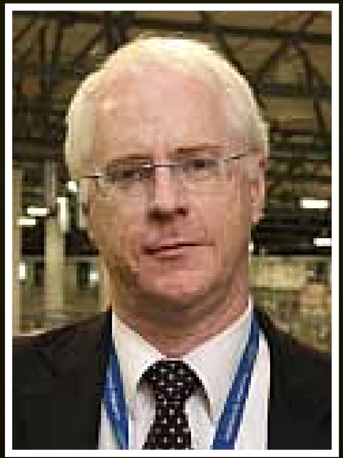
Lightspeed **February 2012**

TOP STORIES



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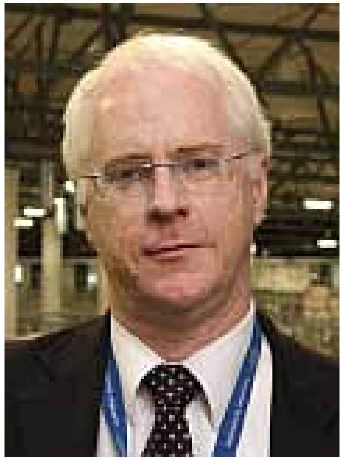
From the Director – Working towards a new era



Welcome to the first edition of Lightspeed for 2012. Judging by the buzz in the networking sessions at the User Meeting in December 2011, our users and staff are looking forward to another year of productive research collaborations.

The User Meeting for 2011 was a fantastic success, with a diverse program that included an excellent opening address from James Whisstock (Monash University), who told us how synchrotron techniques are providing information about protein structures that could help us find ways to control immune-related disorders such as transplant rejection. Among other notable presentations, we also heard from Corey Putkunz (PhD, La Trobe University), who won the 2011 Australian Synchrotron Thesis Medal jointly with Kaye Morgan (PhD, Monash University).

Some great work continues to be done in developing the planning for new beamlines. User Meeting participants enjoyed several presentations and productive discussions about the development of new beamlines. Given the likely constraints on immediate capital funding, it is good to see that new beamline designs are progressing well and are supported by the community.

Also in December, a meeting of our Science Advisory Committee endorsed the synchrotron's work overall as world-class, and described some areas of our work as world-leading. At a meeting of our National Science Colloquium headed by Prof Sir Gus Nossal, we discussed strategies for ensuring greater awareness amongst key Australian decision-makers of synchrotron-related achievements and benefits.

For readers who may have missed the news while on holiday, the synchrotron has a new federal minister: Senator Chris Evans is now Minister for Tertiary Education, Skills, Science and Research. Minister Evans will work closely with Greg Combet, the new Minister for Industry and Innovation.

Keith Nugent
Director, Australian Synchrotron

Beamtime applications open 8 May 2012

Beamtime submissions for round 2012/3 (September-December 2012) open on 8 May 2012.

Key dates for beamtime submissions are listed on the synchrotron website at:

http://www.synchrotron.org.au/index.php/features/applying-for-beamtime/proposal-deadlines

If you would like to discuss your ideas for future beamline proposals with the beamline scientists at the Australian Synchrotron, please allow plenty of time.

For more information about applying for beamtime at the Australian Synchrotron, contact the User Office: user.office@synchrotron.org.au

Up to speed: Lauren Baird

This month our short interview features Lauren Baird, database officer at the Australian Synchrotron.

Describe your job in 25 words or less.

Officially I'm in charge of databases at the synchrotron, though in practice I spend a lot of time programming too.

Best thing about your job?

I have the opportunity to work with lots of different departments within the synchrotron and other organisations such as VeRSI, and every single person is passionate about their work – it's inspiring! (I also have the best view from my window!)

Worst thing about your job?

Getting here... with no bike paths! Car pooling has been a lot of fun too :-)

Biggest challenge facing your team?

I'm also on the environmental committee and the biggest challenge we face is coming up with useful green initiatives that make a positive impact on the staggering amount of resources required to run a synchrotron.

Apart from the Australian Synchrotron, what's the coolest job you've ever had?

Installing solar panels in the foothills of the Himalayas. Though taste-testing for an ice-cream company was pretty high up the list.

Best things about living in Melbourne and why?

We have laws against unauthorised rainmaking, harnessing goats, flying kites, hanging out with pirates and playing annoying games in public... you have to love a city that can make fun of itself!

Your favourite overseas destination and why?

Nepal. For the Himalayas, the people and the deliciously sweet and spicy tea.

A little-known fact about the Australian Synchrotron?

We are soon to have a veggie patch onsite – there are a lot of very keen gardeners amongst the staff!

What's the most unusual or interesting project you've been asked to do at the AS?

Collecting mangrove seeds (and getting covered in mud while doing it) for our annual volunteer day.

If you could change one thing about the AS, and only one thing, what would it be?

The resource consumption. It would be great to make use of renewable, cogen and water-capture technologies to run a completely green facility.

What's the most unusual or interesting question you've been asked about the Australian Synchrotron?

Do you microwave your lunch in the beam?

2011 User Meeting report

The Australian Synchrotron User Meeting in December 2011 attracted an enthusiastic crowd of over 230 synchrotron experts, users and prospective users.

In response to user feedback from the 2010 meeting, synchrotron users, through the User Advisory Committee (UAC), played key roles in setting the agenda, organising the event (ably assisted by the AS External Relations team) and developing the program for the meeting.

Held at the Lakeside Sebel in the Melbourne suburb of Albert Park, the 2011 User Meeting provided a fertile environment for participants to share their research experiences and plan future collaborations. Presentations by plenary speakers from Italy, New Zealand and Australia were complemented by 60 other speakers and more than 80 posters featuring synchrotron research projects.

The meeting commenced with a welcome from the Chair of the UAC, Richard Garrett. Richard was followed by AS Head of Science Andrew Peele and Director Keith Nugent, who provided an update on facility activities and developments over the last 12 month Poster displays and dinner

James Whisstock: mammalian immune systems

Plenary speaker James Whisstock from Monash University talked about an important group of proteins: the membrane attack complex / perforin (MACPF)-like protein superfamily. These proteins play a central role in mammalian immune systems, defending against attack from infectious organisms. Using the Australian Synchrotron (crystallography and small angle x-ray scattering) and other complementary techniques, James and his colleagues determined the atomic structures of a MACPF protein and perforin itself as well as the structure and mechanism of formation of the perforin pore. This new information yielded the surprising finding that the MACPF-like superfamily is structurally related to an ancient and lethal family of bacterial pore-forming toxins – and also revealed striking differences in how these molecules assemble to form pores. Taken together, the data suggest approaches to control unwanted MACPF activity in immune-driven diseases such as transplant rejection.

Mike Lawrence: high-throughput crystallography

Mike Lawrence from the Walter and Eliza Hall Institute discussed his latest research into the binding of insulin to its receptor and its significance in diabetes, cancer and Alzheimer's disease. He noted that structural biologists lead the use of the AS in fundamental and translational research, and pointed out that half of all peer-reviewed AS publications arise from the MX / SAXS beamlines, demonstrating the community's strength and the high operational standards of these beamlines. Mike went on to explain the potential value of developing a new undulator-based beamline (MX3D) at the Australian Synchrotron. This beamline would enable high-throughput tray screening and ultra-high-throughput single-crystal data collection as well standard MX use, rivalling the best such beamlines currently being built internationally.

Simon Clark: earth sciences

Simon Clark from the Advanced Light Source at the Lawrence Berkeley National Laboratory in California spoke about his research into understanding the evolution and dynamics of the earth. This research is a prerequisite to our being able to predict and mitigate natural disasters, such as earthquakes, tsunami and volcanic eruptions, predict the location of natural resources and understand the causes of long-term climate change. The high brightness of synchrotron radiation is essential for in-situ characterisation of earth materials at the pressures and temperatures found in the earth's interior. Simon discussed current knowledge of the earth's internal structure, and plans for establishing a high-pressure facility at the Australian Synchrotron.

2011 User Meeting report (cont.)

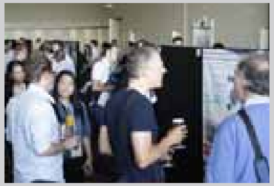
David Thurrowgood with one of his AS collaborators, Daryl Howard, who chaired this session.

David Thurrowgood: technical examination of paintings

David Thurrowgood from the National Gallery of Victoria talked about the technical examination of paintings, in collaboration with CSIRO and AS staff. He focused on the use of x-ray fluorescence microscopy for obtaining images and chemical information from several significant paintings in the NGV collection. Working at the Australian Synchrotron, David and his colleagues have captured the world's highest resolution (by several orders of magnitude) elemental maps of the surfaces of historic paintings.

Poster displays and dinner

Thanks to the volume of abstracts received for the User Meeting, a record number of posters were on display. After a day of thought-provoking presentations, delegates enjoyed viewing posters while sampling canapés and refreshing beverages and listening to the Pete Mitchell Jazz Trio. The official User Meeting dinner hosted at the same venue enabled participants to continue discussing their research interests or simply get to know each other better, and featured an animated talk on accelerator science by Michael Hart from the AS Scientific Advisory Committee.





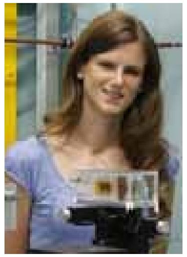




Jeff Tallon: synchrotrons and superconductivity

The second day of the User Meeting began with a plenary presentation by Jeff Tallon from Industrial Research Limited in New Zealand. Jeff reminded his audience that 2011 was the centennial of the discovery of superconductivity and also a quarter of a century since the discovery of high-temperature superconductors (high-Tc or HTS). Despite remaining a puzzle to this day, HTS materials are nonetheless being applied in many areas, such as health, transport, energy, mining and minerals processing, telecommunications, information technology and the research sector. Jeff described how HTS are used in synchrotron magnets and how synchrotrons are playing a central role in unravelling the puzzling physics of these mysterious materials. He noted some recent HTS developments that affect synchrotron technologies, including products from his group's spin-out company HTS-110 Ltd, and highlighted some of the insights that synchrotron science has brought to HTS physics in his own research, including ARPES, infrared ellipsometry, XRD, XAFS and XANES.

2011 User Meeting report (cont.)



Above Left: Kaye Morgan at the AS. Above Right (L-R): AS Director Keith Nugent, David Paganin (accepting the award on behalf of Kaye Morgan), Corey Putkunz and Andrew Peele (AS Head of Science and Corey's PhD supervisor).

Thesis Medal 2011: Kaye Morgan and Corey Putkunz

AS Director Keith Nugent then presented the 2011 Australian Synchrotron Thesis Medal, which was awarded jointly to Kaye Morgan (Monash University) and Corey Putkunz (Melbourne University). As Kaye was unable to attend the meeting due to a prior commitment at a Japanese synchrotron, co-supervisor David Paganin from Monash University accepted the award on her behalf. Corey Putkunz, who undertook his PhD at La Trobe University, gave a presentation about his research into advanced methods of coherent diffractive imaging. His thesis was entitled "New methods in Fresnel coherent diffractive imaging".
Click here to see separate article.

Sherry Mayo: proposed micro-CT beamline

Sherry Mayo from CSIRO (left) talked about the proposal for a micro-CT beamline at the Australian Synchrotron. This beamline would combine multilayer mirror optics with new high-speed x-ray cameras to bring the 4th dimension of time to three-dimensional imaging. It would support imaging and micro-tomography in broadband monochromatic and pink-beam modes with a strong focus on high throughput and high-speed applications. The beamline would draw on existing expertise and infrastructure in phase-contrast imaging and high-speed computing.

Andrea di Cicco: condensed matter under extreme conditions

The final plenary speaker of the 2011 User Meeting was Prof Andrea di Cicco (left) from the FERMI@Elettra free electron laser facility in Trieste, Italy. Andrea gave attendees an insight into the present status of the TIMEX end-station at this facility. TIMEX is devoted to performing experiments on condensed matter under extreme conditions. He discussed the results of the first pilot experiments and end-station tests.

Open forum

In the concluding session of the User Meeting, an open forum with synchrotron scientists, the User Advisory Committee and AS senior management gave participants an opportunity to discuss development issues and challenges at the Australian Synchrotron. The session highlighted the cohesiveness of the Australian Synchrotron research community.

Feedback

Feedback from meeting attendees shows that participants thought the 2011 Australian Synchrotron User Meeting was a resounding success overall. It provided delegates with information, ideas, techniques and updates on the capabilities and future potential of the facility, and a platform for developing and strengthening partnerships and collaborations.

Seventy percent of survey respondents were AS users, and more than 50 percent of respondents were attending an Australian Synchrotron User Meeting for the first time.

Ninety-five percent of respondents rated the 2011 User Meeting as 'good' or 'excellent', offering comments such as "the conference informed me of the current research and abilities of AS and was run in an organised and enjoyable manner".

Many thanks to the UAC and External Relations teams for a job well done.

Thank you to all participants for your support and we look forward to welcoming you again in 2012!

"Hello, is that the user support desk? We were just about to storm the enchanted castle with a war dwarf, an elf and a fifth level paladin when the whole damn system crashed... " (Caption by David Cookson)

Superconductivity and synchrotrons

One hundred years since the discovery of superconductivity, and 25 years since the first high-temperature superconductor (HTS) was discovered, HTS materials are being used in synchrotron instruments and magnets – and synchrotrons are helping to reveal the very complex physics of HTS materials.

Jeff Tallon, an HTS expert from Industrial Research Ltd in New Zealand who addressed the Australian Synchrotron User Meeting on this topic in December 2011, predicts that the impact of HTS in synchrotron science will grow markedly over the next decade.

Although the technology has been slow to mature, HTS magnets and coils are now used in commercial motors, generators, transformers, cables, defence and transport applications (see http://www.hts110.co.nz/, for example). HTS materials are often the only solution, or more economical than conventional systems. Synchrotron applications include HTS magnets built for the Hahn-Meitner Institute for x-ray diffraction at high field, the LNLS in Brazil and the TATA Institute of Fundamental Sciences for ion focussing at the Pelletron LINAC facility in Mumbai. HTS dipole magnets supplied to Brookhaven National Laboratory (retrofit) and the Taiwan Proton Source at NSRRC require 20 times less power than conventional copper-wound coils. Perhaps the most complex HTS magnet system yet delivered to a synchrotron is the 9 Tesla large-area rapid imaging analytical tool (LARIAT) for 3-D NEXAFS measurements being installed at NSLSII (see picture).

Several synchrotron x-ray absorption and diffraction techniques have contributed extensively to HTS physics. More recent studies using an x-ray technique called angle-resolved photoemission spectroscopy (ARPES) and infrared ellipsometry suggest that it may be possible to develop superconductors that operate at higher temperatures (such as 180K or -93 degrees Celsius). A key challenge would be to find a way to suppress the superconducting fluctuations that set in at about 70-100K above current critical temperatures. Now there's a goal.

Warning: seriously technical language below!

Synchrotron science has contributed extensively to HTS physics. While EXAFS, XANES and resonant XRD have been important, the dominant contribution has been from ARPES and, more recently, infrared ellipsometry. ARPES has shown that a Fermi surface exists (at least on the overdoped side), has mapped the dispersion, the Fermi surface and the momentum dependence of energy gaps, and revealed the renormalisation of the bare dispersion that describes the crucial coupling between electrons and bosons. The thermodynamic and magnetic properties calculated from the dispersion agree closely with direct measurements of electronic enthalpy, entropy and susceptibility, across the entire phase diagram. The infrared studies expose the same energy gaps and reveal the transfer of spectral weight as these gaps open. It turns out that superconducting fluctuations set in 70 to 100K above Tc. If these fluctuations could be suppressed, much higher Tc values (180K) could be achieved. Now there's a goal.

Dr Jeff Tallon is Distinguished Scientist at Industrial Research Ltd, Lower Hutt, New Zealand. j.tallon@irl.cri.nz

Above Left: 9 Tesla and 0.8 Tesla magnets for the LARIAT NEXAFS system at NSLSII Brookhaven National Lab. Designed and constructed by HTS-110 Ltd, New Zealand. Above Right: Jeff Tallon, IRL

2011 AS thesis medal winners

The joint winners of the 2011 Australian Synchrotron Thesis Medal are Kaye Morgan (Monash University) and Corey Putkunz (PhD from La Trobe University, now at Melbourne University).

Kaye Morgan (photo below) developed methods for taking synchrotron x-ray images of live biomedical subjects. Her methods are being used to assess promising new treatments for cystic fibrosis.

Corey Putkunz (photo below) developed new synchrotron x-ray imaging techniques for obtaining 2D and 3D images of biological and materials samples with nano-scale features.

Kaye Morgan, joint winner of the 2011 AS Thesis Medal, at the AS imaging and medical beamline.

Kaye Morgan

During her PhD at Monash University, Kaye investigated several aspects of imaging using synchrotron x-rays for phase contrast. Her aim was to achieve live imaging to detect the effect of new treatments delivered to airways suffering from cystic fibrosis.

This type of imaging raises several challenges. It simultaneously requires the spatial resolution to reveal micron-sized features in the liquid lining of the airways and the sensitivity to distinguish that liquid from the surrounding tissue – and exposures that are short enough to capture useful images of constantly moving airways.

Kaye started with a theoretical model of propagation-based phase contrast x-ray imaging from a rounded edge, analytically describing the complex wavefield (visualised in the Argand plane) and comparing an exact description of the wavefield to commonly-used numerical models.

She drew on experimental and simulation data to describe how a spinning paper diffuser (regularly used in synchrotron medical imaging beamlines to even out the x-ray illuminating field) changes the observed coherence of a synchrotron x-ray source, and how this affects the visibility of propagation-based phase contrast images.

Kaye then applied the results of her investigations to optimise propagation-based phase contrast imaging for observing airways in live mice as a means of assessing promising new treatments for cystic fibrosis.

As part of an ongoing collaboration with biomedical researchers from the Women's and Children's Hospital in Adelaide, this work led to the first high magnification phase-contrast x-ray images of live airway surfaces. Kaye and her colleagues used the improved imaging methods to track the motion of micron-size debris, and employed high resolution computed tomography (CT) to look at the lung morphology of mouse models of cystic fibrosis.

Kaye's thesis describes the first experimental demonstration of sensitive, quantitative x-ray phase imaging using a single attenuating reference grid to achieve differential phase contrast in both transverse directions from a single sample image taken with a short exposure. This demonstrates the new method's suitability for live biomedical imaging.

Kaye's method has been incorporated into the ongoing airway surface study. Her involvement in the study is continuing with a Discovery Early Career Researcher Award from the Australian Research Council. Her thesis (including published papers) is available at: http://alturl.com/cuf34

Kaye's PhD was co-supervised by Karen Siu (Monash University and AS) and David Paganin (Monash University). Her experimental imaging work was done at the Biomedical Imaging Centre of the SPring-8 synchrotron in Japan. Kaye is looking forward to bringing her techniques to the Australian Synchrotron's imaging and medical beamline.

2011 AS thesis medal winners (cont.)

(L-R): AS Director Keith Nugent, David Paganin (accepting the AS Thesis Medal 2011 award on behalf of Kaye Morgan), Corey Putkunz and Andrew Peele (AS Head of Science and Corey's PhD supervisor).

Corey Putkunz

As part of his PhD, joint 2011 AS Thesis Medal winner Corey Putkunz developed new synchrotron x-ray imaging techniques for obtaining 2D and 3D images of biological and materials samples with nano-scale features. Unlike conventional microscopy, these diffraction imaging techniques do not require lenses to form images, and are therefore not limited by lens resolution or manufacturing quality.

Corey completed his PhD in the Department of Physics at La Trobe University. His research involved advancing methods for x-ray imaging at the nano-scale, specifically coherent diffractive imaging (CDI). He developed a technique for two-dimensional lens-less imaging called phase diverse coherent diffractive imaging. This technique uses a focused synchrotron x-ray source to illuminate samples ranging in size from 1 micrometre (micron) to 50 microns or more. X-ray diffraction data is collected from numerous positions on the sample and combined using specially developed algorithms. The technique is much more sensitive than similar methods.

He used his 2D technique to quantitatively image the granular structure of the precursors of a protein-based adhesive produced by the sandcastle worm, extracting information about the adhesive's structure, chemical composition and density. The sandcastle worm lives in intertidal surf zones, using its powerful adhesive to build a home out of sand and broken seashells. Other researchers are studying this adhesive for its potential to provide a model for new types of biocompatible glues for medical purposes, such as repairing small bone fractures.

Corey then created a novel method for efficiently performing 3D image reconstructions of an object based on a multitude of 2D image reconstructions from different viewing angles. This method is called bootstrapped Fresnel coherent diffractive imaging (FCDI) tomography. He demonstrated the 3D technique using simulations and data from an insect wing collected using coherent optical laser light.

To provide more robust and timely 3D imaging using FCDI, Corey formulated a method for performing image reconstruction in three dimensions, avoiding the need to reconstruct individual 2D images prior to 3D image formation. He demonstrated his method, and its advantages and limitations, using simulations based on accurate experimental geometries and samples.

As a result of research undertaken during his PhD, Corey can claim several high-profile publications, including papers in Nature Photonics and Physical Review Letters.

Towards the end of his PhD studies, Corey became interested in the possibility of extending the advances made in CDI to electron imaging at the atomic scale. He is currently a post-doctoral fellow at The University of Melbourne developing single shot ultra-fast electron diffractive imaging with the hope of capturing atomic resolution images at time-scales measured in femtoseconds. He collaborates closely with the Monash Centre for Electron Microscopy as a second avenue to implement atom-scale diffraction imaging. This work has already resulted in a publication in Physical Review Letters providing the first demonstration of atomic-scale electron ptychography, a more robust variant of CDI.

Corey is also interested in implementing x-ray CDI methods at the Australian Synchrotron. He has been involved in numerous experiments at the XFM beamline, combining scanning transmission x-ray microscopy (STXM) with diffraction imaging as complementary techniques. This work will further extend the utility of beamlines that are already popular in both biological and materials science research.

Corey's PhD was supervised by Andrew Peele (AS Head of Science, previously at La Trobe University).

Neutrons and x-rays: Why stop at one shining light?

"To do really interesting science, you will have to use both neutrons and x-rays."

This, says Michael James from ANSTO'S Bragg Institute, is the fourth law of neutron scattering.*

Mike's objective at the Australian Synchrotron User Meeting in December 2011 was to encourage his audience to consider using both neutron scattering and synchrotron x-rays as probes of atomic and molecular structure. He described the main differences between the two techniques, presenting them as complementary, and followed up with an impressive set of research examples in which the techniques were used in combination to study the structure and function of a diverse range of advanced materials.

In brief, x-rays offer high flux; high resolution, excellent signal-to-noise and tuneable energies. However, they are surface-sensitive, and the scattering is dominated by large atoms (high Z). Neutrons, on the other hand, are highly penetrating, sensitive to light elements and spin-polarised (a valuable characteristic for investigating magnetism). Disadvantages of using neutrons include the relatively low flux and modest resolution.

Like x-rays, neutrons have the right wavelength to probe atomic and nanoscale structures. Neutrons interact with nuclei and not electron clouds, and can therefore distinguish between hydrogen and deuterium. They can also 'see' light atoms next to heavy ones, penetrate deeply into matter (non-destructively), and interact with magnetic materials. Neutrons are also a highly effective spectroscopic probe for studying the molecular vibrations and the dynamics of materials.

"Together, the Australian Synchrotron and the OPAL research reactor represent Australia's largest-ever investment in scientific infrastructure," Mike told his audience. "In isolation, each facility has hit its stride; with first generation beamlines completed and vibrant international user programs in place. Collectively, the use of neutrons and synchrotron light has aided the untangling of complex molecular and nanoscale problems with a deeper capacity than either probe alone."

Seven of the first 13 neutron-scattering instruments at the OPAL research reactor are available for routine scientific operation, with the remaining six under various stages of construction. OPAL has two proposal rounds per year, and the next deadline is 15 March 2012.

* The laws of neutron scattering, according to Michael James (and first articulated by Prof. John White from ANU):

1. All scattering patterns look the same (more or less)
2. NEVER use neutrons unless you have to
3. Eventually you will have to use neutrons
4. To do really interesting science, you will have to use both neutrons and x-rays.

Photo: Mike James from ANSTO describes the advantages of neutron scattering.

Microbeam radiotherapy experiments at IMBL

Jeff Crosbie from The University of Melbourne places a tumour sample on the IMBL beamline for x-ray irradiation.

A promising experimental radiotherapy technique that uses finely divided synchrotron x-rays to destroy tumours without seriously affecting normal tissue is under investigation at the Australian Synchrotron.

Around half of all cancer patients receive radiotherapy. Although effective, radiotherapy treatments still have significant limitations. For example, the radiation dose delivered to a tumour can't exceed the dose that can be tolerated by normal tissues surrounding the tumour.

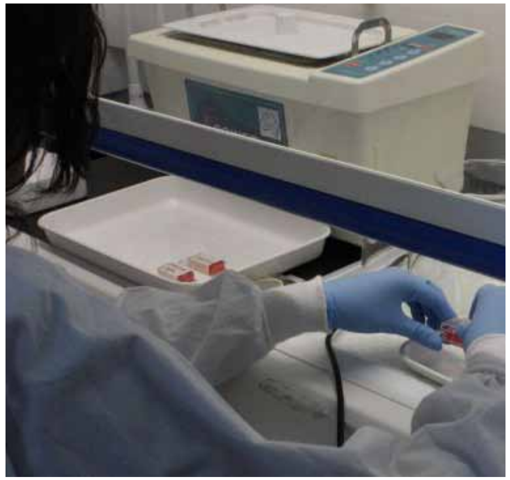
The experimental technique known as microbeam radiation therapy (MRT) challenges pre-conceived ideas about radiotherapy for two main reasons. Firstly, normal tissue seems to tolerate peak MRT doses 100 times greater than the doses used in conventional radiotherapy. Secondly, entire tumours may be destroyed under MRT even though only one-tenth of their volume has been irradiated at peak doses.

Microbeam radiation therapy uses a lattice of kilo-voltage x-ray 'micro-beamlets'. The beamlets are 100-300 microns apart (100 microns is roughly the width of a human hair) and each beamlet is 10-50 microns wide. Typical in-beam radiation doses are 500-1000 Gray, and doses in the valleys between the microbeams are approximately 5-20 Gray.

Much of the ground-breaking work with MRT has been carried out at the European Synchrotron Radiation Facility (ESRF) in France. The imaging and medical beamline (IMBL) at the Australian Synchrotron has been constructed to enable radiotherapy trials in animals and humans, and recently underwent several months of further commissioning and characterisation work.

Jeff Crosbie from the University of Melbourne is part of an Australian research team using the imaging and medical beamline and the recently-completed near-beam preparation area inside the main Australian Synchrotron building. Jeff and other researchers from The University of Melbourne, led by Professor Peter Rogers, together with colleagues from CSIRO and The Alfred Hospital conducted MRT experiments on the IMBL in December 2011.

To investigate the ability of tumour cells to form viable colonies after irradiation with synchrotron microbeams, the researchers irradiated flasks of breast tumour cells with high-dose microbeam radiation therapy using the beamline's new MRT collimator and shutter system. The team also collected data they will use to determine which genes are active in tumour cells at different times following microbeam irradiation. The group are busy analysing their data; just in time for grant-writing season.



Monica Sharma, a 2011 honours student at The University of Melbourne, processes an irradiated tumour sample.

Young tall (Synchrotron) poppies

Victoria's six Young Tall Poppy scientists for 2011 include two Australian Synchrotron users: Matthew Hill from CSIRO and David Turner from Monash University.

Matthew Hill is a materials chemist from CSIRO Materials Science and Engineering. He received a $5000 prize as Victorian Young Tall Poppy Scientist of the Year.

Matthew uses the AS powder diffraction and macromolecular crystallography beamlines in his studies of ultraporous materials known as metal organic frameworks (MOFs). Matthew's MOFs presently hold world records for storage of hydrogen and natural gas at room temperature, and carbon dioxide at zero degrees. MOFs have applications or potential applications in the automotive industry and in clean-energy and energy-efficient technologies. Matthew was previously awarded a Victoria Fellowship 2010 by the Victorian Government.

David Turner is a research fellow in the School of Chemistry in the Science Faculty at Monash University. He is using synchrotron x-ray crystallography techniques to help him develop new materials that can interact with biologically or environmentally important molecules. These new compounds could potentially help address the environmental impact of increasing global industrialisation, with applications such as carbon dioxide storage.

Matthew and David are close collaborators who work together at the AS.

Click here to go to the AIPS (Australian Institute of Policy & Science) website for more information.

The Victorian Young Tall Poppy Awards are supported by Deakin University, La Trobe University, Monash University, the University of Melbourne and the Walter and Eliza Hall Institute, with national support through the Department of Health and Ageing.

Photo competition - enter now

The Australian Synchrotron has an ongoing photo competition for staff, users and visitors. The rules are simple: your photographs must have been taken at the Australian Synchrotron, and professional photographers are not eligible to enter the competition. The next deadline is Friday 16 March 2012. (All photos submitted since December 2011 will be included in this round of judging.)

Click here to enter.

Events diary

Synchrotron-related events in Australia and overseas. Read more

Reader feedback

Lightspeed welcomes your comments and suggestions. Please send these to: info@synchrotron.org.au with 'Lightspeed comments' in the subject line.

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Careers at the Australian Synchrotron

The Australian Synchrotron offers a unique working environment for a wide range of specialists. For information on job postings, go to:

http://www.synchrotron.org.au/index.php/about-us/working-at-the-synchrotron/employment-opportunities

Staff list

http://www.synchrotron.org.au/index.php/about-us/working-at-the-synchrotron/staff-contact