium, and Professor Chris Adams and Mr Malcolm Wilkinson from the UK. Australian industry was widely represented together with speakers from CSIRO and ANSTO.

All of the speakers emphasised the importance of Green Chemistry and in a lively discussion session highlighted areas where the need for Green Chemistry initiatives was imperative. Details of all of the presentations can be found on the Centre's website.

Centre for Green Chemistry PO Box 23, Monash University, Victoria 3800, Australia
Tel: +61 3 9905 4547 Fax: +61 3 9905 8501
Email: green.chemistry@sci.monash.edu.au Web: www.chem.monash.edu.au/greenchem

MONASH University

Speakers at the Green Chemistry Symposium - representating academia, government and industry from Australia, UK, USA and Italy.

Staff Profile - Dr Jamil Chowdhury

Dr. Jamil Chowdhury, a post-doctoral fellow in the Centre, holds the degrees of MSc in Organic Chemistry from Dhaka University, Bangladesh, and PhD in Industrial Science from Kumamoto University, Japan. His doctorate research involved the development of thermotropic, highly ordered silica-supported comb-shaped polymer sorbents for HPLC application. With this new class of polymer-based materials, separation selectivities of non-polar and polar compounds can be very rationally fine tuned, depending on the temperature used. After a visit to Monash University as part of a research collaboration between the Centre for Green Chemistry (Prof. Milton T W Hearn) and Kumamoto University (Prof. Hirotaka Ihara) Jamil realized that the Green Centre would be the ideal place for him to practice his knowledge and extend his experiences. He thus decided to peruse his career under the supervision of the Director.

Jamil has undertaken further training at Kyoto University, Japan and has been involved in several projects of commercial sensitivity within the Centre for Green Chemistry, including the development of molecularly imprinted polymer (MIP) technology within this Centre. Polymers prepared with this technology have a specific 'memory' since they recognize the target molecules with high selectivity. Jamil is currently involved in several projects that include capillary-based separation, such as CEC or micro-HPLC, or downstream purification of biopolymer using imprinted monoliths. The projects further underline the applications of these monoliths to the next generation of state-of-the-art lab-on-a-chip technologies, as part of the commitment of the Centre to minimise waste generation in chemical analysis and synthesis.

Student Profile - Yang Yuanzhong (William)

William's PhD project involves the development of novel capillary electro-separation techniques coupled with electrospray ionisation mass spectrometry (ESI-MS) for the analysis of biomolecules. Compared to traditional HPLC or polyacrylamide gel electrophoresis methods, these new techniques not only offer excellent and complementary selectivity and much higher separation efficiencies but the consumption of solvents, reagents and samples is also significantly reduced. The approach developed, moreover, allows the use of hazardous solvents and reagents to be minimised or completely avoided through the application of "green solvents", such as ethanol, and other reagents of low toxicity. It is expected that these techniques will have a great potential for future applications in biology, drug discovery and biotechnology.

William obtained his Bachelor of Chemical Engineering from East China University of Science and Technology in 1990, and master degree in chemical engineering from Beijing University of Chemical Technology in 1995. During this period, he gained broad experiences in microbial fermentation, laboratory scale separation and purification of biomolecules. He is undertaking his PhD research under the supervision of Professor Milton Hearn and Dr Reinhard Boysen. So far his PhD project has been quite successful with four papers already published in high impact international journals and another two are on their way for publication. He plans to present aspects of his work later this year at the 25th ISPPP (International Symposium on the Separation of Proteins, Peptides & Polynucleotides) in St. Pete Beach, Florida, USA (2005). William is currently in the final stages of experimental work associated with his project and is also writing his thesis. He intends to pursue an academic career in Australia after finishing his PhD.

Visit to Cape Town, South Africa

In late March/early April, Janet Scott visited the Department of Chemistry, University of Cape Town (UCT), South Africa, as a guest of the department, under UCT's "visiting scholar" program. Two of the goals of this scheme are a) to allow development of collaborative research projects and b) to expose UCT students to expertise/research of scientists from institutions outside of South Africa. Formal presentations/lecture courses may be requested but are not a requirement of the award.

Seminars describing recent Green Chemistry research emanating from the Cleaner Synthesis Technology group in the Centre for Green Chemistry were presented at both UCT and the University of Stellenbosch and were well attended by students and faculty. In addition a research group seminar, focused on functional and guest-responsive crystals was presented to the Supramolecular Research Unit some of whom are pictured, at lunch below.

UCT Supramolecular Research Unit.

Left to right: Kirsten Corin (PhD student), Siyanda Lubhelwana (PhD student), Dr Tanya le Roux (postdoctoral fellow), Lesego Moitsheki (PhD student), Gael Ramon, A/Prof. Susan Bourne (Research Director), Prof. Luigi Nassimbeni (retired), Haliema Samsodien (PhD student), Vincent Smith (PhD student), Dr Hong Su (crystallographer). Missing: Welcome Mhlongo, Prof Mino Caira.

Many informal discussions with postgraduate and honours students followed the seminars and, in many cases, students just "dropped in for a chat" about green chemistry and possible implications for their own research.

A collaborative research project was developed and Mr Lesego Moitsheki, under the direction of A/Prof. Susan Bourne, has begun to explore complexation of transition metals by some of the ligands produced using Anthony Rosamilia's novel multi-component reaction for the preparation of substituted anilines. The goal is to prepare novel layered metal-organic crystalline complexes. UCT has a prototype of a "levitating balance" apparatus for measuring absorption of vapours in a sealed chamber and some exciting results were obtained that point to the absorption of solvent vapours by some members of the new class of macrocycles developed in the CGC, named Horning-crown macrocycles. To facilitate further exchanges of ideas and personnel, and thus propagate collaborative projects, an application for funding student exchange between S. Africa and Australia was developed and submitted and formal mechanisms will be explored.

Strap: Scientists in Grain

Cassie Schefe (PhD student)

Plants need phosphate for growth but in much of Australia this essential element is "locked up" in acidic soils. So, finding the key to releasing this resource could present Australian agriculture with huge advantages, says soil chemist, PhD student and Grains Research Scholar, Cassandra Schefe. Cassie is currently examining ways to reduce phosphate lock-up and improve the economic efficiency of phosphate fertilisation.

"Acidic soils reduce plant availability of nutrients such as phosphate. If we can increase the effectiveness of phosphate application by even 10 per cent, it will provide a huge benefit environmentally and economically to farmers in Australia," says Cassie. "It will reduce environmental issues to do with excess fertiliser use, but also reduce costs as less fertiliser will need to be bought. On several levels, the possible research outcome is very good. It's not pie in the sky stuff. The problem for Australia is twofold; not only does the nation have a range of areas affected by soil acidity, but some farming practices also make soils more acidic. My work is looking at ways we can tap into this resource of locked-up phosphate, while also looking at ways that applied phosphate can be better utilised," she says.

Cassie is examining the use of naturally derived products, such as organic carbon compounds, in the hope they can reduce phosphate lockup. Work to unravel these mysteries has seen her travel to Naples, Italy as part of a cooperative agreement between Monash University's Centre for Green Chemistry and the regional government of Campania. During her three-month study trip, Cassie worked under the guidance of Professor Piccolo of the University of Naples, a scientist who is well known for his structural and chemical characterisation of humic substances and organic materials.

"It was a wonderful opportunity," she says. "As well as tapping into their knowledge base, I was able to use instruments not readily available in Australia. Overall, it was fantastic, I learnt how to use different equipment and focus on the fundamental chemistry of soil-phosphate interactions."

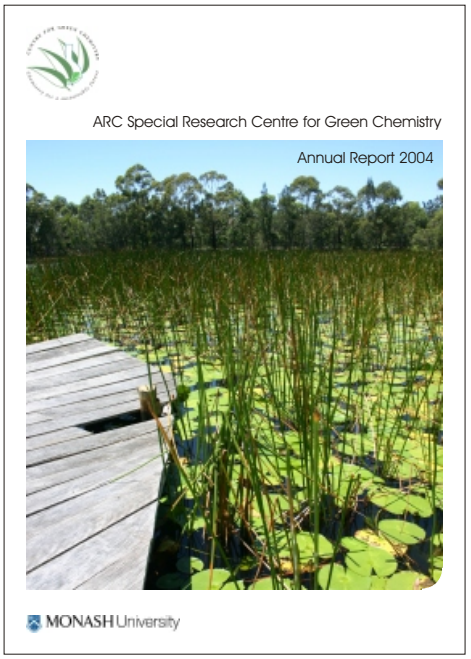
Ms Schefe was also able to attend the EuroSoils conference in Freiburg, Germany on a GRDC travel grant, where she presented her work. "I love the questions posed by soil," she says. "We know so little about it, it's a challenge to find out what's going on." Cassie, who completed her agricultural science degree at Melbourne University in 1999, hopes to move into senior research roles in the future. "But as long as I can stay actively involved in hands-on research, I'll be happy." However, she believes there is a need for researchers and graingrowers to work more closely together. "Both sides need to see what the big picture is and work together for economic and environmental outcomes. There also needs to be more streamlining between research organisations to utilise the research capability we've got in the best way." For the moment, Cassie, who is based at the Department of Primary Industries Rutherglen Centre, will concentrate on completing her PhD through the Centre for Green Chemistry under the guidance of Dr Tony Patti.

"We still need to answer structure and functionality questions. We are looking for key things that govern why organic materials interact with phosphate in different ways, based on their chemical characteristics. This information will be used to identify ways to increase the efficiency with which we manage our soil phosphate resources," she says.

New Research Highlights

Updates on a number of projects have been published in the Centre for Green Chemistry's Annual Report for 2004.

Available for download from our website, or contact the Centre for a free hard copy.



phone: +61 3 9905 4547 fax: +61 3 9905 8501
email: green.chemistry@sci.monash.edu.au
website: www.chem.monash.edu.au/greenchem