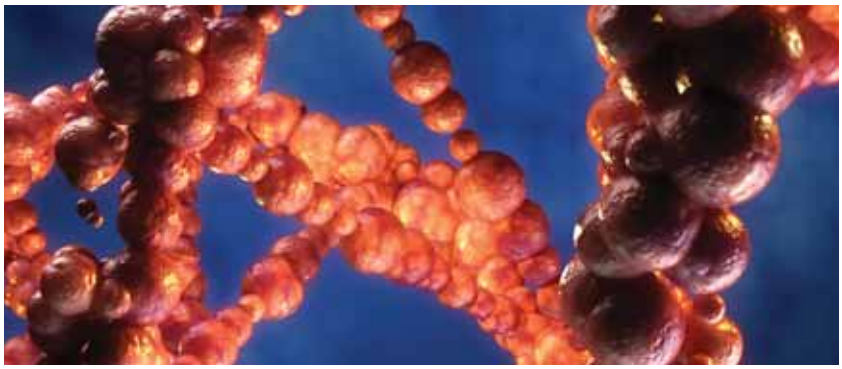
CONNECTIONS

Bioplatforms Australia Newsletter | February 2014



MESSAGE FROM BPA'S NEW CHAIRMAN – DR LES TRUDZIK

Since taking on the role of Chairman for Bioplatforms Australia in August 2013, I have been seeking to capitalise on the strong foundation offered by our suite of world class infrastructure and Australia-wide network of 'omics facilities and expertise.

I do this in the context of the 'genomics age' where the interwoven advances of genetics, high throughput technologies and bioinformatics are allowing unprecedented insight into the functioning of an organism and bringing about profound potential for every field of life science.

To ensure Australian scientists continue to be part of the genomics revolution, our most fundamental role remains steadfast – facilitate researcher access to the full range of biomolecular tools and technologies to enable discovery and innovation. With this firmly in mind, our on-going efforts will continue to focus on the following priorities:

- Catalyse new research collaborations by strengthening our networks and growing our partners.
- Foster the cultural and practical prerequisites for greater levels of cross collaboration and integration across multiple technology fields and researchers from both academia and industry.
- Generate a deeper engagement with Australia's peak research organisations to better serve the scientific community and maintain acute awareness of Australian infrastructure requirements, technology trends and emerging issues.
- Forge links with international organisations to broaden our insight into overseas research trends and secure on-going opportunities for new collaborations.

With this edition of our newsletter, we are thrilled to announce our involvement in a number of outstanding research projects. Genomics based technologies will provide a vital contribution to two flagship research programs, the first is managed by the new Centre of Excellence for Nanoscale BioPhotonics, and the second is represented by the CRC for Alertness, Safety and Productivity.

In addition, Bioplatforms Australia is supporting an enabling project at the ANU which will be utilised by a large number of organisations for a range of biodiversity studies.

I am also pleased to report that Bioplatforms Australia again recorded an upward trend in access numbers for our 'omics infrastructure network over the last financial year. This is an important metric for us and one I hope to grow further as Chairman along with other positive achievements to reflect our efforts.

Les Trudzik

NEW BIOPHOTONICS CENTRE OF EXCELLENCE

The Australian Research Council (ARC) has announced $23 million in funding for a new Centre of Excellence for Nanoscale BioPhotonics.

The Centre's highly innovative research program will merge advance capabilities in nanoscience, photonics and biomolecular science in order to explore and measure molecular processes occurring within living systems.

The new Centre, led by Professor Tanya Monro, an ARC Australian

Prof Moritz's knowledge project is building fundamental resources infrastructure to enable more rigorous species delineation.

Laureate Fellow at the University of Adelaide, brings together leading researchers from the University of Adelaide, Macquarie University and RMIT University. The Centre will be supported by additional technology and research partners, including Bioplatforms Australia.

"Biophotonics" is the extension of photonics - the science of studying and controlling the behaviour of light - to biological applications. A fundamental challenge will be to combine photonic concepts and nanoscale materials in order to create techniques and sensors capable of quantifying molecular structures and compositions within cells and tissues in real time. Such an innovative convergence of optical physics and nanoscience will transform the ability to explore the complex mechanisms of cells and open the potential for new ways of measuring how cells respond to environmental conditions or clinical treatment.

During the seven year research program, research outcomes on new methods of biological measurement will be applied to biomedical challenges that cover the development of embryos; immune signals such as touch and pain; and cardiovascular health. Thus the Centre will translate new abilities to detect change and/or monitor biological processes within the body to important outcomes for diagnostics and healthcare in the longer term.

Bioplatforms Australia is thrilled to be able to support a flagship research program that is at the forefront of converging disciplines. Access to proteomics, metabolomics and glycomics form an integral component of the research plan and will be particularly important in identifying critical molecules that can be targets of sensitive detection. We are also keen to support the drive to integrate multi-discipline expertise across physics, chemistry, materials engineering, biology and medicine to develop new science and technologies. This level of cross-collaboration and technology convergence will be key to achieving the revolutionary breakthroughs anticipated by the new Centre and is very much aligned with our own mission to enable innovation through integrated bioscience research capabilities.

Centre Director Prof Tanya Monro and Associate Investigator Dr Alex François.

ANU BUILDS GENOMICS RESOURCES FOR BIODIVERSITY STUDIES

To enable a deeper understanding of Australian biodiversity and evolutionary history, Bioplatforms Australia is supporting an important 'knowledge' project lead by Prof Craig Moritz at the Australian National University (ANU).

Australia hosts a rich and globally unique biodiversity. It is home to many unique species that are not found anywhere else on Earth yet our scientific knowledge of many of them is sparse and inadequate to meet our desires to protect them. By advancing the growing field of phylogenomics, Australia has tremendous potential to achieve global leadership in applying next-gen sequencing to accelerate species discovery and understand the distribution and drivers of diversity.

Prof Moritz's knowledge project is building fundamental resources (sequence data and methods development) to enable more rigorous species delineation and investigation into the genetic basis of climate adaption. Pioneering genomics techniques provide for much deeper insights into genetic divergence than is possible with conventional taxonomy methods or genetic barcoding (which involves the analysis of only a handful of genes).

A major challenge, however, is cost effectively scaling up a capture and assembly process for hundreds to thousands of genes in order to achieve greater genetic coverage. Likewise, researchers want to access the genetic secrets held in the vast stores of samples within museums so improved DNA extraction from preserved tissue is a fundamental aim but also a significant challenge.

The project is focusing on a transcriptome informed exon-capture method to screen complex genomes and build genetic resources. Australian terrestrial vertebrates are being used as a test case and will utilise both preserved museum skins as well as modern samples. Target species include small mammals, lizards, birds, and frogs on account of the basic taxonomy, distribution and phylogeny knowledge that exists together with the ready availability of tissue samples from museums and key labs.

Refined methods and workflows will be validated with the target species but are anticipated to be relevant for most native vertebrates as well as selected plant and invertebrates. The project will also invest substantial effort into building bioinformatics pipelines and exon-capture arrays.

So far, Dr Jason Bragg, a computational scientist involved

with the work, has sequenced and assembled 22 transcriptomes using the Bioplatforms Australia funded Illumina HiSeq2000 platform at our ANU node. Workflows for designing and analysing exon capture datasets have been refined, and the team is now actively designing exon capture studies for diverse taxa in collaboration with museums and universities. The transriptome data and exon capture design workflows will be shared with the wider community through publications, in the meantime results are being immediately applied to several ARC funded projects and other projects in various universities and museums.

The outcomes of the knowledge project well help answer current questions on what species we have in Australia, their distribution, evolutionary history and response to past climate change and will have ongoing value to Australian biodiversity research.

AUSTRALIA TO LEAD THE WAY IN INNOVATIVE SLEEP RESEARCH

Bioplatforms Australia will support the Cooperative Research Centre (CRC) for Alertness, Safety and Productivity which will receive $14.48 million in Commonwealth funding to reduce the burden of impaired alertness on the safety, productivity and health of all Australians.

This consortium will build on Australia's strengths in sleep and alertness research by bringing together multiple disciplines including medicine and public health; biomedical sciences; psychology, cognitive neuroscience and human factors; physics and biophysical modelling; electrical and bioengineering; lighting design; occupational health and safety; and road safety.

Leading researchers from Monash, Flinders and Sydney universities will collaborate with Bioplatforms Australia and 25 other organisational partners, to develop and deploy new products and services to improve alertness and performance, to bring about fewer injuries, enhanced workplace efficiency and improved quality of life in our 24-hour society. Bioplatforms Australia will particularly support biomarker studies.

This output-driven program is unprecedented anywhere in the world and recognises that impaired alertness due to sleep loss, sleep disorders and body clock disruption is a significant societal problem.

SIX YEARS AND STILL GROWING

Access to 'omics infrastructure and expertise has continually grown since Bioplatforms Australia was established in 2007.

Compared to the baseline data collated in 2006, the year before our national infrastructure network was operational, the number of researchers utilising our biomedical research services in the last financial year has trebled. This represents around a $20 million annual spend on Bioplatforms Australia funded infrastructure and services by universities, publicly funded research organisations and commercial entities.

When analysed by platform, genomics services continue to show the fastest growth and account for the majority of services provided. This reflects the obvious demand for genomics and the

Figure 1: Access to Biolplatforms Australia services between 2007 and 2013

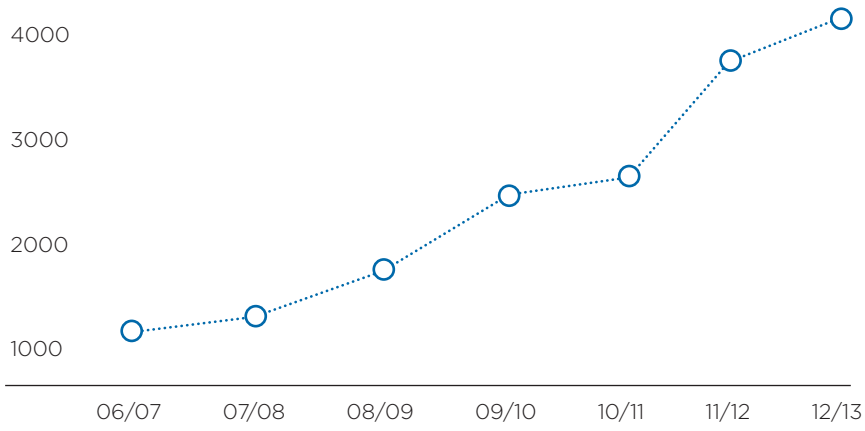
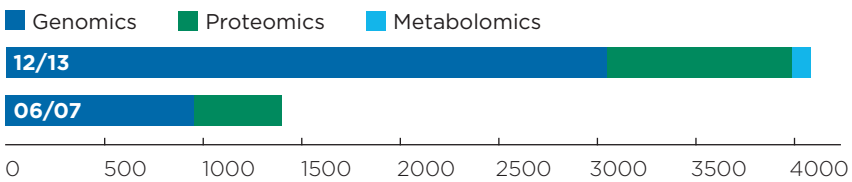
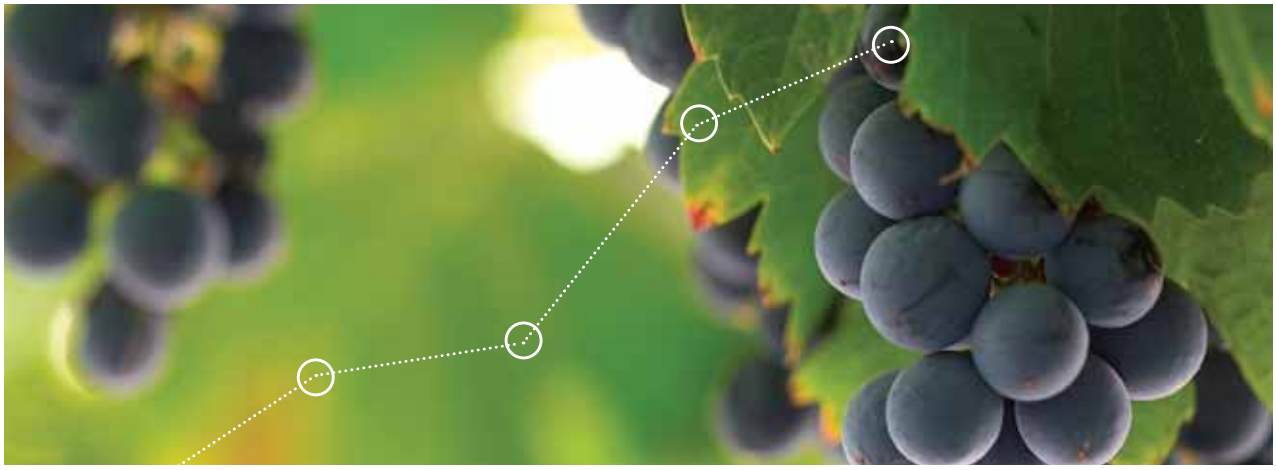


Figure 2: Client Numbers by Platform



Researchers in the environment and agriculture/ food/wine sector are increasing their access and together account for 30 per cent of clients.



fact that it is becoming more deeply related to every aspect of life science research, particularly as bioinformatics capabilities and cloud computing further improve the ability to mine and model next-generation data.

Notwithstanding the importance and demand for genomics capabilities, we are very proud that Bioplatforms Australia has both established and fostered metabolomics capabilities in Australia. This still-emerging 'omics field has already made its mark in a number of important studies covering human health, grape and wine research and other plant based studies. Such diversity of results provides another reflection of the broad applicability of 'omics technologies.

While infrastructure investments are predominantly utilised by the biomedical sector, researchers in the environment and agriculture/ food/wine sector are increasing their access and together account for 30 per cent of clients.

NEW CAPABILITIES IN METABOLITE ANALYSIS

Mass spectrometry is one of the leading analytical tools for the rapid characterisation of biological samples.

Our metabolomics node at the University of Melbourne has acquired new instrumentation that offers superior resolution and mass accuracy in analysing small molecules.

The high-end imaging mass spectrometer, Bruker 7 Tesla SolariX Hybrid-ESI/MALDI-FT-ICR-MS, is the first of its kind to be commissioned in Australia. To learn the instrument and gain knowledge on its potential, Melbourne University staff have been working with leading IMS researchers at Vanderbilt University in Nashville, Tennessee, USA. While at Vanderbilt, the technology was applied to mammalian and plant tissues with novel MALDI matrices.

This new instrument and expertise will be primarily dedicated to metabolite analyses and marks a significant advance in metabolomics characterisation and quantification capabilities.

Bioplatforms Australia 2013 Annual Report is now available on our website at www.bioplatforms.com

BIOPLATFORMS AUSTRALIA

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