

## From the Director



**Professor  
Milton Hearn**

Over the past several months, we have all experienced significantly higher prices at the petrol pump. Does this development foreshadow the start of the post-petrochemical era for the chemical industry? This possibility raises an obvious set of questions. Are well-developed economies now more dependent on oil than they were 25 years ago? If so, what needs to be done globally at a scientific level to rectify this situation and to provide solutions as oil and natural gas reserves become depleted? What are the technological and societal constraints on the continued economic growth of highly industrialised countries with advanced tertiary economies that draw most of their capabilities from advances in the chemical industry, as well as all other less developed countries, which lack this infrastructure, if petroleum prices were to triple or increase by ten-fold as some commentators suggest? Despite the high cost of \$US 50 plus per barrel that currently prevails, in terms of relative costs and allowing for inflation, oil is less expensive today than it was in the 1970's. An inevitable consequence, in keeping with Malthusian concepts of human behaviour and population growth, is that lower costs translate to greater usage. In the petrochemical economy driven by oil and gas, there can be little doubt that well organised Western countries have achieved higher gross domestic product per barrel of oil or Gbtu of natural gas that they did in the 1970's. These gains reflect improved efficiencies, better technologies and enhanced distribution networks. These outcomes create the impression that technology advances have allowed us to consume less oil or gas, when measured against an objective economic unit such as GDP. Following this argument through leads to its conclusion that there may not be any need for immediate concern since further technology enhancements in oil and gas recovery and conversion will arise to provide the products that the world's population has grown accustomed to use. To some extent this may be true, but can we take the chance? Therein lies the challenge. For example, North America, Western Europe and Japan consumed 16 million, 12 million and 4 million barrels a day in 1970, yet today these numbers are in excess of 22 million, 15 million and 6 million barrels a day respectively. What form will the chemical industry take over the next two decades in light of this increased consumption, aging plant and infrastructure, the prospect of depletion of the oil and gas supplies and the consequential much higher price structures for their "raw" materials. To accommodate these developments in consumer needs and expectations, a paradigm shift in production sustainability in chemical

synthesis is required, based on a mix of petrochemical and non-petrochemical feedstocks. This challenge can be addressed through the application of more benign synthetic approaches, the greater utilisation of bioconversion technologies that mimic the natural manufacturing cycle, avoidance of waste generation and the use of alternative feedstocks derived from sustainable agricultural practices, e.g. through the application of Green Chemistry strategies and technologies. As part of its alignment with these imperatives, the Centre has had the pleasure over the past several months to host two eminent chemists, who are committed to these issues. We were thus fortunate to be able to gain first hand from these visits additional insight into key areas of developments internationally.



**Dr Paul Anastas**

Firstly, Dr Paul Anastas, formerly of the White House Office of Science and Technology Policy, and recently appointed the Director, Green Chemistry Institute, based in Washington, D.C., attended his first Advisory Committee meeting of this Centre. His contributions will be invaluable as the Centre rolls out its Strategic Plan over the next several years.

Based also on the outcomes of a very successful visit from Prof. Robert Grubbs, from Caltech and internationally known for his seminal contributions in the field of novel catalysts, an expanded collaboration is being developed, exploring the interface between green renewable substances and metathesis leading to commercially important products.



**Professor  
Robert Grubbs**

Finally, I would like to congratulate the recipients of this year's *Director's Awards for Research Excellence*. These awards were made to Corrie Bos-Van der Zalm and Luke Higham (two talented Postgraduate Students supported by the Centre) and Drs Rachel Daly and Reinhard Boysen (two of the dedicated Post-doctoral Fellows working in the Centre).

**Milton Hearn**

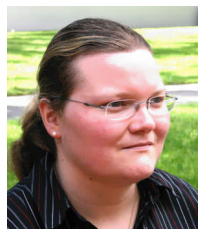
*Information about Luke Higham and his research project is included overleaf. Profiles on the other award recipients will be included in a subsequent newsletter.*

## Centre for Green Chemistry Director's Awards for Research Excellence 2004

Professor Milton Hearn congratulates the award recipients, pictured left to right: Dr Reinhard Boysen, Dr Rachel Daly, Corrie Bos-Van der Zalm and Luke Higham.



### Student Profile - Valérie Sage



Valérie is currently a Postdoctoral Research Fellow in the Centre for Green Chemistry, working under the supervision of Dr Janet Scott and Dr Christopher Strauss. Her project involves the enantiomeric resolution of chiral alcohols. Valérie did part of her undergrad studies at l'Université Claude Bernard (France), and her honours year at Northumbria University (UK). Upon completion, she decided to start a PhD at the University of York (UK), at the Clean Technology Centre, under the supervision of Prof. James H. Clark and Dr Duncan J. Macquarrie. Her doctorate research involved the use of heterogeneous catalysts (solid acids) to promote the cationic polymerisation of vinyl monomers. This work was published in international journals and was presented at various national and international conferences.

Valérie had the opportunity to experience some aspects of green chemistry during the course of her PhD when developing a new solvent-free route for polymerisation using supported reagents. She therefore decided to continue working in the field of Green Chemistry, being really interested in a more environmentally friendly approach of chemistry.

After four years in England, Valérie decided to pursue her career in Australia, a country where she believes the public and government awareness of environmental issues has a strong impact on the development of new technologies. Also, environmentally friendly methods represent a major development goal at research centres such as the Centre for Green Chemistry.

Since December 2003, she has been working on an alcohol resolutions project that was previously started by Drs Dilek

Saylik and Nino Malic. In this research project, new resolution agents are being synthesised and used in a resolution process for a wide range of alcohols (primary to tertiary). These agents are based on carbohydrates, which are renewable, inexpensive and non-toxic raw materials, meeting some of the objectives of Green Chemistry. This technology is the subject of a patent application.

Valérie is enjoying here time in the Centre for Green Chemistry and now looks forward to a continuing career in Australia.

### Student Profile - Luke Higham

Luke obtained his Bachelor of Science with First Class Honours from Griffith University, Brisbane. His honours project involved studies into the enantioselective and environmentally friendly allylation of aldehydes to produce chiral homoallylic alcohols. He found the Green Chemistry philosophy of the project highly attractive and sought out opportunities for research in Green Chemistry within Australia. As a result, Luke moved to Melbourne and commenced his PhD studies at the Centre in September 2002 under the supervision of Dr Janet Scott and Dr Christopher Strauss. His project has involved the preparation and application of novel macrocyclic ligands using Green Chemistry principles.



Some of Luke's research has appeared this year in international peer reviewed journals (two papers in *Organic Letters* and one each in *CrystEngComm* and *Chemical Communications*) and he is a co-inventor on a provisional patent filed by the University. Luke has also presented a lecture at the *29th International Symposium on Macrocyclic Chemistry* in Cairns this July and posters at the *28th Annual Synthesis Symposium* in Melbourne in 2003 and at the *IUPAC 15th International Conference on Organic Chemistry* meeting in Nagoya, Japan, in August. Luke is beginning the third year of his PhD and intends to pursue post-doctoral studies in Japan.

### Postgraduate Scholarships

The Centre for Green Chemistry offers postgraduate scholarships for exceptional graduate students who are highly motivated to work in a team environment. Prospective candidates who hold a BSc (hons 1st class) or equivalent qualifications are encouraged to apply. These scholarships are linked to specific projects that form the current research activities within the field of green chemistry and its application to new synthetic technologies and biotechnology.

See [www.chem.monash.edu.au/greenchem](http://www.chem.monash.edu.au/greenchem) for further information, or contact us at the address below.