Nobel Laureate Reviews the EMU

In 1986, Dr Rohrer was co-recipient, with his colleague Dr Gerd K. Binnig, of half of the Nobel Prize in Physics for designing the scanning tunnelling microscope, an instrument that gave scientists the ability to manipulate atoms on surfaces and that has revolutionised many areas of science and technology. (Incidentally, the other half of the Physics Nobel Prize for that year was awarded to Dr Ernst Ruska for his seminal work in developing the transmission electron microscope in the 1930s.) Dr Rohrer is a retired IBM Fellow and an IFCAM Fellow of Tohoku University, Japan1. As such, he is a respected scientist who has more than a passing knowledge of microscopy and microanalysis and a lot of different scientific fields. Consequently, the EMU’s Director, Prof. Simon Ringer, was delighted that Dr Rohrer was able to participate in a review of the Unit during its 50th anniversary year.

In addition to Dr Rohrer, the panel for the review included Prof. Masud Behnia, Dean of Graduate Studies at the University of Sydney, who chaired the review; Prof. Hideo Ohno, Director of the Research Institute of Electrical Communication at Tohoku University; Prof. Kim Rasmussen, Head of the School of Civil Engineering at The University of Sydney; and Prof. John Drennan, Director of the Centre for Microscopy and Microanalysis at The University of Queensland. The primary reason for the review was to assess the activities and progress of the EMU during the past 50 years, given that 2008 is the Unit’s Golden Jubilee, and to examine and help guide the future goals and aspirations of the Unit.

So on Valentine’s Day 2008, the review panel met in the University’s Darlington Centre to

1 IFCAM is the International Frontier Center for Advanced Materials.
hold the review, which included presentations from three of the EMU’s academics, Prof. Simon Ringer, A/Prof. Filip Braet, and Dr Lilian Soon, on the Unit’s history, recent performance and future vision in the areas of research services, research programs and research training. Prof. Georges Grau (Medical Sciences), Prof. Trevor Hambley (Chemistry), Dr Xiaozhou Liao (AMME) and Prof. Anthony Weiss (MMB), who are all members of the EMU’s user community, also gave short vignettes to showcase how the EMU’s facilities and staff help researchers to do high-quality science and engineering. Finally, after a rigorous questioning of the EMU’s academics, the panel adjourned to develop a list of commendations and recommendations.

Later that day, Dr Rohrer gave a Vice-Chancellor’s Public Lecture in the Great Hall at the University of Sydney. Entitled Nanotechnology – A Key to Sustainability, the engaging presentation aired the Nobel Laureate’s views on the opportunities of nanotechnology and how they might enable greater sustainability in our world. Putting things into context, he began by tracing the move from global scale “research”, as exemplified by Columbus’s discovery of the Americas, to the development of precision machinery at the millimetre scale and below in the Industrial Revolution, to the development of the transistor and other microscale technologies in the IT revolution, and, finally, to the current revolution associated with nanotechnology.

Dr Rohrer discussed how nanotechnology is copying from nature’s strategy of building up large-scale functional objects, like the human body, at the molecular level, which is a far more efficient and sustainable manufacturing approach than our modern approaches. After clearly showcasing the pros and particularly the cons of our current technologies, he presented a fascinating series of examples of the potential of nanomaterials and nanotechnologies illustrating the unique aspects—the disruptive steps—and the amazing promise of nanotechnology.

Dr Rohrer concluded by describing how, with the many possibilities and future opportunities afforded by nanotechnology, we no longer need to ask the question ‘Can we do it?’, but rather questions such as: ‘Do we want to do it?’ ‘Do we need to do it?’ and ‘Can we afford to do it?’ Ultimately, he stressed, mankind will have to make many choices about nanotechnology and it is essential that we consider the benefit for all humanity in doing so.

More information:

Dr Kyle Ratinac
Research Development Manager
Tel. +61 2 9351 4513
k.ratinac@usyd.edu.au
International Collaborative Partnership between the AMMRF and IIRS

At the end of last year, A/Prof. Filip Braet, Deputy Director of the Key Centre and EMU, travelled to Japan thanks to an award from the “Japan Association for the Advancement of Medical Equipment (JAAME)”. This was the second such award to Filip in the space of two years and the trip was Filip’s second in twelve months. During these travels, Filip visited Jikei University, Niigata University, Tokyo University of Science, Japan Women’s University and the International University of Health & Welfare. Besides the seminars that Filip presented on his research and his ongoing collaboration with the Department of Internal Medicine at Jikei University Hospital, he also canvassed the AMMRF in a series of talks in each of these institutions. This journey was topped off by visits to the application laboratories of electron-microscope manufacturers JEOL and Hitachi.

During this visit, Filip spent a considerable amount of time with the General Director of “Integrated Imaging Research Support (IIRS)”, Professor Masako Osumi-sensei, in exploring possible collaborative partnerships between Australia and Japan. IIRS is a major Japanese facility for microscopy-based imaging, particularly in the life sciences, and both groups were eager to see what could be learnt from the different approaches used by their foreign counterparts. After Filip’s meeting with the board members of IIRS, Professors Osumi and Mineyuki soon made a follow-up visit to the AKCMM/EMU at the University of Sydney and the EMU at the University of New South Wales.

Outcomes from these interactions include a memorandum of understanding between the AMMRF and IIRS, which is at an advanced stage of development, and the appointment of IIRS-nominee Professor Emeritus Shohei Yamashina of Kitasato University as a member of the AMMRF’s International Technical Advisory Board.

More information:

A/Prof. Filip Braet
Deputy Director
Tel. +61 2 9351 7619
f.braet@usyd.edu.au
A Year to Celebrate: Happy Birthday EMU 1958–2008!

After hosting our first celebration event, the Golden Jubilee Happy Hour at the ACMM-20/IUMAS-IV conference in Perth on 14 February, we are now looking forward to an exciting jubilee year, and many EMU staff are involved in organising several events that will take place in the second half of 2008. Please earmark the dates for our first major jubilee activity in your diary:

**Small Matters – Exploring the World of Microscopy**

*An exhibition in the University of Sydney’s Macleay Museum*

This exciting 6-month exhibition allows insight into the fascinating world of microscopy. Open to the public and free, *Small Matters – Exploring the World of Microscopy* will offer schools, students, staff and families an introduction to basic modern microscopy techniques and the underlying scientific principles.

**August 2008 – January 2009**

**More information:**

Uli Eichhorn  
Design Coordinator  
Tel. +61 2 9351 4493  
u.eichhorn@usyd.edu.au

**EMU Involvement in ACMM20**

The twentieth biennial Australian Conference on Microscopy and Microanalysis, ACMM-20, was held in Perth, WA, from 7–15 February 2008. Subtitled “Through the Looking Glass”, the conference also incorporated IUMAS-IV, the fourth conference of the International Union of Microbeam Analysis Societies. Consequently, the turn out was particularly large and the conference received 425 registrants from around Australia and around the globe.

Attendees enjoyed the conference and trade exhibition, which contained fifty-two exhibition booths, in the luxurious environs of the Perth Convention Exhibition Centre. The weeklong conference had a very strong scientific program with over 60 national and international speakers.

The AMMRF was well represented at the conference and was a Gold Sponsor. The AMMRF facilities were highlighted in the opening plenary sessions when Emeritus Prof. John de Laeter and the WA Chief Scientist, Prof. Lyn Beazley, both touched on the world-class NanoSIMS capability at the Centre for Microscopy, Characterisation and Analysis at the University of Western Australia and the impending investment in a state-of-the-art large-radius ion microprobe.

Another major activity was the AMMRF Public Evening Lecture presented by Prof. Max Bennett of the University of Sydney. Prof. Bennett, who is a Director of the Brain and Mind Research Institute, gave an extremely stimulating presentation titled, Brain, Mind and Mental Illness. Of course, the AMMRF Internet Café was the focal point of the Exhibition for many delegates and provided that invaluable electronic link to the outside world.
The EMU fielded a large contingent of delegates: 14 oral presentations and 5 poster presentations were made by EMU staff and students; staff from the Unit were also involved in organising pre-conference workshops and chaired 5 of the sessions during the week.

During the conference, the Australian Microscopy & Microanalysis Society awarded A/Prof. Guy Cox life membership “for his sustained and outstanding service to the microscopy community”. Also of note was the award to Ms Kristina Jahn, one of the PhD students in the AKCMM, who received a John Farrant Memorial Prize in Biological Sciences for her presentation: “Monitoring Lipid Rafts in Cancer Cells by Means of Correlative Fluorescence and TEM”. The prize is worth $1000.

Major Changes at the EMU

As with much of the campus, we are about to go through major renovations. We will be doing our best to keep the unit operational throughout this period, but there will be some inevitable down time. This will be kept to a minimum by advance planning and notification. So that is the bad news.

The good news is that, after the renovations, we will have brand new labs incorporating PC2 capabilities and three brand new systems: a live cell imaging system, a total internal reflection fluorescence microscope (TIRF) and a dual-beam scanning confocal microscope. Our multiphoton will also be moved into the PC2 labs.

On the electron microscopy side, we will add a number of new instruments to our arsenal during 2008, including a high-end scanning electron microscope and an advanced cryo-transmission electron microscope with tomographic capabilities. We will provide more news on this front in a future newsletter.

The final dates for this work are yet to be determined, although we anticipate it will begin in the next 8 weeks. Once a timetable is available, we will inform users in a special email.

More information:

Dr Miles Apperley
General Manager
Tel. +61 2 9351 2887
m.apperley@usyd.edu.au

Ellie Kable
Laboratory Manager
Tel. +61 2 9351 7566
e.kable@usyd.edu.au
**Welcome Dr Gang Sha**

Gang took up the role of Senior Research Associate at the EMU in December 2007. He spent the previous six years at Oxford University, where he obtained his PhD in 2002, working in the Atom Probe Group with Professors Alfred Cerezo and George Smith. His research interests are in understanding, predicting and controlling the microstructural evolution of material to optimise materials’ properties in service. He has focused on important engineering materials with applications in energy, aerospace and automotive industries.

Gang is working with Professor Simon Ringer on a range of light metal projects, particularly in Al alloys, at the University of Sydney’s node of the ARC Centre of Excellence for Design in Light Metals.

**Welcome Dr Steven (Xuefeng) Wang**

Steven joined the EMU in January this year after completing his PhD at the University of Hong Kong in 2007. He has expertise in the processing and characterisation of advanced functional materials, particularly non-linear optical chalcogenide glasses for photonics and oxide dilute magnetic semiconductors for spintronics.

Steven’s current role of Research Associate involves working with Professor Simon Ringer and Dr Rongkun Zheng on the microanalysis of spintronic materials at the atomic scale by means of transmission electron microscopy and atom probe tomography.

**Welcome Dr Frankie Stevens**

Frankie started as the Biomolecular Imaging Specialist in January. As part of her undergraduate degree from the University of Sussex, she enjoyed a stint as an Erasmus Research Assistant at the Université de Bordeaux II in France. She then returned to the University of Manchester in the UK to complete her PhD in 2002 and subsequently took on a role as Research Scientist at the Patersen Institute for Cancer Research. More recently, she was a Postdoctoral Research Officer at the Diamantina Institute of the University of Queensland. Her research interests include live cell microscopy and cell cycle studies, in particular mitosis and the G2 phase.

Frankie’s current role requires her to support the day-to-day activities of the AKCMM’s advanced biology preparation and cell culture laboratories. This includes conducting advanced biomolecular, live cell and cryogenic specimen preparation.

**Welcome Ting-Yu Wang**

Ting-Yu took up the role of Research Associate in December of last year following the completion of his PhD at National Taiwan University. His PhD research involved the development of high-k flash memory devices and defect analysis of InGaN/GaN quantum-well structures. He is also interested in crystallography and defect analysis of steels, and silicon and III-V semiconductor structures.

Ting-Yu is collaborating with Professor Simon Ringer and other colleagues on the nanostructural analysis of high-k nanolaminated structures and other nanostructured materials.
Conference News

Dr Judith Field participated in workshops run by the ARC Environmental Futures Network at the University of Queensland and the Australian Museum in December and January, respectively.

The first workshop discussed Australian aboriginal plant management and the role of archaeobotanical studies. At this meeting, a working group named Australia and New Guinea Archaeobotany (ANGA) was formed to investigate methods of raising awareness of plant studies in Australian archaeology. Judith will also chair a session on archaeobotany at the next Australian Archaeological Association meeting in December 2008.

The second workshop involved a number of specialists in the field who came together to devise avenues for investigating the plant record and to explore the possibilities for investigating how Australian aborigines manipulated plants for harvesting. A collaborative agreement with botanists and other colleagues has enabled the expansion of the Australian starch reference collection, which is housed at the EMU.

The analysis of ‘ancient starch’ from archaeological sites is becoming one of the key research areas in archaeological science at the University of Sydney and is focused on the Imagelab and SEM facilities available here at the EMU.

More information:

Dr Judith Field
Senior Research Associate
Tel. +61 2 9351 7547
j.field@usyd.edu.au

Starch grains from the climbing vine of the Hairy Yam (Dioscorea bulbifera) which are typical of tubers. Starch grain morphology varies between plants and the analysis of these microfossils is providing new insights into the function of a range of ground and flaked stone tools from archaeological sites and the types of plants exploited.