



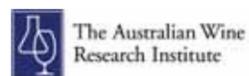
ANNUAL09
Bioplatforms Australia



An Australian Government Initiative
National Collaborative Research
Infrastructure Strategy



THE AUSTRALIAN NATIONAL UNIVERSITY
THE JOHN CURTIN SCHOOL
OF MEDICAL RESEARCH



CONTENT

From the Chairman	04
Bioplatforms Australia Ltd	06
Our Goals	06
Our Agenda	06
BioData Repository - Accelerating Systems Biology	06
2008/2009 Activities Report	08
Access	08
New Infrastructure	08
Access Vouchers	08
Usage Statistics	10
New Members and Affiliates	12
Promotional Activities	13
Conference Attendance	13
Systems Biology	14
Advocacy	14
Governance	15
Scientific Advisory Committee	15
Executive Management Committee	16
Platform Reports	16
Genomics Australia	16
Proteomics Australia	18
Metabolomics Australia	19
The Australian Bioinformatics Facility	20

FROM THE CHAIRMAN

Mr John Grant AM



John Grant, Chairman

This is the second full year of operation for Bioplatforms Australia Limited. In 2007 it was chartered to promote and leverage Australia's bioscience capabilities for the benefit of all Australian researchers. To enable its mission, Bioplatforms Australia manages a substantial investment fund which is applied to advancing bioscience infrastructure and services in the areas of Genomics, Proteomics, Metabolomics and Bioinformatics.

Bioplatforms Australia spent much of its first year establishing an extensive consortium of leading universities and biotech entities which represent Australia's best 'omics capabilities. Once operational necessities were established we increased our focus on improving technology access and increasing collaboration in support of systems biology in Australia. Of course, the infrastructure needs of researchers and associated purchases continue as a high priority and will remain a central focus.

During 2008/09, Bioplatforms Australia achieved major progress across all the initiatives highlighted in last year's report. Client numbers have increased and these trends should continue as key infrastructure is commissioned and rising awareness takes hold. Activities to promote integration and collaboration have now reached a point where a cohesive and unified Australian 'omics sector can be clearly defined. Programs to support meritorious researchers will continue to showcase our network capabilities and solidify an emerging systems biology culture. Highlights for the 2008/09 year include:

Expanding the Bioplatforms

Australia 'omics network. Our affiliate program encourages a broad national "omics" community. A number of organisations have been invited to join Bioplatforms Australia to increase research synergies and provide more comprehensive services. We are pleased to announce that Flinders Analytical and Geneworks Pty Ltd have also become company members adding high calibre 'omics services and further capacity to our infrastructure set.

Increased funding support. Senator the Honourable Kim Carr, Minister for Innovation, Industry, Science and Research has announced a further \$50 million investment in Bioplatforms Australia under the Education Investment Fund Super Science initiative. This additional funding will add to Australia's 'omics infrastructure to increase researcher access to state-of-the-art technology.

Grants for leading meritorious

researchers. The Access Voucher initiative announced last year is now available to early and mid career scientists to promote greater cultural reach of a systems biology approach and provide first hand experience of the capabilities on offer. The vouchers provide \$10,000 to each awardee for any service provided by a Bioplatforms Australia partner. Applications have been received from NHMRC with two important projects approved for support so far. The program will be extended to other research organisations.

Plans to establish a BioData

Repository. Bioplatforms Australia will establish a repository of important datasets that are vital to systems biology but are expensive to generate. Datasets will be efficiently created using the infrastructure available across the network and supported by advanced bioinformatics. This 'soft infrastructure' will then be centralised and made available to all researchers. Market demand and national innovation priorities will guide work programs which will be finalised following extensive consultation.

Promotional activities. Bioplatforms Australia together with its partners continue to publicise the capabilities and expertise of the network through sponsorship, conference attendance and demonstration projects.

Consultation and advocacy.

Bioplatforms Australia continues to support the Australian Life Science research community through its extensive consultations with funding agencies, research institutes and government representatives. Discussions are used to refine our activities and establish investment priorities.

We are pleased that our work is bringing together the 'omics expertise in Australia and providing the necessary support for continued innovation and competitiveness. We will continue to elevate our profile as our research capability and services grow and our rates of access increase. In fact, our statistics show a 21 per cent increase in fee related

services with an increase in volume by some clients. More commercial clients are utilising our services which has welcome implications for technology dissemination to industry.

In closing I would like to thank my fellow Directors - Dr Les Trudzik and Professor John de Jersey - who continue to provide support and invaluable insight in building Bioplatforms Australia beyond its foundations.

I would also like to express my appreciation to of all our facility leaders for another year of dedication and commitment as we strive to enhance Australia's research capability and expertise. They are supported by the unwavering leadership of the four platform Convenors - Dr Sue Forrest (Genomics Australia), Professor Mark Baker (Proteomics Australia), Professor Tony Bacic (Metabolomics Australia) and Professor Matthew Bellgard (The Australian Bioinformatics Facility) who together with the General Manager and Company Secretary, Andrew Gilbert, have made an enormous contribution to the achievements of the last year.

As 2010 marks a new decade and a new measure of progress, I look forward to the exciting times ahead where the national capability built under the NCRIS program is further developed through Super Science support and our continuing endeavours to facilitate a systems biology capability.

Yours sincerely,

Mr John Grant AM
Chairman

BIOPLATFORMS AUSTRALIA LTD

Bioplatforms Australia is a national organisation that was formed in 2007 to oversee specialist services in genomics, proteomics, metabolomics and bioinformatics. It was founded on the premise that research infrastructure and information technologies are vital to boosting Australia's innovation performance and an essential input to facilitate excellent research.

Bioplatforms Australia has now grown into a broad network of universities, research institutions and companies from across the country. The organisation oversees cash and in-kind contributions of approximately \$158 million from government and university partners under the National Collaborative Research Infrastructure Strategy (NCRIS). In the last budget, additional funding support of \$50 million was made under the Super Science initiative.

OUR GOALS

Bioplatforms Australia provides an integrated systems biology resource network offering access to leading technology and specialist expertise. Its mission is to enable Australian scientists to secure the maximum impact from their research endeavours. It aims to achieve this by promoting access to scientific infrastructure and greater integration and collaboration within the research community.

OUR AGENDA

Soon after inception, Bioplatforms Australia developed a Ten Year Strategic Plan. Three broad phases cover the immediate and longer timeframes:

- Execution of the NCRIS investment plan to leverage existing 'omics and informatics capabilities through additional analytical tools, integrating technology platforms and maximising access by Australian researchers.
- Establish a second generation investment plan that continues to align strategic infrastructure provision with national research priorities and market demand.
- Accelerate systems biology capability by investing in 'soft infrastructure' and establishing a BioData Repository.

Extensive consultations during the drafting process helped define these priorities. Consultations will continue as planning and implementation crystallise.



OBJECTIVES

- build a national research infrastructure network
- enhance affordable access to state-of-the-art research technology
- increase collaboration between scientists
- enable Australian scientists to remain competitive on an international level
- provide advice and advocacy on all public policy matters relevant to life science research

BioData Repository - Accelerating Systems Biology

Systems biology is a rapidly growing field and represents a long standing goal of biological sciences. System-level understanding is more than the functionality of the components of a biological system as it must also address the dynamics and symbiotic relationships that occur. Consequently, the challenge in systems biology is coupling high quality quantitative data sets with quantitative models and computer simulations.

To further accelerate systems biology in Australia, Bioplatforms Australia intends to invest in 'soft infrastructure' which describes the large scale datasets together with advanced computational tools and related expertise. Although these are vital to a systems biology approach, available funding within disciplinary boundaries is rarely sufficient to generate significant data mass. The lack of comprehensive datasets has

been identified as a major bottleneck in biological modelling and presents an opportunity for Bioplatforms Australia to further support the innovation process.

To address this deficiency Bioplatforms Australia proposes to establish a repository of biodata generated efficiently using existing instrument time to perform genomic, proteomic and metabolomic analysis of prioritised organisms and samples. Using a centralised fund, datasets of specimens offering broad national benefit will be collected and collectively managed. Organisms and samples offering broad national socio-economic benefit could include wheat, barley, cancer types and unique Australian fauna and flora. These datasets will be supported by advanced bioinformatics to create a national resource that can be utilised by all sectors of the research community.

There are three distinct advantages to this proposal:

- addresses the present deficit in critical datasets hampering systems biology in Australia and will help overcome the financial barriers associated with generating such data;
- allows broad access to critical information assets as they will be held in a BioData Repository that can be accessed by all researchers for data mining, comparative study, model development or any other applicable research question; and
- instrument utilisation will be increased during non peak service periods as capacity is applied to quantitative analysis on prioritised samples. This will ensure more cost effective use of funded infrastructure over the whole year.

Work programs will be prioritised in accordance with national priorities for innovation and national infrastructure investments. Market demand from meritorious researchers and industry requirements will be essential inputs. It is anticipated that priorities will

be established in consultation with leading research agencies and centres such as the NHMRC, CSIRO, ARC, RDCs, DPIs and CRCs together with other stakeholders within Australia's scientific community. It is anticipated that the BioData program will be initiated in the coming year and grown through to 2013. Further consultation on the makeup of the BioData program will continue with inputs from the broader scientific community.

2008/09 ACTIVITIES REPORT

As defined by our mission and objectives, Bioplatforms Australia activities are driven by:

- increased access to state of the art 'omics infrastructure;
- increased collaboration between the 'omics platforms, the 'omics researchers and the broader scientific community; and
- integration of genomics, proteomics, metabolomics and bioinformatics required to support the emerging field of systems biology.

A number of initiatives in pursuit of these objectives were announced last year and represent a significant element of our endeavours over 2008/09. The following report details our progress.

ACCESS

Infrastructure purchases, new network members and access incentives all support the goal of establishing a comprehensive 'omics resource centre and increased access.

New Infrastructure

Infrastructure purchases have embraced technology advancements including next-generation sequencing together with the latest protein identification and quantitation instrumentation. Investments also aim to increase capacity where market demand demonstrates access improvements are warranted. Supporting infrastructure has also

received some emphasis in the form of automation upgrades for high throughput services together with computer infrastructure and increased data storage. A summary of the main infrastructure purchases for each platform is presented in Table 1.

Access Vouchers

The Access Voucher program announced last year has now been established with the NHMRC and is progressing with the ARC. This program provides subsidised access to Bioplatforms Australia funded research infrastructure and services. It aims to promote increased exposure and utilisation of the consortium's resources and support culture change towards multidisciplinary research and cross collaboration in 'omics investigations.

The first applications for financial support were received from NHMRC Career Development Awardees with two so far approved. Dr Michael Piper from the Queensland Brain Institute will be supported in his research to investigate the genetic mechanisms by which embryonic neural stem cells differentiate into neurons. This research will provide a significant advance into the understanding of how neurons are generated from stem cells, which will benefit efforts to harness endogenous neural stem cells in the adult to repair and regenerate injured brain tissue. To achieve this goal, important input will be sought from the AGRF in Melbourne and Brisbane to perform cutting-edge DNA sequencing and downstream data analysis.

Associate Professor Meri Tulic from the School of Paediatrics and Child Health at the University of Western Australia will utilise gene expression profiling to identify the differences observed in the innate immune function of normal and allergic children. This research will seek to understand the impact of microbial-rich environments in the maturation of a naïve immune system during early life and the mechanism underlying any protective effect that occurs. The project aims to achieve better targeted treatment and prevention of allergic disease in young children.

Bioplatforms Australia will award further vouchers in the near future and looks forward to sharing the exciting research of young Australian researchers through our website and newsletter.

Table 1: Infrastructure Purchases

Genomics Australia	
Australian Genome Research Facility (AGRF)	- Second generation sequencing (Illumina Genome Analyzer II; Roche GS FLX) - Robotics (Tecan Evo; Illumina iScan) - Microarray technology (Agilent scanner)
The Ramaciotti Centre	- Microarray technology (Agilent scanner received as an in-kind gift from Dr John Pimanda, Faculty of Medicine, University of New South Wales) - Second generation sequencing (Illumina Genome Analyzer II; Roche GS FLX)
Proteomics Australia	
The Australian Proteome Analysis Facility (APAF)	- Quantitation and identification (Applied Biosystems 4800 Plus, MALDI TOF/TOF Mass Spectrometer) - Data storage capacity
TGR Biosciences	- Liquid handling (pipetting system) - Detection technology (BioCore)
The Queensland Institute of Medical Research (QIMR)	- Post translational modification capability (MAXIS) - Electron transfer fragmentation capability (commissioned onto existing LTQ Orbitrap Mass Spectrometer)
The Monoclonal Antibody Technology Facility (MATF)	- Robotics and operational equipment for high throughput monoclonal antibody development
Metabolomics Australia	
University of Western Australia	- Quantitation and identification (Gas Chromatograph-Mass Spectrometer, Liquid Chromatograph-Mass Spectrometer)
University of Queensland	- Cell analysis (Cellsorter)
Murdoch University	- Quantitation and identification (Varian Fourier Transform Ion Cyclotron Resonance Mass Spectrometer which offers the highest resolution organic MS available in Australia)
University of Melbourne	- Data Storage - Computer infrastructure
Australian Wine Research Institute	- Quantitation and identification (Gas Chromatograph-Mass Spectrometer, Liquid Chromatograph-Mass Spectrometer)



ACCESS AWARDEES

Dr Michael Piper from the Queensland Brain Institute and Associate Professor Meri Tulic, Research Fellow at the School of Paediatrics and Child Health, University of Western Australia have both been awarded \$10,000 of 'omics services provided by partners of Bioplatforms Australia.

Usage Statistics

A key success factor for Bioplatforms Australia is the effectiveness of NCRIS and State Government funding to improve researcher access to world-class infrastructure and associated technical support. In order to measure usage changes, pre-NCRIS transactional data from the major genomics and proteomics nodes was collected in 2006/07 to provide a base line for analysis. Further data has been collected in 2007/08 and 2008/09 which now provides an opportunity for preliminary assessment of usage trends.

Clients Increased

The number of fee for service 'omics clients has increased by 21 per cent in the last two years suggesting that access programs are beginning to have some impact.

Genomics presently accounts for the largest proportion of services and revenue representing 67 per cent of the total. This compares to 30 per cent for Proteomics and 3 per cent for Metabolomics. As each platform is at a distinctively different life stage, comparisons between platforms is not meaningful nor the driver for access records. Indeed, it is the change in usage encouraged through the NCRIS program that is of greatest

interest to Bioplatforms Australia. This is particularly relevant for Metabolomics Australia. This platform was instigated when Bioplatforms Australia was founded and could not provide services until it was fully established with infrastructure and methods development. Consequently, 2008/09 represents the first year of available data and will become a baseline for further analysis in future years.

It is noted that 70 per cent of Proteomics revenue is generated overseas which is viewed favourably as an indication of its international standing. The margin earned on this international work is used to subsidise costs for local meritorious users (Figure 1).

Increased Use by all Research Sectors

As shown in Figure 2, all research sectors have increased their usage. The university sector accounted for the majority of clients in 2008/09 with 65 per cent of the total and 22 per cent growth in the last two years. The commercial sector demonstrated a pleasing increase of 37 per cent and now totals 18 per cent of all clients. By comparison, the public sector recorded moderate growth of 7 per cent and now represents 17 per cent of clients.

Increased Spend by Commercial Sector

The proportion of revenue generated by each sector is roughly even, however, the average spend by each category of client varies considerably. University based clients recorded

an average spend of less than \$4,000 while clients from the public research sector spent approximately \$17,000 each. The average spend of commercial clients is close to \$15,000.

Revenue growth was the greatest for the commercial sector over the last two years showing an increase of 85 per cent. Publicly funded research spending also demonstrated healthy growth of 37 per cent (Figure 3).

Biomedical/Diagnostics Industry the Biggest 'omics User

The majority of research services are provided to the biomedical/diagnostics sector accounting for 66

per cent of clients and 82 per cent of revenue. The agriculture/food/wine industries accounts for 30 per cent of clients and 22 per cent of revenue reflecting a comparatively low level of 'omics input. This may be in transition, however, as clients from this sector have increased by 43 per cent in the last two years possibly reflecting the growing interest in biofuels and food security. The environmental sector is currently a minor user of 'omics services but has significant potential to change with the rapidly increasing interest in environmental genomics (metagenomics) (Figure 4).

“The number of fee for service 'omics clients has increased by 21%.”

Figure 1: Client Numbers by Platform

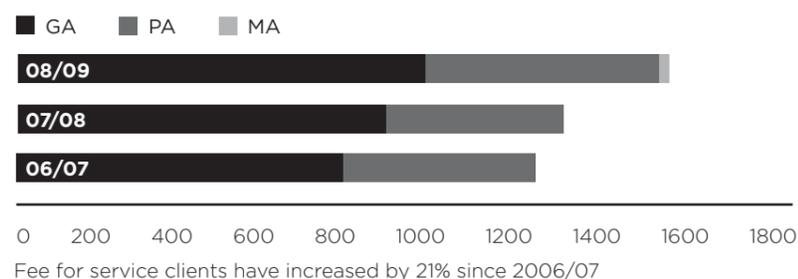


Figure 2: Client Numbers by Sector

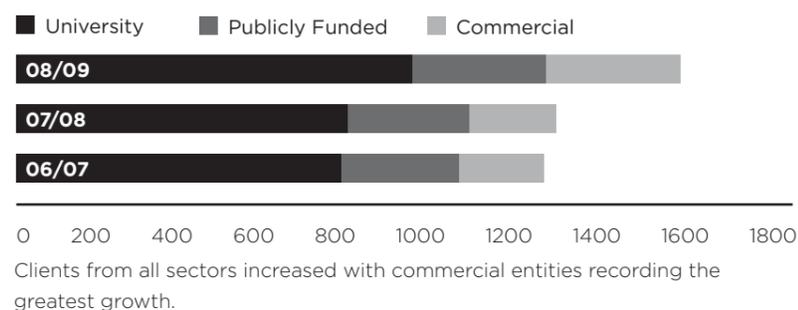


Figure 3: Service Revenue by Sector (Combined Platforms)

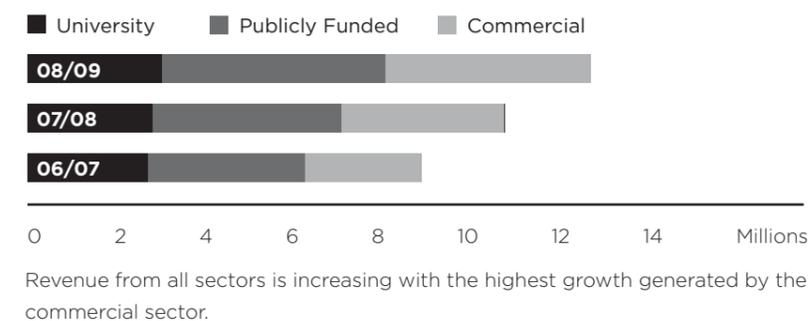
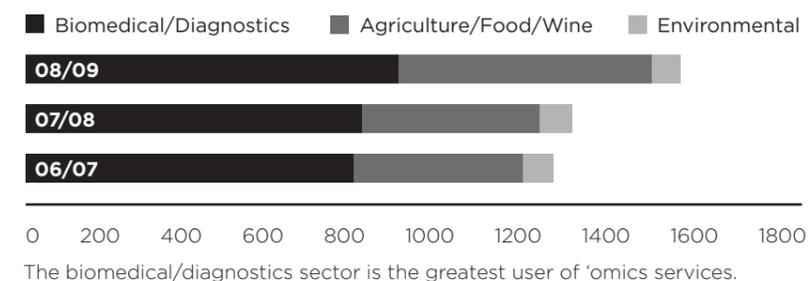


Figure 4: Client Numbers by Research Sector (Combined Platforms)



Summary

Early trends in access data are very encouraging and demonstrate an increase since Bioplatforms Australia was established and NCRIS funding allocated. Particularly pleasing is the increase in the number of clients and revenue generated from the commercial sector. This is likely to reflect the growing partnership of 'omics organisations in biomedical fields but hopefully the increases observed in other industry sectors suggest that the value of an 'omics approach is beginning to infiltrate the commercial sector more broadly. Further increases in client numbers are anticipated in future years as Bioplatforms Australia becomes more established and promotional activities have greater time to make an impact

Affiliated members are seen as key to encouraging collaboration in the 'omics sector. Indeed many already work co-operatively with other platform members to support complex research projects. Affiliates members benefit from their association with Bioplatforms Australia as they are included in:

- promotional activities undertaken by Bioplatforms Australia;
- advocacy for funding and public policy support; and
- activity reports to relevant government bodies and research councils.

In 2008/2009 we welcomed Flinders Analytical and Geneworks Pty Ltd as new members.

Flinders Analytical

Flinders Analytical provides a unique combination of analytical instrumentation, with particular focus on mass spectrometry, for analysing a wide range of compounds from small molecules to large proteins. Its diverse range of equipment and know-how are used to provide services in method development, instrumental analysis and data interpretation.

Geneworks Pty Ltd

GeneWorks provides additional valuable services in genome analysis and custom oligo synthesis relevant to systems biology output of the Australian research community. GeneWorks was established in 1996 as a major Australian supplier of leading edge molecular biology research products including

equipment, reagents, consumables and associated services. Its core business is the synthesis and supply of custom oligonucleotides proudly manufactured in Adelaide.

PROMOTIONAL ACTIVITIES

Bioplatforms Australia marketing activities seek to increase awareness of the range of capabilities and services available to the research community and increase its client base. Our partners undertake promotional activities specific to their service offering.

Conference Attendance

Conference attendance is a critical marketing tool as it increases the exposure of Bioplatforms Australia and individual partners to important target customers. Attendance at and/or sponsorship of key technical forums highlight the services offered by our research partners and publicises specialist capabilities and expertise. In 2008/09, Bioplatforms Australia exhibited either jointly or on behalf of all platforms at:

- ComBio Conference, September 2008. This conference is primarily attended by biochemists, molecular biologists, plant scientists and cell biologists.
- Lorne conferences, February 2009. These conferences (Proteomics, Proteins, Cancer and Genomics) focus on technology development and application across the breadth of the Bioplatforms

Australia portfolio. Bioplatforms Australia sponsored the inaugural Metabolomics workshop as well as the attendance of Professor Mike Snyder at the Lorne Genome Conference. In addition, a number of conference speakers from various Bioplatforms Australia nodes presented across all aspects of the meeting.

- The International Conference on Genome Informatics, December 2008. This conference provided a specific focus on bioinformatics allowing Bioplatforms Australia to target the bioinformatics community with information on our on-going deployments within this field.

These conferences and those to be chosen in future seek a cross section of potential markets based upon:

- past history of node and platform attendance;
- potential to target researchers from the genomics, proteomics, metabolomics and bioinformatics fields;
- potential to target audiences from biomedical and agri-food industries; and
- potential to increase the exposure of Bioplatforms Australia across academic and commercial sectors

“Early trends in access data are very encouraging and demonstrate an increase since Bioplatforms Australia was established and NCRIS funding allocated.”

NEW MEMBERS AND AFFILIATES

To broaden the bioplatforms network and improve technology access for Australian researchers, Bioplatforms Australia initiated an affiliate program and is constantly seeking new members. New members and affiliates enhance the infrastructure set offered by the Bioplatforms Australia network and provide complementary research infrastructure and additional capacity. Affiliate partners do not receive financial support from Bioplatforms Australia but offer service orientated facilities that complement and expand those offered by funded partners.



To broaden the bioplatforms network and improve technology access for Australian researchers, Bioplatforms Australia initiated an affiliate program and is constantly seeking new members.

SYSTEMS BIOLOGY

As Bioplatforms Australia enters its third full year of operation, projects and activities will more heavily focus on integration and collaboration. Initiatives undertaken in the past year highlight this change of focus from infrastructure building with more attention given to fostering research partnerships. Programs such as the access vouchers, funding allocations and future policy development will continue a pro-active push towards systems biology development.

This emphasis on integration and collaboration will soon be an identifying culture among Bioplatforms Australia partners. Already, each platform is increasingly looking at ways to facilitate research partnerships. A number of strategic projects demonstrating significant collaboration are being managed by each of the platforms (see platform reports). Additional projects initiated or progressed throughout the year include:

- Systems biology demonstration projects: The first demonstration project focuses on wine yeast and aims to better understand the biology of yeast to allow new models of fermentation. This project, announced last year, is expected to demonstrate the symbiotic capabilities on offer through Bioplatforms Australia; the value of outsourcing specific components of research; provide an example of collaborative opportunities; and showcase the integrative capacity of bioinformatics in data mining and



The Australian Wine Research Institute will manage a wine yeast project that requires collaboration by all four platforms.

interrogation. Of course, it will also directly benefit the wine industry by providing an opportunity to innovate. The research outcomes are also expected to benefit other yeast fermentation related industries such as bread making, brewing, bioethanol production and pharmaceuticals.

- A collaborative initiative with the European Molecular Biology Laboratory (EMBL) Australia to provide seed funding that will be matched by EMBL Australia to promote use of Bioplatforms Australia facilities. The proposal aims to encourage a collaborative culture between EMBL Australia and Bioplatforms Australia that

will become instituted as both organisations become further established. This agreement is nearing finalisation.

- A number of collaborations are anticipated with CSIRO ranging from a specific joint project, shared bioinformatics expertise and structural arrangements to establish Bioplatforms Australia as a preferred supplier of 'omics services.

ADVOCACY

An ongoing role of Bioplatforms Australia is to provide policy advice to the Commonwealth Government on issues related to

Australian research infrastructure and services to researchers. Over the year, Bioplatforms Australia and its partners have continued their dialogue with all levels of government, advisors and relevant departments. Discussions aim to ensure relevance of our on-going strategy; promote the value of shared infrastructure; and seek continued support beyond the current 2010/11 completion date.

GOVERNANCE

Bioplatforms Australia is managed by a Board of Directors who meet formally four times a year with additional meetings scheduled as required. In 2008/09 Board meetings were held on the following dates together with two teleconferences convened for specific project issues:

- 28 August 2008
- 20 November 2008
- 23 February 2009
- 28 May 2009

Board members have taken on specific roles in addition to their fiduciary responsibilities as follows:

John Grant – Financial oversight, Commonwealth Government liaison, NSW State Government Liaison, NSW subcontractor liaison.

Les Trudzik – Performance and Impact framework development, Victorian State Government liaison, Victorian subcontractor liaison, Western Australian State Government liaison, Western Australian subcontractor liaison.

John De Jersey – Chair of Scientific Advisory Committee, Queensland State Government liaison, Queensland subcontractor liaison, South Australian State Government liaison, South Australian subcontractor liaison.

Scientific Advisory Committee

A Scientific Advisory Committee was established by the Board of Directors to oversee scientific progress and review the needs of platforms sectors. The Scientific Advisory Committee comprises:

- Prof John De Jersey, Director, Bioplatforms Australia, Chair
- Dr Tim Littlejohn, IBM
- Prof John Mattick, University of Queensland
- Prof Peter Klinken, Western Australian Institute for Medical Research
- Prof Merlyn Crossley, University of Sydney

The Scientific Advisory Committee has been chartered to provide advice to the board across a number of initiatives including:

- Promoting and facilitating a systems biology offering for researchers.
- Overseeing strategic demonstration projects in the area of systems biology.
- Making recommendations for future infrastructure investment within the 'omics sectors.

“As Bioplatforms Australia enters its third full year of operation, projects and activities will more heavily focus on integration and collaboration.”

Bioplatforms Australia representatives have met with the Scientific Advisory Committee members throughout the 2008/09 year to seek input to the ten year strategic plan. This plan will provide the basis for future investment and guide the future direction and scope of Bioplatforms Australia activities.

Executive Management Committee

The Board of Directors chartered an Executive Management Committee which has day to day carriage of executing company activities in accordance with its objectives and responsibilities defined by the NCRIS Funding Agreement.

Committee members are:

- Andrew Gilbert, General Manager, Bioplatforms Australia, Chair
- Dr Sue Forrest, Convenor, Genomics Australia
- Prof Mark Baker, Convenor, Proteomics Australia
- Prof Tony Bacic, Convenor, Metabolomics Australia
- Prof Matthew Bellgard, Convenor, Australian Bioinformatics Facility

PLATFORM REPORTS

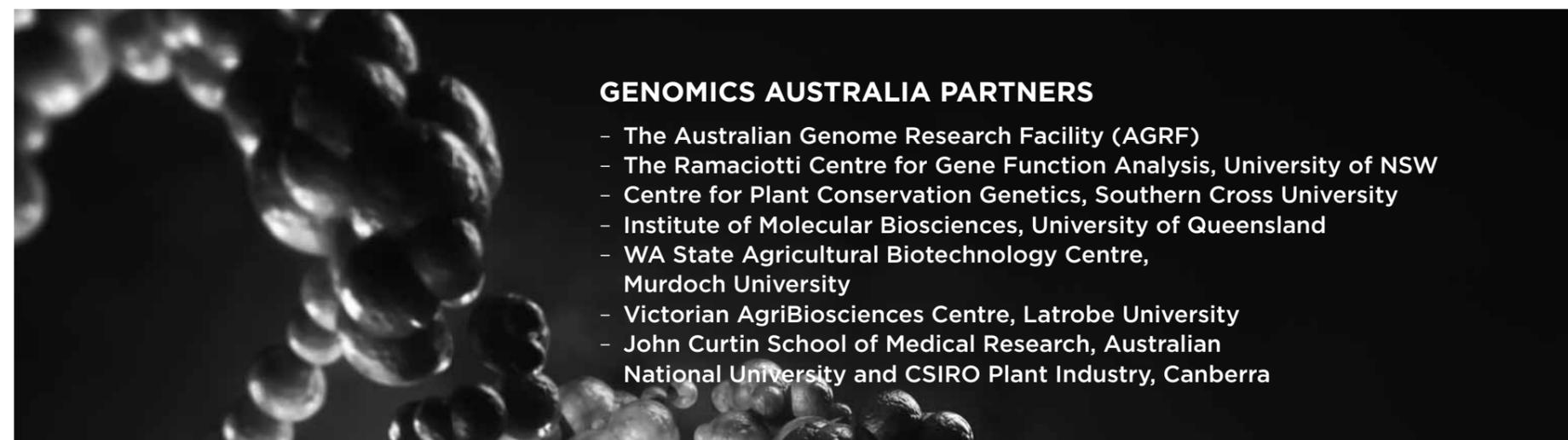
Each platform consortium co-ordinates a number of activities and projects across their technology sector in line with the goals of Bioplatforms Australia. A brief summary for each consortium is provided as follows.

Genomics Australia

Genomics Australia offers a number of specialist services in genomics, transcriptomics and epigenomics. One of our priorities over the past year has been to keep up with the exciting trend in sequencing technology. Next-generation sequencing is causing a genomics revolution. Experiments previously unfeasible on technical or economic grounds are now undertaken on a mind-boggling scale. The force of the technology will soon make the "\$1,000 genome" a reality which presents significant opportunities for future genomics research. Genomics Australia has invested in the latest sequencing instruments together with advances in microarray technology and automation to ensure that genotyping thousand-fold samples continues to become viable and within reach for all Australian researchers.

Research collaborations have been an important focus for Genomics Australia. We are pleased to be partnering in a number of strategic projects which leverage our existing expertise and make the most of our latest infrastructure purchases. A summary is provided as follows:

- Victorian Life Sciences Computing Initiative (VLSCI): A joint initiative between the University of Melbourne and the State Government of Victoria will see the installation of a supercomputer at the university. AGRF is collaborating with VLSCI staff to provide genomic data sets



GENOMICS AUSTRALIA PARTNERS

- The Australian Genome Research Facility (AGRF)
- The Ramaciotti Centre for Gene Function Analysis, University of NSW
- Centre for Plant Conservation Genetics, Southern Cross University
- Institute of Molecular Biosciences, University of Queensland
- WA State Agricultural Biotechnology Centre, Murdoch University
- Victorian AgriBiosciences Centre, Latrobe University
- John Curtin School of Medical Research, Australian National University and CSIRO Plant Industry, Canberra

to help develop data handling requirements. Opportunities for bioinformatics specialists to cross train at each organisation are also being explored.

- AGRF Australian Genome Sequencing Project: AGRF will lead a landmark de novo sequencing project of an iconic Australian genome (Staghorn coral - *Acropora millepora*) with the support of free reagents from Illumina. Bioinformatics support will be vital for such an ambitious project together with the support of the other 'omics platforms. The project offers an exciting opportunity for a truly national and collaborative project in functional genomics.
- Bioinformatics Upgrade for Ramaciotti Centre: Next-generation sequencing services have presented significant

challenges in storing and processing data. Joint funding by the NSW State Government and University of NSW will support collaborations with Intersect Australia, the NSW based eResearch group and the NSW Systems Biology Initiative (SBI) to solve these issues.

- The Ramaciotti Centre will further enhance its relationship with the Peter Wills Bioinformatics Centre (PWBC) at the Garvan Research Institute. The PWBC houses and distributes all microarray data generated by the Centre which will collaborate in a grant project to expand PWBC's bioinformatics service.
- Genome Sequencing for Wheat, Rice and Sugarcane at Southern Cross University: Genome sequencing of wheat, rice and sugarcane is occurring with

international collaboration. Given these crops represent two highly significant global food crops and the leading industrial crop (sugarcane), these projects aim to support food and energy security.

- Epigenetics Research Projects: The CSIRO/ANU Genomics development node is investigating the role of epigenetics in immune function, with a particular focus on Tcells, and plant hybrid vigour. Both projects involve novel findings and development of isolation, characterisation and sequencing methods in the areas of small RNA-sequencing, ChIP-on-chip and ChIP-seq technology.

“Next-generation sequencing is causing a genomics revolution. ”

PROTEOMICS AUSTRALIA PARTNERS

- Australian Proteome Analysis Facility (APAF)
- Bioanalytical Mass Spectrometry Facility
- TGR Bioscience
- Monash Biomedical Proteomics Facility
- Monash Antibody Technology Facility
- Queensland Institute of Medical Research (QIMR)
- Adelaide Proteomics Centre

METABOLOMICS AUSTRALIA PARTNERS

- University of Melbourne
- Australian Wine Research Institute (AWRI)
- University of Western Australia
- Murdoch University
- University of Queensland, Australian Institute for Bioengineering and Nanotechnology

Proteomics Australia

Proteomics Australia offers world class infrastructure and expertise in advanced protein related services vital to research in life sciences, agri-food and human health. As intended by the move to national infrastructure networks and co-ordinated investments, a trend of cross referrals has been noted over the last year and a broad technology suite is now available to the Australian research community.

The last year has seen a significant upgrade in capacity to meet increased demand for quantitation and protein identification services. New infrastructure purchases have primarily catered to this demand, however, significant investment has also been directed to emerging technologies such as glycoproteomics, amino acid analysis and a high sensitivity MAXIS instrument housed at the QIMR for

specialist work in Post Translational Modification studies.

The Monash Antibody Technology Facility (MATF) is now fully commissioned with a full suite of robotics. This facility seeks to be the highest throughput monoclonal antibody development facility in the world and will build on its current proprietary technology to generate powerful new assays for discovery research and drug development. MATF's location in Melbourne provides Australian researchers with a unique opportunity to readily access one of the few high throughput suppliers available in the world.

The drive for research collaboration and continual upgrade in the services offered to the Australian researchers is a major theme of our activities. Highlights include:

- Increased Bioinformatics Capacity at APAF: Additional

staff and critical data storage upgrades have been undertaken to meet increased requirements for advanced statistical and bioinformatics analysis. Technology updates for improved data analysis have also been implemented including increased automation to improve multivariate analysis and visualisation techniques that can offer further clues for analysing experimental data. Another significant project aims to merge four different proteomic protein identification search engines into a single web based submission and output tool.

- Respiratory Syncytial Virus: QIMR is working in collaboration with SASVRC, University of Queensland and the National Institute of Allergic and Infectious Diseases at the US National Institutes of Health to investigate how respiratory syncytial virus (RSV), thwarts the host cell antiviral

response, including the interferon system. The aim of the project is to seek vaccines and/or therapeutic agents to combat the most important respiratory diseases of infants and young children.

Metabolomics Australia

Metabolomics Australia has now reached its first full year of operation. It was established in recognition of the growing importance of small molecule analysis to systems biology particularly in the fields of animal/human, microbial and plant research. Considerable effort has been applied to delivering infrastructure requirements with Gas Chromatograph and Liquid Chromatograph Mass Spectrometers among essential purchases. The platform intends to establish a fully accredited metabolomics facility in Perth to provide unique quantitation data and pre-clinical trial services. It is presently commissioning a Fourier

Transform Ion Cyclotron Resonance Mass Spectrometer which will be the highest resolution organic mass spectrometer in Australia and a centrepiece for this new service. Considerable effort has also been applied to standardising analytical protocols and informatics tools for high throughput data acquisition and analysis across all partners in the Metabolomics platform.

Metabolomics Australia has already established a number of affiliations and intends to grow these to further advance metabolomics research and outcomes. One such initiative seeks to establish expertise in the emerging area of lipidomics. Important collaborations with the Baker Institute and Wollongong University will assist in developing capability in lipid profiling and analysis which is likely to become an invaluable service for biomedical research. Likewise, the AWRI and University of Melbourne nodes are working to meet

“Metabolomics Australia has already established a number of affiliations and intends to grow these to further advance metabolomics research and outcomes.”

requirements for handling biological materials, particularly human fluids such as blood plasma. Such a capability will be another important contributor to biomedical research. Other highlights include:

- Biosecurity Project: The University of Melbourne will be working with the Defence Science and Technology Organisation to develop metabolite approaches to analysing the effects of various chemical agents.
- Anti-Cancer Projects: Collaboration between the University of Melbourne and the Peter MacCallum Cancer Institute will occur on two projects. The first will involve a major research program with the Institute and other commercial partners to screen anti-cancer compounds with the aim of establishing methods for investigating their mode of action. The second, separate project aims to develop

strategies for avoiding drug resistance through investigating the mode of action of a new anti-cancer drug. The University of Western Australia has an active program with the Subiaco Hospital to profile cancer cell lines and seek potential biomarkers.

- Australian Institute for Bioengineering and Nanotechnology: The University of Queensland's AIBN is working on several projects to provide quantitative analysis of fermentation samples of a number of organisms. A future project will focus on developing a systems biology platform for mammalian cells.
- Wine Yeast Demonstration Project: As previously mentioned, the AWRI will manage a wine yeast program that will require the collaboration of all four platforms. Over the next three years, 'omics data generated from a model wine

yeast will be integrated so that it can then be used to construct predictive models of fermentation. The project aims to develop a systems biology capability as well as provide improved knowledge of yeast fermentation processes relevant to a number of industries including winemaking.

The Australian Bioinformatics Facility (ABF)

The ABF delivers critical bioinformatics infrastructure and services to the 'omics platforms. Advanced data handling and manipulation techniques are already integral to 'omics investigations and the need for high-level capabilities will only increase as the full extent of systems biology is realised. ABF's bioinformatics solutions are developed and co-ordinated centrally from its home base at Murdoch University as well as through geographically disbursed staff who

work on site in direct collaboration with 'omics scientists. This embedded support ensures best practice in bioinformatics and statistical analysis can be widely disseminated throughout the Bioplatforms Australia research network and allows for customised solutions where required.

Now that a national workforce is established within each 'omics platform, substantial progress can be made to integrate bioinformatics at every stage of a project. From inception to experimental planning through to data analysis and presentation, the integration of bioinformatics into routine workflows represents the first step in ensuring data produced through 'omics science can be exploited for maximum value and impact. ABF's initiatives on this front are outlined below.

Genomics Australia

Activities have focused on developing a number of pipelines capable

of handling the next-generation sequencing technologies recently acquired by Genomics Australia. The focus has been on generating support tools for the epigenomics development group. Bioinformatics pipelines allow life scientists to effectively analyse biological data through automated multi-step processes enabled by individual programs and databases. Pipelines cater to the huge amount of data and time consuming computations required so that results can be delivered within a reasonable time.

Proteomics Australia

Activities are again directed to developing data handling mechanisms with particular focus on adopting international standards established for publication in specific journals. Projects include implementation of the Trans-Proteomic Pipeline (TPP) that incorporates a series of integrated tools for mass spectrometer proteomic data. This pipeline allows data conversion, protein searching, probability protein matching, as well as labelled quantitation of protein expression. In addition, a decoy database can be employed to reduce false positives and provide more accurate results. In parallel with search analyses, any unmatched results from high quality spectra can be further analysed.

Implementation of the web-based Proteomics IDentification (PRIDE) data repository and annotation system for mass spectrometer data has also been an important deliverable. The PRIDE database

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“The ABF also has a strategic role in integrating bioinformatics effort across the different platforms.”

houses protein and peptide identifications from various experiment types, species, tissues, subcellular locations, and disease states.

Metabolomics Australia

ABF support has occurred more broadly given the green field nature of the Metabolomics Australia platform. Initiatives include:

- Implementation of Metabolomics Australia Data and Sample Management System (MADAS).
- Ongoing development of the internet-based Metabolomics Australia Metabolite Mass Spectral database, MAMBO enabling the collaborative curation of a national metabolite repository.

Strategic Projects

The ABF also has a strategic role in integrating bioinformatics effort across the different platforms. This capability is expected to be developed and showcased in the support provided for the wine yeast systems biology demonstration project. The project brief includes the development and implementation of a mechanism for multidisciplinary data management and integration. The framework will need to be transferable to analogous projects in the future and demonstrate utility over a number of industry sectors.



BIOPLATFORMS AUSTRALIA LTD

Level 4, Building F7B Research Park Drive,
Macquarie University NSW 2109, Australia

P: +61 410 538 648

F: +61 2 9850 6200

www.bioplatformsaustralia.com



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Macquarie University NSW 2109, Australia

P: +61 410 538 648

F: +61 2 9850 6200

www.bioplatformsaustralia.com

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