

ARC/NHMRC NETWORK



FLUORESCENCE APPLICATIONS

in Biotechnology and Life Sciences

ARC / NHMRC Research Network

**Fluorescence Applications in
Biotechnology and Life Sciences
FABLS**

**Annual Report
for 2008**

**Prepared for Australian Research Council and
National Health and Medical Research Council
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Acknowledgements

The FABLS Team would like to acknowledge the valuable contributions to the Network made by the ARC, NHMRC, our Advisory Board and Committees, our Members and the Macquarie University staff. The funding, effort and input from all involved have been crucial in facilitating the success of the Network

It is a pleasure working to bring together and report on the highlights of the vibrant and active community of scientists utilising fluorescence techniques in their search for deeper understanding and greater knowledge.

Thank you again to the ARC and NHMRC for providing the vision and funding for this most successful and fruitful project.

Ewa Goldys, Network Convenor

David Tayler, Business Development Manager

Leah Boucher, Network Manager

March 2009

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Executive Summary

Synopsis

The *Fluorescence Applications in Biotechnology and Life Sciences* (FABLS) Network aims at taking a leading role in Australian research, education and postgraduate training in fluorescence applications. It stimulates commercial interest and awareness of fluorescence as well as fosters links with commercial organisations.

As of 12th March 2009, FABLS membership has grown by 27% from 402 to 512 members over the last 12 months, increasing tenfold since foundation in 2004. Over 350 members have been active and have collectively engaged over 1,500 times in FABLS activities. FABLS membership includes 112 Early Career Researchers (ECR) Members and 119 postgraduate (PG) students undertaking their Honours, Masters or PhD degrees.

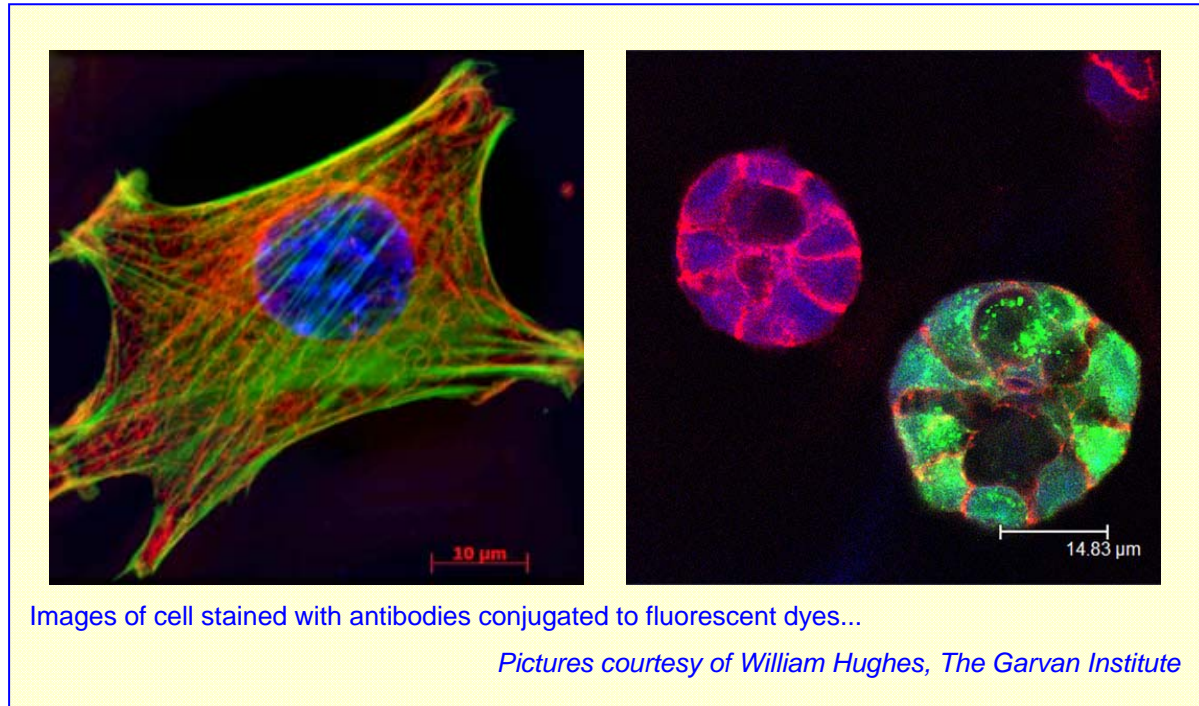
According to the ARC / NHMRC guidelines, the Networks are designed as a capacity building exercise. We are pleased to report our capacity building achievements for 2008, organised with respect to the following performance indicators (P1-P3):

P1. Stimulation of research

Research was stimulated by the Network in a number of ways, including:

- The seventh and eighth (final) funding rounds for Network projects were carried out in 2008 and resulted in the funding of 41 projects, to the total value of \$337,514. Seventy project reports from 140 projects funded in 2005 - 2008 have been received to date. Project outcomes include new project funding and funding for visits to overseas agencies and laboratories, new scientific breakthroughs, forming new partnerships and collaborations, ECR and student mentoring, producing publications and research and training workshops in Australia.
- Of the total 140 seed projects funded over the past 4 years, FABLS has granted funding to 43 Early Career Researchers (ECRs) and 9 Postgraduate students as Chief Investigators, thus facilitating their ability to undertake research, extend their knowledge and develop international networks. Many more ECR and PhD members have also been assisted as Partner Investigators included in other funding awards. Capacity building enabled by FABLS is highlighted below.
- Network Projects supported by FABLS in the six previous funding rounds (2005-2007), i.e. 99 projects to the value of \$1,051,442, have been largely completed and reported, with 11 reports overdue and 23 not yet due. Project outcomes include new project funding and funding applications, visits to overseas agencies, new partnerships and collaborations, both nationally and internationally, publications and research and training workshops in Australia, building the skills and capabilities of Australian researchers. New project reports received in 2008 are found in Appendix 5.
- The FABLS Fourth Annual Workshop in Brisbane (21-22 February 2008) brought together the FABLS community for a series of cross-disciplinary talks, networking sessions and the Annual General Meeting. The community endorsed the strategic plans for 2008 and the FABLS research priorities (see Appendix 1).

- The Strategic Initiatives Committee (SIC) continued their search for new large scale funding opportunities. The engagement with the EU funding schemes took new direction with the approach by Professor Gert von Bally to the SIC. Continuation of FABLS agenda after the cessation of funding was discussed. Subsequently it was decided to establish a Foundation entitled “Light in Life Sciences” to facilitate the continued momentum for networks and collaborations generated by FABLS.



P2. Activation of academia-industry interface

The Convenor and the FABLS Business Development Manager (BDM) have, through a number of complementary strategies, achieved for the Network, a high profile and far reaching visibility, as well as fostered opportunities for the researchers among us to establish improved connections with the research end-users. These strategies were:

- Meetings with senior company and government representatives:

In 2008, the Convenor and the BDM met with a wide range of representatives from over 148 industry and government organisations to promote the FABLS community, utilising PowerPoint presentations, member’s capability statements and project descriptions, case studies and other targeted information.

All meetings listed were held face-to-face and involved presenting information on FABLS and its background, our member’s expertise, mechanisms for industry interface and its benefits, and other Network events and highlights. There were many more contacts where FABLS was described in the process of introductions, where cards were exchanged and brochures given, however these are not reported as they are too numerous and not well targeted.

Discussions were held with the following **government organisations** (15), Australian federal and state organisations and US organisations:

Food Standards Australia New Zealand	NSW Food Authority
CSIRO Mathematical Sciences	NSW Dept of State & Regional Development
Invest Australia	NSW Office for Science and Medical Research
Dept of Agriculture, Forestry and Fisheries	National Security Science and Technology branch (Dep't of Prime Minister and Cabinet.)
Maxine McKew, Federal MP	AQIS
NSW DPI	North Carolina Biotechnology Centre (US)
Verity Firth, NSW State MP	Maryland Dept of Economic Development (US)
Indiana Economic Development Board	

Discussions were held with the following **industry organisations** (21) representing science, food, horticultural and meat industries in Australia:

AusBiotech	Science Industry Australia
InnovationXchange	Australian Food and Grocery Council
Australian Nano Business Forum	AusMedTech
Environmental Biotechnology CRC	Fisheries Research & Development Corporation
Meat and Livestock Australia	Dairy Innovation Ltd
Horticulture Australia Limited	Tasmanian Salmonid Growers Association
AusVeg	Australian Egg Corporation Limited
Apple and Pear Australia Ltd	Grape and Wine R & D Corporation
Citrus Australia Ltd	Cherry Growers of Australian Inc.
Australian Pork Limited	Australian Nashi Growers Association
ManufactureLink	

We also held discussions with Australian representatives and, in many cases, with international representatives from the following **companies** (38):

BD Biosciences (Aust and US)	Beckman Coulter Australia P/L
AI Scientific/ AES Chemeux (France)	Biomérieux (France)
Agilent Technologies (Germany)	Bio-Rad Laboratories Pty Ltd
3M (formerly Tecra in Australia)	Eppendorf South Pacific
GE Healthcare	Fonterra Co-operative Group Ltd (NZ)
Genera Biosystems	GalaxoSmithKline
Guava Technologies Inc (US)	George Westons Group
Invetech (Part of Danaher Group, US)	Invitrogen Pty Ltd
Johnson & Johnson Research	Leica Microsystems Pty Ltd
Foss Pacific (Denmark)	Merck Pty Ltd
Novartis	Olympus Australia Pty Ltd
Pfizer Australia	PerkinElmer (Australia and US)

SGE Analytical Science Pty Ltd	Woolworths Limited
Merck GmbH (Germany)	Merck Sharp and Dohme
Carl Zeiss Pty Ltd	MDS Analytical Technologies
Milipore Corporation (US)	Millipore Australia Pty Ltd
DTS Food Laboratories	Arrow Scientific
Key Diagnostics	ALS Laboratory Group
Syngenta (UK)	ZyGEM Corp Ltd (US)

Aspects of FABLS credentials were also presented to the following **companies** (38) with representatives from Australian companies and companies headquartered overseas:

Astra Zeneca Pharmaceuticals	Boeringer Ingelheim Pharma GmbH & Co
Sanofi-Aventis	Advanced Analytical Laboratories
Biopharmica	NC Medical Research Inc (Japan)
PicoQuant GmbH	Proctor & Gamble Pharmaceuticals (Canada)
Bilaterals Co Ltd (South Korea)	EBRI Cambridge (UK)
Wyeth Pharmaceuticals	Univ. of Maryland Biotechnology Institute
Promega Corporation	BASF - The Chemical Company
Amgen	Rigaku Corporation (Japan)
Lilly	Clean Cells S.A (France)
RNL Biostar	Dow Chemical (Australia) Ltd
Nanopoint	Univ. of Colorado at Denver, Health Services
Medtronic	Opticsan
Sony DADC	Proteogen Inc (South Korea)
DASGIP AG	Biolink
Biocompatibles UK Ltd	Emergent Technologies Inc (US)
Avesthagen	Clinical Trials NSW
Iris Bio-Technologies Inc (US)	Circadian Technologies Ltd
NewSouth Innovations Pty Ltd	Queensland Health Scientific Services
Inspection Systems Pty Ltd	Silliker

- Development of a CRC bid – CRC for Rapid Pathogen Detection

In 2007 the FABLS Management endorsed the development of a CRC bid based on capabilities of selected FABLS Members. A team of about 20 researchers was initially assembled to develop research programs in real time multiplex detection of pathogens in a health care setting, cellular biosensors and purification of isolated cell populations. In 2008, following extensive interaction with both science industry and end-users of the proposed technology, the focus of the CRC was narrowed to the rapid detection of pathogens in the food industry, incorporating food contamination and biosecurity (quarantine). The CRC focus will be the development of precision instrumentation, DNA/RNA amplification and imaging reagents and software to facilitate and accelerate pathogen detection.

- CRC partner

The Convenor and Business Development Manager undertook a major effort to draw industry into this initiative. The initial Partner Universities (Macquarie, Monash and UTS) invested in excess of \$80,000 to support this development. The Universities of Queensland and New South Wales were also involved. We sought the expertise of several key government departments to identify potential commercial partners. We engaged in excess of 100 meetings in 2008. In parallel we developed compendia of promotional documents including a strategic overview, academic and company research partners, areas of interest, and the team's credentials, publications, patents.

- The CRC memorandum of information was developed

We surveyed all biotechnology companies on the eastern seaboard, identified potential participants and developed a database of contacts. We also put together detailed information packages which we customised and sent to 13 major multinationals including Pfizer, Novartis, Merck, GE Health, Foss Pacific, 3M, Millipore, Invitrogen, Biomerieux, GlaxoSmithKline, Agilent (part of Hewlett Packard), PerkinElmer and Merck Sharp & Dohme. Finally we developed a qualitative economic analysis of CRC proposition for selected major partners.

- Definition and promotion of FABLS capability

47 one-page descriptions of members' projects have been collected and updated and used as a representation of the expertise within FABLS. Copies were made available to most of the companies listed above. Also, 44 capability statements describing the expertise of FABLS members were voluntarily collected. All descriptions are posted on the FABLS website. In addition a comprehensive capability description was compiled to represent the skill base for the above mentioned CRC.

- Organisation of nine industrial seminars in both Sydney and Melbourne and the dissemination of three FABLS newsletters

The seminar invitations and newsletters were disseminated to our mailing list of 700, which includes FABLS members and representatives of companies interested in fluorescence technology, as well as those mailing lists of associate network organisations.

- Development of contact databases

The FABLS database of those having an interest in the Network currently holds approximately 500 names in addition to the 512 members of FABLS. Many contacts were the result of direct contact by the FABLS management team as part of the quest to expand the community's awareness of the use of fluorescence science in biology, biotechnology and medical science. In addition, FABLS is able to reach the AusBiotech membership of 2,400; the Science Industry Australia's membership of 90; and the Fluorescence Imaging Group's membership of 300.

P3. Development of education and training programs

- FABLS supported several teaching and training workshops, via postgraduate and ECR subsidies and bursaries and sponsorship of international speakers' visits, reaching over 700 attendees throughout 2008.

FABLS Sponsored Workshops in 2008

	Workshop Name	Workshop Convenor	When & Where	Number of Attendees
1	Pasteur & WEHI Workshop "Imaging infectious diseases at the molecular, cellular and tissue level"	Dr. Emanuela Handman	31 Jan-1 Feb 2008; WEHI, Melbourne	120
2	1st Advanced Fluorescence Bio-Imaging Workshop	Dr. Anya Salih	8-12 Sept 2008; UWS, Hawkesbury	300
3	CXS 2008 Workshop - Facilitating X-ray Biophotonics... Physicists and Biologists Working Together	Dr. Leann Tilley	17-19 Sept 2008; BIO 21 Institute, Melbourne	146
4	Live Cell Imaging Workshop	Dr. Ian Harper	1-4 Dec 2008; MMI Centre, Monash Univ.	24
5	Australian Key Centre for Microscopy and Microanalysis Jubilee Commemorative Symposium	Dr. Lilian Soon	3-5 Dec 2008; EMU, University of Sydney	100

- Reports from these workshops and from the FABLS-sponsored participants can be found in Section 3.4.4 and Appendix 14.
- FABLS, in 2008 and early 2009, coordinated 9 free seminars in Sydney and Melbourne, mostly in conjunction with another interest group including FIG, MQ Photonics, MMI, and Olympus, bringing together researchers and industry for information and technology sharing and networking (See Appendix 16).
- The book "Fluorescence Applications in Biotechnology and Life Sciences" has been finalised and is due for publication by Wiley in 2009. The book was authored by 35 FABLS members and edited by Network Convenor, Professor Ewa Goldys. It will be the most up-to-date reference available and will be marketed worldwide.

Good News from the Garvan Institute



FABLS Member, Prof. David James of the Garvan Institute of Medical Research leads a project entitled "Identification of compounds for the treatment of human type 2 diabetes", included in the NHMRC's publication "10 of the Best Research Projects 2008". He says type 2 diabetes involves a complex interplay between all major systems of an individual's body, genes and environment.

Quantitative indicators of FABLS Network in 2008

<p><i>Number of ECRs and post graduate students funded for various activities</i></p>	<ul style="list-style-type: none"> • 15 ECR and 5 PhD student projects funded in 2008 rounds • 10 PhD students and 10 ECRs were directly sponsored via FABLS Bursaries to attend various training courses • More than 50 postgraduate student activities are covered by established researcher projects funded in 2008, including 8 international lab visits and 3 interstate lab exchanges by postgraduate students (Appendix 12)
<p><i>Number of proposals from participants to the Network and the number of activities funded</i></p>	<ul style="list-style-type: none"> • 5 training workshops / activities (Section 3.5.2) were supported in 2008, & 2 training activities approved for 2009; • 41 research projects funded from 44 applications received (Appendix 3); and a proposal for a CRC for Rapid pathogen Detection is under development for a collaborative group arising from the Network
<p><i>Governance</i></p>	<p>FABLS has 4 operational committees + the Advisory Board</p> <ul style="list-style-type: none"> • Executive Management Committee (EMC) – 4 face-to-face meetings in 2008, Network Governance role • Resource Management Committee (RMC) – email discussion, project approvals, resource management role • Education and Training Committee (ETC) – 1 teleconference in 2008, training activities role • Strategic Initiatives Committee (SIC) – 2 face-to-face meetings in 2008, large research initiatives role • Advisory Board – 1 face-to-face meeting in 2008, industrial interaction role <p>Details of membership and meeting dates can be found in App 2.</p>
<p><i>Number of workshops, conferences or seminars conducted and the number of attendees</i></p>	<ul style="list-style-type: none"> • 4 training workshops (560 participants) supported • 1 Symposium (~100 participants) supported • 1 FABLS Annual workshops (66 participants) • 9 Industrial Seminars conducted (~250 participants). See Section 3.4.4 & Appendix 16 • ECRs and Postgraduate students were well represented at Network events e.g. 25% of attendees of the FABLS 2008 workshop were ECRs & PG students and they were well represented at all training workshops and industrial seminars e.g. at the Kraemer Seminar hosted by Olympus at Sydney University, almost half the audience were PG students • 10 PhD students were specifically sponsored to participate in certain events e.g. the 1st Advanced Fluorescence Bio-Imaging workshop 2008 at UWS.
<p><i>Number of international visits</i></p>	<ul style="list-style-type: none"> • In 2008, 44 International visits were funded, for Australian researchers travelling to overseas laboratories and for bringing international experts and lab representatives here to Australia. • 25 International visits were reported by members in the Project Reports we received in 2008. • Since 2005, 167 international visits, both to and from Australia, have been facilitated by FABLS funding (Appendix 12);

<i>Number of outreach activities</i>	<ul style="list-style-type: none"> • Over 440 outreach activities were undertaken; among those was a large number of company meetings and presentation of FABLS credentials. (Section 3.4.1, Section 4); • Activities with around 130 companies, 5 industrial seminars, 4 SIA meetings, 4 MedTechDev meetings, 4 others, 4 government agencies).
<i>Number of publications produced, and their impact factors</i>	<ul style="list-style-type: none"> • 50 publications were reported to FABLS in 2008 arising from FABLS funded projects (Appendix 18)
<i>Number of targeted activities</i>	<p>Activities involving research interaction for postgraduate students:</p> <ul style="list-style-type: none"> • 1 Symposium, 4 training workshops, 9 seminars (Section 3.4.4); • 1 FABLS Annual workshop (with members' expenses covered); • FABLS funded 50 postgraduate activities through its funding program in 2008, including 8 postgraduate international lab visits; • 21 FABLS funded projects in 2008 benefitted from the Infrastructure Access Program, totalling \$75,590 <p>Industry stakeholder interactions:</p> <ul style="list-style-type: none"> • 440 company interactions (Section 3.4.1). Repeated contacts with many companies.
<i>Number of universities receiving funding</i>	<ul style="list-style-type: none"> • 2008 Funding recipients (Chief Investigator's Institution) were from 15 Universities, inc. 3 International Universities (Appendix 3) • A further 23 Universities were reached when all collaborating institutions are included.
<i>Number of Network web hits and articles downloaded</i>	<ul style="list-style-type: none"> • In 2008, there were approximately 6,437 unique visitors to the FABLS website (Section 8) • Approximately 16,114 page hits (Section 8) across the year. • International distribution of web visitors i.e. Website visitors from over 22 countries in the past 500 visits (Section 8)
<i>Survey of Network participants to ascertain usefulness and user-friendliness of web site</i>	<ul style="list-style-type: none"> • Website was seen by Members as easy to use, relevant and up-to-date.
<i>Number of National Competitive Grants Program (NCGP) proposals and successful proposals result of membership</i>	<ul style="list-style-type: none"> • 44 ARC and NHMRC successful grants in 2008 round (Appendix 7), totalling over \$27,675,000
<i>Number of (active) participants</i>	<ul style="list-style-type: none"> • 350 Active Members from 512 total members have participated in over 1,500 FABLS initiatives over the period of this report (Appendix 6)
<i>What/how much additional funding was generated because of the Network</i>	<ul style="list-style-type: none"> • Funding of over \$27,675,000 associated with the 44 ARC and NHMRC grants; • Funding by other Universities to co-support activities with FABLS e.g. MMI (Monash University) supported the Prof. Dan Axelrod seminar, with internal flights and accommodation.

	<ul style="list-style-type: none"> • Funding by private industry towards workshops, training sessions and seminars e.g. Olympus brought Dr. Benedikt Kraemer to Australia and he gave 3 seminars in Sydney and Melbourne; • Funding by industry associations and government departments to circulate information e.g. FABLS attendance at BIO 2008 was subsidised by AusBiotech (\$9K) and NSW Department of State and Regional Development (\$5K); • FABLS Members: P. Thordarson and F. Braet were awarded \$50,000 in December 2008 from The Cancer Institute NSW Research Innovation Grants (2008) for their project: 'Self-assembled gels for local anti-cancer drug delivery'; • In-kind funding by Macquarie University for administrative services; • Given its disparate nature, the total value of additional funding is difficult to quantify. • Funding (\$80,000) by Macquarie University, Monash University and University of Technology, Sydney towards establishing a CRC bid
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In many of the categories listed above, the numbers reported represent only a fraction of the real activity, as much individual activity goes unreported to FABLS.

"I was sceptical that the Networks would be making any difference, but this one certainly did"
(unsolicited comment from Prof. Brian Orr, Macquarie University)

Qualitative Performance Indicators for the FABLS Network in 2008

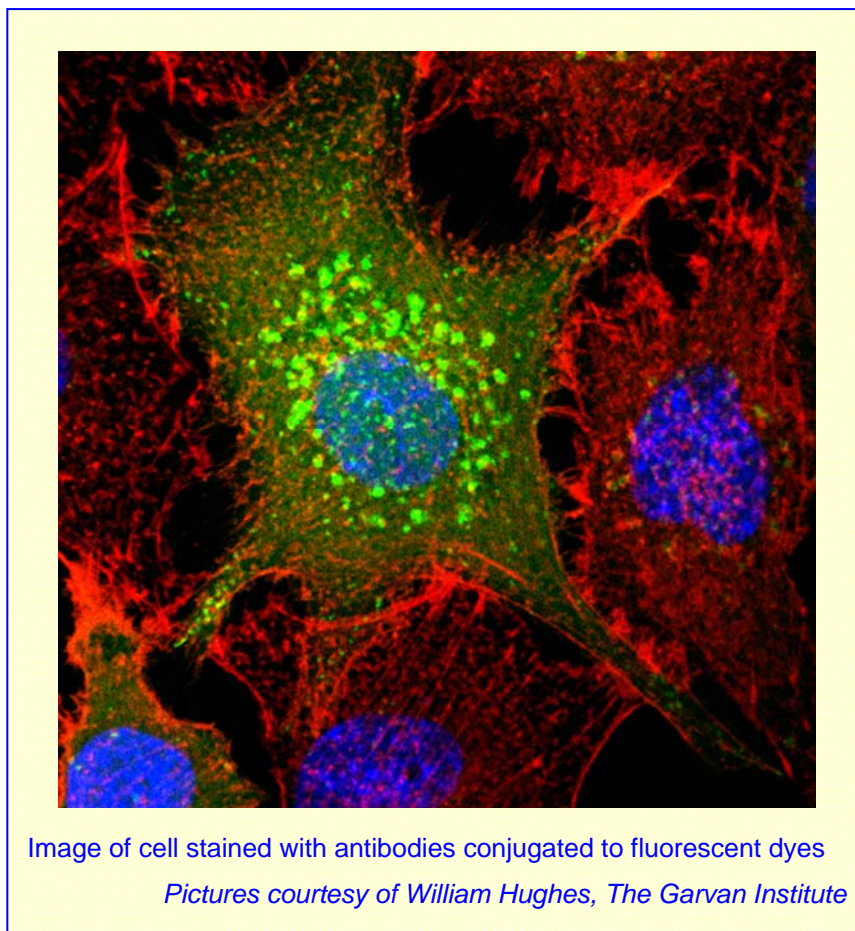
<p><i>How research undertaken by the Network is different to what might have occurred without the Network</i></p>	<ul style="list-style-type: none"> • This Network has stimulated additional research activities (Section 3.2). We are able to demonstrate that it generated added value (Section 12.1), contributed to the enrichment of the research environment (Section 12.1) increased the scale/focus of research (Section 12.2) and strengthened international alliances and linkages (Section 12.3).
<p><i>What sort of different sharing / collaboration arose because of the Network</i></p>	<ul style="list-style-type: none"> • The shared values by the FABLS Members and the unified vision exemplified in the Network research priorities (Section 1.2.4) helped the Members develop new strong connections. • Multidisciplinary partnerships supported by FABLS are listed in Appendix 4 and members reflected on these in Section 3.2. The sharing of infrastructure is described in Section 1.2.4. • See quotes in 'New Sharing Enabled by FABLS' text box.
<p><i>Effectiveness of governance processes in place</i></p>	<ul style="list-style-type: none"> • Appendix 13 describes details of the governance and account of the activities as well as it includes members' opinions on quality of governance. See also Appendix 2 for details of 2008 committees and their meetings.

<p><i>Different kinds of research generated – research building capacity, or removing impediments to research</i></p>	<ul style="list-style-type: none"> • The principal impediment to research our members encounter is insufficient research funding. FABLS works hard at the root cause of the problem. Our activities in this respect include efforts to attract business support (Section 3.4), establishment of the Strategic Initiatives Committee (Section 12.2), and efforts to use FABLS resources to leverage further funding (Section 3.3). • External awards to FABLS members are listed in Appendix 7; we have also directly supported 41 projects in 2008 (Appendix 3), 5 training courses and workshops (Appendix 14) and numerous research visits (Appendix 12). • The Annual Workshop contributes to collaborations and research priority identification as seen in Section 3.1.
<p><i>Breadth of Network - qualitative aspects</i></p>	<ul style="list-style-type: none"> • The breadth of backgrounds of FABLS members and thus the cross-disciplinary nature of the Network is apparent from the Members Register (Appendix 9), with more detailed information on members' diverse capabilities in Appendix 8. • FABLS Members come from an astounding number of disciplinary and technical backgrounds, as evidenced by the vast array of Departments listed in the Members Register (Appendix 9). To name just a few: Biology, Chemistry, Photonics, Dentistry, Medicine, Surgery, Stem Cells, Microscopy, Lasers, Physics, Optical, Biochemistry, Marine Studies, Molecular Biology, Genetics, Forensic Science, Nanotechnology, Pharmacy & Engineering.
<p><i>Increased boundary crossing, multi-disciplinary collaboration</i></p>	<ul style="list-style-type: none"> • At least 40 multi-disciplinary links have been developed through the incentive of FABLS project funding, which are awarded only to multidisciplinary collaborations. These have been described in detail in Appendices 4 and 5.
<p><i>New collaboration & partnerships as a result of Network activities, and different types of end users</i></p>	<ul style="list-style-type: none"> • In addition to partnerships developed through earlier FABLS support, in 2008, 122 new partnerships were forged. • Our interactions with external organisations are detailed in Sections 3.4.1 – 3.4.4.
<p><i>What workshops and similar meetings the Network provided financial support to</i></p>	<ul style="list-style-type: none"> • We supported 5 such workshops in 2008, with details given in Section 3.5.2 and reports available in Appendix 14. • In addition, the 2008 FABLS Workshop, with attendance expenses covered, was well attended (see Section 3.1).
<p><i>What mechanisms are in place for communication with the Network membership</i></p>	<ul style="list-style-type: none"> • We communicate regularly with members via email, informing them of upcoming events, courses and opportunities. This works so well that, on a regular weekly basis, new members are joining the Network even as this report is being written. • We also disseminated 3 newsletters in 2008 (Appendix 15) to the FABLS community. The newsletters also reached a total of over 3000 individuals through other mailing lists. • The website (Section 8) is continuously updated and keeps members up to date and informed with the "News" section on the Home page, Upcoming Events page and others.
<p><i>Increased interest in Network, in Australia and overseas</i></p>	<ul style="list-style-type: none"> • The increasing number of international partnerships (Appendix 4) continues to stimulate awareness of the FABLS Network overseas, evidenced by international membership levels at 25%. This is also evidenced by the details of visitors to the website (Section 8).

	<ul style="list-style-type: none"> • Further information regarding international institutional linkages we endeavour to forge is provided in Section 12.3.
<i>International activities and/or visitor program</i>	<ul style="list-style-type: none"> • Most FABLS sponsored visitors and International activities are funded through the Members' projects and these visits are listed in Appendix 12. • Some visitors gave talks at various FABLS supported Workshops (Sections 3.1 and 3.5.2) and spoke at industrial seminars (Section 3.4.4).
<i>What exceptional successes, if any, have occurred during the reporting period</i>	<ul style="list-style-type: none"> • Completion of the book "Fluorescence Applications in Biotechnology and Life Sciences" to be published by Wiley (Section 3.5.1), with 35 members involved as Co-Authors. • Our Business Development Program increased in scale evidenced by the large number of new documented interactions (Section 3.4.1). This increase arose from the CRC bid focussed on fluorescence technologies and rapid pathogen detection. • Our membership reached over 500 members worldwide. • Successes are highlighted in Section 4.
<i>What disappointments, if any, occurred during the reporting period</i>	<ul style="list-style-type: none"> • The issue of greatest concern for us is the shortage of research funding available to our members, especially to encourage collaboration and cross-disciplinary sharing. • Our Strategic Initiative Committee has also identified the disturbing absence of funding schemes able to support large scale initiatives, such as the Centres for Excellence. • Disappointment that FABLS will not continue in its current form, just when momentum for real benefits is high and members' rewards could be effectively optimised.
<i>How new skills have been acquired as a result of research technology</i>	<ul style="list-style-type: none"> • Members acquire new skills through access to equipment and associated methodologies not normally available at their research institution. See FABLS funded projects (Appendix 3). • For example A/Prof. Liz Harry (UTS) established contact with the Microscopy group in Melbourne (A/Prof T. Smith). Jointly they secured \$750,000 of LIEF grant for unique structural illumination microscope with cutting edge capabilities.
<i>Any surveys carried out to ascertain membership benefits</i>	<ul style="list-style-type: none"> • The survey is carried out annually and feedback from Members is quoted throughout report.
<i>Outreach activities and how these may have been reported by the media</i>	<ul style="list-style-type: none"> • As described in Appendix 20, our members engaged well with the media. For example, Prof. Alan Trounson received high profile media attention, and 5 members were highlighted in Australian Life Scientist, incl Prof. Weninger. • Member Mark Prescott was interviewed on ABC Radio regarding the Nobel Prize awarded in Physics to the team developing the 'GFP' technique. • Some of our members were also successful in attracting media attention to their ground-breaking research e.g. Sandeep Menon on 'Fluorescence of Urine', and Dr. James Rabeau on nanodiamonds & Quantum Computing (Catalyst).
<i>Collaborations between Networks in Australia</i>	<ul style="list-style-type: none"> • SIA (hosting seminars), AusMedTech (networking), Australian Nano Business Forum (networking), Ausbiotech

<p><i>Linkages with international Research Networks</i></p>	<ul style="list-style-type: none"> • Reported linkages are covered in Section 12.3 • Interactions with the EU network of Excellence Photonics4Life
<p><i>Development of tools, software, databases etc.</i></p>	<p>A significant number of advances to products and services at the research and industry level continue to be made.</p> <p>They include:</p> <ul style="list-style-type: none"> • hardware – lasers, flow cytometers, microscopic techniques (Jin) • reagents – novel fluorophores, biosensor molecules (Prescott) • health care – drug identification (Rabeau) • software – improved imaging analysis (Valloton) • identification of <i>Staphylococcus spp.</i> and EMSRA (Connally) • fluorescent methods of stem cell separation (Vesey) <p>Databases for contact have been developed in instrumentation, biotech and life science companies.</p>
<p><i>How the networks between researchers are being strengthened as a result of using web-based & other technologies.</i></p>	<p>Issues related to the website are discussed in Section 8.</p>

The individual aspects and details listed above are explained further in the full report.



FABLS ANNUAL REPORT to ARC/NHMRC for 2008

1. Summary of the overall goals and objectives of the FABLS Network

1.1 Aims

The Australian Research Network for Fluorescence Applications in Biotechnology and Life Sciences (FABLS) has been established to inspire and coordinate research programs relating to applications of fluorescence that require a high degree of interaction between the diverse disciplines of biology, physics, chemistry, bioengineering and medicine. FABLS works towards enhancing the international profile of the Australian science and developing connections of the Australian scientists to the leading centres overseas. Its activities facilitate the transfer of new science and, technologies to help resolve important problems in areas such as public health, safety of foods and environmental monitoring as well as to contribute to the Australian economy.

The Network has the following aims:

- I. To inspire and capitalise on fundamental fluorescence-based research in physics, chemistry and life sciences concerned with much-needed deeper understanding of biological systems.
- II. To facilitate inter-disciplinary research by fostering closer linkage of the traditionally separated physical and life sciences.
- III. To assemble and link our critical mass of scientific and technological expertise in fluorescence applications.
- IV. To facilitate interactions with the global scientific fluorescence community, in order to improve awareness of international priorities and encourage collaborations within international programs.
- V. Through the research infrastructure access program, to improve the efficiency of infrastructure utilisation and minimise unnecessary duplication of resources managed within this Network.
- VI. To apply the findings of the basic research of the Network Members to generate internationally-marketable products of value to the Australian economy and the development of new, technology-based companies.
- VII. To seek improved feedback from technology end-users to stimulate, develop and transfer internationally competitive fluorescence-based diagnostic and analytical technologies.
- VIII. Through applications of these technologies within Australia, to foster benefits such as improved public health diagnostics, improved processing and quality of foods and beverages, and better environmental monitoring.
- IX. To improve the quality of the Australian postgraduate learning environment by adding a distributed, cross-disciplinary component and industrial perspective.
- X. To provide a high quality environment for the support of early-career research and professional training to meet the needs of academia and industry.

Members' Praise for the FABLS Network

"All communication, follow-up and meetings organised by FABLS chair and committees members were characterized by a high degree of professionalism and devotion to the network."

Filip Braet, University of Sydney

"I think that FABLS is very well organised and administered. Project-related bureaucracy is quite light."

Riccardo Cicchi (ECR), University of Florence

"Overall, FABLS has been very successful in promoting fluorescence related sciences and I hope that we are able to continue these activities in some form in future."

Ian Harper, MMI, Monash University

"Every time I have had questions or needed to interact with people of the ARC/NHMRC Network, the reply has been fast, kind and very efficient."

María Tricerri, INIBIOLP, Instituto de Investigaciones Bioquímicas

1.2 Network strategies and programs

The FABLS Network coordinates research in areas of fluorescence applications in biotechnology and life sciences. Examples include new diagnostic technologies and their innovative applications in areas such as biotechnology, environmental monitoring and public health, for example through improved safety of drinking water. This coordination is achieved by collaborative identification of the most promising research strategies, provision of incentives for their development through funding for pilot joint projects and an access program for cooperative use of infrastructure.

The Network showcases and enhances our Members' research internationally through an exchange program. It also helps cultivate industry sponsors for applications-oriented aspects of the Network's research and helps capitalise on emerging commercial opportunities in biotechnology, drug discovery, medical diagnostics, and agriculture and food industries. Funding targeted at industry-wide dissemination of research innovations assists in this element of the program. The descriptions of FABLS programs are presented below.

1.2.1 Mechanism for identification of research priorities and articulation of research programs

FABLS programs help define the research agenda for fluorescence applications in biotechnology and life sciences and, by improving the connectivity of the community they bring together new, multidisciplinary teams to develop new research programs. This is best achieved in a structured and focussed process engaging the entire Network community, and, to this aim, a **yearly Network workshop** is organised. The workshop identifies international and national priorities in areas represented by the Network members. As a result of the Network workshops and the identification of projects, common interest groups and working parties emerge to further fine-tune the research programs, identify strategies, set milestones and monitor progress. A number of new research groupings have now been created such as the group of researchers focussing on fluorescence for pathogen detection (including Drs. Connally and Paulsen).

1.2.2 Mechanism for seed-funding of emerging research programs identified by FABLES

Since its inception, this Network has put in place a **funding scheme, with several salient funding opportunities, to advance emerging joint Network projects**, so they can become competitive for major funding. The support is available for project areas identified by the Network Workshops. Each of these project areas is supported with funding of \$10,000 maximum (in 2008) for a year, as this is the minimum time for meaningful progress in a new field. Funding is on offer for Lab Exchanges, Focus Groups or Working Party meetings, Infrastructure Access and Strategic Groups.

Members' project resources, outside the Network's funding scope, can be funded by cash support pledged by Macquarie University and other Partner institutions including the Universities of Melbourne, Queensland and Sydney. Previously seeded projects with Macquarie University as a Partner have access to further support for one year, up to \$50,000 p.a. on a dollar for dollar cash contribution basis from other Partner(s). In this manner the Network ensures at least two years of pilot funding for emerging projects.

We anticipate that by the end of the second year, leaders of successful projects would be in a position to make strong bids for external funding. Cash contributions from Partner institutions other than Macquarie University are used exclusively to support the Members' projects from those institutions. In addition, Macquarie University pledged up to two full-fee postgraduate scholarships per year for Network projects in which it was a partner, with competitive allocation through University procedures.

The existence of the FABLES project support scheme makes a real difference to the funding prospects of postgraduate (PG) students and Early Career Researchers (ECRs). The funding environment in Australia is very competitive and strongly track-record oriented. Being able to access funding to nurture one's own international networks has enabled numerous members not only to enhance their professional development, but also to generate much more competitive applications for more substantial funding (See Appendix 3).

1.2.3 Mechanism to facilitate research interactions between diverse disciplines and institutions

We have introduced a program of **staff and student exchanges** to provide much needed contact between the disciplines and between different types of organisations, leading to increased mutual awareness of ideas, issues and facilities. This program is especially valuable for transferring knowledge and expertise between academic settings and industry. In 2008, funding was granted to support **30 interstate and 44 international visits**. Support of such placements is available to Members of this Network, as well as to their research group members, other employees and postgraduate students, especially for those working on projects identified by the Network. Such exchanges are promoted within and between research and development organisations and industry.

This program provides funds for travel and accommodation expenses. We ensure laboratory exchanges are of sufficient duration such that appropriate immersion in new disciplines and training can occur. The funding guidelines also stipulate cross-disciplinary and multi-institutional collaborations, resulting in many exciting exchanges and knowledge sharing, as well as wider perspectives and skills-bases.

CAPACITY BUILDING BY FABLES

As a broad-scale outcome of this project, through the funding we have received from FABLES, and the workshops we have run (and hope to continue running) we envisage that we can develop a strong network of researchers with correlative imaging expertise and experience that can provide support for new researchers coming into the field."

Deborah Barton (ECR), University of Sydney

"The collaborative arrangement enabled the transfer of micro-fabrication technology from Centre for Micro-Photonics (Swinburne University) to the Optical Trapping Group (University of St. Andrews, Scotland) to facilitate the long term isolation and confinement of cells for imaging applications."

Charles Cranfield (ECR), Tyndall National Institute

"The use of fluorescence lifetime measurements in microscopy and the life sciences is continuing to increase, and the capability of obtaining lifetime images is available on all commercial microscope systems."

Stuart Rumble, Lastek Pty Ltd

"The CI of this project is a postgraduate student. This funding provided a training to prepare actin for a postgraduate candidate. Further it helped characterise profilin-I and II using folding and unfolding which is going to be part of CI's PhD thesis."

Kannan Krishnan (PhD Student), Monash University

"The success of this project has enabled us to initiate collaboration between the Garvan Institute and CSIRO with the aim of better analysing the image data generated by our constructs and TIRF-M. We have been able to lever 50% of a salary to employ an image analyst. We have also been able to attract further funding (private philanthropy) to improve our TIRF-M apparatus, principally through acquisition of a state-of-the-art EMCCD."

William Hughes, The Garvan Institute

"[With the] funding provided by FABLES, we were able to achieve the construction of a CARS microscope at the University of Adelaide"

Tak Kee (ECR), University of Adelaide

"On a personal level this was an excellent opportunity for me as a biologist to work with a physicist interested in the same field. This mixture of the biology and physics expertise I believe was highly beneficial for both of us and has definitely helped me in my understanding of image processing and tomography."

Rob Bryson-Richardson (ECR), Victor Chang Cardiac Research Institute

"The outcomes of the lab exchange have provided the skills needed to write the required code needed to process data, where the algorithm will be approximately completed by the end of April. In addition a GUI will be constructed, to be provided to biologist, to minimize user complexity."

Betty Kouskousis (PhD Student), Swinburne University of Technology

"The expertise acquired during that US visit was essential to the supervision of a new PhD student, Wei Deng, who will continue the research on fluorescence enhancement in proximity to metal nanostructures and use of metal enhanced rare earth doped nanoparticles for biosensing applications."

Krystyna Tomsia, Macquarie University

"Funds from the network have strengthened my research capacity through increased purchasing power for things like photolithographic masks, a digital manometer and lab consumables."

David Inglis (ECR), Macquarie University

1.2.4 Mechanisms to facilitate dialogue with research end-users to create awareness and opportunities

The FABLS Network activities aim to draw together more closely the academic and industrial communities so that research is reoriented towards real problems and its industrial relevance is augmented. To this end, a Business Liaison program was established by this Network which has been facilitating contacts with industry. Mr David Tayler, the FABLS Business Development Manager (BDM) works to create mutual awareness of the opportunities for industry offered by the research of Network Members. This involves **interacting with industrial organisations**, seeking potential opportunities for FABLS Network Members for further research engagement and interactions, as well as identifying and communicating the needs of industry to the Network.

The BDM presents the Network potential to external organisations and may act as a broker of new research contracts or of utilisation of the Network infrastructure by industry. He is also able to further assist by identifying opportunities within the business portfolio that overlap with the capabilities and skills represented in the Network.

The BDM publicises the potential of the Network to research customers through face to face contacts. He also is responsible for the yearly **program of industrial seminars**, designed to raise awareness of fluorescence-based technologies (see Appendix 16). Such seminars are given at industrial sites, if appropriate or at other locations e.g. Universities, Institutes and are widely publicised including through business networks and professional societies. The industry partners and other fluorescence users such as students might need deeper understanding of these technologies. The Network also supports **professional training courses** through publicity, sponsorship and occasionally administrative assistance.

'NEW SHARING' ENABLED BY FABLS

"The success in upgrading the optical tweezers is due to the joined efforts by Dr Gibson and Siyi Ong from the Voelcker group together with Dr Raj in Iowa. These achievements have led to a closer tie between Voelcker group and Dr Raj research group and these new connections we have made with Dr Raj group have provided us with a better understanding of the expertise of each members of his group."

SiYi Ong (PhD Student), Flinders University

"The outcomes of the lab exchange also enable our research group to obtain photoactivatable protein constructs required for photoactivatable localization microscopy, i.e. Eos and Dronpa."

Betty Kouskousis (PhD Student), Swinburne University of Technology

"Indeed, it was a lot of new research ideas arose because of the interdisciplinary exchange of views between the Network members."

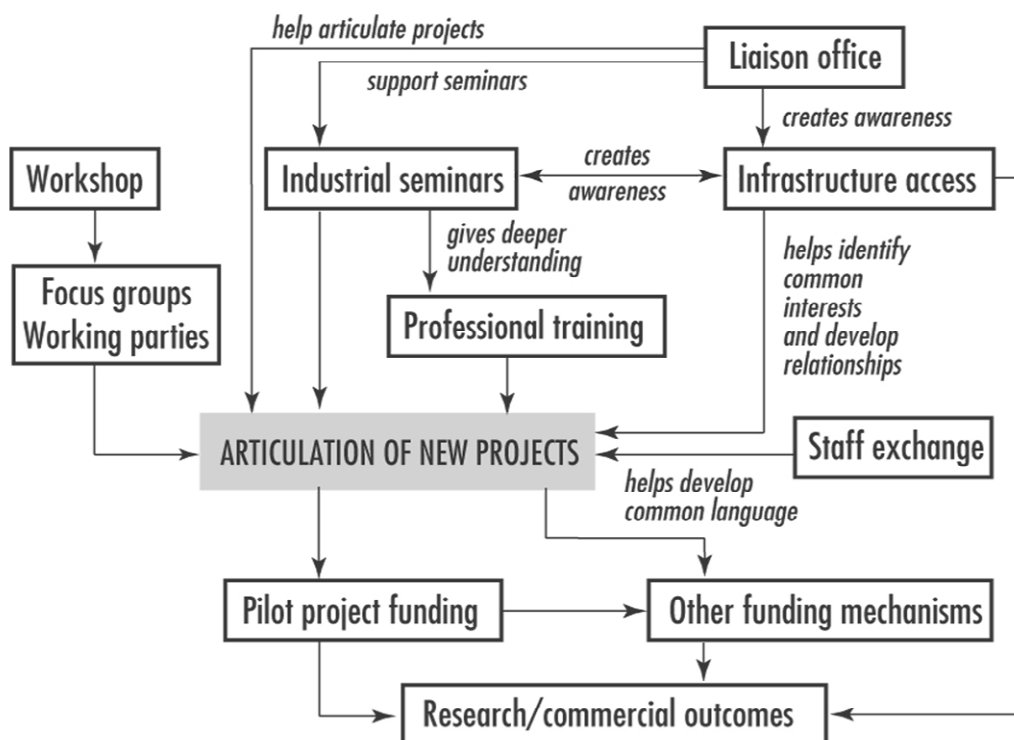
Anna Guller (ECR), Sechenov Moscow Medical Academy

"Having the support of this organisation allows us to share the expertise with several institutions locally and regionally and thus maximises the impact that these world class scientists have in Australia, and also provide mechanisms for knowledge flow between organisations."

Ian Harper, MMI, Monash University

"The network has provided an amazing opportunity for me to work with specialists in imaging. We have published a paper and are currently working on another."

Janna Morrison, University of South Australia



The Infrastructure Access Program

Fifty-six (56) funding requests totalling \$235,210, ranging from \$500 to \$10,000 with an average request of \$4,200, were funded from the Infrastructure Access Program.

Designed to provide research groups and commercial and public organisations access to rare and expensive infrastructure, this program has improved access to sophisticated diagnostics capabilities, along with expert advice. The availability of this to the broader research and industrial community should expedite discoveries and make it possible to meet more significant industrial challenges.

The network strategies are closely intertwined and support one another as indicated in the above schematic.

We have established a funding mechanism to facilitate access for Network Members, including access and travel costs and full or partial cost offset of Network facilities for designated project areas identified by the Network. Since the inception of this funding category in 2006, there have been **56 requests to this funding stream, totalling \$235,210**, ranging from \$500 to \$10,000 with \$4,200 being the average request, the vast majority of which were granted.

A high proportion of the **122 new partnerships developed in 2008** (detailed in Appendix 4) describe researchers' access to equipment and laboratories, not normally available. In 2008, 21 of the 41 projects funded (51%) had an Infrastructure Access component, compared with 23 of 37 projects 2007 (62%), and 12 of 25 in 2006 (48%).



As an example, in 2008 Dr. David Inglis (Macquarie University) was granted \$5,140 funding to use state of the art nano-fabrication facilities at the Cornell Nanoscale Science and Technology Facility (CNF) in the USA.

1.3 Summary of research priorities and any changes to these that may have occurred during the past year.

FABLS Strategic Objectives: The ARC / NHMRC expect the Networks to be dynamic organisations and, responding to this, FABLS has a continuing process of reviewing their strategic priorities. The FABLS Strategic Priorities were developed by the consultation with the whole FABLS community at the Network inception. These Priorities have been revised by all Members at the subsequent 2006, 2007 and 2008 FABLS Workshops and they continue to inform the FABLS Committees and their decisions. The priorities for 2008 are listed below.

2008 PRIORITIES - COMMUNICATION

- Facilitate the transfer of multidisciplinary fluorescence knowledge & techniques throughout the Network and maximise collaborations where success can be acknowledged (e.g. *“facilitated and supported by the ARC Network for Fluorescence etc.”*) and performance indicators quantified;
- Market the FABLS Network - stronger outreach, methods registry, services registry of members, international meetings (e.g. US Biophysical Society), top laboratories and groups, website chat room;
- Maintain balance between applied (commercial) and pure (basic) science.

2008 PRIORITIES - SCIENTIFIC

- Ensure cutting-edge research institutes are involved with technology developers;
- Support endeavours that isolate, characterise, improve & capitalise on new fluorescent probes;
- Support endeavours that lead to the development of new and multiplexed analytical (SPR-FRET), microscopic, cellular and tomographic imaging technologies (improved sensitivity, improved resolution, new spectral characteristics, whole body imaging, improved penetration, single molecule detection sensitivity, femtosecond laser-induced transfection, improved quantum yield, reduced toxicity, increased photo-stability, live cell/tissue imaging);
- Support endeavours that analyse, discover and measure dynamic cellular events.

2008 PRIORITIES - EDUCATION

- Attraction, education and scientific exchange of future workforce (e.g. workshops, conferences, travel, top laboratory exchanges, industrial seminars, senior professional refresher courses, intensive courses);
- Provision of funding for demonstration projects (videos, Power Point lectures, scientific).

2008 PRIORITIES - LONG TERM GOALS

- Solicit suggestions, identify and initiate (using seed funding, where available) for high impact and/or high risk multidisciplinary project(s) as a FABLS “Challenge Project” fostering more “big” ARC Discovery or Linkage Programs;
- Create long term funding through ARC Centre of Excellence, NCRIS Scheme or international sources (e.g., NSF, NIH).

The activities of the FABLS Network are guided by its Strategic Plan (see Appendix 1), developed by the Executive Management Committee, overseen by the Advisory Board and ratified by Members. This Strategic Plan undergoes regular revisions and modifications.

GOOD NEWS STORY – Regeneus Regenerates

Do you or your dog have joint arthritis? If so, read on...



Dr Graham Vesey CEO of Regeneus and his team developed a ground-breaking new therapy for animals suffering from arthritis. The therapy has a very high success rate and you can see for yourself the videos on the U-tube of the dogs whose biological clock has been virtually rewound!

The therapy is using adult stem cells harvested from the fat of patient's themselves. It involves removing stem cells from a dog's fat, and injecting them into the problem joint. The stem cells have an anti inflammatory effect and help the joint regenerate. This technology has proven to be successful on dogs and scientists say it won't be long before humans will also be benefiting from these developments.

Dr. Vesey is one of the foundation members of FABLS and his pioneering work with stem cells has been possible thanks to cell selection by fluorescence.

The company success made recent headlines, with stories on the ABC **7:30 Report**, 23rd December 2008 and **Channel Ten News**, 24th December 2008.

2. Extent to which the objectives of the Research Network and the Approved Proposal have been met

This report presents evidence that FABLS continues to perform at a high level with respect to the approved proposal and the meeting of objectives. There have been no substantive departures from the Approved Proposal in 2008. Specific details relevant to individual objectives are given in the following sections of this report:

Aims	References to sections of report
<p>I. Fundamental fluorescence research in physics, chemistry and life sciences</p> <p>II. Closer linkage of physical and life sciences</p> <p>III. Link our scientific and technological expertise in fluorescence applications</p> <p>IV. Improve awareness of international priorities and encourage international collaboration</p>	<p>FABLS hosted its fourth annual workshop in February 2008.</p> <p>In 2008, FABLS supported a total of 41 Members' research projects, to the total value of \$337,514 (Section 3.2). In total, FABLS has supported 140 projects, valued at \$1,388,956 since its foundation in 2004, for more details see Appendix 3.</p> <p>FABLS also supported 5 training workshops / activities, providing sponsorship totalling \$15,630.</p> <p>FABLS has fostered, through its funding program, a total of at least 350 new partnerships at the research, company, national and international levels in the years 2005-2008. 122 new partnerships arose for members from projects funded in 2008. This adds to the 89 partnerships reported in 2007, 45 in 2006 and 97 in 2005. Appendix 4 gives a breakdown of the partnerships and project reports received are in Appendix 5.</p> <p>Industry partnerships are at several levels and are both active and pending. These levels are (1) research collaboration, (2) information dissemination, and (3) seminar/conference support. In 2008, 2 reported new collaborations commenced, four news company items were disseminated by FABLS, and 10 companies supported, either financially or in-kind, seminars (their support often underpins the financial success of the event.). Partnerships reported pending include: seven at research level, and 10 at conference level. These numbers represent only a fraction of the real activity, as much goes unreported to FABLS.</p> <p>44 ARC and NHMRC grants awarded to FABLS Members in 2008 are presented in Appendix 7.</p> <p>Approximately 6,437 unique visits to the website were made in 2008 (see Section 8).</p> <p>113 FABLS members are from international destinations, an increase of 30% in 2008. Australian members maintain contact through the network with international counterparts.</p>
<p>V. Improve the efficiency of infrastructure utilisation</p>	<p>A high proportion of the 122 new partnerships developed in 2008 (detailed in Appendix 4) describe researchers' access to equipment and laboratories, not normally available. Since the inception of the Infrastructure funding category, FABLS has received \$235,210 of requests for this funding, ranging from \$500 to \$10,000, with \$4,200 being the average request.</p> <p>21 of the 41 projects funded in 2008 (51%) included an infrastructure access component, compared with 23 of the 37 projects in 2007 (62%), & 12 of 25 in 2006 (48%). For example A/Prof. Filip Braet visited NCKU, Taiwan for 10 working days to perform darkfield / CSLM imaging on cells exposed to fluorescence-conjugated nanoparticles, accessing approx. 25 hours of Cytoviva imaging time at the Biomolecular Imaging Facility (BIF) at NCKU.</p>

<p>VI. To apply the findings of the basic research of the Network Members to generate products of value to the Australian economy</p> <p>VII: To seek improved feedback from technology end-users</p> <p>VIII. Through applications of these technologies within Australia, to foster benefits such as improved public health diagnostics, improved processing and quality of foods and beverages, and better environmental monitoring</p>	<p>Over the past 12 months, FABLS has:</p> <ul style="list-style-type: none"> • Engaged with collaborative alliances with 36 government and industry organisations (Section 3.4.1), including several networks. These networks help disseminate information about FABLS activities to about 3000 people with an interest in biotechnology and life sciences; • Initiated potential projects with fifteen research organisations, such as dairy industry, horticultural industry and food processing industry as well as a number of commercial companies, outside the FABLS network; • Approached representatives from about 148 companies for potential project support (Section 3.4.1). <p>The company and government interaction activities are described in more detail in Section 3.4. Currently, 49 members of FABLS are company representatives, and 9 of them joined in 2008.</p> <p>As part of a program to develop a capability description of FABLS' members, a compendium of research project summaries has been assembled and is listed in Appendix 8</p> <p>The project summaries describe the real and potential outcomes of the research and how the research findings can be applied for the benefit of the community. For example, several projects address issues involving the discovery of new biosensors and fluorescent compounds, prototyping new luminescent equipment, the rapid detection of microorganisms causing disease and food contamination, the use of nanodiamonds in drug discovery and the enhancement of molecular imaging techniques at the cellular level.</p> <p>Applied research activities presented in Appendices 4 and 5 provide evidence of how members' research is contributing to the Australian economy. Examples include:</p> <ul style="list-style-type: none"> • Dr. Robert Bryson-Richardson was able to develop his software to improve OPT resolution based on frequency space filtering of out of focus data and by using improved bleach correction, to improve the accuracy of the 3D reconstructions generated; • A/Prof. Filip Braet confirmed the successful application of smart conjugates for detecting anti-cancer drug resistance via fluorescence image technology; • A/Prof. Michelle Gee has shown that polymer microgels can indeed be utilised as metal sponges with the ability to uptake very high amounts of electrolyte from solution. This finding will help for environmental remediation of heavy metals from waterways. <p>Management's strategy to further develop the integration of research and application is identified in Appendix 10. With a focus on business development, improving training opportunities, identification of new strategic directions and fostering large scale research program in the form of a CRC requiring a significant corporate input.</p>
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	<p>In 2008, FABLS distributed 3 newsletters to members, and also to a broad spectrum of non-members (research, company, government) with an interest in biotechnology and life sciences. Copies of the newsletters published in the last 12 months can be seen in Appendix 15.</p>
<p>IX. To improve the quality of the Australian postgraduate learning environment</p> <p>X. To provide a high quality environment for the support of early-career research and professional training</p>	<p>112 Early Career Researchers (ECRs) and 119 post-graduate students are members of FABLS. Projects involving 15 ECRs and 5 postgraduates' projects were funded in 2008.</p> <p>FABLS activities facilitate learning opportunities. Including:</p> <ul style="list-style-type: none"> • Production of an advanced textbook covering the latest trends in fluorescence described in Section 3.5.1; • Support of 4 training workshops and one conference, summarised in Section 3.5.2, with reports submitted in Appendix 14; • FABLS has funded member activities (Appendix 3) enabling them to visit organisations to learn new techniques, generate new research directions, and expand their knowledge. Specific examples of the outcomes of new partnerships formed as a result of better networking are presented in Appendix 4 and 14; • Presentation of 9 industrial seminars (Appendix 16).



M. Digman (left) & E. Gratton (centre) teaching FLIM in a hands-on training session at the 1st Advanced Fluorescence Bio-Imaging Workshop held at Univ. of Western Sydney in Sept. 2008.

As shown in the above table, the FABLS Network is generating a high level of activity and achievement in all key areas. Since this Network began in 2004, the community has developed strong national, international and cross-disciplinary links and we have overwhelming evidence that the FABLS vision is shared. The Members and the FABLS management are supporting a common set of objectives. It is a pleasure to acknowledge the dedication of our Committee Members and those leading the various initiatives.

The increasing membership, high subscription rates for the FABLS funding program and a growing number of Committee volunteers emphasises that FABLS activities respond not only to the ARC / NHMRC directives but are also synergistic with individual Members' motivations and strategies and those of the organisations with whom we interact. Thus, for example, the FABLS funding program responds to the vital need of academics to cultivate their personal research networks. The development of the professional training programs is closely aligned with the need of our industrial Members, who sell advanced equipment to educate the community, but also responds to the needs of postgraduate students to educate themselves about these cutting-edge technologies.



Our previous annual report highlighted that FABLS would like to be able to achieve more in the following areas:

A. Increase direct funding for research projects of the members

In recognition, we initiated several additional activities;

- FABLS continued the development of a CRC bid in the area of pathogen detection. The timeline for this activity is now extended until after the completion of the Innovation Review in 2009.
- FABLS introduced a new funding scheme "Strategic Groups Initiative" for other Members to develop similar bids.
- FABLS has been invited by Professor Gert Von Bally (Coordinator) to establish a relationship with a European Consortium Photonics4Life.

'Photonics 4 Life' is a consortium with a well-balanced pan-European dimension, self-sufficient in human resources and top-technology. 'Photonics 4 Life' shows the proper mass to span across the value chain from photonic components to applications and from fundamental to applied research, while progressing on a single but broad theme: "Biophotonics". As a Network of Excellence, 'Photonics 4 Life' aims at providing a coherent framework for the strongly fragmented field of Biophotonics in Europe. One of the challenging tasks of 'Photonics 4 Life' is therefore to structure and integrate the research and technological developments throughout the various subdisciplines of Biophotonics with their manifold interdependences.

'Photonics 4 Life' gathers the human resources, the infrastructure, the capabilities, the expertise and knowledge of 13 top-research partners in the field of Biophotonics. All of these partners are from EC member states (10 different countries). The partners include:

Institute of Photonic Technology, Jena (Coordinator)	Germany
University of Muenster	Germany
University of Twente	Netherlands
Istituto di Fisica Applicata "Nello Carrara"	Italy
CNRS Institut d'Optique graduate school	France
Vrije Universiteit Brussel	Belgium
University of St. Andrews	United Kingdom
Imperial College of Science, Technology and Medicine	United Kingdom
Institut De Ciencies Fotoniques, Fundacio Privada	Spain
Valtion Teknillinen Tutkimuskeskus	Finland
Forschungszentrum Karlsruhe	Germany
Lund Laser Centre	Sweden
Saratov State University	Russian Federation

- In our ongoing discussions with the industry we were able to identify major commercial organisations that have distinctive partnering programs which are designed to facilitate interactions with the academia; these include Pfizer, Novartis, Sanofi-Aventis, GlaxoSmithKline, Merck Sharp and Dohme, Perkin Elmer, and recently, Agilent and Millipore. We have also established personal links with these companies and many others. We were able to identify the nature of business for many of these companies and obtained their PowerPoint presentation and other documents which can help academics to enter into partnerships.



Benefits of the Network accessed by Researchers

Funds to Travel, Use Equipment or Collaborate With Other Institutions

- FABLS network provides financial support for individual members' projects, designed to assist with networking and collaboration and to nurture seed projects prior to applications for major funding;
- FABLS network offers financial support to access a large array of facilities around Australia and internationally. This support is available as part of project funding.

Support for Education and Training

- FABLS provides financial sponsorship for student members to attend various sponsored workshops or conferences;
- FABLS hosts and financially supports seminars, teaching and training workshops throughout the year, facilitating cross-disciplinary learning and networking.

Promoting Your Science

- FABLS network offers a valuable capacity to promote researchers and their research, highlighting professional skills and research interests;
- Outreach, beyond the network, promotes members' activities at industry conferences and expos through FABLS newsletter and through contact with companies, both direct and at industry association levels.

Information Sharing

- The FABLS website is regularly updated with latest industry relevant information;
- FABLS produces a newsletter which, along with other events held throughout the year, provides members with the opportunity to keep up-to-date with the latest technologies;
- FABLS contributes towards the reimbursement of costs to attend the FABLS annual workshop, to encourage and facilitate members to gather, make contact with people from a variety of disciplines and exchange ideas.

B. Need to better motivate the young Members:

FABLS is very pleased to report that the motivation and participation of younger FABLS members has continued to increase and the trend reversal apparent in 2007 has been consolidated. Where once we reported a less than desired level of initiative among our young Members to utilise existing opportunities to their best advantage, through publicity, mentoring and 'word of mouth', the uptake of membership benefits such as the Seed Funding Program and provision of sponsorship for workshop attendances, has significantly improved our role in providing opportunities for young members.

There are **now 112 ECRs and 119 postgraduate students among FABLS members**, together comprising 45% of the FABLS membership. 43 of our ECRs have been successful in applying for project funding of research projects since the inception of the Network; 15 of these ECR projects were approved in 2008, following 16 ECR projects in 2007. We have received many personal statements from our ECRs highlighting how FABLS has supported them in their studies or career which are spread throughout the report. See Section 3.2.1 to see how FABLS supports ECRs and PG students and also Appendix 14.

3. The achievements of the Research Network

FABLS Contributions to the Economy

"The success of this project has gained interest from analytical scientists at Melbourne and La Trobe Universities working on water purification. Discussions are underway on a new project in which polymer microgels are fabricated into membranes for separations processes in environmental remediation."

Michelle Gee, University of Melbourne

"A few biomedical companies have expressed their interests in the temporal domain resolution flow cytometry techniques, for example, BD Bioscience is proposing a linkage project with us for 2009 April application."

Dayong Jin (ECR), Macquarie University

"In summary, the work is ongoing, and it is hoped that the project will lead to a prototype product in 2009."

Stuart Rumble, Lastek Pty Ltd

"There is a possibility of a potential industry linkage with Guava Technologies, via their Australian distributors Millipore. Dr David King, Vice-President of R+D, believed that "our thoughts about bead based assay for pathogen testing for water might be of interest to Millipore".

Niina Tujula (ECR), Macquarie University

"It can be assumed that the increase in added value will be linked to the growing science capacity of the final goods. As the final products of our investigations are the medical treatment and diagnostics, it should be expected that the new developed approaches would be useful for a population health and medical industry."

Anna Guller (ECR), Sechenov Moscow Medical Academy

3.1 Setting of research agenda by FABLS

FABLS recognises that research ideas are generated spontaneously and continuously. A structured process of putting researchers in contact with one another and with the leaders in similar and complementary research fields assists in this process, and, to this aim FABLS conducts a yearly Workshop at varying locations throughout the country. To date, four such Workshops have taken place: the first on 21-22 February 2005, the second on 23-24 February 2006 (the latter embedded within an international conference "Biophotonics in Australia: Showcase and Strategic Planning" (BIA)).

The third Workshop took place on 2nd of February 2007, at Bio21 Institute in Melbourne, as a satellite meeting to the Lorne Protein Conference. The fourth was hosted by the Institute of Biomolecular Sciences at the University of Queensland 21-22 February 2008. A summary of the 2008 workshop can be found below. Summaries from all prior FABLS Workshops were presented in earlier reports (2006, 2007) and will not be repeated here.

Fourth FABLS Workshop, UQ Brisbane (21-22 February 2008)

Feedback on FABLS Annual Workshop 2008

"I really liked the (FABLS annual) meeting here in Brisbane and am looking forward to contribute something for the next year".

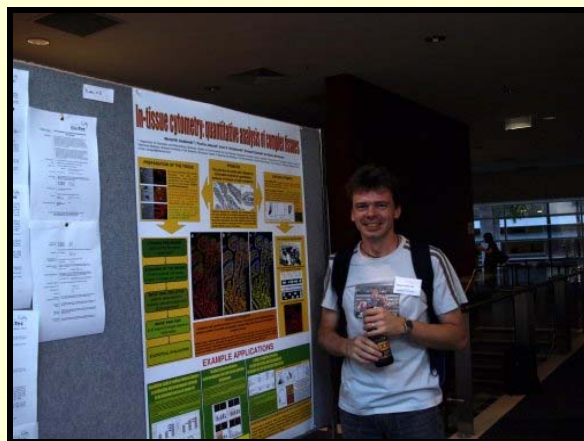
Daniel Gruber. (ECR) University of Queensland

FABLS Fourth Annual Workshop took place in the Institute of Bio-Molecular Sciences at the University of Queensland 21-22 February 2008. This year we decided to include in the program two presentations by the representatives from the relevant industries. Their brief was to help the audience understand the industrial priorities and interests at their organisation in areas in connection with fluorescence. The talks were intended to facilitate the engagement of academics with these organisations in research partnerships, so that they will be better able to approach these organisations with specific ideas. The meeting also contained a poster session and had ample opportunities for networking.

Members network during a break at the 4th Annual FABLS Workshop in Brisbane



Dr. Mick Godlewski, FABLS Member, presents his research in a poster



The presentations were collected and made available on the FABLS website to provide a record of corporate direction as far as fluorescence is concerned. The remaining speakers were academics: leading researchers in various interdisciplinary areas which had connection with fluorescence and younger FABLS Members who earlier received FABLS funding and were able to demonstrate outstanding research progress. The speakers included:

- **Professor Matt Trau** from the University of Queensland and Australian Institute for Bioengineering and Nanotechnology who gave a talk about Nanotechnology in Early Disease Detection & Diagnostics. It covered miniaturised, inexpensive, flexible and robust "plug-and-play" molecular reading systems, which can be effectively deployed in the field. In his talk he presented several platforms currently under development for such applications. One of these designed for screening for disease biomarkers on extremely cheap platforms uses encoded colloidal suspensions. A unique feature of the technology is the ability to interrogate complex biological mixtures.

- **Professor Jenny Stow** from Institute of Molecular Bioscience at the University of Queensland talked about quantitative imaging of organelles in living cells. The specific focus was the recycling endosome, a multi-functional organelle in mammalian cells. While it is well known as an endocytic compartment, it is increasingly also recognised as a key site for secretory trafficking. The talk presented the first evidence for the subcompartmentalisation of recycling endosomes by demonstrating segregation of different cargo proteins within them. The results elucidate a mechanism that allows macrophage to spatially and temporally orchestrate cytokine secretion in order to control the immune response. These methods will be widely applicable to the analysis of cell organelles and protein tracking inside living cells.
- **Dr. Volker Buschmann** from the company Picoquant GmbH discussed the industry perspective on Time-Resolved Confocal Fluorescence Microscopy: Novel Technical Features and Applications for FLIM and FCS. He spoke about proprietary approaches to time resolved fluorescence measurements which allow following fluorescence dynamics starting in the sub-nanosecond range up to fluctuations in the second range and beyond. Microscopy based on this unrestricted photon data acquisition approach enables easy study of dependencies between the various fluorescence parameters. He also explained how to improve the accuracy in common FCS and FRET analysis schemes by applying sorting and weighting of the detected photons on the basis of the photon arrival time.
- **Dr. James R. Rabeau**, FABLS member, formerly from Melbourne University, currently at Macquarie, talked about Single Photon Fluorescence in Diamond Nanocrystals. Diamond is host to a variety of fluorescing colour centres, which have been studied in detail using optical & magnetic resonance techniques. It is only recently that viable application for these colour centres are being identified. For example, there is widespread interest in using single diamond defects in quantum information applications such as quantum cryptography, quantum computing and single-spin measurement. The use of diamond nanocrystals in biological applications has also recently gained considerable interest. The talk covered active research in using diamond nanocrystals containing fluorescing defects as bio-markers for molecular labeling, tracking and other such applications.

Diamond Glitter Holds the Key to Data Security

As any locksmith would testify, if you want home security, then make sure your keys can not be copied. Quantum Physics is learning that Diamonds are also an encrypter's best friend.



Light produced by minuscule diamonds can not be copied, cloned or reproduced. The transmission of data by using such light provides a unique "quantum" level of security. Realising this, FABLS Member, James Rabeau set out to produce a light source based on such diamonds. He uses diamond crystals that are 1000 times smaller than the width of a human hair. On such a small scale each diamond contains just a single spot, comprising only several atoms that produce light. Working in complete darkness in his lab, he is able to see this light and send it down the optical fibre. Once in the fibre, the diamond light is harnessed and we have made the first step to unbreakable data encryption.

The story about James and his diamonds appeared on The Catalyst on 19 March 2008. It can be viewed at <http://www.abc.net.au/catalyst/stories/2519671.htm>

- **Assoc. Professor Elliot Botvinick**, Beckman Laser Institute, UC Irvine, US presented a talk on laser microbeams in the study of cellular mechanics, cell energetics, and mechano signalling. His lab uses laser microbeams and fluorescence techniques to quantify and study the relationships between external cues, both chemical and mechanical, and internal biomolecular activity of the cells. Picosecond and femtosecond pulsed lasers are used for laser microsurgery of cytoskeletal proteins, centrosomes, and DNA. He and his group are currently combining our mechanotransduction experiments with the technique of 3D traction force microscopy in order to fully characterise the 3D stress field to study its relationship to dynamic cell signalling.
- **Assoc. Professor Alpha Yap**, Institute of Molecular Biosciences, University of Queensland talked about using fluorescence microscopy to characterise the spatio-temporal regulation of cadherin-cytoskeletal interactions. Adhesive interactions between cells control many aspects of tissue organisation. This is exemplified by the cadherin family of cell surface receptors. To study the underlying processes it is imperative to complement biochemical assays of intermolecular interactions with optical measures that probe the spatial and temporal aspects of cadherin-actin cooperation. Accordingly, Professor Yap and his group have adopted a range of tools in our work, including live cell fluorescence imaging, FRET reporters of cell signalling, and FRAP measures of molecular turnover. These approaches were illustrated in the presentation.
- **Dr. Peter Banks**, Perkin Elmer Pty Ltd spoke about luminescent energy transfer immunoassays for the rapid and sensitive detection of analyte in complex matrices. PerkinElmer has a rich history in the development of labelling and detection technologies for immunoassays. In the mid-'80's, PerkinElmer began developing fluorescence-based immunoassay methods that did not require enzymatic turnover of substrate for sensitivity. Labelling antibodies with proprietary lanthanide chelates allowed the use of time-resolved background reduction techniques to significantly improve signal to background ratios relative to other direct fluorescence methods. The talk covered technology based on luminescence energy transfer not limited by Förster radii. The technology, termed Luminescent Oxygen Channeling Immunoassay (LOCI), is bead based where donor beads transfer energy to acceptor beads through singlet oxygen generated by irradiating donor beads with red light.
- **Dr. Ronald J. Clarke**, University of Sydney gave a talk entitled "Dimers are forever: New developments in the mechanism of the Na⁺,K⁺-ATPase". The Na⁺,K⁺-ATPase (or sodium pump) was the first ion pump to be discovered (Skou, 1957) and it is one of the most fundamentally important enzymes of animal physiology. New characterisation results as well as inconsistencies with the Albers-Post model used previously led Dr Clarke to propose a new mechanistic model in which the enzyme cycles at a low rate with ATP hydrolysis by one catalytic subunit or at a high rate with ATP hydrolysis by two catalytic subunits simultaneously within a dimer, depending on the concentration of available ATP. This bicyclic model with two gears is set to replace the classical Albers-Post cycle, especially in the light of the recent unveiling of x-ray crystal structure of the Na⁺,K⁺-ATPase.

FABLS IS MAKING A DIFFERENCE

“Without FABLS seeding-project funding, these publications are impossible, so that the FABLS was acknowledged in all of [our] publications.”

Dayong Jin (ECR), Macquarie University

“This project and explanation of the FABLS network has also led to the commercial partners in this project to being more fully aware and supportive of Australian research, conferences and workshops. They have show tangible support by supplying instrumentation, personal and sponsorship.”

Stuart Rumble, Lastek Pty Ltd

“My understanding of the fluorescent proteins in particular, and of biomolecular photophysical modelling, has advanced tremendously thanks to the funding of FABLS.”

Seth Olsen (ECR), University of Queensland

“As CI, the postgraduate student learned several techniques and visited two labs and carried out several experiments. Further, he has established collaboration with biophysics experts, A/Prof. Brett Hambly and Prof. Paul Curmi.”

Kannan Krishnan (PhD Student), University of New England

“We also had the opportunity to visit the Beckman Laser Institute, headed by Bruce Tromberg, and gained great insight into the operations of this world-class facility.”

Trevor Smith, University of Melbourne

“The results of the study have stimulated an application for NHMRC / Heart Foundation of Australia funding in 2009. Dr Lal has an ongoing interest in this research and he will be a co-chief investigator on this project.”

Cris dos Remedios, University of Sydney

“The results achieved in this project represent a major contribution to the field. They address what is probably the longest standing controversy of the Na⁺,K⁺-ATPase (sodium pump) field, i.e. whether the enzyme functions as a monomer or a dimer.”

Ron Clarke, University of Sydney

“The new personal connection with Dr Gerhard Nebe-von-Caron (Swiss Precision Diagnostics Development Company Ltd, Bedford, UK) has been useful on several levels, as he made efforts to introduce myself to other key players in microbial flow cytometry in the UK arranging a visit to Dr Roy Bongaerts at the Institute of Food Research. Furthermore, his industrial experience and contacts are helpful in terms of mentoring and fostering a relationship with potential industry partners.”

Niina Tujula (ECR), Macquarie University

“Support from the Network allowed me to move quickly, by accelerating the prototyping process, into collaboration with medical researchers, capitalizing on some excitement for their preliminary work in stem cell enrichment. This multidisciplinary research track may not have happened without the support of FABLS.”

David Inglis (ECR), Macquarie University

“My experience [of FABLS] is ultimately positive over the line – not only because a productive collaborative research network among different institutes was established – but also because FABLS can provide key performance indicators & innovative outcomes in a relatively short period of time, showing that it achieved all its original mission statements & goals, and even far beyond. It would be unfortunate to see a good functioning network disappear – I would experience this as a waste of investment, and a serious loss for the Australian FABLS community.”

Filip Braet, University of Sydney

“It follows from the fact that the pooling of interests of scientists of different specialties in a common research group helps us to take open-minded approach to the subject of investigation.

Anna Guller (ECR), Sechenov Moscow Medical Academy

3.2 Stimulation of research by FABLS

FABLS stimulates new research through a focused seed funding program that supports Members' research initiatives referred to as "FABLS projects". These projects are in their initial stages, sometimes still evolving and FABLS funding is needed to help bring them to a level of maturity where they become eligible for major funding such as Discovery and Linkage grants. The projects are expected to meet a range of criteria listed on the specially designed application form and they include cross-disciplinary character, agreement with FABLS mission and with the strategies identified by the FABLS yearly workshop, potential of industry linkages, involvement of students and use of Members facilities. The ARC / NHMRC funding is distributed with due consideration to funding constraints expressed in the ARC / NHMRC Funding Contract for the Networks and this allocation is not used to support project consumables nor personnel (research assistance) which is indicated in the letter of offer.

In 2008, FABLS supported a total of 41 projects, to the total value of \$ 337,514. The list of projects is given in Appendix 3 and ECR and PG recipients are highlighted Section 3.2.1. This funding has been instrumental in establishing a range of new research and industrial partnerships, compiled in Appendix 4. FABLS has fostered a total of at least 350 new partnerships at the research, company, national and international levels in the years 2005-2008. 122 new partnerships arose for members from projects funded in 2008. This adds to 89 partnerships reported in 2007, 45 partnerships reported in 2006 and the 97 partnerships reported in 2005. The Project Reports received since submission of the previous Annual Report to the ARC / NHMRC are presented in Appendix 5.

GOOD NEWS STORY

Sandeep Menon (PhD Student), Macquarie University



When PhD student Sandeep Menon Pernichery began his doctoral research in Biophotonics, it did not occur to him that in six months time he would reach the research frontier in fluorescence and that his work would make such a difference for future disease diagnostics.

Sandeep is using fluorescence to identify differences in human urine related urinary tract infections. In this day and age of growing antibiotic resistance, rapid diagnostics is the key to effective treatment. Fluorescence offers such an immediate indicator while the currently leading culture methods require more than 24 hours.

In a study of a large cohort of patients, Sandeep found that healthy individuals have a much lower fluorescence signal specific to urinary tryptophan than those who are sick. He also explained his findings in the context of human physiology.

This work was presented at the Congress of the International Commission of Optics in Sydney in June 2009 and was also selected by the Australian Broadcasting Corporation to feature on the ABC website. It has now been published in *Chemical Clinica Acta*.

In 2008, FABLS Members reported 50 publications as resultant from direct funding by FABLS or collaborations developed through the FABLS Network. See Appendix 18 for a listing of those publications reported, which represents only a small percentage of the total publications actually produced by our members.

FABLS activities have greatly increased the connectivity of the fluorescence research community. This is in evidence for example, through the growing membership of FABLS, which, at inception brought together 50 Members, grew to 120 by March 2006 to 270 by 2007, 402 members in March 2008, and now stands at 512 (as at March 2009), from Australia and overseas, in academia and business (for a summary of active Members see Appendix 6). A range of projects funded foreshadowed research visits, and these have been listed in Appendix 12. The project reports highlight outcomes of such visits for individual members (see Appendix 5).

FABLS projects began receiving financial support in mid 2005 (on average), and some of them can now be traced to successful major funding. Members have also indicated that the FABLS funding has strengthened their Discovery bids, and applications to other schemes such as Human Frontiers and Sir Mark Oliphant (ISL) have also been successful e.g. Prof. Min Gu (Swinburne). For completeness, we have included the list of 44 successful ARC & NHMRC grants awarded to FABLS members in 2008, many of which involve collaboration between FABLS members, to provide solid evidence of the research vitality of this section of research community (see Appendix 7).

3.2.1 FABLS support of ECR and postgraduate students

Distribution of FABLS Members as at 12 March 2009

	# of Members	% of total Membership
Early Career Researchers	112	22%
Postgraduate Students	119	23%
Established Academics	220	43%
Company Representatives	49	10%
Technicians & Research Assistants	22	4%
Internationals	113	22%
All Members	512	

The FABLS funding program makes a significant contribution to stimulate research of the Early Career Researchers (ECRs) within FABLS. We have documentary evidence that FABLS funding acts as a lifeline to these ECRs while they develop their research strengths and can not yet successfully bid for major funding. It also assists them to build a strong network within the research community and establish connections both nationally and internationally for collaborations. Please note the personal statements from our ECRs and PGs throughout the report and specifically on the next page, highlighting how FABLS has supported their studies or career development.

FABLS STRENGTHENS LINKAGES

"The FABLS project grant has facilitated visits to Picoquant, Berlin Germany, LaVision Biotec Bielefeld Germany, Horbia Jobin Yvon in Edsion, USA, Longjumeau France and Ocean Optics, Dunedin USA. The discussions identified that the incorporation of fluorophores in thin films using a sol-gel synthesis was a promising route and using micro-fabrication techniques to create the desired three dimensional structures."

Stuart Rumble, Lastek Pty Ltd

"As a result of the funding I have had many opportunities that I would not otherwise have had to travel and meet important researchers in the field. This is very important for a young researcher in Australia, where costs associated with international networking can be prohibitive."

Seth Olsen (ECR), University of Queensland

"A personal connection has been established with Prof Kishan Dholakia & Dr David Stevenson from the Optical Trapping Group in Scotland. This new relationship has enabled a closer more collaborative working relationship with the OTG."

Charles Cranfield (ECR), Tyndall National Institute

"This FABLS project has led to a strong collaboration between the University of Melbourne and Bristol University and a new collaboration with La Trobe University."

Michelle Gee, University of Melbourne

"This project provided a mechanism (and the funds) by which we were able to bring Prof. Enrico Gratton and Dr. Michelle Digman out to Melbourne from UC Irvine to discuss several aspects of joint interest to the two groups... This FABLS grant has enabled far stronger linkages to be initiated between the LFD at UC Irvine and the UML at Melbourne (and many other local researchers) that will surely continue long into the future. We thank FABLS for this support."

Trevor Smith, University of Melbourne

"We have successfully established collaboration with the leading lab developing optical tomography software and implemented these improvements in Sydney. We brought together all of the Australian users of this technique and have begun further discussions on local development and also are investigating collaborative funding opportunities."

Rob Bryson-Richardson (ECR), Victor Chang Cardiac Research Institute

"Partially as a result of strong international collaboration with The Department of Immunology and Cell Biology, Health Science Centre, University of North Texas, US, we have made a successful ARC grant application with funding commencing in 2008 "Amplifying light emission with metal-fluorophore nanostructures for ultrasensitive biosensing".

Krystyna Tomsia, Macquarie University

"Thanks to FABLS I started collaboration with OBEL group at the University of Western Australia. In my opinion FABLS activities and projects are really contributing to strengthen the already-established networks between researchers, as well as to give the opportunity to start up new collaborations and network between researchers."

Riccardo Cicchi (ECR), University of Florence"

As discussed in Section 2, within the FABLS network there are 112 ECRs, and 119 postgraduate students, making up 45% of all FABLS membership. To date, FABLS has funded 43 projects with an ECR as Chief Investigator (CI), and 9 with PhD students as CI, totalling 37% of all projects funded, with 20 of these projects being approved in 2008. This specific project support of ECRs and PhD students as CIs is in addition to the support they receive within established researcher grants funded by FABLS, for example, more than 50 postgraduate student activities were covered by established researcher projects funded in 2008, including 8 international lab visits by postgraduate students (See Appendix 3).

In addition there is the general support offered to all members for travel and attendance at workshops and conferences supported by FABLS as well as the targeted student sponsorships we offer for some events e.g. 1st Advanced Fluorescence Bio-Imaging workshop 2008 in Western Sydney.

**GOOD NEWS STORY –
PhD Student Fang Xie Wins
MQ Innovation Award**

Congratulations went to FABLS member and ex-FABLS casual administrative assistance, (now) Dr. Fang Xie (pictured with her PhD Supervisor, Prof. Ewa Goldys) on winning the 2007 Macquarie University Postgraduate Award for Innovation!

More information:

<http://www.mq.edu.au/innovationawards/Movies/2007/winners.htm>



The influx we observed in 2007 and 2008 of early career researchers and PG students is a clear indication that FABLS responds to their special needs. The ECRs can take full advantage in the opportunities for engagement and some participate in the FABLS Committees. They can utilise our Business Development Management support and many of them do. FABLS also began to help with career placements and some graduates have found employment opportunities within the FABLS Network

ECRs and PG STUDENTS BENEFIT FROM FABLS SUPPORT

“The money provided by FABLS for networking has been very helpful to me as a young researcher establishing a reputation in a new location. Travelling back to the north eastern USA a year after graduating sent a signal to close colleagues that my research program was in good shape.”

David Inglis (ECR), Macquarie University

“FABLS has given me the opportunity to interact with graduate and postgraduate students, as well as with researchers at the University of Western Australia.”

Riccardo Cicchi (ECR), University of Florence

“In my opinion, FABLS is different from other networks because FABLS gives the opportunity to apply for a project as a PI to young researchers and postgraduate students.”

Riccardo Cicchi (ECR), University of Florence

“I carried a monthly visit to Macquarie University in January –February 2008 from Russia. It was aimed to assist in the project entitled “Non-linear optical microscopy of cartilage towards in vivo sensor” in collaboration with the OBIS specialists. This visit was funded by the ARC Network (FABLS). It turned out to be a amazing experience of very interesting collaborative work with a number of outcomes, including immediate research output of several papers (in preparation) to the credible scientific journals.”

Anna Guller, (ECR), Sechenov Moscow Medical Academy

“Thank you very much for granting my application for membership into FABLS. Many of my colleagues recommended the membership to me, stating it is very rewarding to be a part of this network. .”

Laura Andrews (Honours Student), University of Western Sydney

We stress that ECRs have equal access to the project funding, on the same level with senior researchers, as track records are not a considered part of the funding assessment. FABLS can demonstrate that ECRs have, in fact been preferentially supported by the funding program. The ECRs also benefit from the FABLS assistance with project submission. Although no formal structures are in place, we understand mentoring has also been strengthened as ECRs have now a better platform to look for support.

Many education and training initiatives were supported by FABLS by making available student bursaries, offsetting fees or accommodation costs, thus facilitating the participation of ECRs and students, as discussed previously.

3.3 Leverage of ARC/NHMRC Network funding

The FABLS Network makes conscious efforts to leverage the ARC/NHMRC funding for the benefit of the organisation as well as for individual Members. In this context, the home institutions of new Members are requested to provide additional funding to enable them to fully participate in the Network activities.

We have established a strong potential to leverage industrial funding and support for training programs in fluorescence and especially microscopy, where very significant in-kind support has been foreshadowed and cash support may also be possible. This is followed up in the context of our training workshop, FLUORO organised biannually by Dr Pierre Moens, in Coffs Harbour.

Over the last 4 years, the relationship between the Network and industry has matured to the point that the network is able to demonstrate success in brokering collaborative research projects. It was recognised that an establishment period (colloquially referred to as a "getting to know where you fit in the scheme") was needed and to date, two academic/industry research projects have been funded (value \$50,000 each) with several others in the negotiating phase. The pattern of creating more opportunities is now comfortably established. The Network scheme offers an innovative alternative to promote cross-institutional, cross-disciplinary and cross-sector collaborations.

FABLS is designed to support large scale initiatives such as setting up of CoEs, CRCs and other types of Centres including those funded from overseas. To facilitate coalescence of the participants and the development of Centre programs, FABLS established a support mechanism called Funding Strategy Groups.

A Funding Strategy Group is a consortium of individuals with a common goal to establish a funded Research Centre with some connection to fluorescence. FABLS encourages the expression of interest for forming such a group. Funding is available to a maximum level of \$5,000 per group. This funding comes in the form of travel support only, to travel to group meetings. A group meeting is defined as having 3 or more participants. A condition of support is the requirement to have formal meetings with agendas, minutes and action items as well as ensuring that the action items are followed up. The documentation of these meetings (possibly in a sanitized form with confidential details removed) is required to acquit the funding.

The main area where leverage has been achieved has been in the major research project funding. A number of FABLS Members were able to secure large grants with FABLS support of earlier stage research. These are listed in Appendix 7. There was additional leverage which may not have been captured in this appendix as indicated in the following testimonial:

FEEDBACK FROM MEMBERS - LEVERAGE OF FUNDING BY FABLS

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www.endeavour.deewr.gov.au

Endeavour in focus: Ayad Anwer

Iraqi Ayad Anwer spent 6 months in Australia undertaking research at Macquarie University.

"Australia, this big island continent is one of the most beautiful countries in the world. Once settled, you can start discovering what makes life so special here - an attractive life style, peaceful society and beautiful surrounds. No two cities are alike, perhaps because of their independent development due to the distances between them: Perth is 3,984 kilometres from Sydney, about the distance from London to Moscow. I am a microbiologist and a staff member at the Institute of Laser for Postgraduate Studies at the University of Baghdad, Iraq. My PhD is focused on laser application in microbiology.

Within the framework of the Endeavour Research Fellowship, I started my research work at Macquarie University in Sydney with one of the leading research groups in Biophotonics in Australia. I was able to take part in a research program which emphasises laser scanning microscopy and related techniques, under the supervision of Professor Ewa M. Goldys. Involvement in this research gave me the possibility to improve my skills in fluorescence based technologies, including fluorescence spectroscopy, confocal laser scanning microscopy, fluorimetry assays for biomolecules and micro-organisms.

Through interacting with key Australian researchers at Macquarie University, I hope that I will become thoroughly familiar with Australia's scientific research and technology capabilities in biomedical optics and biophotonics, which will help me to position my own research within the field of Biophotonics. With the help of Professor Ewa Goldys, I hope to map out a collaborative research and postgraduate training program with the hope that a partnership will emerge. Participation by postgraduate students in Iraq will be encouraged through co-operative arrangements and possibly exchange visits. Working in this field will support one of the new research programs recently established at the Laser Institute for Postgraduate Studies in Baghdad and related to the application of fluorescence spectroscopy in biology and medicine. Behind the establishment of this line of inquiry is the need to develop and improve new diagnostic techniques and applications of lasers in life sciences and medicine. My deep thanks to the Endeavour Awards and team for providing invaluable support to this research activity."



Ayad in the lab at Macquarie University

3.4 FABLS Business Liaison and Interaction with Government and External Organisations

FABLS is an outward-oriented organisation and engagement with partners outside of academia is a core part of the FABLS mission. Of specific significance are interactions with the business community, professional associations and with government organisations. In this role, FABLS receives guidance from its Advisory Board whose composition reflects this outward focus and which had its meetings on 21 February 2006, on 15 February 2007 and 1 April 2008. We have been fortunate that the following representatives from industry agreed to provide advice to FABLS: Mr Martin Harris, Founding Director (now Director of Fundamental Research), Optiscan; Mr John Wotherspoon, (PhD), Technology Development Manager/Asia Pacific Becton and Dickinson; and, Mr Duncan Jones, Executive Director Science Industry Australia (withdrawn due to other commitments in 2008).

FABLS Network has an established Business Liaison office supported by the Business Development Manager, Mr David Tayler who has introduced a number of strategies to achieve better visibility of the network, and foster opportunities for the researchers among us to establish improved connections with the research end-users. Similarly, information channels are being developed enabling the representatives of various companies and the research world to better connect. These have been the guiding ideas into 2008.

GOOD NEWS STORY - Significant advances in sensing applications

Research grants from Macquarie University have helped Dr. Coutts, He and Orr to set up relevant coherent-Raman micro-spectroscopic instrumentation, based on a passively mode-locked Nd:YAG laser and a synchronously pumped optical parametric oscillator (OPO) that is being built as a broadly tunable coherent source. A major goal is to dramatically increase the detection sensitivity of coherent-Raman micro-spectroscopy, down to the level of single molecules, by using plasmonic metal nanostructures for surface enhancement.

New laser and photonic technology is also being used to develop and exploit innovative coherent-Raman molecular sensors that will be field-deployable. Such instrumentation is expected to enable significant advances in sensing applications ranging from cancer screening to ultra-sensitive detection of substances such as explosives, pathogens and forensic residues.

The three FABLS Project Grants to Coutts, He and Orr have facilitated their highly instructive visits to some of the world's leading coherent-Raman microscopy laboratories, including those of S. Kawata (Osaka University, Japan), S. Leone and R. Saykally (UC Berkeley, USA), G. McConnell (University of Strathclyde, UK), D. Palanker (Stanford University, USA), H. Rigneault (Institut Fresnel, Marseille, France), A. Volkmer (Universität Stuttgart, Germany), W. Wadsworth *et al.* (University of Bath, UK), X.S. Xie (Harvard University, USA), A. Zumbusch (Universität Konstanz, Germany) – with more such FABLS-supported visits planned in 2009. This exposure to leaders in the field has assisted preliminary experiments at Macquarie University.

Brian Orr, Macquarie University

3.4.1 Activities in 2008

➤ Presentation of FABLS credentials

Aspects of the FABLS network have been presented through personal approaches to a number of organisations. These are:

Government and Organisations (15)

- **Food Standards Australia New Zealand** - Discussion with Principal Microbiologist and General Manager, Risk Assessment Branch. They have no funding to support research, but provide research supporting letter.
- **NSW Food Authority** - Limited discussion with this organisation. They are an operational unit rather than an R&D group.
- **NSW Department of Primary Industries** - Several discussions in fluorescence applications in animal and plant pathology, post harvest handling and to some extent biosecurity, collaboration on project by project base sought.
- **CSIRO Mathematical Sciences** - alliance for development of cell imaging software.
- **NSW Department of State and Regional Development** - organising seminars with a business focus, circulating invitations to attend to company representatives, and networking. DSRD is keen to know what we are doing with industry.
- **NSW Office for Science and Medical Research** - Discussion regarding research collaboration and funding programs. OSMR offered help to support large scale research projects in NSW. (Sydney).
- **Invest Australia** - cooperation to identify contacts to the multinational industries in Europe - Chemenux, Agilent Technologies, Biomerieux.
- **National Security Science and Technology branch, Department of Prime Minister and Cabinet** - With their interest in the detection and identification of CBR agents, this is a long term opportunity to seek research funds, project by project. FABLS capability was discussed.
- **Dept of Agriculture, Forestry and Fisheries -and AQIS** Organised a seminar in DAFF and presented the science. It was explained that they need to handle requests for research support such as ours at an arms length. AQIS people were meant to attend this seminar but did not show up. Recommended that we approach **Dept of Health and Aging**.
- **Maxine McKew, MP** - As FABLS is 'headquartered' in Maxine McKew's electorate FABLS capabilities were presented and the benefit arising to researchers and the industry/academia interface. At her suggestion preparing a letter for her to forward onto Minister Kim Carr.
- **Verity Firth, MP, NSW Minister for Science and Medical Research** - offers of help to prepare economic analysis report on science matters.
- **Indiana Economic Development Board** - Network of science companies in Indiana. Discussed linking into their network and working to mutual advantage.

- **North Carolina Biotechnology Centre and Maryland Department of Economic Development** – These focus on encouraging biotechnology industry and research. Discussions considered how we might approach organisations like these in the US and lessons learnt which might apply in Australia.

Industry Organisations (21)

- **Ausbiotech** – Discussion identifying how FABLS can maximise its membership with Ausbiotech organisation. Examples include newsletter distribution, seminar event notification and articles for their journal. (Sydney), attendance at BIO2008 in June 2008.
- **AusMedTech** (formerly Medical Devices Industry Association of Australia) – networking activities with companies involved in the medical devices industry.
- **Science Industry Australia** – organising seminars with a business focus, circulating invitations to attend to SIA members, representation in the NSW chapter and at the national level to attract more industrial members into FABLS.
- **InnovationXchange Australia**, to promote FABLS member's projects to IXC's company clients. IXC is a commercially neutral, global knowledge network which delivers connections business and research. Also assisted FABLS with industrial seminars.
- **Australian Nano Business Forum** – Complementary networking.
- **Australian Food and Grocery Council** – Discussions with Deputy Chief Executive. Their Health Nutrition and Scientific Affairs Committee and have proposed a seminar for selected council members who are interest in food contamination.
- **ManufactureLink**, to establish channels to exchange information. ManufactureLink is an online sourcing network for Australian custom manufacturing and engineering services. It connects buyers with suppliers of custom manufacturing and engineering services.
- **Fisheries Research & Development Corporation** – interested to support research using fluorescence technologies for biosecurity issues, and fish pathogen identification.
- **Environmental Biotechnology CRC** – Discussion focused on mutual cooperation on disseminating news about each other's organisations and potential training. (Sydney) In addition a forum was organised for the CRC to seek researchers to collaborate in the CRC's program.
- **Grape and Wine R & D Corporation** – interest focussed on supporting projects in plant pathogen detection.
- **Horticulture Australia Limited** – discussions with Plant Health Manager, Food Safety Portfolio Manager and Postharvest & Emerging Technologies Manager, who suggested HAL would be favourable towards application for research projects. There is a need to gain industry support and recommended that we liaise with AusVeg, Apple and Pear Limited and Citrus Australia Limited. Expecting a positive outcome.

- **AusVeg** - FABLS and CRC discussed with CEO.
- **Apple and Pear Australia Ltd** - discussions with General Manager and Industry Development Manager. The organisation is very interested in how FABLS' technology can be applied not only to food quality, but also biosecurity and plant pathology. *Currently, discussions are looking at a future ARC Linkage Grant.*
- **Citrus Australia Ltd** - information with a focus on pathogen detection sent to CEO.
- **Cherry Growers of Australian Inc.** - discussions and information sent to President. Focus on pathogen detection.
- **Australian Nashi Growers Association** - discussions and information sent to General Manager, Fruit Growers Victoria. Very interest to support research projects.
- **Australian Pork Limited** - after positive discussions, information sent.
- **Australian Egg Corporation Limited** - information sent to CEO. We know the industry has a problem with *Salmonella spp* in eggs which needs to be addressed.
- **Meat and Livestock Australia** - detailed discussions with Manager, Market Access Science and Technology, Client Innovation Services who explained how MLA functions and his role developing safety regulations. He indicated MLA is concerned with fresh meat and will not be interested nor in a position to support our R&D ideas.
- **Tasmanian Salmonid Growers Association** - Discussion with General Manager identified a potential for fish disease research on project basis.
- **Dairy Innovation Ltd** - Presentation to CEO and several other key persons. At the time they were overwhelmed with responses as to technologies for sensing applications in dairy manufacturing and that we need to push our story. Indicated excellent alignment but it is unclear about moving forward.

Companies (38)

- **Agilent Technologies** (part of Hewlett Packard based in Germany) - The concept of developing flow cytometry assays for food industry applications is at the core of their current corporate strategy. Agilent has developed a strategic partnership with MQ in the form of a \$100,000 pilot project. This is a successful company interaction and there is more to come.
- **Foss Pacific** (North Ryde, NSW) - Danish company focusing on dedicated analytical solutions in microbiology. Discussions with the Australian MD and Commercial Manager. Food safety is their area of interest; expressed an interest to be involved and need confirmation from Denmark. Expecting positive outcomes.
- **Millipore Corporation** (Massachusetts, USA) - Several discussions with US based Director, Strategic Alliances and Technology. Interest in many FABLS technology areas. Specific interest in Luminex rapid microbial detection by

- multiplexed flow cytometry. Follow-up discussions with Business Business Manager Aus/NZ, **Millipore Australia Pty Ltd** (North Ryde, NSW) encouraging applications from FABLS members to take part in their annual science award.
- **George Westons Group** (Enfield, NSW) – UK headquartered company that owns several food companies. Discussion with Australian Chief Scientist whose interest is rapid detection of food pathogens. Enabled FABLS to engage with their network. Expecting a positive research collaboration outcome on a limited level.
 - **Woolworths Limited** (Baulkham Hills, NSW) – Australian retailer Discussion with National Compliance Manager, Retail Support and QA Laboratory Manager. Prepared to endorse projects improving food safety and consider philanthropic alliances.
 - **AI Scientific AES** (Brisbane, QLD), distributor for **AES Chemunex** (France) who are leaders in cytometry applied to microorganisms detection - laser scanning cytometry, real-time PCR for food pathogens, BIOLOG identification system for over 2000 bacteria, yeast, mould and filamentous fungi. FABLS information sent to headquarters in France. Feedback has been positive but is decision making is slow.
 - **BD BioSciences** (North Ryde, NSW and USA) – discussed technical issues for collaborative research in the field of bioimagers, flow cytometers, and cell sorters with US Principals (Vice President, R&D) and Australian representatives.
 - **Beckman Coulter Australia P/L** (Gladesville, NSW) to discuss general research opportunities in biomedical fields, cell analysis, diagnosis and treatment of disease, especially those involving aspects of fluorescence. Unlike the Australian office, US headquarters show little interest in collaboration.
 - **Biomérieux** (France) with a letter of response presenting selected FABLS capabilities to following representation of FABLS by Invest Australia. The company is interested to find common ground with Australian researchers.
 - **Bio-Rad Laboratories Pty Ltd** (Gladesville, NSW) – three discussions regarding involvement in CRC.
 - **Eppendorf South Pacific** (North Ryde, NSW) to discuss general research opportunities.
 - **Fonterra Co-operative Group Limited**, (New Zealand) – five discussions on cooperative development of a flow cytometry test that can be used to assess the quality of milk. Interest fell away.
 - **GE Healthcare** (Bundoora, Vic and Rydalmere, NSW) – continuing to develop potential for research alliance. The company has included activities with FABLS in its business plan for 2008. Very likely to support project through FABLS. Feedback from Australian representatives has been positive but is decision making in the US is slow. Confidentiality agreements exchanged.

- **3M (formerly Tecra Pty Ltd in Australia)** (Frenchs Forest, NSW) – Company has a strong focus on pathogen solutions and look for new opportunities. Very likely to support project through FABLS, but we will need to see how it will develop.
- **Genera Biosystems** (Bundoora, Vic) – research alliances in multiplexed assays.
- **Guava Technologies Inc** (California, USA) – to discuss cooperative projects in flow cytometry and in association with **Millipore Australia Pty Ltd** seeking collaborative project awards.
- **Invetech (part of US Danaher Group)** (Melbourne, Vic and San Diego, USA) – discussed opportunities in flow cytometry development. There is the possibility of partnership and the alignment of business models, which still need to be developed. Confidentiality agreements exchanged.
- **Invitrogen Pty Ltd** (Carlsbad, California) – discussion on opportunities in bioimagers, fluorophores, with Australian and US principals. Principal interest is commercialisation of blue fluorophores and other IP ready for commercialisation that fits their business focus.
- **Johnson & Johnson Research** (Strawberry Hills, NSW) for collaborative research opportunities especially for stem cell research. Company closed down at end of 2008.
- **Leica Microsystems Pty Ltd** (North Ryde, NSW) – regular contact with the MD and technical representatives from this company whose interest is cell imaging technologies.
- **Merck GmbH** (Damstadt, Germany) – 10 discussions on potential collaboration opportunities and more detail as requested on fluorophore and antibody methodologies and lateral flow assays availability. The company say they need to go back to their marketing division to evaluate commercial prospects of the area in light of better market acceptance of PCR. Bead assays still under evaluation.
- **GlaxoSmithKline** (Boronia, Vic) – 4 meetings with Head of R&D Alliances Australia/NZ. Interested in development and application of biosensors. Monash researchers followed up the opportunity.
- **Merck Sharp and Dohme** (Granville, NSW) – discussed potential collaboration opportunities associated with antibody and fluorophore methodologies, imaging and especially biosensors. Main interest is IP currently available. Monash team was asked to pursue further. MSD emphasized they only work with people with whom they have worked in the past, so encouraged us to develop a track record. MSD regularly publicise their development priorities.
- **Novartis** (North Ryde, NSW) – bead assay for multiplex pathogens with the use of antibodies and cell biosensors.
- **Olympus Australia Pty Ltd** (Melbourne, Vic) – Several positive discussion on how the two organisations can help each other. Olympus is already involved in a collaborative project in 2007/8 with opportunities for more in 2009.

- **PerkinElmer Life and Analytical Sciences** (Massachusetts, USA) – Several meetings with Biochemistry Team Leader and technology assessment head for Asia-Pacific Region. Very interested in biosensors and invited the Monash research team for a teleconference. PE wants exclusivity on such biosensors.
- **Pfizer Australia** (West Ryde, NSW) – research alliances in long lifetime fluorophores suitable for time-resolved imaging and flow cytometry. Several Contacts with Head of Strategic Alliances –Australia. No interest in projects with long time horizons. Hopes to collaborate on more specific programs. Wishes to be updated about FABLS.
- **ZyGEM Corporation Ltd** (California, USA) – several discussions with company principals including President and CEO, and Technical Director US regarding development of isothermal amplification. Confidentiality agreements exchanged.
- **Syngenta and Manchester University** (Manchester, UK) - applications of fluorescence, specifically their possible integration into Syngenta’s core activities in the plant protection and plant breeding. Interest in transgenic biomarkers. Next step is technical discussion with HQ in UK as engagement is quite possible, but in the context of more specific projects.
- **SGE Analytical Science Pty Ltd** (Ringwood, Vic) – With the CEO, discussed FABLS network, potential to help train technicians for the Science industry, organising and promoting seminars with an industry-academic interest.
- **Merck Pty Ltd** (Kilsyth, Vic) – meeting with Business and Segment Manager; R&D, Victoria. R&D outside core Australian business. Second meeting with Product Manager and product Specialist, Calbiochem, Novagen & Novabiochem. Information being considered.
- **MDS Analytical Technologies** (Hawthorn East, Vic) – Interested in collaborative projects. Spoke with Applications Scientist and LCM product Manager, both of whom took part in the FABLS 2008 Workshop in Brisbane.
- **Arrow Scientific** (Lane Cove, NSW), **ALS Laboratory Group** (Springvale, Vic), **Key Diagnostics** (Gymea, NSW), **DTS Food Laboratories** (Kensington, Vic) Diagnostic test laboratories all with an interest in in-kind contributions to research.
- **Carl Zeiss Pty Ltd** (North Ryde, NSW) – discussion with Product Manager, Laser Scanning Microscopy about collaborative research and support FABLS “Light in life Sciences” conference.

A program of follow up meetings and/or distribution of further information matching the company’s interest to the expertise in FABLS are in place.

Aspects of FABLS credentials were also presented to representatives of the following Australian and overseas headquartered companies (in writing or during networking opportunities (38 in total) :

- **Sanofi-Aventis** (Paris, France) - VP, Prospective Portfolio Management and Scientific Support. Focus is stem cells, better selection of stem cells and

regenerative medicine. Interested to hear more about expertise in FABLS, but fit uncertain. We sent more information.

- **Boeringer Ingelheim Pharma GmbH & Co** (Germany) – spoke to Global Licensing Technologies manager. Exchange of organisational core foci.
- **University Of Maryland Biotechnology Institute** (Maryland, USA) – Spoke with Director, Technology Transfer & Development. Looking for partners for commercial development of microscopes.
- **Advanced Analytical Laboratories, Inc** (Iowa, USA) – spoke with Director of Research & Development. Specialists in electrophoresis and rapid microbial detection. Possible interest in collaborative development of MicroPro microbial identification system (flow cytometry).
- **NC Medical Research Inc** (Japan) – spoke with US Executive Adviser, based in Washington. Company's focus is stem cells and use in personalised medicine; explored prospects for partnership.
- **Proctor & Gamble Pharmaceuticals** (Canada) – discussion with Tim Hendrickson, informed about the FABLS initiatives.
- **Bilaterals Co Ltd** (South Korea) – spoke to CEO about magnetic and fluorescent nanoparticles for stem cell tracking, good synergy with some FABLS members, but company is small (University spin-off). They followed up with us.
- **EBRI Cambridge (UK)** – This is a network organisation in the UK. At BIO we spoke to the Business Development Director. Discussed partnership on stem cell research.
- **Promega Corporation** (Wisconsin, USA) – spoke to VC President of Finance who was interested in hearing more about FABLS. Further information was sent. Need to follow-up with GM.
- **Wyeth Pharmaceuticals** (New York, USA) – spoke with Senior Director Vaccines Licensing, interest in receiving more information.
- **Amgen** (California, USA) – Discussion with Director, External R&D Affairs, informed him about the initiative. Amgen discovers and manufactures medicines. Also spoke separately to Glenn Beagley (an Australian expat) - very good source of advice and would help with introductions to key biotechnology people in USA.
- **BASF - The Chemical Company** – Discussion with Senior Manager - Future Business. Possible mutual interactions in chemicals, water treatment, algae for small molecules.
- **Lilly** – Discussion with Manager, Global External Research & Development. Will pass on to Technology Assessment Dept to see whether there is a fit with Lilly R&D Programs.
- **Rigaku Corporation** (Tokyo, Japan) – Discussion with Senior Manager Planning, NDT Imaging Technologies Division. Focus on imaging vascular system. Mid sized Japanese company that does partnerships with academia.
- **RNL Biostar** (Maryland, USA) – Discussion with Manager of Business

Development. Interest in stem cells, characterisation of cells. Have a favourable attitude to partnerships.

- **Clean Cells S.A** (Bouffere, France) – spoke to Business Development Manager (works with Sanofi Aventis) and discussed cell analysis and sorting and partnerships.
- **Nanopoint** (Hawaii, USA) – spoke with President. Company specialises in hardware for cell screening, possibility of partnership.
- **Dow Chemical (Australia) Ltd** (Frenchs Forest, NSW) – discussion with Business Development Leader, Emerging Technology, ASEAN. Further contacts in Dow.
- **Medtronic** – Leinesa Adams looking for detection of residual cancer cells during surgery, possible detection by autofluorescence.
- **University of Colorado at Denver, Health Services** (Colorado, USA) – discussion with Director, Technology Transfer.
- **Sony DADC** – Discussion with VP - Microstructured Polymer Device Business. Particularly interested in micro fluidics chips and production of laser-based devices. Interested in large-scale production of chips.
- **Optiscan** (Waverley, Vic) – discussion with CEO.
- **DASGIP AG** (Juelich, Germany) – Discussion with President and CEO. High throughput culture screening; Possible collaboration in design of fluorescence-based analyses.
- **Proteogen Inc** (Seoul, South Korea) – discussion with CEO.
- **Biocompatibles UK Ltd** (Surrey, UK) – Discussion with Business Research and Development Manager. They use stem cells as a drug delivery vehicles.
- **Biolink** (Eveleigh, NSW) – discussion with Business Development Manager.
- **Avesthagen Ltd** (Bangalore, India) – talked to Rajami K Vangala .Very positive response; Interested in partnering - biomarker project, stem cells, biomarkers and assay development.
- **Emergent Technologies Inc** (Texas, US) – discussion with VP, Business Development. Advisory company.
- **Iris Bio-Technologies Inc** (California, US) – spoke with President. Advisory company.
- **Clinical Trials NSW** (Eveleigh, NSW) – discussion with Director.
- **Astra Zeneca Pharmaceuticals** (North Ryde, NSW) – FABLS and CRC information packages sent following initial contact to Head of Clinical Research.
- **Circadian Technologies Ltd** (Toorak, Vic) – spoke with MD.
- **NewSouth Innovations Pty Ltd** (UNSW, NSW) – discussion with GM Commercialisation Life Sciences about technology transfer and IP management.

- **Inspection Systems Pty Ltd** (North Melbourne, Vic) – discussion with Director.
- **Queensland Health Scientific Services** – discussion with Manager and Director, Scientific Operations. They are very interested and already take part in several CRCs.
- **Biopharmica** – discussion with Technical Development Manager, who was interested. Sent him CRC information.
- **PicoQuant GmbH** (Berlin, Germany) – Discussion with Senior Scientist Microscopy about detection of single molecule detection in the context of rapid detection diagnostics.
- **Silliker Australia** (Regents Park, NSW) – an accredited food testing and consulting network with an interest in in-kind contributions to research.

Other companies contacted (36):

Pacific GMP - Andrea Lynn	London Development Group - Jimmy Ayodej
KBI Biopharma - Tim Keen	Fisher Scientific Company LLC - Ruth Sutyak
Biotechnologica - Peter Doliva	Axcela - Consulting - Stacey Stewart
Wolters Kluwer Health - Nicola Hott	WiCell - Marian Piekarczyk, Louise Sacha
Pharmazell - John Nolan	Stem Cell Therapeutics - C Douglas-Crampton
Fisher Bioservices - Fayez Memon	Lifetree Clinical Research - Greg Mann
TMS Co., Ltd. - Hiroyuki Kasuya	Choate Hall & Stewart LLP - Sonia Mangino
SciLog, Inc. - Juliette Schick	BioPortUSA - James Laird
Biortech Logic - Peter Dellva	Genetrix - Gabriel Marquez, Miguel Mulet
EvaluatePharma - Andrew Beaven	Cyntellect - Manfred Koller
Global IP Estimator - Anthony Andrade	Knobbe Martens - Jerry Hefner, Boris Zelkind
PharmaZell - John Nolan	Evaluate Pharma - Anthony Raeside
Lytix Biopharma - Øystein Rekdal	Labsupport - Philip Cooke
Assay Depot - Rita Wilby	Axcela - Stacey Stewart
Alsace Biovaley - Antoine Agathon	Choate Hall and Stewart - B Herschbach
CfPie - William Beyer	CellResearch Corp - Edwin Chow
Pluristem - Zami Aberman	Clinuvel - Colin Mackie
Nestle Purina PetCare - George Wells	DuPont Agriculture & Nutrition – C Goldstein

FABLS Convenor, Professor Ewa Goldys, Business Development Manager, David Tayler and many others have established a very successful domestic and international network of industry people with an interest in the application of fluorescence.

From the beginning, the management strategy was, among other objectives elsewhere described, to deliberately integrate the network with industry, companies and government organisations, to promote research in our broad discipline area. With so many medical and industrial applications for fluorescence technology, our understanding was that working with industry would help to focus research targets and identify commercial openings.

FABLS has been very successful at this. Its management has been working at the interface between research and commercialisation for more than 20 years, and assisting in the development of some excellent multidisciplinary collaboration. Our achievements to date include:

- Cooperation and collaboration across common research areas to create critical mass and allow wider access to specialist resources. The drawing together of selected resources within FABLS to promote the network at a major international biotechnology conference in the USA is one example.
- Crossing institutional barriers and bundling a number of discrete research projects involving researchers that have not collaborated before across institutions to create a product which provides systemic solutions in response to real community/commercial needs;
- Packaging institutional research to industry and providing a solution to an identified need rather than part of a solution as often occurs;
- We have garnered the interest of nearly 110 organisations with an interest in fluorescence technology, or who now have acquired an interest given our promotion of its benefits. We have received expressions of interest from Merck GmbH, GE Healthcare, 3M, Foss Pacific, George Weston Foods and Woolworths among others.

As we have been operating effectively for the last 4 years, industry is using the network. We have expressions of interest from industry people to tell them more about what our researchers are doing. The ultimate outcome, of course, is direct industry investment (funds and resources) into Australian research through, for instance, linkage grants or partnership in a CRC, or academic research projects. We can cite several linkage grants facilitated through FABLS, the most recent with the German office of Agilent Technologies (part of Hewlett Packard). Another example is a potential project with the Apple and Pear industry and with GlaxoSmithKline. Many other examples are in their early stages.

Our activity has led to the development of a CRC application focusing on rapid detection of pathogens in food. This is something that could not have considered without the network. Interest in the CRC is gathering excellent momentum and it is hoped to make our bid in 2009/10.

Due to the network, our researchers' ability has been vastly improved to network with groups of companies through their industry networks. A key advantage of networking through FABLS is its cost effectiveness. We are able to introduce and potentially broker an array of research works to a large range of companies.

Funding for FABLS comes to an end in 4 months time, meaning the FABLS network and its activities will be unable to continue. It may lead to the break up of valuable co-operative research teams. This will leave a large gap in the research arena as there is no other functioning facility to fill the void and continue to promote cross-institutional, cross-disciplinary and cross-sector collaborations like FABLS'.

➤ **Definition of FABLS capability**

- **One page description of research:** FABLS has collected 47 one-page descriptions of Members projects to help display their capabilities to the industrial organisations (see Appendix 8 for a list of projects). These are made available to interest parties. Copies have been given to the companies previously mentioned.
- **Capability statements**

In addition to the one page project descriptions, we now have 44 individual capability statements describing the expertise of FABLS members. These have been submitted using a template developed by the BDM. In addition a comprehensive capability description was compiled to represent the skill base for the above mentioned CRC.

- These are voluntarily collected from Members and are posted on the website. Selected copies were made available to most of the companies listed above.
- Collection of the expressions of expertise is an on-going activity.

➤ **Preparation and dissemination of three newsletters.**

Topics covered in the newsletters include, business liaison activities, articles on training courses, members research projects, latest equipment updates, funding opportunities, and about the membership. The newsletters appear in Appendix 15. The newsletter is disseminated to our mailing list of FABLS Members, and about 500 company representatives.

➤ **Development of databases**

A FABLS database of people having an interest in the network currently holds approximately 500 recipients in addition to the 504 members of FABLS. Development and refining the database has been an on-going activity. Many contacts were the result of direct contact by the FABLS management team as part of their quest to expand the community's awareness of the use of fluorescence science in biology, biotechnology and medical science.

In addition, FABLS has established contacts with:

- Ausbiotech - with a membership of 2,400 (FABLS did not renew its membership in 2009 due to its imminent demise;
- Science Industry Australia association (SIA) - representing about 90 companies;
- AusMedTech (Medical Devices Industry of Australia Association) - representing about 50 company members;
- e-Bulletins associated with InnovationXchange and the NSW Department of State and Rural Development (this is being expanded to similar departments in other states).

3.4.2 Interactions with government organisations and instrumentalities

The FABLS network has engaged the support by the industry and the government. The following list summarises the networks' mutual involvement:

- Industry and government representatives attended 8 industry seminars. FABLS collaborated with NSW Department of State and Regional Development and several other interest groups to host these seminars. They are described above.
- FABLS Convenor and BDM met with Maxine McKew (Member for Bennelong) to discuss the Network and future possibilities, which lead to a letter written and passed on to the Hon. Kim Carr, Minister for Innovation, Industry, Science and Research.
- FABLS was awarded a \$5,000 sponsorship from the NSW Department of State and Rural Development to attend the BIO 2008 Conference in San Diego, USA.
- FABLS drew upon the expertise of Invest Australia to develop contacts with decision makers in science companies headquartered in Europe. The companies included BioMérieux, France, AES Chemunex, France, Novartis Switzerland, and Merck GmbH, Germany.

3.4.3 Cooperative Research Centre Initiative - CRC for Rapid Pathogen Detection

In 2007, the FABLS Management endorsed the development of a CRC bid based on capabilities of selected FABLS Members. A team of about 20 researchers was initially assembled to develop research programs in real time multiplex detection of pathogens in a health care setting, purification of cell populations and cellular biosensors. In 2008, following extensive interaction with science companies and with the end-users of the proposed technology, the focus of the CRC was narrowed to the rapid detection of pathogens in the food industry, incorporating food contamination and biosecurity (quarantine). The CRC focus will be the development of precision instrumentation, DNA/RNA amplification and imaging reagents and software to speed up pathogen detection.

Focus on Rapid Detection Methods

The growth and survival of many companies worldwide, within a number of industries, depend on the safety and non-contamination of their product and processes. Ensuring the safety and quality of processed food supplies is vital in maintaining brand values, public confidence and cost competitiveness. Food borne diseases have emerged as an important and growing public health and economic problem in many countries during the last two decades. Frequent outbreaks caused by new pathogens, the use of antibiotics in animal husbandry and the transfer of antibiotic resistance to human, as well as the ongoing concerns about bovine spongiform encephalitis (BSE) are just a few examples. From process water to water consumed in the products, there is not a person or virtually any industry that is not reliant on microbial testing for the guarantee of food supply safety. From airlines to cruise ships, water bottlers to small goods manufacturers, breweries to hotels, all are dependent upon regular and accurate microbial analysis.

There are approximately 76 million cases of food poisoning annually in the US, with an estimated 5,000 deaths per year as a result of food poisoning or food borne diseases.

Nutrient-based culture growth methods are the standard for micro-organism detection and identification, usually with a 30 hour return rate. This has presented difficulties for the distribution chain, as by the time anomalies are detected the product has usually begun its journey to market, possibly necessitating an expensive and negative recall program.

Recent advances in technology however, will soon allow for far more rapid microbiological detection and identification, offering, approximately, a 2 hour return, giving much more control to industry over quality standards and their distribution process. There is an economic and social benefit to develop this technology as it can lead to an increase in consumer trust in food products, the reduced risk of food poisoning, and, by association, reduce social costs due to resultant illness, loss of productivity, healthcare system resources, hospitalisations and deaths.

CRC Focus

The CRC focus is the real time multiplex detection of pathogens using novel approaches. It will involve developing approaches for rapid detection of a range of harmful micro-organisms to assist with food contamination (including milk) and bio-security. The work will primarily involve, in the short term, modifying existing commercial devices and the creation of new protocols in the long term. Applications will involve screening foods for a range of bacteria and viruses. Multiplexing will address constraints in diagnostic laboratories such as ever-increasing workload, costs, the need to improve turnaround time and limited expertise of staff. The focus is to develop new automated methods which reduce the need for manual observation and the need for time-consuming culturing.

CRC partners

A board comprising several well renowned science leaders has been established. The Convenor and Business Development Manager undertook a major effort to draw industry into this initiative. The initial Partner Universities (Macquarie Monash and UTS) invested in excess of \$70,000 to support this development. We teamed up with several government departments to identify potential commercial partners and had in excess of 100 meetings in 2008. In parallel we developed compendia of promotional documents including a strategic overview, academic and company research partners, areas of interest, and the team's credentials, publications, patents.

The CRC memorandum of information was developed. The majority of biotechnology companies on the eastern seaboard, identified as potential participants were approached for potential partnerships in the CRC. A database of contacts was and continues to be developed. Detailed information packages were compiled and customised and sent to 13 major multinationals including Pfizer, Novartis, Merck, GE Health, Foss Pacific, 3M, Millipore, Invitrogen, Biomerieux, GlaxoSmithKline, Agilent (part of Hewlett Packard), PerkinElmer and Merck Sharp and Dohme. Other companies and industry organisations which have been approached are listed in the previous section.

The Australian science industry has a high proportion of multinationals which are headquartered overseas. More time is required to develop the relationship and show the value of our research capabilities. More marketing of our scientific capability and success to-date is required to bring our science to the decision makers' attention. It is perceived that the financial down-turn is having an adverse effect. There are few Australian companies with sufficient turn-over to partner research in a CRC.

The bid for a CRC has been postponed beyond the next round due at the end of March 2009. Competition in this round is one reason. Many CRC are competing for funds, so this bid will be delayed until its success is more certain in 2009/10. Also time is required to negotiate with industry partners. In the meantime, emphasis is now about establishing smaller projects, such as linkage grants, with these companies to reinforce our expertise to decision makers.

3.4.4 Other interactions with external organisations

- A number of companies have provided material for the network's newsletter, viz, Leica Microsystems Pty Ltd, Carl Zeiss Pty Ltd, Scientifix Pty Ltd, and Scitech Pty Ltd;
- Attendance by company staff at 2008 workshop – PicoQuant GmbH, MDS Analytical Technologies, Lastek Pty Ltd, and PerkinElmer Life and Analytical Sciences;
- A number of company members are involved in FABLS committees e.g. Lastek Pty Ltd, Coherent Scientific Pty Ltd, Leica Microsystems Pty Ltd, and PerkinElmer Analytical and Life Sciences, Canon Cisca, Universal Biosensors Ltd, and Australian Proteome Analysis Facility
- Nine representatives from companies joined the network in 2008, totaling 49 company members;
- A number of companies have provided material for the network's newsletter.
- A FABLS team took part in industry partnering sessions at BIO 2008 meeting in San Diego, June 2008, more detail is provided below.
- Five workshops were sponsored by FABLS in which industry support was vital (these are further detailed in Section 3.5.2 and reported in Appendix 14). They were:
 - **1st Advanced Bio-Imaging Workshop** 8-12 September 2008, at Confocal Bio-Imaging Facility, University of Western Sydney. Participating companies were PerkinElmer, Becker & Hickel, SciTech (The Imaging Specialists), Invitrogen, Coherent Scientific, Nikon, AntiCancer Incorporated, Millennium Science., Optiscan, Imaris, Lastek Pty Ltd, MDS Analytical Technologies, MetaMorph, Bitplane (Scientific Solutions), and Leica Microsystems.
 - **Live Cell Imaging Workshop** 1-4 December 2008, at the Advanced Optical Imaging Facility in Monash University's Science Technology Research Innovation Precinct (STRIP). Participating companies were Leica Microsystems Australia, Olympus Australia, Nikon/Coherent Scientific, Invitrogen.
 - **Pasteur-Walter and Eliza Hall Institute Workshop on Imaging Infectious Diseases at the Molecular, Cellular and Tissue Level**, 31 January - 1 February 2008, the Walter and Eliza Hall Institute. Participating organisations were the Walter and Eliza Hall Institute of Medical Research, the Embassy of France in Australia, the Pasteur Institute, PerkinElmer, and the ARC/NHMRC Network for Parasitology.
 - **The Coherent X-ray Science (CXS) Annual Workshop 2008: Facilitating X-ray Biophotonics - Physicists and Biologists Working Together** 17th-19th September 2008 at Bio21 Institute, Melbourne. FABLS co sponsored this workshop with the Australian Academy of Technological Sciences and Engineering, Xradia Inc, the Australian Society for Biochemistry and Molecular

Biology, the Australian Synchrotron, the Australian Society for Biophysics, Dectris, Coherent Scientific, and the Cooperative Research Centre for Biomedical Imaging Development.

- **Electron Microscope Unit Commemorative Symposium**, 3 - 5 December 2008, University of Sydney. FABLS co sponsored this workshop with NSW Office for Science and Medical Research, Australian Research Network for Advanced Materials, Australian Research Council Nanotechnology Network, and the ARC Centre of Excellence for Design in Light Metals.

➤ **Organisation of nine (9) industrial seminars** (See Appendix 16)

The seminar invitations were disseminated to our mailing list of 700, which includes FABLS members and representatives of companies interested in fluorescence technology, as well as those mailing lists of associated network organisations e.g. SIA, FIG etc.

“Luminescent Energy Transfer Immunoassays for the Rapid and Sensitive Detection of Analyte in Complex Matrices”, (19 February 08), Dr Peter Banks, Technology Leader, Biochemistry, PerkinElmer Life and Analytical Sciences, Waltham, Massachusetts, spoke to a predominantly academic audience of 27 at Macquarie University and presented at the FABLS 2008 Workshop (21 February 08) attended by 89 people at Queensland University. Dr Bank’s responsibilities are technology assessment and business development in the Molecular Medicine business element, with a focus primarily on biochemistry applications. Dr Banks spoke about developments in PerkinElmer over the last decade based on luminescence energy transfer that is not limited by Förster radii. The technology, termed Luminescent Oxygen Channelling Immunoassay (LOCI) in the scientific literature, is bead based where donor beads transfer energy to acceptor beads through singlet oxygen generated by irradiating donor beads with red light. The singlet oxygen generates a cascade of energy transfer within the acceptor bead that results in light emission of higher energy than excitation.

“Time Resolved Confocal Fluorescence Microscopy: Novel Technical Features And Applications For FLIM & FCS” (19 February 08), presented by Dr Volker Buschmann, Microscopy Division, PicoQuant GmbH, at The University of Melbourne. Today, time resolved measurements allow us to follow fluorescence dynamics starting in sub-nanosecond range up to fluctuations in the second range and beyond. Microscopy based on this unrestricted photon data acquisition approach enables one to easily study dependencies between the various fluorescence parameters. Furthermore, the significance and accuracy in common FCS (Fluorescence Correlation Spectroscopy) and FRET (fluorescence resonance energy transfer) analysis schemes can be improved applying sorting and weighting of the detected photons on the basis of the photon arrival time. Dr Buschmann demonstrated the power of this approach for different techniques. On the one hand, this data format can be easily integrated into a confocal microscope and be utilised for fluorescence lifetime imaging microscopy (FLIM). In measurements with single molecule sensitivity, the nanosecond lifetime information allows easily to remove scattered light and common detector artefacts in standard FCS experiments. Moreover, Fluorescence Lifetime Correlation Spectroscopy (FLCS) offers the possibility to separate FCS curves for species which

differ only in their fluorescence lifetime but, for example, cannot be distinguished spectrally. Another example for using nanosecond timing information is pulsed interleaved excitation (PIE) to identify single diffusing FRET pairs.

“Photons have a bright future” (1 December 2008), Prof. Dan Axelrod, Physics Department, University of Michigan at Monash University Clayton Campus hosted by FABLS and Monash Micro Imaging. The seminar presented Professor Dan Axelrod work in the field of Experimental Biophysics, with a research focus on the development of novel optical microscopy techniques useful in cell biology. His group develops novel optical microscopy techniques to study the motion and organisation of biological molecules and cellular organelles near biological surfaces. One project examines the mechanisms of stimulated secretion of adrenaline-containing vesicles from chromaffin cells as studied mainly by time lapse total internal reflection (TIR) fluorescence quantitative imaging & analysis. Dynamic Light Scattering (DLS) is a standard technique for measuring the diffusive rates of biological molecules. They are developing a new spatially-resolved imaging approach to DLS such that it can be used in a microscope to view the rates of molecular motions in living cells. Other optical biophysics techniques under development include detection of single biomolecules based on surface plasmon radiation, and fast new methods for detecting fluorescence resonance energy transfer in living cells among molecular neighbours that associate with each other only transiently.

“Solutions to perform ultra sensitive homogeneous detection of intracellular and blood-borne markers” (29 August 08), Dr Roger Bossé, Technology and Business Development Manager, Bio-discovery, PerkinElmer LAS Inc. spoke to an audience of 15 at Macquarie University. Dr Bossé spoke about the role of high-throughput screening (HTS) assay technologies to screen recurrently the many millions of compounds across multiple therapeutic targets to find new drug candidates. HTS assay technologies must be sensitive, robust, reproducible, automatable and miniaturisable while staying cost effectual. Examples involving PerkinElmer assay technologies developed to measure the activity of G-protein coupled receptors (e.g. LANCE cAMP, Ca²⁺ sensitive Photoproteins) and kinases (e.g. AlphaScreen, SureFire) in a cellular context will be presented as well as customer cases studies showing the benefits of using AlphaLISA, an evolved version of AlphaScreen based on Europium emission, to perform ultrasensitive detection of biomarkers in complex assay medium including tissue homogenates and serum.

“Novel Upconverting Phosphors” (2 December 08), Professor Hans Tanke, Head of Department of Molecular Cell Biology, Leiden University Medical Centre, presented this seminar to an audience of 35 at Macquarie University. Prof Tanke who is a pioneer in the area of imaging, microscopy and fluorescence spoke about (1) novel upconverting phosphors, (2) application to FISH, point-of-care, (3) fluorescence multiplexing techniques, and (4) detection of bioterrorism agents. The development of sophisticated particle-based bioassays with reporter molecules engineered for specific applications has had a major impact on the development of diagnostic devices. Particle-based bioassays now offer: (i) high sensitivity; (ii) possibilities for quantitation; and (iii) simultaneous detection of multiple analytes. Up-converting phosphor technology (UPT), utilising rare earth doped ceramic particles, represents a new generation of highly sensitive particle-based bioassays. Unlike conventional fluorescent

reporters, up-converting phosphors transfer low energy IR radiation to high-energy visible light by multi-photon absorption and subsequent emission of dopant-dependant phosphorescence. They are currently developing a novel, oral-based microfluidic system, designed for use in the diagnosis of multiple infectious diseases. Key to this project is the adaptation of our flexible core technology (UPT) to allow simultaneous analysis of viral and/or bacterial antigens and nucleic acids, as well as antibodies to these pathogens. The platform will be applicable for the detection of infectious agents including those associated with bioterrorism.

“Optimised laser sources for linear and nonlinear microscopy applications”

(27 February, 2009) Dr. Gail McConnell, Centre for Biophotonics, University of Strathclyde, UK presented her seminar to an audience of 24 at Macquarie University. A great time was had by all when Gail McConnell and Elric Esposito from the Institute of Biophotonics, University of Strathclyde visited us from 24th Feb until 4th March. Much of their time was spent in the lab building a synchronously-pumped external resonator Raman laser with Eduardo, a very colourful affair as you can see from the photo on the following page.

The Institute of Biophotonics has a strong emphasis on developing laser sources



which can enable new biophotonic processes, and/or make such processes work more effectively, and this visit, partly funded by FABLS, enabled us to identify areas for potential collaboration where the wavelength versatility of Raman lasers and potentially UV Cerium lasers can add value to biophotonic processes such as Flash Photolysis, Combinatorial Chemistry, and 2-Photon Microscopy.

A follow up visit later in the year (part funded by FABLS) by Eduardo and Helen will establish a picosecond Raman system at the University of Strathclyde which can be used in experiments there. Dr. McConnell presented an overview of current photonics research at the Centre for Biophotonics, University of Strathclyde (Glasgow, UK). Their research is largely aimed towards improving sources for various imaging applications including confocal and multi-photon microscopy, photolysis and coherent anti-Stokes Raman scattering imaging. Hence, a synopsis of the improvements in imaging that can be achieved by employing nonlinear optical methods such as pre-dispersion compensation and white-light supercontinuum generation will be presented, in conjunction with incumbent biophysical applications.

“Modern Approaches to Time-Resolved Single Molecule Microscopy” (3 March 09), Dr. Benedikt Kraemer, Senior Scientist Microscopy, PicoQuant GmbH, Berlin, at the University of Sydney. The seminar was hosted by Olympus Australia Pty Ltd, the Australian Microscopy & Microanalysis Research Facility (AMMRF) and FABLS. There was an audience of 38. Ultrasensitive fluorescence detection and spectroscopy is important in many fields of fundamental research as well as chemo- and bio-analytical applications. In recent years, technical improvements in photo-

detector sensitivity, microscope objective optics, and laser light sources have advanced the capabilities for the detection of single molecule detection. The technique allows the visualisation of variations from molecule to molecule which would be hidden performing ensemble measurements. Time-resolved measurements permit to follow fluorescence dynamics of single molecules starting in the sub-nanosecond range up to fluctuations in the second range and beyond. By exploiting the full information content of such a multi-dimensional measurement, classical intensity based analysis schemes like FCS and FRET in confocal microscopy can be significantly improved by sorting and weighting the detected photons. Dr Kraemer presented actual instrumentation and discussed recent applications in (1) Fluorescence Lifetime Cross Correlation Spectroscopy (FLCCS) – a superior tool to detect binding of two molecules, each marked with a fluorophore, in liquid environment, (2) Two-Focus FCS (2fFCS) – Small structural changes of molecules like proteins can be investigated in their natural environment by the determination of the diffusion coefficient, and (3) Lifetime Förster Resonance Energy Transfer (Lifetime FRET) – FRET allows the study of distances of molecules tagged with two fluorescent labels in the nanometer range.

This seminar was also presented at Monash University, Clayton Campus on 4 March 09, and Howard Florey Institute, University of Melbourne on 5 March 09 and co-sponsored by FABLS and The Fluorescence Imaging Group

➤ **Participation in BIO 2008, San Diego, California, June 2008**

FABLS was represented at BIO 2008 in June 2007. BIO is the leading biotechnology conference which is renowned for the industry partnering sessions. In excess of 21,000 delegates from around the world attended and over 2,000 companies exhibited. The FABLS team of Richard Mollard, Rob Learmonth, David Tayler and Ewa Goldys joined the Ausbiotech/Australian delegation in the Australian Pavilion as an exhibitor seeking research partnering and commercialisation opportunities. There were many visitors and it was a great base from which to go out and visit the many thousands of other exhibitors from around the world.

The aims for participation were to:

- Commence discussions with research institutes and companies present at BIO;
- Initiate contacts with appropriate people for follow-up in the near future;
- Identify further opportunities for collaborative R&D and funding for FABLS members;
- Promote FABLS members and collaborative opportunities to companies worldwide.

The areas of expertise promoted at the conference fell into the categories of flow cytometry applications, updated flow cytometry, antibodies development, biosensors, fluorescent proteins, and imaging and software and how through the network multidisciplinary, cross institutional research teams are being brought together for:

- **Real time multiplex detection of pathogens** involving developing approaches for rapid detection of a range of harmful microorganisms to assist with medical diagnosis, bio-security and food contamination.

- **Purification of cell populations** by developing approaches for efficient purification of important cell populations such as adult stem cells with potential use in tissue engineering, cell and gene therapies.
- **Cellular Biosensors** involving the development of novel cellular assays based on the use of genetically encoded fluorescent probes.

Ewa and David took part in the business partnering program and were able to describe the technologies and skills of the people in FABLS in direct conversations with key people in 16 organisations such as Millipore, Sanofi Aventis, Amgen and Invetech and were able to further develop contacts with Pfizer, Merck Sharp and Dohme, and Invitrogen. The US venue facilitated higher quality contacts with several Australian offices.



Overall, the FABLS team talked with more than 90 representatives from international companies. A detailed report with contact details is available to those looking for more information. Since the conference and in cases of mutual interest there have been follow-ups. FABLS needs to be a patient 'investor' when developing relations with company people, and our presence at BIO has shown that as a research/corporate network we have a serious attitude towards developing good alliances. Many of these companies have been described above.

One of our Founding members, Prof. Alan Trounson (profiled below) received a special mention by Californian Governor, Arnold Schwarzenegger in his keynote address.

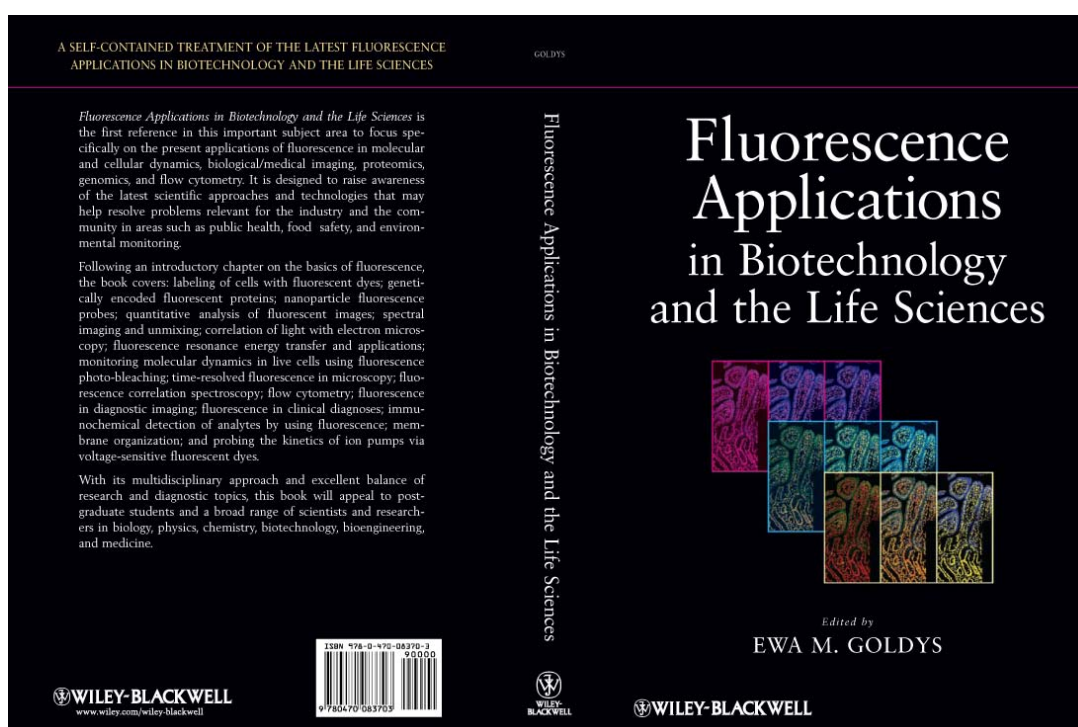
3.5 FABLS support of education and training

3.5.1 FABLS book

The FABLS community has now written an advanced textbook that looks at fundamental concepts in fluorescence applications in biotechnology and life sciences, and under the same title. It comprises 17 chapters prepared by 35 FABLS Members. The book will be published by Wiley in late 2008. It is designed to assist in the cross-disciplinary dialogue both at postgraduate and specialist level, between biology, biochemistry and physics, in

the multi-disciplinary area of fluorescence. It will be aimed at a postgraduate level, suitable also for students from outside of these fields of research.

This book will appeal to those who need an induction to the field or a brief package of information with all the basics but also extending towards the latest in science and technology. Such mode of learning is much better suited to modern postgraduate students and professionals who rarely have time for properly sequenced and structured learning. As the use of fluorescence techniques in biotechnology and life sciences has advanced rapidly, the book gives a sense of reaching the cutting edge of research. Importantly with its authors spanning a range of disciplines it presents the subject matter from these varying perspectives and gives a thorough coverage of applications. In addition to postgraduate training we hope that the book will also support multi-disciplinary research into applications of fluorescence which require a high degree of interaction of expertise in biology, physics, chemistry, bioengineering and medicine.



The book begins with an introductory level explanation of fluorescence where we revisit the key fundamental concepts and explain the terms. Fluorescence labelling forms an integral part of modern fluorescence technologies. This book covers labelling with fluorescent dyes and genetically encoded fluorescent probes that have revolutionised the life sciences as well as the important emerging fluorescent nanoparticles. Fluorescence labelling coupled with digital imaging leads to new opportunities such as scanning cytometry and spectral imaging as well as challenges of "spectral unmixing" where similar fluorophores are separated by specialised software packages. These are covered in subsequent chapters. Finally we address the fundamental challenge of the correlation of laser scanning microscopy with electron microscopy. We further develop the theme of advanced fluorescence techniques. Among these the spectroscopic and microscopic techniques of Fluorescence Resonant Energy Transfer (FRET) and Fluorescence Recovery After Photobleaching (FRAP) and other photobleaching methods feature prominently.

The following chapters focus on various fluorescence technologies, such as time-resolved techniques in fluorescence microscopy, fluorescence correlation spectroscopy (FCS), and flow cytometry, all illustrated with specific applications. In the final part we discuss the applications of fluorescence in broadly understood fields of diagnostic imaging, genetics and clinical biochemistry, as well as for immunochemical detection of analytes. The book concludes with more specific applications in the context of specialised topics such as fluorescence analysis of membranes and probing the kinetics of electrogenic ion pumps via voltage-sensitive fluorescent dyes.

This book is unique in bringing together key teams with world-class expertise in biological and biomedical sciences, chemistry, physics and optoelectronics. Worldwide book sales are expected to be more than 5,000. We believe that this book will become a lasting legacy of the FABLS Network, which would have been difficult to create without the framework of the Network organisation.

3.5.2 FABLS - supported workshops

In 2008, FABLS supported the following education and training initiatives (please see Appendix 14 for detailed Workshop Reports):

	Workshop Name	Workshop Convenor	When / Where	# of Attendees
1	Pasteur & WEHI Workshop "Imaging infectious diseases at the molecular, cellular and tissue level"	Dr. Emanuela Handman	31 Jan-1 Feb 2008; WEHI, Melbourne	120
2	1st Advanced Fluorescence Bio-Imaging Workshop	Dr. Anya Salih	8-12 Sept 2008; UWS, Hawkesbury	300
3	CXS 2008 Workshop - Facilitating X-ray Biophotonics... Physicists and Biologists Working Together	Dr. Leann Tilley	17-19 Sept 2008; BIO 21 Institute, Melbourne	146
4	Live Cell Imaging Workshop	Dr. Ian Harper	1-4 Dec 2008; MMI Centre, Monash Univ.	24
5	Australian Key Centre for Microscopy and Microanalysis Jubilee Commemorative Symposium	Dr. Lilian Soon	3-5 Dec 2008; EMU, University of Sydney	100

3.5.3 Support of other teaching/training initiatives

FIG group: The fluorescence community in Melbourne has established the Fluorescence Imaging Group (FIG) in 2000. FIG is a not-for-profit organisation that was formed for the support and development of fluorescence imaging techniques including (but not limited to) Confocal and Multiphoton microscopy. The Group convenes a variety of meetings that cover issues of relevance to novices as well as experienced microscopists. The objective of the Group is to advance and disseminate knowledge and information concerning the art and science of fluorescence imaging and allied sciences. To accomplish the objective, the Group conducts seminars, workshops, conferences, symposia or other

meetings on scientific and technical subjects. The President of the FIG group is currently Stephen Cody, with Andrew Clayton, Sarah Ellis and Nick Klonis are also strongly involved with the management. The FIG group is extremely successful and their seminars typically gather a minimum of 50 attendees.

In 2008 FABLS continued to explore ways in which FIG could be more actively supported, and as such we co-organised a number of seminars.

There were also the 9 FABLS industrial seminars and other training initiatives both coordinated and more *ad hoc* (with opportunities provided to individual students and researchers), organised by FABLS members.

4. Contributions to the Research Network of particular significance during 2008

The highlights for FABLS in 2008 were:

- Exposure of the network and the combined expertise within to about 150 companies, identifying many companies interested in collaborative research and commercialisations, and several companies, already mentioned in this report, have already invested cash into specific research projects;
- FABLS Team attends BIO 2008, presents FABLS capabilities at the FABLS Booth in the Australian Pavilion and participates in a large number of partnering meetings described in Section 3.4.1.
- Development of a CRC bid in pathogen detection described in Section 3.4.3;
- Strengthening of alliances with government organisations, professional associations, industry bodies and other networks.
- The commitment given by FABLS Committee members throughout 2008 was once again, wonderful. From attendance and contributions at the 4 meetings by the Executive Management Committee, to the outstanding work done by the Resource Management Committee, chaired by Dr. Mark Prescott, on project funding allocations, FABLS was honoured to have such dedicated and capable members contributing to its ongoing success. We would like to officially thank all our Committee members for their support and efforts over the past 4 years.

5. Register of Participants

The Network currently comprises 512 members. Please see Appendix 9 for the full Member's Registry as at 12 March 2009.

6. Contribution to the National Benefit

The FABLS Network creates a forum for the researchers from the physical and engineering sciences to interact with researchers in biomedical and life sciences. Nurturing the development of inter-disciplinary fields helps enhance innovation and generate ground-breaking research outcomes. With that in mind the FABLS programs are set up to realise benefits from inter-disciplinary research. For example the Network coordination supports research programs into new diagnostic technologies and their significant innovative applications. Technologies are being developed to enhance disease detection (such as cancer and malaria), to enhance techniques for

detecting disease causing pathogens, enhancement and potential commercialisation of advances in flow cytometry, bioprospecting for new fluorophores and antibodies. Appendix 8 lists some examples of this work. Although the research findings are usually disseminated within the academia the network highlights these to outside organisations through its website and newsletters.

Alan Trounson, FABLS Member

Alan Trounson, Ph.D., is President of the California Institute for Regenerative Medicine in San Francisco, California. The California Institute for Regenerative Medicine ("The Institute" or "CIRM") was established in early 2005 following the passage of Proposition 71, the California Stem Cell Research and Cures Initiative, which provided \$3 billion in funding for stem cell research at California universities and research institutions. This new state agency has the authority to make grants and provide loans for stem cell research, research facilities and other vital research opportunities.

The mission of CIRM is to support and advance stem cell research and regenerative medicine under the highest ethical and medical standards for the discovery and development of cures, therapies, diagnostics and research technologies to relieve human suffering from chronic disease and injury. To date, the CIRM governing board has approved 279 grants totaling more than \$693 million, making CIRM the largest source of funding for embryonic and pluripotent stem cell research in the world.

Prior to joining CIRM in January 2008, Trounson was Professor of Stem Cell Sciences and Director of the Monash Immunology and Stem Cell Laboratories at Monash University, where he retains the title of Emeritus Professor. He also founded the National Biotechnology Centre of Excellence – 'Australian Stem Cell Centre'.

Trounson held various positions at Monash University beginning in 1977 and was appointed Director of the Centre for Early Human Development in 1985. He was awarded a Personal Chair in Obstetrics and Gynaecology / Paediatrics in 1991 and in 2003 was awarded a Personal Chair as Professor of Stem Cell Sciences. A Fellow of the Royal College of Obstetricians and Gynaecologists and an Honorary Fellow of the Australian and New Zealand College of Obstetricians and Gynaecologists, Trounson was awarded an honorary doctorate by the faculty of medicine at the University of Brussels.

He is a pioneer of human in vitro fertilisation (IVF) and associated reproductive technologies; the diagnosis of inherited genetic disease in pre-implantation embryos; the discovery and production of human embryonic stem cells and of their ability to be directed into neurones, prostate and respiratory tissue.

Science and technologies whose development has been supported by FABLS have a history of success in solving clinical and research problems in diverse applications through such products and techniques as spectroscopy, lasers, microscopy, imaging and fibre optics. Applications of these technologies within Australia will have beneficial effects for the well-being of all Australians. Examples of technologies include cellular biosensors designed to report on the action of specific drugs of utility in high throughput drug screening. This and other similar technologies have already attracted significant interest in the industry described in more detail in section 3.4.3. To capitalise on this the Network makes a significant effort to raise industry awareness of its Members' research. In the long term this will enhance commercial opportunities in biotechnology, drug discovery and medical diagnostics, as well as in fields such as agriculture and food industries.

In 2008 our leading initiative in this area the preparation of the CRC bid in Rapid Pathogen Detection. The CRC is typically a \$100 million organisation with economic outcomes at a level of \$1Billion of Net Added Value. An example of a fluorescence-based project being developed by Network members with industry users and

commercialising companies is the rapid detection of a disease causing bacteria in fruit trees, which is economically significant worldwide. The IP associated with a successful diagnostic will have commercial application.

The FABLS Network manages the access program for cooperative use of infrastructure and makes an effort to improve its efficiency of use. Support of LIEF applications for major infrastructure such as the STED microscope secured in 2008 is one example of such coordination. In addition, the program facilitates access for industrial organisations to research infrastructure. The success of the network in this respect can be seen from the 350 new partnerships (Appendix 4) formed over the last three years, in most such partnership the infrastructure sharing is improved. As the majority of the equipment manufacturers are international companies, increased utilisation of expensive infrastructure has a direct effect on the need for imports.

The interactions with international research groups and with international commercial organisations were visibly enhanced in 2008. In many respects FABLS and its Business Development Manager acted as a major link to funded international collaborations within the academia and with the industry. It is important that Australian research keeps pace with the development overseas, and that young researchers and students are exposed to world-class standard interdisciplinary way of thinking.

The FABLS laboratory exchange program raises the international competitiveness and global impact of research produced within this Network. Moreover, FABLS organises and promotes broad interest talks and seminars, as well as focussed training workshops. All these enrich the Australian environment for multi-disciplinary postgraduate and postdoctoral education and professional development, in line with the needs of research institutions and industry. All elements together contribute to enhanced productivity of research, development and commercialisation of technologies of economic benefit to Australia.

STATE OF THE ART COLLABORATION

“At the Garvan Institute we aim to identify defects contributing to disease. One of the ways we are doing this is to use state-of-the-art microscopy to visualize physiological processes in live cells or tissue and how they may alter in models of disease. The use of fluorescent reagents, such as GFP, has revolutionised our ability to do this. The second revolution has been in our ability to analyse our images - FABLS has helped support collaboration between the Garvan Institute and Pascal Vallotton’s Biotech Imaging group at CSIRO.”

William Hughes, The Garvan Institute

Relationship to National Priorities

We emphasise that the aims of the FABLS Network correspond with several National Research Priorities.

Research Priority RP 3

The new knowledge, techniques and methodologies stimulated by this Network, and the application of these in food process monitoring, food and water quality monitoring, environmental monitoring, as well as assaying techniques in

biotechnology, pathology and in vivo diagnostics, are predominantly classified as Research Priority RP 3. They have a common base in Priority Goals of Breakthrough Science and strongly relate to Frontier Technologies and Advanced Materials.

The Network has identified the synthesis of new ultrasensitive, targeted fluorophores as one of their scientific objectives. These advanced materials are created through advanced biotechnology in the case of GFP variants or through nanotechnology in the case of metal and inorganic nanoparticles. Several Network Members are involved in such activities and it should be emphasised that such research ultimately results in intellectual property of high commercial value.

The development of improved fluorophores makes it possible to visualise in-vivo low abundance proteins within cells, leading to new tools for studying and understanding the dynamic processes that underpin the functioning of cells. Within this Network several strong teams led by specialists in biology, medicine and biotechnology focus on this area. The breakthrough basic science of such processes can lead to advances at the frontier of modern technology, such as testing for new disease markers or commercial exploitation of specific enzyme secretion.

Research Priority RP 4

The activities are also of relevance to RP 4 through the Priority Goals of Protecting Australia from invasive diseases and pests and Protecting Australia from terrorism and crime. The highly biospecific technique of fluorescent labelling which is advanced through this Network supports well new approaches to microbial testing. Moreover, the development of instruments and systems by physicists and bioengineers associated with the Network will lead to practical implementation of the testing methods developed by specialists in life sciences. The development of rapid and ultrasensitive detection methods of trace analytes will provide much needed analytical technologies of utility in forensic detection and as anti-terrorism measures.

Research Priority RP 1

Smaller in scale but nevertheless important is the relationship to a Priority Goal within RP 1, of Sustainable use of Australia biodiversity. This will be realised through a theme of scientific identification and use and commercial exploitation of naturally occurring fluorescent proteins from the Australian coral reef.

7. An indication of the activities and strategies for the coming year

The strategy for 2009 has been extensively discussed by the Executive Management Committee at several EMC meetings. In contrast to previous years, in this final year of the ARC/NHMRC funding we decided to consolidate the efforts for which foundations have been laid in previous years, hence the activities will no longer follow the established pattern. In particular:

- The FABLS support of members projects will continue; there will be substantial new project activity for members projects funded in the last FABLS funding round in late 2008. This last round was accelerated at increased level in order to

enable project completion within the timescale commensurate with the Network funding period. However there will be no new funding rounds.

- The Business Development efforts will continue. We will be drawing on our extensive database of contacts made during 2007 and 2008, and fostering the relationships already established. Efforts to develop the CRC will continue in the area of pathogen detection. In parallel, we will be trying to set up Linkage grants for those members whose research is synergistic with industry interests.
- Promotion of FABLS capability will also continue along the lines as previously introduced, but with stronger emphasis of external publicity. We will be proactively seeking engagement with the media so that the FABLS identity is strengthened.
- Support for teaching and training support will be available in 2009. We will also continue to discuss the book initiatives. We have been discussing the compilation of a book with fluorescence practicals and have a current offer from CRC Press to write a textbook about Biophotonics.
- Instead of an annual, internally oriented FABLS Workshop, since early 2008 we have been planning to mount a large international conference event "Light in Life Sciences" 24-27 November 2009. The conference will take place in Melbourne. The preparations are already under way and sponsorship is being actively sought. We are expecting that such regular event will become a constant feature in the life of the science community in Australia and it will provide a lasting focus for the Fluorescence community.
- FABLS is planning to set up a Foundation under the name Light in Life Sciences. The purpose of the Foundation will be the seeding of the periodic conference and any other efforts oriented towards the development and integration of the fluorescence community in Australia. Fundraising activities will be mounted for the Foundation in 2009.

8. URL of the Research Network's web site

<http://www.physics.mq.edu.au/research/fluoronet>

FEEDBACK FROM MEMBERS CONCERNING FABLS WEBSITE

"I think that the website is user-friendly. It's easy to find what you are looking for inside the website. Moreover, all the forms to be filled when presenting a project are simple and clear."

Riccardo Cicchi, (ECR) University of Florence, Italy

"We would like to emphasize the informational richness and user-friendly interface of FABLS website. Also want to thank for the interesting material in the newsletters."

Anna Guller, (ECR) Sechenov Moscow Medical Academy

"FABLS website is easy to use, friendly and gives large amount of information for members and non-members researchers."

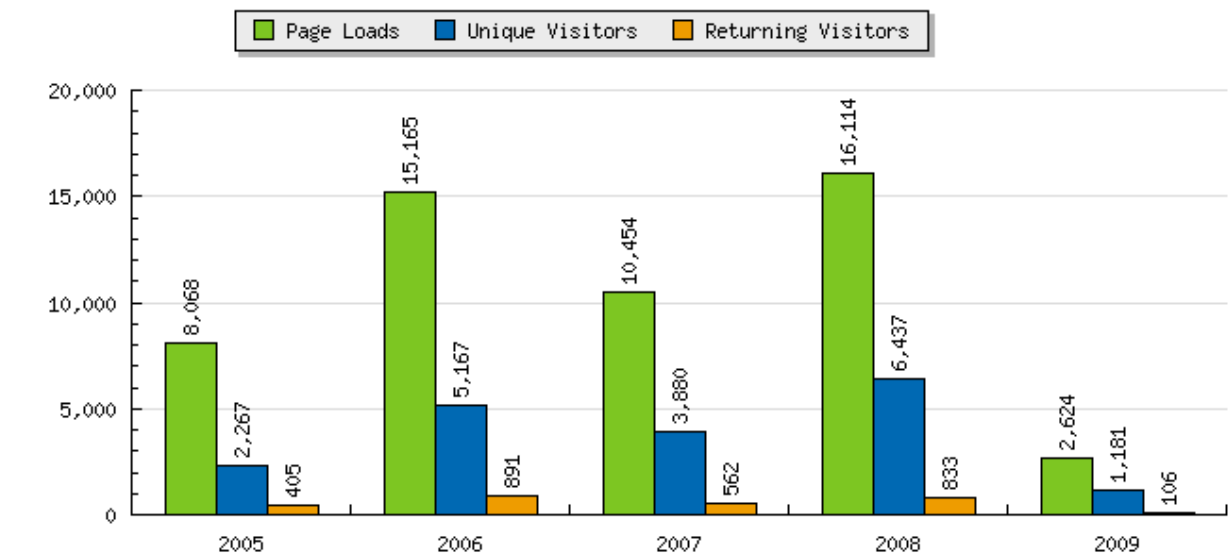
Maria Tricerri, INIBIOLP, Instituto de Investigaciones Bioquimicas

The improved FABLES website, updated in 2007 for ease of navigation and information access, has been increasingly popular with members and non-members alike. Increased relevance and dynamism was achieved by more significant inclusion of contributions from Members, including their personal research or product news, and a changeable display of items on the home page. Most of the earlier content was kept and reorganised for ease of access.

The number of people accessing FABLES website has grown each year. The above diagram shows that in 2008, 6,437 unique visitors accessed the website, with approximately 16,110 page loads for the website – the highest hit rate yet. NB. Figures given for 2007 are missing data for a number of months. This information and more, including more specific visitor information and keywords used to find the website, can be found at:

my.statcounter.com/project/standard/stats.php?project_id=576039&guest=1

2005 - 2009 (March) Yearly Web page visitors



The Website is updated regularly as new members join the Network and are added to the membership list. The latest news, conferences, workshops and events are publicised using the 'News & Events' section on the Home page as well as in the relevant section of the site.

Many of our visitors are brought to the website either by searching (in Google or Yahoo) for a particular researcher or on a topic or technology that is covered by our expert members and discussed either on the website or in the Member documents, such as their Project Profiles or Capability statements.

The internationalisation of the Network, and the increasing relevance and usefulness of the website has led to many of the users of the website coming from overseas destinations. Section 12.3 highlights that 32% of the past 500 users of the website came from international origins.

Snapshot of FABLS Website Visitors - World Map



The FABLS funding documents are easily available via the home page and within the Members forum. As in past years, our collection of publications is increasing, including audio and PowerPoint presentations of various presentations sponsored by FABLS (with permissions). Members can also access past Annual Reports to the ARC/NHMRC, as well as minutes from Committee meetings.

Past issues of the newsletter are also accessible from the website and we include step by step instructions on how to access less traditional sources of funding. We also maintain the Visitors Information Exchange where Members can submit the details of their visiting academics or company representatives so that they can be shared around the community.

Screen shot of FABLS Home page

A screenshot of the FABLS website home page. The header features the text "ARC/NHMRC NETWORK" and "FLUORESCENCE APPLICATIONS in Biotechnology and Life Sciences". A navigation menu includes "About FABLS", "Related Resources", "Expertise", "Facilities", "Funded Projects", "Publications", and "Membership". The main content area has a featured article titled "Biophotonics in Australia" with a sub-headline "Showcase and Strategic Planning" and a note "In conjunction with FABLS Workshop 2006". To the right is a "NEWS & EVENTS" section with three entries: "FABLS Funding Round 1, 2008 - Applications now open...", "FABLS Priorities and Challenges 2008...", and "36th Course: Multi-dimensional Optical...". Below the main content are four boxes: "Member's Resources" (with links for funding forms, visitor info, and discussion forum), "Current Members" (with links for researchers, companies, and benefits), "Research Projects", and "Funded Projects". At the bottom, there are links for "Education & Training" and "Facilities". The footer contains a navigation bar and the text "Copyright FABLS 2003".

9. Expenditure of ARC / NHMRC Funding

Financial Statement

ARC / NHMRC Research Network name:

FLUORESCENCE APPLICATIONS IN BIOTECHNOLOGY AND LIFE SCIENCES

Administering Organisation:

MACQUARIE UNIVERSITY

Sources of Funding:

	Cash	In-kind
• ARC / NHMRC Research Network Funding	433,078	
• Macquarie University	100,000	354,007
• Other	0	468,000
TOTAL:	\$ 533,078	\$ 822,007

Expenditure ARC / NHMRC Research Network Funding and Contributing Organisation cash and in-kind contributions:

(Please report on the expenditure on the budget items as stated in the Approved Proposal (or any revised budget approved by the ARC) for the Research Network. Where applicable, provide details of items of expenditure as indicated below, e.g. salary components should be listed by individual, the cost of each workshop, individual working group, or other meetings should be given, as well as any research project funds expended).

Description	2007 ARC / NHMRC Research Network Funding	Contributing Organisation contributions	
		Cash	In-kind
❖ Personnel Salaries and on-costs: Network Convenor Business Development Mgr Administrator & other staff All institutions in-kind	1,587 69,869 68,269	50,000	
Sub-total	139,725	50,000	816,007
❖ Shared Research Resources: Infrastructure Access Grants	101,090		
❖ Bringing People Together: Annual Workshop Network Management Meetings Lab Exchange Grants Project Meeting Grants	19,518 22,973 165,271 42,310	50,000	
Sub-total	250,072	50,000	0

❖ Purchase of specific Assets or Intellectual Property	0	0	6,000
❖ Other expenditure: Industrial seminars & Professional training	34,732		
Sub- total	34,732		
TOTAL EXPENDITURE	\$ 525,619	\$100,000	\$822,007
Surplus/ (Deficit)	\$ (92,541)		
Add 2007 Carryover	\$ 205,278		
2008 Carryover amount:	\$ 112,737		

Provide the reason for carryover in the column below:

It is essential that reasons be provided by carryover requests

- 1) Late appointment of Business Development Manager, Mr D. Tayler has left salary residual – use for extension of Network life beyond July 2009;
- 2) Late invoicing by institutions for allocated Members' projects (\$16,285) and other activities (\$12,203);
- 3) Outstanding reimbursements for Committee meetings (~\$3000);
- 4) 2008 Inflationary top up was mostly kept to allow for continued Network existence to end 2009 (~\$33,000).

It is the responsibility of the Research Network to ensure that the carryover amount requested in this document has been discussed with the Administering Organisation's Research Office and that it is consistent with the carryover amount, which is forwarded electronically, and in hard copy, to the ARC / NHMRC in a separate End of Year Report.

Research Network Convenor or Delegate:

Signature: _____

Date: _____

10. Expenditure of Partner's funding

The FABLS Approved Proposal states that the partner's contributions remain at Partner's institutions and that they are used in support of Members' project from that institution. These contributing institutions include: University of Sydney, University of Queensland, and the University of Melbourne.

To activate this funding FABLS informs the Deputy Vice Chancellors Research and/or Research Offices each time the relevant Members receive the FABLS funding. They are advised to establish an internal account from which the Members should be able to draw up to the amount indicated in the FABLS Approved Proposal. The letter also indicates that all the Members at this Institution are entitled to access the funding and that they should decide themselves on the way of dividing the funds.

11. Details of in-kind contributions provided to the Networks

The institutions who were part of the original proposal listed in Section B2 have indicated their in-kind support is at a level of \$10,000, which reflects the time commitment spent by these Members on activities supported by FABLS. This includes development of FABLS projects, participation in workshops or workshop organisation, contributing book chapters, as well as participation in FABLS management. Lastek Pty Ltd indicated \$20,000 p.a. and University of Southern Queensland \$20,000, related to major contributions to the FABLS Committees. The University of Melbourne and the University of Sydney indicated a more substantial in-kind of \$62,000 and \$50,000 related to a large number of Members from these institutions and their significant contributions to the FABLS committee work and other FABLS events. The In-kind from Macquarie University of \$ 325,235 is linked to the salary on-costs and infrastructure support for the FABLS management and cost of hosting the organisation.

12. Other information

12.1 Added value - *How the Research Network tackles issues in a manner that may not otherwise been achievable without the mechanism of a Research network*

We are aware of several aspects of this Network that add value to research in ways not possible otherwise, for example through the Linkage International Scheme. These include: funding coupled with long-term mentorship, enrichment of the research environment and business development management, all of which are expanded below. We wish to recognise and acknowledge a significant voluntary management effort on the part of FABLS Members that largely contributes to this value adding.

Other issues which would have been difficult to organise without the FABLS Network are:

- the proposed publication of a fluorescence textbook for the international market;
- the assembly of a compendium of research skill and experience, focused on fluorescence, which can be used to promote the science to industry and government;
- the employment of dedicated staff to foster networking activities;
- a platform to raise the international profile of Australian research;
- a structure to ease ECR access to senior researchers.

Funding coupled with long term mentorship

The FABLS Network is particularly proud of their Project Funding scheme which continues to be well received by the Members. It is supporting individual Member's links and helps them to better develop their individual research objectives and with increased impact. With its management structure close to the Membership, FABLS Network has the ability to see where the real needs of researchers are more effectively than larger funding agencies.

Many Members, especially ECRs, have been able to take their research performance to the next level with this very modest support

Enrichment of research environment

It should be stressed that the Network sponsorship makes it possible to fund initiatives which are not possible otherwise. Teaching and training workshops normally incur fees, but formal avenues for funding support for PhD students are infrequent. At the same time, their training needs are not always met at their own institutions and they show a great desire to take advantage of all available opportunities. It is therefore important that FABLS is able to support such students in various ways. We have, for example offered bursaries offsetting the workshop fees and charges or, alternatively, supported their accommodation costs whilst at a FABLS-sponsored workshop. We have also invited leading international experts to speak at such workshops, thus leveraging the impact of each individual visits. Such flexibility in applying the (small scale) funding, provides the enrichment of the research environment in ways impossible within other ARC schemes.

Business Development Management

The Business Development Management undertaken by FABLS is our response to the limitations individual academics and their Universities are facing when developing industrial partnerships. Individual academics rarely present the exact set of skills that companies require in the case of problems that require external assistance. Therefore, individuals are usually seen as too specialised or not exactly situated in the correct area to offer research partnerships of value to large commercial organisations and thus may be seen as a waste of time.

The Universities have their own commercial arms and structures to handle interactions, but the research proposition is organised vertically across a very wide range of areas, and finding specific help is again difficult. However FABLS represents both a large research cross-section and is also organised vertically around fluorescence (but spread geographically). This gives various companies a much broader and therefore more useful partner to work with, than the individuals or universities. Over the last year FABLS expended a lot of effort to represent the Australian fluorescence community, in discussions with major multinational companies. Therefore, the definition of a broad but well articulated research profile is one of the important strengths of this Network and it greatly contributes to value adding.

FABLS presents this research profile by collecting one page research project descriptions for Members and their descriptions of capabilities available for consulting and contract research, and has also developed multiple documents summarising the Members capabilities in specific areas.

Source of value adding

The cases presented illustrate how FABLS adds value and leverage to the funding. It is perhaps interesting to realize that some of this added value is created because of a very significant unpaid contribution of Members to the Network activities and especially those involved with management. For example, our voluntary Resource Management Committee is able to help members rectify their funding applications if they do not initially meet the criteria, helping them to restructure and improve so that FABLS can fund all submissions. Such processes are impossible in larger funding agencies.

Moreover, thanks to volunteers, FABLS has the resources to follow up projects long term and couple funding with mentorship. This is uniquely suited to assist early career researchers in their professional development. Because of the very close proximity of the applicants to the financial decision makers in FABLS, the decisions are much better informed by individual circumstances. For example FABLS works to strengthen the Fluorescence Imaging Group, an unfunded grouping who organise very well attended scientific seminars. We took upon ourselves to assist with promotion of some of their events and sponsoring of speakers as they did not have the resources to expand activities. This was possible only because FABLS personally engages with the Australian fluorescence community.

12.2 Increase of scale/focus of research - *How FABLS has increased on is planning to increase the scale and focus of research activities.*

New research collaborations are promoted by the FABLS funding program and these have already been described in Sections 1.2.3 and Appendix 4. FABLS has also established the new Strategic Initiatives Committee (SIC). The purpose of the SIC is to discuss ways in which the FABLS community, or its parts, can form groupings to advance large scale projects and access large scale funding. The SIC explores how to create new funding opportunities with the industry, government and overseas agencies in addition to working with existing programs such as CoE and CRC. The SIC also proposes and supports activities towards better convergence or complementarities of research programs, if such are seen as helpful in achieving large scale funding.

In order to achieve these and other aims FABLS has carefully considered the process for engagement of Members with the organisation and we foster Members' engagement in a variety of ways. These include:

- Mailing list: FABLS maintains a mailing list of all Members for ease of communication. Both broadcast and personal messages are being sent to the Members, mostly from the Convenor;
- Members are invited to participate in the annual workshop. The attendance is free and the date carefully chosen to maximize participation. The Workshop is run in conjunction with selected scientific conferences and the annual general meeting (up to 2 hours) is coupled with scientific talks of interest to the community;
- Members are invited to take part in FABLS Management, by contributing to the FABLS' Committees;

- Within the Business Development Program Members are invited to contribute their one page project descriptions and capability statements. These are then promoted to the industry. FABLS conveys back to the Member if they have attracted interest of the potential partners;
- Members (especially industrial) are invited to contribute to the FABLS newsletter, where we include their research stories and description of products;
- FABLS broadcasts information about the funding rounds to the entire community. Assistance is available with FABLS funding applications;
- FABLS has avenues for funding special initiatives of the Members, including support of their teaching and training initiatives;
- FABLS' team has a policy of personally answering all emails. The Convenor and the Business Development Manager attempt to respond within 24 hours;
- FABLS' team carries out personal meetings especially with the industry. If the opportunity arises, they also visit the various Members;
- The Visitors Information Exchange on the FABLS website enables easy communication between each Member and the rest of the FABLS community concerning the visitors;
- The FABLS website maintains the members' only area (Forum) and a chat room.

12.3 Internationalisation of research and international linkages - *How the Network has facilitated the internationalisation of research and international linkages*

FABLS promotion and support for communication, collaborations and travel by FABLS Network members has resulted in the development and strengthening of many international relationships between researchers and their institutions, as well as with industry. Many FABLS members have given positive feedback attesting to the fact that communication and collaboration, both at a National and International level is much more efficient and effective with FABLS involvement than it would be otherwise.

The FABLS Membership base has spread out across the world after an initial international membership of approximately 10%, there has been a steady increase in international membership growth. From 5 members at foundation to 113 currently, membership from outside Australia now makes up 22% of FABLS membership. The range of countries represented has also grown, from 4 to 29 countries.

The Founding Members of FABLS were from:

Australia	UK
New Zealand	USA

Since foundation, FABLS has welcomed members from another 25 countries:

Argentina	Finland	Italy	Portugal
Belgium	France	Japan	Russia
Canada	Germany	Kuwait	Singapore
China	India	Netherlands	Spain
Cote D Ivoire	Iraq	Pakistan	Switzerland
Denmark	Ireland	Poland	Taiwan

FABLS Funded International Visits

"As a result of the funding I have had many opportunities that I would not otherwise have had to travel and meet important researchers in the field. This is very important for a young researcher in Australia, where costs associated with international networking can be prohibitive.

Seth Olsen, (ECR) University of Queensland

"The visit to UC, Davis gave insight into the synthesis of rare earth doped nanoparticles, with and without magnetic core, as the reference markers in quantitative immunoassays and hands on experience in bioconjugation protocols using these nanoparticles for biosensor applications."

Ewa Goldys, Macquarie University

"The three FABLS Project Grants to Coutts, He and Orr have facilitated their highly instructive visits to some of the world's leading coherent-Raman microscopy laboratories, including those of S. Kawata (Osaka University, Japan), S. Leone and R. Saykally (UC Berkeley, USA), G. McConnell (University of Strathclyde, UK), D. Palanker (Stanford University, USA), H. Rigneault (Institut Fresnel, Marseille, France), A. Volkmer (Universität Stuttgart, Germany), W. Wadsworth *et al.* (University of Bath, UK), X.S. Xie (Harvard University, USA), A. Zumbusch (Universität Konstanz, Germany) – with more such FABLS-supported visits planned in 2009. This exposure to leaders in the field has assisted preliminary experiments at Macquarie University."

Brian Orr, Macquarie University

"FABLS funding made possible two international visits (June 2008: the Center for Engineering in Medicine at Massachusetts General Hospital and Princeton University; and November 2008: to Chalmers University of Technology and Lund University Sweden) where, in each case I gave seminars, took lab tours and held discussions."

David Inglis (ECR), Macquarie University

"Thanks to FABLS support, I had the opportunity to have a short scientific visit (three weeks) to the Optical+Biomedical Engineering Laboratory (OBEL), University of Western Australia, under the supervision of Prof. David Sampson, who is currently heading the OBEL lab."

Riccardo Cicchi (ECR), University of Florence

FABLS plays a significant profile-raising role for the Australian fluorescence research community profile as a whole, and also for the many individual researchers within this community. There are many examples which highlight this, including those members who have presented their research at the various workshops, seminars and conferences supported by FABLS, as well as through the regular FABLS Newsletter which disseminates information about developments and outcomes for members e.g. publications, innovations, successes etc.

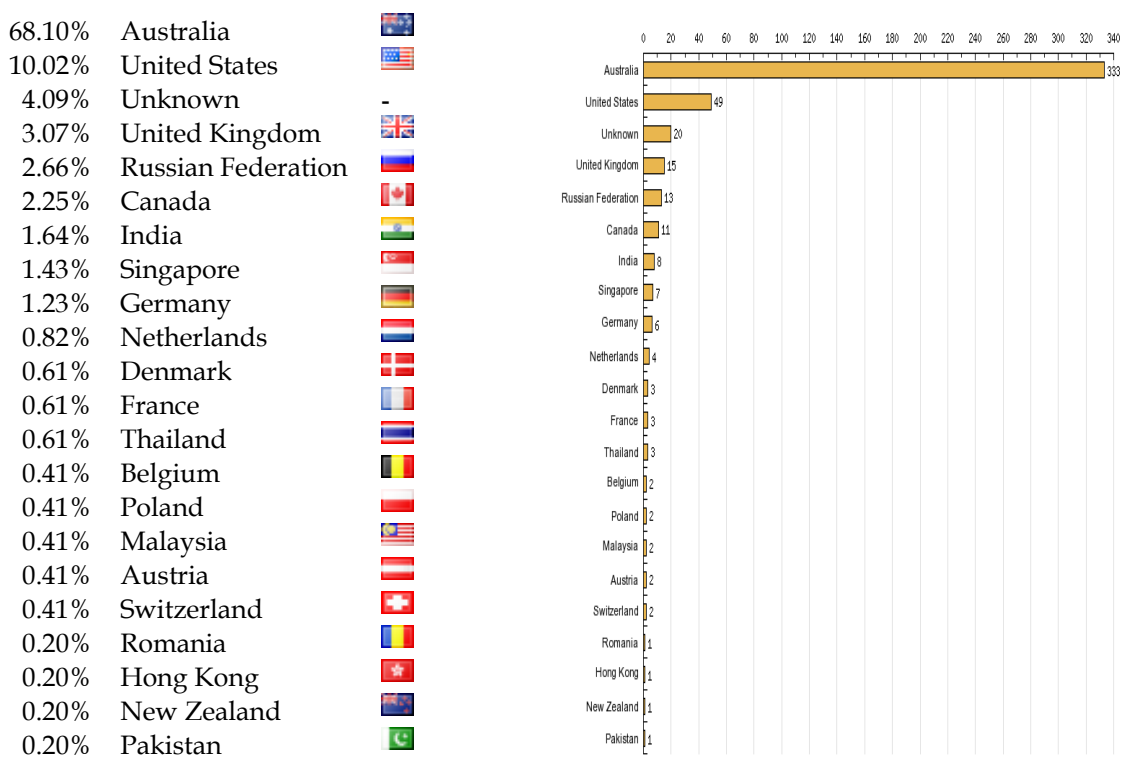
Following is a list of the origin of the past 500 visitors to the FABLS website. As we do not pay for the upgraded web statistics service, data is only held on the last 500 logged visits. This data gives a good indication however of the range of origin of visitors to our website and international interest generated.

Formal collaborations have been fostered among FABLS members at the workshops, conferences and seminars supported and promoted by the FABLS Network, as well as via our website and forum, increasing communication and information sharing amongst differing contributors in various disciplines to the Fluorescence industry. FABLS has also made a major contribution through the support of international collaborations and dialogue.

FABLS project funding has allowed members to travel internationally, visiting relevant leading edge laboratories and companies around the world, as well as facilitating many international experts to visit Australia, offering seminars and the latest information to members. Thus enabling members to gain and maintain cutting edge knowledge as well as capitalise on the many new breakthroughs and advances in technologies relevant to the fluorescence industry.

PhD students have benefited with exposure to international expertise and researchers in 2008 in a number of ways including: (1) funding travel and accommodation to overseas research laboratories to learn new techniques or use the latest technology; and (2) through the provision of student bursaries and travel support for attendance at FABLS-supported workshops, conferences and seminars.

FABLS Past 500 hits - Country of Origin Distribution



FABLS management has also been proactive in developing links with overseas agencies and corresponding Networks. We searched for the opportunities to establish formal links with similar overseas organisations. This has been challenging because, unlike FABLS, the European network organisations focus on carrying out well-defined large scale research programs which the EU Networks coordinate.

FABLS management continues to explore the opportunities to establish formal links with similar overseas organisations. This has been challenging because, unlike FABLS, the European network organisations focus on carrying out well defined large scale research programs which the EU Networks coordinate. Discussions were held with the emerging Network in Biophotonics headed by Professor Gert von Bally from Muenster), and which has some scientific connections with fluorescence. We continue

our links with The Ontario Cancer Institute and Laser Biophysics group (Brian Wilson) with NSF Center for Biophotonics (Dennis Matthews).

Along with the numerous formal collaborations that have formed with the support of FABLS funding, more connections have also been established with FABLS support, with non-FABLS members around the world, many with future collaboration-potential. A range of new connections have been made by FABLS Members (through FABLS funding) with researchers and industry experts in the following locations around the globe (more details can be found in Appendix 4 and 12):

UK (Liverpool, London, Strathclyde)	Poland	Korea
France (Paris, Strasbourg)	Belgium	New Zealand
Netherlands (Amsterdam, Leiden)	Canada	Poland
USA (Texas, Los Alamos, Illinois, New York, Indiana, Hawaii, Oregon, California, Washington, North Carolina, New Jersey, San Francisco)	Germany	Singapore
	Ireland	Switzerland
	Italy	Spain
	Israel	Taiwan
	Finland	
	Japan	

These international connections range in activity from the hosting of FABLS members' PhD students in their labs, sharing techniques and knowledge, to bringing international experts to Australia to present at FABLS supported workshops, seminars and conferences. They also include discussions held at overseas conferences or other meetings that members have indicated have potential to develop into future collaborations.

These increases in internationalisation are a positive outcome of the FABLS network's formation and activities over the past 2 years, which would not have otherwise been so readily facilitated. This clearly demonstrates the achievement of objectives in this area.

13. Conclusion

This report, together with the reports submitted in 2005, 2006, 2007 and 2008, presents conclusive evidence of the strengthening of the fluorescence community as a result of the existence of this Research Network. The fostering of links within Australia and especially with leading centres overseas has been extremely successful. Scientists, both young and established, are able to access new modes of support and many of them have substantially benefited from membership and interaction with the Network.

Over the past 4 years, FABLS has supported hundreds of researchers with financial resources, through the funding of 140 projects, Student/ECR bursaries and training courses and also with introductions and access to experience and skills from fellow members and international experts in the field. It is more than likely that much of this interaction and benefit would not have happened without the FABLS Network.

It is now timely for this Network and many others to start planning for the next steps, which are major research projects to be undertaken within the Network. Such

progression is embedded in the European Network of Excellence scheme, but not yet in its Australian counterpart. At the same time, progression to other funding mechanisms represents a major challenge, with only two large funding streams. One is the CRC scheme, which has limitations on the conduct of the more fundamental research carried out by most of our members, but nevertheless is a valuable structure to enhance fluorescence applications in biotechnology and medicine. The other funding stream, the ARC CoE scheme, is presently closed. Thus, as this and other Research Networks appear to have little place to go and at this time, no indication of a new network funding round, the achievements of the current networks, as well as the momentum gathered in a number of critical areas e.g. industry interaction and collaborations, will simply dissolve, without realising its long-term economic potential.

The Network is unique and addresses several key issues in science management. FABLS has provided members with an interaction platform through which we are able to communicate much more effectively within the research fraternity and with industry than is possible as individual academics or members of individual universities. In doing so, we have taken advantage of a critical mass in research and broad representation of competencies as well as vertical integration around our core competency in fluorescence. It clearly demonstrates new ways to garner cross-institutional and multi-disciplinary projects to solve community problems as well as generate new knowledge. A key example of this is the continued application of Photonics to healthcare and biosecurity issues.

It is repeatedly described as a national priority to create close relationships between researchers and industry and to encourage structures that bridge the gap between academics and industry. FABLS is making a major effort in this respect and the network is achieving wide acceptance with industry people. Industry collaboration is an iterative process. Industry requires time to become confident with emerging technology and possibilities. Part of this confidence is contingent upon working with facilitating networks able to relate what is happening at the research level and, for the researcher, what industry is seeking. Industry confidence is also built by knowing that the effort individuals and organisations put into developing an intermediary body focused on our broad science discipline is not a short-term project but rather will be appropriately supported and encouraged to grow and will be around for the foreseeable future.

A single point of contact for the fluorescence industry in Australia is viewed as a valuable asset. Many company representatives were impressed with the success of FABLS in attracting over 500 members.

A conference entitled 'Life in Light Science 2009' is planned for November 2009 to bring the community together at the end of the life of the Network. It is hoped that this will be the first of a series of annual conferences that will maintain some of the dynamic cross-pollination and sharing that has been facilitated via the FABLS Research Network.

The FABLS Network is extremely grateful to the ARC and NHMRC for their support over the past 4 years.