DEAN'S REPORT

As an established 'centre of excellence', maintaining the highest international standards for over 30 years, the RSC has concentrated on areas of research of national importance and international significance. These research activities strengthen the discipline of chemistry in Australia and lead to numerous potential applications in medicine and industry, as well as maintaining a focus on fundamental research.

The Australian National University underwent a major Quality Review in 2004. The Review was conducted by a committee of twelve internationally eminent academics. The five best publications of ANU researchers were assessed by international experts in the respective research fields. The total number of international assessors involved in the ANU Review numbered over one thousand. The Executive Summary of the Review report states in part: "On the basis of all the available evidence and our own observations, we confirm the standing of ANU within the elite "Top 100" research intensive universities in the world, even among the top 50 or so." On the basis of chemistry citations, ANU chemistry already ranked in the top 100 institutions world wide. We quote from the Review's comments on chemistry research:
The research topics of the inorganic chemistry group at the Research School of Chemistry (RSC) cover a broad range of very high standard fundamental research. The School also has strengths in synthetic organic chemistry. The creative work in supramolecular chemistry and the approach to chemo-enzymatic synthesis are at the forefront of new developments internationally.

Important areas of biological and structural chemistry are being investigated, reflecting the growing importance of organic chemistry to biological problems. The ANU has some of the world's leading researchers in physical and analytical chemistry – working on colloids and interfaces, solar energy, electron diffraction and X-ray diffuse scattering. Similarly, the theoretical and computational chemistry group at RSC is regarded as one of the best in the world.

Since it was founded in 1968, the RSC has earned seven Fellowships of the Royal Society of London. Prior to 2004, the RSC had more Fellows of the Australian Academy of Science than any other chemistry department in Australia. Continuing its outstanding record of performance and recognition in this regard, Professors Christopher Easton and Martin Banwell were both elected Fellows in 2004, bringing our total membership to fifteen. Given the rules governing elections to the Academy of Science, the election of two chemists from one School or department in any one year is quite exceptional.

Other major prizes and awards won by RSC staff during 2004 include:
To Professor Banwell the Birch Medal of the RACI, the Novartis Lectureship and the Royal Society of Chemistry's Industrially Sponsored Award for Synthetic Organic Chemistry; Professor Beckwith was awarded an "Order of Australia" in the Queen's Birthday Honours List; to Professor Michael Collins the Physical Chemistry Division Medal (RACI); to Professor Chris Easton a Fellowship of the

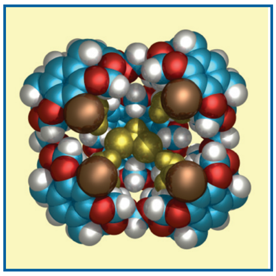
World Innovation Foundation; to Professor Denis Evans the Moyal Medal (Macquarie University) “for distinguished contributions to mathematics, physics or statistics”, and our honours year student Mr Mathew Baker has been awarded the 2004 General Sir John Monash award for excellence. This scholarship will handsomely support Matthew’s PhD research at Vrije Universiteit in the Netherlands.

The RSC has built on its previous ARC Grant successes with grant income for 2004 totalling approximately $4m with an additional $1m from all other sources (ref. page 111).

2004 Research Highlights

Work in the Protein Structure and Function Group, headed by Dr Nicholas Dixon, has revealed an unusual protein-DNA interaction. Copying of DNA molecules in cells that are about to divide requires that the two strands of DNA in the double helix are pulled apart. The process is stopped when a chromosome is completely copied because the two strands are held together tightly by a special protein called Tus. An intriguing problem that has occupied biochemists for twenty years is how this process can occur when the strands unzip in one direction but not the other. Experiments this year by Mark Mulcair and Patrick Schaeffer indicate that Tus works like a molecular mousetrap. The trap is set by the DNA unzipping process itself, and is sprung when a particular base in the DNA flips out of the double helix and wedges itself into a pocket in the surface of the protein. This unusual protein-DNA interaction, discovered by curiosity-driven research, should have many applications in biosensors and diagnostic devices.

Dr Mick Sherburn and colleagues have developed a promising new class of nano-sized containers called “superbowl” molecules that show promise for precision drug delivery. Shaped like a miniature football stadium, the molecules are capable of delivering a wide range of drugs – ranging from painkillers to chemotherapy cocktails – to specific areas of the body, potentially resulting in improved treatment outcomes and perhaps saving lives. The molecules also show promise for a wide range of other applications, including the removal of environmental toxins and aiding in chemical purification procedures.



Professor Elmars Krausz, Joe Hughes, and a team of researchers at ANU, have found that the wavelength of light needed for oxygen production is much longer than previously thought. The chemical reaction which provides energy for photosynthesis, enabling plants to convert sunlight into energy and oxygen, is the most powerful process in biology. This breakthrough overturns 20 years of thinking about the photosynthesis powerplant, sending biologists, chemists and physicists back to the drawing board. These discoveries will not only have a profound impact on our understanding and ability to control, modify and adapt natural photosynthesis, but will also extend the potential of engineered chemistry which can copy nature *via* the technique of artificial photosynthesis. Such work clearly underscores the pivotal importance of fundamental research and the need to continue to provide adequate funding for basic and enabling research in Australia.

The School is pleased to announce the formation of the new Theoretical Quantum Chemistry Group headed by Professor Peter Gill, formerly of Nottingham University, UK. Peter brings with him a postdoctoral fellow, Dr Andrew Gilbert, and three PhD scholars: Mr Darragh O'Neill, Ms Ching-Yeh Lin and Mr Siu-Hung Chien. In 1926, Erwin Schrödinger proposed that the behaviour of all matter is governed by a certain linear, second-order partial differential equation. The new group's aim is to devise and develop new methods for finding approximate solutions to this extremely difficult-to-solve equation, and to implement these within an easy-to-use software package called Q-CHEM. Such packages are helpful to other chemists, and theoretical calculations have become a valuable complement to experimental measurements.

For personal reasons, Professor Leo Radom resigned from his position as head of Computational Quantum Chemistry after 30 years. Professor Radom accepted a position in the School of Chemistry, University of Sydney, but will continue his close association with the School *via* an Adjunct Professorship.

As a result of their appointment as Fellows of the Australian Academy of Science, Chris Easton and Martin Banwell were promoted to E2 Professor. Dr David Ollis was promoted to E1 Professor, Dr Max Keniry was promoted to Senior Fellow, and Drs Yun Liu, Gloria Moyano, David Sinclair and Matthew Smith were promoted to Research Fellow. Ms Christine Sharrad received the General Staff Excellence Award for her absolutely outstanding work for the ANU Quality Review.