

- Biodiversity helps the fight against bacteria
- AMAS X conference success for Adelaide
- International advisors convene in Sydney
- Qemscan mineral analysis system now available

RESEARCH

Indigenous medicine meets biomaterials development



Eremophila denticulata subsp. trisulcata (Chinnoek), a taxon identified as having resin with antibacterial activity. The glossy and waxy appearance of the leaves is typical of resinous *Eremophila* species.

AMMRF @ SARF

Australian native plants, traditional aboriginal culture, biotechnology and improved healthcare all come together in a uniquely Australian good news story.

Prof. Hans Griesser and his collaborators at the University of South Australia have identified a suite of novel antibacterial serrulatane diterpenes, from the resin and leaves of many species of *Eremophila*, and are using them to prevent bacterial growth on medical implants.

Over 216 species of *Eremophila* have been found across arid regions of inland Australia. Aboriginal people have used extracts from several of them to treat skin sores and sore throats for generations. It was this pattern of use that had suggested an antibacterial action, and this was subsequently confirmed in the lab. All the active compounds isolated were able to prevent proliferation of dangerous multi-drug resistant strains of bacteria, such as MRSA, which are often the cause of serious hospital infections.

By employing specially designed adhesive interlayers, the active compounds isolated from the plants were attached covalently to the surfaces of polymer and ceramic implant materials through amine groups, retaining their antibacterial activity in the process.

The ToF-SIMS and XPS were used to confirm the presence of the specific diterpenes on the surfaces, and that the linkage chemistry was as it should be. Culturing bacteria on treated and untreated surfaces was the next step and, as you can see in the image below, bacteria were very unhappy on the diterpene-coated surfaces.

In practice, the surfaces of implanted biomedical devices are particularly prone to the build up of bacteria and this can happen weeks or even months after a device is put in. Bacterial infections are routinely controlled with antibiotics, but by the time an infection has been identified on an implant deep inside the body, the patient can already be seriously ill. "If someone in their seventies has an artificial hip inserted and then they have an infection and have to go back to get the hip taken out and another put in, that's traumatic for someone who is already compromised health-wise", says Hans. It also causes avoidable expense and wasted time for the healthcare system. The covalent binding of the antibacterial diterpenes to the surface of the implants circumvents these problems and will hopefully provide permanent protection, stopping the implant from ever harbouring infection. Preliminary results also suggest that mouse cells, unlike the bacteria, can attach and grow on some of the modified surfaces.

COMMUNITY

Nanotechnology Ambassador inspires young Australians

AMMRF @ UQ

Yanan Guo, a PhD student based in the Centre for Microscopy and Microanalysis (CMM) at the University of Queensland, was recently selected as a Young Nanotechnology Ambassador by the Australian Research Council Nanotechnology Network (ARCNN). He received his award from the Hon. Anna Bligh MLA, Premier of Queensland, in December 2008 at a ceremony at Parliament House, Brisbane. "I think it is a great honour to be one of the ambassadors", he says.

As a Nanotechnology Ambassador, Yanan, whose research is on semiconductor nano-wires, is out and about, inspiring young Australians in science and nanotechnology. He has already visited two primary schools in north Queensland at Mission Beach and El Arish. Yanan's presentation was multi-faceted, showing the children micrographs (taken at the CMM) of everyday things at different magnifications. He also had them folding dodecahedrons to build up a 3-D crystal model by using just A4 paper. The children had never met a real scientist before and "they really enjoyed the activities", according to one of the teachers. "They didn't even want to go off for their break – they just wanted to keep going".



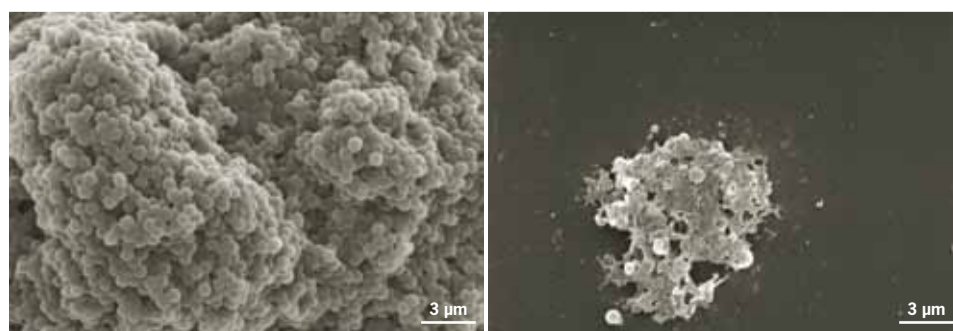
Mr Yanan Guo receiving his award from the Hon. Anna Bligh, MLA, Premier of Queensland, as part of Science in Parliament. Photo: Clare & Pappi Photography.

As well as talking to schools across Queensland, Yanan will engage in a number of other science promotion activities – meeting parliamentarians and addressing Academy Fellows at an end of year function.

Yanan is thoroughly enjoying his role so far: "the moment I love the most is the kids with wide open mouths when I showed them what a fire ant looks like when magnified 150 times. The message I tried to pass to the kids is simple – nature is beautiful, science is fun". ■

Hans's PhD student Hardi Ys recently presented this work at a biomaterials conference hosted at the University of New South Wales. Multi-national healthcare companies have expressed interest in the technology and patents have been taken out. However, Hans

is clear that he and the rest of the team want to ensure that the Aboriginal community also benefits from the exploitation of these novel compounds. "We can learn so much from nature and traditional knowledge". ■



After 24 hours of growth: well-developed bacterial biofilms on a control surface (left), and very few adhering bacteria, with broken biofilm structures, on a serrulatane-coated surface (right).

EXECUTIVE DIRECTOR'S COLUMN

It is early 2009 as this current edition of AMMRF News is being prepared, and despite it being a quieter time for university teaching, research programs continue and research proposals are being hatched. Many researchers grab the chance to access instrumentation at this time and consequently the AMMRF has experienced high levels of usage during January and February. Some nodes have even reported a growth in usage compared to the same time last year, due in part to the availability of world-class instruments and facilities, but also to the technical support that is available all year round.

During this time, AMMRF facilities around Australia begin to plan and build momentum as new projects are registered, users are welcomed and training schedules are planned. The user experience is a hallmark of the AMMRF and a key element of this is training. A comprehensive range of courses and workshops are available in addition to the extensive one-on-one training and support provided by AMMRF staff. A summary of the training options around the AMMRF is included in this edition of the News, and I commend these courses to you – not just for the first time user, but also for the experienced researcher looking to update and increase their skills.

Providing a high level of training and support requires an investment in staff development. At the time of writing, the tenth biennial meeting of the Australian Microbeam Analysis Society (AMAS X) was being hosted by Adelaide Microscopy, a node partner of the AMMRF. Meetings of this type provide our technical support staff, researchers and students with an opportunity to learn about technologies and techniques that push the boundaries in the area of characterisation and analysis. It is also an opportunity to acquire new know-how at associated workshops, all of which benefits our user community.

And, to all our colleagues burning the midnight oil writing ARC and NHMRC research proposals, please do take a look at our website ammrf.org.au for the 'Advice to applicants for ARC and NHMRC grants for funding in 2010'.



These are simple guidelines that will help you to incorporate the costs associated with access to our people and instruments into your grant application. We wish you well in your proposals and look forward to working with you at the other end of the research cycle. ■

Regards,
Simon Ringer, Executive Director & CEO

COMMUNITY

AMAS X – microbeam conference a big hit in Adelaide

AMMRF @ SARF

With perfect synchronicity, AMAS X, the tenth biennial symposium of the Australian Microbeam Analysis Society, began as Adelaide's two-week-long record-breaking heatwave ended – much to the relief of the organisers! The meeting was held at the University of Adelaide from the 9–13 February 2009.

The new Bioskills Laboratories in the Medical

School made a great venue for most of the well-attended workshops before and after the symposium, covering such subjects as analytical TEM, focussed ion beam microscopy, electron probe microanalysis, EBSD and LA-ICPMS, among others.

A twilight welcome function, held in the Cloisters in the heart of the campus, was sponsored by Oxford Instruments Nanoanalysis, and provided the opportunity for symposium delegates



GOVERNANCE

International Technical and User Advisory Group meets

The AMMRF International Technical and User Advisory Group (ITUAG), convened by Prof. David Sampson, met for the first time in Sydney during December 2008. Starting small, the group will grow to comprise about 30 leaders in the science and technology of microscopy and microanalysis, and researchers whose programs heavily use these characterisation methods.

The interests of the members span all the disciplines of science and engineering, providing a diverse pool of expertise and research

experience. The role of the ITUAG will be to advise the AMMRF Board and Operations Team on matters concerning facility management, technology foresighting, opportunities for international linkages and continuous improvement of the AMMRF user experience. The first meeting of the ITUAG also provided an opportunity for the group to meet the AMMRF Board and to receive a briefing by Prof. Simon Ringer, Executive Director and CEO, on the performance and research achievements of the AMMRF over the last 18 months. ■



The inaugural ITUAG meeting with the AMMRF Board at the University of Sydney on 4 December 2008.

to renew acquaintances and make new ones.

Convenor Angus Netting and Pro-Vice-Chancellor Professor Richard Russell opened the symposium, welcoming delegates to the university. Notable among the many local and international keynote speakers were Prof. Raynald Gauvin from Canada, with Prof. Nestor Zaluzec, Dr Paul Kotula, Dr Ed Vicenzi and Dr Paul Carpenter all from the USA. We are grateful to all the invited speakers who gave generously of their time and knowledge during the symposium and workshops.

On Thursday night, the nanoTechnology Systems symposium dinner was held in the Equinox Restaurant in the Union Building. With the tragedy of the Victorian bushfires on everyone's mind during this week, an impromptu raffle of prizes donated by organising committee members saw delegates dig deep and quickly raise \$1120 for the cause.

The organising committee would like to sincerely thank all of the invited speakers, sponsors and delegates whose support made AMAS X such a success. ■

The brightest X-rays in the Western Hemisphere



Dr Murray Gibson, Director of the Advanced Photon Source (APS), and Associate Laboratory Director of Photon Sciences at Argonne National Laboratory in Illinois, USA, recently visited the AMMRF. The APS is the brightest source of X-rays in the Western Hemisphere, and is used to study the structures of materials and processes at the atomic scale. Dr Gibson highlighted its capabilities in a fascinating talk on X-ray imaging.

Before moving into X-ray science and becoming Director of the APS, Dr Gibson's background and research interests were firmly based in electron microscopy and therefore he had an appreciation of the broad range of capabilities that the AMMRF offers. He was very interested and enthusiastic about the AMMRF model of forming and operating a national collaborative research facility and was happy to consider how the two facilities may learn from each other how to further improve the user experience.

The APS is the largest scientific user facility in North America, with over 3,000 users visiting each year. ■

LAB NEWS

Node celebrates golden end to a golden year

AMMRF @ USYD

The celebrations for the 50th Anniversary of the University of Sydney's Electron Microscope Unit culminated in a frenetic week of events in early December last year.

Things kicked off with a public lecture, on the evening of Tuesday, 2 December, by the internationally respected biologist Prof. Hans Tanke, who leads the Department of Molecular Cell Biology at Leiden University in the Netherlands. A large crowd gathered to hear Hans's talk about using microscopy to see DNA molecules at work. His easily understandable and highly entertaining presentation explained something of the wonders of DNA, and how key developments in microscopy are helping researchers understand the way that DNA and proteins work within the human body. He also provided inspiring examples of how such techniques allow doctors to accurately diagnose when the body's molecular machinery goes haywire.



The commemorative symposium *Excellence in Microscopy* started the following morning, with a host of leading national and international speakers and eager listeners. The 100 or so delegates were treated to presentations that ranged from advanced materials to archaeology and from biotechnology to nanotechnology, but all shared the common theme of incorporating some form of microscopy.

The Golden Jubilee Networking Luncheon, another major event, occurred on the Thursday afternoon as the symposium delegates moved



Excellence in Microscopy

to the University's Great Hall for the luncheon and accompanying plenary lectures. Numbers swelled as various other guests – including University dignitaries, former EMU staff and industry representatives – joined the delegates for the event. To mark this special occasion, the unit launched its history book *50 Great Moments – Celebrating the Golden Jubilee of the University of Sydney's Electron Microscope Unit*, and, after a delightful lunch, plenary lectures on both the biological and physical aspects of high-resolution tomography were

given by Prof. Wolfgang Baumeister and Dr Thomas Kelly.

EMU staff were also kept busy by satellite events around the symposium: a two-day STEM workshop with Prof. Tetsuo Oikawa from JEOL (Europe) preceded the symposium, and a three-day summit on atom-probe data reconstruction followed it.

This was a wonderfully exciting time for Australia's first centralised microscopy facility and it will surely lead to new highlights in the years to come. ■

Qemscan acquisition – a boost for mineral analysis

AMMRF @ USYD

A Qemscan automated mineral analysis system has recently been acquired by the Australian Key Centre for Microscopy and Microanalysis, the University of Sydney node of the AMMRF. This valuable instrument is now available to the entire Australian research community, significantly increasing the AMMRF's capability in the area of mineral analysis.

The Qemscan is an automated mineral analysis system based on a Zeiss EVO 50 scanning electron microscope. Four EDS detectors are used simultaneously to rapidly determine the mineral phases in a polished section of rock. Sophisticated software differentiates the mineral from the mounting resin so that analy-

sis time is devoted only to the rock itself. The results are visually presented in colour-coded mineral maps, which are readily interpreted by mineralogists and process metallurgists.

With the four EDS detectors, the instrument can analyse up to 200 points per second, making it a serious tool for improving productivity in the analysis of rocks in geoscience research and the mining industry. It will be an absolute boon to anyone in these fields.

As well as being a specialised, mineral-analysis instrument, the Qemscan is also a very high quality scanning electron microscope in its own right. The Qemscan system was developed by Intellection, a Brisbane-based spin-off of the CSIRO that was recently acquired by FEI. ■

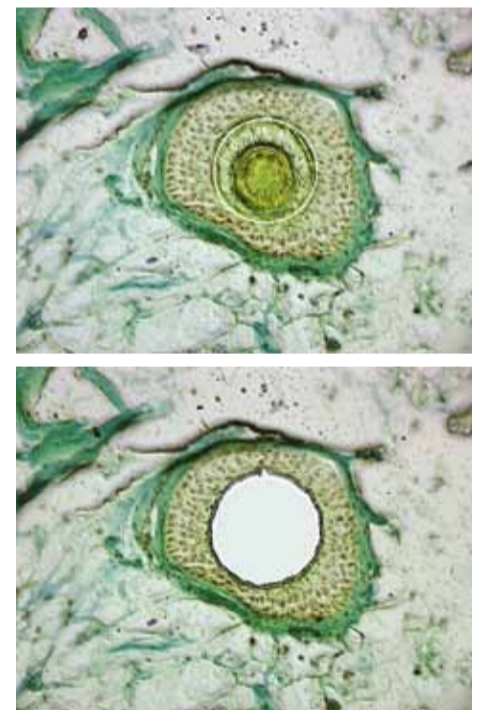


TECHNOLOGY

What is laser microdissection?

Laser microdissection (LMD) technology provides researchers with the ability to isolate individual cells and pure cell populations from within paraffin-embedded or frozen tissue sections by using focussed laser light as a cutting tool. The area to be isolated is marked out on an image of the sample and, at the click of a mouse, the laser cuts along the pre-marked path with very high precision. For example, with a 100x objective, a laser spot approximately 700 nm in diameter is produced that can dissect and isolate individual nuclei, single chromosomes or chromosomal pieces. The wavelength of the laser light is long enough not to cause damage to nucleic acids and proteins, allowing researchers to work with live cells in tissue culture and with ova and sperm without interfering with cell viability. To collect the isolated material, the laser is pulsed in a focal plane just below the specimen, creating a photonic cloud that flicks the sample up into a collecting vessel. Once a sample has been isolated, it is then available for any number of further studies.

The CMCA at the University of Western Australia and Adelaide Microscopy at the University of Adelaide both have laser microdissection systems. UWA is set up for fixed and living cells and has the additional feature of the laser tweezer module that 'traps' specimens in a near-infrared laser beam. It is used for moving and manipulating cells and can be used for such applications as *in vitro* fertilisation, cell fusion, or force measurements of motor-molecule action. Adelaide Microscopy has two LMD systems.



A section through a human hair follicle showing the cutting path marked around the cortex, cuticle and inner root sheath (top). The same section after laser dissection of the marked region (bottom). The dissected area is approximately 140 µm in diameter.

They are used mainly to collect specific cellular material from frozen sections, which is then processed to obtain DNA/RNA information. One of the systems has clever software that allows users to teach the instrument to harvest material based on shape or colour (stain).

Workshops on this technique are available at Adelaide Microscopy (see page 4). ■

For more information on LMD contact:

Mr John Terlet: john.terlet@adelaide.edu.au

Dr Kathy Heel: kathy.heel@uwa.edu.au

TEACHING

AMMRF teaching timetable 2009

The University of Sydney, Australian Key Centre for Microscopy and Microanalysis	
Introduction to Microscopy and Microanalysis	March 9–19, and July 27 – August 15
Operation of the Transmission Electron Microscope	March 30 – April 3, and September 14–18
Operation of the Scanning Electron Microscope	March 23–27, and September 21–25
Biological Specimen Preparation for TEM & SEM	April 27 – May 6
Fluorescence Microscopy Techniques	May 11–15, and August 10–13
Light Microscope Workshop	May 18, and August 17
Introduction to Confocal Microscopy	May 19–22, and August 18–21
Stereology	May 25–26, and August 24–25
Image Analysis	May 27–29, and August 26–28
Materials Specimen Preparation for TEM & SEM	April 6–9, and October 6–9
TEM of Crystalline Materials	April 20–24, and October 12–16
Research Methodology	August–October
Microscopy of Biomolecular Processes	August 31 – September 11
Nanostructural Analysis of Materials	October 19–30
The University of Western Australia, Centre for Microscopy, Characterisation and Analysis	
Scanning Electron Microscopy	Weeks beginning 9 March, 29 June, and 9 November
Transmission Electron Microscopy	Weeks beginning 16 March, 6 June, and 16 November
Electron Microprobe Analysis	Weeks beginning 23 March, 13 July, and 23 November
Optical & Confocal Microscopy	Weeks beginning 2 March, 22 June, and 2 November
Introduction to Flow Cytometry	10–12 March; June 30–July 2; and 12–15 October
Workshop: Preparing Images for Theses and Publication	Date TBA
Workshop: Tissue Fixation and Immunolabelling for Biological Samples	Date TBA
Workshop: Specimen Preparation for Biological TEM	As required
Workshop: High-Resolution TEM	As required
Workshop: WDS X-ray Microanalysis	As required
Workshop: Energy-Filtered TEM	As required
Workshop: Selected Area Electron Diffraction	As required
Workshop: Electron Energy-Loss Spectroscopy	As required
Workshop: Variable Pressure/Environmental SEM	As required
Australian National University, Electron Microscopy Unit	
A decision on the courses to be offered will be made later in the year	Dates TBA
The University of New South Wales, Electron Microscope Unit	
Introduction to Electron Microscopy	April, June, September and November
SARF: Adelaide Microscopy	
General Training Sessions for SEM, TEM, Dualbeam FIB, EPMA, LAICPMS, X-ray, MicroCT, Laser Dissection, Confocal & Optical Microscopy, Sample Preparation	Available on demand
Workshop: Laser Capture Microscopy	May (date TBA)
Workshop: Laser Ablation ICPMS	September (date TBA)
Workshop: EBSD/EDS Fast Mapping	September (date TBA)
SARF: Flinders University Nanotechnology	
Advanced SPM Techniques	February 10
Basic AFM Techniques	End of April
The University of Queensland, Centre for Microscopy and Microanalysis	
General training sessions are scheduled throughout the year	
SEM, TEM & XRD	Commencing March 23, May 18, July 13, September 14, and November 9



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Got it covered

AMMRF @ UWA

Research done at the University of Western Australia's Centre for Microscopy, Characterisation and Analysis has been producing world-class images.

A recent review paper by Murdoch University PhD student Hanna Borowski on infection by *Cryptosporidium* parasites has seen her SEM image make the front cover of the highly ranked international review journal *Trends in Parasitology*, 24 (11), 2008. Dr Peta Clode also supplied a front-cover image to accompany her article in *Plant, Cell & Environment*, 32 (2), 2009, one of *ScienceWatch's* 'Hottest Journals of the Millennium'. ■

STAFF NEWS

South Australian Regional Facility



We welcome **Dr Ben Wade** who has recently started as a microscopist at Adelaide Microscopy, part of the AMMRF's SARF node. His background is in geology, and he completed his PhD at the University of Adelaide in 2006 on age dating and isotopic analysis of rocks from the far north-west of South Australia. Ben initially will be involved in the maintenance of the two Agilent 7500 ICP-MS instruments, along with instruction of users on the Philips XL20 and XL30 SEMs. He is keen to become familiar with the Philips CM200 TEM/STEM and he's confident that his knowledge of geological processes and systems will open up new avenues of analysis for potential users. ■

The University of Sydney



Dr Dave Mitchell recently started at the University of Sydney node of the AMMRF as Senior Microscopist and Advanced TEM Specialist. He will be enhancing the TEM capabilities of the unit through technique development and optimisation, especially in electron tomography. He will also provide training for users of TEM. Dave has moved from ANSTO where he was an electron microscopist in the Materials Division. Although his background is firmly in transmission electron microscopy of low alloy steels, ceramics, semiconductors and catalysts, Dave says he is looking forward to broadening his horizons into the all important 'squishy things'. ■

Third Annual AMMRF Strategic Planning Workshop

The 2009 workshop for AMMRF staff will take place in Perth on 10-11 June 2009. ■

LAB NEWS

New flagship instrument crosses the Nullarbor

AMMRF @ UWA



After an arduous journey from Paris, the Cameca IMS 1280 ion probe was delivered to UWA in December.

Freight restrictions at Perth Airport meant it had to be flown to Adelaide and endure a three-day crossing of the Nullarbor on the back of a truck. Fortunately the twelve crates arrived in Perth with all shock-sensors and tilt meters intact. The next task was to lift the components up to the first floor and slide them into the building through an office window. Sensitive freight handlers COPE did an excellent job and it was all unpacked and in the lab by 3 pm. Assembly proceeded with only minor setbacks, such as a missing foot and a leaky airlock, and both positive and negative beams were operational by mid-January. Commissioning tests and staff training will now begin. ■

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Editorial enquiries:

Prof. Simon P. Ringer, Executive Director & CEO
Ph: 02 9351 2351
Email: simon.ringer@ammrf.org.au

Dr Jenny Whiting, Marketing & Business
Development Manager
Ph: 02 9114 0566
Email: jenny.whiting@ammrf.org.au

Layout: Uli Eichhorn

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