EMBL Australia Annual Report

January – December 2016

NCRIS
National Research Infrastructure for Australia
An Australian Government Initiative

EMBL Australia

EMBL Australia

Australia is an associate member of the European Molecular Biology Laboratory (EMBL), an internationally renowned life sciences research institution.

The associate membership gives Australia the opportunity to internationalise our life sciences research, introduce the world's best young researchers to new networks and tools here in Australia, and develop highly competitive research teams networked across the nation and with Europe and Asia.

EMBL Australia was created to maximise these opportunities and does so via ambitious research programs and training across Australia. The secretariat is hosted at Monash University.

EMBL Australia has:

- a Partner Laboratory Network consisting of nine research groups led by outstanding early-career researchers at nodes in Victoria, South Australia and New South Wales
- a nationwide reach through student training programs, including a PhD course, postgraduate symposium, travel grants and PhD program
- a national resource (EMBL-ABR) that provides bioinformatics support to Australian life science researchers
- international linkages through EMBL and the European Bioinformatics Institute (EMBL-EBI).

Contents

Report of the Chair of the EMBL Australia Council

This has been a remarkable year of change for EMBL Australia.

We began the year with a new governance structure, following the renewal of Australia's associate membership of EMBL, funded by the Australian Government through the National Collaborative Research Infrastructure Strategy (NCRIS), in 2015. We broadened membership of the EMBL Australia Council so that if fully represents Australia's research community. I also took on the role of Chair of the EMBL Australia Council, after being a member since its inception.

I offer my sincere thank you to the esteemed Council members who gave their time and expertise in fruitfully leading the initiative for many years: Prof Richard Larkins AO (former Chair), Prof Chris Goodnow, Prof Kiaran Kirk, Dr Seán O'Donoghue, Prof Edwina Cornish, Prof Ross Coppel, Prof Mike Brooks, Assoc Prof Paul Thomas, Prof Paul Gleeson, Prof Merlin Crossley, Prof Peter Gunning, Prof Robyn Ward, Prof Trevor Hambley, Prof Jill Trewhella, Prof Peter Leedman, Prof Robyn Owens, Prof David Day, Prof Simon Foote, Prof Steve Wesselingh and Prof Doug Hilton.

New leadership further heralded the entry of EMBL Australia into a new phase, with Prof James Whisstock – National Health and Medical Research Council Senior Principal Research Fellow at Monash University and Australian Research Council Centre of Excellence in Advanced Molecular Imaging – leading the charge as Scientific Head and Ms Maree Trovato joining us as Chief Operating Officer. In 2016, both James and Maree have successfully continued building upon the strong foundation and vision established thanks to the unwavering dedication of the inaugural Scientific Head, Prof Nadia Rosenthal, and former Executive Director Mr Silvio Tiziani.

After a most successful year in terms of advancement, expansion and scientific excellence, momentum continues to grow and I look forward to new challenges and opportunities in 2017.

Prof Bandon Wainwright
Chair of The EMBL Australia Council

Prof Brandon Wainwright,
Chair of the EMBL Australia Council

Report of the Scientific Head

It is with great excitement and optimism that I write my first report as Scientific Head of EMBL Australia.

With the benefit of the fantastic ground work of Prof Nadia Rosenthal, now Scientific Director of The Jackson Laboratory in the USA, 2016 saw EMBL Australia thrive as a research organisation with strong local and international linkages.

In 2016, significant outcomes include:

» The Partner Laboratory Network almost doubled in size, with four new and promising early-career researchers establishing their laboratories at our existing host institutes, and more institutes recognising the value of the network and commencing the early stages of recruitment. To date, more than $10 million has been invested by host institutions in establishing the Partner Laboratory Network.

» We strengthened ties between the international and Australian research communities by working with EMBL to submit a joint response to the National Research Infrastructure Capability Issues Paper, which will inform the national agenda around research infrastructure capability areas, and improving the lines of communication between EMBL and EMBL Australia with several visits to EMBL by the senior leadership team and ensuring two seats at EMBL Australia Council to EMBL's Director General, Iain Mattaj, and Director of International Relations, Dr Silke Schumacher.

» Our Partner Laboratory Network group leaders hosted a number of international visitors and collaborators, presented at international conferences, published more than 50 papers, including many in high-ranking journals, and continued to win competitive grants to support their innovative research.

» Our student programs flourished, with our Partnership PhD Program – trialled last year in conjunction with the University of New South Wales – being expanded across our entire network to assist our group leaders in recruiting the most talented students from across the globe.

» The EMBL Australia Showcase at the Australian National University introduced many early-career researchers to our research and the benefits of Australia's associate membership to EMBL.

I look forward to this success continuing as more institutes recognise the benefits of our research network and its related international linkages, scientific excellence and access to infrastructure in 2017. We are well on our way to our ambition of growing the Partner Laboratory Network to more than 20 research groups over the next two years.

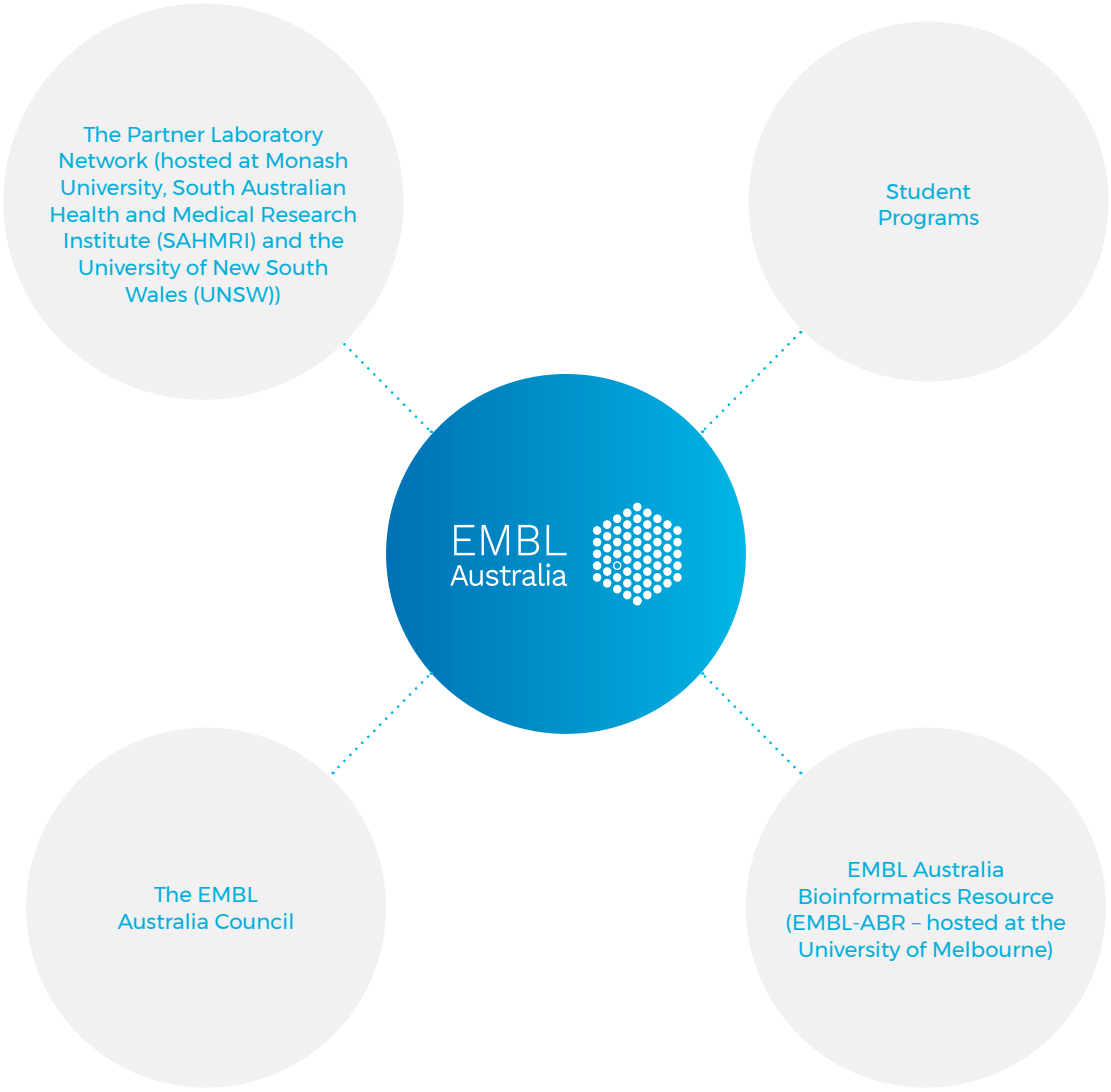
As our group leaders continue to establish their labs and grow their science, I eagerly await the results of our unique local model – having the best young researchers working on innovative, long-term and potentially life-changing research in the life sciences.

Prof James Whisstock
Scientific Head of EMBL Australia

Prof James Whisstock,
Scientific Head of EMBL Australia

EMBL Australia

EMBL Australia at a glance



EMBL Australia is a life science network that supports ambitious research projects and provides access to infrastructure and training to early-career Australian scientists.

"EMBL Australia has created a unique advantage for emerging Australian scientific talent with an enriched and sustainable international collaborative framework that positions Australian discoveries in the spotlight and offers our scientists access to an extraordinarily valuable professional knowledge network."

Prof Brandon Wainwright
Chair, EMBL Australia Council

It was created in 2008 to maximise the benefits of Australia's associate membership of the European Molecular Biology Laboratory (EMBL).

EMBL Australia – supported by the National Research Infrastructure for Australia (NCRIS) program, an Australian Government initiative – is at the cutting edge of life sciences research in Australia. Among other things, our researchers are:

» investigating the inner workings of molecules, cells and genes of animal embryos and plant seedlings to learn more about how different tissues and organs develop, with the aim of improving regenerative medicine technologies;

» using a systems approach to comprehensively investigate metabolic processes and immune responses;

» using advanced imaging techniques to understand the molecular interactions underpinning key cellular processes during development and beyond; and

» developing the bioinformatics tools and skills required to analyse large datasets.

Associate membership of EMBL

Australia became the first associate member of the renowned EMBL in early 2008. Launched in 2010, the EMBL Australia Partner Laboratory Network set out to take full advantage of this unique affiliation, with the goal of strengthening the nation's global position in life sciences research. Inspired by EMBL, the network adopted a research model unique to Australia that focusses on nurturing ambitious early-career researchers and building a national network to best utilise Australia's scientific infrastructure.

Australia's membership of EMBL creates opportunities for:

» internationalising Australian research

» empowering and training Australia's best early-career researchers and future scientific leaders

» embedding powerful new enabling tools, such as bioinformatics and systems biology, in Australian life sciences through programs run by the EMBL Australia Bioinformatics Resource (EMBL-ABR).

As an associate member, Australia has observer status in EMBL's governing body, Australian scientists have access to EMBL's world-class facilities, services and training programs and an array of connections to international life science researchers.

About EMBL – Europe's flagship life sciences laboratory

The European Molecular Biology Laboratory was founded in 1974, when the life sciences field was strongly dominated by the United States.

Its 25-plus member states realised that together they could achieve more than each could by themselves.

With sites in the UK (Hinxton, near Cambridge), France (Grenoble), Germany (Heidelberg and Hamburg), Italy (Rome) and Spain (Barcelona), EMBL now comprises about 85 independent research groups and more than 1,600 people.

Some of its many unique features include:

» nine years of funding security for research leaders (subject to review at five years), after which they move on

» training for more than 7,000 researchers per year

» highly sought-after PhD and post-doctoral positions

» research networks across Europe and the world

» a culture that focusses on young scientists and builds strong research alliances.

In 2008, Australia became the first associate member state of the EMBL. Argentina followed suit in 2014.

EMBL Australia's Core Program – The Partner Laboratory Network

EMBL Australia's flagship program is its network of research groups embedded in existing research institutes and universities across the country – the EMBL Australia Partner Laboratory Network (PLN).

Following the EMBL model in providing talented young scientists with solid funding and the freedom to drive the development of ambitious new research, the EMBL Australia Partner Laboratory Network mentors and nurtures outstanding young scientists selected from an international pool by offering up to nine years of secure funding.

Working with current and potential host institutions, the EMBL Australia secretariat is building up the PLN to create around 20 research groups across Australia, providing host institutions who join the network access to the scientific excellence and governance that drives both EMBL and EMBL Australia. In 2016, four new research groups were established as part of the PLN.

The PLN model, together with the prestigious brand and reputation of EMBL, enables host institutions to attract the best early-career researchers – researchers who may not otherwise consider establishing their laboratory in Australia – and develop the next generation of scientific leaders by providing group leaders:

» the freedom to drive their own ambitious research projects in a multi-disciplinary manner

» strong international links for collaborations

» access to infrastructure and expertise to maximise technology investment

» a community of like-minded leading scientists to tackle the new challenges in science together

» use of the EMBL brand to attract high-calibre staff and students to their group and

» access to exceptional scientific mentorship and leadership.

Victorian node

The Victorian node of the laboratory network is hosted at Monash University and currently consists of four research groups:

» Edwina McGlinn, based at the Australian Regenerative Medicine Institute (ARMI), is working to understand the genes controlling formation of the skeleton and neural circuits.

» Chen Davidovich, based at the Monash Biomedicine Discovery Institute (BDI), is studying key proteins involved in the maintenance of stem cell fate, which play an important role in multiple cancers.

» Max Cryle, also based at BDI, is using a combination of techniques to understand and harness the major protein machines that catalyse the production of some of the most important antibiotics in clinical use.

» Mikaël Martino, based at ARMI, focusses on the immune regulation of stem cells and regeneration, seeking to design regenerative medicine strategies integrating a control of the immune system.

Internationalising Australian research by creating highly competitive research teams that are networked across the nation, and with Europe and Asia, through the associate membership of EMBL.

South Australian node

The South Australian node of the PLN is hosted at the South Australian Health and Medical Research Institute (SAHMRI) and comprises three groups, supported by the University of Adelaide, University of South Australia and Flinders University.

- David Lynn is based at the SAHMRI Infection and Immunity theme, where he investigates the regulation of the innate immune system from a genome-wide or systems-level perspective.
- Ville-Petteri Mäkinen is based at the Heart Health research theme at SAHMRI, where he uses big data to better understand pathologic phenomena at the intersection of ageing, obesity, diabetes and cardiovascular disease.
- Pirjo Apaja, based in SAHMRI's Nutrition and Metabolism theme, focusses on organelle biology and disease, investigating mechanisms in autophagy and endo-lysosome network trafficking and their contribution to disease conditions, such as neurological disorders and cancer.

New South Wales node

The New South Wales node of the PLN is hosted at the University of New South Wales (UNSW) and comprises two research groups:

- Yann Gambin is based at UNSW's Centre in Single Molecule Science. He combines single molecule detection and microfluidics to develop a microscopy-based pipeline to readily study protein-protein interactions at high resolution.
- Maté Biro is also based at the UNSW Centre in Single Molecule Science. He studies actomyosin mechanisms during cytoxic T cell action and the elucidation of the biomechanical cell-cell interaction between T cells and their cancerous targets.

Collaborating Groups

Though not part of the PLN, a number of research groups have strong and direct collaborative links between Australia and EMBL scientists.

Currently, three Australian research teams are recognised as EMBL – Australia Collaborating Groups due to their active collaborations with EMBL researchers: Professor Thomas Preiss (Australian National University), Associate Professor James Bourne (ARMI, Monash University) and Dr Mirana Ramialison (ARMI, Monash University).

EMBL Australia Bioinformatics Resource (EMBL-ABR)

Another significant initiative under the associate membership to EMBL, EMBL-ABR is a national resource that provides bioinformatics support to Australian life science researchers.

It was formed in collaboration with the European Bioinformatics Institute (EMBL-EBI), which also supports the resource through representation on its International Science Advisory Group. EMBL-ABR currently consists of a hub and ten nodes, which are organised around six key areas: data, tools, compute, standards, training and platforms.

Embedding new enabling tools into Australian life sciences

The Nodes are at institutions located across Australia and the Hub is hosted by the EMBL-ABR: Melbourne Bioinformatics Node at the University of Melbourne, with Associate Professor Andrew Lonie as Director.

EMBL-ABR aims to:

- increase Australia's capacity to collect, integrate, analyse, exploit, share and archive the large heterogeneous data sets now part of modern life sciences research
- contribute to the development and provision of training in data, tools and platforms to enable Australia's life science researchers to undertake research in the age of big data
- showcase Australian research and datasets at an international level and
- enable engagement in international programs that create, deploy and develop best practice approaches to data management, software tools and methods, computational platforms and bioinformatics services.

Read about the achievements of EMBL-ABR in their **2016 Annual Report**.

EMBL Australia's Student Programs

As part of EMBL Australia's commitment to ensuring students have access to training that gives them a head start in their scientific careers, it provides gateways for students to enhance their scientific knowledge and opportunities for collaboration through travel and networking.

Training activities include:

- Travel grants for PhD students to attend EMBL international conferences and workshops and to visit EMBL laboratories in Germany, Italy, France and the UK
- A two-week intensive PhD course
- Opportunities for Australian PhD students to study in a fully funded PhD program at EMBL or for top international and local PhD students to complete their PhD studies within EMBL Australia groups
- Supporting an annual student-developed symposium.

Empowering and training young researchers

2016 Highlights

January

Group Leaders Maté Biro (UNSW) and Max Cryle (Monash University) commenced and Prof Brandon Wainwright took over as Chair of the EMBL Australia Council

01

February

The first four students of a pilot scholarship program with UNSW were announced and the EMBL Australia Partnership PhD Program was adopted nationally

02

March

Prof James Whisstock commenced as EMBL Australia Scientific Head following the departure of Prof Nadia Rosenthal earlier in the year

Group Leader Mikaël Martino commenced at ARMI, Monash University

03

April

Pirjo Apaja commenced as a Group Leader at SAHMRI

04

June

Prof Whisstock visited EMBL-Heidelberg to meet with the EMBL leadership team and tour the scientific core facilities

05

06

07 08 09 10 11 12

July

The EMBL Australia Showcase was held at the Australian National University to introduce early-career researchers to EMBL Australia's research and the benefits of EMBL Australia's connections to the EMBL.

The EMBL Australia Council met in Melbourne

September

Maree Trovato commenced as EMBL Australia Chief Operating Officer and Head of Secretariat.

EMBL, EMBL Australia and EMBL-ABR submitted responses to the National Research Infrastructure Capability Issues Paper

October

Prof Whisstock and Ms Trovato visited EMBL-Heidelberg to meet with EMBL Director of International Relations Dr Silke Schumacher and senior members of her staff to discuss the development of an agreement that aims to strengthen the EMBL-EMBL Australia relationship

November

A competitive international recruitment process was held at Monash University and resulted in Dr Harald Janovjak of the Institute of Science and Technology, Vienna, being chosen to join EMBL Australia as a Group Leader at ARMI.

The third annual EMBL Australia Postgraduate Symposium (EAPS) was held at SAHMRI

December

The EMBL Australia Council met in Melbourne

2016 Highlights

In 2016, EMBL Australia continued to grow, with the Partner Laboratory Network expanding its fundamental biomedical research and almost doubling in size.

Experienced and innovative new leaders stepped up to further consolidate EMBL Australia's strong position in the Australian life sciences community, continue and expand its high quality training and support of early-career scientists with the introduction of its inaugural Partnership PhD Program, and enhance links between Australian scientists and their international peers.

Securing a bright future

Following the renewal of Australia's associate membership of EMBL in 2015, the EMBL Australia PLN has continued to flourish. Four new research groups commenced in 2016 and the organisation secured another promising international early-career researcher, following a highly competitive recruitment round in November 2016.

It was a year of regeneration in terms of leadership. After six years of successfully growing the organisation from the ground up, Professor Nadia Rosenthal stepped down from her position as Scientific Head of EMBL Australia in early 2016 to take on the prestigious role of head of the Jackson Laboratory in Maine, USA. EMBL Australia's momentum has continued under the leadership of Professor James Whisstock, who was appointed after an exhaustive search and commenced as Scientific Head in April.

Maree Trovato also took the reins as a dedicated Chief Operating Officer and Council Secretariat in September 2016, as Silvio Tiziani's role as Executive Director of the Australian Regenerative Medicine Institute expanded. The Monash Biomedicine Discovery Institute hosted the EMBL Australia secretariat from July.

Professor Brandon Wainwright commenced as Chair of the EMBL Australia Council, taking over from Professor Richard Larkins, who stepped down in December 2015. The Council met twice to provide strategic oversight of the activities under the associate membership in 2016: on 12 July and 14 December in Melbourne.

Internationalising Australian research

- EMBL's Director General, Professor Iain Mattaj, and Director of International Relations Dr Silke Schumacher have seats on the EMBL Australia Council, enabling them to have input into the management of EMBL Australia and ensuring that a direct line of communication is kept open between Europe and Australia.
- Members of EMBL, EMBL Australia and EMBL-ABR submitted considered responses to the National Research Infrastructure Capability Issues Paper (NRIRC 2016) in September 2016. The paper, released in July to foster consultation to support the 2016 Roadmap, will inform the national agenda around research infrastructure capability areas.
- Collaborations between EMBL and Australian researchers resulted in dozens of joint publications and a number of joint grants in 2016. Many Australian nationals attended EMBL's courses and conferences and several local scientists were invited to present their research at EMBL events.
- Scientific Head Professor James Whisstock visited EMBL's headquarters in Heidelberg, Germany, in June and again with Chief Operating Officer Maree Trovato in October.
- The Australian scientific community was one of the most intensive users of core biomolecular databases and bioinformatics tools administered by the European Bioinformatics Institute (EMBL-EBI) in 2016.

EMBL Australia group leaders gave a number of invited conference presentations and seminars to local audiences, as well as audiences in Singapore, Canada and Sweden.

EMBL Australia received visitors from a number of international collaborating partners and EMBL scientists in 2016, including:

- EMBL Director Professor Matthias Hentze, who spoke at the 2nd EMBL Australia Showcase at the Australian National University, Canberra, in July.
- Professor John Quakenbush (Harvard University & Dana-Faber Cancer Institute) and Professor Nadia Rosenthal (Jackson Laboratory) spoke at the EMBL Australia Postgraduate Symposium in November.
- Professor Mika Ala-Korpela, Dr Mari Karsikas and Ms Qin Wang – of the Computational Medicine Research Team at the University of Oulu, Finland – visited the EMBL Australia research groups at SAHMRI in November to strengthen their collaborative programs.

Opportunities were provided for high-calibre Australian and international students to study and travel:

- Ten Australian PhD students received travel grants to attend the 18th annual EMBL PhD Symposium in Heidelberg in November.
- The EMBL Australia Partnership PhD Program enrolled three international students.
- Two Australian students are completing their PhDs at EMBL and a further two students were enrolled in the EMBL International PhD Programme.

Professor Brandon Wainwright
Chair of EMBL Australia Council

As well as his role as Chair of the EMBL Australia Council, Professor Brandon Wainwright is the Director at the Institute for Molecular Bioscience (IMB), based at the University of Queensland, and serves on various boards, including: Life Sciences Queensland, the Australian Genome Research Facility and a number of international scientific review committees. In 2015, Prof Wainwright also chaired the Queensland Institute of Health. Prof Wainwright's laboratory at IMB focusses on understanding the genetic pathways behind skin cancer and medulloblastoma, a type of brain tumour that occurs predominantly in children. He is best known for the co-discovery of Patched, the gene responsible for both the inherited and sporadic forms of basal cell carcinoma, and his research on cystic fibrosis.

Professor James Whisstock
Scientific Head

Professor James Whisstock is a highly regarded research scientist with an extensive publication record. Based at the Biomedicine Discovery Institute at Monash University, he is a National Health and Medical Research Council Senior Principal Research Fellow and Scientific Director of the Australian Research Council Centre of Excellence in Advanced Molecular Imaging. After completing his PhD in bioinformatics and structural biology at Cambridge University, Prof Whisstock came to Monash University as a research fellow and established his laboratory. His team uses a variety of techniques – encompassing structural biology (X-ray crystallography and electron microscopy), biochemistry, bioinformatics and molecular genetics – to address questions in the fields of infection and immunity, blood coagulation, developmental biology and cancer.

Maree Trovato
Chief Operating Officer and Council Secretariat for EMBL Australia

Maree Trovato comes to EMBL Australia with considerable experience in international relationship management, business development and operational expertise from various roles within the higher education and public service research sectors. In her most recent role as Director of the Science and Technology Program at the Defence Science and Technology Group, she fostered a high-performing culture of collaboration to deliver innovative science and technology outcomes. As well as managing the operational aspects of the organisation, Ms Trovato leads the secretariat (based at Monash University) to ensure the network of group leaders, as well as local and international stakeholders, are well-connected and engaged.

Empowering and training Australia's best early-career researchers

Research

Expansion of the Partner Laboratory Network continued, with four new group leaders establishing their laboratories and commencing their research in 2016.

» Dr Maté Biro joined EMBL Australia as a group leader in January 2016, establishing his research group within the Centre for Single Molecule Science at the University of New South Wales.

» Associate Professor Max Cryle joined EMBL Australia as a group leader in January 2016, based in the Department of Biochemistry and Molecular Biology at Monash University.

» Associate Professor Mikaël Martino joined EMBL Australia as a group leader in April 2016, based at the Australian Regenerative Medicine Institute, Monash University.

» Associate Professor Pirjo Apaja joined EMBL Australia as a group leader in April 2016, based in the Nutrition and Metabolism Theme, Hopwood Centre for Neurobiology at SAHMRI.

» A highly competitive recruitment round at Monash University in November resulted in the experienced panel's preferred candidate signing on as a new EMBL Australia group leader, to be hosted at the Australian Regenerative Medicine Institute in 2018. Two other innovative early-career researchers from the recruitment drive were also offered research roles at the host institute and will remain closely linked to the EMBL Australia network.

Publications

EMBL Australia group leaders published 51 papers in the 2016 calendar year. Papers with EMBL Australia scientists as first or last author were published in high-impact journals, such as *Nature Communications* and *Journal of the American Chemical Society*.

Funding

EMBL Australia's research continues to attract significant grant funding, with more than $4 million in grants awarded to EMBL Australia group leaders in 2016 (see Appendix 3 for more details).

Student programs

EMBL Australia launched its inaugural Partnership PhD Program, in conjunction with UNSW, in 2015 with the aim of attracting some of the best international students to Australian laboratories.

Following the successful pilot program, which saw four exceptional students – Jorge Luis Galeano Niño, Jonathan Franco Berengut, Andre Leitao and Ana Montserrat Martinez – commence their PhD studies at UNSW in early 2016, the program was launched nationally this year.

In 2016, EMBL group leaders enrolled three students in the program.

Life science postgraduate students came from around Australia to attend the third student-run EMBL Australia Postgraduate Symposium (EAPS) at SAHMRI in Adelaide on 16-18 November.

EMBL Australia also provided support to:

» The 2016 Australian Bioinformatics & Computational Biology Society (ABACBS) annual conference

» The Australian Mathematical Sciences Institute's BioInfoSummer 2016 and

» The 2016 Winter School in Mathematical and Computational Biology.

Working together to inform the strategic mapping of Australia's research agenda

It was a truly collaborative effort between members of EMBL, EMBL Australia and EMBL-ABR that saw these organisations submit well-informed and considered responses to the National Research Infrastructure Capability Issues Paper (NRIRC 2016).

The paper – which presents a range of issues relating to national research infrastructure capability areas – was released in July to encourage consultation to support the development of the 2016 Roadmap.

The EMBL Australia Partner Laboratory Network was invited to respond.

In the joint response, the organisations highlighted the current and projected outcomes of Australia's associate membership of EMBL, including: the internationalisation of local research, the sharing of expertise, increased access to key international infrastructure, access to European research funding, improved training for the next generation of scientists and a transformation of our ability to handle extreme volumes of biological data.

Collectively, these activities substantially leverage Australia's national research investment and enable Australian scientists to address major future research and societal challenges, especially in the areas of health, agriculture and big data.

New group leaders

Maté Biro
University of
New South Wales

Hailing from Sweden, Dr Maté Biro completed his PhD at the Max Planck Institute of Molecular Biology and Genetics in Dresden, working with Professor Ewa Paluch. Dr Biro has worked at the Bioinformatics Institute of A*STAR in Singapore, the MIT BioImaging Center in Cambridge, Massachusetts (USA), the KEK: High Energy Accelerator Research Organization in Tsukuba, Japan, and the Centenary Institute, Sydney, where he established his own team. As an EMBL Australia group leader, Dr Biro has continued his studies into the way actomyosin complexes control cell shape, homeostasis and migration in cancer and immune function, focussing on the elucidation of biomechanical cell-cell interaction between T and target cancer cells.

Mikaël Martino
Monash University

Associate Professor Mikaël Martino combines his research experience in cell biology, immunology, bioengineering and regenerative medicine to further investigate the immune regulation of tissue repair and regeneration, in the hopes of translating his findings into novel regenerative medicine strategies that will integrate a control of the immune system. A/Prof Martino recently developed a breakthrough technology that drastically improved regenerative medicine strategies based on growth factors, which is in clinical development. Originally from Switzerland (where he received his PhD at the École Polytechnique Fédérale de Lausanne), A/Prof Martino most recently worked at the International Immunology Frontier Research Centre at Osaka University, Japan.

Pirjo Apaja
South Australian Health and
Medical Research Institute

Associate Professor Pirjo Apaja is originally from Finland, where she undertook her PhD at the University of Oulu, Institute of Biomedicine. Her PhD focussed on the protein quality control (QC), the mechanism by which a cell monitors proteins to ensure they are appropriately folded. It includes all the components needed for detecting, removing and degrading damaged disease-associated or otherwise conformationally challenged proteins. A/Prof Apaja has worked at the Institute of Biomedicine in Finland, as well as in Canada – at the Hospital for Sick Children, Toronto, the University of Toronto and McGill University, where she researched membrane proteins' conformational sorting at the cell periphery.

Max Cryle
Monash University

Associate Professor Max Cryle trained as an organic chemist at the University of Queensland before moving to the Max-Planck Institute for Medical Research (MPIMF), in Heidelberg, Germany. There he established a research group, whose focus was understanding the later, crucial stages of glycopeptide antibiotic biosynthesis. His research is based at the interface of chemistry and biology, using a combination of chemical synthesis, biochemical characterisation and X-ray crystallography. A/Prof Cryle won the inaugural Otto Schmeil prize in 2016, awarded by the Heidelberg Academy of Arts and Sciences to a young academic deemed to have been the most successful working in biology or medicine in the German state of Baden-Wüerttemberg in the preceding year.

Our Research (The Partner Laboratory Network)

Victorian Node

Peter Currie
Victorian node head

Peter Currie, based at the Australian Regenerative Medicine Institute, was appointed as the head of the Partner Laboratory Network's Victorian Node in September 2012. The node head provides scientific mentorship and guidance to the group leaders in the node.

Peter Currie heads a research group that uses zebrafish – an organism that can repair and regenerate heart injuries without any scar tissue or collateral damage – to learn about how muscle cell types are determined within the developing embryo, how they grow and how they regenerate after injury. The Currie Group researches the mechanics of stem cell generation with the aim of finding a cure for a range of blood disorders and immune diseases.

Professor Peter Currie is a highly regarded researcher, who in 2016 won the NHMRC Research Excellence Award for the highest-ranked application in the NHMRC Project Grant scheme and led a research group whose work was featured in prestigious journals *Science* and *Nature*.

Victorian node head Peter Currie was also announced as the new Director of ARMI in February 2016.

Cryle Group

Max Cryle joined EMBL Australia as a group leader in January 2016. He is based in the Department of Biochemistry and Molecular Biology at Monash University and is an Associate Investigator at the Australian Research Council Centre of Excellence in Advanced Molecular Imaging.

The Cryle Group focusses on antibiotics: understanding how these compounds are made in nature and how we can reengineer these natural systems to produce new antibiotics, as well as developing novel approaches to treat bacterial infections.

Antibiotics are one of the most important discoveries in human health. These compounds – largely derived from compounds found in nature – have enabled many aspects of modern medicine that we call upon today.

However, the early success of antibiotics has led to a serious underinvestment in identifying new antibiotics and antimicrobial targets: this means that we, as a society, are in dire need of new antibiotics. One of the difficulties in achieving this goal is that antibiotics are often highly complex molecules and we are restricted to natural compounds or modified forms of these compounds.

If we are to develop new antibiotics, we will need to reengineer the natural enzymatic machinery that produces antibiotics – and this will only be possible once we understand the how these complex enzymatic machineries work.

The Cryle Group aims to understand the biosynthesis of one of the most important classes of clinically relevant antibiotics – the glycopeptide antibiotics, such as teicoplanin and vancomycin – in order to be able to re-engineer this machinery and thus produce novel antibiotics. The Cryle Group applies a range of techniques, including synthetic chemistry, biocatalysis, biochemistry and structural biology, to study these systems. The group also applies these techniques to develop novel antibiotic compounds and explore potential new targets for treating bacterial infections: here, with a focus on the serious bacterial pathogen Staphylococcus aureus.

Ultimately, this research will enable the development of novel antibiotic therapies, as well as unlock new pathways to treat serious bacterial infections in the clinic.

Max Cryle was awarded the inaugural Otto Schmeil prize at a ceremony in Heidelberg, Germany and was a keynote speaker at the International Biotechnology Symposium (IBS 2016) in Melbourne.

Bio-inspired synthesis of glycopeptide antibiotics

In our arsenal of agents to combat pathogenic bacteria, glycopeptide antibiotics (GPAs) are the big guns – a range of highly effective antibiotic molecules that specifically target bacterial cell walls.

But bacterial resistance is growing; current techniques of GPA synthesis do not allow for clinical scales of production, nor easy manipulation of the molecule shape, whilst exploitation of biosynthesis requires re-engineering of a large and complicated enzymatic machinery.

Associate Professor Cryle and his team have secured funding from the ARC to look at one of the critical hurdles in chemically synthesising GPAs. A key feature of these molecules is a pattern of cross-linking that determines both the GPA's final shape and its effectiveness as an antibiotic. By combining GPA precursors with cytochrome P450 enzymes – a group of molecules that catalyse cross-linking reactions – A/Prof Cryle's team aims to artificially recreate the natural formation sequence of efficient GPAs. The goal is to observe closely the relationships between each part of the production, identifying exactly what mechanisms underpin their success.

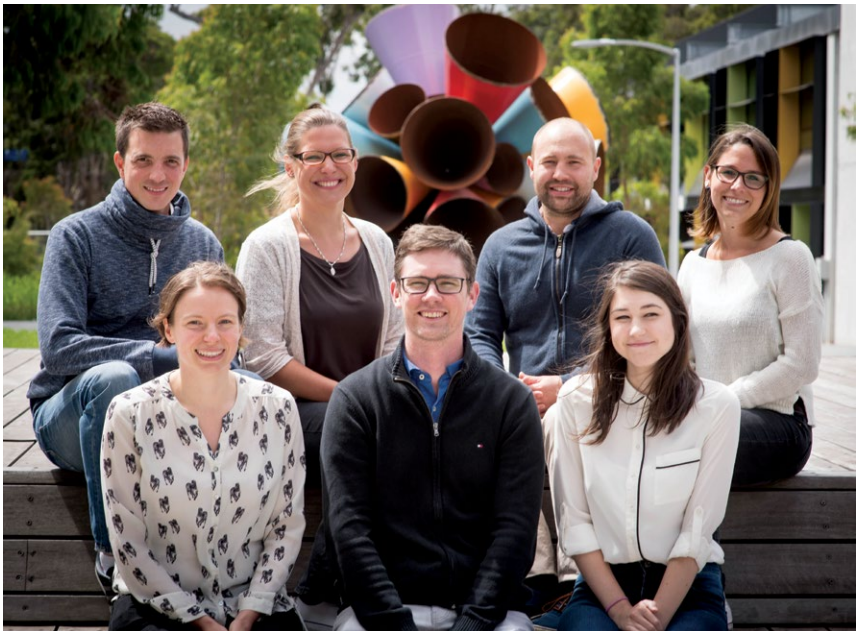
The group previously published in *Nature* in 2015 on the discovery of how natural cross-linking enzymes interact with the synthase molecules that generate the GPA precursors, identifying when a peptide strand is ready for its final assembly and modification. This new work will build on that knowledge to give us a more complete understanding of the entire process, bringing us one step closer to replicating these complicated and unique reactions.

By using different combinations of P450 enzymes, there is also the chance to create new cross-linking patterns in the hope of synthesising novel and efficient antibiotics.

Associate membership to EMBL enables access to world-class facilities

A/Prof Max Cryle has been instrumental in helping his final-year PhD student, who is based in Copenhagen, access crystallisation facilities at EMBL Hamburg.

The remarkable facilities at Hamburg are open to researchers worldwide, but as part of the associate membership to EMBL, EMBL Australia researchers can take advantage of the facilities at about half the usual cost.



Davidovich Group

Chen Davidovich joined EMBL Australia in September 2015. He is based in the Department of Biochemistry and Molecular Biology at Monash University and is an Associate Investigator at the Australian Research Council Centre of Excellence in Advanced Molecular Imaging.

The Davidovich Group researches polycomb group (PcG) proteins, which play a role in epigenetic regulation of embryonic development and cancer. Within a cell, the DNA is packaged up into a complex structure called chromatin.

In addition to genomic DNA, the chromatin contains RNA and proteins. Among these, some of the most abundant proteins within the chromatin are histone proteins, which compact the DNA and assists with the control of gene expression.

PcG proteins are assembled into histone-modifying complexes that interact with the chromatin to turn off or silence the expression of thousands of genes. PcG proteins play a vital role in embryonic development and normal cell differentiation, but have also been implicated in cancer. The Davidovich Group is using a multi-disciplinary approach – cutting-edge molecular techniques in vivo, combined with structural biology, biochemistry and biophysics in vitro – to understand the detailed molecular events that underlie the recruitment and regulation of these histone-modifying complexes by their cofactor proteins, RNAs and DNA.

Investing in the best people for the brightest future

When it comes to running a successful laboratory, having the best people is a key part of the equation.

Associate Professor Chen Davidovich says that the EMBL Australia program provides the opportunity to recruit internationally competitive scientists.

"It's a great way to attract really bright people who have lots of potential, people that really want to work on big projects and do big science, to bring something completely new – not only to the relevant institution, but to Australia," he says.

And once you find the right person, do whatever you can to entice them to join the lab and to keep them happy, A/Prof Davidovich advises.

In 2016, he recruited two scientists with differing areas of expertise – Dr Qi Zhang, a Chinese postdoctoral structural biologist who completed her first postdoc in Canada, and Dr Vita Levina, an Australian scientist with expertise in biochemistry and mass spectrometry.

An undergraduate student, Nicholas McKenzie, also worked part-time in the laboratory as part of BioMedVic's Undergraduate Research Opportunities Program (UROP).

The highly competitive scheme provides high-performing undergraduate students with experience in the biomedical sciences through paid work.

Nicholas' work in the laboratory provided him with real-world insight and assisted him in his decision to continue his studies and undertake an Honours degree.

"It's mainly about not making compromises about what facilities you work with, who you collaborate with, the people you're hiring, or the scientific questions you're asking – really aim to get the best you can."

Q&A: The realities of setting up a new laboratory

What is your philosophy for running a lab?

"I like to have good people in the lab who can come up with their own ideas about how to do things. I also like to be very involved in what they are doing, so I try to find a good balance between giving them the freedom to do what they think is right and checking that they are moving along the right track and in line with the overall aim of the lab."

How important is the set-up stage in the lifespan of a lab?

"Lab set-up – not just the equipment, but also the people and the environment – is crucial for overall success. The people have to be really good to do cutting-edge research, and the facilities need to be state-of the-art to allow the people to do that cutting-edge research."

Setting up a lab: expectation versus reality?

"I was very happy with the high standard of facilities at Monash University – some are the best I've worked with (that includes not only the equipment but, in some cases, the people that run these facilities). The overall standard of students in Australia is also very high, possibly because it's quite difficult to get scholarships here so the students who have them are usually people with heightened abilities, which is a valuable thing for labs – and small labs in particular."

Can you sum up your first year as a group leader?

"The first year was challenging because I had to set up a lab, which involved doing both a tissue culture using mammalian cells to study gene regulation in cells and setting up the bioinformatics capabilities required to deal with genomics data. Basically, I had to set up all the things required to do structural biology and also biochemistry and biophysics, while hiring people in parallel. But the set-up didn't stop the science, which I was lucky to be able to do throughout 2016 from an early stage – not in all of the aspects described, but at least in some."

What do you hope to achieve at EMBL Australia?

"I want to know how genes are regulated by polycomb group proteins and I think it's something that can be achieved in the next few years. I think understanding how genes are regulated at a molecular level down to atomic resolution is something that will probably take more than five years to understand, but in the meantime there is a huge amount of information we can gain. The way I see the system and field going, I believe that within five years we are probably going to understand how genes are being switched off at a molecular level, but with some open questions left to be resolved. But I think the big questions are solvable within the next five to nine years."

What are the lessons learnt from setting up a laboratory?

"I think getting good people is the most important thing. Don't make any compromises about people and be selective. It's mainly about not making compromises about what facilities you work with, who you collaborate with, the people you're hiring, or the scientific questions you're asking – really aim to get the best you can."

Image: Monash University

Martino Group

Mikaël Martino joined EMBL Australia as a group leader in April 2016, based at the Australian Regenerative Medicine Institute, Monash University.

The Martino Group combines research in immunology, stem cells and bioengineering in order to understand the mechanisms governing tissue repair and regeneration.

Ultimately, the group aims to engineer novel regenerative strategies using bioengineering approaches.

To design successful regenerative therapies and make regenerative medicine a more widespread reality, we need to understand how our body is able to create an environment suitable for regeneration.

For instance, tissue injury and the healing process is usually accompanied with the activation of the immune system and the mobilisation of endogenous stem cells. The type of immune response, its duration and the cells involved can considerably change the outcome of the healing process from tissue repair (which may include scarring or fibrosis and loss of function) to true regeneration.

Using tools that include genetically modified and chimeric mice, as well as injury models in tissues such as bone, skin, and muscle, the Martino Group aims to reveal the key mechanisms which lead to tissue repair or regeneration. After understanding the basic biological mechanisms, the group seeks to design effective strategies to stimulate endogenous regenerative pathways using various bioengineering approaches.

A/Prof Martino received the Australian Research Council's Discovery Early Career Researcher Award for his research on how T lymphocytes modulate stem cells and tissue regeneration.

Healing after injury

When our tissues are injured, the body reacts with two response pathways. An immune response floods the damaged area with inflammatory molecules, to attract leukocytes and protect against pathogens, while a healing response begins knitting the tissue together with newly-generated cells.

However, despite both reactions aiming to return the body to health, a strong or prolonged immune response can interfere with healing, leading to scarring, fibrosis, and decrease of function.

Investigating the interactions between these two responses is critical, both for understanding the body's natural repair processes and for increasing the effectiveness of regenerative medicine therapies. Stem cell-driven bone regeneration, either naturally following a fracture or following surgical bone grafting, is inhibited by the activation of cytokine IL-1ß pathways (an interleukin signaller that increases leukocyte migration and inflammation). Associate Professor Martino and his team published this work in *Nature Communications* in 2016 and have since been investigating a stem cell-delivery system that will incorporate ways to suppress IL-1ß signalling to allow post-transplantation bone regeneration to occur at a much more effective pace.

In an additional coup for the lab, A/Prof Martino's research into how T cells regulate the healing process has been recognised with a Discovery Early Career Researcher Award from the Australian Research Council's Discovery Program. This funding will secure research for his group over the next three years, as they work to illuminate the complex interactions of the body's response to injury.

McGlinn Group

Edwina McGlinn joined EMBL Australia as a group leader in January 2011, based at the Australian Regenerative Medicine Institute (ARMI), Monash University. She went on maternity leave from November 2015, returning in April 2016.

The McGlinn Group aims to elucidate novel gene networks that drive growth and identity in the early embryo.

Their broad focus is on the critical developmental regulators, the Hox genes, and how microRNAs shape Hox functional output during embryonic development and in disease states. They are specifically interested in how the developmental modules that define total vertebral number are integrated with those that impart vertebral identity.

Moreover, the McGlinn lab has developed novel genetic tools to address critical questions regarding formation and function of neurons within the spinal cord that relay sensory information directly to the brain.

The McGlinn lab uses elegant mouse genetics, coupled with cutting-edge functional genomics technologies, to unravel novel gene networks and mechanisms of regulation.

Associate Professor McGlinn established the first EMBL Australia Partner Laboratory Group in 2011 and was awarded continuation for a further four years in October 2015.

Student Eamon Coughlan, supervised by A/Prof McGlinn, was awarded his PhD in June 2016. His thesis was entitled 'Hox-cluster genes in the spinocerebellar system'.

A/Prof McGlinn was awarded a Monash Platform Access Grant to generate a novel mouse line that will allow her to investigate progenitor cells of the vertebral column and spinal cord.

Images

01

Organisers of the 8th Australian Developmental Biology Workshop with international speakers (L-R): Edwina McGlinn (EMBL Australia & ARMI), Natasha Harvey (Centre for Cancer Biology), Claude Desplan (New York University), Cliff Tabin (Harvard Medical School), Brigid Hogan (Duke University), Peter Currie (EMBL Australia & ARMI).

02

Attendees at the 8th Australian Developmental Biology Workshop.

Giving back to the scientific community

Scientific success is largely measured by publications and accolades. But contributing to the development of future scientific leaders and advancing the science by fostering the sharing of information are arguably just as important – especially for a community-minded researcher, like A/Prof McGlinn.

"I've always benefited from being a part of the developmental biology and wider scientific community – whether that be in Australia or in the USA – so to me it's incredibly important to give back, to participate in external activities and to train the next generation of scientists," she says.

Despite being busy balancing her own group's research with the demands of a young baby, A/Prof McGlinn still managed to find time to devote to giving back to the wider scientific community in 2016.

She was a member of an NHMRC Grant Review Panel in August, spoke about her work on spinocerebellar neural patterning at the Hunter Cell Biology Meeting in April, and was co-convenor of the 8th Australian Developmental Biology Workshop, held in December at Flinders, Victoria.

A/Prof McGlinn said organising the four-day intensive workshop or 25 students and postdoctoral fellows required a significant amount of time and commitment, but securing multiple presentations and workshops by pre-eminent international and national developmental biologists – Professor Claude Desplan from New York University, Professor Brigid Hogan from Duke University and Professor Cliff Tabin from Harvard Medical School, Prof Alan Davidson from University of Auckland and Dr Mirana Ramialison from ARMI – was worth the effort.

"It was really wonderful to provide a platform for these outstanding international researchers to train the next generation of scientists," she said.

"The intense nature of the workshop also allowed them to develop personal relationships with the students, providing outstanding mentoring opportunities."

New South Wales Node

Katharina Gaus
New South Wales node head

Katharina Gaus, based at the University of New South Wales, was appointed as the head of the Partner Laboratory Network's New South Wales Node in 2014 and leads the UNSW Centre in Single Molecule Science. The node head provides scientific mentorship and guidance to the group leaders in the node.

Katharina Gaus and her team use innovative microscopy techniques (combined with mouse models, mathematics and molecular biology) to investigate how the behaviour and interaction of individual molecules shape the system as a whole. They want to know how T-cells make decisions, which will enable us to understand how the human body directs defences and assist in the development of tools to fight cancer.

In 2016, Scientia Professor Gaus and her group designed and built super-resolution fluorescence instruments that have the ability to image molecules within living cells by gaining access to pre-commercial equipment through an industry partner. The microscope captures images of molecules with about 10 nanometre precision, allowing the group to view the workings of a signalling network in a fully functioning T cell without pulling it apart. There are more than a dozen specialised microscopes in action in the Gaus laboratory, built by a combination of cell biologists and physicists.

Using a new microscopy technique, the Gaus Group discovered that nanoparticles shaped like rods and worms are more effective at moving to the centre of a cell and had their work published in highly respected journal *Nature Nanotechnology*.

Biro Group

Maté Biro joined EMBL Australia as a group leader in January 2016, establishing his research group within the Single Molecule Science Node at UNSW. He is also an Associate Investigator at the Australian Research Council Centre of Excellence in Advanced Molecular Imaging.

The Biro Group are primarily concerned with the cell biology and mechanics of the actin cytoskeleton, and how immune cells (T cells) locate and kill cancer cells.

The group uses high-speed imaging to watch how T cells, and the cancer cells they target, interact and move throughout complex three-dimensional environments.

The Biro Group (L to R): Group Leader Maté Biro, PhD student Jorge Luis Galeano Niño, lab manager Hernan Carol Garis, research assistant Feyza Colakoglu, Postdoctoral fellow Szun Tay, PhD student Matt Alfred Govendir.

Frozen fighters retain cancer-preventing qualities

The traditional tools of cancer treatment – chemotherapy and radiotherapy – are far from perfect.

Promising new techniques are being developed to augment the body's own defence and regulation systems, with the aim of personalised and targeted treatments that avoid damage to healthy cells while effectively working against tumours.

Cytotoxic T lymphocytes (CTLs, also known as CD8+ T cells) can destroy cancerous and transformed cells, and can be stimulated to better recognise the markers of particular cancers and to improve their antitumour activity.

Research shows that effector T cells (activated cells that defend the body in an immune response) collected at an early stage of tumour growth act with greater efficiency than those collected later in the cancer's development; early harvested T cells are therefore the best candidates for immunotherapeutic cultures.

However, such T cells maintained in the laboratory will lose their functionality over successive generations, reverting to regulatory states and ageing faster.

Jorge Luis Galeano Niño, a PhD student in the Biro group, published an article in *Immunology and Cell Biology* in which expanded cultures of murine tumour-reactive CTLs were stored using cryopreservation before thawing.

These cells were found to completely retain their viability for up to 10 months, and maintain levels of antitumour activity; they were able to infiltrate and reject E.G7-OVA tumours in mice with the same efficiency as freshly isolated T cell cultures.

The ability to amplify and store the body's defence weapons could facilitate the development of targeted, effective methods of completely destroying tumours without damaging healthy tissue.

This work is a promising development on the path to personalised cancer treatment.

Galeano Niño JL, Kwan RYQ, Weninger W, Biro M (2016) Antigen-specific T cells fully conserve antitumour function following cryopreservation. Immunology and Cell Biology, 96: 411-418.

Building bodies by manipulating stem cells

Satellite stem cells are the body's safeguards against injury; following muscle damage, they enter the cell cycle to regrow healthy cells and restore tissue function.

In the case of severe injury, or surgery, synthetic biomaterial scaffolds are inserted to assist these cells in effectively rebuilding muscle tissue.

The shape of the scaffold has traditionally been thought to play a passive role in regrowth, providing a backdrop for biochemical cues to regulate cell growth and differentiation.

However, work in recent years has shown that the mechanical and textural properties of the biomaterial is just as important in determining the fate of stem cells and the success of the regeneration.

Peter Newman, a PhD student from the University of Sydney who is co-supervised by Dr Maté Biro and biomedical engineer Professor Hala Zreiqat, discovered a way to manipulate stem cells into producing more successful regeneration of specific tissues.

Their article in *Scientific Reports* used innovative fluorescence time-lapse imaging to monitor the growth and shape of adipose-derived stem cells on three different scaffold types over 21 days.

By aligning carbon nanotubes on glass to create a textured microtopography, they induced the spherical fat cells to quickly develop the elongated shape of muscle cells in the parallel arrangement critical to correct muscle function.

This work is in early stages; the cells did not completely differentiate into muscle cells, and it is likely that further biochemical cues will be needed to drive full commitment to myogenesis.

But the new imaging techniques tested here can be further used to find clear relationships between scaffold shape and stem cell outcomes, and could combine with advances in nanofabrication techniques to provide better environments for manipulating stem cells and regrowing tissue.

Newman P, Galeano Niño JL, Graney P, Razal JM, Minett AI, Ribas J, Ovalle-Robles R, Biro M, Zreiqat H* (2016) Relationship between nanotopographical alignment and stem cell fate with live imaging and shape analysis. Scientific Reports, 6: 37909.*

Gambin Group

Yann Gambin joined the EMBL Australia Node in Single Molecule Science at UNSW as a group leader in July 2015. He is also an Associate Investigator at the Australian Research Council Centre of Excellence in Advanced Molecular Imaging.

The Gambin Group uses a novel approach to research how certain proteins clump together, leading to cell death and diseases affecting the brain, heart, muscle and other areas on the body.

They are developing new single-molecule approaches to detect the early signs of protein 'misbehaviours' and open new therapeutic avenues for neurodegenerative diseases, such as Parkinson's disease.

By using a cell-free protein expression system, the proteins under study do not require separation and purification from other cellular material, speeding up the process by a factor of ten and better preserving the protein's structure and function.

In 2016, the Gambin Group created a special one-day scientific event for Tigger's Honeypot Childcare Centre at the University of New South Wales to teach four and five-year-old children about microscopy, microbes and other small living organisms.

New methods of studying aggregating proteins pay off

The misfolding and pathological aggregation of proteins is a hallmark of many neurodegenerative diseases.

In Parkinson's or Alzheimer's disease, the formation of protein clumps and plaques is known to create havoc in the cells. In synucleinopathies, such as Parkinson's disease, large protein aggregates called Lewy bodies are found.

Although synuclein is the main component of Lewy bodies and the most studied protein, these structures contain more than 70 other proteins. Many of these proteins could play a major role in the development of the disease, and represent new targets for the development of drugs.

Many of these proteins may not participate in the formation of the structure itself, but might be recruited at a later stage or just be "sticky" proteins (proteins that misfold and promote clumping or aggregation).

The Gambin Group first set about developing methods to identify which proteins can co-aggregate and decipher the order in which these aggregates are formed. The first hurdle for studies of these Lewy bodies is obtaining sufficient amounts of the individual proteins to perform tests.

In general, protein purification is a time-consuming step which can also potentially alter protein structure and function, providing misleading results. Many of these proteins have a natural propensity to aggregate and are almost impossible to purify. The Gambin Group created a unique combination of single-molecule methods and 'on-demand' cell-free protein expression to quantify protein clumping and do away with the need to purify proteins beforehand. In these measurements, one can visualise individual proteins and watch as they come together in larger clumps.

This combination quickly revealed surprising results, published in two separate studies in 2016.

When studying pathological mutants of synuclein – the main protein involved in the formation of the Lewy bodies – the group discovered that oligomers and protein fibrils formed 100 times faster in cell-free systems than from purified proteins. Proteins also aggregated at much lower concentrations, compatible with physiological levels, solving a long-standing issue for the field.

The characterisation of the pathological mutants also revealed unexpected differences in behaviour and suggested, for the first time, that the molecular mechanisms at play are very different. In short, these cases probably represent different diseases. These findings were published in *Scientific Reports*.

The Gambin Group started to screen for the behaviour of other disease-related proteins, building up their large effort towards a comprehensive mapping of the neuronal 'aggregosome', containing all the proteins that could form pathogenic inclusions in the brain. In collaboration with Professor Frederic Meunier (Queensland Brain Institute, University of Queensland), the group characterized the propensity of aggregation of a protein called Munc18-1. A range of Munc18-1 disease-causing mutations have recently been identified with several developmental defects and neurodegenerative phenotypes, such as early infantile epileptic encephalopathy.

The collaboration discovered that the mutation creates an unexpected gain-of-function by making the protein fibrillate. These fibrils had the ability to self-replicate, grow and trap the 'normal' protein into aggregates, depleting the pool of active proteins.

The group then looked for other proteins that could be affected by this process.

Here, the Gambin Group's screening approach paid off – they uncovered a new link between Munc18-1 and synuclein and showed that in normal conditions Munc18 actually prevents the aggregation of synuclein. This discovery was published in the *Journal of Cell Biology*.

South Australian Node

Steve Wesselingh
South Australian node head

Steve Wesselingh is the Executive Director of the South Australian Health and Medical Research Institute (SAHMRI) and leader of its Infection and Immunity Theme. He was appointed as the head of the Partner Laboratory Network's South Australian Node in July 2015. The node head provides scientific mentorship and guidance to the group leaders in the node.

Steve Wesselingh has spent decades researching in the fields of neurovirology, HIV and vaccine development and now focusses on the role of microbiome in immune development, an area in which he is collaborating with EMBL Australia group leader David Lynn.

The highly respected Professor – whose previous roles have included Dean of Medicine, Nursing and Health Sciences at Monash University and Director of the Burnet Institute – has consistently worked towards the integration of high quality medical research with healthcare delivery, leading to improved health outcomes for Australia and poorly resources countries in the Asia-Pacific region.

Apaja Group

Pirjo Apaja joined EMBL Australia as a group leader in April 2016, based in the Nutrition and Metabolism Theme, Hopwood Centre for Neurobiology at SAHMRI.

The Apaja Group researches the functional crosstalk between signalling and protein networks in membrane trafficking.

The group is currently investigating regulation of neuron-astrocyte homeostasis using proteins associated with human brain diseases.

Her laboratory combines experimental cell biological and biochemical systems to study protein-protein interactions and signalling using targeted proteomics and advanced light microscopy.

Fine-detailed FRET work

The generous financial support EMBL Australia offers its researchers allows them to access the state-of-the-art facilities and equipment needed to pursue their ambitious research goals.

To this end, one of Associate Professor Apaja's first moves as a new group leader in 2016 was to arrange the installation of a ratio/FRET (fluorescence resonance energy transfer) microscope in her lab.

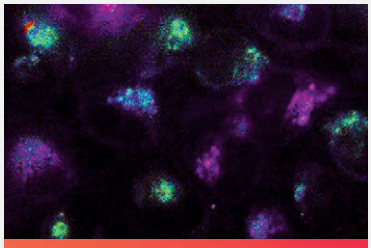
Ratio/FRET microscopy is a recent advance in fluorescence imaging technology.

Traditional fluorescence imaging lacks the spatial resolution needed for fine understanding of protein interactions, using the proximity of molecules within a cell to infer their relationship to each other.

By looking at the specific signatures of energy transfers between a protein and its surroundings, ratio/FRET microscopy gives researchers the opportunity to monitor single protein molecules as they are trafficked through a living cell.

A/Prof Apaja's team are able to use this technology to promising effect, studying how molecules move through organelles in cells and how organelle function changes in disease conditions.

Mapping these pathways can explain how organelles lose function and structure during certain diseases – many neuronal disorders, for instance, stem from the dysregulation of membrane trafficking and signalling in endolysosomes.



Visualisation of signalling in endosomes using FRET. Image supplied.

Slowed and steady improvement

Cystic fibrosis (CF) is one of the most common genetic diseases in Caucasian Australians, with some Tasmanian communities showing the second-highest rate of CF occurrence in the world.

Malfunctions in the body's secretory systems result in an overproduction of thick mucus that undermines digestion, obstructs the airways, and greatly increases the risk of damaging lung infections.

There are around 2000 different mutations that result in the disease, with varying seriousness; all affect the ability of the CF transmembrane conductance regulator (CFTR) to control what enters and leaves surface cells.

A/Prof Apaja's team worked with an international group of scientists across Canada and the USA to uncover a key way to improve the outcome of CFTR function. Their work was published in *PLOS Biology* in May 2016.

"My lab here in Australia is working on cross-talk between membrane trafficking, signalling and ion fluxes," A/Prof Apaja says.

"One of the questions is how protein conformation influences protein function and trafficking, and how we can harvest these events to search for, or develop, therapeutics.

"In the *PLOS Biology* paper collaboration, we ventured to the very early stages of the biosynthetic pathway to study the effect of translation speed as a potential therapeutic target to correct folding defects."

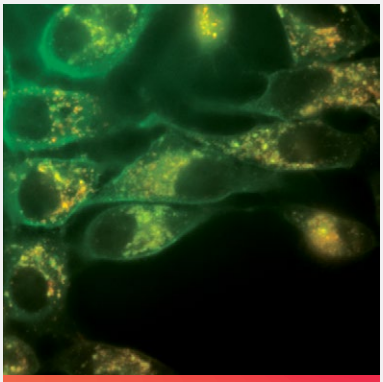
The specific CFTR mutation addressed in the article, a deletion of phenylalanine 508, prevents the long polypeptide chains from folding themselves into the correct 3D configuration.

"We discovered that intrinsically slow and inefficient folding of complex multi-domain membrane proteins CFTR and hERG can be rescued by slowing down the translational elongation," she says.

Slow translation further enhanced folding of disease-associated mutants for these ion channels.

"This study was a good thing for us, because we are facing similar questions with another protein we are working on. It is also a blast from the past, because I started my research studying maturation efficiency of membrane proteins at the early biosynthetic pathway."

The article showed that slowing the assembly of the mutant protein improves its function to 50% of a wild-type channel when combined with treatment using the CF corrector VX-809.



Imaging autophagosomes.

Lynn Group

David Lynn joined EMBL Australia as a group leader in March 2014. He is based in the Infection and Immunity Theme at SAHMRI.

The Lynn Group researches the regulation of innate immunity, as well as two aspects of vaccines: their effect on mortality and morbidity, independent of their role in preventing the targeted diseases; and how particular vaccines can assist immune cells to be more responsive to unrelated antigens.

The group applies these integrative biology approaches to human health. The Lynn Group develops novel computational analysis tools to facilitate this research, including new network analysis and visualisation tools. They administer the high-performance computing system that provides the computational infrastructure for bioinformatics across SAHMRI.

The Lynn Group participated in a range of engagement activities in 2016 – from having a film crew in the lab for a *Wall Street Journal* story on Australia's innovation economy, to hosting school student for a day.

Funding research into the gut's impact on vaccine response

Our bodies host a myriad of microorganisms in a complex symbiosis that affects our daily lives, our moods and our health.

The gut microbiome is particularly abundant and diverse; it is becoming accepted that disruption to the composition of the gut microbiota has consequences throughout the body.

The Lynn Group began receiving NHMRC funding in 2016 to investigate how antibiotic-driven microbial imbalance in the gastrointestinal tract could affect the immune system. They hypothesised that the success of vaccine immunogenicity in newborns could depend on a functional and heathy gut microbiome, and that newborns who start out with a disrupted gut microbiota would experience an impaired vaccine response.

By treating pregnant mice with antibiotics, limiting their pups' exposure to a typical range of microorganisms, the Lynn Group will investigate the antibody responses in newborns to five real-world vaccines.

Vaccines protect us from disease at an enormous scale, coming second only to water cleanliness as a goal of public health, but there is still unexplained variation in their effectiveness from one person to another.

Finding ways of improving vaccine success can better protect us from pathogens and also help us probe the workings of the immune system itself.

Colorectal cancer flight maps

Understanding why some cells turn cancerous is an ongoing mission, and research continues to identify genetic mutations associated with cancers of many kinds.

But a mutation alters the function of a single gene, or the creation of a single protein, and the growth of a tumour is the result of many safeguard failures.

Genes don't function in isolation. Network medicine identifies the connections and interactions between genes, finding the pathways through which a mutation can ripple and cascade to cause widespread alteration, even in non-defective genes.

By finding the nodes (genes and proteins) connected to a mutation, it is possible to focus on downstream parts of the network to determine which treatments will be most effective in reverting the system from pathological to normal.

In a boon for Australian research, Associate Professor Lynn has brought his work with PRIMES (Protein Interaction Machines in Oncogenic EGF Receptor Signalling) to SAHMRI and EMBL Australia.

PRIMES is a 13-partner European project investigating the interactions of proteins during health and disease and, with the bioinformatics computing power available at SAHMRI, the Lynn Group has been deducing the interactions of the epidermal growth factor receptor (EGFR) network – a key factor in the development of colorectal cancer.

Their software, DyNet, was developed to map the regulation of nodes in a cell with a mutant KRAS gene, a famously 'undruggable' mutation in causes of colorectal cancer. DyNet can identify which nodes have been rewired in cancerous tissue, allowing both an understanding of the cancer mechanism, identification of possible treatment pathways, and a prediction of individual patients' prognosis – for this and other cancers too.

It's a step closer to accurate and effective treatment.

Mäkinen Group

Ville-Petteri Mäkinen joined EMBL Australia in 2013, becoming a group leader in March 2014. He leads the Molecular Life Course Research Group at SAHMRI.

Diabetes, kidney disease and atherosclerosis often co-occur and interact in vulnerable individuals.

The Mäkinen Group works towards understanding the underlying genetic traits that leave some people susceptible to these diseases, while others live healthy lives despite the same environmental exposures. The disease processes seem to depend on a high number of genes that gradually go out of balance over decades. For this reason, the resulting human datasets are highly complex and the exact causes for disease are difficult to untangle.

The Mäkinen Group applies new and emerging subgrouping and network methods to analyse complex diseases.

For instance, by screening large numbers of metabolites and other molecular traits across many individuals, it is possible to investigate the emergent metabolic phenotypes that predict future clinical end-points, such as heart attacks.

Eventually, this will enable us to understand the combined effects of genetic and environmental factors, and to develop targeted and personalised therapies.

Revisiting research a decade on yields surprising insight into molecular risk factors of diabetic complications

It takes a long time for extra weight to creep on to people's waists, and the same is true for the vascular system; it usually takes decades of sedentary lifestyle to clog the arteries.

Therefore, to study the effects of epidemiological risk factors on age-associated diseases, and premature deaths from those diseases, can take a lifetime, literally.

Type 1 diabetes is an example of a genetic autoimmune disease that cannot be prevented by lifestyle changes as it starts in childhood and adolescence (as opposed to type 2 diabetes, where diet and exercise play a prominent role).

But once someone develops type 1 diabetes, the treatment they get and the life they lead has a profound impact on long-term health, especially those who are genetically susceptible to diabetic complications.

So long-term follow-up is required to determine why some individuals with type 1 diabetes get serious complications, such as diabetic kidney disease or retinal disease.

Kidney disease, in particular, needs to be avoided, as it often goes unnoticed but carries a substantial risk of heart disease (one in ten Australians show signs of kidney disease, but most do not know it).

For this reason, the Mäkinen Group investigates the molecular risk factors for diabetic kidney disease and its effects on heart disease and life span in people with type 1 diabetes in the pursuit of new ways to protect the affected individuals.

In 2008, A/Prof Mäkinen – then a PhD student – published, together with the FinnDiane Study Group, a paper in *Diabetes* on the biochemical 'subtypes' of type 1 diabetes and their statistical relationships to premature death over an eight year follow-up. Now, Dr Raija Lithovious from FinnDiane and the Mäkinen group are revisiting these subtypes and comparing them with new hospital records, serial biochemical data and two decades of personal medication histories.

The first follow-up analyses were completed at the end of 2016, and A/Prof Mäkinen and his colleagues observed that, surprisingly, the relative mortality rates across the six metabolic subtypes had not changed at all between the first period (1997-2007) and 2008-2016.

And there was also a dramatic difference between men and women, when the incidence rates of cardiovascular disease were compared against the general Finnish population – women lost their health advantage over men in the presence of type 1 diabetes.

It is possible that these metabolic subtypes capture the molecular vulnerability of tissues to the adverse effects of diabetes, so the next stage is to leverage recent genomics datasets to better understand the systemic metabolism and to investigate if differences in medications could explain these findings.

On a positive note, it is now clear that metabolically favourable subtypes had only modest increases in cardiovascular risk, despite type 1 diabetes.

Therefore, diabetes itself is not dangerous if its impact on systemic metabolism can be countered.

In the short term, A/Prof Mäkinen's results also have practical value: "Our study focussed on finding subgroups of people who share similar molecular markers and who are at high or low risk of disease," he said.

"Because there are existing medications to target some of these risk factors, our study helps allocate these treatments to the people who will benefit from them the most."

As we are still clueless as to what drives the development of diabetic kidney disease, the added immediate benefit from the subgrouping insights to patients will be much appreciated.

Student Training

EMBL Australia's student programs give Australian PhD students access to first-rate training and networking opportunities in Australia and overseas.

EMBL International PhD Programme:

Australian students have the opportunity to study in a fully funded PhD program at EMBL.

The EMBL International PhD Programme is one of the best life sciences PhD programs in Europe. Its model has spawned many similar programs at science institutions across the world. The high quality of the program was recognised in 1998, when EMBL was authorised to award a PhD degree, either alone or jointly with other universities.

International perspectives from an Australian student at EMBL

Australian student Morgan Oatley entered EMBL's esteemed International PhD Progamme in May 2015, joining the Lancrin Group at EMBL Monterotondo, Italy, where she studies embryonic haematopoiesis. She previously completed her undergraduate and honours degrees at Monash University in Melbourne.

Tell us about your experience in the EMBL International PhD Programme?

Being part of the EMBL International PhD Programme has been an incredible opportunity. There have been many benefits to studying in Europe, but the one that stands out most is having cutting-edge resources that I can access right here at my doorstep.

Another is being part of the collaborative and enthusiastic culture of EMBL – it's a place where researchers are inspired to share information, seek input from those around you and try new techniques. I'm constantly encouraged to challenge myself and to develop multi-disciplinary skills.

What's it like studying at EMBL?

Studying for your PhD overseas can be quite challenging, especially when you are so far away from family and friends. Luckily at EMBL you make friends quickly. EMBL is truly a uniquely international environment, one that has given me many professional and personal development opportunities. On a professional level, I've been able to upskill in all sorts of areas and have had the opportunity to network on an international scale. I have met, interacted and collaborated with people from all around the globe, which is very exciting.

What extra insight have you gained from studying abroad?

One thing EMBL's International PhD Programme has given me is a new perspective on how the tertiary education system operates in Australia compared to that in Europe. In Europe, there is a lot more focus on laboratory experience at the undergraduate level. Therefore, extra laboratory experience is essential for Australian students to compete with European students for a position at the EMBL laboratories. Also, finding a mentor early in your science career is essential.

I have thrived as an EMBL PhD student in Italy and am thankful for the unique opportunity to be a part of EMBL and to study in such an amazing place, with such fantastic people and facilities.

EMBL Australia Partnership PhD Program

EMBL Australia launched its inaugural Partnership PhD Program, in conjunction with UNSW, in 2015 with the aim of attracting some of the best international students to Australian laboratories.

Following the successful pilot program, which saw four exceptional students – Jorge Luis Galeano Niño, Jonathan Franco Berengut, Andre Leitao and Ana Montserrat Martinez – commence their PhD studies at UNSW in early 2016, the program was launched nationally this year.

The program allows students to undertake interdisciplinary, postgraduate research for a PhD degree at one of the EMBL Australia PLN laboratories. Successful applicants for an EMBL Australia Partnership PhD position are invited to apply to the host university for a scholarship to cover a living stipend and, for international students, tuition fees. Supervisors, who are EMBL Australia group leaders or alumni, provide top-up funding, plus travel grants and participation fees for EMBL courses and symposia.

In 2016, EMBL Australia group leaders recruited three students under the program: Milda Kaniusaite (from Lithuania) and Mathias Hansen from Denmark) joined the Cryle Group and Rezvan Karami (from Iran) joined the Martino Group.

EMBL Australia Postgraduate Symposium (EAPS)

The third EMBL Australia Postgraduate Symposium – themed 'Unravelling Nature's Secrets: Using science to see beyond' – was held on 16-18 November 2016 at SAHMRI, Adelaide.

The symposium, organised by students for students, allows research students (Honours, Masters and PhD) from a broad range of disciplines across Australia to present their work to a professional, but less intimidating, audience than that of open-level symposiums. It also provides the opportunity for students to grow their professional network, networking skills and scientific knowledge.

The symposium featured Australian and international speakers, oral and poster presentations from research students and early-career researchers, and informal panel sessions with keynote speakers.

Keynote speakers included:

- Professor John Quakenbush (Harvard University & Dana-Faber Cancer Institute)
- Professor Nadia Rosenthal (Jackson Laboratory)
- Associate Professor David Lynn (SAHMRI)
- Associate Professor Geoff Faulkner (Mater Research – University of Queensland)
- Dr Misty Jenkins (Walter and Eliza Hall Institute)
- Professor Ross Hannan (John Curtin School of Medical Research)
- Professor Michelle Haber (Therapeutic Children's Cancer Institute & UNSW, Faculty of Medicine)
- Associate Professor Julia Heng (Harry Perkins Institute)

The three-day symposium – attended by 108 students from 18 different research organisations – focussed on the use of new technologies and techniques to conceptually and practically model both disease and the environment.

The event was a great success, with plenary speakers and conference delegates complimenting the high calibre of presentations and the superb running of the event.

During the conference, 80 students presented their research to their peers through poster presentations and 18 delivered oral presentations. The best were awarded prizes:

- Best oral presentation: Simon Hardwick, Garvan Institute of Medical Research and the UNSW, on the topic "Spliced synthetic genes as internal controls in RNA-Seq experiments".
- Best poster presentation (Session A): Don Cameron, John Curtin School of Medical Research, The Australian National University, on the topic of "POL I inhibitor cx-5461 functions as a targeted DNA damaging agent to selectively kill tumour cells".
- Best poster presentation (Session B): Marnie Winter, Future Industries Institute, University of South Australia, on the topic of "Detection and characterization of rare disseminated cancer cells; towards improved patient prognostication".
- Best Honours Poster: Kate Galbraith, South Australian Medical Research Institute and the University of Adelaide, on the topic of "Effects of the JAK1/2 inhibitor ruxolitnib on CRLF2 rearranged JAK2 mutant acute lymphoblastic leukaemia".

The EAPS 2016 organising committee:

Co-Chairs:
Julienne O'Rourke
and Tanja Racic

Treasurer:
Beth Signal

Secretary:
Sionne Lucas and
Becky Johnson

Sponsorship:
Jennie Chandler

Marketing (webmaster):
Jessica Anania

Logistics:
Sissy Charitou
and Mike de Ieso

(L-R) Student Programs Coordinator Jane McCausland, EAPS 2016 Convenors Tanja Racic and Julienne O'Rourke, with EMBL Australia Scientific Head Professor James Whisstock

Travel Grants to attend the EMBL PhD Symposium

EMBL Australia awarded 10 travel grants to assist students enrolled at an Australian university in attending the annual EMBL PhD Symposium, held at EMBL's headquarters in Heidelberg, Germany.

The 18th EMBL PhD Symposium – organised each year by second-year PhD students at EMBL – was held between 17 to 19 November 2016 and titled 'Life by Numb3rs: Towards Quantitative Biology'. The student symposium is an excellent training opportunity and enables young scientists to develop their international networks and alliances, paving the way for future intercontinental collaborations.

After careful consideration of the 42 high-calibre students who applied for an EMBL Australia travel grant, the selection panel awarded grants to 10 students (five female and five male) from across Australia: ACT (1), NSW (3), QLD (3), VIC (2) and WA (1).

Outreach

EMBL Australia undertakes a wide range of activities to communicate the value that the associate membership of EMBL brings to its members, potential members and life sciences in Australia generally.

As well as internal communications across its various nodes and regular interactions between group leaders, activities reach beyond the organisation to engage with: other scientists, students, science organisations in Australia and internationally, government departments and funding organisations, business leaders, media and the general public.

To this end, EMBL Australia releases monthly newsletters, maintains a regularly updated website and has an active presence on social media channels like Twitter and Facebook. In 2016, members of the Partner Laboratory Network participated in a public showcase, community outreach activities, external educational and networking events and various media stories.

EMBL Australia Showcase

In July 2016, EMBL Australia showcased its research programs and the benefits of its strong links to EMBL to early-career researchers at the Australian National University in Canberra.

The free public event was a great opportunity for researchers to learn about the depth and breadth of research being undertaken across the EMBL Australia network and to gain an understanding of EMBL Australia's goals and objectives over the coming years.

Attendees heard from special guest EMBL Director Professor Matthias Hentze, EMBL alumnus and Deputy Director of St Vincent's Institute of Medical Research Michael Parker, EMBL-ABR Director Andrew Lonie, six EMBL Australia Group Leaders from three states and two Collaborating Group Leaders.

The one-day event was hosted by Professor Simon Foote, director of the John Curtain School of Medical Research.

Community Outreach

Community outreach activities included:

- The Lynn Group hosted four Year 11 students in their lab for a day to learn about immunology, microbiology and genomics.
- A/Prof Mikaël Martino was invited to present at the Tissue Engineering and Regenerative Medicine International Society-EU, Uppsala, Sweden.
- A/Prof Edwina McGlinn presented a seminar on 'Developmental gene networks: Building an embryo from top to bottom' at the University of Sydney's School of Life and Environmental Sciences.
- The Apaja Group hosted students from local high schools for work experience placements.
- A/Prof David Lynn was on a career panel at the Australian Mathematical Sciences Institute's BioInfoSummer 2016 meeting in Adelaide.
- The Biro Group raised funds and represented charitable organisations Cure Cancer Australia and CanToo.
- The Gambin Group created a one-day scientific event for a childcare centre associated with UNSW to teach four and five-year-old children about microscopy, microbes and other small living organisms.
- A/Prof Mäkinen was one of the organisers of BioInfoSummer 2016 in Adelaide and held a workshop on statistical analyses during the event.

SA Node hosts Finnish delegation to enhance collaborative programs

EMBL Australia's South Australian Node hosted a delegation from the University of Oulu in Finland at SAHMRI in November 2016.

The visitors – including Professor Mika Ala-Korpela, Dr Mari Karsikas and Ms Qin Wang – specialise in population-based large-scale metabolomics and genetics of common human diseases. They are members of the Computational Medicine Research Team, which is collaborating with EMBL Australia research groups at SAHMRI on two projects: one on post-prandial metabolic responses to high-fat meals and the other on genetics of circulating metabolites. The visit served to strengthen their ties and further develop collaborative programs.

L-R: Professor Mika Ala-Korpela, A/Prof Ville-Petteri Mäkinen and SAHMRI Executive Director Professor Steve Wesselingh.

PhD student Qin Wang feeds kangaroos at Cleland Wildlife Park, Adelaide.

Events proudly supported by EMBL Australia

2016 Australian Bioinformatics & Computational Biology Society (ABACBS) annual conference

More than 180 people attended Australia's national bioinformatics conference, held in Brisbane at the Queensland University of Technology (QUT) from 31 October to 2 November. Organised by the Australian Bioinformatics and Computational Biology Society (ABACBS) and a hard-working local organising committee, the conference was held in conjunction with QUT's annual B3: Big Bioinformatics and Biology Symposium, cumulating in the AB3ACBS Festival of Bioinformatics.

The conference kicked off with the COMBINE Student Symposium, which comprised eight student talks and a panel discussion attended by around 80 people (mainly students). As well as financially supporting the event, EMBL Australia had members of its South Australian node – Dr Song Gao and Dr Aaron Casey – present their work at the ABACBS conference.

Other invited speakers included: bioinformatician and plant evolutionary biologist Kate Hertweck (from the University of Texas at Tyler); leader in bioinformatics education and training Terry Attwood; metabolomics specialist Ute Roessner (University of Melbourne); computational evolutionary biologist Simon Ho (University of Sydney); bioinformatics and cancer genomics expert Andreas Schreiber (Centre for Cancer Biology, Adelaide); microbial bioinformatics specialist Nouri Ben Zakour and statistical bioinformatician Matt Ritchie (WEHI, Melbourne).

Image (bottom right)

Dr Song Gao – a research fellow in the Mäkinen Group – presenting his work at the ABACBS Conference.

The Australian Mathematical Sciences Institute's BioInfoSummer 2016

More than 200 attendees from around Australia and the world came together for BioInfoSummer 2016 at the University of Adelaide in late November to learn the newest trends and methods in bioinformatics and take this new knowledge back to their labs.

One of the flagship events of the Australian Mathematical Sciences Institute (AMSI), the annual symposium provides bioinformatics training to students, researchers and other professionals with both specialist lectures and hands-on workshops, including computing and wet lab sessions.

EMBL Australia was an official supporter of BioInfoSummer 2016, held from 28 November to 2 December, and the Mäkinen Group from the SA node was involved in its organisation and delivery. EMBL Australia group leader A/Prof Ville-Petteri Mäkinen ran a workshop where researchers analysed data from diabetic kidney disease using permutations and bootstrapping to learn how to spot significant differences between clinically relevant groups. Other members of the SA Node supported the event and group leader A/Prof David Lynn featured on a careers panel.

BioInfoSummer had a great line-up of national and international speakers, including A/Prof Xia Yang from the University of California, Los Angeles (UCLA), FIMM-EMBL group leader Dr Simon Anders from the Institute for Molecular Medicine Finland, and EMBL-ABR bioinformatician Dr Philippa Griffin.

2016 Winter School in Mathematical and Computational Biology

The 2016 Winter School was attended by 245 participants and speakers from 57 institutions – with some researchers and students coming from as far as Spain, Poland, Taiwan, Malaysia and Germany to attend the event.

A mix of international and local experts gave 35 presentations in the field of bioinformatics. Highlights included talks by: a founder of the field of metagenomics, marine microbiologist Professor Edward DeLong from the University of Hawaii; President of the International Society for Computational Biology Professor Burhard Rost (Technical University of Munich); and Dr Kate Patterson from the Garvan Institute of Medical Research on visualisation and experimentation at the interface of art and design. Happily, gender balance was a feature of this year's event, with almost equal numbers of male and female presenters and workshop leaders.

Practical training workshops – including a Genomics Virtual Laboratory training workshop, Software Carpentry Bootcamp and a workshop on protein visualisation tool, Aquaria – were oversubscribed. Sponsorships contributed to the high calibre program of speakers, as well as student travel scholarships, which enabled 11 talented students to attend the informative course.

Images

01

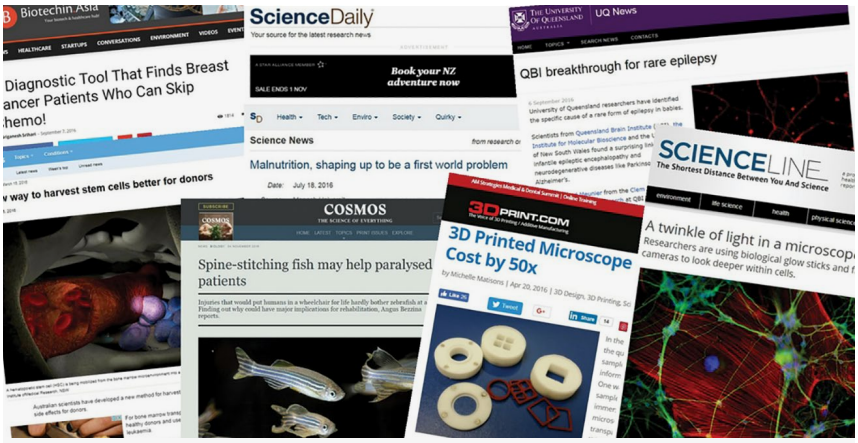
Marine microbiologist Professor Ed DeLong (University of Hawaii) presenting on systems biology of the sea at the 13th Annual Winter School in Mathematical and Computational Biology.

02

Professor Burkhard Rost (Technical University of Munich) taking a question during a Winter School panel discussion.

Media

- American newspaper *The Wall Street Journal* filmed in the Lynn Group lab for a story on Australia's innovation economy.
- A/Prof Max Cryle was interviewed on SBS Radio for a segment titled 'The threat of antibiotic-resistant bacteria'.
- Professor Peter Currie was quoted in a number of stories for various publications, including ***Cosmos Magazine*** ('Spine-stitching fish may help paralysed patients') and ***Medical Xpress*** ('New way to harvest stem cells better for donors')
- Scientia Professor Katharina Gaus was quoted in a number of stories for various publications, including ***ScienceLine*** ('A twinkle of light in a microscope's eye') and ***ScienceDaily*** ('Malnutrition, shaping up to be a first world problem') .



EMBL Australia Council

Council Chair

Prof Brandon Wainwright
Universities Australia

Brandon Wainwright is a Professor of Molecular Genetics and Director of the Institute for Molecular Bioscience (IMB) at The University of Queensland. His research interest is developing new therapeutic approaches for paediatric brain tumours and his group was the first to identify a causative gene for any brain tumour. Prof Wainwright has been a member of the EMBL Australia Council since its inception and was elected Chairperson in December 2015.

Council Secretariat

Mr Silvio Tiziani (until Sep 2016)
EMBL Australia

Silvio Tiziani was the Executive Director of EMBL Australia from its establishment until late 2016, when he moved into the role of Director of External Relations and Strategy at the Australian Regenerative Medicine Institute at Monash University. Mr Tiziani has an extensive knowledge of the research landscape and a network of contacts in industry, tate and federal government and international organisations.

Ms Maree Trovato (from Sep 2016)
EMBL Australia

Maree Trovato took on the role of EMBL Australia Chief Operating Officer and Council Secretariat in September 2016. She has considerable experience in international relationship management, business development and operational expertise from various roles within the higher education and public service research sectors.

Council Members

Prof Iain Mattaj
EMBL

EMBL Director General Professor Iain Mattaj is a distinguished scientist whose contributions have been recognised by his election as a Fellow of the Royal Society (London), Fellow of the Royal Society of Edinburgh, Member of Academia Europaea, Foreign Honorary Member of the American Academy of Arts and Science, Fellow of the Academy of Medical Sciences (London) and Foreign Associate of the National Academy of Sciences (US). He is a member of the European Molecular Biology Organisation (EMBO) and helped make *The EMBO Journal* a highly successful international scientific journal, acting as Executive Editor from 1990 to 2004.

Dr Silke Schumacher
EMBL

Dr Silke Schumacher has a degree in biology and in public administration and is the Director of International Relations at EMBL-Heidelberg. She is responsible for all government and EU relations at EMBL, as well as relations with EIROforum, and she oversees the European Learning Laboratory for the Life Sciences. She studied Biology at the University of Hamburg and holds a PhD in Structural Biology from the Université Paris XI. She worked in pharmaceutical business development and communications before moving into international relations.

Prof John Carroll
Universities Australia

Prof John Carroll obtained his PhD from the University of Adelaide before moving to the MRC Experimental Embryology Unit in London. He joined University College London (UCL) in 1996 and became Director of the UCL Division of Biosciences in 2007. Since moving to Monash in 2012, Prof Carroll has led the formation of the Monash Biomedicine Discovery Institute. His research focusses on understanding the mechanisms of oocyte development, maturation and fertilisation in mammals. His laboratory is known or using live cell imagery to address questions that improve understanding of oocyte polarity, the control of meiosis and the fidelity of chromosome segregation in the oocyte and early embryo. His research has been funded by long term MRC Programme Grants and the ARC, and the results published in leading journals, including *Nature Cell Biology, Science, Developmental Cell, Development* and *Journal of Cell Biology.*

Prof Frank Gannon
Association of Australian Medical Research Institutes

Professor Frank Gannon is the Director and CEO of QIMR Berghofer Medical Research Institute. He joined QIMR Berghofer in January 2011, having been Director General and board member of Science Foundation Ireland (SFI) since 2007. He obtained his PhD from the University of Leicester, England in 1973 and worked subsequently in the USA, France, Ireland and Germany, where he was Executive Director of the European Molecular Biology Organisation (EMBO) and Senior Scientist at EMBL from 1994-2007. His major research interest is the regulation of gene expression by the oestrogen receptor, which plays a major role in breast and endometrial cancer.

Dr Paul Savage
CSIRO

Dr Paul Savage is the Research Director of CSIRO's Biomedical Manufacturing Program. The Program's aim is to work collaboratively with existing companies in the Australian biomedical industry to develop new and innovative devices, materials and processes, thereby leading to growth, global competitiveness and economic benefits. Paul has a PhD in synthetic heterocyclic chemistry from the University of Queensland, and an MBA

(Technology Management) from the Chifley Business School, La Trobe University. He joined CSIRO in 1990 following a postdoctoral fellowship at the University of Florida and is a Fellow of the Royal Australian Chemical Institute and a Fellow of the Australian Institute of Company Directors.

Professor Robert Saint AM
Universities Australia

Professor Robert Saint is Vice-President and Deputy Vice-Chancellor (Research) at Flinders University. After gaining his undergraduate, honours and PhD degrees from the University of Adelaide, Professor Saint was a postdoctoral fellow at Stanford University and at the Walter and Eliza Hall Institute for Medical Research. He pioneered research into cell cycle control during animal development at the University of Adelaide and held senior roles at the Australian Research Council, the Australian National University, the University of Melbourne, where he was appointed Dean of the Faculty of Science in 2009, and the University of Adelaide, where he was Pro Vice-Chancellor (Research Strategy). Professor Saint has been awarded the Julian Wells Medal of the Lorne Genome Conference, the MJD White lectureship of the Genetics Society of Australia and the President's medal of the Aust. New Zealand Society for Cell and Developmental Biology. In 2017, he was appointed a Member of the Order of Australia for service to tertiary education as an academic, administrator and researcher, and to the biomedical and molecular sciences.

Prof Andrew Sinclair
Association of Australian Medical Research Institutes

Professor Andrew Sinclair is Deputy Director of the Murdoch Children's Research Institute and a Professor in the Department of Paediatrics at The University of Melbourne. Nationally, Professor Sinclair co-leads the Australian Genomic Health Alliance, a network of over 40 organisations that aims to integrate genomics into the Australian health care system, and is in the Executive Management group of Melbourne Genomics. He leads an NHMRC research program (2004-2019) focussing on disorders of sex development (DSD); genomics and diagnosis to inform clinical care. His contributions have been fundamental to the advancement of the field, including significant gene discovery and development of an accurate, rapid diagnostic assay that has improved outcomes for patients with DSD.

Mr Andrew Gilbert
Bioplatforms Australia

Andrew is the General Manager of Bioplatforms Australia, overseer of a $150 million Commonwealth Government research infrastructure investment in the discovery sciences of genomics, proteomics and metabolomics. In addition to managing the national infrastructure network (which supports 4500 users per annum across the spectrum of pure research to commercial production), Bioplatforms Australia has catalysed the formation of a series of strategic national scientific collaborations – in the broad themes of wheat productivity and quality, Great Barrier Reef genomic surveying, wine characterisation and development, native fauna sequencing and melanoma biology. Prior to his current endeavours, Andrew was the Commercial Manager for Life Therapeutics and involved in a broad range of activities surrounding the commercialisation of cutting-edge biotechnology developments.

Prof Sarah Russell
Universities Australia

Professor Sarah Russell has a background in immune cell signalling, particularly T-cell development and fate determination. Her research interest is in the control of cell fate determination and leukemogenesis by polarity, asymmetric cell division and the tumour suppressor proteins of the Scribble family. She has expertise in microscopy and image analysis, particularly time-lapse microscopy, quantitative image analysis and super-resolution microscopy.

Dr David Hansen
Universities Australia

Dr David Hansen is CEO of the Australian e-Health Research Centre, CSIRO's Digital Health Research Program and a joint venture between the CSIRO and Queensland Health. Dr Hansen leads a research program of over 80 scientists and engineers developing technologies for improving our healthcare system across health informatics, biomedical informatics and health services research. He worked at the European Bioinformatics Institute in 1998, before leaving to join LION Bioscience with the SRS technology team.

Representative from the Australian Government Department of Education and Training

The Department of Education and Training – which operates the National Collaborative Research Infrastructure Strategy (NCRIS), the initiative that funds Australia's associate membership to EMBL – has a standing seat at the EMBL Australia Council.

Meetings

Members of the EMBL Australia Council met twice in 2016, on 12 July 2016 and 14 December 2016, in Melbourne to oversee the strategic direction of the range of activities under the associate membership to EMBL.

Funding and stakeholders

Financial report

Statement of income and expenditure for the year ending 31 December 2016

	Note	ARMI Managed		BDI Managed	Total
		Secretariat	Research	Secretariat	
		$	$	$	$
Income					
Internal Support (Monash Contribution)		810,472	1,281,665	413,620	2,505,757
Commercial (Conference Sponsorships, Fees)	*1*	88,138	–		88,138
Interest earned on invested income	*2*	21,645	–		21,645
Total income		920,255	1,281,665	413,620	2,615,540
Expenditure					
Personnel and Related		147,965	538,541	44,522	887,380
Central and Falculty Overheads	*3*	805,471	–		1,828,659
Lab & Operating Expenses		124	284,161		284,285
Communications, Printing & Stationery	*4*	119,423	351	15,996	135,770
Travel & related Expenses		66,774	44,363	8,248	119,385
Sponsorships (Grants / Donations)	*5*	130,109	–	(76,000)	54,109
Student Prizes / Awards / Stipends		40,829	4,161		44,991
Staff Recruitment & Advertising		16,112	–	170	16,282
Other Operating Expenses		49,425	13,992	6,829	70,247
Recovery between programs		456,324	(456,324)		
Total Expenditure		1,832,558	585,597	(235)	2,417,920
Net Balance for the year		(912,203)	696,068	413,855	197,620
Opening Balance as at 1 January 2016		446,753	412,878	–	859,630
Closing Balance as at 31 December 2016		(465,550)	1,108,946	413,885	1,057,250

Notes

01 Income generated to support the EMBL Australia PhD Symposium, Nov 2016

02 This represents interest earned by Monash on the principle Commonwealth Funding Agreement 2009

03 Monash contribution to Central and Faculty Overheads

04 Communication consultants, The Social Science & Monkii Pty Ltd

05 Bioinfomatics Network Collaboration sponsorship agreement with CSIRO

06 Biomedicine Discovery Institute (BDI) commenced hosting EMBL Aus from 1 July 2016

Auditor's report

RSM

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INDEPENDENT AUDIT REPORT
EMBL AUSTRALIA PARTNER LABORATORY NETWORK

This audit opinion is prepared for the purpose of the Grant Agreement dated 11th December 2009 for the EMBL Australia Partner Laboratory Network ("the Project") between the Commonwealth of Australia as represented by the Department of Innovation, Industry, Science and Research and Monash University.

Scope

We have conducted an independent audit in accordance with Australian Auditing Standards of the attached Statement of Income and Expenditure ("the Statement") for the period 1 January 2016 to 31 December 2016. The Statement specifies an amount of $2,417,920.00 of Expenditure and an amount of $2,615,540.00 of contributions towards the EMBL Project comprising of the Secretariat and Research programs.

Our audit has been conducted in accordance with the Australian Auditing Standard ASAE 3000 '*Assurance Engagements Other than Audits or Reviews of Historical Financial Information*'. Our audit involved an examination, on a test basis, of evidence supporting the amount of the grant funds incurred, and the amount of the income received on the Project. This included an examination of the University's financial records, and receipts, and an evaluation of the policies and procedures used to calculate the expenditure on the Project. These procedures have been undertaken to form an opinion as to whether the methodology used to calculate the expenditure is in accordance with the Agreement, and that the figures stated are true and fair.

The Audit Opinion expressed in this report has been formed on the above basis.

Audit Opinion

We confirm that in our opinion:

- The Statement of Income and Expenditure is true and fair;
- The funding was expended for the Project in accordance with the Agreement (Expenditure of $2,417,920.00 and Contributions of $2,615,540.00); and
- The balance of funds as at 31 December 2016 is $1,057,520.00.

RSM Australia
Chartered Accountants

K DUNDON
Director
27 March 2018
Melbourne, Victoria

Funding and in-kind support

The following in-kind and financial contributions to the EMBL Australia initiative are acknowledged:

Commonwealth Department of Education and Training

Financial support of Australia's associate membership of EMBL via the National Collaborative Research Infrastructure Strategy (NCRIS).

Monash University

Operational budget for EMBL Australia Council Secretariat and Partner Laboratory Network activities, including student programs and EMBL Australia secretariat staff salaries, office accommodation and corporate support services (including legal and payroll).

Partner Laboratory Network host institutions

Monash University

South Australian Health and Medical Research Institute

University of New South Wales

Council Secretariat and Partner Laboratory Network Secretariat host

Monash University

EMBL Australia Bioinformatics Resource host

The University of Melbourne

Affiliations

EMBL Australia has affiliations with the following organisations:

- Australian Genome Research Facility
- Australian Microscopy and Microanalysis Research Facility
- Australian Nuclear Science and Technology Organisation
- Australian Phenomics Facility, Australian National University
- BioGrid Australia
- Bioplatforms Australia

Appendix 1.
Staff and students

Research staff and students

Apaja Group
Assoc Prof Pirjo Apaja,
Group Leader

Sandra Isenmann,
Senior Research Assistant

Tina Rozaklis,
Research Assistant

Biro Group

Dr Maté Biro,
Group Leader

Feyza Colakoglu,
Research Assistant

Dr Jorge Luis Galeano Niño,
PhD Student

Matt Alfred Govendir,
PhD Student

Dr Szun S. Tay,
Postdoctoral Fellow

Dr Hernan Carol Garis,
Lab Manager

Cryle Group

Assoc Prof Max Cryle,
Group Leader

Dr Thierry Izore,
Postdoctoral Fellow

Dr Jennifer Payne,
Postdoctoral Fellow

Dr Julien Tailhades,
Postdoctoral Fellow

Melanie Schoppet,
Research Assistant

Kieren Watkins,
Honours Student

Hengkang Yan,
Honours Student

Davidovich Group

Assoc Prof Chen Davidovich,
Group Leader

Vita Levina,
Lab Manager

Qi Zhang,
Postdoctoral Fellow

Nicholas McKenzie,
Honours Student

Gambin Group

Dr Yann Gambin,
Group Leader

Emma Sierecki,
Research Fellow

Mehdi Moustaqil,
PhD Student

Ailis O'Carroll,
PhD Student

Ana Monserrat Martinez,
PhD Student

Andre Leitao,
PhD Student

Nichole Giles,
Research Assistant

Akshay Bumkhar,
Research Assistant

Dominic Hunter,
Research Assistant

Lynn Group

Assoc Prof David Lynn,
Group Leader

Dr Miriam Lynn,
Senior Postdoctoral Fellow

Dr Damon Tumes,
Senior Postdoctoral Fellow

Dr Sriganesh Srihari,
Senior Research Scientist

Dr Max Moldovan,
Bioinformatics Research Officer

Dr Stephen Blake,
Postdoctoral Fellow

Ms Anastasia Sribnaia,
Postdoctoral Fellow

Ms Tanja Meutze,
Bioinformatics Research Officer

Ms Priyanka Pillai,
Senior Postdoctoral Fellow

Dr Kenneth Bryan,
Senior Postdoctoral Fellow

Mr. Manuel Bernal-Llinares,
Senior Software Developer

Ms Theodosia Charitou,
PhD Student

Dr Damien Drew,
Advanced Placement
Medical Student

Dr Ben Tucker,
Advanced placement
Medical Student

Ms Laura Sourdin,
Honours Student

Mr John Salamon,
Honours Student

Mäkinen Group

Assoc Prof Ville-Petteri Mäkinen,
Group Leader

Dr Aaron Casey,
Postdoctoral Research Fellow

Dr Song Gao,
Postdoctoral Research Fellow

Dr Stefan Mutter,
Postdoctoral Research Fellow

Ms Kara Paxton,
Undergraduate Student

Ms Carrie Warden,
Undergraduate Student

Ms Anindita Goswami,
Masters Student

Martino Group

Assoc Prof Mikaël Martino,
Group Leader

Ziad Julier,
Postdoctoral Fellow

Anthony Park,
Research Assistant

McGlinn Group

Assoc Prof Edwina McGlinn,
Group Leader

Heidi Bildsoe,
Postdoctoral Fellow

Victoria Garside,
Postdoctoral Fellow

Lisa Wong,
Research Assistant

Laura Stein,
UROP Student

Daniel Sweeney,
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Prof Thomas Preiss,
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EMBL Australia Secretariat

Prof Nadia Rosenthal,
Scientific Head (until March 2016)

Prof James Whisstock,
Scientific Head (from March 2016)

Silvio Tiziani,
Executive Director
(until September 2016)

Maree Trovato,
Chief Operating Officer and Council
Secretariat (from September 2016)

Laura Crilley,
Executive Officer

Jane McCausland,
Student Program Coordinator

Penny Rowlett,
Finance Officer

Appendix 2. Publications

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Appendix 3. Grants

These are the grants awarded to EMBL Australia Group Leaders in 2016.

Victorian Node

Funding body	Grant type	Host institution	EMBL Australia group leader(s)	Project title	Amount awarded	Years funded
National Health & Medical Research Council	Equipment grant	Monash University	Chen Davidovich, Max Cryle	Beckman Coulter Optima Analytical Ultracentrifuge (AUC)	$80,000	1
Monash University	Universities Australia – DAAD 2016 Australia – Germany Joint Research Co-operation Scheme results	Monash University	Max Cryle	Characterisation of novel glycopeptide antibiotic biosyntheses pathways	$23,000	2
Australian Research Council	Equipment grant	Monash University	Max Cryle	A collaborative electron microscopy pipeline for structural biology	$382,500	1
Australian Research Council	Discovery project grant	Monash University	Max Cryle	Development of a bio-enabled synthesis for the Glycopeptide Antibiotics	$281,000	3
Australian Research Council	Discovery Early Career Researcher Award	Monash University	Mikaël Martino	Understanding how T cells modulate stem cells and tissue regeneration	$410,507	3
Astellas Foundation for Research on Metabolic Disorders	Project grant	Monash University	Mikaël Martino	Understanding and controlling the immune regulations of tissue regeneration	$15,350	2
National Health & Medical Research Council	Project grant	Monash University	Edwina McGlinn	Redefining proprioceptive circuitry at a molecular level	$546,226	3
National Health & Medical Research Council	Equipment grant	Monash University	Edwina McGlinn	Ultramicroscope II: 3D Fluorescence Light-Sheet Microscopy from Macro Structure to Cellular Resolution	$100,000	1
National Health & Medical Research Council	Equipment grant	Monash University	Edwina McGlinn	Fluorescent Fish: Installation of fluorescence microscopes for screening of fluorescent transgenic animals Fish/Aqua Core	$39,637	1

New South Wales Node

Funding body	Grant type	Host institution	EMBL Australia group leader(s)	Project title	Amount awarded	Years funded
National Health & Medical Research Council	Project grant	University of New South Wales	Maté Biro	The role of the actomyosin cytoskeleton in t cell-mediated anti-tumour immunity	$297,063	3
Cancer Institute NSW	Early career fellowship	University of New South Wales	Maté Biro	Mechanobiology of cellular protrusions and the actomyosin cortex in invasive tumour cell migration	$200,000	1
National Health & Medical Research Council	Project grant	University of New South Wales	Yann Gambin	Prion-like behaviour in immunity: super-sized signalling platforms?	$525,995	3

South Australia Node

Funding body	Grant type	Host institution	EMBL Australia group leader(s)	Project title	Amount awarded	Years funded
National Health & Medical Research Council	Project grant	South Australian Health and Medical Research Institute	David Lynn	The impact of neonatal gut microbiome on specific and nonspecific vaccine responses	$661,495	3
National Health & Medical Research Council	Project grant	South Australian Health and Medical Research Institute	David Lynn	Blood serum microRNA biomarkers for oesophageal cancer	$495,432	3

Appendix 4.
Journal editorial roles

As well as being involved in the peer-review of publications, EMBL Australia group leaders took on a number of editorial roles with scientific journals in 2016.

Journal	Editorial role
Scientific Reports	Max Cryle, Editorial Board
Frontiers in Chemistry and Molecular Biosciences	Max Cryle, Editorial Board
Natural Products Reports	Max Cryle, Co-editor of a themed issue
Frontiers in Bioengineering and Biotechnology: Tissue Engineering and Regenerative Medicine	Mikaël Martino, Editorial Board
Frontiers in Bioengineering and Biotechnology: Tissue Engineering and Regenerative Medicine	Mikaël Martino, Research Topic Leader: "Vascularization for Regenerative Medicine"
Cogent Biology, Taylor & Francis Publishing	Maté Biro, Editorial Advisory Board
Science Matters, UZH Publishing	Maté Biro, Editorial Board

Appendix 5. Additional academic contributions

Scientist	Editorial role
A/Prof Pirjo Apaja	2016 Grant Review Panel Member – National Health and Medical Research Council, Canberra, Australia
A/Prof Max Cryle	Chair, Monash Biomedicine Discovery Institute Working Group on Maximising Common Research Resources Advisory Board Member, 4th Annual Microbiology & Infectious Diseases Asia Congress (Singapore, 2017) Member, Local Organisation Committee for the 6th Modern Solid Phase Peptide Synthesis & its Applications Symposium (Fraser Island, Australia, 2017) Member, Local Organisation Committee for the 21st International Conference on Cytochrome P450 (Brisbane, Australia, 2019)
A/Prof David Lynn	Panel member, Australian Mathematical Sciences Institute, BioInfoSummer 2016 meeting, Career Panel evening, Adelaide 2016 Grant Review Panel Member – Genetics; Molecular Biology; Bioinformatics and Computational Biology Panel. National Health and Medical Research Council, Canberra, Australia Visualisation and Analysis of Dynamic Molecular Interaction Networks, PRIMES annual project meeting, Mallorca, Spain (October 2016) Elected to the Executive Committee of the Australian Bioinformatics and Computational Biology Society (ABACBS)
Dr Maté Biro	Selection Panel Member for the EMBL Australia/CSIRO Group Leader recruitment 2016 Examiner, PhD (Monash University, University of Sydney) and Honours (UNSW) 2016 Grant Review Panel Member – Early Career Fellowships, National Health and Medical Research Council, Canberra, Australia
A/Prof Ville-Petteri Mäkinen	Assessor panel for possible scientific misconduct, VTT Technical Research Centre of Finland Ltd Organising Committee Member and Statistical Analyses Workshop Convenor, BioInfoSummer 2016 in Adelaide

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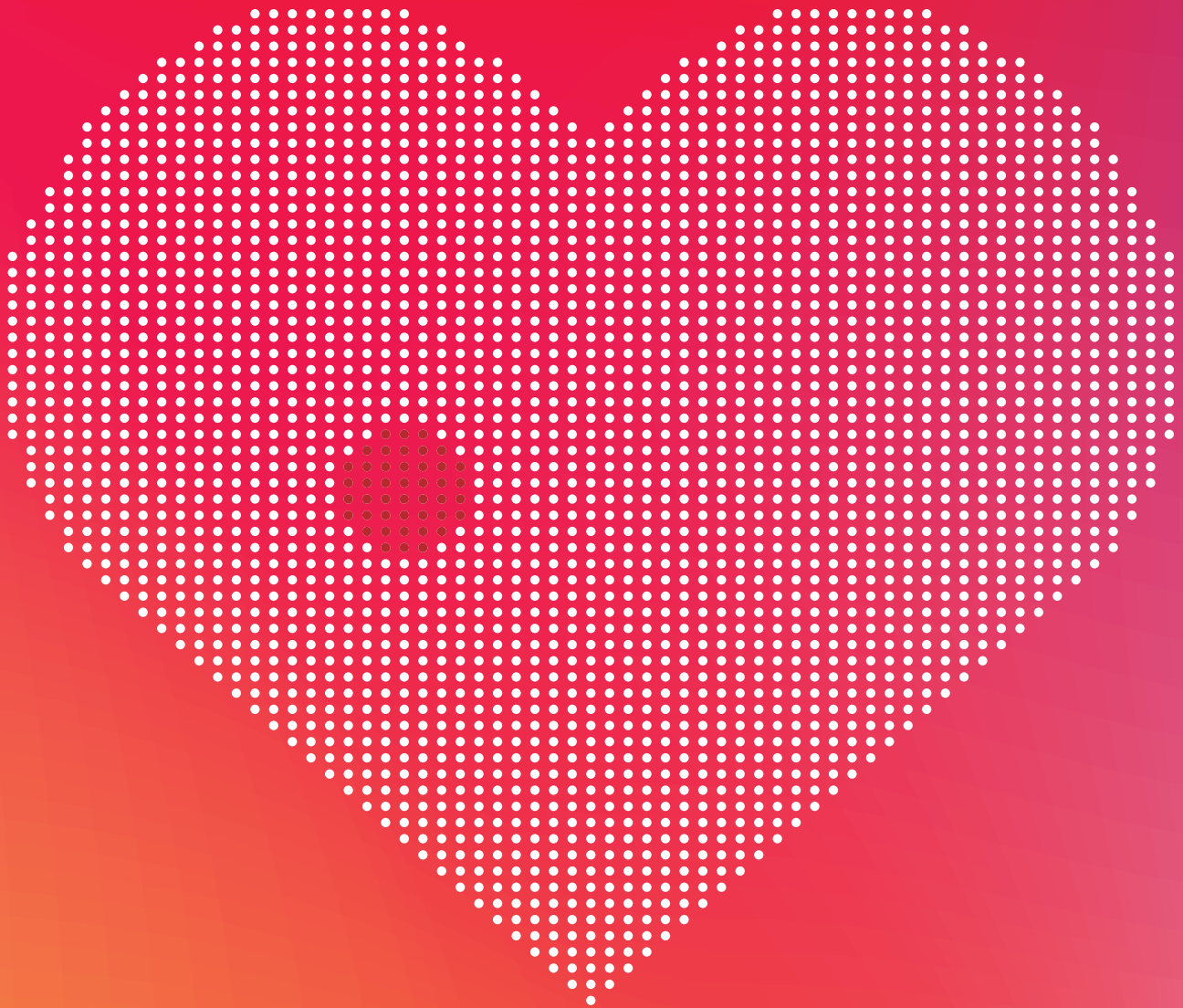

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