

The 2007 Royal Society of Chemistry Australasian Lectureship Tour - Report

Prof. Peter Schwerdtfeger

Centre of Theoretical Chemistry and Physics, New Zealand Institute for Advanced Study, Massey University Auckland, PB 102904, North Shore City, 0745 Auckland (e-mail: p.a.schwerdtfeger@massey.ac.nz)

I was absolutely delighted when Professor Graham Bowmaker (University of Auckland) told me that I was to be the 2007 RSC Australasian Lecturer. This meant that, according to the RSC web-site, I should visit (theoretically) 32 universities in Australia and 6 in NZ. Well, after some careful planning, with the kind support of Professors Allan Bond (Monash) and Graham Bowmaker (Auckland), I made it to 11 universities in Australia and 6 in New Zealand, gave in total 21 talks on 7 different research topics (although 10 topics were offered, titles such as *Nuclear Multipole Moments* and *Electric Field Gradients* somehow were less popular). Most appropriately, I set the starting line at my home university (Massey) and finished not far away from where I started, at my former University of Auckland. And here is my report.

The most popular talks were *Left or right in Nature?* and *The Quest for Absolute Chirality*. The two talks are connected, as the main theme is symmetry breaking in nature. *Left or right in Nature?* describes the preference of L-amino acids and D-sugars in life (termed biomolecular homochirality). The fundamental question is how and when did nature choose one enantiomer over the other. My first talk at the Te Manawa Museum in Palmerston North was well attended (fully packed is the right term), and the 15 minutes of discussion went well. What I really enjoyed that evening was that a number of school children attended, and even sent me e-mail messages a week later asking some very good questions. My critical comments about creationism and intelligent design, where I used a well-known phrase by Aristotle - *Contra principia negantem disputari non potest* - may have created a bit of controversy (fully intended, of course).

The talk on *The Quest for Absolute Chirality* held at the University of Queensland (Brisbane) dealt with the breaking of symmetry at the microscopic level. There is a tiny energy difference between the enantiomers of chiral molecules due to Z-boson exchange between electrons and nucleons. This is well known from the standard model, but has not yet been seen experimentally. At Griffith University, a joint chemistry/physics seminar was organized and the topic How to Pack Rare Gas Atoms was chosen. *How to Pack Rare Gas Atoms* is a very old problem dating back to Max Born in 1940, and was recently solved (and laid to rest) in our research group. Both Queensland and Griffith are wonderfully located and I enjoyed walking around the two campus sites.

The campus of the Charles Darwin University (CDU) is equally nice and, of course, located close to the famous Kakadu National Park. But science first! There are only a few chemists left at CDU and the word goes round that Darwin University does not need chemistry: Stage 1 teaching could be done by (retired) school-teachers. I find this quite

unbelievable! It is an unnecessary cost cutting exercise, especially as the mining industry in this area now recruits qualified chemists from overseas (see below). My talk on super heavy elements was well received and well organized by the local Northern Territory Branch of the RACI. The talk gave an overview over the current activities in this area, mainly the synthesis of new elements (recently 118 was produced in Dubna), and atom-at-a-time chemistry to study the chemical behaviour of these new elements. On the weekend I took a trip with my wife to Kakadu National Park, which was certainly the highlight of the tourist part. On our way back to Darwin at night by car I almost hit a 3 m long crocodile dozing in the middle of the road. My suggestion to get out of the car and to chase it off met some fierce resistance from my wife, and I gave up this interesting idea. I really like the Northern Territory.

In Sydney I gave three lectures. *The Quest for Absolute Chirality* (University of New South Wales) was held in a brand new lecture theatre, and the physics section there took the opportunity to invite me for a seminar on *Small Effects, Large Consequences: from Relativity to Electroweak Interactions*. What I find amazing is that most physicists still believe that relativistic effects are not so important for chemical and physical properties of atoms, molecules or the solid-state; I hope I put that misconception to an end. At Sydney University *Relativistic Effects in the Chemistry of Gold* was presented to a department that has a very strong theoretical and computational chemistry section, and the talk was therefore more tailored towards theory.

The last stop of my first trip to Australia was Canberra, where I had spent two years as a research fellow 18 years ago. It was nice to be back and meet many of my former friends and colleagues (and they still tell stories about me ...). Interestingly, I was told that they forgot to send an e-mail message around reminding people to attend the seminar, and I should therefore not be too disappointed if few turn up. Well, the lecture theatre was packed, with no seat left vacant; the discussion after my talk on *The Quest for Absolute Chirality* went on for a long time, and was very stimulating indeed. It was great to see some former members like Martin Bennett and Alan Sargeson asking the hard questions.

Back in NZ I gave two talks at Otago University. The theoretical group there chose *The Pseudopotential Approximation*. Pseudopotentials are the most widely used approximation for computing molecules containing heavy elements, and the talk addressed the advantages and pitfalls of this method. The physicists at Otago took the advantage to invite me to talk on *Parity Violation in Molecules*, which is really the *The Quest for Absolute Chirality* talk tailored for the theoretical physicist. On the same trip I visited Canterbury University and gave a talk on superheavy

elements.

I gave two talks in Wellington at VUW on *The Quest for Absolute Chirality* and *The Chemistry and Physics of the Superheavy Elements*. I find the chemistry and physics sections at Victoria an exciting place at the moment, with a lot of positive thinking and exciting research. Of course, this is largely due to the fact that the McDiarmid Centre of Excellence is located there, with a good number of young and excellent researchers. I also had a more political discussion with their Dean of Science (David Bibby) on the role of fundamental science in our society, which I really enjoyed. At Waikato University I gave the talk on *The Quest for Absolute Chirality*, which was well received.

My second trip to Australia started in Perth (University of Western Australia). I was impressed by the new chemistry building with its large ground floor area tiled in a Penrose pattern; in fact, the largest Penrose tiling in the world (and signed by Roger Penrose). The new lecture theatres, offices, and laboratories are carefully designed, and major equipment like NMR and X-ray facilities are state-of-the-art. The lecture choice was for relativistic effects in the chemistry of gold. Perth is a wonderful city and has a very nice botanical garden which is not to be missed.

Next stop was Adelaide with a talk on superheavy elements. In Hobart I gave two talks, one in the Chemistry Department (superheavy elements - again), and one in the Physics Department on *Kepler's Conjecture*, *Newton's Kissing Problems* and *How to Pack Rare Gas Atoms*. With the physicists there, I had some very interesting discussions on future collaborations.

Last stop was Melbourne where I gave two talks, one at Monash University (superheavy elements) and the other on *Left or Right in Nature?* at RMIT. I also participated at the Biannual Humboldt Meeting of the Australian Humboldt Association, where I gave another talk. As the NZ president of the Humboldt Foundation I delivered an after-dinner speech in which I emphasized the importance of fundamental science in our universities. As Humboldt fellows we celebrate Alexander von Humboldt as one of the true pioneers – and perhaps one of the last generalists – in the natural sciences. However, of equal importance is his brother, Friedrich Wilhelm Christian Karl Ferdinand Freiherr von Humboldt, born in 1767 two years before Alexander. He was a German linguist and philosopher, a government functionary and diplomat, founder of the Humboldt University in Berlin, and friend of both Goethe and Schiller. In his essay *On the Limits of State Action* he describes the development of liberalism and the role of liberty in the individual development and pursuit of excellence, where the state or government must not be allowed to limit these actions. What Humboldt called *the Enlightenment* is often closely linked with the Scientific Revolution emphasizing reason, science, and rationality against intolerance. It is the source of critical ideas, such as the centrality of freedom, democracy and reason as primary values to our society. Freedom to teach, the unity of teaching and research, and academic self-governance are key factors associated with his ideas. And here I come to my final (but may be most important) point.

Aside from delivering all these lectures - I gave my last talk at Auckland University on *Left or Right in Nature?* which was organized by the local NZIC Branch – I very much enjoyed talking to many of my colleagues about their current research activities, and the many difficulties they face in the current funding environment in the chemical sciences both in NZ and Australia. I carefully observed the *political* climate at each university, and met many researchers who seem not to be very happy (mildly put) with their's. Many Chemistry Departments have been turned up-side down (New South Wales and Auckland to mention but two), and others are at the brink of extinction, e.g. Darwin. There seems to be more emphasis now on materials science (*Nano* seems to be the magic word) and bio-sciences, with traditional chemistry disciplines going out the window, e.g. inorganic chemistry. I personally believe that such radical changes are quite damaging for the reputation of a university, and for the country as a whole, and I sincerely hope that most universities invest in excellence irrespectively of the research area. The future direction in many departments nowadays is determined by administrators who base their decisions on financial income, and not by (most of) the academic staff who base their decisions on excellence. Hence, a shift away from basic science to applied and even commercial science is clearly visible at many institutions, which (at least for me) is of great concern. We need to convince universities that the fundamental research of today becomes the technological application of tomorrows [see *This Journal* 2007, 71(July), 50-52]. ***If in your science you only look for business, then you risk finding neither knowledge nor business*** (Haldor Topsøe, Chairman of the Denmark-based catalysis and high-tech company). On a positive note, however, I found Otago, Sydney, and the Australian National University still in very good shape and most stimulating. They have not lost their touch with fundamental sciences, and the departments there may serve as future role models for all the others.

All in all it was a wonderful experience for me (and my wife), and I was overwhelmed with the generous hospitality everywhere. Financial support of the RSC is gratefully acknowledged. My special thanks goes to Profs. Allan Bond and Graham Bowmaker for organizing my complete lecture tour. The Royal Society of New Zealand financed my trip to Wellington, which is gratefully acknowledged. Financial support came also from the RACI and the NZIC. Finally, explicit thanks go to my hosts at each stop for their time and energy in facilitating this lecture tour: in Australia - Mark Riley, Debra J. Bernhardt and I. D. Jenkins (Brisbane), Kezia Lim and Naseem Peerzada (Darwin), David Black, Trevor Hambley, Jeff Reimers, Craig P. Marshall, and Victor V. Flambaum (Sydney), Martin Banwell (Canberra), Tak Kee and Michael Bruce (Adelaide), Sue Berners-Price (Perth), Paul Haddad and Peter Jarvis (Hobart), Alan Bond and Helmut Hügel (Melbourne); in New Zealand - Mark Waterland (Massey), Sally Brooker and Jevon Longdell (Otago), Jan Wikaira (Canterbury), Kate McGrath (VUW), Michele Prinsep (Waikato), and Graham Bowmaker, Gordon Miskelly and Brent Copp (Auckland). I also thank all the staff and students who attended my lectures and asked some very interesting questions, and giving me some good new ideas.

Introducing our Research at Massey University

The research in the Schwerdtfeger group at Massey University is concerned with all aspects of quantum chemistry and physics focused toward fundamental issues. Current research areas include: parity-violation in chiral molecules, relativistic effects, the chemistry of heavy and superheavy elements, simulation of metallic clusters, quantum-electrodynamic effects in atoms and molecules, solid state chemistry and physics including high-pressure materials, surface science, chemical evolution theory and mathematical and philosophical aspects of quantum theory. For further details see <http://ctcp.massey.ac.nz> and <http://www.nzias.ac.nz>.



New Zealand Science Scene: Communicating Science

One Site for All

In the last few issues of this journal climate change has caused some debate. A new website on the subject has been developed by two Canterbury Philosophers.

Climatedebatedaily.com includes both sides of the debate. Associate Professor Denis Dutton and lecturer Doug Campbell from the Department of Philosophy at Canterbury University, created the website after a tearoom debate on the subject. Professor Dutton was surprised no one had thought to put together such a website before.

The website has two main columns. The first links essays and research supporting the notion that global warming poses a threat to humans, that it is caused by human activity and that it can be solved. The second column links to essays and research challenging that view, and also whether the earth's climate is within human control. As well this, there are links to climate news articles, blogs written by people on both sides of the debate, and links to official sites.

Professor Dutton said scientists needed to drop the rhetoric and present the best, most balanced view of the facts. He did not think we needed moralizing about this issue but open discussion. He said "to stigmatise criticism as somehow immoral is intolerable for real science".

The site has a similar layout to *arts&lettersdaily.com*. This is no surprise since that site was also founded and edited by Professor Dutton.

The site will be updated daily by the philosophers. They have future plans of including a page to rank arguments and a predictions page. The predictions page would track scientists' predictions and note which turned out to be accurate.

The website has been supported by a grant from Dr Peter Farrell, a visiting professor at the University of New South Wales, who also has a number of business interests.

A First in New Zealand Science Communication

Communication of Science has been given a boost with the opening of New Zealand's first Science Communication Centre.

The Centre has opened at the University of Otago. Director, Professor Lloyd David, said the Centre's ultimate role was to enhance communication about science to the public.

The Centre would also run a new Master of Science Communication programme. It has three options; science and natural

history film making, creative nonfiction writing in science and popularizing science.

The Centre was financed by a \$1.6m donation by the Stuart Residence Halls Council and by the Government's Partnerships for Excellence Programme.

Professor Jean Fleming has returned to Otago to be a Professor of Science Communication at the Centre. She had a high profile role in the Royal Commission on Genetic Modification. Emmy award winner, Ian McGee, from NHNZ has been appointed Director of Filmmaking.

New Approach to Discussing Science

The genetic engineering debate proved useful in one student's research into new ways to communicate controversial science and technology to the general community.

Victoria University PhD Graduate, Karen Cronin developed new communication methods for scientists and community interest groups in workshops.

She said new communication methods were evolving from educating the public about science to involving the public in two-way communication about science.

This area of social engagement in science has become a big area of research worldwide.

Dr Cronin said not every technology would require this sort of approach but if there were uncertainties about outcomes or possible big systemic effects from research, it would be a more useful way to go.

The general idea would be to involve the public before large investments and commitment has been made in a technology, rather than waiting until something was commercialised, entered the public consciousness and there was an outcry.

Rather than debate her methods were based on dialogue and questions of inquiry.

She took six years to complete her PhD part-time and believes the research would be helpful in discussions on possible future issues like nanotechnology before they come topics of public controversy.

Dr Cronin is currently applying for funding to use her research with Crop and Food in the area of food technology.

Examples of using these techniques in New Zealand can be found at the bottom of the webpage; www.morst.govt.nz/current-work/science-in-society/dialogue/fund/.

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