



## Coherent X-ray Science (CXs) Symposium 18-19 November 2013

*"Frontiers of Light Microscopy – Physicists, (Chemists) and Biologists Working Together"*

Report by Mike Ryan and Trevor Smith

The Australian Research Council Centre of Excellence for Coherent X-ray Science (CXs) was pleased to host a symposium entitled *"Frontiers of Light Microscopy - Physicists and Biologists Working Together"* November 18-19, 2013. Light microscopy techniques have, in recent years, undergone remarkable advances, improving the resolution achievable to be comparable with that of the X-ray techniques being developed through CXs, such as coherent diffractive imaging (CDI). It is for this reason that optical microscopy formally came within the gambit of the CXs during its lifespan, as these techniques can now provide complementary information to CDI. Since sample preparation protocols, particularly for biological samples, are well established for optical microscopy, these techniques can also provide confirmation of image reconstructions from other, sometimes less sample-friendly, techniques including CDI. Correlative imaging, whereby two or more imaging modes are used to gain information from the same sample, is now also gathering momentum with electron/optical, and X-ray/optical methods being established. This two day workshop, which attracted over 230 participants, concentrated on new and advanced optical imaging modes, with a strong emphasis on super-resolution optical microscopy, which built on the success of some previous workshops CXs has hosted such as that at the Convention Centre, in Melbourne, on 1st October 2010.



This meeting was held in two locations; the La Trobe Institute for Molecular Science (LIMS) at La Trobe University on November 18 and the Bio21 Institute at the University of Melbourne on Tuesday November 19. The dual locations enabled the optical imaging capabilities at both institutions to be highlighted with laboratory tours of microscopy laboratories featuring the new fluorescence lifetime imaging facility at LIMS and the super-resolution (SIM) facilities at Bio21, both of which have significant

connections with CXs. The meeting comprised a series of invited talks; two international speakers and several speakers from various Australian institutions from Melbourne and interstate.

The director of CXs, Professor Leann Tilley, opened the meeting explaining the goals of the workshop. She gave an overview of some of the activities within CXs and explained how Physicists and Biologists work together to achieve the aims of the Centre. She explained that CXs, which was established to develop X-ray imaging, has seen the exciting opportunities offered by the new Super-Resolution visible light methods and is keen to provide leadership and scientific contributions in this area. Leann then passed proceedings over to the chairs of the first session featuring our first international speaker, Schuyler van Engelenburg, National Institutes of Health USA followed by Till Boecking (UNSW), Yann Gambin (UQ), and Kat Gaus, (UNSW) using super-resolution methods to understand T cell processes.

Professor Keith Nugent, the founding director of the CXS and now Deputy Vice Chancellor Research at La Trobe University, then officially opened the LIMS microscopy facility. Keith spoke about the importance of optical microscopy, including his own contributions to the field, and reiterated the connection between optical and X-ray imaging modes. This opening was followed by a short talk by Manoel Veiga from our sponsor, PicoQuant GmbH on advances in time-resolved fluorescence techniques. Talks from Anne Rios (WEHI), Sarah Russell (Swinburne University of Technology), Nicolas Plachta (Monash University), and Kirstin Elgass (La Trobe University (CXS)) followed. After a short break the day was completed with talks from Elizabeth Hinde (University of New South Wales), Paul Timpson (Garvan Institute) and Michael Roberts (UQ).



The attendees of the workshop enjoyed lively discussions during the question times and in the tea/coffee breaks. Further discussion ensued at a dinner for speakers, chairs and CXS executive members at Café Italia in Carlton.

Day two began with Lynne Turnbull (UTS) talking on SIM applied to live cell microbial imaging, Angus Johnston (University of Melbourne/MIPS) on the application of optical imaging to nanotechnology and potential drug delivery, Matt Dixon (University of Melbourne (CXS)) using SIM to study Malaria virulence, and Nick Dixon (University of Wollongong) looking at single-molecule studies of protein transactions on DNA.

The afternoon session began with a talk by Prof. Johan Hofkens from the Katholieke University, Leuven Belgium who is a world leader in the development of single molecule-based spectroscopy and microscopy, particularly localisation-based methods. He is also a key player in the development of new fluorescent probes including variants of fluorescent proteins. This talk led a slightly more “physics-oriented” session in which some new techniques, including some non-fluorescence-based methods were discussed by Jeff Davis (Swinburne University (CXS)) and Shan Shan Kou (University of Melbourne (CXS)). Ethan Scott from UQ spoke on optogenetic imaging in zebrafish. Toby Bell reported on the recent introduction of dSTORM to Monash.



The final session concentrated on multi-photon and intravital imaging with talks by Scott Mueller (University of Melbourne), Steve Petrou (The Florey Neuroscience Institutes) and Michael Hickey (Monash University).

CXS-sponsored workshops in this and other fields have been able to bring together some of the best national and international researchers, and this meeting was no exception, providing an outstanding programs of high quality scientists; several of which came great distances to speak. It was a very stimulating event and each of us learned from each other to develop new ideas, collaborations and friendships. The ability to host outstanding meetings such as this is one of the important privileges of being a member of a well-resourced Centre of Excellence.





It has become apparent through these CXS-supported events that scientists need access to a range of instruments and techniques because different techniques are best suited to different applications and each modality has advantages and disadvantages. Bringing people together in this format has heightened the awareness of what can be done and who is doing what in this field. It has also opened up the door for new collaborations.

We are now thinking about how we can continue the legacy of CXS beyond December 2013, when our current funding ends. One aspect that CXS has initiated is the development of the Cellular Nano-Imaging Consortium (CNIC) as an affiliation of scientists with interests in Super-Resolution Optical Microscopy and other advanced imaging techniques. CNIC brings together institutions and research leaders with cross-disciplinary expertise and an interest in using and/or developing nano-imaging optical methods. It provides on-line access to information about conventional and Super-Resolution optical imaging techniques and details the resources that are currently (and potentially) available to interested parties. It is hoped that through CNIC additional workshops and conference sessions might be organised to inform Australian scientists about new high-resolution imaging modalities, and further collaborations. The CNIC site can be accessed at <http://www.cnic.net.au>.

Mike Ryan and Trevor Smith closed proceedings by acknowledging the work conducted by the organising committee, particularly Fabienne Perani who was involved in all aspects of the organisation. They also thanked the participants of the meeting, and advertised the CNIC initiative, encouraging people to contribute to this by providing details of their own facilities and capabilities. This was followed by a mixer session in the atrium of the Bio21 Institute, at which more lively discussions were had and farewells bid.

The Organising Committee for the workshop (Mike Ryan, Trevor Smith, Fabienne Perani, Peter Lock, Paul McMillan, Kirstin Elgass, Tania Smith and Leann Tilley) thanks the session chairs the speakers, and all of the participants for contributing to such an excellent program. The Committee would also like to thank PicoQuant for sponsoring the concluding mixers session, La Trobe Institute for Molecular Science (LIMS), the Bio21 Institute, and of course CXS. Photos will be available at [www.coecxs.org](http://www.coecxs.org).

